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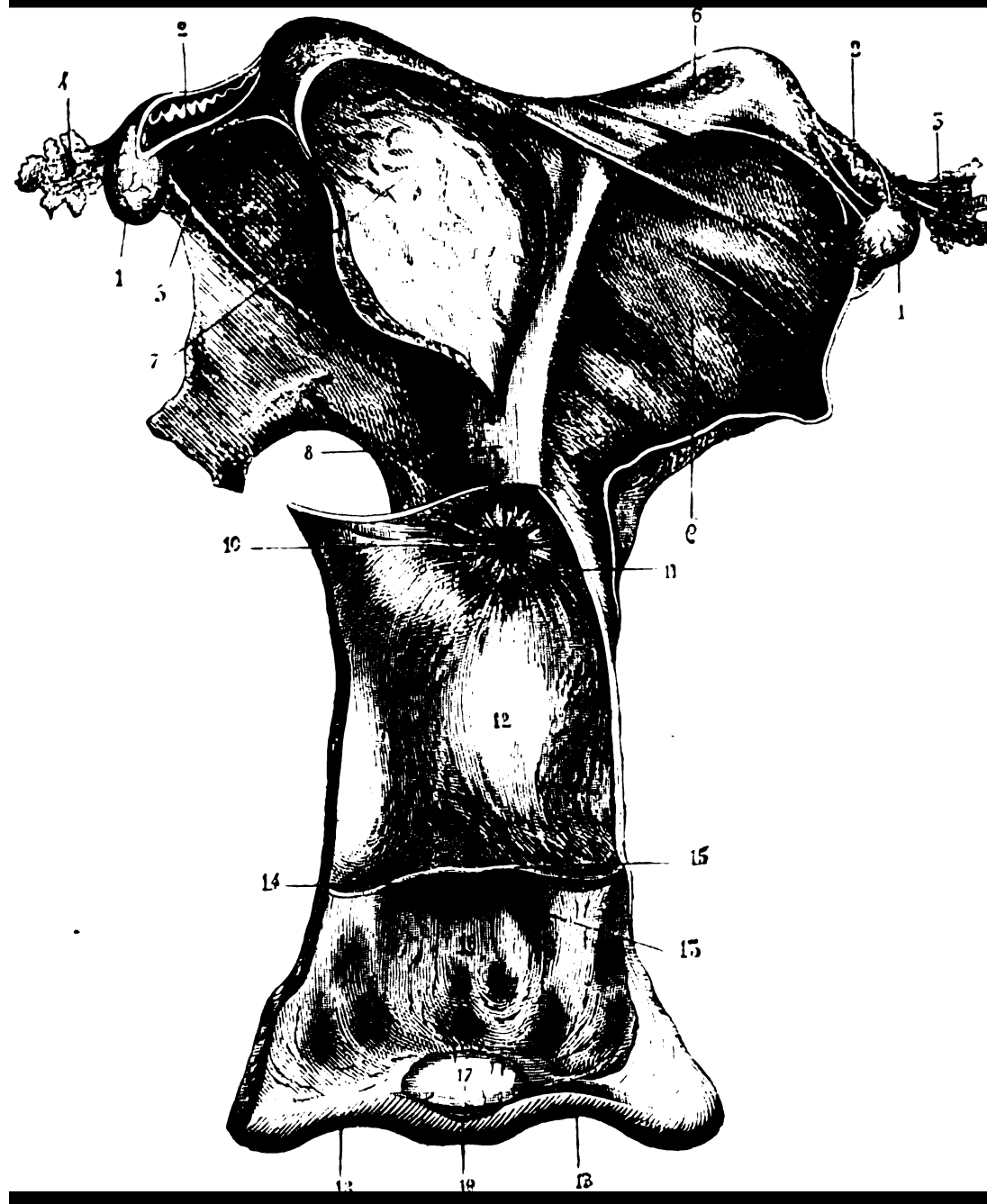

A text-book of veterinary obstetrics

George Fleming

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A TEXT-BOOK

OF

VETERINARY OBSTETRICS:

INCLUDING THE DISEASES AND ACCIDENTS INCIDENTAL TO PREGNANCY, PARTURITION, AND EARLY AGE IN THE DOMESTICATED ANIMALS.

With Two Hundred and Twelve Illustrations.

BY

GEORGE FLEMING,

VETERINARY SURGEON, 2ND LIFE GUARDS; FELLOW, MEMBER OF COUNCIL AND OF THE EXAMINING BOARD, OF THE ROYAL COLLEGE OF VETERINARY SURGEONS; FELLOW OF THE ROYAL GEOGRAPHICAL SOCIETY, ANTHROPOLOGICAL INSTITUTE, AND OF THE ANTWERP, NEW YORK, MONTREAL, CENTRAL, AND LIVERPOOL VETERINARY MEDICAL SOCIETIES; CORRESPONDING MEMBER OF THE PARIS CENTRAL VETERINARY SOCIETY, ETC.,

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KING WILLIAM STREET, STRAND.

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1878.

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TO THE

MEMBERS OF THE VETERINARY PROFESSION AND

STOCK BREEDERS

IN ALL ENGLISH-SPEAKING COUNTRIES,

THIS CONTRIBUTION TOWARDS THE

IMPROVEMENT AND PERFECTING OF A

VERY IMPORTANT BRANCH OF VETERINARY AND

AGRICULTURAL SCIENCE,

AND THE

PRESERVATION AND DEVELOPMENT

OF A

SOURCE OF NATIONAL WEALTH.

Is respectfully Dedicated by the Author.

REGENT'S PARK BARRACKS, LONDON,
November, 1877.

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PREFACE.

When we consider the vast and yearly increasing amount of animal wealth we possess, the great skill, attention, and expense bestowed on the perfecting of the most important of the domesticated creatures, which are daily becoming more essential factors in our progressive civilisation, it is somewhat remarkable, and rather discreditable, though not altogether inexplicable, that nothing in the way of a work devoted to the parturition of animals, and to the diseases and accidents incidental to that period, has yet appeared in the English language. For very many years the Anglo-Saxon race has devoted itself most assiduously and praiseworthily, and with the greatest measure of success, to the multiplication and full development of those qualities which more particularly enhance the value and utility of animals. This has entailed unwearied efforts, the closest and shrewdest observation, and all the judgment and practical and scientific knowledge which generations of men could afford.

It might therefore be considered that everything relating to the reproduction and rearing of these creatures must, from a materialistic point of view alone, be of great moment not only to breeders and stock-raisers, but to the entire community. Great loss may be, and far too often is, quickly sustained among animals during the pregnant or parturient period, and this loss may not only prove very serious to individuals, but make itself gravely felt by the general public. A treatise which might aid, to however small an extent, in pointing out how these losses may be averted or remedied, must surely, then, prove a welcome boon to those who are engaged in breeding and raising animals, as well as to all who are interested—and few are not—in their multiplication and welfare. At the commencement of this century a book was published, entitled "A Practical Treatise on the Parturition of the Cow, or the Extraction of the Calf; and also on the Diseases of Neat Cattle in General." The author was Edward Skellet, "Professor of that part of the Veterinary Art;" but that and other parts of this art were certainly in a very crude, meagre, and elementary condition in the days when Skellet ventured to touch upon them; and yet his book may be said to be the only attempt which has been made in this direction in England. Papers on obstetricy—some of them of much value—have appeared from time to time in professional journals; but while in other countries many treatises have been produced, no one in this country has undertaken the task of supplying what has, for very many years, been an urgent want—a text-book of Obstetrics worthy of modern Veterinary Science. The necessity for such a guide has been felt more particularly by the Veterinary practitioner at the commencement of his career; for only too frequently he has had to rely entirely upon his own resources, and to painfully acquire, at the expense of his employers, that knowledge of the subject which was either very imperfectly or not at all taught at the Veterinary Schools, and could not be found elsewhere. To deliver one of the larger domesticated

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animals in a case of difficult parturition requires special knowledge and aptitudes; and even those practitioners who are fortunate in possessing these will be the first to confess that to attempt delivery in many cases is really a work of the Danaides.

To the members of the Veterinary profession, therefore, no apology can be necessary in offering for their acceptance the present book. Every endeavour has been made to make it a standard work, representative of the most advanced views relating to this department of Veterinary Medicine. Animated by the desire to present my colleagues in English-speaking countries with a text-book at least equal to the best of the many which have been published on the Continent—a list of which is appended—every likely source of information has been made available, and no labour or pains have been spared to render my onerous and very difficult task as complete and as useful as possible. A glance at the references and illustrative cases will testify to the correctness of this statement.

It has often been a matter for regret by the accoucheur of women, that the parturient period of animals was one upon which they could obtain but little, if any, information; and its relations and importance with regard to this and the puerperal period in the human species has frequently been insisted upon. I trust that this cause for regret may be at least partially removed, and that the text-book may prove of some service to those medical men who are anxiously striving to advance human obstetricy, and a knowledge of those pathological processes around which there is still doubt and uncertainty.

My best thanks are due to Professor Saint-Cyr, of the Lyons Veterinary School, for allowing me to use many of the drawings which illustrate his excellent treatise on the same subject, and to which I have often referred with much advantage. I am also greatly indebted to Mr. W. A. Cartwright, of Whitchurch, Salop, for his kindness in looking over the proof-sheets containing the more practical portion of the subject; his long experience and skilful practice, combined with careful reading and study, rendered his assistance particularly valuable in this respect.

In this first attempt to deal with a very serious task, omissions and defects will doubtless be discovered. But in the circumstances in which I was placed they were unavoidable, and perhaps, after all, they will not interfere with the utility of the work. Now that certain principles in animal obstetrics have been laid down, and a commencement has been made to establish the practice of the Veterinary Obstetrist on a sound scientific basis, it is to be hoped that rapid progress will be made in rendering it more perfect. Humanity is perhaps as deeply concerned in this direction as in many others, and it must always be an important object with the Veterinary Surgeon to spare animals pain, and to abridge their sufferings as much as possible.

GEORGE FLEMING,
Second Life Guards.

REGENT'S PARK BARRACKS,
November, 1877.

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CHRONOLOGICAL LIST OF WORKS ON VETERINARY OBSTETRICS PUBLISHED UP TO THE PRESENT TIME.

France.

Rainard. Traité Complet de la Parturition des Femelles des Animaux Domestiques. Paris, 1845.

Saint-Cyr. Traité d'Obstétrique Vétérinaire. Paris, 1875.

Germany.

Jörg. Anleitung zu einer Rationellen Geburtshülfe der Landwirthschaftlichen Thiere. Leipsic, 1818.

Binz. Theoretisch-praktische Geburtshülfe für die Haussaugethiere. Freiburg, 1830.

Thomas. Kenntnisse, Erfahrungen und Hulfsleistungen bei den Geburten der Pferde. Glogau, 1832.

Seyffert. Die Geburtshülfe bei den Kühen, 1838.

Ziller. Kurzgefastzter jedoch möglichst gründlicher Unterricht über die Geburtshülfe der Grötzeren landwirthschaftlichen Hausthiere. Schleusingen, 1838.

Dieterichs. Handbuch der Praktischen Geburtshülfe bei den Groszeren Hausthieren. Berlin, 1845.

Baumeister-Rueff. Die Thierarztliche Geburtshülfe.

Zürn. Handbuch der Thierärztlichen Geburtshülfe. Leipsic, 1863.

Kehrer. Beiträge zur vergleichenden und experimentellen Geburtskunde. Geissen, 1864.

Thomas. Versuch einer Anweisung zur Geburtshülfe der Pferde. Marburg, 1866.

Harms. Lehrbuch der Thierärztlichen Geburtshülfe. Hanover, 1867.

Franck. Handbuch der Thierärztlichen Geburtshülfe. Berlin, 1876.

Belgium.

Delwart. De la Parturition des Principales Femelles Domestiques. Brussels, 1839.

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HOLLAND.

Eberhard and *Gunther.* Verhandeling over het Verlossen der Koeyen. Amsterdam, 1793.

SWEDEN.

Sjostedt. Handbok i Förlossnings Konsten för Veterinärer och uppfödare af Husdjur. Stockholm, 1875.

AUSTRIA.

Henkel. Die Geburtshülfe bei den Kühen. Vienna, 1840.

POLAND.

Seifert and *Tenneker.* Lehrbuch der Pferdeärztlichen Geburtshülfe. Prague, 1820.

Kahlert. Praktische Anleitung zu einer naturgemäszen Geburtshülfe der landwirthschaftlichen Hausthiere. Prague, 1830.

ITALY.

Cataneo. Manuale di Obstetricia Veterinaria. Milan, 1845.

Lanzillotti-Buonsanti. Manuale di Obstetricia Veterinaria. Milan, 1871.

ENGLAND.

Skellet. A Practical Treatise on the Parturition of the Cow, or the Extraction of the Calf; and also on the Diseases of Neat Cattle in general. London, 1807.

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TABLE OF ILLUSTRATIONS.

FIG.			PAGE
1.	Pelvis of the Mare	*Baumeister and Rueff*	7
2.	Pelvis of the Cow	*Ibid*	10
3.	Pelvis of the Sheep	*Ibid*	11
4.	Lateral Ligaments of the Sacrum and Pelvis	*Leyh*	12
5.	Ligaments of the Lumbar Vertebræ, Sacrum and Pelvis	*Ibid*	13
6.	Longitudinal Section of the Mare's Pelvis	*Saint-Cyr*	16
7.	Longitudinal Section of the Cow's Pelvis	*Ibid*	19
8.	Median Section of the Horse's Pelvis	*Franck*	20
9.	Median Section of the Mare's Pelvis	*Ibid*	20
10.	Pelvis of Mare	*Saint-Cyr*	25
11.	Pelvis of Horse	*Ibid*	25
12.	Generative Organs of Mare *in situ*	*Ibid*	27
13.	Lobule of Mammæ	*Virchow*	34
14.	Section of Cow's Teat	*Guibourt*	34
15.	Generative Organs of the Mare, isolated	*Chauveau*	36
16.	Utricular Gland of a Pregnant Goat	*Franck*	41
17.	Utricular Gland of a Pregnant Cow	*Ibid*	41
18.	Horizontal Section of Uterine Glands	*Ibid*	42
19.	Uterus, Oviducts, and Ovaria of the Sheep	*Owen*	43
20.	Ovary opened Vertically	*Saint-Cyr*	47
21.	Portion of the Ovary of a Pig	*Ibid*	47
22.	Graafian Vesicle in Mare's Ovary	*Franck*	47
23.	Ovulum of Mare	*Ibid*	47
24.	Formation of the Ovisac in the Bitch's Ovary	*Bischoff*	49
25.	Graafian Vesicle and Ovum	*Barry*	50
26.	Escape of Ovum from Ovisac	*Thomson*	50
27.	Successive Stages in Formation of Corpus Luteum	*Pouchet*	51
28.	Ovum from Oviduct of Rabbit	*Bischoff*	63
29.	A more advanced Ovum	*Ibid*	63
30.	Ovum from Uterine Half of Oviduct	*Ibid*	64
31.	Ovum from Uterine End of Oviduct	*Ibid*	64
32.	Blastoderm and Primitive Trace	*Saint-Cyr*	65

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FIG.			PAGE
33.	Ovum from Twenty to Twenty-five Days old	*Saint-Cyr*	67
34.	Ovum about a Month old	*Ibid*	68
35.	Chorion of Mare at Mid-term	*Colin*	69
36.	Fœtal Membranes of the Cow at Mid-term	*Ibid*	70
37.	Fœtal Membranes of the Goat at Full Time	*Ibid*	71
38.	Fœtus and Fœtal Membranes of Cat	*Buffon*	72
39.	Fœtus of Mare and its Envelopes	*Chauveau*	73
40.	Plan of Fœtal Envelopes in Mare	*Saint-Cyr*	76
41.	Portion of Chorion with Placentulæ: Cow	*Gurlt*	80
42.	Maternal and Fœtal Cotyledons of the Cow	*Colin*	82
43.	Cotyledon of a Cow's Uterus	*Pettigrew*	83
44.	Fœtal Circulation in a Transition State	*Saint-Cyr*	95
45.	Fœtal Circulation: Advanced Period	*Colin*	97
46.	Male Fœtus of the Mare	*Franck*	101
47.	Genito-urinary Organs of a Fœtal Sheep	*Müller*	102
48.	Female Organs of a Fœtal Deer	*Ibid*	104
49.	Female Fœtus of the Cow	*Franck*	104
50.	Genital Organs of a Hermaphrodite Goat	*Leuckart*	105
51.	Section of Maternal Cotyledon during Gestation	*Franck*	118
52.	Gravid Uterus of a Multiparous and Uniparous Animal	*Thomson*	119
53.	Twin Pregnancy: Cow	*Saint-Cyr*	148
54.	A Mole	*Zundel*	165
55.	Hydated Kyst	*Boivin*	168
56.	Cow in the Act of Parturition: Standing Position	*Original*	217
57.	Mare in the Act of Parturition: Recumbent Position	*Baumeister*	218
58.	Vertebro-sacral Position of the Fœtus	*Saint-Cyr*	223
59.	Lumbo-sacral Position of the Fœtus	*Ibid*	224
60.	Right Cephalo-ilial Position of the Fœtus	*Ibid*	225
61.	Cephalo-sacral Position of the Fœtus	*Ibid*	226
62.	Sterno-abdominal Position of the Fœtus	*Ibid*	227
63.	Mammary Gland and Milk-cells	*Virchow*	247
64.	Completely Deformed Pelvis	*Saint-Cyr*	264
65.	Exostosis of the Pelvis	*Ibid*	266
66.	Fracture of the Pelvis	*Ibid*	267
67.	Uterine Hernia: Mare	*Ibid*	273
68.	Incomplete or Simple Torsion of the Uterus	*Zundel*	287
69.	Multiple Torsion of the Uterus	*Gurlt*	288
70.	Diagram of Uterine Torsion	*Saint-Cyr*	296
71.	Left Uterine Torsion	*Gurlt*	297
72.	Right Uterine Torsion	*Ibid*	297
73.	Right Uterine Torsion: Manipulation	*Saint-Cyr*	298
74.	Left Uterine Torsion: Manipulation	*Ibid*	298
75.	Left Uterine Torsion *in situ*	*Rossignol*	300
76.	Darreau's Uterine Retroversor	*Darreau*	308

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FIG.			PAGE
77.	Barnes's Uterine Dilator	*Original*	337
78.	Skull of a Hydrocephalic Calf	*Saint-Cyr*	371
79.	Skull of a Hydrocephalic Calf	*Rueff—Baumeister*	371
80.	Skull of a Hydrocephalic Foal	*Saint-Cyr*	372
81.	Calf Affected with Hydrocephalus	*Rueff—Baumeister*	373
82.	Head of a Hydrocephalic Foal	*Original*	372
83.	Extraordinary Development of the Cranium of a Hydrocephalic Calf	*Original*	375
84.	Deformed Head and Neck of a Foal	*Franck*	382
85.	Ectromelian Monstrosity: Horse	*Zundel*	393
86.	Ectromelian Monstrosity: Goat	*Rueff—Baumeister*	393
87.	Symelian Monstrosity	*Ibid*	394
88.	Celosomian Monstrosity	*Ibid*	394
89.	Ectopia Cordis	*Hering*	395
90.	Pseudencephalian Monstrosity	*Ibid*	395
91.	Cyclopian Monstrosity: Ram	*Ibid*	396
92.	Cyclopian Monstrosity: Ass	*Gurlt*	396
93.	Acephalian Monstrosity	*Ibid*	397
94.	Schistocephalus Fissilabrus	*Rueff—Baumeister*	397
95.	Camylorrhacchis Contorta	*Ibid*	398
96.	Monomphalian Monstrosity	*Ibid*	399
97.	Skull of Syncephalian Monstrosity	*Franck*	399
98.	Monocephalian Monstrosity	*Rueff—Baumeister*	400
99.	Sysomian Monstrosity	*Ibid*	400
100.	Monosomian Monstrosity	*Original*	401
101.	Polymelian Monstrosity	*Rueff—Baumeister*	401
102.	Double Parasitic Monstrosity	*Zundel*	402
103.	Sysomian Monstrosity	*Saint-Cyr*	409
104.	Celosomian Monstrosity: Lamb	*Youatt*	411
105.	Twin Fœtuses in Different Presentations	*Saint-Cyr*	419
106.	Solid Repeller	*Original*	425
107.	Jointed Repeller	*Ibid*	425
108.	Jointed Repeller: Open	*Rainard*	425
109.	„ „ Closed	*Ibid*	425
110.	Anterior Presentation: Fore-limb Crossed Over the Neck	*Saint-Cyr*	432
111.	Anterior Presentation: Fore-limbs Bent at the Knees	*Ibid*	434
112.	Anterior Presentation: Extending the Fore-limb	*Franck*	435
113.	Anterior Presentation: One Fore-limb Completely Retained	*Saint-Cyr*	437
114.	Anterior Presentation: Both Fore-limbs Completely Retained	*Ibid*	438
115.	Anterior Presentation: Downward Deviation of the Head	*Ibid*	442
116.	Anterior Presentation: Extreme Downward Deviation of the Head	*Ibid*	443

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FIG.			PAGE
117.	Anterior Presentation: Lateral Deviation of the Head Towards the Shoulder	*Saint-Cyr*	446
118.	Anterior Presentation: Lateral Deviation of the Head Towards the Abdomen	*Ibid*	447
119.	Straight Porte-cord	*Original*	449
120.	Bent Porte-cord		449
121.	Finger-hook		449
122.	Short Blunt Hook		449
123.	Long Blunt Hook		450
124.	Serrated Forceps		450
125.	Binz's Porte-cord		451
126.	Nelson's Blunt Forceps		452
127.	Long Sharp Hook		453
128.	Anterior Presentation: Deviation of the Head Upwards and Backwards	*Saint-Cyr*	455
129.	Anterior Presentation: Deviation of the Head Upwards and Laterally	*Ibid*	455
130.	Deviation of the Hind-limbs in the Pelvis in the Anterior Presentation	*Ibid*	458
131.	Hind-limb Deviation: Anterior Presentation	*Franck*	459
132.	Lumbo-sacral Position of the Fœtus	*Saint-Cyr*	464
133.	Hock Presentation: Calf	*Franck*	468
134.	Diagrams of the Hind-limbs in Hock Presentation	*Ibid*	468
135.	Hock Presentation: Hock Corded	*Saint-Cyr*	471
136.	Thigh and Croup Presentation	*Ibid*	473
137.	Thigh and Croup Presentation: Thigh Corded	*Ibid*	474
138.	Thigh and Croup Presentation: Body Corded	*Franck*	475
139.	Transverse Presentation: Right Cephalo-ilial Position—Side View	*Saint-Cyr*	480
140.	Transverse Presentation: Right Cephalo-ilial Position—Upper View	*Franck*	480
141.	Transverse Presentation: Vertical or Cephalo-sacral Position	*Saint-Cyr*	481
142.	Sterno-abdominal Presentation, Head Retained: Calf	*Ibid*	485
143.	Sterno-abdominal Presentation, Head and Feet Engaged: Foal	*Franck*	486
144.	Darreau's Olive-shaped Repeller		487
145.	Traction Cord and Band, and the Manner of Applying them	*Baumeister*	492
146.	Schaack's Traction Cord	*Saint-Cyr*	492
147.	Cartwright's Porte-cord		494
148.	Darreau's Porte-cord		494
149.	Gunther's Bent Porte-cord		494
150.	Darreau's Bent Porte-cord		494

Digitized by Google

FIG.			PAGE
151.	Binz's Simple Head-collar	*Baumeister*	496
152.	Rueff's Head-collar, No. 1	*Rueff*	496
153.	Rueff's Head-collar, No. 2	*Ibid*	496
154.	Binz's Forceps-band	*Baumeister—Rueff*	497
155.	Schaack's Forceps-halter	*Saint-Cyr*	498
156.	Manner of Placing Schaack's Halter	*Ibid*	498
157.	Schaack's Halter Placed on a Calf's Head	*Ibid*	499
158.	Short Blunt Crotchet	*Original*	500
159.	Blunt Finger Crotchet		500
160.	Short Sharp Crotchet with Round Point		501
161.	Short Sharp Crotchet with Broad Point		501
162.	Long Blunt Crotchet		502
163.	Long Pointed Crotchet		502
164.	Long Pointed Crotchet: Darrean's Pattern		502
165.	" " " " " "		502
166.	Schaack's Crotchet		504
167.	Simple Short Crotchet-forceps		506
168.	Long Simple Crotchet-forceps		507
169.	Gunther's Long Crotchet-forceps		507
170.	Jointed Crotchet-forceps		507
171.	Nelson's Blunt Crotchet-forceps		508
172.	Nelson's Serrated Crotchet-forceps		508
173.	Tallich's Short Bent Crotchet-forceps		508
174.	Andre's Crotchet-forceps		509
175.	Bitch Forceps		510
176.	Weber's Forceps		510
177.	Defay's Forceps		511
178.	Defay's Wire-extractor with the Torsion-rods		511
179.	Defay's Wire-extractor Applied		512
180.	Breulet's Tube and Noose		512
181.	Breulet's Noose Fixed on the Fœtus		513
182.	Diagram of the Pelvic Axis	*Saint-Cyr*	514
183.	Obstetric Pulleys	*Ibid*	518
184.	Baron's Obstetric Machine	*Ibid*	519
185.	Straight Embryotom	*Original*	524
186.	Curved Embryotom		524
187.	Gunther's Embryotom: Improved Pattern		525
188.	Scalpel Embryotom		525
189.	Gunther's Long-handled Embryotom		526
190.	Cartwright's Subcutaneous Spatula		526
191.	Carsten Harm's Spatula		526
192.	Ungefrohrn's Spatula		527
193.	Cartwright's Bone-chisel		527
194.	Cartwright's Bone-saw		527
195.	Swedish Bone-saw		527
196.	Pad Pessary	*Saint-Cyr*	582
197.	Ring Pessary	*Ibid*	583
198.	Cup and Ball Pessary	*Ibid*	584

Digitized by Google

FIG.			PAGE
199.	Labial Sutures	*Zundel*	586
200.	Loop of Delwart's Truss	*Franck*	587
201.	Delwart's Truss Applied	*Saint-Cyr*	588
202.	Renault's Truss	*Ibid*	589
203.	Leather Truss	*Franck*	590
204.	Lund's Truss Iron	-	591
205.	Lund's Truss Applied	*Saint-Cyr*	592
206.	Parturient Apoplexy: Cow	*Armatage*	646
207.	Teat-syphon	*Original*	697
208.	Ringed Teat-syphon	-	697
209.	Lüthi's Perforating Sound	-	705
210.	Armatage's Umbilical Truss	*Armatage*	713
211.	Wooden Clam for Hernia	*Ibid*	717
212.	Iron Screw-clams for Hernia	*Ibid*	717

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TABLE OF CONTENTS.

PAGE

PREFACE - - - - - - - - - - 1
INTRODUCTION - - - - - - - - 1

PART FIRST.

EUTOKIA.

BOOK I.—OBSTETRICAL ANATOMY - - - 5

CHAPTER I.—THE PELVIS - - - - 5

SECTION I.—BONES OF THE PELVIS - - - - 6
1. Os Innominatum - - - - - 6
Ilium - - - - - - - - 6
Ischium - - - - - - - 8
Pubis - - - - - - - - 8
2. Sacrum - - - - - - - 9
3. Coccyx - - - - - - - - 10
Differences in the Bones of the Pelvis of other Animals 10
Cow - - - - - - - - 11
Sheep and Goat - - - - - - 11
Bitch and Cat - - - - - - - 11
Pig - - - - - - - - 11

SECTION II.—ARTICULATIONS OF THE PELVIS - - 12
1. Sacro-lumbar Articulation - - - - 12
2, 3. Sacro-iliac Articulations - - - - 12
4. Ischio-pubic Symphysis - - - - 13
5. Sacro-coccygeal Articulations - - - - 14
Differences in the Pelvic Articulations of other Animals 14
Cow - - - - - - - - 14
Sheep and Goat - - - - - - 14
Bitch and Cat - - - - - - - 14
Sacro-sciatic Ligament - - - - 14

SECTION III.—THE PELVIS AND ITS CAVITY - - - 15
Mare - - - - - - - - 15
External Surface - - - - - 15
Anterior Opening or Inlet - - - 17

Digitized by Google

PAGE

Posterior Opening or Outlet - - - - 17
The Cavity of the Pelvis - - - 18
Differences in other Animals - - - 18
Cow - - - - - - 18
Sheep and Goat - - - - 19
Pig - - - - - - 19
Bitch and Cat - - - - 19
SECTION IV.—CAPACITY OF THE PELVIS OR PELVIMETRY - 20
Differences in the Pelvis according to Sex - - 25

CHAPTER II.—FEMALE GENERATIVE ORGANS - 26

SECTION I.—EXTERNAL GENERATIVE ORGANS - 27
The Vulva - - - - - 27
Differences in the Vulva of other Animals - - 30
Cow - - - - - - 30
Sheep - - - - - 30
Pig - - - - - - 30
Bitch and Cat - - - - 31
SECTION II.—THE MAMMÆ - - - - 31
Differences in other Animals - - - 33
Cow - - - - - - 33
Sheep and Goat - - - - 34
Pig - - - - - - 34
Bitch - - - - - 34

CHAPTER III.—INTERNAL ORGANS OF GENERATION 35

SECTION I.—THE VAGINA - - - 35
Differences - - - - - 37
Cow, Sheep, and Goat - - - - 37
Pig - - - - - - 37
Bitch and Cat - - - - 37
SECTION II.—THE UTERUS - - - - 37
Differences - - - - - 40
Cow - - - - - - 40
Sheep and Goat - - - - 42
Pig - - - - - - 43
Bitch and Cat - - - - 43
Development - - - - - 44
SECTION III.—FALLOPIAN TUBES OR OVIDUCTS - 44
Differences - - - - - 45
Cow, Sheep, and Goat - - - 45
Pig - - - - - - 46
Bitch - - - - - 46
SECTION IV.—THE OVARIES - - - - 46
Differences - - - - - 48
Cow, Sheep, and Goat - - - - 48
Pig - - - - - - 48
Bitch and Cat - - - - - 48
Development - - - - - 48

Digitized by Google

PAGE

BOOK II.—OBSTETRICAL PHYSIOLOGY - - 52

REPRODUCTION - - - - 52

CHAPTER I.—SECTION I.—PUBERTY - - - 54

SECTION II.—ŒSTRUM OR MENSTRUATION - - 55

SECTION III.—MATURATION OF THE GRAAFIAN VESICLES - - - - - - 59

CHAPTER II.—FECUNDATION - - - 60

CHAPTER III.—STERILITY - - - - 60

CHAPTER IV.—CHANGES IN THE OVUM - 62

SECTION I.—DEVELOPMENT OF THE EMBRYO - - 65

SECTION II.—ANNEXES OF THE FŒTUS - - 68

Chorion - - - - - - 69

Differences - - - - - 71

Ruminants - - - - - 71

Pig - - - - - 72

Bitch and Cat - - - - - 72

Amnion - - - - - 72

Liquor Amnii - - - - - 74

Differences in the Amnion of other Animals - - 75

Ruminants - - - - - 75

Pig - - - - - 75

Bitch and Cat - - - - - 75

Allantois - - - - - 75

Differences - - - - - 77

Ruminants - - - - - 77

Pig - - - - - 78

Bitch and Cat - - - - 78

Umbilical Vesicle - - - - 78

Differences - - - - - 79

Ruminants and Pig - - - - 79

The Placenta - - - - 79

Differences - - - - - 80

Cow - - - - - 80

Sheep and Goat - - - - - 83

Pig - - - - - 83

Bitch and Cat - - - - - 84

Functions - - - - - 84

Umbilical Cord - - - - 85

Differences - - - - - 86

Ruminants - - - - - 86

Pig - - - - - 86

Bitch and Cat - - - - - 86

SECTION III.—DEVELOPMENT OF THE FŒTUS - 87

The Nervous System - - - - 88

The Organs of Sense - - - - 89

The Skin and its Appendages - - - 91

Digitized by Google

PAGE

The Locomotory Apparatus - - - - 92
The Circulatory System - - - - - 94
The Respiratory Apparatus - - - - 98
The Digestive System - - - - - 99
The Genito-urinary Organs - - - - 101

SECTION IV.—PERIODS OF DEVELOPMENT - - 105

SECTION V.—PHYSIOLOGICAL PHENOMENA IN THE FŒTUS - 108
Nervous Functions - - - - 108
Absorption - - - - - 110
Nutrition - - - - - 111
Circulation - - - - - 111
Secretion - - - - - 113

SECTION VI.—WEIGHT AND DIMENSIONS OF THE FŒTUS AT BIRTH - - - - - 115

CHAPTER V.—GESTATION - - - - 116

SECTION I.—MODIFICATIONS IN THE UTERUS DURING PREGNANCY - - - - - 117
Volume - - - - - 117
Structure - - - - - 117
Sensibility - - - - - 119
Form - - - - - 121
Situation - - - - - 122
Direction - - - - - 123
Influence on and Alterations in the Position of Neighbouring Organs - - - - 123

SECTION II.—POSITION OF THE FŒTUS IN THE UTERUS 125

SECTION III.—SIGNS OF PREGNANCY - - - 126
Rational Signs - - - - - 126
Material Signs - - - - - 128
Sensible Signs - - - - - 131

SECTION IV.—DURATION OF PREGNANCY - - 135
Mare - - - - - 136
Cow - - - - - - 137
Sheep and Goat - - - - 138
Pig - - - - - - 139
Bitch - - - - - 139
Cat - - - - - - 139

SECTION V.—GEMELLIPAROUS, PLURIPAROUS, OR MULTIPAROUS GESTATION - - - - 139
Mare - - - - - 140
Cow - - - - - - 141
Sheep - - - - - 143
Goat - - - - - - 145
Free-Martins - - - - 146
Diagnosis of Multiple Pregnancy - - - 146
Position of the Fœtuses in Multiple Pregnancy - 147

Digitized by Google

PAGE

CHAPTER VI.—HYGIENE OF PREGNANT ANIMALS - 149

BOOK III.—PATHOLOGY OF GESTATION - 152

CHAPTER I.—ANOMALIES IN GESTATION - - 152

SECTION I.—SUPERFŒTATION - - - 152

SECTION II.—EXTRA-UTERINE PREGNANCY - - 156

Symptoms, Course, and Terminations - - 163

Diagnosis and Treatment - - - - 164

SECTION III.—SPURIOUS OR PSEUDO-PREGNANCY - 164

Moles - - - - - - 165

Uterine Kysts - - - - - 167

Hydrops Uteri or Hydrometra - - - 169

CHAPTER II.—DISEASES OF THE PREGNANT ANIMAL - - - - - 171

SECTION I.—INFLUENCE OF GESTATION ON ORDINARY DISEASES - - - - - 171

SECTION II.—DISEASES PECULIAR TO PREGNANCY - 172

Cramp - - - - - - 172

Pica - - - - - - - 173

Constipation - - - - - 173

Œdema - - - - - - 173

Hydrops Amnii - - - - - 173

Paraplegia - - - - - 176

Amaurosis - - - - - 177

Cough - - - - - - 177

Albuminuria - - - - - 177

CHAPTER III.—ACCIDENTS OF PREGNANCY - 177

Ante-partum Prolapsus of the Vagina - - - 177

Hernia of the Uterus (Hysterocele) - - 179

Ante-partum Rupture of the Uterus - - - 180

Metrorrhagia - - - - - - 185

Abnormal Retention of the Fœtus - - - 186

Abortion - - - - - - 193

Sporadic Abortion - - - - 194

Epizoötic, Enzoötic, or Infectious Abortion - 204

BOOK IV.—NORMAL PARTURITION - - - 209

CHAPTER I.—PHYSIOLOGY OF PARTURITION - 209

SECTION I.—CAUSES OF PARTURITION - - - 210

SECTION II.—THE EXPELLING POWERS - - 210

SECTION III.—SYMPTOMS, AND COURSE OF PARTURITION - 214

CHAPTER II.—PRESENTATIONS OF THE FŒTUS AND MECHANISM OF PARTURITION - - 221

SECTION I.—PRESENTATIONS - - - 221

SECTION II.—POSITIONS - - - - 222

SECTION III.—MECHANISM OF PARTURITION - - 227

Digitized by Google

PAGE

CHAPTER III.—NECESSARY AID IN NORMAL PARTURITION - - - - 232
SECTION I.—ATTENTION TO THE MOTHER - - 232
SECTION II.—ATTENTION TO THE OFFSPRING - - 240
CHAPTER IV.—SEQUELÆ OF PARTURITION - - 243
SECTION I.—FUNCTIONAL MODIFICATIONS - - 244
SECTION II.—ORGANIC MODIFICATIONS - - - 250

PART SECOND.

DYSTOKIA.

GENERAL CONSIDERATIONS - - - - 253

BOOK I.—MATERNAL DYSTOKIA - - - 263

CHAPTER I.—DYSTOKIA BY PELVIC CONSTRICTION - - - - - - 263
Complete Deformity of the Pelvis - - - 264
Exostoses - - - - - - 266
Fractures - - - - - 266
Tumours in the Pelvic Cavity - - - 269
Indications for Surgical Treatment - - 269

CHAPTER II.—DYSTOKIA BY DISPLACEMENT OR CHANGED RELATIONS OF THE UTERUS - 272
Hernia of the Uterus—Hysterocele - - - 272
Origin and Symptoms in Uniparous Animals - 273
Origin and Symptoms in Multiparous Animals - 274
Diagnosis - - - - - 275
Indications - - - - - 276
Pathological Anatomy - - - 279
Deviation of the Uterus - - - - 280
Diagnosis - - - - - 281
Complications - - - - - 282
Indications - - - - - 282
Torsion of the Uterus : Contorso Uteri - - 283
History - - - - - 283
Nature and Frequency - - - - 286
Etiology - - - - - 290
Symptoms - - - - - 292
Diagnosis - - - - - 295
Prognosis - - - - - 299
Pathological Anatomy - - - 299
Treatment - - - - - 303

Digitized by Google

PAGE

Torsion of the Uterus in the Mare - - 317
Causes - - - - - - 317
Symptoms - - - - - 317
Prognosis and Treatment - - - - 318
Torsion of the Uterus in other Animals - - 318

CHAPTER III.—DYSTOKIA FROM MORBID ALTERATIONS IN THE GENITAL ORGANS - - 319

1. Utero-vaginal Tumours - - - - 319
Diagnosis - - - - 320
Treatment - - - - - 321
Cancerous, Carcinomatous, or Sarcomatous Tumours - - - - - 322
Condylomatous, Papillomatous, and Lipomatous Tumours - - - - - 322
Fibroid and Myomatous Tumours - - 323
Thrombus or Hæmatoma - - - 327
Serous Kysts - - - - - 328
Hernia of the Bladder into the Vagina: Vaginal Cystocele - - - - - 328
Treatment - - - - - 330
Tumours in the Vicinity of the Genital Organs - 332
2. Rigidity of the Cervix Uteri - - - 332
Symptoms - - - - 333
Diagnosis - - - - - 334
Prognosis - - - - 334
Treatment - - - - - 334
3. Induration of the Cervix Uteri - - 341
Symptoms - - - - - 342
Diagnosis - - - - 342
Prognosis - - - - - 343
Pathological Anatomy - - - 343
Treatment - - - - - 344
4. Complete Obliteration of the Os Uteri - 347
Causes - - - - - 348
Symptoms - - - - 348
Results - - - - - 348
Diagnosis - - - - 348
Treatment - - - - - 348

CHAPTER IV.—OTHER CAUSES OF MATERNAL DYSTOKIA - - - - - 350
Anomalies in the Placenta - - - 350
Schirrous Chorion - - - - - 350
Morbid Adhesion between the Fœtus and Uterus - 350
Stricture or Occlusion of the Uterus by External Bands or Membranes - - - - 352
Persistent Hymen - - - - - 355
Treatment - - - - 356
Vaginal and Vulvular Constriction or Atresia - - 356

Digitized by Google

PAGE

BOOK II.—FŒTAL DYSTOKIA - - - 359

GROUP I.—OBSTACLES INDEPENDENT OF PRESENTATIONS AND POSITIONS - - 360

CHAPTER I.—EXCESS IN VOLUME OF THE FŒTUS - 360

Causes - - - - - 360
Diagnosis - - - - 363
Prognosis - - - - 365
Indications - - - - 365
Anomalies in, and Diseases of, the Fœtal Membranes 366
Abnormal Quantity of Placental Fluid - - - 368
Indications - - - - - 370

CHAPTER II.—DISEASES OF THE FŒTUS - - 370

Hydrocephalus - - - 370
Pathological Anatomy - - - 370
Dystokia - - - 374
Diagnosis - - - - 375
Indications - - - 375
Ascites, Anasarca, and Hydrothorax - - 377
Causes - - - - - 378
Dystokia - - - - - 379
Diagnosis - - - - - 379
Indications - - - - - 380
Emphysema - - - - - 381
Indications - - - - - 381
Polysarcia - - - - - 382
Indications - - - - - 382
Contractions - - - - 382
Indications - - - - - 383
Tumours - - - - - 384
Indications - - - - - 385
Death - - - - - 385

CHAPTER III.—MONSTROSITIES - - - 386

Classifications - - - 387
CLASS I.—SIMPLE MONSTROSITIES - - - 387
Order I.—Simple Monstrosities through Absence of Parts - - - - - 387
Order II.—Simple Monstrosities through Smallness of Parts - - - - - 388
Order III.—Simple Monstrosities through Abnormal Division of the Body - - - - 388
Order IV.—Simple Monstrosities through Absence of the Natural Division of Parts - - - 388
Order V.—Simple Monstrosities through Fusion or Coalition of Organs - - - - 389

Digitized by Google

PAGE

Order VI.—Simple Monstrosities through Abnormal Position and Form of Parts - - - 389
Order VII.—Simple Monstrosities through Excess in Formation - - - - 389
Order VIII.—Hermaphrodites - - - - 389
Class II.—Treble and Double Monstrosities - - 390
Order I.—Trigeminal Monstrosities - - 390
Order II.—Monsters with Two Heads - - 390
Order III.—Double-headed Monstrosities, with the Trunk Wholly or Partially Double - - 390
Order IV.—Monstrosities with a Single Head, but the Trunk or Limbs more or less Completely Double - - - - - - 390
Order V.—Monstrosities with a Single Head and Trunk, and more than Four Limbs - - 391
Order VI.—Monstrosities with the Head, Trunk, and Limbs more or less Completely Double - 391
Origin of Monstrosities, and the Laws of Teratology - - - - - - 402
Frequency of Monstrosities - - - 406
Distorted Monstrosities - - - - 407
Cyclopian Monstrosity - - - - 408
Pseudencephalian Monstrosity - - 408
Double-headed Monstrosities - - - 408
Celosomian Monstrosities - - - 410
Diagnosis - - - - - 411
Prognosis - - - - - 411
Extraction - - - - 412
Double and Triple Monstrosities - - 415
Diagnosis - - - - - 415
Extraction - - - - 416

CHAPTER IV.—DYSTOKIA FROM MULTIPARITY - 417
Diagnosis - - - - - 419
Extraction - - - - 420

GROUP II.—DYSTOKIA FROM MALPRESENTATION OR MALPOSITION OF THE FŒTUS - - 422

CHAPTER I.—DYSTOKIA DEPENDING ON THE ANTERIOR PRESENTATION - - - 430
Section I.—Dystokia Due to the Fore-limbs - 431
1. Anterior Limbs Incompletely Extended in the Pelvis - - - - - 431
Indications - - - - - 432
2. Fore-limbs Crossed Over the Neck - - 432
Indications - - - - - 433
3. Fore-limbs Flexed at the Knees - - - 433
Indications - - - - - 434
4. Fore-limbs Completely Retained - - - 437
Indications - - - - - 439

Digitized by Google

PAGE

SECTION II.—DYSTOKIA DUE TO THE HEAD - - 440
Downward Deviation - - - - 441
Indications - - - - - 443
Lateral Deviation to the Right or Left - - 445
Indications - - - - - 448
Deviation Upward and Backward - - 454
Indications - - - - - 454
SECTION III.—DYSTOKIA DUE TO MISDIRECTION OF THE HIND-LIMBS IN THE ANTERIOR PRESENTATION - 456
Extreme Abduction of the Hind-limbs - - 456
Indications - - - - - 457
Deviation of the Hind-limbs in the Pelvis, the Anterior Part of the Body Presenting - - 457
Indications - - - - 459

CHAPTER II.—DYSTOKIA DEPENDING ON THE POSTERIOR PRESENTATION - - 463

SECTION I.—DYSTOKIA RESULTING FROM THE LUMBO-PUBIC AND LUMBO-ILIAL POSITIONS - - 464
Lumbo-pubic Position - - - - 464
Indications - - - - - 465
Lumbo-ilial Positions - - - - 466
SECTION II.—COMPLICATIONS CAUSED BY DEVIATION OF THE HIND-LIMBS - - - - 466
Fetlock Presentation - - - - 467
Hock Presentation - - - - 467
Indications - - - - - 468
Thigh and Croup Presentation - - - 472
Indications - - - - 472
Dystokia from the Head and Fore-limbs in the Posterior Presentation - - - 477
Indications - - - - - 477

CHAPTER III.—DYSTOKIA FROM TRANSVERSE PRESENTATIONS - - - - - 478
Dystokia from the Dorso-lumbar Presentation - 479
Indications - - - - - 481
Dystokia from the Sterno-abdominal Presentation - 484
Indications - - - - - 485

BOOK III.—OBSTETRIC OPERATIONS - - 490

CHAPTER I.—MECHANICAL MEANS FOR THE EXTRACTION OF THE FŒTUS - - - 491
Cords and Bands - - - - 491
Head-cord or Head-collar - - - 495
Crotchets or Hooks - - - - 500
Forceps - - - - - 505
The Employment of Force in Dystokia - - 513

Digitized by Google

PAGE

Direction of Traction - - - - 513
Degree of Traction - - - - 514
Means for Developing the Necessary Force - 517
Comparison between Manual and Mechanical Force - 520

CHAPTER II.—EMBRYOTOMY - - - 522

Embryotomy Instruments - - - - 523
Preliminary Arrangements for Embryotomy - 529
Cephalotomy - - - - - 529
Puncture of the Cranium - - - 529
Craniotomy - - - - - 530
Decapitation - - - - 531
Amputation of the Limbs - - - - 533
Amputation of the Fore-limbs - - 534
Amputation of the Hind-limbs - - - 536
Division or Detruncation of the Fœtus - - 536
Evisceration - - - - - 537
Thoracic Evisceration - - - 537
Abdominal Evisceration - - - - 538

CHAPTER III.—VAGINAL HYSTEROTOMY - 539

CHAPTER IV.—GASTRO-HYSTEROTOMY, OR THE CÆSAREAN SECTION - - - - 543

Indications - - - - 546
Operation - - - 547

CHAPTER V.—SYMPHYSIOTOMY - - - 556

BOOK IV.—ACCIDENTS INCIDENTAL TO PARTURITION - - - - - 557

CHAPTER I.—RETENTION OF THE FŒTAL ENVELOPES - - - - - - 557

Symptoms and Terminations - - 558
Causes - - - - - 559
Treatment - - - - 560

CHAPTER II.—POST-PARTUM HÆMORRHAGE - 566

Symptoms - - - - 567
Treatment - - - - 568

CHAPTER III.—INVERSION OF THE UTERUS - 571

Symptoms - - - - 571
Complications - - - 573
Prognosis - - - - 574
Causes - - - - 575
Treatment - - - - 576
Preliminary Measures - - 577
Reduction or Reposition - - - 578
Contention or Retention of the Uterus - 582

Digitized by Google

PAGE
After Treatment - - - 592
Amputation of the Uterus.—Metrotomy 593

CHAPTER IV.—INVERSION OF THE VAGINA - 600
Symptoms - - - - 601
Prognosis - - - - 602
Treatment - - - 602

CHAPTER V.—INVERSION OF THE BLADDER - 604

CHAPTER VI.—TRAUMATIC LESIONS OF THE GENITAL AND NEIGHBOURING ORGANS - 608
SECTION I.—LACERATION AND RUPTURE OF THE UTERUS 608
Treatment - - - - 610
Rupture of the Uterus after Parturition - - 611
SECTION II.—LACERATION AND RUPTURE OF THE VAGINA - 614
Complications of Ruptured Vagina - - 617
Rupture of the Perinæum - - - - 621
Vesico-vaginal Fistulæ - - - 624
SECTION III.—THROMBUS OF THE VAGINA AND VULVA - 625
SECTION IV.—RELAXATION OF THE PELVIC SYMPHYSES 625
SECTION V.—RUPTURE OF THE BLADDER - - 626
SECTION VI.—RUPTURE OF THE INTESTINES - - 627
SECTION VII.—RUPTURE OF THE DIAPHRAGM - - 627
SECTION VIII.—RUPTURE OF THE ABDOMINAL MUSCLES 627
SECTION IX.—RUPTURE OF THE SACRO-SCIATIC LIGAMENT - 627

BOOK V.—PATHOLOGY OF PARTURITION - 629

CHAPTER I.—VAGINITIS - - - - 629

CHAPTER II.—LEUCORRHŒA - - - 630

CHAPTER III.—METRITIS, METRO-PERITONITIS, AND PARTURIENT FEVER - - - 631
Symptoms - - - - 632
Terminations - - - 633
Pathological Anatomy - - - 635
Causes - - - - 638
Prognosis - - - - 642
Prophylaxis - - - 642
Treatment - - - - 643

CHAPTER IV.—PARTURIENT APOPLEXY—PARTURIENT COLLAPSE - - - - 644
Symptoms - - - 645
Duration, Terminations, and Complications - 648
Prognosis - - - - 649
Causes - - - - 650
Pathological Anatomy - - 653
Nature - - - - 654

Digitized by Google

PAGE

Preventive Treatment - - 662
Curative Treatment - - - 663

CHAPTER V.—POST-PARTUM PARALYSIS - 667

Symptoms - - - - 667
Nature - - - - 668
Treatment - - - - 668

CHAPTER VI.—PARTURIENT ECLAMPSIA - - 669
Symptoms - - - - 670
Nature and Causes - - - 671
Treatment - - - - 671

CHAPTER VII.—EPILEPSIA UTERINA.—MANIA PUERPERALIS - - - - - 675

Symptoms - - - 675
Causes - - - - 676
Treatment - - - - 677

CHAPTER VIII.—PARTURIENT LAMITIS - - 677

Symptoms - - - - 678
Causes - - - - 678
Treatment - - - - 680

CHAPTER IX.—MAMMITIS OR MASTITIS - - 680

Pathological Congestion of the Mammæ - - 681
Causes - - - - - 681
Symptoms - - - - - 682
Treatment - - - - - 683
Inflammation of the Mammæ - - - 683
Symptoms - - - - - 684
Course and Terminations - - - 686
Prognosis - - - - - 691
Complications - - - - 692
Pathological Anatomy - - - - 692
Causes - - - - - 693
Treatment - - - - - 697

CHAPTER X.—AGALACTIA - - - 702

CHAPTER XI.—INJURIES TO THE TEATS - - 702

Fissures - - - - 703
Causes - - - - 703
Symptoms - - - - 703
Treatment - - - - 703
Obliteration of the Galactophorus Sinus - - 704
Symptoms - - - - - 704
Treatment - - - - 704
Fistula of the Teat - - - 705

Digitized by Google

PAGE

BOOK VI.—DISEASES AND ABNORMALITIES OF THE YOUNG ANIMAL - - - - 706

CHAPTER I.—ASPHYXIA OF THE NEW-BORN ANIMAL - - - - - - 706

CHAPTER II.—UMBILICAL HÆMORRHAGE - 707
Treatment - - - - 707

CHAPTER III.—PERSISTENCE OF THE URACHUS 708
Treatment - - - - 708

CHAPTER IV.—UMBILICAL HERNIA - - 709
Causes - - - - 710
Pathological Anatomy - - 711
Symptoms - - - - 711
Prognosis - - - - 712
Diagnosis - - - - 712
Treatment - - - - 712

CHAPTER V.—ŒDEMA OF THE UMBILICUS - - 718
Treatment - - - 719

CHAPTER VI.—INFLAMMATION OF THE UMBILICAL CORD - - - - - 719
Symptoms - - - - 719
Pathological Anatomy - - 720
Causes - - - - 720
Treatment - - - - 722

CHAPTER VII.—ARTHRITIS - - - - 723
Causes - - - - 724
Symptoms - - - - 726
Prognosis - - - - 728
Pathological Anatomy - - - 729
Treatment - - - - 732

CHAPTER VIII.—INDIGESTION - - - 734
Causes - - - - 734
Symptoms - - - - 735
Treatment - - - - 735

CHAPTER IX.—DIARRHŒA - - - - 736
Symptoms - - - - 737
Pathological Anatomy - - - 738
Causes - - - - 739
Prognosis - - - - 741
Treatment - - - 741

Digitized by Google

PAGE

CHAPTER X.—RETENTION OF MECONIUM.—CONSTIPATION - - - - - - 744
Causes - - - - - 744
Symptoms - - - - - 745
Treatment - - - - - 745

CHAPTER XI.—SKIN DRYNESS OF THE NEW-BORN ANIMAL - - - - - - - 745

CHAPTER XII.—IMPERFORATION OF THE ANUS - 746
Symptoms - - - - - 746
Treatment - - - - - 746

CHAPTER XIII.—IMPERFORATION OF THE VULVA AND VAGINA - - - - - 749

CHAPTER XIV.—IMPERFORATION OF THE PREPUCE - - - - - - - 749

CHAPTER XV.—CYANOSIS - - - - 751

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A

TEXT-BOOK OF VETERINARY OBSTETRICS.

INTRODUCTION.

The generation and development of animated creatures is correctly described as an "eminently physiological act," and one which is ordinarily carried out, from beginning to end, as a perfectly natural process, and without any extraneous interference being required for its accomplishment. But, speaking now with regard to the higher orders of viviparous animals, this happy termination of a most important series of phenomena is not always observed; and not unfrequently various causes—internal as well as external—may operate unfavourably in a number of ways, and more or less imperil the perfect development or existence of the young creature, or compromise the health or life of the mother. More especially is this danger likely to occur when the period arrives for the expulsion of the fœtus from the abdomen of its parent.

With the domesticated animals, when these obstacles to development or birth intervene, in order to remove or overcome them, and assist or supplement nature, recourse must be had to artificial means, and the resources of science and art are accordingly invoked.

The term "parturition (from *partus*, to bring forth)" is the act by which the product of conception, when it has reached a certain stage of development, is expelled from the body of the mother; and this act is that which is usually considered to be the most critical in the existence of the young creature, and to most frequently demand attention in such valuable animals as the Mare, Cow, Sheep, Bitch, etc.

The parturition of the domesticated animals, and the abnormal conditions which may precede or follow that event, come within the province of Veterinary Science, and form that division of it named "Obstetrics," which has aptly been designated the "Science of Midwifery," when applied to this division of human surgery. Though it is that which has been selected as the title of this work, and though it is also that which is most frequently employed

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in technical speech by the Veterinarian, yet it is not so correctly applied with respect to animals as it is to mankind; inasmuch as, according to one derivation, it implies to "stand before" (from *obstare*, to stand before), whereas, in aiding in the birth of animals, the operator generally stands behind the creature which is in difficulty; though if the derivation from *obstare*, which also means to "oppose," "hinder progress," "offer obstruction," be accepted, then the term is quite justifiable and expressive. The term "accouchment," so often used when speaking of the birth of a human being, is not always appropriate when employed with reference to this event in animal life, as the larger domesticated creatures are more frequently delivered of their young in a standing than a recumbent position.

Instead of Obstetrics, the terms "Tokology" (τοκος, a birth, from τίκτειν, to bring forth, and λόγος, a discourse), "Tokognosia," "Tokarexeologia," and "Toxarexis"—the practice of Tokology—have been introduced; but they are not sufficiently familiar to warrant their adoption at present, and we have therefore deemed it advisable to retain the better-known word.

The term Obstetrics is not, as has been already shown, limited to the act of parturition—certainly one of the most important, and yet difficult, of all the animal functions—but includes not only rules which should be followed in order to remove or remedy the material obstacles or accidents which may hinder the accomplishment of that act, and likewise embraces everything connected with the health and preservation of the female parent and the young creature while they are in the closest relations with each other before parturition, as well as for some time after their disjunction.

It therefore essentially comprehends a mechanical portion, which consists in devising means for surmounting obstacles that may impede the birth of the young animal; and, scarcely less important, a thorough knowledge of those complex functions and conditions connected with conception, generation, and the parturient state. The Veterinarian, then, to be a successful obstetrician, must possess special and varied information of a highly scientific kind in the domain of anatomy, physiology, hygience, pathology, surgery, etc., and to this must be added the benefits to be derived from experience; for, as has been well remarked by Saint-Cyr, in proportion as his intervention is salutary and beneficial when it is intelligent and opportune, so may it be fatal and disastrous when it is irrational or even inopportune. His knowledge of the subjects above named must be grouped in a certain order, so as to form a doctrinal code, and to constitute a perfect science, having its object, its rules, and its means perfectly defined.

The science of Veterinary Obstetrics, then, demands a perfect acquaintance with the anatomy and physiology of the generative organs and the region in which they are situated in the different animals. The study of the organs concerned in generation is essential to acquiring a knowledge of their several functions, and it is only through understanding these functions that we can appreciate the normal or abnormal course they may pursue, and be prepared

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to interfere successfully when required. And a correct notion of the formation, structure, magnitude, and other features of the space containing these organs—and which has been named the *pelvic cavity*—is absolutely necessary if we wish to understand the act of parturition in the several animals, and be able to render useful service if the delivery of the young is hindered by mechanical obstacles. A knowledge of the physiology of these organs and the phenomena pertaining to generation, the formation of the fœtus, its development, and external conformation, and its connections with the parent, with gestation and the modifications it produces in the organism, as well as the anomalies, accidents, and diseases which may occur during this period, is required, in addition to an acquaintance with that of the final act, which we have named "parturition."

The four chief functions of the generative system may be enumerated as follows: *menstruation* or *œstrum*, *conception*, *gestation*, and *parturition*, all of which are intimately related to and dependent upon each other: a failure or defect in one disturbing their relationship, and leading to sterility or irregularity. Deviations or anomalies in form or structure of the individual organs upon which these functions rely for their proper performance, will also tend to interfere more or less with their accomplishment.

Everything connected with this portion of the subject, which terminates with *natural* or *spontaneous parturition*, has been included under the head of EUTOKIA (from εὖ, well, and τοκος, birth).

The difficulties attending parturition, whether they depend upon the mother or the fœtus, or upon both, with the means for overcoming them, and the accidents which may complicate difficult parturition, come under the general designation of DYSTOKIA (from δύς, difficult, and τοκος, birth).

This arrangement of the various subjects is necessary in a comprehensive treatise on Obstetrics, and it is the one which will be followed in our manual.

The maladies to which the parent is most exposed after parturition, and their medical or surgical treatment, as well as the condition of the young animal after birth and up to the time of weaning, also form a portion of the veterinary obstetrist's study.

Such is the plan of the work: and I have only now to state that the animals more particularly referred to are of the Horse, Ox, Dog, Pig, Sheep, and Goat species; the other creatures which man has domesticated—such as the elephant, camel, rabbit, and cat—coming but rarely within the observation of the veterinary *accoucheur*.

It may be remarked that gestation and parturition in the domesticated animals differ in several important features from these processes in the human species—the differences being mainly due to the dissimilarity in their respective attitudes: the quadrupedal position of the former, and the horizontal direction of the trunk, giving rise to peculiarities which are not observed in our own species, whose vertical and bipedal characteristics again entail wide contrasts in this respect.

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In addition to the knowledge which has been mentioned as necessary for the successful prosecution of Veterinary Obstetrics, other qualifications must be looked upon as essential. The practitioner must be possessed of great tact in manipulation, a certain amount of mechanical skill, much patience, and readiness in device; and for the larger animals, address, a fair amount of physical strength, and the advantage which long arms and fingers confer.

We need not allude to the immense importance of this branch of Veterinary Science from an economical point of view. The highly-increasing value of nearly all the domesticated animals, and the necessity for their multiplication to supply the demands and meet the requirements of a widely-extending and rapidly-progressive civilisation, renders everything connected with their reproduction of great moment and concern; while to assist creatures in the pangs of protracted or impotent labour, and to prevent or abbreviate suffering—in all probability to preserve their life—previous to, during, or subsequent to the occurrence of this physiological act, is no less a duty than it should be a source of satisfaction to the Veterinarian.

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PART FIRST.

EUTOKIA.

THOSE divisions of ANATOMY, PHYSIOLOGY, and PATHOLOGY which are directly related to the processes of *generation*, *gestation*, and *parturition*, as well as that act itself, belong to the section of Obstetrics to which the designation of EUTOKIA (εὖ, *well* or *favourable*, and τόκος, *birth*) has been given. We shall discuss each of these subjects in the order in which they now stand, commencing with the *anatomy of the pelvis*, and of the *external and internal organs of generation*.

BOOK I.

OBSTETRICAL ANATOMY.

THE female organs chiefly concerned in generation and parturition are either entirely passive, or more or less active; according as they are composed of hard or bony, or soft parts. The *pelvis* constitutes the first, while the second are composed of the organs and structures contained within, or more or less directly attached to it. The pelvis also forms the passage which the fœtus has to traverse in order to reach the external world in the act of parturition.

The soft organs are the *vulva*, *vagina*, *uterus*, *ovaries*, and *mammæ*: the latter furnish the young creature with its proper nourishment immediately after birth. Of these soft organs some are *external*, and others are *internal*; the first are the vulva and mammæ, and the second are the vagina, uterus, and ovaries. The vagina and the greater portion of the unimpregnated uterus are contained in the cavity of the pelvis; and the ovaries, as well as the uterus during pregnancy, are lodged in the abdomen.

Our study will commence with an examination of the pelvis in the various domesticated animals, beginning with a description of the bones of which it is composed; then its ligaments; and, lastly, this osseous framework, which is of much importance, will be considered as a whole, and from an obstetrical point of view.

Afterwards the external and internal organs of generation will be described, and their differences noted in the various species.

The equine species will be taken as the type, and the differences in the other species compared with it.

CHAPTER I.

The Pelvis.

THE pelvis is the large, symmetrical, more or less horizontal, conoidal cavity or canal which continues the abdomen posteriorly, and with which it communi-

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cates in front. It is formed of bony and ligamentous walls, and contains, sustains, and protects a portion of the genito-urinary apparatus, as well as the terminal portion of the alimentary canal. It is situated towards the end of the spine, and is supported by the posterior extremities, with which it is connected by joints and muscles. For the hind limbs, as well as for some of the powerful muscles of the trunk, the pelvis constitutes a most important fulcrum or fixed point in various movements. It is one of the two mechanical elements concerned in the act of parturition, and its form varies more or less in different species; though its direction is always rectilinear in the domesticated animals, and not incurvated as in woman.

SECTION I.—BONES OF THE PELVIS.

The pelvis is composed of the three principal bones—the two *coxæ* or *ossa innominata*, and the *sacrum*; and to a certain extent of the *coccygeal* or tail bones. At an early period of life these bones can be subdivided, but after a certain time they become consolidated. Each coxal bone, for instance, is at an early stage of intra-uterine existence composed of cartilage only; subsequently three centres of ossification appear, and these extend until at birth they have coalesced to form three bones which are united by cartilage. In addition to these centres, two complementary nuclei are present, one of which constitutes what is termed the *anterior iliac crest* or *spine* and the *ilio-pectineal line* or *ridge*, and the other the *ischiatic tuberosity*. After birth, the three chief portions of the coxæ are completely ossified, and meet in the acetabulum —where they are closely joined—and at the pubic symphysis, where the coxa of one side meets its fellow of the other. In youth, the different parts of each coxa are very thick, the spongy tissue being abundant, and the compact tissue scanty; as the animal advances in age, the former diminishes and the latter increases in density and thickness, the two layers closely approaching each other.

1. *Os Innominatum.*

The *coxa* or *os innominatum* is a pair bone, there being one on each side; it belongs to the trunk, through its concurrence in the formation of the pelvis, and also to the posterior limb, of which it constitutes the first ray or *haunch*.

It is a flat bone, widely expanded at either extremity, rather constricted in the middle portion, and curved or twisted in two different directions, its anterior part forming an obtuse angle with the posterior; so that while its external surface is inferior in the hinder portion, the anterior looks outwards, or even upwards, in front. At its middle portion it offers a wide and deep articular depression surrounded by a high rim—the *cotyloid cavity* or *acetabulum* —in which the corresponding articular head of the femur is lodged and moves. Above this cavity is a marked, roughened thin ridge—the *supra-cotyloid crest* or *ischiatic spine*, into which the sacro-sciatic ligament is fixed.

Below the cotyloid cavity, and inclining inwards, is a large circular or oval aperture, which is occupied by the obturator muscles, and is named the *foramen ovale* or *sub-pubic opening* or *foramen*.

The two coxæ are united inferiorly on the median line, and posteriorly by an articulation or solid suture—the *symphysis pubis* or *ischio-pubic symphysis*, and form by this junction a kind of V-shaped figure, the widest portion of which is in front, and renders the lateral diameter of the pelvis more extensive before than behind. Above, they articulate with the sacrum.

Each coxa, as has been stated, is composed of three portions which unite at the acetabulum; and although consolidated into one piece, yet they are

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separately described as if distinct. The names of these divisions are *ilium*, *ischium*, and *pubis*.

ILIUM.—The *ilium*, *hip*, or *haunch bone* (*os ilium*), gives its name to the region it occupies. It is the largest of the three bones, as well as being that which is most elevated. In shape it is irregularly triangular and flat, and is directed obliquely downwards, inwards, and backwards, and has two faces, three borders, and three angles. Its *external* or *superior face* or *dorsum* is marked by some muscular imprints, and is curved in its widest part to form a concave space—the *external iliac fossa*—which lodges the gluteal muscles. The *internal* or *inferior* face, or *venter*, offers a smooth external

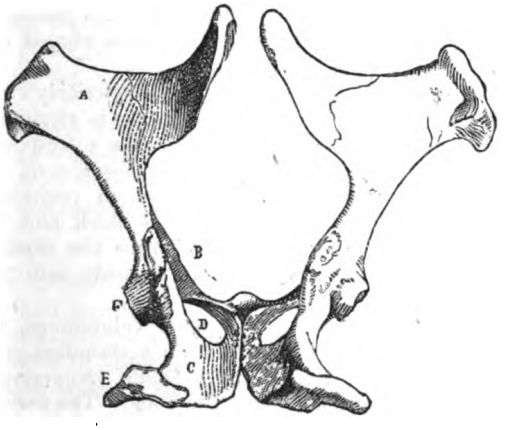

Fig. 1.

PELVIS OF THE MARE.

A, Ilium; B, Pubis; C, Ischium; D, Foramen Ovale; E, Tuberosity of the Ischium; F, Cotyloid Cavity.

portion—the *iliac surface*—into which is implanted the iliac psoas or iliacus muscle; and an internal roughened, ear-shaped, irregularly diarthrodial surface, most apparent from behind—the *auricular facet*—for articulation with the sacrum.

The *anterior border*, or *crest of the ilium*, is slightly concave, and bears a rugged lip for muscular insertion. The *external border* is thick and roughened, and grooved for the passage of bloodvessels; inferiorly it has three nutrient foramina. The *internal border* is thin and concave, especially in its posterior part, where it constitutes the *great sciatic notch*; it affords attachment to the sacro-sciatic ligament. The *spine* or *ridge* of the same name partly belongs to it.

The *external angle*, *antero-superior spinous process*, or *point of the hip*, is a wide, thick, and flattened portion, bearing four tuberosities affording attachments to muscles. The *internal* or *antero-internal angle* or *supero-posterior spinous process*, is a rough tuberosity curving upwards and backwards to form an angle with the corresponding portion of the opposite ilium—the *summit of the croup*. The *inferior*, *posterior* or *cotyloid angle* (concurring in the formation of the acetabulum) is very large and prismatic in shape. Posteriorly, it offers a concave articular surface (acetabular), and above this cavity is the *supra-cotyloid ridge* or *crista ilii*: an elongated eminence passing backwards,

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sharp at its summit, smooth internally, and roughened externally, which is continuous anteriorly with the inner border of the bone, divides its iliac and articular surfaces, becomes lost on the anterior margin of the pubis, and laterally limits the anterior circumference or border of the pelvic cavity—the *linea ilio-pectinea*.

The ilium is therefore united to or in contact with the sacrum superiorly, and inferiorly and posteriorly with the two bones next to be described.

ISCHIUM.—The *ischium* (*os sedentarum* of man) is next in size to the ilium, and the most posterior of the three bones. In form it is flat and irregularly quadrilateral; and is composed of a thick solid portion—the *body*, and a narrow part—the *neck*. It has *two faces*, *four borders*, and *four angles*.

The *upper face* is smooth and nearly flat, and forms part of the floor of the pelvic cavity. The *lower* or *external* face bears some rugged imprints, particularly towards the symphysis.

The *anterior border* is thick and concave, and posteriorly circumscribes the obturator or oval foramen. The *posterior border* is straight and directed obliquely forward and inward, composing, with the corresponding border of the opposite bone, a large notch—the *pubic* or *ischiatic arch*. Throughout its extent it exhibits a roughened depressed lip which projects on the lower face—this is the *spine*. The *external border* is thick and concave, affords attachment to the sacro-sciatic ligament, and forms the small sciatic notch. The *internal border* joins its homologue of the opposite side to complete the ischio-pubic symphysis.

The *external* or *cotyloid angle* is the most voluminous, and shows: an excavated diarthrodial facet, forming part of the acetabulum; and the posterior extremity of the crista ilii, limited by a small transverse fissure which separates it from the external border of the bone. The *antero-internal angle* joins the posterior angle of the pubis. The postero-external angle is the most important in an obstetrical point of view, as it constitutes what is commonly named the point of the hip; with the corresponding bone of the opposite side, it forms the ischiatic tuberosity (*tuber ischii*): a thick, up-curved prismatic mass which is continued by a prominent ridge elongated from before to behind, the thin margin of which is curved outwards and downwards. The distance between the external tuberosities of the two ischii gives the width of the ischial arch, and allows an estimate to be formed of the transverse diameter, of the posterior opening of the pelvis. The postero-internal angle constitutes, with that of the other ischium, the summit of the triangular notch or space named the "ischial" or "pubic arch" in some species.

PUBIS.—The *pubis* (*pecten* or *share-bone*) is the smaller of the three, and is situated between the ilium and ischium. It is irregularly triangular, and is described as having *two faces*, *three borders*, and *three angles*.

The *upper face* is concave and smooth, and concurs in forming the floor of the pelvis. In the pelvis of many Mares it has a more or less marked depression, apparently produced at the expense of the anterior portion of the bone, which is thin; while in the Horse it is generally much thicker at this part, and instead of a depression the surface may be plane or even convex. The *lower face* is rough and traversed on its whole length by a wide groove which reaches the bottom of the acetabulum, and lodges the pubio-femoral ligament and a very large vein.

The *anterior border* is thin and uneven, and is curved like the arc of a circle; it concurs in forming the anterior circumference of the pelvis. The

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posterior border is thick and concave, and in front circumscribes the *oval, sub-pubic*, or *obturator foramen*. It is channeled, near the acetabulum, by a fissure that passes obliquely downwards and inwards. The *internal border* joins that of the opposite pubic bone in the middle line, to form the anterior portion of the ischio-pubic or pelvic symphysis.

The *external* or *cotyloid angle* is the thickest, and constitutes the largest portion of the roughened depressed surface at the bottom of the acetabulum. The *internal angle* is united to the corresponding angle of the opposite bone. The *posterior angle* is fused at an early period with the antero-internal angle of the ischium, to form the inner boundary of the obturator foramen.

The pubis does not alter much in form with age, but retains its convex shape, while the part around the acetabulum is of considerable thickness: a circumstance which tends to diminish the pelvic cavity to a notable degree. During life, the pubic bones gradually lose their spongy tissue, and to such an extent that in old age it has almost disappeared, and the parts are translucid.

It may also be well to note that the compact tissue is most abundant in the vicinity of the acetabulum, that cavity being the point where the impulsive efforts communicated to the body by the posterior limbs are concentrated; at this part, also, ossification commences.

2. *Sacrum.*

The *sacrum* (*os basilare* of man) may be said to terminate the vertebral spine posteriorly, and results from the fusion of five vertebræ into a single, voluminous, pyramidal or triangular mass. It encloses the pelvic cavity above, and articulates in front with the last lumbar vertebra, behind with the first coccygeal or tail-bone, and laterally with the ossa innominata. It has an *upper* and a *lower face*, *two lateral borders*, a *base* or *anterior extremity*, *summit* or *posterior extremity*, and *central canal*.

The *upper face* shows the *supra-spinous processes* or *supra-sacral spine* (though the processes only meet at their base). On each side of this spine is a channel in which are four openings—the *supra-sacral foramina*, which communicate with others on the inferior face. The *lower face* is smooth, and slightly concave from before to behind; this is the roof of the pelvic cavity, and shows traces of its being composed of five bones, as well as offers four foramina for the passage of the sub-sacral nerves.

The *two lateral borders* are thick and concave, and posteriorly show a rugged lip. In front is an irregular oblique surface for articulation with the ossa innominata; this is divided into two portions, the lower of which, slightly uneven and diarthrodial, is the *auricular surface;* the upper is for the insertion of the sacro-sciatic ligament.

The *base*, or *anterior extremity*, is articulated by a slightly oval and convex surface with the last lumbar vertebra, and forms with the spine a salient angle looking down towards the abdominal cavity, named the *sacro-vertebral angle*. Laterally, it is united with the two coxæ, between which it is fixed like a horizontal wedge. In front it shows the opening of the spinal canal.

The *summit* or *posterior extremity* likewise offers the opening of the spinal canal, and a surface for articulation with the first tail-bone. The *central canal* is a continuation of that in the other vertebræ, for the passage of the spinal cord. In this bone, however, instead of being circular, it is triangular, and diminishes in width posteriorly.

The position of the sacrum is more or less inclined downwards from before to behind, according to the breed of the Mare.

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3. *Coccyx.*

The *coccygeal* or tail-bones are a series of small, cylindrical, or irregularly prismatic pieces, from fifteen to eighteen in number, behind the sacrum, the first three of which may be said to belong to the pelvis. They form the base of the tail.

Differences in the Bones of the Pelvis of other Animals.

In all the domesticated animals, the coxæ are nearly horizontal, and the ilium has a vertical direction.

Cow.

In the pelvis of the Cow, the space between the coxæ is no greater before than behind; they are not so solid nor voluminous, comparatively, as in the Mare. This is more particularly the case with the *ilium*, the iliac con-

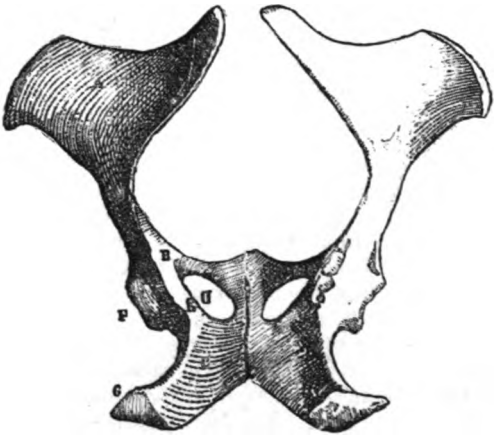

Fig. 2.

Pelvis of the Cow.

A, Ilium; B, Pubis; C, Ischium; D, Foramen Ovale; E, Ischiatic Spine; F, Cotyloid Cavity; G, Tuberosity of the Ischium.

cavity of which is not so wide. It is more vertical than in the Mare. The *ischium*, though thinner than in the Mare, has a much wider surface, and is more curved from before to behind and from side to side; while the ischiatic spine or supra-cotyloid crest, is very prominent and thin. Three tuberosities are observed on the postero-external angle.

The *pubis* is wide and thin; it has no channel on its inferior face, and the upper face is very concave. The foramen ovale is large, and its margin thin. The symphysis is ossified earlier than in the Mare.

The *sacrum* is longer, and more curved and voluminous than that of the Mare. The lateral borders are sharp and directed downwards. It is composed of the same number of vertebræ as in the horse. The articular surfaces for union with the coxæ approach the vertical direction.

The *coccygeal bones* are stronger and more tuberous: they are from sixteen to twenty in number.

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The pelvis of the Cow is therefore more developed than that of the Mare, and has more extensive bony walls. We shall see that it also differs in its form and direction, and that this has a notable influence in the mechanism of parturition.

Sheep and Goat.

In the Sheep and Goat, the bones of the pelvis greatly resemble those of the Cow. The *ischium*, instead of being curved in a longitudinal direction, however, is nearly rectilinear, and the external iliac fossa is divided into two portions by a small longitudinal crest. The pelvis, on the whole, is more horizontal and longer.

Bitch and Cat.

In the Bitch and Cat, the lateral diameter of the pelvis is greater before than behind; the *ilium* is almost vertical, and its external face is much de-

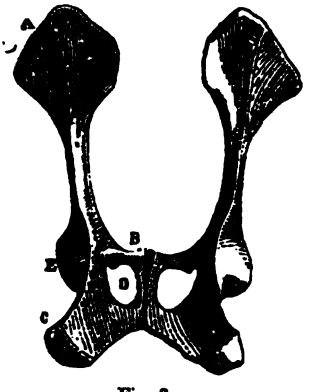

Fig. 8.

PELVIS OF THE SHEEP.

A, Ilium; B, Pubis; C, Ischium; D, Foramen Ovale; E, Cotyloid Cavity.

pressed. The space which forms the pubic arch only occupies the inner moiety of the posterior border of the *ischium*, which is very broad; between the arch and the ischial tuberosity is a roughened lip, which is directed downwards. The *sacrum* is somewhat quadrangular and composed of three bones, which are anchylosed at an early age, and the lateral surfaces for articulation with the ilium are turned outwards and almost vertical. There are only three vertebral foramina. The coccygeal bones are strong and tuberous, and the first five or six are as perfect as the true vertebral bones.

Pig.

The pelvis of the Pig resembles that of the Sheep. The crest of the *ilium* is convex, and there is no external protuberance on the symphysis pubis. The *pubis* is narrow; and the *ischium*, instead of a crest, has a tuberous prominence. The *sacrum* is formed by four vertebræ, which do not become fully consolidated for a long time, and it is sometimes difficult to discover where the sacrum ends and the coccyx begins. The spinous processes are absent; and the neural arch being deficient on each side, the spinal canal is open above. There is nothing particular to note in the *coccygeal* bones.

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SECTION II.—ARTICULATIONS OF THE PELVIS.

The bones of the pelvis are united by articulations and ligaments, as well as fibrous bands, which are complementary. A knowledge of these is of some importance to the obstetrist. The articulations are five in number: (1) the *sacro-lumbar*, (2, 3) the two *sacro-iliac*, (4) the *ischio-pubic symphysis*, and (5) the *sacro-coccygeal* articulations. The *ilio-sacral* and *sacro-sciatic* ligament complete the subject of this section.

1. *Sacro-lumbar Articulation.*

The *sacro-lumbar articulation* is formed between the anterior face or base of the sacrum, and the last lumbar vertebra; the union takes place by five articular surfaces and thick fibro-cartilages, and numerous strong ligaments bind the two bones closely and very firmly together, so as to allow only a minimum amount of movement between them. It would appear that these bones, though so limited in their movements on each, yet are never anchylosed through old age, nor yet by accident, even if all the other vertebræ in this region should happen to be consolidated.

This arrangement is particularly remarkable in the Mare, on which it confers great strength and solidity. It is not present in the Cow; consequently that animal is liable to a kind of incomplete luxation, which may at times become an obstacle in parturition.

We have already alluded to the salient angle formed by the union of the last lumbar vertebra with the sacrum (*sacro-vertebral angle*), and which looks downward into the abdominal cavity.*

2, 3. *Sacro-iliac Articulations.*

The *sacro-iliac articulation* of each side establishes the union of the posterior limbs with the spine, and is formed by the sacrum and ossa ilii; it

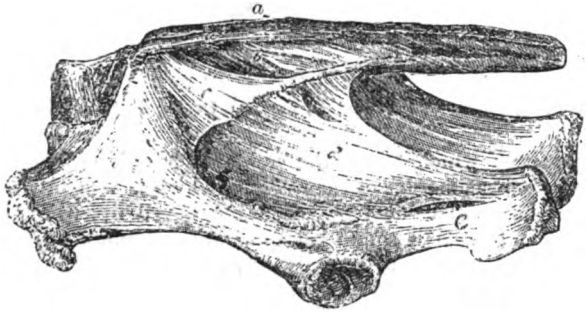

Fig. 4.

LATERAL LIGAMENTS OF THE SACRUM AND PELVIS.

A, Superior Sacro-iliac Ligament; B, Sacral Ligament; C, Lateral Sacro-iliac Ligament; D, Sacro-sciatic Ligament; E, Small Ischiatic Notch; F, Great Ischiatic Notch.

belongs to the arthrodial class of joints. The two surfaces which come into opposition have been already described, and it only now remains to point out that the sacrum is fixed between the antero-superior extremities of the ossa ilii,

* This angle is much more marked in woman, and is immediately at the entrance to the pelvis; for these reasons it is frequently a cause of difficult parturition in her, while, from its less development and distance from the pelvis, it offers no obstacle in animals.

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like a horizontal wedge or the keystone of an arch inverted: the transverse diameter is greater below than above—the pressure it has to resist being from below. The oblong roughened surfaces on the sacrum and ilium have a layer of cartilage between them to diminish shock and facilitate movement, which is further promoted by each articulation being provided with a synovial membrane, though the amount of synovia secreted is very trifling. The union of the bones at this part is strengthened by three powerful ligaments: the *sacro-iliac*—superior and inferior, and the *sacro-iliac proper*. There is also the *sacro-sciatic* or *sacro-ischiatic* to be noticed hereafter. Though the movements of this articulation are very limited, but still useful in locomotion and parturition, yet it rarely, if ever, becomes consolidated. The diarthrodial union between the bones appears to be chiefly, if not exclusively, intended to obviate the fractures which must occur had they been united in a more solid manner; while the two articulations being the centre towards which all the impulsive efforts of the posterior extremities converge, a great degree of mobility would not be compatible with their solidity.

4. *Ischio-pubic Symphysis.*

The *symphysis pubis*, as it is sometimes termed, is the amphiarthrosis formed by the union, inferiorly, of the two ossa pubis and ischia. The articulation is consolidated by means of a layer of fibro-cartilage between the margin of these bones, and which becomes ossified more or less completely and rapidly according to species; and by a layer of white ligamentous fibres —short and compact—which pass across above and below, the latter being

Fig. 5.

LIGAMENTS OF THE LUMBAR VERTEBRÆ, SACRUM AND PELVIS, SEEN FROM BELOW.

A, Intertransverse Ligament of the Lumbar Vertebræ; B, Capsular Ligament of the Spinous Process of the fifth and sixth Lumbar Vertebræ; C, Capsular Ligament of the Sacrum; D, Inferior Sacro-iliac Ligament; E, Obturator Ligament; F, Transverse Ligament of the Ischio-pubic Symphysis.

the strongest. The movements of this articulation are very limited, and depend solely upon the elasticity of the interosseous cartilage; they are abolished when ossification occurs. This happens in the majority of horses before adult age; though sometimes the posterior portion is cartilaginous after this period.

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5. *Sacro-coccygeal Articulations.*

These resemble those of the vertebræ in general: there being a thick disc of fibro-cartilage placed between each tail-bone, the first of which is joined to the posterior extremity of the sacrum. Their solidity is further assured by a common fibrous sheath which completely envelops them, but without interfering with their mobility. This mobility greatly favours parturition; but it must be noted that not infrequently the first coccygeal bone is completely ossified with the sacrum, and as this necessarily limits the elevation of the tail, it diminishes the supero-inferior diameter of the posterior opening of the pelvis, and may in this way prove an obstacle to the expulsion of the fœtus.

Differences in the Pelvic Articulations of other Animals.

In all the domesticated animals other than the Equine species, the sacrum is joined to the last lumbar vertebra by *three* diarthrodial surfaces only: the *head* of the body and two *transverse processes;* these latter on the vertebræ not being in immediate contact with the base of the sacrum, an interosseous ligament unites them. Therefore it is that, in the *Cow* more particularly, there is greater mobility in the sacro-lumbar articulation, and the possibility of a greater increase in the supero-inferior diameter of the pelvis when it is subjected to such eccentric pressure as the passage of the fœtus would produce.

Cow.

In the Cow the *ischio-pubic symphysis* is longer than in the Mare, not rectilinear, and much curved downwards in the middle; across this concavity on the floor of the pelvis, the fœtus passes during parturition. In the Cow ossification of the symphysis is less complete, and does not take place until much later than in the Mare, though it may in some instances be found entirely accomplished in old animals. Ossification, according to Saint-Cyr, commences in the Cow at the ischial arch, and proceeds forwards, while in the Mare it begins at the pubis and extends backwards. The same authority remarks that this symphysis in the Cow has often a salient crest projecting into the pelvic cavity, and which, if it does not offer a very considerable obstacle to the passage of the fœtus, may nevertheless greatly fatigue the obstetrist when his hand is engaged between it and the young creature, during the straining of the mother.

Sheep and Goat.

In these animals the *ischio-pubic symphysis* is rectilinear; the interposed cartilage is not ossified until very late in life, and almost never in those which have had many young. The same remarks are applicable to this symphysis in the Pig.

Bitch and Cat.

The symphysis in the Bitch and Cat scarcely ever ossifies; so that these animals, when advanced in age, still have a notable degree of mobility in this region, and the diameter of the pelvic cavity may be proportionately increased.

Sacro-sciatic Ligament.

The *sacro-sciatic ligament* (Fig. 4, *d*) transforms the pelvic cavity into a complete canal by filling up the space on the side of the pelvis, between

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the sacrum and coxæ. It is a wide membranous expansion, composed of white fibrous tissue—the fibres crossing each other in different directions, and serves rather to enclose this portion of the pelvic space than to maintain the solidity of the sacro-iliac articulation. It is irregularly quadrilateral; its *superior border* being rectilinear, and attached along the rough crest on the side of the sacrum, as well as to the first two or three coccygeal bones. Its *anterior border* is irregular, and not well defined, but it is inserted above into the base of the sacrum, and below into the inner border of the ilium, circumscribing in its middle the opening which has been named the great ischiatic notch, through which the gluteal vessels and nerves, as well as the sciatic nerves, pass, and to the compression of which against the bones of the pelvis during pregnancy may be due cramp of the posterior limbs, or even more or less persistent paralysis; the *inferior border* is attached to the spine of the ischium, as well as to the ischiatic tuberosity, and between these insertions, and immediately behind the cotyloid cavity, it forms the small ischiatic notch, the opening through which the obturator internus muscle passes; while the *posterior border*, not well limited, completes the posterior circumference of the pelvic cavity, and divides into two layers, between which lies the semimembranosus muscle, and above it is mixed up with the enveloping sheath of the tail muscles and bones.

The *inner face* of this wide ligament is covered by peritoneum to the extent of one-third in front; and behind it is in direct relation with various organs contained in the pelvic cavity, by means of an abundant loose connective tissue. Its *external face* is traversed by the sciatic nerves and covered by muscles.

SECTION III.—THE PELVIS AND ITS CAVITY.

Having now studied the individual pieces which compose the pelvis, as well as the manner in which they are united, it remains to consider this region in its entirety, and with regard to its general conformation, dimensions, axes, and other important features. This study is of much moment in an obstetrical point of view, and for the full comprehension of the mechanism of parturition. We will first notice the pelvis of the Mare, and proceed to compare it with the other domesticated animals.

Mare.

Considered in a general manner, the pelvis of the Mare represents a slightly cone-shaped, bony cavity at the posterior part of the trunk, completing or continuing the abdominal cavity; the base of this conical excavation, intersected obliquely downwards and backwards, is anterior: its axis forming, with that of the abdomen, a very wide angle, the sinus of which is inferior. The summit or narrowest part of the cavity is posterior. With regard to conformation, it offers, for convenience of description, an *external* and *internal surface*, and *two openings*.

External Surface.—This surface may be considered as consisting of *four regions, planes, or faces*. The *superior region* or *croup* is the narrowest, and is slightly oblique downwards and backwards: the degree of obliquity varying not only in different breeds, but also in different animals of the same breed and species. In the Mare it is indicated by the droop or slope of the croup, which is generally greater than that of the Cow. It is more conspicuous in common than in well-bred horses, in which the croup is almost horizontal, and the tail nearly on a level with its highest point. The width of this

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region also varies not only with the height and volume of the a but also according to breed: the draught or coarse-bred horse h croup than the thorough-bred one. This region is constricted f behind, and shows, on the middle line, the spinous processes o and the first coccygeal vertebræ; and on each side the channel open the four sacral foramina.

The *inferior region* is nearly horizontal, and is slightly conv by the pubic and ischial bones, it offers in the middle the symp on each side the subpubic channels, and the obturator foramen, an the cotyloid cavities through which the pelvis rests on the poste

The lateral regions are more extensive than the others; they downwards and inwards, and are wider before than behind. C observed the crest of the ilium and the two anterior iliac spines, t iliac fossa, the great sciatic notch, the spine of the ischium, the s notch, and the tuberosity of the ischium.

The internal surface, as has been already mentioned, is form bony and partly of ligamentous walls, and circumscribes the pel which is a continuation of that of the abdomen, and with which it cates by a wide osseous circle—the *anterior opening* or *inlet* of the transverse section of this canal shows that it is oval shaped, the l tion being towards the pubis, and the narrowest to the sacrum.

The internal surface is more regular than the external, but it divided into two portions like the human pelvis, the inner aspect not being excavated to form an anterior cavity. It may, howeve sidered as having *four concave planes*, an *anterior opening* or *in posterior opening* or *outlet*.

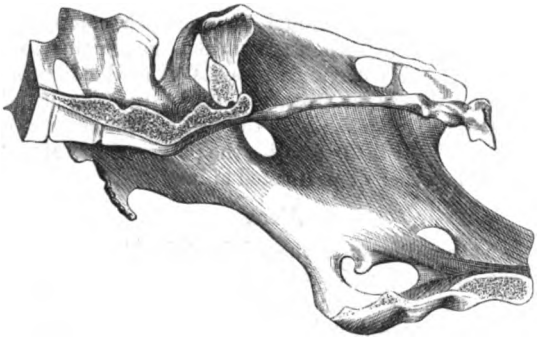

Fig. 6.

LONGITUDINAL SECTION OF THE MARE'S PELVIS.

The *superior*, *sacral*, or *rectal plane*, or *roof of the pelvis* is formed lower face of the sacrum, and is in contact with the rectum, subsacral and sympathetic nerves. It is slightly concave longitudinally.

The *inferior plane*, or *floor of the pelvis*, is constituted by the upper of the pubic bones and ischia. It is rectilinear from before to behin concave from side to side. The symphysis pubis occupies the median it is salient, and varies in length according to the size of the animal, usually about six or seven inches. In front, at the pubis, is a depr more or less marked, in which the previously-emptied bladder may be l during the passage of the fœtus. On each side is the obturator for

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which is partly closed by the internal obturator muscles, and through which the obturator vessels and nerves make their exit.

The two *lateral planes* are formed by the inner surface and spine of the ischia, and in great part by the sacro-sciatic ligaments; the sciatic notches belong to them, and they are traversed from before to behind by the obturator vessels and nerves, and pierced by the gluteal and ischio-muscular vessels and nerves, the internal pudic, and the great and small sciatic nerves. As has been stated, it is the compression of these nerves by the uterus and its contents which cause the cramps pregnant animals experience towards the termination of gestation. The lateral planes are readily dilatable during parturition.

Anterior Opening or Inlet.—This, which may also be designated the *brim, anterior circumference,* or *abdominal opening of the pelvis,* is nearly circular, or slightly oval, the widest part corresponding to the symphysis pubis. It is a little obliquely inclined downwards and backwards, and is limited above by the anterior border of the sacrum and its articulations with the lumbar vertebra and ilia; below, by the anterior border of the pubic bones; and on each side, by the ileo-pectineal crest and a portion of the inner aspect of the ilia. Owing to this circumference being entirely bony, and to the solidity of the articulations between the different bones, the inlet of the pelvis cannot be dilated to any appreciable degree, even under the most violent efforts, and supposing the sacro-iliac and ischio-pubic ligaments to become softened and relaxed before pregnancy—a change which must be indeed rare in the Mare.

It is by the *inlet* that the fœtus enters the pelvic cavity, and a knowledge of its dimensions is therefore of much moment to the obstetrist. These dimensions are ascertained by taking the diameter of the opening at several points, but two diameters are generally recognised: a *supero-inferior* and a *transverse.* The *supero-inferior,* or *sacro-pubic diameter,* is the width between the sacro-vertebral angle and the symphysis pubis. This is generally the largest diameter, though exceptions are met with now and again; it is the diameter which should receive the widest part of the fœtus when it enters the pelvis. It varies with the size of the Mare, but is usually between eight and ten inches. The *transverse diameter* is measured from one ileo-pectineal crest to another, and is generally less than the supero-inferior, though sometimes it may be equal, or even greater. It is from seven to nine inches.

Posterior Opening or Outlet. — This is also sometimes named the *perineal circumference,* or *recto-urethral opening;* it includes in its contour the rectum and vagina, and is related to the vulva and anus, which are external to it. Owing to the horizontal direction of the Mare's pelvis, this outlet is limited above by the apex of the sacrum and the base of the coccyx; below, by the ischial arch formed by the junction of the two ischia; and, laterally, by the upper face of the ischia and posterior border of the sacro-sciatic ligaments. The opening is oval.

The *diameters* are ordinarily much less than those of the inlet—perhaps one-fifth; but this circumstance has rarely any influence in parturition, as the opening is very dilatable, owing to the relaxation that takes place in the sacro-sciatic ligaments during the later months of pregnancy, and the great mobility of the sacrum and coccyx, which may allow the supero-inferior diameter to be increased considerably.

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The Cavity of the Pelvis.

The *cavity of the pelvis* is the space between the inlet and outlet. In the human female, it lodges nearly the whole of the uterus, and in the early days of pregnancy the fœtus also. This is not the case with the domesticated animals, owing to their different attitude, until the act of parturition carries the progeny there.* With its two openings, the pelvic cavity is capable of more or less increase in capacity in every direction, through relaxation of the pubic and sacro-iliac articulations and sacro-sciatic ligaments. The yielding of the latter is very noticeable in the larger animals immediately before parturition, as well as the elevation of the coccyx by the body of the fœtus in its passage outwards. It is also a fact of daily observation that the pelvis permanently widens in animals which have had young frequently; this accounts for the peculiar rocking gait they exhibit in progression, which, in some of the domesticated creatures at least, is no doubt due to persistent relaxation in the articulations above mentioned.

It may be again observed that the anterior margin of the floor of this cavity is nearly straight, and its posterior border is deeply cut into by the ischial arch, while the floor itself often offers some diversities. For instance, it may be convex in front and concave behind, or *vice versâ*, the concavity being separated from the convexity by a transverse ridge, which may also be represented by a series of small conical eminences; or the floor may be a smooth plane sloping upwards from before to behind, with a kind of raised border surrounding the anterior contour of the obturator foramen.

Differences in other Animals.

Cow.

In the Cow, the pelvis is longer than in the Mare, and less vertical; the ischio-pubic symphysis is also longer, and instead of being straight is very curved; so that the floor of the pelvis is concave in every direction. The ischial arch is more deeply cut at the symphysis, and the posterior borders of the ischia join at an acute angle or V-shape, the opening being supero-posterior. The external border of these bones is higher, and the sciatic spine or supra-cotyloid crest is thinner and more elevated. So that, altogether, the bony parietes of the Cow's pelvis are more extensive, comparatively speaking, than the Mare's. The sacral surface is more concave, and the sacro-sciatic ligaments wider, though shorter.

The pelvic cavity of the Cow is also less wide, when compared with its height. The diameters of the *inlet*—which is more oblique than in the Mare—are very unequal; the difference between the sacro-pubic and the transverse, according to Saint-Cyr, being one-third (nine and six inches). The dimensions of the *outlet* are more equal, and are about those of the transverse diameter of the inlet. It therefore results that the pelvis of the Cow is more cylindrical and less conical than that of the Mare; but this feature does not render parturition any easier, for though the outlet is a little larger than in the latter animal, yet this advantage is counterbalanced by the length of the pelvic cavity, the greater extent of its bony walls, and the very marked curvature of the symphysis. So it is that, while it rarely happens that the foal experiences any difficulty in passing through the pelvis, once it has fairly cleared

* Girard thought that, in the Bitch, one of the young in the body of the uterus might occupy this space; but Raiuard could not verify this, all his examinations of pregnant animals which had died before bringing forth their young proved the body of the uterus to be quite empty.

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the inlet, it is not at all infrequent for the calf to become fixed in the pelvis, and to remain there unless removed by artificial means.

It is also to be noted that the floor of the pelvic cavity is on a much

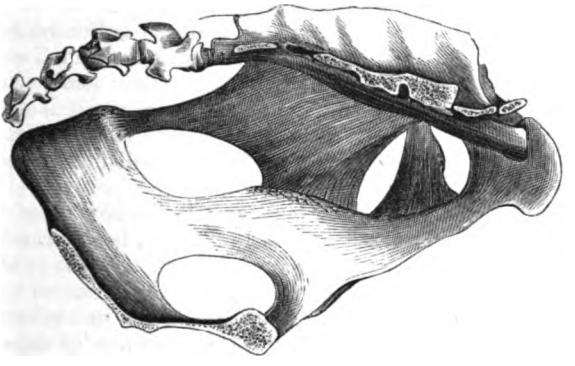

Fig. 7.

LONGITUDINAL SECTION OF THE COW'S PELVIS.

higher level than that of the abdomen; so that a kind of steep step has to be ascended by the calf before it can enter this passage; consequently, it often remains fixed against this upper level at the inlet.

Sheep and Goat.

With these animals the pelvis does not differ to any notable extent—except, of course, in size—from that of the Cow. The *symphysis* is nearly rectilinear in its direction, and its ossification occurs at a very much later period than in the Cow or Mare; this allows the diameters of the pelvic cavity to be increased during parturition, and accounts for the rarity of difficult births in the Sheep and Goat.

Pig.

The general conformation of the pelvis in the Pig is not unlike that of ruminants, except that the *sacro-vertebral angle* or "promontory of the sacrum" is more salient, the canal longer, the *plane* of its *anterior circumference* more oblique, and the direction of the *ischio-pubic symphysis* perfectly rectilinear. The *pelvic cavity* is very large in proportion to the size of the young at birth; therefore it is that accidents are very rare during the act of parturition.

Bitch and Cat.

In these creatures the *sacro-vertebral angle* is still more marked, and diminishes the inlet of the pelvis to a notable extent; the direction of the symphysis is rectilinear, and the general outline of the pelvic cavity is nearly cylindrical. The *ischium*, immediately above the obturator foramen, rises abruptly to almost a right angle; this is the narrowest part of the canal, and here it is that the passage of the fœtus is obstructed in small females which have been impregnated by large dogs. It must be remarked, however, that the late, and often incomplete, ossification of the symphysis allows a certain amount of dilatation of the canal, and renders the passage of a comparatively large fœtus possible.

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SECTION IV.—CAPACITY OF THE PELVIS OR PELVIMETRY.

We have already casually alluded to the capacity of the pelvic cavity in the larger domesticated animals, and to its diameters; and it will be inferred that these must vary with the different sizes existing in the Mare, Cow, Pig, and Bitch, though in others which are generally of uniform volume—as the Sheep, Goat, Ass, and Cat—the pelvis does not offer much diversity. In this respect the latter species resemble mankind, in the female of which a difference in size does not make much difference in pelvic dimensions: half an inch probably covering the variations. But in the Mare or Cow, if we compare a small with a large animal, this difference in diameters may extend to nearly two or three inches.

The subject of *pelvimetry* is very important to the *accoucheur* of the human species, as the female pelvis is particularly liable to be deformed or defective in its proportions. It is not nearly of so much moment to the veterinary obstetrist, as the head of young animals generally experiences no difficulty in passing through the pelvic cavity, except sometimes in the carnivora or in cases of hydrocephalus; and also because the less value of animal life leads

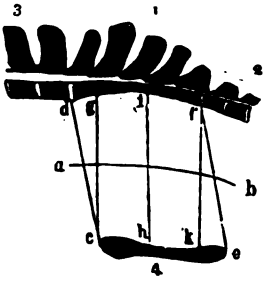

Fig. 8.

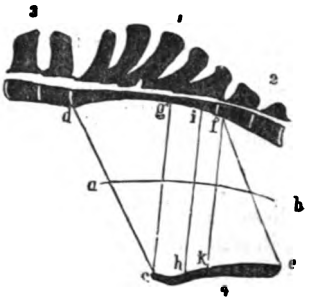

Fig. 9.

MEDIUM SECTION OF THE PELVIS OF THE HORSE (Fig. 8) AND MARE (Fig. 9).

1, Sacrum; 2, Two first Coccygeal Vertebræ; 3. Two last Lumbar Vertebræ; 4. Ischio-pubic Symphysis: *a*, *b*, Axis of the Pelvic Cavity; *c*, *d*, Supero-inferior Diameter of the Inlet; *e*, *f*, Supero-inferior Diameter of the Outlet; *c*, *g*, Vertical Diameter of the Inlet; *i*, *h*, Vertical Diameter of the Mid-pelvis; *k*, *f*, Vertical Diameter of the Outlet.

the operator, when in difficulties, to sacrifice the fœtus rather than endanger the existence or value of the mother.

It is, nevertheless, useful to know the diameters of the pelvis of different animals, in order not only to fully understand the mechanism of parturition, but also with regard to the indications it may furnish in many cases of dystokia.

We have shown that the pelvic canal in the large and small herbivors is somewhat of an oval shape, the narrowest part being above, and the widest below; and that in the carnivora it is somewhat cylindrical. This difference in outline is conformable with the shape of the fœtal thorax, which in the former is deeper than it is wide, particularly at the period of birth. During parturition, the fœtus of herbivorous animals is so placed, generally, that the withers and shoulders are towards the roof or superior plane of the pelvis; while the sternum and anterior limbs, which form a larger mass, rest on the floor or inferior plane. The passage of the thorax of the fœtus in these animals is, apart from other causes, the chief difficulty in parturition. In

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the human female, it is the head of the fœtus. The thorax of the carnivorous fœtus is not nearly so deep, comparatively; it is therefore better adapted to pass through the nearly circular canal.

The term *diameter*, in obstetrics, is employed to designate the distance between certain points in the pelvic cavity, and by which, practically, we may compare the capacity of that space with the volume of the largest part of the fœtus that has to pass through it.

In the human species, four diameters are usually given for the inlet and outlet of the pelvis, and some veterinarians also furnish these measurements. They are: (1) a *vertical* or *sacro-pubic*, from the sacro-lumbar articulation to the ischio-pubic symphysis; (2) a *transverse*, passing between the most concave portion of the ilia; and (3, 4) two oblique, from the ilio-pectineal line of one side to the sacro-articulation of the other.

Chauveau, in his measurements of the Horse's pelvis, gives these four measurements for the *inlet* (mean vertical, 8¼ inches; transverse, 8½ inches; oblique, 8½ inches); but for the *outlet* only the vertical and transverse (mean vertical, 6½ inches; transverse, 7 inches). Rainard, for the *inlet*, gives three diameters: (1) a *supero-inferior*, from the sacro-lumbar articulation to the anterior border of the ischio-pubic symphysis; (2) a *transverse*, from the inner surface of the cotyloid angle on one side to the same point on the opposite side; (3) a *vertical*, from the middle of the sacrum to the ischio-pubic symphysis in the larger animals, and to the sacro-coccygeal articulation in the smaller. But for the *outlet*, he has only two diameters: (1) a *vertical*, from the posterior part of the ischio-pubic symphysis perpendicularly to the sacrum or its prolongation, the coccyx; (2) a *transverse*, from one ischial tuberosity to the other.

The most important diameter is certainly that between the middle of the sacrum and the ischio-pubic symphysis in the larger animals, and the sacro-coccygeal articulation and ischio-pubic symphysis in the smaller creatures. For it must be remembered that the pelvis of the domesticated animals offers a very inclined plane, and if, placing it in the position of the human pelvis, we draw a horizontal line from the symphysis towards the spine, it will be found that this line does not touch the sacro-lumbar articulation, but the middle of the sacrum in the large, and the sacro-coccygeal articulation in the smaller animals. This point is the narrowest through which the fœtus has to pass, and in which it will meet most resistance; for while the top of its shoulder is towards the sacrum, its chest is resting on the pubis. So that it may be said that this is really the first solid resistance to be overcome in parturition.

Considering the variations in size in some species, it is not possible to give general measurements for all; but we may follow the example of Rainard, and give average diameters for different-sized animals. These are tabulated as follows; the last column, headed "Symphysis," gives the length of the floor of the pelvis.

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Species.	Height.	OPENINGS.			
		Inlet.		Outlet.	
		Diameters.	Measures.	Diameters.	Measures.
Horse	15 hands	Supero-inferior Vertical Transverse	9½ in. 9¼ in. 9¼ to 9½ in.	Vertical Transverse	6 7/10 in. 7½ in.
	14 hands	Supero-inferior Vertical Transverse	9¼ to 9½ in. 8 7/10 in. 8 7/10 to 9 in.	Vertical Transverse	6 to 6⅛ in. 6 7/10 to 7 in.
	12 hands	Supero-inferior Vertical Transverse	8 3/10 to 8 7/10 in. 7 9/10 in. 7½ to 7 9/10 in.	Vertical Transverse	4 3/10 to 4 7/10 in. 5 1/10 to 5½ in.
Ass	Middle size	Supero-inferior Vertical Transverse	7 9/10 in. 5 9/10 in. 4 7/10 in.	Vertical Transverse	4 7/10 in. 3 9/10 in.
Cow	Middle size	Supero-inferior Vertical Transverse	8 1/10 in. 7 9/10 in. 7 1/10 in.	Vertical Transverse	7 9/10 in. 7½ in.
Sheep	Ordinary size	Supero-inferior Vertical Transverse	4 7/10 in. 2 4/10 in. 3 1/10 in.	Vertical Transverse	3½ in. (varies) 2 4/10 in.
Goat	Middle size	Supero-inferior Vertical Transverse	4¾ in. 2¾ in. 3½ in.	Vertical Transverse	2¾ in. 2¾ in.
Pig	27½ in. Length from snout to tail, 54¾ in.	Supero-inferior Vertical Transverse	4 in. 3 3/10 in. 3 3/10 in.	Vertical Transverse	2 4/10 in. 4 in.
Dog	Large	Supero-inferior Vertical Transverse	2⅛ in. 2 in. 2 in.	Vertical Transverse	2⅛ in. 2 in.
	Small	Supero-inferior Vertical Transverse	2 in. 1 6/10 in. 1 3/10 to 1 6/10 in.	Vertical Transverse	2 in. 1 6/10 in.
Cat	Ordinary size	Supero-inferior Vertical Transverse	2⅛ in. 2 in. 1 3/10 in.	Vertical Transverse	2⅛ in. 1 6/10 in.

Some veterinarians, however, who have made this subject an special study, only specify two diameters, the *supero-inferior* or *sacro* and the *transverse* or *bis-iliac*. The following are the measuremen nished by four of these authorities :

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MARE.

Diameters.	Baumeister and Rueff.	Carsten-Harms.	Arloing.	Saint-Cyr.	Remarks.
INLET.	Inches.	Inches.	Inches.	Inches.	
Supero-inferior Diameter	9 to 10	9½	9	8¾*	*The average of 28 measurements of Mares varying from 13½ to 16·1 hands in height.
Transverse Diameter	11 to 12½	9⅛	9⅛	8 1/10†	†The average of 25 measurements as above.
OUTLET.					
Supero-inferior Diameter	9 to 10	7½	7	–	
Transverse Diameter	9	6½	7½	–	

COW.

Diameters.	Baumeister and Rueff.	Carsten-Harms.	Arloing.	Saint-Cyr.	Remarks.
INLET.	Inches.	Inches.	Inches.	Inches.	
Supero-inferior Diameter	9 to 9½	8⅛	–	10½*	*The average of 5 measurements of Cows of different sizes and breeds.
Transverse Diameter	6⅞ to 7⅞	7	–	7¼†	†Ibid.
OUTLET.					
Supero-inferior Diameter	9	–	–	–	
Transverse Diameter	9	6½	–	–	

It will be seen from these measurements that no great practical utility can be derived from pelvimetry, so far as averages are concerned; as the diameters of the pelvis must vary with the size and other peculiarities in an animal's conformation; so that we may have considerable differences. In the Mare alone, Saint-Cyr found a difference in the supero-inferior diameter of 2½ inches, and in the transverse diameter of 2½ inches.

With the view of determining the capacity of the pelvis of the living animal at a given time, *external pelvimetry* has been resorted to. This consists in ascertaining the distance between the angles of the haunch on each side, that between the two ischial tuberosities, and that between the coxo-femoral articulation and the highest part of the croup. To find out the first, a piece of wood is placed vertically against each haunch, and the space between them is measured; for the second, a tape measures the distance between the ischial tuberosities; and for the third, a piece of wood is placed horizontally across the summit of the croup, while another is laid in the same direction along the trochanter and the ischial tuberosity, the vertical distance between the two pieces giving the measurement. Taking into consideration the shape of the pelvis, it has been calculated that the transverse diameter of the outlet should be nearly equal to one-fourth of the distance between the haunches added to that between the ischial tuberosities; while the supero-inferior diameter of the outlet is supposed to be equal to three-fourths of the vertical distance separating the coxo-femoral articulation from the summit of the croup. These measurements only give the supposed diameters of the outlet; but Arloing, who has devoted much attention to pelvimetry in animals, points out the means whereby the diameters of the inlet may be attained.*

* The calculations and measurements are given in Saint-Cyr's "Traité d'Obstétrique Vétérinaire," p. 21.

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This method is, however, so complicated and unsatisfactory, that it requires further elaboration before it can be recognised as useful and reliable.

Saint-Cyr has endeavoured, in a somewhat similar manner, to arrive at some criterion as to the diameters of the inlet of the pelvis—which is, after all, the most important in parturition—in the living animal. For the *sacro-pubic* diameter, he has taken for guide the *height of the Mare*, supposing that the two should be nearly always constant in their relations; and to fix this relation, the diameter was measured in twenty-eight animals of various sizes. Taking the average of these twenty-eight measurements, and dividing it by the average of the heights, the quotient obtained gave the *co-efficient*, by which it was necessary to multiply the height of any Mare to find the sacro-pubic diameter of its pelvis. For the *transverse* or *bis-iliac diameter*, the width of the croup measured between the external angles of the ilia (taken by a tape), or between the coxo-femoral articulations (taken by a large pair of compasses), was adopted. But it was soon discovered that one and the same co-efficient would not serve for all cases; as in common-bred lymphatic horses, the bones are large, the soft textures abundant, and the pelvic cavity less than would be surmised from the width of the croup; while in those which are well-bred, the bones are smaller and denser, the soft tissues more condensed, and the pelvic space large, comparatively speaking. So that the co-efficient had to be less in the latter than the former.

The results of Saint-Cyr's measurements and calculations are fairly reliable; and the external measurements do not differ very widely in their indications from those furnished by actual measurement of the pelvic cavity.

This method, however, even when accepted as perfectly reliable, only furnishes us with the dimensions of the well-formed normal pelvis; it gives no information with regard to internal deformities, for the estimation of which it is necessary to have recourse to "direct exploration," either through the vagina or rectum, by which we may not only discover the character, but also, approximately, the extent of the deformity. "Internal pelvimetry" may also be resorted to in this way; and in practice, after a little experience, it will be found sufficiently simple and trustworthy to be of much service. This internal measurement of the pelvic cavity cannot be satisfactorily made by means of compasses or other instruments in the living animal, as in woman; but the hand may be successfully employed in ascertaining the different diameters by spans—as the thumb from the index, to the middle finger, and even widely spread to the little finger: the distance between these being previously known, we may readily ascertain with sufficient accuracy the diametrical capacity of the pelvis.

The *axis of the pelvis* is the term given to an imaginary line drawn through the canal of the region from before to behind, at an equal distance from the circumference. In the human pelvis there are *two* axes—those of the upper and lower outlet, and a knowledge of them is of much importance in midwifery; they form an obtuse angle with each other, and when combined with the inclination of the pelvis, we observe that the direction the human fœtus must take is somewhat tortuous or curved. In animals there is only one axis, and that is almost rectilinear: the sacro-vertebral angle or "promontory" being comparatively little developed, and the sacrum passing almost in a direct line from the vertebral column. This rectilinear direction of the pelvic axis is greatly to the advantage of animals during parturition; so that the *axis* of this canal requires but little notice from the veterinary obstetrist, except when the passage is very constricted.

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Differences in the Pelvis according to Sex.

There is a considerable difference in the size and conformation of the *male* and *female pelvis* in the domesticated animals, the latter being larger in every sense, but more particularly in its transverse diameter. These differences

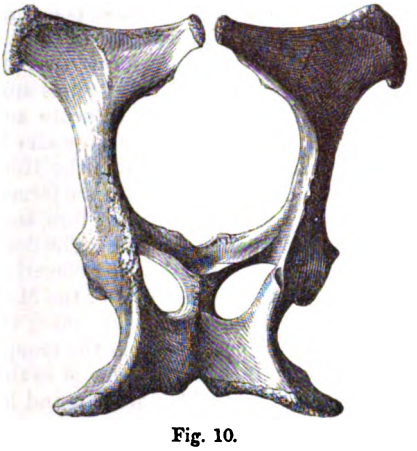

Fig. 10.

Pelvis of Mare.

have only been carefully studied in the equine species, but they exist in a somewhat similar degree in the pelvis of other species.

In the Mare, in addition to the pelvis being wider than that of the

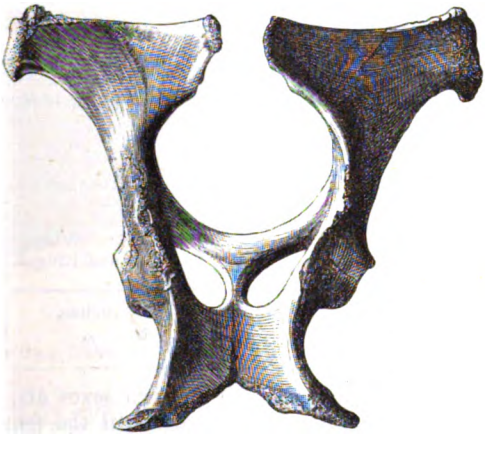

Fig. 11.

Pelvis of Horse.

Horse, the inlet is much larger, the ileo-pectineal crests are further apart, and the distance between the lower face of the sacrum and the anterior border of the pubis is much greater, the ilia and pubis being broader and more concave. On the upper surface of the Mare's pelvis, the sacro-sciatic notches are very deep; the inner border of the ilium forms a very concave

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line, and the ischiatic spines are widely separated. The floor of the pelvis is wide, and the bones composing it have a tendency to assume the same horizontal direction. In the Horse, the ischiatic border does not describe a regular curve; it is composed of two nearly straight portions, which unite where the neck of the ilium begins. The supra-cotyloid crests are not much separated, and are turned outwards, and the two portions of the floor of the canal are directed very obliquely downwards and inwards. In the Mare, the ischial arch is wider than in the Horse, and forms a regular curve in joining the tuber ischii; while in the Horse, these tuberosities are not nearly so wide apart, and the ischial arch forms a somewhat acute angle, the margin of which is nearly straight. The obturator foramina are also large and almost circular in the Mare, while they are small and oval in the Horse; the ischio-pubic symphysis is farther from the cotyloid cavities in the former than in the latter.

The sacrum is also broader and longer in the Mare, and in the majority of animals it is more concave from before to behind. The first coccygeal vertebræ are larger and more flexible, and carried at a greater elevation than in the Horse.

This difference of conformation in the pelvis of the Mare is adapted to the passage of the fœtus through the canal, and it causes the animal to appear lower in the forehand than the Horse, in which the croup is not so high. It is rare to find a Mare which has the croup so square as the Stallion, the hind quarter of which is almost equal in depth, breadth, and length.

The width of the pelvis of the Mare, as before observed, produces a rocking motion during progression, and this is all the more marked as the animal has been frequently bred from; for the same reason the speed is not so great, and Mares which have had several foals are not well adapted for the circus.

The differences between the pelvis of the Mare and Horse are sometimes noticeable at birth; but they are generally most apparent when the adult period has been reached, and the body has acquired its definitive form. In both sexes, the supero-inferior diameter of the inlet is greater than the transverse in early life.

Some idea of the difference in the dimensions of the pelvic cavity in the Mare and Horse, may be obtained from the following measurements of two animals about the same in size:

	Vertical Diameters.		Horizontal Diameters.	
	Between the Sacrum and Pubis.	Between the Sacrum and Ischium.	Between the Pectineal Ridges.	Between the Ischial Spines.
Mare . .	9 inches.	$6\frac{9}{10}$ inches.	$9\frac{1}{4}$ inches.	$7\frac{1}{2}$ inches.
Horse . .	8 ,,	$6\frac{2}{10}$,,	8 ,,	$6\frac{1}{2}$,,

The differences between the pelvis of the two sexes are, perhaps, not so marked in the smaller domesticated animals until the female has brought forth young several times.

CHAPTER II.

Female Generative Organs.

The *genital organs* of the female are much more complicated than those of the male, from the far greater share they take in the process of generation.

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They are usually described according to their situation—as *external* and *internal;* or from their function—as *copulative* and *formative.*

Proceeding from the exterior to the interior, these organs may be enumerated as follows: the *vulva* and *mammæ* or *mammary glands*, the *vagina, uterus, Fallopian tubes*, and *ovaries.* We will describe these in the above-mentioned order, taking the Mare again as the type, and indicating the differences in the other domesticated animals.

SECTION I.—EXTERNAL GENERATIVE ORGANS.

The Vulva.

The external orifice of the generative organs, the *vulva*, appears as a vertically elongated slit, situated beneath the anus, between the perineum and ischial arch and the posterior margin of the two hind quarters. It presents two thick *lips* or *labia*, and *two commissures*, externally; and internally, it forms a cavity which is confounded with that of the vagina, and extends beyond the *meatus urinarius.* The limit between the vulva and vagina is not perceptible in the adult, but is always conspicuous in the fœtus.

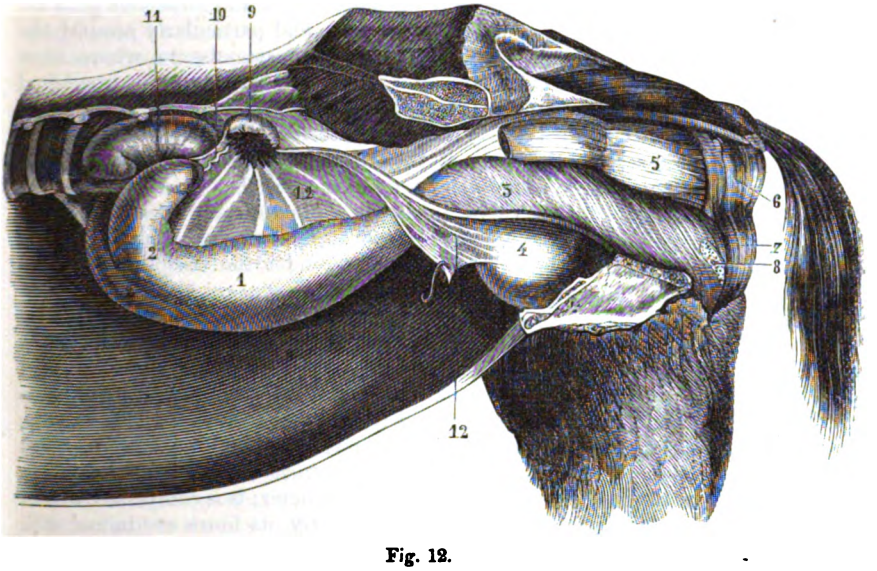

Fig. 12.

THE GENERATIVE ORGANS OF THE MARE *in situ.*

1, Body of the Uterus; 2, 2, Cornua of the Uterus; 3, Vagina; 4, Bladder; 5, Rectum; 6, Sphincter of the Anus; 7, Constrictor Muscle of the Vulva; 8, Bulb of the Vagina; 9, Ovary and Fimbriated Body; 10, Fallopian Tube; 11, Kidney; 12, 12, Broad Ligament.

The *lips* (*labiæ vulvæ*) are usually in contact, and they, with the opening which separates them (*rimæ vulvæ*), vary in size according to age and condition. They are slightly prominent and thick, being composed of firm, flexible, and elastic tissue, which is covered with a fine, smooth, unctuous skin destitute of hair, but rich in pigment in the majority of animals. Internally, they are covered by mucous membrane, a continuation of that lining the vagina, and which is constantly lubricated by a greasy mucus possessing

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a special odour, according to the species of animal; on the free
the vulva, this membrane and the skin meet.*

At the junction of the labia above and below are the *commissur*
this junction. The *superior commissure* is situated close to the a
which it is only separated by a narrow space—the *perineum.* I
angular, and corresponds to the *fourchette* in woman. The *inferior c*
is obtuse, rounded and more voluminous; it lodges the *clitoris,* a
ated immediately above the *raphé.* The *cavity* of the vulva some
tains the *hymen,* which separates it from the vagina at a certain
life; it also contains the *meatus urinarius* and its *valve,* as we
clitoris.

The *structure* of the vulva consists of the *mucous membrane* lini
terior, and which is covered by pavement epithelium; an erecticle
connected with it, named the *vaginal bulb;* two *constrictor mus*
muscular ligaments, fasciæ, etc. The *mucous membrane* is continu
that of the vagina and bladder; it is usually of a pink or rosy tin
the period of œstrum it has a bright-red hue. Near the margin of
it frequently shows black pigmentary patches, which give it a marbl
ance. It is provided with numerous mucous follicles and sebaceou
the latter are chiefly found near the free border, and particularly a
clitoris and the space between it and the inferior commissure, wl
aggregate to form several small sinuses. This membrane is also
with great numbers of papillæ. The *vaginal bulb* is wholly con
erectile tissue with wide spaces, which constitutes the *plexus*
This tissue passes from the base of the clitoris to the sides of t
where it terminates in a round salient or ring-like lobe. Covere
posterior constrictor of the vulva, this bulb communicates inferic
the cavernous veins, and the afflux of blood into its meshes dimin
capacity of the vulva; thereby concurring to render the co-aptatic
copulatory organs more complete during coition.

The *muscles* of the vulva are constrictors—an anterior and poster
are voluntary. The *anterior constrictor* is analogous to Wilson's n
the male, and is formed of arciform fibres which surround the s
lower part of the vagina at its commencement, its extremities be
tinued by means of aponeurotic fasciculi as far as the sides of the
where they disappear. Posteriorly, this muscle is confounded with
to be described. The *posterior constrictor* (*constrictor cunni*) is anal
the constrictor of the vagina, and forms a real sphincter; it is comprise
the substance of the lips of the vulva. Superiorly, its fibres are mi
those of the anal sphincter, and are attached to the sacrum by mear
suspensory ligaments. Inferiorly, the most forward are fixed to the
the clitoris, and the middle are prolonged to both sides of the thigh
they are inserted into the skin. Inwardly, this muscle is in relati
the vaginal bulb and the mucous membrane of the vulva. Its exte
is separated from the skin of the lips by a very vascular cellulo-fibro
which is capable of contracting, and in the midst of which are obser
isolated red muscular fasciculi—given off from the principal muscle.

The *posterior constrictor* of the vulva is very powerful, and i
during copulation, contracts the vagina and compresses the penis; b
of its attachment to the clitoris, when it acts it erects that organ. I

* The two lips correspond to the *labia majora* of woman; there are no *labia*
animals.

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which are rutting, the movements of the clitoris are frequent, and it then projects outwards; this is particularly observed after micturition, and in this case the fibres of the constrictor attached to the clitoris elevate the latter by acting on its base, those fibres which are inserted into the skin of the thighs depressing the inferior commissure of the vulva, which exposes that very sensitive erectile body lodged in this space.

The *muscular ligaments* of the vulva in reality correspond to the *ligamentum suspensorium* of the penis in the male; they arise from the lower face of the sacrum, and descend as flat bands until they unite beneath the rectum, when they pass in several fasciculi into the lips of this part, and mix with the fibres of the posterior constrictor. They are composed of non-striated fibres. The *skin*, as already mentioned, is very fine and thin, black in the great majority of Mares, has scarcely any hair, and is very unctuous, odorous, and elastic. The bulk of the vulva is made up of subcutaneous *fascia*, to which the skin closely adheres; as well as adipose and connective tissue, and bloodvessels and nerves.

The *clitoris* is an exact, but miniature, counterpart of the corpus cavernosum of the male penis. From two to three inches in length, this body commences by two roots attached to the ischial arch, and which are covered by a rudimentary ischio-cavernous muscle. After being fixed to the ischial symphysis, by means of a suspensory ligament similar to that of the male, it passes backward and projects into the vulvular cavity, towards the inferior commissure, in which it is lodged. Its free extremity is enveloped in a mucous cap—the *preputium*, which is plicated in different directions; and towards the centre of the tubercle is a follicular cavity containing sebaceous matter, and which represents that in the extremity of the male penis. In every respect the clitoris resembles that organ, having a fibrous framework, erectile tissue, cavernous vessels or "plexus retiformis," and a pair of muscles —the *erectores clitoridis*. This organ is more especially the seat of venereal excitation during coition. It is present in all the domesticated female animals, and is frequently erected while they are in "heat," as well as in the act of copulation. It is abundantly supplied with nerves, which endow it with most acute sensibility, and the mucous membrane enveloping it is usually dark coloured or marbled, though in white horses it may be colourless.

The *meatus urinarius* is the orifice of the urethra, which is a very short canal in the female. This canal passes immediately beneath the anterior sphincter muscle of the vulva, and after a brief course (about two inches) in the textures composing the floor of the vagina, opens into the vulvular cavity at from four to six inches from its exterior. This opening, which is on the floor of the cavity, is covered by a wide duplicature of the lining membrane that acts as, and is designated, the *valve* of the meatus or vagina (*valvula vaginæ*); its free border is turned backwards, and it would thus appear to direct the urine towards the external opening of the vulva, and prevent its reflux into the vagina. Rainard states that this valve is more extensive as the vagina is narrow, and consequently as the female is young; it has been compared to the hymen of woman. Brugnone was of opinion that it was attached to the upper surface of the vagina by a small cord, and that it was the rupture of this by the forced entrance of the penis which caused the slight flow of blood from the vulva observed in Mares put to the horse for the first time. This is no doubt the *hymen* to which he refers—a membrane found generally in the filly, though not often in the Mare, but which, when present, separates the vulvular from the vaginal cavity. This membrane forms a circular par-

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tition, fixed by its circumference to the vulvo-vaginal walls along
valve of the meatus, and is perforated by one or more openings, w
sometimes very small. Not infrequently old brood Mares show in
ation pediculated appendices, which are the *débris* of this mucous di

The urethral orifice of the Mare is wider than that of the Horse,
readily admit a large catheter. In passing that instrument, it is we
member that the urethral canal curves forward and downward, and
valve must be raised either with the point of the instrument or th
before the passage can be entered.

In ordinary circumstances the vulva is retracted, and with Mare
have foaled several times, the labia usually exhibit as many wrinkles
as parturition has been frequent.

During œstrum, but especially towards the termination of pregna
labia become tumified and soft, the inferior commissure descends,
vular opening is enlarged, and from it is discharged a quantity of t
stringy mucus.

Differences in the Vulva of other Animals.

Cow.

In the Cow the lips of the vulva are larger, softer, and thicker,
inferior commissure, angular and prolonged into a curved peak, is fu
with a tuft of hair. The *meatus urinarius* is disposed as in the Ma
in the interior of the urethral canal, fixed to its lower aspect, is a valv
free margin is directed backwards; this valve surmounts a *cul-de-sa*
the third of an inch. This valve of the canal must be remembered i
ing the catheter into the bladder. About an inch within the entranc
vulva, and embedded within the substance of its lips, are the *vulvo-
glands* (*glandula vaginæ, S. Duverneyi, S. Bartholini*)—large almond-
bodies whose widest extremity is directed upwards, and the narro
situated near the clitoro-ischiatic muscle, is prolonged into their ex
canals. These are conglomerate glands, whose excretory ducts unite t
a kind of sinus that at last opens into the vulva, about the third of
from the labia. The *clitoris* is longer, and more tortuous and slender t
the Mare, and contains a dense fibrous nucleus of a spiral shape.
vaginal bulb is much more extensive than in the Mare, and is contin
the clitoris, where it is covered by a thick muscle, which descends fr
extremity of the sacrum, and terminates on the clitoris. The same c
occur in the vulva of the Cow as in the Mare during œstrum, and t
the termination of pregnancy; the mucous secretion of the vagina is
abundant in the Cow, however, and persists longer.

Sheep.

In the Sheep which has not copulated, a filamentary band, stre
across the constriction between the urogenital canal and the vagina,
sents the *hymen*. The *Malpighian canals* open into that passage ne
constriction, and the crura of the clitoris are enfolded by erector mu
while the clitoris itself protrudes immediately within the peak of the

Pig.

In the Pig, the *urethra* opens between two longitudinal ridges; b
surface of these and other similar prominences in the urogenital pass
interrupted by numerous fine, wavy, oblique furrows. There is no v

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valve, as in the other animals. The *clitoris* is comparatively small, and the inferior commissure of the vulva is still more acute and pointed than in the Cow and ruminants in general. Towards the *meatus* are numerous fine points—the openings of glands analogous to the prostates; and on the sides of that orifice are two small fossæ surrounded by a raised border.

Bitch and Cat.

In the Bitch, the *vulva* is triangular, and the *inferior commissure* acute. The *clitoris* is a small tubercle, and the *urethra* opens between a little transverse fold and the triangular flattened clitoris; beyond which is a second transverse cresentic fold with its concavity opposite that of the preceding. In the Cat, a small cartilage or bone exists in the *clitoris;* this is not found in any other of the domesticated animals.

The PERINEUM is the name given to the space betwen the superior commissure of the vulva and the lower margin of the anus. Its length varies in different species, and in different-sized animals of the same species, but it is shorter in creatures which have produced young than those which have not. It is composed of various tissues: externally is the smooth, fine, and very elastic skin, with the vertical prominent line passing down its middle—the "raphe;" beneath this are connective and adipose tissue, and fascia, with various muscles, bloodvessels, and nerves.

The internal limits of the *vulva* are defined by the constriction or *bulb*, which forms a marked prominence in early life, but tends to disappear in relaxed folds after the animal has brought forth young several times. The dimensions of this aperture are rather adapted for the passage of the fœtus than the penis; though its narrowness is sometimes an obstacle to the delivery of a primipara. The limbs, body, or head of the fœtus are at times arrested at the superior or perineal commissure, which they so distend as to threaten rupture of that part. In emaciated animals, and particularly Mares, the vulva is deeply retracted above the ischia, and consequently disposes them to be injured in this region during coitus, by the accidental introduction of the male organ into the anus, the mechanical action of which damages, and may even rupture, the rectum. Rainard alludes to several occurrences of this kind, which terminated in the death of the Mares.

SECTION II.—THE MAMMÆ.

The *mammæ*, or *udders*, may be said to be appendices to the external organs of generation. They are the glands destined to secrete the fluid—milk—which is to nourish the young animal for some time after birth. In early life they are rudimentary, but become developed with age, and attain their full dimensions when the female is capable of reproduction; and especially at the full period of gestation, when their function is about to be carried on actively. After parturition their largest development is reached, and when the young creature has completed its term of sucking, they lose their activity and diminish considerably in size. In the Mare they are two in number, placed beside each other in the inguinal region, about nine inches in front of the vulva, where they take the place of the scrotum in the male. Externally, they appear as two hemispherical masses separated by a shallow furrow; each has in its centre, on each side of the mesian line, a conical, slightly flattened prolongation named the *teat* or *nipple*, which is perforated

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by several orifices from which the milk escapes, and by which the young creature obtains that fluid by suction. The two glands are retained in their position by the fine thin skin covering them, and which, destitute of hair at the extremity of the teats, though elsewhere provided with a soft short down, is smooth, pliable, and unctuous from the presence of sebiparous follicles. At the base of the teat are a number of small tubercles, which correspond to the areola of the nipple in woman ; these are the glands.

The mammæ are also attached to the abdominal tunic by means of several wide, short, but elastic bands, which bear some analogy to the suspensory ligaments of the prepuce in the male.

In STRUCTURE each udder offers an *envelope of yellow elastic fibrous tissue, glandular tissue*, the *sinuses* or *galactophorous reservoirs*, and the *lactiferous ducts*, with *excretory canals* or *milk ducts*.

The *elastic envelope*, joined at the mesian line with that of the opposite udder, is strengthened by wide bands detached from the *tunica abdominalis* ; it furnishes from its internal face numerous prolongations which, crossing each other in the mass of the gland, form septa or partitions that divide it into distinct lobes and lobules, which are in this way somewhat independent of each other ; so that one or more may be diseased or deranged in function, without the others being involved. Externally, this envelope is closely adherent to the skin, through the medium of a thin but dense layer of connective tissue.

The *glandular tissue* offers the same arrangement as other conglomerate glands, and is composed of *acini* or cæcal vesicles clustered, like grapes on their stalk, around the *tubuli lactiferi*, or ultimate terminations of the excretory ducts. These, commencing by *cul-de-sac* extremities, open into one another to form dilatations (*ampullæ*), and finally converge into a number of principal canals, which end in the galactophorous sinuses (*sinus lactei*). The acini of the lobules, as well as the ducts, are lined by polyhedral epithelium ; this becomes spherical and infiltrated with fat during lactation.

The *galactophorous sinuses* or *reservoirs* are situated slightly above the base of the teat, and are generally two in number—one in front, the other behind ; though there are sometimes three, and even four. They nearly always communicate with each other, and are prolonged into the teat by a corresponding number of terminal and independent excretory canals, whose orifices are always very narrow, and are seen at the free extremity of that body, which is obtuse and rounded. Collectively, these excretory canals are much wider at the base of the teat than at the extremity ; the orifices are usually behind each other, and are about a line apart ; and the canals and orifices are lined by a fine membrane which is continuous with the skin, the latter being closely adherent at this part.

The length of the *teats* varies with use ; the elastic or dartoid tissues surrounding them, composed of non-striated circular and longitudinal fibres, renders them capable of a kind of erection, under the influence of stimuli. The extremity of the teat is well provided with this tissue, which acts as a sphincter, and prevents the passive flow of the milk.

Connective tissue, bloodvessels, nerves, and absorbents complete the organisation of the mammæ. The *arteries* are given off from the external pudic ; the *veins* are of two orders—deep, which follow the arteries, and superficial. The nerves are derived from the renal or mesenteric plexus.

As before mentioned, the mammæ undergo remarkable modifications at the age of puberty and the termination of gestation ; and these changes have reference not only to their volume and secretion, but also to their minute

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structure. In the young or virgin Mare, they are hard, and can scarcely be perceived; and their dimensions are not much increased in those which have had only one or two foals, though the teats are usually larger than before; but when they have borne several foals, the mammæ continue somewhat enlarged and pendulous. When gestation is not going on, the glandular *culde-sucs* are contracted and wasted-looking; the lining membrane is shrivelled on itself, and covered with only a polygonal epithelium. At the termination of gestation, however, the mammæ assume the functions of the uterus to a certain extent; the vesicles become enlarged, and new ones are developed; the epithelium presents a sphericle shape, is charged with fat granules, and fills the acini; the entire gland has become progressively, but greatly increased in size, and instead of being soft to the touch, it now feels firm. Shortly before parturition the secretion of milk commences, and soon after that event the glandular cavities become fully distended, and assume their maximum dimensions, which are maintained, with slight variations, during the entire period of lactation. When this period is terminated, the secretion gradually ceases, and the gland again assumes its quiescent condition, and nearly its ordinary size.*

Differences in other Animals.

Cow.

In the Cow the mammæ are also inguinal, as in the Mare, and each lateral mass, although enveloped in a single fibrous capsule, is made up of two quite distinct glands—or "quarters," as they are commonly termed—and which can be seen, or felt as limited by a slight depression. Each gland has its corresponding teat, much more developed than that of the Mare; so that this animal really possesses four mammæ and four teats. The glands are compacted into a roundish mass, which is more or less pendulous when they are in active function; in the centre of each, and at the base of the teat, there is a single large galactophorous sinus, which is the general confluent of all the lactiferous ducts, and which opens externally through the teat by a single excretory canal. This canal is widest at its commencement, and narrow at its termination at the end of the teat. The walls of the latter are very thick, elastic, and retractile. Not infrequently, there are found behind the four teats one or two rudimentary teats, which are generally imperforate; though in very rare instances they have been observed to be perforate and to yield milk.

The teats of the Cow are generally from two and a half to three and a half inches in length, and, as has been said, this length varies according as the animal has reared a large or small number of calves. The two anterior are generally the longest, and the corresponding quarters furnish more milk than the others. The dartoid tissue around the free extremity of the teat, acting as a sphincter, prevents the passive escape of the milk from the orifices of the excretory ducts; for if a small canula, scarcely larger than one of these ducts, be inserted slightly beyond the orifice, the secretion immediately flows. And when the end of a teat has been incised, or when the elastic tissue of this part has been divided in the performance of some operation, there is no longer any obstacle to the emission of the milk.

The arteries that supply the mammæ of the Cow with blood are derived from the external pudic. The branch of each side, on reaching the lateral glands, divides into two principal trunks, one of which goes to a corresponding

* In the male we find rudimentary teats, which are concealed within the prominent annular fold of integument towards the extremity of the prepuce. They are not always present, however; though they are so in the Ass, which has them largely developed.

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quarter: that which is destined for the posterior gland bends at a right an backwards, the branch for the anterior quarter—the largest—descending p pendicularly, to become subdivided into numerous ramuscules and termi twigs. The veins and nerves are derived as in the Mare.

In the Cow, the secretion of milk can be excited and maintained by regu "milking," the only suspension occurring before the birth of another calf

Sheep and Goat

In the Sheep and Goat there are only two mammæ, as in the Mare Ass, though they are formed on the same plan as in the Cow. They are inguinal, somewhat hemispherical and voluminous, particularly in the G and each is provided with a single conical, well-detached teat. The la animal has sometimes, in addition, two posterior rudimentary teats, and galactophorous sinus of each ordinary teat in this animal is very large, walls of the teat being thin; it is capable of containing, in some instan nearly three ounces of milk.

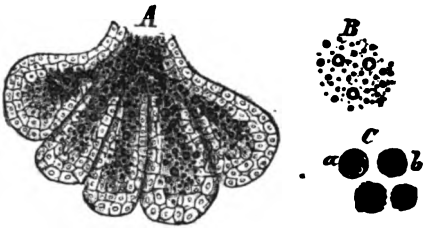

Fig. 13.

A, Lobule of the Mammæ filled with Milk; B, Milk Globules; C, Colostrum: *a*, Cell with a visible Nucleus; *b*, Cells from which the Nucleus has disappeared.

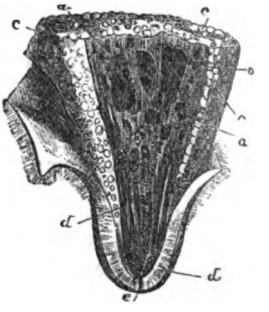

Fig. 14.

SECTION OF THE COW'S TEA

a a, Principal Lactiferous Ducts; *cc*, Lactiferous Sinus; *d*, Acini: Elastic or Dartoid Tissue of Teat; *e*, Orifice of the Teat.

Pig.

In the P[illegible]ig the mammæ are ten or twelve in number, disposed by pai two parallel [illegible]ows extending from the inguinal region to beneath the thc and distinguis[illegible]hed as *inguinal*, *abdominal*, and *thoracic* mammæ. They not, as in the la[illegible]rger animals, any sinuses; the lactiferous canals of each joining directly t[illegible] form a variable number of excretory ducts, which ope the free extremity [illegible] of the teat by from five to ten orifices. The limits of gland is denoted, ex[illegible]ternally, by a slight vertical depression, and a tri convexity correspondi[illegible]g to the teat.

The mammæ of this animal are scarcely perceptible while they ar active; but during lactati[illegible]n they form two series of well-developed emine divided on the middle line by a wide and deep furrow.

Bitch.

In the Bitch there are eight [illegible]o ten mammæ, arranged as in the Pig. V the latter number is present they [illegible] are disposed on each side as two pec two abdominal, and one inguinal.

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The secretion of milk is a special function of the mammary glands, and takes place in the cæcal vesicles of the lobules. The fluid is conveyed from these into the lactiferous ducts and sinuses, where it is stored until a certain period: this retention after a time distending the glands very much, and putting the elastic envelope greatly on the stretch; while the teat also increases in size, length, and firmness. When this distention becomes inordinate, it causes the animal uneasiness and pain; and if not relieved by natural or artificial means, it may occasion mischief. The pressure of the envelope on the contained fluid in the majority of cases overcomes the resistance of the sphincter at the end of the teat, and relief is in this way afforded.

CHAPTER III.

Internal Organs of Generation.

THE *internal* or *formative* organs of generation are contained within the pelvis and abdomen, and comprise the *vagina* (which some writers include with the external organs), *uterus*, *Fallopian tubes*, and *ovaries*.

SECTION I.—THE VAGINA.

The VAGINA is a musculo-membranous canal of variable dimensions, with thin walls; it extends almost horizontally within the pelvic cavity, from the vulva posteriorly to the uterus anteriorly, the cervix or neck of which it embraces in a kind of semicircular *cul-de-sac*. The rectum lies above it, and the bladder below; on each side are the ureters and the walls of the pelvis, and posteriorly it is surrounded by adipose and loose connective tissue. When distended it is cylindrical in form, but usually its sides are in contact. Its length is variable of course, but in a full-sized Mare it is about a foot long. It is maintained in its position anteriorly by folds of peritoneum, which attach it to the rectum above and to the bladder beneath, the attachment to the rectum being accomplished through the medium of the loose connective tissue referred to. But this tissue, which also unites it to the bladder, is here close and firm, and this fact may serve to explain why the rectum is so rarely involved in displacements of the uterus; while the bladder is always more or less so. *Laterally*, it is attached to the muscular and aponeurotic structures in the cavity of the pelvis. *Internally*, it is lined by a thin mucous membrane, which is always abundantly covered with mucus (in women this mucus is acid, while that of the uterus is alkaline), and is disposed (in the Mare) in longitudinal rugæ, which are more conspicuous after several births. These rugæ no doubt favour the dilatation of the canal during coitus or the passage of the fœtus; a transverse ridge, already described as existing on the lower face of the canal, covers the meatus. This membrane is continuous with that of the vulva, and anteriorly, at the *cul-de-sac*, it is reflected over the cervix of the uterus, which projects, like a cauliflower in shape, into the cavity. It is provided with papillæ, and covered with pavement epithelium. It usually has a pale pink hue, but at the period of œstrum its colour becomes heightened to a bright red, and its secretion is considerably increased.

Externally, the vagina is invested by a muscular coat which is enveloped

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by an abundant layer of connective tissue, and traversed by a large number of bloodvessels; in front, however, this tunic is invested in peritoneal mem-

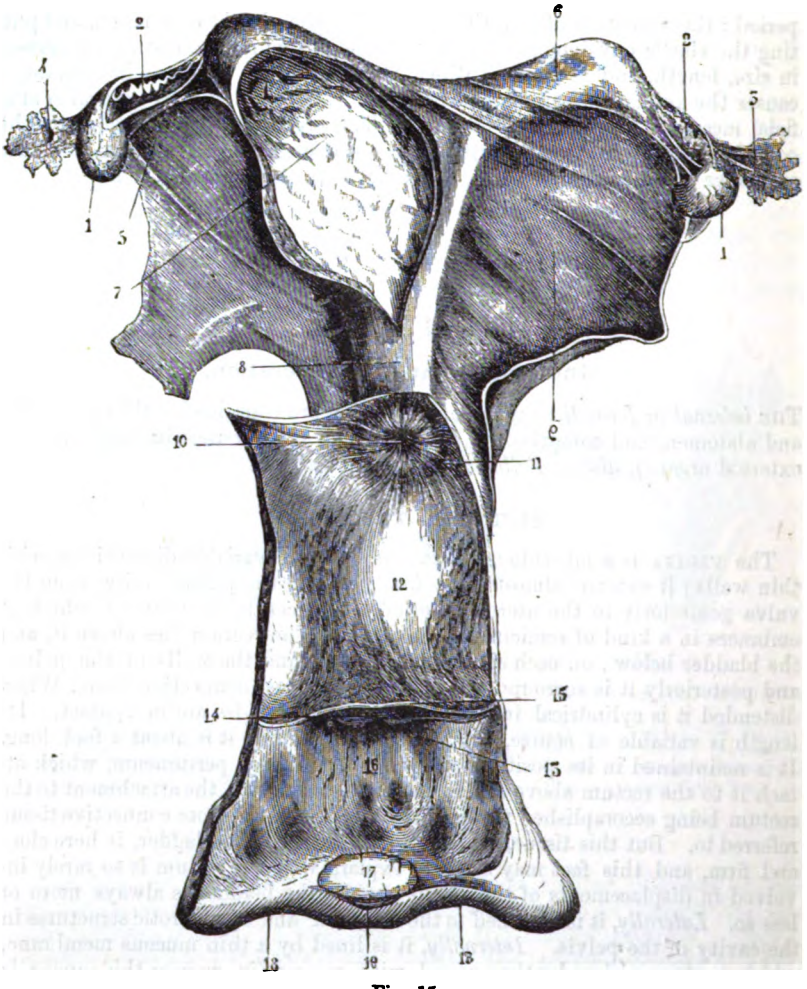

Fig. 15.

GENERATIVE ORGANS OF THE MARE: ISOLATED AND PARTLY OPENED.

1, 1, Ovaries; 2, 2, Fallopian Tubes; 3, Pavilion of the Tube, External Face; 4, *Ibid.*, Inner Face, Showing the Opening in the Middle; 5, Ligament of the Ovary; 6, Intact Horn of the Uterus; 7, A Horn Opened; 8, Body of the Uterus, Upper Face; 9, Broad Ligament; 10, Cervix, with its Numerous Folds; 11, *Cul-de-sac* of the Vagina; 12, Interior of the Vagina, with its Folds of Mucous Membrane; 13, Urinary Meatus and its Valve; 17, Clitoris; 18, 18, Labia of the Vulva; 19, Inferior Commissure of the Vulva.

brane, which is folded in a circular manner around it to pass over the uterus.

The vagina is supplied with blood by the internal pudic artery; its veins are disposed as a plexus around it, and terminate in the satellite trunk of the

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artery. The vagina serves for copulation and the passage of the fœtus. At the periods of œstrum and parturition, the mucous secretion is more active than at other times. In youth it is contracted; after copulation its dimensions are increased, and these are greatest during parturition. In old age it is much diminished; in the third or fourth months of gestation in the larger animals, it becomes elongated from displacement of the uterus, which is carried farther forward into the abdominal cavity; towards the termination of this process, its length diminishes as the uterus acquires increased volume, and to such an extent does this occur, that at the commencement of parturition, if the fœtus is large, and especially if there be two fœtuses, the posterior wall of that receptacle, pushed back into the pelvis, nearly or entirely effaces the cavity of the vagina, and even in some instances thrusts it between the labia of the vulva or beyond.

Differences.

Cow, Sheep, and Goat.

In the Cow, the canal is longer and wider than in the Mare; the mucous membrane of the vagina is thicker, is disposed in transverse rugæ as in the human species, and at each side of the passage for a certain distance, between the mucous and muscular layers, there exists a mucous canal that opens into the vulvular cavity, in front of, and at the side of the meatus.

The uses of these canals, which are not present in the Sheep or Goat, and rarely in the Mare, and which are usually known as the "canals of Gærtner," are unknown. They pass backwards into the broad ligaments of the uterus, and terminate in a *cul-de-sac*. They have some function during fœtal life.

Pig.

In the Pig these canals are present; the folds of mucous membrane are longitudinal, and gradually subside towards the line of separation between the vagina and vulva. The vagina is from eight to nine inches long.

Bitch and Cat.

There are no "Gærtner's canals" in the Bitch or Cat. The vagina is of comparatively great length, and has longitudinal rugæ, which are interrupted by transverse folds. In both animals the canal is wider towards the vulva than the uterus, and its walls are rendered very thick by white fibrous tissue, in addition to the non-striated muscular fibres it contains.

SECTION II.—THE UTERUS.

The UTERUS, or WOMB (Figs. 12, *1*; 15, *8*), is an elongated musculo-membranous sac which receives the ovum, and constitutes the receptacle for the nutrition, maturation, and, finally, after a certain period, for the expulsion of the fœtus. It is situated in the sub-lumbar region of the abdomen, towards the inlet of the pelvic cavity, into which its posterior extremity enters. This portion—the *body*—represents a simple cylindrical reservoir, slightly flattened from above to below, while the anterior part is bifid; and the two divisions—the *cornua* or *horns*—curve upwards and forwards. The *body* is situated horizontally beneath the rectum, which is in contact with it after passing between the two cornua; on each side of its upper external face it receives the insertions of wide ligaments; and its sides and anterior face are in contact with the intestines. Its lower surface is in contact with the bladder and the pelvic cur-

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vature of the colon; while its anterior extremity is continuous with each of the cornua, and the posterior is separated from the vagina by the constriction named the *col*, *cervix*, or *neck* of the uterus. The *cornua* are cylindrical bodies, and, lodged among the intestines occupying this region, proceed at an angle from the body in an upward direction, describing two curves: an inferior, convex, which is free; and a superior, concave, to which the suspensory ligaments are attached. Each horn has also a posterior extremity or base, a continuation of the body of the organ; and an anterior or summit rounded into a *cul-de-sac* which is turned upwards, and has at the bottom a small tubercle, the insertion of the oviduct.

Floating in the abdominal cavity, like the intestines, the uterus is also attached, as they are, by two membranous bands which suspend them from the sub-lumbar region, and are consequently designated the *broad* or *suspensory ligaments* of the uterus; also, from the general resemblance to the wings of a bat, the *alæ vespertilionis*. These bands, derived from the peritoneum of the abdomen, are larger in front than behind, and in shape are irregularly triangular; behind, they are close to each other, but in front diverge like the sides of the letter V. They descend from the lower face of the lumbar region, and attach themselves by their inferior border to the sides of the upper face of the body and the smaller curvature of the cornua; their anterior border is free and sustains the oviducts and ovaries, the first being included between the two layers of the ligament, while the ovary, placed within it, also receives a layer detached from the principal one, which with it forms a little cup-shaped cavity. Another small, long, and narrow band of peritoneum is observed external to the broad ligament; this can be traced posteriorly to the internal inguinal ring, and anteriorly it presents a little enlarged appendix. Between the two layers composing this band, is a thin muscle similar to the cremaster of the male before the descent of the testicle into the scrotum; this band is the analogue of the round ligament in woman. The uterus is also maintained in its position by the vagina posteriorly, and by the peritoneum which at this part forms four bands—the *recto-uterine* and *vesico-uterine*.

The interior of the uterus is divided into three compartments, corresponding to its divisions into body and cornua. The cavity of the body communicates with the vagina by a narrow canal which traverses the constriction or cervix of the uterus, and is designated the *canal of the cervix*. In all the domesticated animals, except the Rabbit, this canal is prolonged into the anterior extremity of the vaginal cavity like the end of a tap into a barrel; forming a very marked protrusion—the cervix. In this is the opening (*orificium uteri externum*) leading from the vagina to the body of the uterus—the *os uteri* or *os tincæ*; around this aperture the utero-vaginal lining membrane is curiously arranged in transverse rugæ disposed in a circular manner, and which gives to this prominent part the appearance of a radiating flower. In woman the rugæ of the canal are differently disposed, and resemble the branches from the stem of a tree; consequently, they have been named the *arbor vitæ uterina*.

The uterus is composed of three membranes—an *external*, or *serous*; a *middle*, or *muscular*; and an *internal*, or *mucous tunic*. The *serous* or *peritoneal* membrane envelops all the organ, and is in reality only an expansion of the broad ligaments which are prolonged backwards on the posterior extremity of the vagina, which they encircle and then pass to the rectum and bladder, as well as to the lateral parietes of the pelvis, constituting the four ligaments already referred to. Between the two cornua this membrane forms a peculiar frænum, which is very developed in solipeds. Owing to this arrangement,

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the cervix does not receive any peritoneal covering. The *muscular* layer is composed of longitudinal and circular fibres, analogous to those of the small intestines. At the insertions of the broad ligaments into the uterus, a series of fasciculi are given off from this layer, which pass up between the folds composing them, and have been found throughout their extent, especially towards the ovaries. The fibres composing this coat belong to the class of non-striated or involuntary muscles, being made up of fusiform nucleated fibres lodged in a matrix of exceedingly coherent granular matter. The appearance of this coat is different to that of ordinary muscle, being much more dense and of a faint yellowish-red hue, like the middle coat of arteries or the small intestines. The superficial set of fibres are irregularly longitudinal in their direction, and frequently interlace with each other; the deep set is circular, especially around the orifice of each oviduct and the os uteri, where they are thick and close; though even among these fibres irregular fasciculi pass in different directions. Both layers are thicker in the cornua than the body; their obvious function is to diminish the volume of the uterus during parturition.

At an early period of life these fibres are perceptible, but during gestation they are greatly increased, and present a manifest striation. Their increase is doubtless to permit the necessary dilatation of the uterus, without allowing its parietes to become too attenuated and feeble; though to some extent they do diminish in thickness, according to the species. The inner set are but loosely adherent to the lining or mucous membrane of the uterus. A rich venous network is lodged in the muscular tunic of this organ.

The *mucous* layer is a thin, delicate, pulpy membrane, covered by ciliated columnar epithelium in the body and cornua of the organ, ordinary cylindrical squamous or stratified epithelium in the canal of the cervix, like that on the intestines, and tessellated or squamous on the rugæ of the cervix. This differs from ordinary mucous membrane in the presence of a very delicate sub-mucous connective tissue, in which the utricular glands, blood and lymph vessels, as well as nerves supplying the membrane, are situated; for this reason it appears to receive its vascular supply directly from the muscular coat, its vessels being continuous with those of that layer. This difference is probably related to its irregular, though higher, organising function.

On the cervix, the basement membrane covers multitudes of villi, the points of which in woman are nipple-shaped, with a depression in the centre; within the cervix these villi are very large, but in the body of the organ there are no villi. The membrane here is remarkable for the series of longitudinal rugæ formed on it, and which are not effaced by ordinary distention of the organ; though they disappear during the increase in size of its cavity in pregnancy. On these rugæ and in the fossæ between them, particularly towards the cervix, are a great number of simple mucus and special cylindrical glands. The first are particularly abundant towards the cervix; some here and there have closed mouths, are enlarged, and form small vesicular prominences, which have been named the "ova of Naboth" (*ovula Nabothi*), from their supposed identity with the ovarian ova.

The cylindrical, uterine, or utricular glands (*glandulæ utriculares*), are situated close to each other; they are sometimes bifurcated, frequently spiral, and terminate in a *cul-de-sac* in the substance of the mucous membrane, something like the agminate glands. In the Mare they are long, slender, and tortuous, and divide repeatedly in the deeper part of the mucosa, and in such a manner that numerous branching tubes are connected with a single stem or gland-duct. They are lined by columnar cells, which project vertically into the gland tube; these cells have a ciliary

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movement. The utricular glands do not exist at birth, and it is probable that they are only fully developed when sexual maturity is reached. At certain periods, as during œstrum, they throw out a large quantity of very viscid, almost transparent, mucus. They are secreting structures, and during gestation play a most important part, becoming largely developed, and furnishing a thin, white, albuminous fluid, the so-called "uterine milk." This secretion comes more particularly in contact with the intervillous portions of the fœtal placenta, in which are curious pockets that act as receptacles for this milk, which is absorbed by the vessels on their walls.

The uterus is supplied with blood by the *uterine* and *utero-ovarian arteries*, which arise from the posterior aorta, and passing between the layers of the broad ligament reach the uterus. The first divides into two branches—an ovarian and a uterine; the former is very flexuous and goes to the ovary, while the second passes to the cornua of the uterus, where its ultimate divisions anastomose with those of the proper uterine artery. This vessel, on reaching the smaller curvature of the cornua, also divides into two portions—an anterior, anastomosing its branches with the utero-ovarian; and a posterior, spreading over the body of the organ and communicating with the vaginal artery. The blood is conveyed from the uterus by corresponding *veins*, which are more numerous than the arteries, and are capable of great distention. They have no valves. In animals which have bred frequently, the vessels are greatly enlarged and very flexuous; indeed, from an early period the arteries are remarkable for their large size, their tortuous course, and their frequent anastomoses; while the considerable calibre of the veins, which have no valves, is as conspicuous as the complex networks they form.

The *lymphatic vessels* issuing from the organ are as remarkable for their large size as their number; they all proceed towards the sub-lumbar region.

The *nerves* are derived from the small mesenteric and pelvic plexuses.

Differences.

Cow.

The uterus of the Cow, with regard to its general disposition in the pelvic and abdominal cavities, does not offer any striking differences from that of the Mare, except that the body is short, and it does not extend so far into the latter cavity. If the uterus was perfectly horizontal, a transverse line drawn across the abdomen, in front of the external angle of the ilium, would be exceeded to the extent of some one and a half to two inches by the extremities of the cornua; so that if the animal were placed on its back, the uterus would only be found to reach to the fourth or fifth lumbar vertebra.

With regard to shape, however, the uterus of this animal offers some noteworthy features. For instance, the concave curvatures of the cornua look downwards, whereas in the Mare they are in the opposite direction; though in both the broad ligaments are attached to this concavity. The consequence is, that in the Cow, if the uterus be considered as freely suspended in the cavity of the abdomen, the extremity of the horn is twisted outwards and upwards; while its base near the body of the organ, although drawn in the same direction by the ligaments, yet retains its position, being firmly maintained in it by the body of the uterus, which also receives the insertion of the broad ligaments on its *lower plane*. This insertion causes the uterus to project above them; while in the Mare, in which the ligaments are inserted

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at the upper part of the body, the uterus projects below them. In the Cow these ligaments are very extensive, particularly at their anterior border, and widely separated from one another in front near their lumbar attachment, which is prolonged as far as the flank. The ligaments, taken as a whole, may be compared to a triangular sheet, one angle of which is fixed to the floor of the pelvis, and the other two to the tuberosities of the ilia; on this sheet rests the body of the uterus and a portion of the cornua.

The cornua are thin and tapering at their anterior extremity, and the body is short and narrow; while the interior of the uterus is not so ample as in the Mare. Here it offers a peculiarity which is not observed in the latter animal, the carnivora, nor the Pig, in the presence of rounded smooth prominences, named *caruncles* or *cotyledonal processes* (*placentæ uterinæ*), which

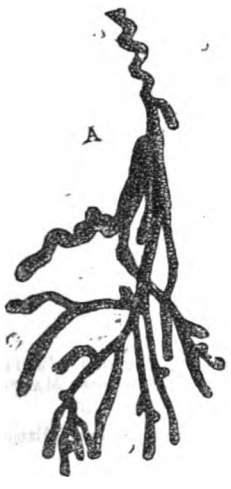

Fig. 16.

A, Utricular Gland of a pregnant Goat.

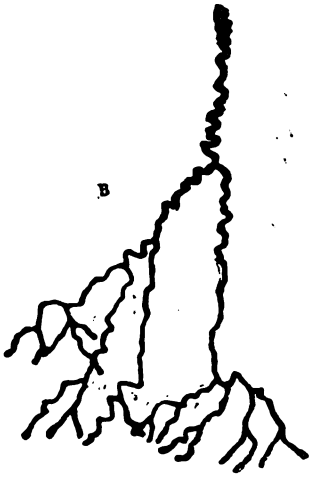

Fig. 17.

B, Utricular Gland of a pregnant Cow.

increase in number with the size of the species. These maternal cotyledons are most numerous in the cornua, and few and small in the body of the uterus; in volume they are about the size of a pea or haricot-bean in calves; at a later period they have acquired the dimensions of a button, and they increase largely and assume variable shapes during gestation. In the Cow they are flat or slightly convex on the top, but concave in the Sheep and Goat, and their colour is usually pale; after conception, however, they become red from the affluence of blood to them. They are intended for the implantation of similar processes existing on one of the fœtal membranes, the chorion, and will be noticed more fully hereafter. It may be sufficient now to mention that their number in the calf sometimes amounts to thirty or forty; and after parturition there have been counted as many as from eighty to one hundred and twenty. Each is attached to the mucous membrane by a narrow pedicle, and in removing the fœtal placenta after parturition, care has to be taken not to tear them off.

The *cervix uteri* of the Cow is from $2\frac{1}{2}$ to $3\frac{1}{2}$ inches in length, is narrow, almost as firm as cartilage in texture, and irregular; the mucous membrane

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is more finely plicated over it around the *os tincæ* than in the Mare. The fibres composing the cervix are divergent and circular. At an early age this part is nearly circular in shape, and the body of the uterus is so small that the cervix and cornua are close, or joined to each other at their origin from it. Towards puberty, however, in all the larger domesticated animals, it becomes fusiform, and shows two lips, about two inches in length—an anterior and posterior, the last the longest—which are pulpy to the touch; these lips are composed of flattened, dense, transverse fibres. The orifice or *os uteri* is either circular or elongated transversely, and corresponds to the middle of the posterior part of the vaginal cavity. During pregnancy the cervix is firm and tense, and appears to become shortened in animals which have had young several times. The folds of mucous membrane which we have described as existing in its interior and around the os, permit its dila-

Fig. 18.

HORIZONTAL SECTION OF THE UPPER SURFACE OF THE MUCOUS MEMBRANE, NEAR TO A COTYLEDON, OF THE UTERUS OF A NON-GRAVID COW: MAGNIFIED 180 DIAMETERS.

a, Section of a Utricular Gland, and a^1 its Proper Structure; *bb*, Mucous Glands; *cc*, Adenoid Tissue.

tation during the passage of the fœtus. A knowledge of the presence of the two lips of the cervix, and their position, is useful when explorations by hand are necessary in cases of inversion of the uterus.

The utricular glands are wider than in the Mare, and have lateral diverticuli.

The muscular tunic altogether is thicker in the Cow than in the Mare; indeed, the walls of the uterus in this animal are more dense than in any of the domesticated creatures, the muscles having a red tint, and being continued well into the broad ligaments.

Sheep and Goat.

In the Sheep and Goat the disposition of the uterus is similar to that of the Cow. The cornua are relatively longer, more tortuous and pendant, and expand more gradually from the termination of the oviducts; while the longitudinal rugæ in the body and cervix are disposed in a series of transverse folds in the latter, which gives them the appearance of so many *ora tincæ*. The cotyledons we have mentioned already; they are concave in their centre in these animals.

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Pig.

In the Pig the uterine cornua are long and tortuous, and float among the intestines, which they resemble; the body of the uterus is short, and the numerous irregular ridges on the inner surface of the cornua gradually sub-

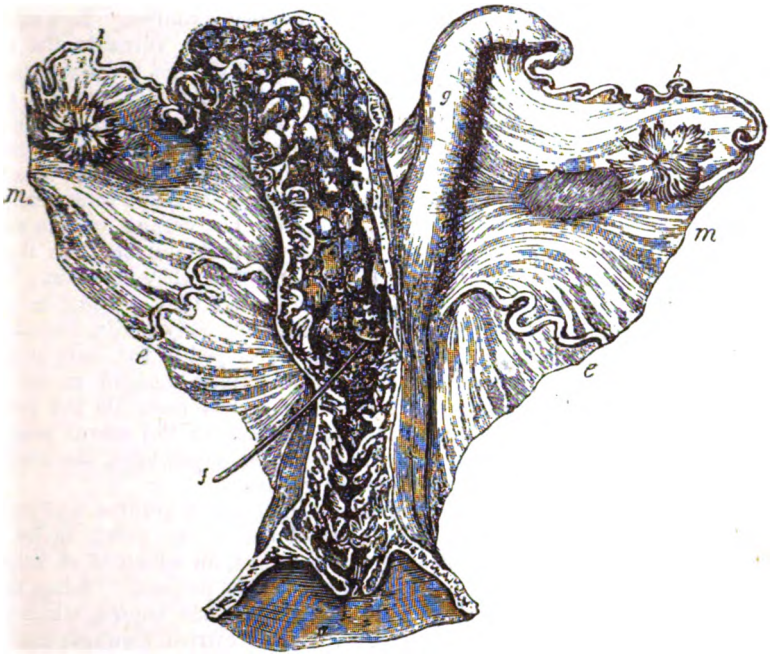

Fig. 19.

UTERUS, OVIDUCTS, AND OVARIA OF THE SHEEP.

a, Vagina; *b*, Os Uteri; *c*, Transverse Folds of Cervix Uteri; *d*, Body of Uterus; *e e*, Caruncles or Cotyledonal Processes; *f*, Confluence of the Cornua; *g*, Intact Cornu; *h h*, Oviducts or Fallopian Tubes; *i i*, Fimbriæ; *k k*, Ovaries; *l*, Round Ligament; *m m*, Broad Ligaments; *n n*, Cotyledons.

side towards the cervix, where they form two or three series of thick, soft rugæ. The os uteri is marked by a series of narrow, close-set, longitudinal laminæ, but there is no labial or valvular projection into the vagina; so that there is no exact limit between the two cavities. The broad ligaments resemble the mesentery. The utricular glands divide repeatedly in the deeper parts of the mucosa, as in the Mare.

Bitch and Cat.

In the Bitch and Cat the cornua are long, slender, straight, and slightly compressed, with a number of flat eminences on their inner surface. They extend to the lumbar region, and unite externally for nearly two inches before they join the corpus uteri. The interior of the latter shows a few smooth longitudinal rugæ, and the os uteri is a smooth, thick, and even prominence, larger almost than the body of the uterus, which is short. It projects very

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markedly into the vagina. The utricular glands are pyriform; the rou ligaments escape from the abdomen by the inguinal rings.

Development.

In the fœtus and the adult animal which has not been fecundated, t uterus is comparatively small, narrow, and insignificant; but it increases volume with age after the venereal desires become manifest. In a call little more than a month old, the total length from the vulva to the e tremity of the cornua was about ten inches, of which the vagina form about five-eighths. In the lamb the uterus and vagina only measure about si inches in length. From this period until the animal is capable of breedin the uterus receives so little blood that it may be removed without much risl

During gestation the uterus acquires a great volume, and its cavity, usuall less than that of the vagina, is considerably increased, its shape then bearin some resemblance to one of the large intestines. The cornua vary in size according to the dimensions and species of the different animals. In thos which are uniparous (one fœtus), as the Mare and Cow, they are short; bu in those which are multiparous (more than one fœtus), they are long in pro portion to the number of young they bear, while the body is diminished ir length. In the uniparous animal the fœtus is developed in the body of the uterus, and its posterior extremities only are sometimes engaged in one of the cornua; but in the multiparous females the cornua resemble the intestines, and the young are developed in them, the body of the uterus seldom containing any. In the Rabbit, indeed, there is no *corpus uteri*, the cornua opening independently and directly into the vagina.

As gestation proceeds, the uterus of course increases in volume, and pushing the pelvic curvature of the colon forward out of the pelvic cavity, it gradually descends towards the floor of the abdomen, on which it at length rests, towards the middle line, until the end of this process. During this change of position, it draws with it the cervix and the vagina, which becomes notably elongated, and even the vulva is carried forwards until it appears to be buried between the ischiatic tuberosities.

After parturition the uterus gradually diminishes in size, and some of its supplementary structures disappear; but it never resumes its previous volume.

The *ligaments* of the uterus suspend it loosely, yet securely in the abdominal cavity; and while allowing it a certain range of movement, permit its full development during gestation. At this period they become developed in a peculiar manner, and, as we have seen, between their laminæ appears a layer of muscular fibres; in the Cow these fibres are arranged in fasciculi, one of which, larger than the others, extends from the ovary to the *cervix uteri*. These ligaments would also appear to stretch considerably in version or inversion of the uterus in the herbivorous animals; even in the carnivora they accompany the uterus when hernia takes place; and in the torsions of this organ which sometimes occur in the herbivora, when its upper face becomes the lower, or even when it has made a complete turn upon itself, they encircle and strangle the uterus at the cervix.

SECTION III.—FALLOPIAN TUBES OR OVIDUCTS.

The *Fallopian tubes* or *oviducts* are two small, cylindrical, flexuous canals, about ten inches long, white in appearance, one of which is lodged in each broad ligament between its serous layers, and near its anterior border. Each tube commences at the extremity of the uterine horn, at a small hard tubercle

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in its *cul-de-sac* (*ostium uterinum*). This tubercle is its opening into the horn, and from this it proceeds, more or less tortuously, and increasing slightly in diameter, towards one of the ovaries, upon which it terminates by a free, widened extremity (*ostium abdominale*) in the *pavilion* of the tube. The calibre of this canal is small, and scarcely admits a thin straw at its middle portion, and it is still smaller towards the uterine extremity; as it approaches the ovary, however, it increases in width until it ends in the pavilion. The uterine extremity of the canal opens through the small hard tubercle just referred to as existing at the *cul-de-sac* of the cornua. The ovarian extremity offers in all the mammalia a peculiar disposition. It opens into the peritoneal cavity of the abdomen (the only instance of a serous cavity communicating with the exterior), near the ovarian fissure, in the middle of the pavilion, which is also named the *fimbriæ tubarum*, or *morsus diaboli*, from its fringed or dentated border. This pavilion is fixed to the external side of the ovary, and its inner surface is marked by numerous narrow, close-set, minutely plicated laminæ, while its circumference is irregularly disposed into a number of unequal prolongations or fringe (*fimbriæ*) which hangs into the abdominal cavity. This arrangement is interesting, from the fact that it gives us a unique example of a breach of continuity between a gland (the ovary) and its excretory canal (the tube).

Each tube is composed of three tunics: an *external* or *serous*, formed by the broad ligament; a *middle* or *muscular*, constituted by longitudinal and circular non-striated fibres, continued from those of the uterus, which are also disseminated in the pavilion and its fimbriæ; and an *internal* or *mucous*, which exhibits longitudinal rugæ in the tube, and radiated in the pavilion; this membrane is covered by ciliated epithelium, and its villi are greatly enlarged after impregnation. It ceases abruptly at the margin of the fimbriæ, where it meets the peritoneum.

The bloodvessels supplying the Fallopian tubes are derived from the ovarian arteries, and their nerves are from the great sympathetic.

Their *function* is to convey the spermatozoa of the male to the ovary in the first instance, and afterwards to transmit the impregnated ovum to the uterus or its horn; in this respect they are the excretory ducts of the ovaries. When the Graafian vesicle of the ovary ruptures, the fimbriæ of the tube grasp the ovary, and receive the ovum, which they carry to the ovarian extremity of the canal; this act, together with the application of the pavilion to the ovary, takes place either through the contraction of the non-striated muscular fibres which this part contains, or from the swelling of the bulb of the ovary. At times, however, the act is not properly accomplished, and the fecundated ovum, instead of passing into the uterine cavity, escapes the fimbriæ and falls into the abdomen, where it constitutes that most remarkable form of gestation termed *extra-uterine*.

Differences.

Cow, Sheep, and Goat.

In the Cow, Sheep, and Goat, the fimbriated extremity of each tube is expanded upon the outer margin of the ovarian capsule; the inner surface of the pavilion is beset with numerous fine oblique striæ, and is further increased by narrow folds of laminæ converging toward the contracted opening of the duct. The duct itself forms three or four wavy folds, and is then continued along the walls of the wide ovarian capsule to the extremity of the uterine horn, which makes an abrupt curve to meet it.

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Pig.

In the Pig the oviduct has but few or no inflexions, but its length is proportionately greater than in the other species. The pavilion is wide and deep, and the margin of its abdominal opening is almost even; its inner surface is augmented by many long, narrow, and highly vascular folds, which radiate from the commencement of the contracted part of the tube upon the expanded pavilion.

Bitch.

In the Bitch the fimbriated commencement of the oviduct is attached to the exterior boundary of the aperture opposite the ovarium, while the tube itself, long and fine, passes in a wavy course round the anterior aspect of the latter to the uterus. The length of the tube is from two and a half to three and a half inches.

SECTION IV.—THE OVARIES.

The *ovaries* (*testes muliebres*), the essential organs of generation in the female, and analogous to the testes of the male, are two ovoid or elongate reniform bodies, smaller than the latter, but of the same shape, and situated in the abdominal cavity. They are loosely suspended in the sub-lumbar region, behind the Fallopian tubes and the kidneys, among the convolutions of the intestines; though sometimes their position is altered. In four instances in the Pig they have been found in the perineal region, occupying small cavities analogous to the scrotum of the male.* Smooth externally, each ovary shows in the middle of its upper portion a more or less oblique, but deep fissure, resembling the hilus of the kidney, and which gives attachment to the pavilion of the Fallopian tube. Each ovary is suspended at the anterior border of the broad ligament, and is also sustained *in situ* by the vessels passing to and from it, as well as by a small cord of non-striated muscular fibres called the *ligamentum ovarii*, which connects it with the uterus.

The *structure* of the ovary comprises a *serous* and *fibrous* membrane, the *proper tissue* of the ovary, and the *Graafian vesicles* embedded in it. The *serous* membrane is continuous with the broad ligaments—is, in fact, a peritoneal tunic, which entirely envelops it, adhering closely to the covering beneath. This is the *tunica albuginea:* a dense resisting membrane similar to the structure enveloping the testicle, and sending lamellar prolongations into the substance of the ovary.

The *proper tissue* or *stroma* of the ovary is solid and hard, and has a speckled-grey tint. It is divided into two layers, which are distinct in appearance and structure. The *medullary* layer is nearest the hilus, and is somewhat red and spongy; it is formed by the intercrossing of connective tissue, non-striated muscular fibres, and by a large number of vessels which radiate from the centre towards the periphery of the organ and nerves. The *cortical* layer has for its basis connective tissue; it is not very vascular, but it contains in its substance the *Graafian vesicles* or follicles, and for this reason is named the *ovigenic layer.*

* A remarkable, if not unique, case of displacement of the ovaries is recorded by M. Dupont, in the *Journal des Vétérinaires du Midi* for 1869. In four female pigs, fifteen days old, beneath the vulva were observed two protuberances exactly like the testicles of the male, and which, on examination after death, proved to be the ovaries. The other organs of generation were normal. The same Sow which produced them, had, in a previous litter, brought forth two females with the ovaries similarly misplaced.

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These *Graafian vesicles* are generally in various stages of development; the smallest are situated beneath the tunica albuginea, and they descend towards the deeper layer, increasing in volume as they do so. When they have reached their period of full growth, they are filled with a transparent citron-coloured fluid, and the ovigenic layer being incapable of containing

Fig. 20.

OVARY OPENED VERTICALLY.

a a, *b b*, Graafian Vesicles at different stages of development.

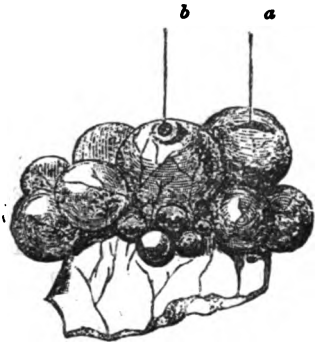

Fig. 21.

PORTION OF THE OVARY OF A PIG.

a, Point at which a ripe Vesicle is about to escape; *b*, Fissure by which an Ovule has escaped.

them, they form a more or less considerable prominence on the surface of the ovary. A *Graafian vesicle*, when perfect, is composed of an envelope and its

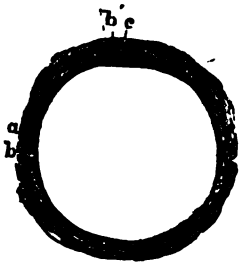

Fig. 22.

GRAAFIAN VESICLE IN MARE'S OVARY.

a, Membrana Propria of the Graafian Follicle; *b*, Membrana Granulosa; b^1, Discus Proligerus; *c*, Ovum. Magnified 5 Diameters.

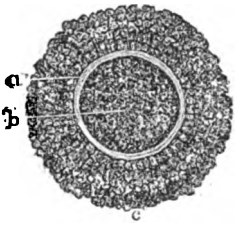

Fig. 23.

OVULUM OF THE MARE.

a, Zona Pellucida; *b*, Vitellus, containing the Vesicula Germinativa; *c*, Cells of the Discus Proligerus.

contents. The *envelope* comprises two tunics—a fibrous membrane (*tunic of the ovisac*), which is confounded externally with the stroma of the ovary, and internally is rich in bloodvessels; an inner (*ovisac*), formed by a smooth membrane which derives its bloodvessels from the latter; it is lined by an epithelial or granular membrane (*tunica granulosa*), composed of round or polygonal granular cells. At the bottom of the vesicle this epithelium forms

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an aggregation (the *cumulus*, or *discus proliger*), in the centre of which exists the *ovum* or *ovulum* of mammalia. The contents of the vesicle is a yellowish, transparent, albuminous mass, that becomes reddened by an admixture of blood when the vesicle ruptures.

The *ovulum*, *ovule*, or *ovum*, is a small cell imbedded in the cumulus, and surrounded by an amorphous, thick, white membrane, which has been designated the *zona pellucida;* within this membrane is a granular layer, the *vitellus* or *yolk*, the larger granules of which are superficial and compact, while internally it is a transparent albuminous fluid, in which are but few granules. Enclosed in this vitellus, though nearer its circumference than centre, is the nucleus—the *germinal vesicle*, or *vesicle of Purkinge*, a most important portion of the ovum; it has the appearance of a very small clear ring, measuring about 1-60th of a line in diameter, and upon its surface is a dark spot, the *macula germinativa*. This is always observed as a simple rounded body measuring from 1-200th to 1-300th of a line in diameter; it is rarely found double or as an aggregate of granules, except in miniature ova.

The large flexuous arteries supplying the ovary, are from the utero-ovarian trunk; they spread over the spaces in the tunica albuginea, before entering the hilus of the organ to be distributed in its interior. The veins are extremely large, and form a very close plexus around the gland (*bulb of the ovary*), emptying themselves into the vena cava near the renal veins. The lymphatics pass to the sub-lumbar ganglia, and the nerves come from the small mesenteric plexus.

Differences.

Cow, Sheep, and Goat.

In the Cow the ovaries are relatively smaller than in the Mare, but their form and structure are the same. Each is lodged in a depression or sacculus of the broad ligament which is more or less deep, and the Graafian vesicles are visible through the tunica albuginea. The same arrangement is observable in the Sheep and Goat.

Pig.

In the Pig the ovaries are comparatively large, oblong bodies, with an irregular tuberculated or lobulated aspect, due to the Graafian vesicles, which, when well developed, project beyond the surface of the organ, instead of remaining within it. When these ovisacs enlarge, the stroma is scanty in proportion. Each ovary is enclosed within a peritoneal sac, near the opening of which it has a pedunculate attachment. The posterior wall of this sac, as we have seen, appears to be formed by the wide and deep pavilion of the Fallopian tube.

Bitch and Cat.

There is nothing particular to indicate in the ovaria of the Bitch and Cat, except that the ligaments suspending them to the spine are very short, and they are contained in a fold of peritoneum.

Development.

The development of the ovaria and the ova is very interesting. In the Mare the ovaria of the fœtus are, compared with the uterus, of an immense size, and at six months are almost as large as in the adult. In aged animals they become atrophied, and it is not unusual in old Mares to find either one or both in an unhealthy condition. Not unfrequently they are hypertro-

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phied, and their fibrous envelope and stroma are much thickened. Sometimes the vesicles are greatly enlarged, and converted into cysts which contain either a limpid, sanguinolent, or purulent fluid, secreted from their walls. Flandrin cites the case of a Mare, one of whose ovaria weighed 26½ pounds, and measured 14½ inches in its long, and 12 inches in its short diameter. The texture of the ovaries is also liable to various abnormal alterations.

The Graafian vesicles are present in the ovary of the fœtus, but they do not attain their full development until puberty; neither are they all present at birth, but are continually being developed beneath the *tunica albuginea*. The first-formed elements in the fœtal ovary are cells and cell-nuclei; these next appear in somewhat circular groups, which are more opaque than the other parts of the regularly uniform mass (Fig. 24, A). A kind of film soon condenses round these groups (B), and upon the inner surface of this there is fixed an epithelial precipitate from the fluid and granules of the interspaces of the contained primary cells. Within the ovisac thus formed, a large nucleate cell becomes visible: this is the commencement of the ovum (C, *g*). As this expands, the proportion of fluid to the formified particles increases, and the latter are attracted to the contiguous surfaces: some to that of the ovisac, which thus becomes lined by a thicker layer of cells; others to the ovum, accumulating around it. With the enlargement of the ovisac, the stroma of the ovum condenses around its delicate membrane (Fig. 25, *b*), to form what has been called the "theca folliculi" of Baer —the fibrous tunic already noted; this vascular tunic (*a*), with the other (*b*), constituting the *vesicle;* while the stratum of nucleate cells lining this double covering is the *membrana granulosa*, and those surrounding the ovum itself form the *proligerous disc* (*e*), the mass of cells adhering thereto being the *cumulus*.

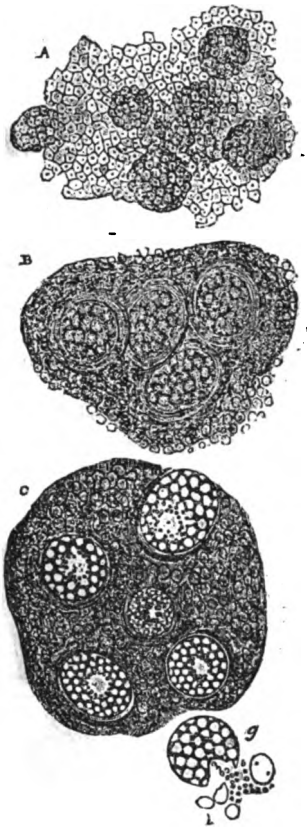

Fig. 24.

FORMATION OF THE OVISAC IN THE BITCH'S OVARY.

The *hyalinion*, or proper tunic of the ovum, thickens into the clear substance improperly named the *zona vellucida* (*f*), which in reality is a bag. As the cells and cell-nuclei of the ovum become developed, they are pushed deeper into the stroma by those of more recent formation; while, as the ovum ripens, the cells immediately around it become elongated and pyriform, the tapering extremity being attached to the zona: those of the cumulus diverge irregularly into the fluid intervening between them and the membrana granulosa of the ovisac. What have been termed *retinaculæ* (*d*) have been

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described by some authorities; they are four processes formed by the ce of the cumulus, and may be merely exceptional divergences.

Until puberty there is no great activity apparent in the vesicles; but this time the ovary becomes more vascular, and certain vesicles increase volume. At the period of "rut" or "heat," one or more vesicles, accordi to the species of animal, show evidence of increased vascularity, and b come distended; the ovisac thins at the most prominent part to which th

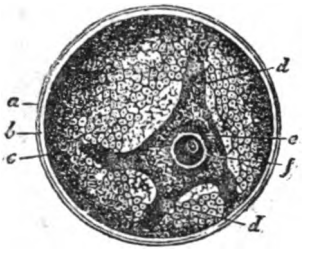

Fig. 25.

GRAAFIAN VESICLE AND OVUM.

ovum tends, and blood is extravasated into it; then, partly by absorption and partly by pressure, the coverings give way, the proligerous disc and ovum escape outwards, and are either received into the Fallopian tube for

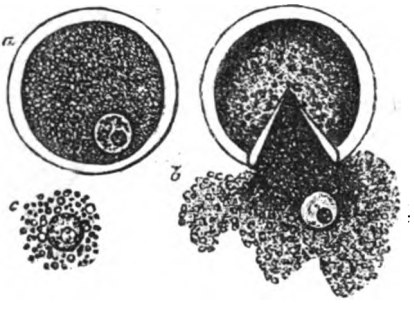

Fig. 26..

ESCAPE OF OVUM FROM OVISAC.

conveyance to the uterus, or, which is rare, fall into the cavity of the abdomen.

The size of the mature ovum in the Cow is $\frac{1}{120}$, Pig $\frac{1}{200}$, Bitch $\frac{1}{150}$, Cat $\frac{1}{180}$, Rabbit $\frac{1}{150}$ of an inch.

After the rupture of a Graafian vesicle and the escape of the ovum, the cavity of the ovisac is filled with a clot of blood, while its walls are thickened and altered in colour, being in most animals partially everted at the ruptured orifice. In the Cow and Sheep the follicle has a brick-red colour, and in the Pig it is yellowish-brown—it is then designated in the human subject, from its colour, the *corpus luteum;* but gradually the clot shrinks, loses its tint, and the cavity contracts; at the same time the walls are hypertrophied,

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and the tunica granulosa becomes wrinkled and transformed into cylindrical epithelium. By the time the succeeding ovisac with the ripening ovum has begun to protrude from the surface of the ovary, the old ovisac has lost its colour with much of its dimensions, and fallen inwards; the cylindrical epithelium are infiltrated with fat and are gradually absorbed. This change, with collapse of the wall, depresses the cicatrix of the aperture; and these successive shrinkings and cicatrisations of the ruptured ovisacs give the ovary a pitted and furrowed appearance in advanced life.

If the expelled ovum be not impregnated, the changes of the ovisac into the yellow convolute cavity, then into the depressed stellate cicatrix, occur somewhat rapidly; but if impregnation takes place, the maturation of successional ova is delayed, and the first change in the ruptured ovisac goes on to a greater extent, the *corpus luteum* not becoming obliterated for a com-

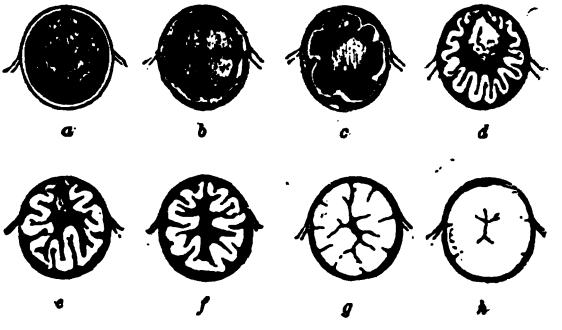

Fig. 27.

SUCCESSIVE STAGES IN THE FORMATION OF THE CORPUS LUTEUM IN THE GRAAFIAN FOLLICLE OF A SOW: VERTICAL SECTION.

a, Follicle immediately after the Expulsion of the Ovum, its cavity being filled with blood, and no ostensible increase of its epithelial lining having yet taken place; at *b* a thickening of this lining has become apparent; at *c* it begins to present folds, which are deepened at *d*, and the clot of blood is being absorbed and decolorised; a continuation of the same process, as shown at *e*, *f*, *g*, *h*, forms the *Corpus Luteum*, with its stellate cicatrix.

paratively long time. In this period the inner coat, or original ovisac, is much thickened by a larger deposit of yellow oil-granules; it becomes more deeply plicated, is impacted into a yellowish mass, and gains an adventitious white lining membrane, and it rarely happens that the cavity is obliterated before full gestation. It is then, in the human species, represented by a stellate linear figure surrounded by the corpus luteum, which is ultimately absorbed, but usually not before some weeks after parturition.

It is this difference between the impregnated and unimpregnated condition which enables us to distinguish, in these ruptured vesicles, the *true* and *false corpora lutea*.

In the Mare the retrocession of the true corpus luteum is more rapid than in the other domesticated animals, and it has not that deep yellow colour observed in the Cow; but it is of a darker, dull reddish-brown hue, and on section presents convolutions resembling those of the brain. When recent, the corpus luteum of the Mare is voluminous, and drawn towards the hilus of the ovary; it has two layers, the internal being constituted by a clot of blood the size of a small nut.

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Franck has convinced himself, by *post mortem* examination of Mares, of the possibility of ova being thrown off from the ovary during pregnancy.

It is to be remarked that the number of ovisacs and ova which become matured at each "rut" or "heat," depends upon the multiparity or uniparity of the species; in the Mare and Cow there is usually only one, in the Sheep and Goat one or two, in the Pig from four to a dozen, and in the Bitch a variable number.

BOOK II.

OBSTETRICAL PHYSIOLOGY.

REPRODUCTION.

Having described the situation, structure, and peculiarities of the external and internal organs of the female domesticated animals, we have now to inquire into their functions. These functions have for their end the conception, development, and preservation of the young animal for a certain period, until it can maintain a more or less independent existence, when some of them are brought into play in order to place it in direct relation with the external world in the act of parturition, while others cease. But in order that generation should take place in the higher classes of animals, it is necessary that the two sexes be placed in favourable relations with each other. This preliminary condition is indispensable, as the essential of reproduction is the contact with, and action of the male fecundating fluid on, the ovum of the female. Nature has ordained that this creative act should be accomplished by engendering in these animals an instinctive, irresistible desire at a certain stage of existence; which desire, continuing only for a brief period, is renewed after particular intervals, until the faculty of reproduction ceases.

The advent of the power of reproduction in the male and female sex of animals is very unequally distributed among the various species, and is generally in proportion to the duration of their existence: the creatures which are short-lived being capable of bringing forth young at an earlier period of life than those which enjoy a longer term.

The Elephant only brings forth one at birth, and this occurs but once in three or four years; while the descendants of the Rabbit in the same space of time may be reckoned at more than a million. This great disparity has nothing of chance or accident in it, but is in admirable harmony with the designs of Nature. The individuals of every species produce, as has been justly remarked by Verheyen, a total number of germs which amply covers the losses caused by death; and the premature destruction of many of these germs is likewise a providential safeguard against their too numerous multiplication.

Two factors regulate fecundity; these comprise the nutritive excess which the maintenance of the individual renders disposable, and the sum total of the materials necessary for the embryonic evolution; but the divergences of these two factors are as extensive as those of fecundity itself.

If we take the weight of the fœtus at birth as the equivalent to the nutritive matter that the parent has endowed it with, and multiply this weight by the number of young annually produced, we shall obtain the total amount of the materials which have been derived from the maternal organism. Then weighing the mother, and comparing her weight with that of the

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fœtus, we shall arrive at the disposable nutritive excess; and from this, according to Leuckart, be able to calculate the fertility of a species. Although this calculation is only approximate, it none the less demonstrates, in principle, the relations between fecundity and the two before-mentioned factors. This is shown in the following table, drawn up by Leuckart, with reference to the domesticated animals.

Species.	Weight of Body.	Annual Number of Young.	Weight of each Young Animal.	Annual nutritive excess of the Maternal Organism.	Relation between the living weight of the Mother and that of the Young.	Nutritive Matter yielded to the Fœtus.
	Grammes		Grammes	Grammes		Per cent. of the living Maternal Weight.
Horse	325,000	½	50,000	25,000	100 : 7,7	14
Cow	175,000	1	35,000	35,000	100 : 20,0	20
Sheep	50,000	2	4,500	9,000	100 : 18,0	9
Pig	90,000	20	2,400	48,000	100 : 53,0	3
Dog	22,000	18	0,440	7,950	100 : 36,0	2
Fowl	0,900	100	0,044	4,400	100 : 500,0	5

The nutritive reserve of the Horse, compared with that of the other animals, is here seen to be very limited; while, on the contrary, the Fowl yields in reproductive material a sum equivalent to five times the weight of its own body. When a balance is struck between the profits and losses in the animal economy, it is found that the great difference existing has its own reasonable explanation. The function which makes the greatest demand upon the nutritive capital, is doubtless that with which the muscles are charged; and their maintenance in power exacts the heaviest compensation; as they consume material in proportion to the weight of the body, and the energy, extent, and frequency of the movements. In proportion as the height increases, the cubical weight augments at the expense of the motive power; while the latter, equal to the square of the transverse section of the muscles, follows an arithmetical, and not a geometrical, progression.

The nutritive maintenance, then, demands in an absolute manner an expenditure much more considerable in the larger than the smaller animals; so that the latter are more fruitful than the former, and their economy renders them more apt to hold in reserve a much more considerable nutritive capital.

A rich and abundant aliment, given regularly, increases reproductiveness; as is evidenced in the case of our domesticated animals, if compared with the wild creatures of the same species; and their fecundity increases or declines as their food is plentiful and good, or scarce and bad. But this influence of alimentation on fecundity, and the faculty of living beings to maintain a nutritive reserve, has its limit; for the intestinal absorption goes on in direct proportion to the superficies of the mucous membrane lining it, and this is definite.

The sum of materials necessary for embryonic evolution is also founded on the nutritive reserve. In proportion as the organisation is simplified and the various apparatus decrease in number, so does the maturity of the embryo gain in precocity, and the nutritive matter serve for a larger number of germs. Thus, as has been aptly said, what would be required to maintain the single fœtus of a large mammal, whose organisation is complete at its birth, would

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suffice for the evolution of many millions of frogs. Besides, the parent having once evacuated the product of her fecundation, has done with it: the tadpoles issuing from the ova find their nourishment in the outer world; but the young mammal derives its sustenance from the mammæ of the mother, at whose expense it continues, for a more or less protracted period, to live as a parasite. With the higher animals, which give birth to an incomplete being, there is observed an increase in fecundity: the Bitch only yields two per cent. of its weight, but the Calf absorbs twenty per cent. of its parent's weight.

This unequal distribution of fecundity among the animal species is a conservative element in the scheme of organic nature. The reproductiveness and the numerous chances of destruction surrounding the germs, are compensated for in just proportion; for out of many thousand ova furnished by the most prolific species, a comparatively limited number only find all the conditions favourable for their development.

CHAPTER I.

THE acts by which generation is accomplished are four: these are *copulation, fecundation, gestation, and parturition;* but it is only on the attainment of a certain age—that of *puberty*—that these sexual offices are in activity, and they continue so for a variable period, according to the species. During this time, ova from the ovaries, fecundated by the male seminal fluid, are received into the uterus, and remain there for a regulated period, until they have become transformed into young creatures possessing certain physical attributes and resemblances to their parents. This is the gestation period, and is followed by that of parturition, when the young are born.

SECTION I.—PUBERTY.

The generative organs of the domesticated female animals are, like those of the human female, only in a state of activity during the prime of life; and the most notable characteristic of their functions, as in woman, is their periodicity. These functions commence at puberty, when certain very marked modifications occur throughout the whole organism, but particularly in the generative organs of the male and female animals. In the first the testicles become more voluminous, and in some species they leave the abdominal cavity to be lodged in the scrotum; they also begin to secrete an abundance of a special fluid—the "spermatic," in which particles of a definite shape—spermatozoa—endowed with motion, appear. This fluid is stored up in the *vesiculæ seminales* which, until this period, were small and wasted-looking. The organ for the conveyance of this spermatic fluid to the female becomes more developed, and is capable of complete and frequent erection. In the female the mammæ enlarge, the ovaries are more vascular and turgid-looking than before, and the Graafian vesicles are more or less developed. The periodic ovipont then begins to be carried on, with all the distinctive peculiarities which it is to bear during the prolific period of life.

The age at which animals arrive at *puberty* or *sexual maturity*, is not only different in different species, but is influenced to some extent by the rapidity of their growth and the duration of their life. Domestication has more particularly brought about changes in this respect, and by inducing a more rapid development of the organism, has hastened the advent of this period. And

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it may be said that puberty is sooner attained in the female than the male, and that domesticity has also considerably modified the periodicity of the procreative manifestations in the former; though in the latter it may also be affirmed that this periodicity is not so marked, the generative functions being always more or less in activity.

The aptitude to procreate, though generally admitted as an indication of adult age, yet appears before animals have attained their full physical development, and is present in some creatures at a comparatively early period of life, depending upon climate, food, and other circumstances; the Pig may conceive when only four or five months old, or earlier; the Sheep and Goat at eight to twelve months; the Bitch at seven to ten months; the Cat at from eight months to a year, though it is usually in "heat" for about ten days before it is a year old; the Cow at twelve to eighteen months; and the Mare at from twelve months to two years.

Saint-Cyr has seen Mares which foaled when thirty months old; and others which, going at large, have received the Horse before the end of their first year, and foaled at twenty-two months. Heifers have also taken the Bull at five, six, seven, and nine months, and calved at fourteen, fifteen, sixteen, and eighteen months. In the first volume of the *Lancet* (1835-36), there is mention made of a Bull calf less than three months old, which copulated with a Quey calf about two months old, and within nine months the latter brought forth a calf. Quey and calf did well.

With regard to the period when procreation ceases in animals, I cannot discover any reliable data to arrive at a trustworthy conclusion. The Mare has not ceased to breed after thirty years of age, and the Cow and Sheep have bred beyond twenty years. I have notes of Mares producing foals at twenty-eight, thirty-two, and thirty-eight years of age.

The changes incidental to the procreative period of life in the female are chiefly centred in the ovaries and uterus: organs destined to play a pre-eminent part in the perpetuation of the species, and whose functions are interdependent. The ovary is doubtless the principal and essential agent in generation; as it gives the necessary and effective stimulus to the condition termed *rutting* or *heat*, and furnishes the germ which has been, or is intended to be, fecundated; while the uterus secretes mucus and the peculiar fluid ejected at that period, receives the ovum, forms the decidual temporary or enveloping membranes in some cases, nourishes the fœtus, and finally expels it. So that the ovaries and uterus co-operate in the accomplishment of the four chief functions of the uterine system: *œstrum*, *conception*, *gestation*, and *parturition*. These we will consider in the order in which they stand, describing the phenomena which characterise or accompany them, and noting the conditions upon which their evolution mainly depends.

SECTION II.—ŒSTRUM OR MENSTRUATION.

The *rutting*, *heat*, *œstrum*, or *venereal œstrum* of animals is analogous to "menstruation" in woman, and marks the period of maturation in the ovarian ova or ovum, according to species. This condition is *intermittent* or *periodic*, not continuous; and is characterised by a peculiar systemic excitement that usually continues for a somewhat definite period in the two sexes. In the male and female, but especially the latter, the generative organs at this period become more or less turgid and sensitive, and the uro-genital secretions are increased. In the female there is a determination of blood to the ovaries, and changes take place in these which have already been de-

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scribed. The excitation of the generative apparatus reacts o
system, and produces a kind of fever or irritability in the anim
sibility is increased; the appetite is more or less in abeyance o
and usually there is thirst; if the secretion of milk has been previo
it now diminishes, and in the non-impregnated Bitch milk even
the mammæ; restlessness is a notable feature, and the movements
prevailing desires. There is an uncontrollable tendency to seek th
sex; with some animals the ordinary disposition becomes strangely
and in others again, certain physical changes accompany the sexu
bation. Attempts at micturition in the female are frequent, but on
quantity of urine is passed; the mucous membrane of the vagina is
and with solipeds there are oft-repeated movements of the clitoris a
and an opaque white secretion, or even emissions of blood, are eject
modically *per vulvam*.*

In other animals this ejection sometimes consists of a viscid, red
or sanguinolent fluid. In all it has a special and powerful odour, w
tracts the males, and enables them to distinguish between the females
are in "rut" or "heat," and those which are not, as well as exciting i
the most ardent amatory desires.

The uterine mucous membrane is also very congested, and there is p
out on its surface a fluid containing epithelial *débris*, mucus corpuscle
blood globules.

The existence in the lower animals of what is analagous to the *mens*
discharge in the human female, has frequently been denied, but wit
any reason or proof. A discharge of blood from the sexual organs of wo
announces the advent of puberty; and its coincidence with the maturity
escape of the ovarian ovule, as well as its periodical appearance until the
mination of fertility, establishes between this phenomenon and the "heat'
"rut" (*œstrum*) of animals a very close analogy. And this analogy is r
dered complete by the fact that animals also at this period have more or l
evident sanguine emissions. Kahleis, Fuchs, Spinola, Numann, and othe
have observed this in the Cow, and have also noted that the discharge occu
regularly at intervals of nineteen or twenty days when the animal is nc
giving milk or in calf. The hæmorrhagic flow appears two or three day
after the commencement of "rutting," and when this is most intense. Th
amount of blood does not exceed one or two ounces, and the coagulated clot
remains in the vagina until it is expelled with the urine. There can be no
doubt as to its source. If, at the moment when traces of it are perceived
externally, the Cow is killed and the inner surface of the uterus examined,
blood will be seen exuding from the cotyledons. And this phenomenon has
been proved to extend beyond the bovine species, for it has been witnessed
in the Mare, Bitch, Cat, Rabbit, etc.; and in the red-coloured mucus of the
vagina and uterus, multitudes of blood-corpuscles have been found.

The cause of menstruation or periodical discharges of blood in female
animals, has received a satisfactory explanation from the researches of Rouget,
who has established the fact that the utero-ovarian artery, on arriving at the
body of the uterus, near the Fallopian tube, divides into curved or spiral
bouquets of vessels which open into veins, like the helicine arteries of the male

* Kaiser, in the *Magazin für die gesammte Thierheilkunde* for 1859, mentions a Mare, twenty-four years of age, which every three weeks had a sanguineous emission from the vulva; this discharge ceased towards the middle of pregnancy, but returned after parturition. I have frequently witnessed the periodic discharge from Mares either streaked with blood, or blood-tinted.

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cavernous sinus. Along the inferior border of the ovary, this artery forms a series of branches that wind and twist exactly like the arterial ramifications at the root of the *corpus cavernosum*, penetrating the stroma of the ovary, and giving rise to spiral convolutions. The venous system composes the uterine sinuses—contorted venous canals not unfrequently spiral, like the art ries.

The uterus is, therefore, an erectile organ like the penis, and its erection is connected with the periodic hæmorrhage from its inner surface. The venous sinuses in the meshes of the muscular tissue, crossing each other at the hilus of the ovary, are partially compressed, and the immediate result is the distending and erection of the bulb of the ovary. This modification in the ovarian circulation extends to the uterus, so that both are in a state analogous to erection; the prolonged tension is communicated to the vessels and capillaries of the mucous membrane; the epithelium is shed, leaving the tunic of the capillaries exposed, and this soon gives way, whence results the hæmorrhage, which persists as long as the erection and obstruction to the free flow of blood through the veins continues. This is the case in the human female, but it must be admitted that, in several animals, the erectile formations are either in a rudimentary condition or entirely absent.

In the Bitch the bulb of the ovary is moderately developed; but the arteries of the uterus, although contorted in a spiral form, are not such a vascular mass of vessels as to constitute a real erectile organ. In Ruminants, small vascular masses or formations are observed near the cotyledons, which may be taken to represent the spongy texture of the human uterus.

With regard to the season at which this "heat" takes place, it has been observed that it is usually the spring-time, when food becomes plentiful, especially with herbivorous animals. The Carnivora are in heat during winter. The Mare is usually in heat from April to June, or later. With the Cow whose calf is sold at from one to two months old, with a view to utilising the milk, the season of course is varied: as care is taken to induce conception again as soon as the lacteal secretion begins to diminish; but it has been observed that midsummer is more particularly the rutting period. And the "heat" in Sheep, though naturally present in September, is usually only shown during summer, because the Ewes are kept apart from the Ram at the natural time, in order that the lambs may be born at a favourable season—the spring; and the period of suckling over (four or five weeks), they may be weaned when the herbage is tender and nutritious. And in other circumstances, particularly with animals bred for the butcher, the rut is induced sooner by putting the Ewes in contact with the Ram at an earlier period, so as to obtain two or three lambings in the year.

The Bitch is in heat from December to February, or in the autumn and spring-time.

The Cat is in this state in January and February, and also in the spring and autumn; sometimes the heat appears three or four times a year, and the animal may produce young as frequently, though in the wild state it seldom does so more than twice a year.

The Pig manifests rutting in October or November; at least that is the period when it is usually put to the male; and it may be put a second time towards the end of spring, in order to have two litters within the twelvemonth.

The *frequency* and *duration* of the period of "rutting" or "heat" depends upon the age, species, and other circumstances; but it may be said to persist in the domesticated animals from one to fifteen days at the most. The

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shortest period is witnessed in the Cow and Sheep, and the longest in the Bitch. It is sometimes only present from twelve to twenty-four hours in some non-fecundated animals. With impregnation, however, it ordinarily ceases until after parturition; and if impregnation does not occur, it gradually disappears until the next period, which is somewhat variable. Its re-appearance in the Cow has been noted every month or three weeks, and sometimes at closer intervals; and in the Sheep and Pig it lasts for one or two days, and again appears from the fifteenth to the thirtieth day, but usually every month. When removed from artificial conditions, it is stated that the ovine species is in rut in September, that this persists only for a day, but re-appears every fourteen days until the end of December. From the spring until the end of summer, it may be said the Mare manifests a desire for the Horse every three or four weeks, and the objective phenomena which announce it continue from two to four days. In the Bitch they last for nine or ten days, and, as has been stated, only appear in the spring and autumn.

This periodicity is regulated by Nature, with a view to the preservation of species; and in animals not influenced by artificial conditions, it is so arranged that the young creatures may arrive during the season when their maintenance will be best assured.

With the subsidence of venereal excitement in unimpregnated animals, there succeeds a period of calm, which is almost equivalent to that of gestation in impregnated creatures. And, strange to say, with Bitches at the end of this interval—from the fortieth to the sixtieth day—there sometimes appear phenomena allied to the parturient period: as tumefaction of the mammary glands, followed by swelling and increase of the opening of the vulva, with reddening of the vaginal mucous membrane and the escape of a viscid fluid. The animal also acts as if about to bring forth: making a bed for her young; moving about uneasily; neglecting her food for three or four days, during which the mammæ become still more developed, firm, and elastic, the teats elongated, and the lactiferous sinuses filled with an abundance of good milk, which is easily obtained by slight pressure. If a Bitch in this state is presented with a young puppy, she will take to it as if it was her own, and rear it most affectionately. This strange condition has been observed, though more rarely, in the Cat; and Chauveau has also noticed it in a Mare which had been put to the Horse, but did not prove in foal.

The years during which œstrum continues varies with species, and particularly with regard to the age they attain; but it always disappears towards the decline of life.

Climate, inseparable from the conditions of alimentation, exercises a marked influence on the "rut," in hastening its development and its periodicity; but the economical law to which it is subordinate does not vary. With many species, the rut only appears once a year; while in others which are favourably placed with regard to alimentation, it persists in every season, or at least during a large part of the year. Domesticity, in assuring animals food and shelter, and removing them from the risks and alternations of an erratic life, multiplies the periodical returns of this condition. Fowls, Pigeons, etc., lay despite the rigours of winter, and the domesticated mammals are in heat at short intervals.

Though, as a rule, œstrum does not appear until after parturition is achieved, and lactation has nearly or quite ceased, yet it is not rare to find some animals, as the Mare and Pig, manifest a desire for the male, and even copulate; and it is no less a fact that rutting and impregnation may, and does occur, soon after parturition. The Cow, Ass, and Sheep, and, it is believed,

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the Mare, will copulate with a greater certainty of success on the ninth day after parturition than at any other time.

It must be remembered that various conditions influence the appearance of this function, and more or less change the period and the intervals of its advent. Warmth, shelter from vicissitudes of weather, an abundance of nourishment, especially that of a stimulating nature, and easy labour, favour its more frequent and early appearance, and especially a judicious bringing together of the male and female. It has also been induced by the injection of certain substances into the vagina.

The persistence of this condition for longer than the natural period is a symptom of uterine or ovarian derangement, and therefore unfavourable. It renders the animals of less value, or even dangerous, constituting the disturbance designated "nymphomania."

SECTION III.—MATURATION OF THE GRAAFIAN VESICLES.

The spontaneous and periodic ripening and dehiscence, or discharge, of the ovarian vesicle that marks the period of œstrum in the domesticated animals, though independent of fecundation, yet is doubtless intended to commence the act of generation. The peculiar condition which accompanies the maturation of the ovum, the intense desire of the female for the male, and the excitation produced in the latter at this period, with its aptitude for procreation, conclusively demonstrates this. At this time, as we have seen, particular changes occur in the ovaries. A certain Graafian vesicle or vesicles, according to the species and whether the animal is uniparous or multiparous, becomes more voluminous than the others, raises the enveloping membrane of that body, and makes a more or less salient projection on its surface, as is witnessed in the ovary of the Pig. Around this vesicle the bloodvessels enlarge, and the stroma is congested; while in its interior an effusion of blood takes place; the capsule becomes greatly distended and injected, and at a particular point gives way, leaving an irregular gap through which the ovum (Fig. 21, *b*) escapes. In the Pig, during the evolution of the vesicle, the corpus luteum is red, deep red, blue, or nearly black. It is probable that the Graafian vesicles open at any part of the surface of the ovary, in those animals in which the pavilion of the Fallopian tube is large enough to envelop it more or less completely. But in those creatures, such as the Mare, in which the ovary is so voluminous, the pavilion cannot cover it; and it is not at all unlikely that in this case the rupture of the vesicles occurs at the hilus of the ovary, as the corpora lutea have only been observed at this part. In multiparous animals, the rupture of the vesicles at one period of rutting does not appear to take place simultaneously, but successively.

The number of Graafian vesicles which come to maturity and rupture at each period of œstrum, depends, with some exceptions, upon the number of young each female brings forth at a birth. The Mare, Cow, and Sheep, having usually only one offspring at a time, only one vesicle ripens during œstrum; the Goat has most frequently two young, and in this case a vesicle ruptures in each ovary; while the Pig and Carnivora having several at a birth, a corresponding number of vesicles open and their contents occupy each cornu of the uterus.

The ovum liberated by the bursting of the vesicle is seized by the pavilion of the oviduct, which is applied somewhat closely to the surface of the organ, and is carried down the tube to the uterus, where, if fecundation does not ensue, it remains only a brief period before it is expelled or perishes. The

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seizure of the ovum, as has been stated, is all the more certain in proportion as the pavilion is large enough to grasp a large surface of the ovary; this condition is found most developed in the Carnivora.

CHAPTER II.

Fecundation.

The effective intercourse of the male with the female is followed by certain remarkable changes in the ovum and generative apparatus of the latter, which, at first known as *fecundation*, *conception*, or *impregnation*, ultimately results in the formation of a new creature possessed, to a certain degree, of individual or independent life. The intercourse, to be effective, depends upon the presence of a healthy ovum in the apparatus of the female, and the introduction into this apparatus of the seminal fluid by the special organ of the male. This fluid contains the essential elements known as "spermatozoa"—organic particles of a particular shape, and endowed with motion. For conception, it is absolutely necessary that the ovum of the female should be brought into contact with these particles; though whether this contact can occur in the ovisac, prior to its escape, has not yet been definitely ascertained. It is certain that by reason of their particular movements, and also doubtless through the aid they receive from the special motion of the ciliated epithelium covering certain portions of the lining membrane of the uterus, these spermatozoa, when the uterine opening is patent, are diffused soon after *coitus* to the most distant parts of that cavity, and high up in the Fallopian tubes; though they have never been traced so far as the ovisac. Nevertheless, a very strong argument in favour of their attaining this region, and producing what is called "ovarian" or "tubal impregnation," is afforded in the occurrence of extra-uterine—ovarian or tubal—gestation; for in this case the spermatozoa must have reached both oviduct and ovary.

Before the ovum leaves the ovary, changes occur in it which may be noted here. The germinal spot, previously at the inner surface, passes to the centre of the germinal vesicles; and this, which was before at the surface, goes to the centre of the yolk or *vitellus;* while the membrane investing the latter, from being thin, suddenly thickens. When the ovum is discharged, the *tunica granulosa* and *retinacula* accompany it through the small opening in the vesicle; the whole being received into the pavilion or infundibulum of the Fallopian tube, which at this time is firmly applied against the ovary. Arrived at this part, the ovum is carried along by the slow vermicular motion or contraction of the tube, as well as by the ciliary movement of the cells covering the mucous membrane lining this duct, until at last it reaches the uterus.

CHAPTER III.

Sterility

Hitherto we have been treating of successful fecundation as if it was always a sure result of the coupling of the male and female sexes at a certain period. Successful fecundation, however, is not always the case, and in some species —particularly the equine—sterility, temporary or permanent, in the female

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is far from being uncommon, and is sometimes serious. Sterility or infecundity depends on numerous causes, to some of which we must allude, as in distinguishing their presence we may be able to remove or counteract them.

It is difficult to ascertain the extent to which it prevails, especially in the larger and more important animals. In the Stud Book, it is shown that among thorough-bred Mares the per centage of those which carry foal is 73·36, and those which abort or are infecund 26·64. In the studs of France the fruitful Mares are 59·57, and the unfruitful ones 40·43 per cent. The Duke de Guiche gives 68 per cent. of fecund Mares. At the haras of Pin, during a period of twenty years, there was a per centage of 68·27 fecund Mares, abortions 5·06, non-fecund 26·67; while at the Pompadour haras, where oriental horses were chiefly bred, the births in three years were 79·55, abortions 2·27, and non-fecunds 20·45.

In the Cow, the fecundations appear to average about 79 per cent.

With the Sheep, sterility or infecundity is not so common. Rueff, at Hohenheim, found among 8500 sheep, only 740, or 8 per cent. unfruitful.

Sterility may depend upon organic or physical causes, and may amount to permanent impotence, more particularly when congenital, and located in the generative apparatus. Monstrosities, hermaphrodites, animals in which one or more important organs of the sexual apparatus are absent, and hybrids, are generally permanently sterile.*

Prolonged continence and old age is not an unfrequent cause of infecundity, as is witnessed in Mares which have worked for many years in towns, and then been transferred for breeding purposes.

Change of climate has in many cases a marked influence on fecundity; sometimes putting it altogether in abeyance, and at others rendering the animals infecund for only a longer or shorter period. It may also be impaired, or suspended temporarily or permanently, by abuse of the generative functions, bad hygiene, etc.

It may likewise be due, though temporarily, to premature or tardy coition when the generative organs are not in a physiological condition for conception, or when they are in an irritable, abnormal state. Under-fed or over-fed animals generally do not breed so readily as those which are in moderate condition; fat animals are especially unfruitful. Excitable, vicious Mares are less likely to procreate than those which are of an equable and gentle disposition. The latter are often impregnated at one attempt; and it has been observed that with Mares accustomed to work, active exertion, even to produce fatigue, before being put to the horse, is favourable to conception. So it is that the Arab submits his Mare to a severe gallop, and brings her almost breathless before the stallion, when, the act being accomplished, he leaves her quietly at rest for some hours.

Various diseased conditions of the generative or other organs, as well as general derangements, may also prove antagonistic to fecundity. There may be disease or alterations in the ovaries, Fallopian tubes, uterus, or vagina, which will hinder conception; and if any material obstacle to the contact of the spermatic fluid with the ovule be present in these parts, fecundation cannot take place. Tumours of various kinds in this region are not an infrequent cause of sterility.

Rueff and others have observed an imperforate, dense, and tough hymen to be a cause of infecundity in the Mare.

* There are exceptions to this rule. Several well-authenticated instances are recorded in which the soliped mule has bred, as well as other hybrids.

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In all these conditions a careful examination should be made, as removal of the obstacle to generation may be quite within the scope of surgical or medical measures. More particularly is this the case when the obstacle is related to some abnormal condition of the cervix uteri—a circumstance more common than is generally supposed.

Occlusion of the canal leading to the cavity of the uterus—the *os*—has been known as a cause of sterility in the Mare and Cow from the earliest times. This occlusion may be complete during coition, and prove fatal to conception; it may be due merely to a spasmodic condition of the muscles of the cervix. The oiled hand should be introduced into the vagina to ascertain the state of the part; when, if the closure is suspected to be owing to muscular defect, the cervix may be smeared with extract of belladonna. If, however, this does not succeed, or if there be hypertrophy, disorganisation, or rigidity then an operation will be necessary. Hypertrophy from plastic exudation, and the formation of false membranes, is a frequent cause of sterility, and usually occurs during or after the first birth, particularly in the Cow. In many cases the morbid closure of the *os* can be remedied in a very safe and simple manner. The animal is secured—if a Mare by the "side-line," if a Cow by fastening the two hind legs together, though not too close—and the oiled hand, in the form of a cone, passed up the vagina to the cervix in a half-rotary or screwing manner; on reaching this, the tips of the fingers are to be gently insinuated, by the same movement, into the *os*, and pushed on until the cavity of the uterus is reached. A simple sound, well greased, and the size of an ordinary catheter, may be employed with the same object as the fingers, and appears to answer quite as well. Various instruments have been devised to dilate the cervix, but nothing is equal to the fingers or the sound. The animal may be put to the male on the same or the following day. This simple operation for the cure of sterility has been very often practised, and is well known to the Arabs of the Sahara, who treat their barren Mares in this manner, and in the majority of cases with success.

In rare instances dilatation may require to be effected by a cutting instrument, but this should never be resorted to until the simpler and safer means have failed.

Disease of the mucous membranes, with altered secretions, must be treated according to their indications.

CHAPTER IV.

Changes in the Ovum.

During the progress of the ovum towards the uterus, and soon after its reception into that cavity, some remarkable alterations occur. The ovum has encountered the fructifying element of the male semen—the spermatozoa; at least, this has been established in the Rabbit, in whose oviducal ovum they were found to have passed through the *zona pellucida*, though no opening has yet been discovered in that extremely fine evanescent film. The germinal vesicle disappears, or has changed its character, and a somewhat more opaque *embryonal cell* succeeds, which may be, or includes, a combination of the nuclear matter of the sperm-cell with that of the germ-cell. Then the vitellus, escaped from its enveloping membrane, becomes depressed in a circular manner, and breaks up into independent masses.

This change, and others to be described, takes place during the course of

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the impregnated ovum through the Fallopian tube. It may chance, however, that impregnation takes place in the uterus; for it is probable that the ovum may be retained there for a certain time previous to perishing or being ejected, and that, should it meet the spermatic fluid, impregnation will ensue and the usual results follow.* But it is more likely that the initial changes are, in the majority of instances, accomplished in the tube. There, the ovum is bathed and moved about in the clear fluid containing the spermatozoa, by the peristaltic action of the walls of the duct, in order to enable the largest number of the fertilising particles to obtain access to the yolk, and thus ensure fecundity.

With the formation of the embryo-cell, the vitellus becomes separated or retracted by fluid from the zona pellucida, and begins to rotate therein; while one or two minute granular or oil-like bodies may appear in the surrounding fluid (Fig. 28).

A division or *segmentation* of this primary embryo-cell into two portions (Fig. 29), each provided with a nucleus, is the next step; then there is mutual repulsion of these secondary globes, and further cleavage of each into two portions (Fig. 30), and these again into other binary divisions (Fig. 30) of

Fig. 28.

OVUM FROM OVIDUCT OF RABBIT, PENETRATED BY SPERMATOZOA IN ITS VITELLINE LAYER.

Fig. 29.

AN OVUM MORE ADVANCED IN THE OVIDUCT.

the germ yolk, through attraction round each cell of the particles contiguous thereto, until the whole is worked up into a mass of finely nucleated corpuscles —the ultimate segmentations of the impregnated parent embryo-cell. Each of these corpuscles contains a colourless pellucid nucleus, and each of these again a nucleolus. The eight-fold cleavage of the yolk has been observed three days after impregnation in the Rabbit, four days in the Guinea-pig, and ten days in the Bitch; and always in the ova found towards the uterine extremity of the oviduct. In the latter animal the smooth surface of the zona pellucida becomes irregularly flocculent, as if a granulo-mucus substance had been deposited thereon; in the Rabbit the ovum acquires a thick adven-

* It may be remarked that, with multiparous animals, the number of young in the cornua are not in proportion to the corpora lutea of the same period. Franck mentions an instance in which there were eleven corpora lutea and only five fœtuses; from which it might be inferred that six ova had perished, or, if they had been impregnated, that the fœtuses must have died at a very early period, and been absorbed. It has also been stated that an ovum from the right ovary (which bore recent traces of the rupture of a Graafian vesicle), has been found in the left cornu, whither it must have wandered. This has been observed in woman, in the Bitch, the Guinea-pig, and also in the Sheep. Kehrer mentions, in the *Monatsschrift für Geburtskunde* (vol. xxii., p. 225), finding a fœtus in each horn of the uterus, and in the right ovary two true corpora lutea. One ovum had migrated to the left cornu by means, probably, of the uterine contractions.

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titious layer of albumen before entering the uterus (Fig. 31, *a*); in the Guinea-pig the zona continues smooth. After entering the uterus, on the fourth day the zona grows fainter, as the final segmentation or mulberry state of the yolk is attained, and it disappears altogether when the germ-mass is completed. The act of impregnation is thus consummated, and a series of new changes begin, which are replete with interest and importance.

When arrived in the uterus, a layer of very small vesicles makes its appearance on the whole of the inner surface of the membrane now investing the yolk. The *mulberry* structure then passes from the centre to a certain part of that layer, the vessels of the latter coalescing with those of the former, where the two sets are in contact, to form a membrane—the future amnion; while the interior of the mulberry-like body is now seen to be occupied by a large vesicle, containing a fluid and dark granules. In the centre of this fluid is a spherical body, composed of a substance having a finely

Fig. 30.

OVUM FROM THE UTERINE HALF OF OVIDUCT.

Fig. 31.

OVUM FROM THE UTERINE END OF THE OVIDUCT, WITH AN ADDITIONAL LAYER OF ALBUMEN.

granular appearance, and containing a cavity filled with a colourless and pellucid fluid; this hollow and spherical body seems to be the true germ. The vesicle containing it disappears, and in its place is seen an elliptical depression, filled with a clear fluid, and in the centre of this is the "germ," still presenting the appearance of a hollow sphere.

The fluid presses the nucleate corpuscles of the yolk outwards against the inner face of the enveloping membrane, and as it increases the pressure from within flattens these corpuscles, until they resemble pavement epithelium; and, finally, they all coalesce to compose a membrane lining the zona, which has been named the *blastoderm*. This blastodermic vesicle divides into two layers—an *external* and *internal*—the first of which is pale and only slightly granular, while the cells of the second are filled with fat granules; it is consequently of a deeper tint.

Though the foregoing changes in the impregnated ovum have been chiefly observed in the Rabbit and Guinea-pig, yet there can be little doubt that they are of the same character in the domestic creatures whose embryology we are now studying.

It is only to be remarked that, in hoofed animals, no envelope of the ovum is superadded to the zona pellucida before it enters the uterus; im-

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pregnation of the ovum taking place in the Fallopian tube, where it meets the spermatozoa, the first stages of cleavage in its interior go on there, but the germ-mass is completed in the uterus. In this process the zona thins away and finally disappears, and a mass of albuminoid matter accumulates around the ovum, which affords material for imbibition. The germ-mass becomes fluid at the centre, and expands into a hollow sphere, whose wall offers two layers: both consisting of coherent cells, and only differing, as just remarked, in the size and proportion of the oil-globules.

SECTION I.—DEVELOPMENT OF THE EMBRYO.

The ovum having been lodged in the uterus, and the *germ-membrane* or *blastoderm* having divided into two layers—an upper or *serous*, and a lower or *mucous*—and between which, at a later period, a vascular layer is developed, another modification occurs by which the outline of the embyro becomes evident.

In the centre of the blastoderm, where it is supposed to divide into these

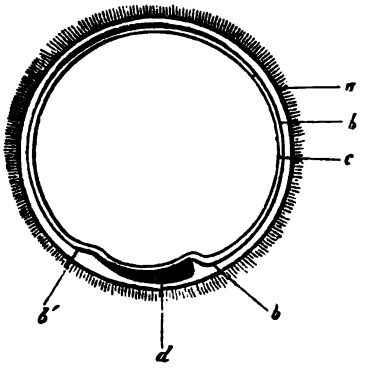

Fig. 32

BLASTODERM AND PRIMITIVE TRACE.

a, Vitelline Membrane with its commencing Villosities; *b*. External (or Serous) Layer of the Blastoderm; *c*, Internal (or Mucous) Layer; *d*, Body of the Embryo; b^1, b^1, Earliest Cephalic and Caudal Elevation of the External Layer.

layers, there is observed a clear space which has been designated the *area proligera* or *pellucida*, in the centre of which, and in the transverse axis of the vitellus, there is going on a multiplication of loosely connected cells in a small rounded mass, which forms the *germinative area*, *primitive streak*, or *trace* of Von Baer; while around this another space—the *area vasculosa*—is developed. The "primitive streak" is the centre where the blastoderm commences to be separated into the external and internal layers; the middle layer, which is to form the fœtal organs, not extending beyond the "germinative area" or "streak."

By a proliferation of the elements of the outer and middle layers of the blastoderm, the primitive trace increases in surface and thickness, becoming clearly defined and prominent, in the form of a shield, and is named the *opaque area*, which, when it grows transparent in its centre, is named the *transparent* or *pellucid area*; the clear spot, narrowing or constricting in its middle part, is named the *area vasculosa* or *embryonic*. In the middle of this

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embryonic area appears a dark line, or median furrow, due to changes occurring in the primitive streak; and below it a round cord—the *chorda dorsalis*—the axis of the future embryo, and which is to develop the spine; on each side of the streak is the *lamina dorsalis*, and the portion of fluid separating them from the chorda dorsalis is the future spinal cord and brain. The inner layer of the blastoderm, at the points corresponding to the embryo, becomes doubled, so as to form a new layer—the *middle layer*. The *chorda dorsalis* thickens at the front part, to form the first appearance of the skull, and the fluid between the dorsal laminæ is in larger quantity, in correspondence with it; so that the central parts of the nervous system and their coverings are laid down at the same time and grow simultaneously. The separation between the spinal cord and brain takes place early, being coincident with a curving downwards, towards the yolk, of the anterior part of the laminæ dorsalis, which defines the limit between the skull and spine, brain and cord.

Next follows the closing of the dorsal laminæ over the fluid which is to constitute the brain and cord. Two other laminæ are in the meantime proceeding from the axis of the embryo, one on each side. They grow out laterally, and tend to converge in the median line, as did the dorsal laminæ; but they form a larger curve, and follow a different direction, converging to meet *below* the axis, where they join, except at the umbilicus.

After the rudiments of organic life have been commenced in the central portion of the serous layer, a fold of its peripheral portion arches over the dorsal surface of the embyro, so as to represent a sac whose opening is at the edge of the fold. The opening gradually decreases until the opposing folds of membrane are in contact; it then disappears, leaving the fœtus surrounded by two membranes. The one next the fœtus is the *amnion*, and the other is gradually separated from the amnion, and joins the serous lamina of the blastoderm, forming the "false amnion" of Pander, or the "serous covering" of Von Baer. The membrane surrounding the vitellus or yolk is very vascular; it becomes oval in shape, and more pointed when it is in contact with the embryo, until at length it contracts into a narrow duct, constituting the *vesicula alba* and duct. Thus, then, we have seen the embryo developed in the layers of the blastoderm, and formed by a gradual closing in of the laminæ towards the median line; the brain and spinal marrow, which are its earliest rudiments, are covered in, and the parts anterior to the spine—the thorax, abdomen, etc.—are formed.

We will now direct our attention to changes occurring elsewhere, and return to the development of the embyro again.

Towards the twelfth day, in the higher orders of animals, the chief modifications which have just been described as occurring in the condition of the ovum after fecundation, are accomplished. The ovum then measures from one-third to one-fourth of an inch in diameter, and is composed in reality of four layers or shells, enclosed one within the other, but only three of which are complete; they are: (1) the yolk membrane; (2) the external layer of the blastoderm; (3) the middle layer; (4) the inner layer.

By ulterior modifications, the layers of the blastoderm form the various organs of the fœtus, and what have been termed its *annexes*, or enveloping membranes. The different layers have also received other names than those mentioned, according to their functions: thus, the external or serous has been named the *sensitive* layer, because it originates the epidermis and the organs of sense; the middle layer has been named the *vascular* or *germinative*, as it contains the principal vessels of the embryo, and the locomotory organs

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are developed in its substance; while the internal layer is known as the *mucous* or *intestino-glandular*, from its constituting the mucous membranes, its principal portion forming the intestines and glands. Each of these layers furnishes, in the course of its development, the intra-fœtal and the extra-fœtal parts. We shall examine the latter first; merely noting, in the meantime, that the intra-fœtal parts of the external or sensitive layer of the blastoderm form the epidermis and its appendages—as the hair, claws or hoofs, glands of the skin, etc.—the central nervous system, and the organs of sense—such as the retina and the labyrinth of the ear; while the extra-fœtal parts it forms are due to its alteration in shape.

The fœtus, as we have seen, is a circular body applied against a certain point of the blastoderm, whose outer layer is continuous, and extends over the internal face of the chorion and the surface of the embryo without any limit. But the inflection or bending of the latter at its two extremities causes the external layer to become depressed, and to constitute two folds;

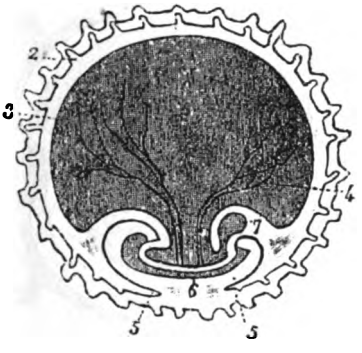

Fig. 33.

OVUM TWENTY TO TWENTY-FIVE DAYS OLD.

1, Villosities of the Vitelline Membrane; 2, External Layer of the Blastoderm, or Second Chorion, with its Villosities; 3, Umbilical Vesicle, formed by the Inner Layer of the Blastoderm; 4, Vessels of the Umbilical Vesicle; 5, Cephalic and Caudal Processes; 6, Embryo; 7, Allantoid Vesicle.

one investing the head, the other the opposite extremity of the body. The lateral parts of the embyro are also inflected towards each other to form the thoracic-abdominal cavity, and it is thus enclosed in the serous layer, whose sides soon meet above the back of the young creature, and a short pedicle —the superior umbilicus—joins the two portions of the blastoderm. This pedicle soon disappears, and the embryo is then enclosed in an independent sac—the *amnion* already alluded to. The sensitive layer is, therefore, decomposed into two sections: an internal, the *amnion;* and an external, the *serous vesicle*, which is applied against the inner face of the zona pellucida, and concurs to form the chorion.

The middle layer will be noticed hereafter, and we now go to the interna layer. The intra-fœtal parts of this so-called "mucous layer" form the epithelium of the intestines and the glands belonging thereto, the respiratory apparatus, the kidneys, and the bladder. These organs are developed at the same time as the extra-fœtal parts.

In curving-in upon itself, the embryo encloses a portion of the internal blastodermal layer, but the union between the free and the imprisoned parts

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is at first largely maintained; soon, however, it contracts, and in a brief period is only represented by a somewhat narrow canal, the *inferior umbilical ring*. The mucous layer is therefore divided into two distinct portions: the *intestinal furrow*, or *intra-fœtal* portion; and the *umbilical vesicle*, *vesicula alba*, or *extra-fœtal* portion. These two divisions communicate by the *omphalo-mesenteric* or *vitelline duct*. The "umbilical vesicle" is filled with a granular fluid, which is conveyed by the omphalo-mesenteric vessels for the nutrition of the fœtus; when this alimentary reserve is nearly expended, the *allantois* appears. This begins by a small enlargement, which the intestinal furrow pushes towards the inferior part of the abdominal cavity; the enlargement becomes elongated and vesicular-looking, and gradually increases in size by bringing the umbilical vessels towards its borders. Becoming still more elongated, it passes through the umbilicus and spreads itself over the inner

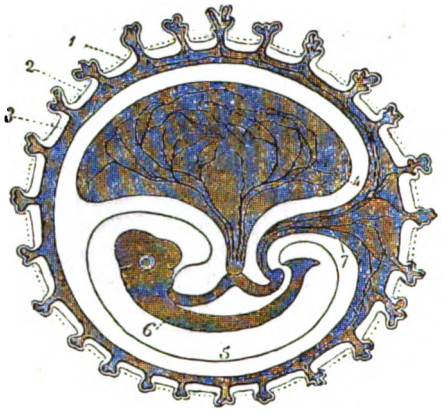

Fig. 34.

OVUM ABOUT A MONTH OLD.

1, Vitelline Membrane or Primitive Chorion, which has almost disappeared; 2, External Layer of the Blastoderm or Second Chorion; 3, Allantois penetrating the Villosities; 4, Umbilical Vesicle; 5, Union of the Caudal and Cephalic Processes, and Formation of the Cavity of the Amnion; 6, Embryo; 7, Allantois.

face of the chorion, between the latter and the amnion. It is divided into two sacs by a constriction, the *urachus*, at the umbilical ring; the inner sac is the smallest, and forms the *bladder;* while the external, the most voluminous, composes the *proper allantois.*

We have now seen that the vitelline membrane, lined by the serous vesicle, forms a complete shell around the ovum in process of development; and that the layers of the blastoderm eventually constitute three membraneous sacs, two of which envelop the embryo. These various membranes constitute the "envelopes" or "annexes" of the young creature during utero-gestation, and in describing them it is usual to include the "cord" composed of bloodvessels, as well as the capillary ramifications which establish and maintain such important relations between the mother and its offspring during this period.

SECTION II.—ANNEXES OF THE FŒTUS.

The annexes, then, comprise the *chorion*, a membraneous envelope exactly

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adapted to the uterus; the *amnion*, a second ovoid sac included within the latter, and containing the fœtus; the *allantois*, a membrane composed of two layers, which are spread over the external face of the amnion and the inner surface of the chorion, and thus lines the cavity formed by these two envelopes; a small bladder of a pyriform shape, the *umbilical vesicle;* the *placenta*, a collection of vascular tufts grafting the fœtus to the mother; and the *umbilical cord*, composed of vessels that attach the fœtus to the envelopes which contain it, and which ultimately ramify in the placental tufts. We will describe each of these in detail, as a correct knowledge of their anatomy is essential to the comparative obstetrist. As before, we will take solipeds as the type of comparison.

Chorion.

The *chorion*, the outer envelope proper to the ovum, is found covering it loosely at the earliest period of its existence, and corresponds to the mem-

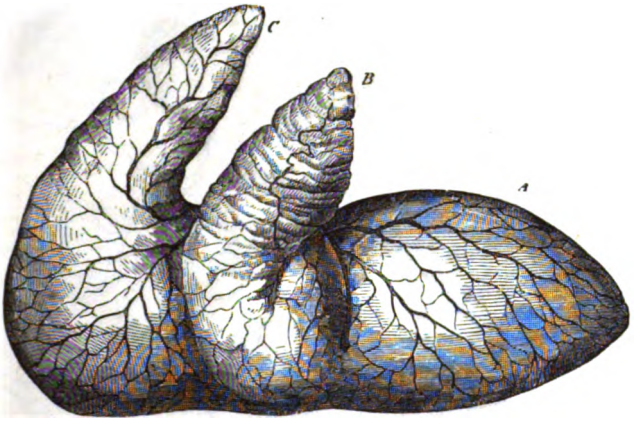

Fig. 35.

Chorion of the Mare at Mid-term: Inflated.

A, Posterior portion occupying the Body of the Uterus; B, Left Cornu plicated and sacculated; C, Right Cornu, longer than the left, and containing a portion of the Fœtus.

brane lining the egg in oviparous animals. It is a vast membraneous sac, completely closed, and which, being moulded upon the uterine cavity, resembles the uterus in form, having a body and two cornua; the latter, however, are not co-extensive with those of the uterus. When the chorion is distended, its cornua show fine and deep plicæ or bulgings, like the cæcum; the cornua are always unequal in size, that in which the fœtus is developed being of course the largest. The external surface, otherwise smooth, is studded with innumerable small, red, short papillæ or "processes," which are formed by the placental villous tufts. This papillary face adheres slightly to the internal surface of the uterus, and between the two surfaces a trifling quantity of brown or blood-coloured fluid is found. The inner face is lined by the external layer of the allantois, to which it is closely adherent except at the insertion of the vascular cord, where there exists a kind o conical infundibulum occupied by the umbilical vesicle. On this surfa c

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the umbilical arteries and veins ramify, their minute divisions traversing the membrane to form the placental villosities. The chorion may be divided into two laminæ, the outer of which has been called the *exochorion*, and the inner the *endochorion*. From the endochorion are derived the vessels which pass to the villi, the chorion itself being destitute of vessels until the allantois is developed. The structure of this envelope is that of a delicate cellular membrane, traversed by the vascular ramifications of the placenta.

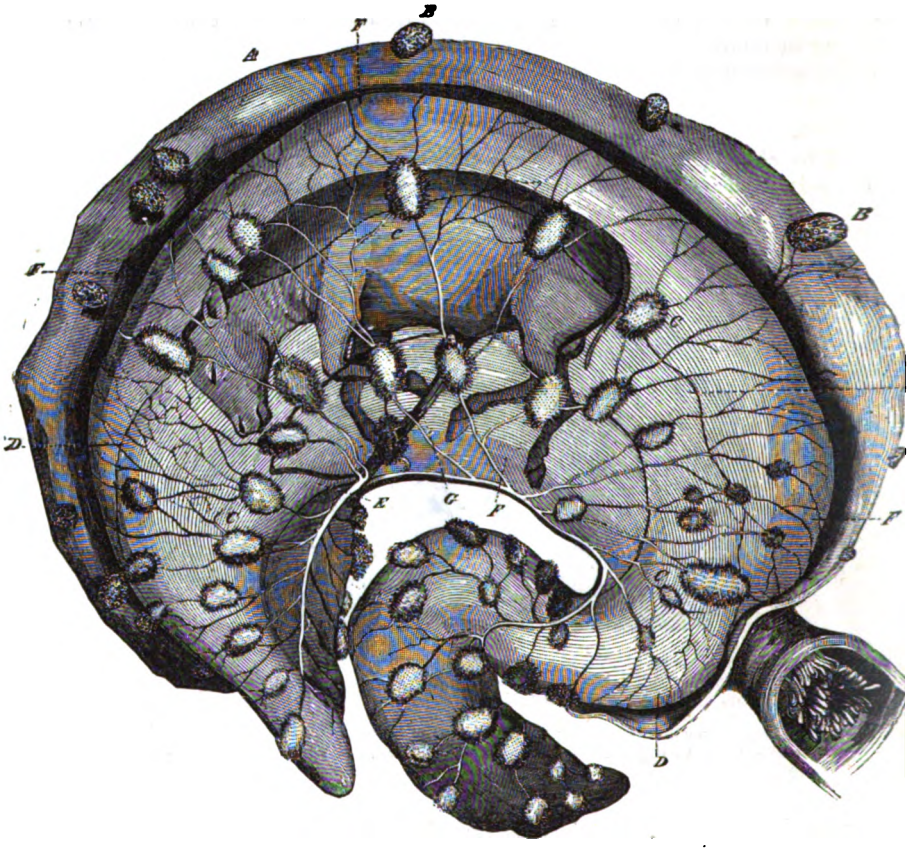

Fig. 36.

FŒTAL MEMBRANES OF THE COW AT MID-TERM.

A, Uterus opened on its left side; B,B, Cotyledons of the Uterus; C,C, Placentulæ; D,D, Allantois; E, Vesicle of the Urachus; F, Amnion; G, Umbilical Cord.

In many places its cellular arrangement closely resembles that of vegetables, each cell containing a distinct nucleus; the villi have the same texture, but their cells are filled with a granular matter. The strength of the membrane is greatest in the early ovum; it is formed by the *zona pellucida*, which is lined by the external layer of the blastoderm. It is thought that the primitive chorion disappears by resorption, and that this blastodermic layer becomes the definitive chorion; also that when the allantois has spread itself

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between the amnion and the external envelope, carrying outward the umbilical vessels, this definitive chorion becomes vascular, and furnished with its numerous villosities.

Differences.

Ruminants.

In Ruminants, the chorion corresponds to the internal face of the uterus, whose form it repeats, and with whose surface it is more or less in contact.

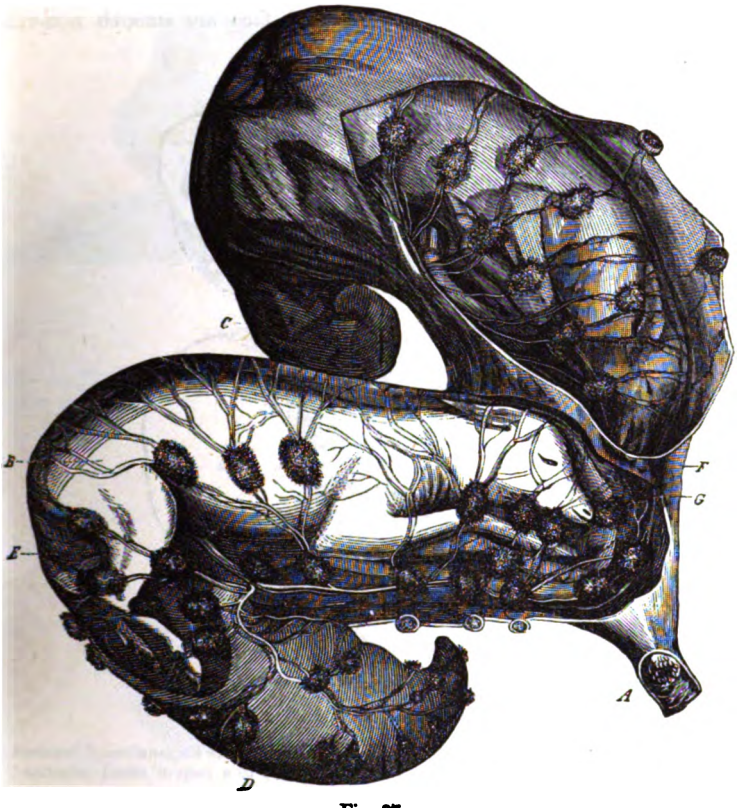

Fig. 37.

Fœtal Membranes of the Goat at Full Time: Twins.

A, Cervix of the Uterus; B, Left Cornu; C, Right Cornu; D, Allantois of one of the Fœtuses; E, Amnion of ditto; F, Portion of the Uterine Wall left at the middle of its Body, where the Fœtuses come in contact; G, Union of the Two Chorions at the *Cervix Uteri*.

The middle of its inner surface is united to the amnion and the allantois by loose gelatinous connective tissue, so laminated that it might be mistaken for different layers of membrane. It is only covered by the allantois in the portions corresponding to the cornua, which are longer than those of the uterus. It offers numerous small red masses, studded at variable distances from each other on the surface next the uterus, and which effect a very

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important connection between the latter and the chorion. These are the *placentulæ* to which we shall allude presently.

In the Sheep and Goat, when there are two young creatures, the two cornua of the chorion are joined, so as to look externally like one sac.

Pig.

In the Pig there are no cornua, but the whole appears as an elongated sac, whose two extremities, much exceeding those of the embryos, are in relation with the envelopes of the contained progeny. Its internal face is similar to that of ruminants; on its external face are smooth non-villous spots.

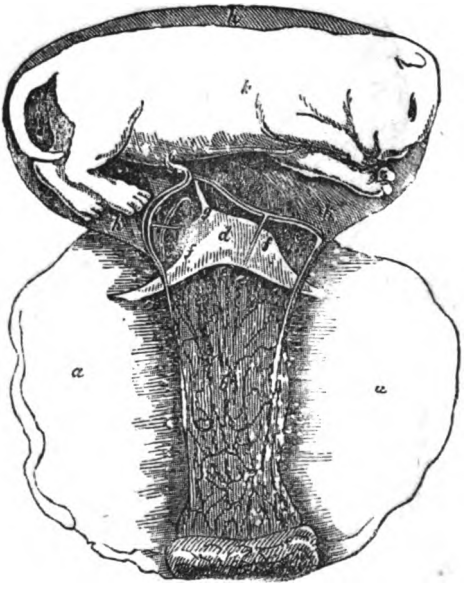

Fig. 38.

FŒTUS AND FŒTAL MEMBRANES OF THE CAT.

a,a, Chorion; *b*, Zonular Placenta; *d*, Umbilical Vesicle, with its Expansions, *f*, between Amnion and Placenta, and *g*, its Pedicle of attachment to a loop of small intestine; *h*, Allantois; *k*, Fœtus.

Bitch and Cat.

In the Bitch and Cat, the arrangement of the chorion is similar to that of the Pig; it has no cornua, its extremities are obtuse, and its inner face is everywhere in contact with the allantois, though it does not adherre closely to it.

AMNION.

The *amnion* is the second complete sac enveloping the fœtus. It floats freely in the chorial sac, to which it is only attached at a single point, through the medium of the umbilical cord; and it contains the fœtus, which is fixed to its inner face by the same means. It is formed by the external layer of the blastoderm. It envelops the embryo very closely at an early

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period, and is continuous with the common integument of the fœtus at the open abdominal parietes. At a later period it is distended with fluid, and so is separated from the fœtus; and after being reflected upon the funis, of which it forms the outer coat, it terminates at the umbilicus. In shape it is at first spherical, but is afterwards ovoid, and it has thin transparent walls. The

CORRECTION.

N.B.—In Page 47, Fig. 21, transpose the reference letters, *a* and *b*, appended to Illustration.

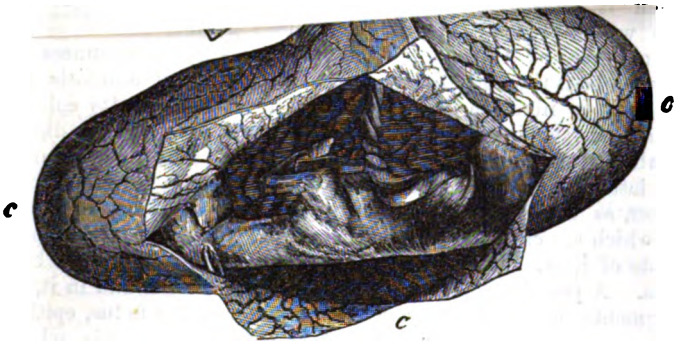

Fig. 39.

FŒTUS OF MARE AND ITS ENVELOPES.

A, Chorial Sac; C, Amniotic Sac withdrawn from the Allantoid Cavity, and opened to expose the Fœtus; D, Infundibulum of the Urachus; B, Allantoid portion of the Umbilical Cord: *b*, Portion of the External Surface of the Chorion destitute of Placental Villosities, and corresponding to the point of insertion of three pediculated Hippomanes.

external face is covered by the inner layer of the *allantois*, to which it slightly adheres. The internal face is quite smooth, and applied more or less directly to the skin of the fœtus. It exhales or secretes a fluid—the *liquor amnii*—which bathes the fœtus, and serves an important purpose in intra-uterine life.

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In the fœtus, as above mentioned, the amnion is continuous with the skin around the umbilicus, and is constituted by two superposed layers: one, a very fine fibrous membrane that adheres to the allantois; and another, an epithelial layer, which lines the inner face of the latter. At certain points of its internal surface in solipeds, according to some authorities, though denied by others, there are small white opaque masses of what are supposed to be epidermic cells; hence, this membrane has been designated a true epidermis of the blastoderm. Though thin and transparent, it is nevertheless of a firm texture, and resists laceration better than the other membranes. It does not exhibit either vessels or nerves when in a healthy condition. When the amniotic sac is inflated, there is observed, at the portion adjoining the infundibulum of the urachus, a kind of vascular plexus, having the shape of a goose's foot, between the branches of which the two superposed layers are much less transparent than elsewhere. At this part, between the amnion and the allantois, is the small membraneous pouch, quite empty, in which the umbilical vesicle terminates; and here also the amniotic sac forms, opposite the cord, a little conical *cul-de-sac*. Towards the termination of gestation, one of the extremities of the sac corresponding to the posterior limbs of the fœtus, is stretched into a very short wide horn.

Liquor Amnii.

The *liquor amnii* is an albuminous alkaline fluid contained in the amniotic sac, and in which the fœtus is suspended as in a hydrostatic bed. It is in greater or less quantity, according to the period of gestation: being abundant and limpid, or slightly lactescent, at an early period; and becoming scantier, viscid, and citron or reddish-tinted, at an advanced stage, when it is adhesive and agglutinates the hair. In a Mare, twenty-one weeks pregnant, Gurlt found two pounds twelve ounces of fluid; in another, at thirty-six weeks, four pounds five ounces; and, finally, in one about the fortieth week, the allantoid and amniotic fluids weighed collectively nineteen pounds and half an ounce. Its colour during this period may be due to the meconium thrown out from the digestive passages of the fœtus; and its composition doubtless varies with the development of the latter. It is somewhat salt to the taste, and contains 99 per cent. of water, as well as albumen, mucosine, kreatin, glycose, and salts, the chief of which are chlorides of sodium and potassium, and the sulphate and phosphate of lime. There is also a yellow matter analogous to bile, as well as urea. A peculiar acid, the *amniotic*, has also been found in it, in addition to fragments of meconium from the intestines of the fœtus, epithelial cells and their nuclei, besides portions of the thick epidermis which covers the plantar face of the hoof of solipeds. Towards the end of gestation the albumen diminishes. Probably the formation of the mucus covering that invests the young animal at birth, is due to the precipitation on its skin of the mucus and yellow matter contained in this fluid. Hoppe-Seyler gives its chemical composition as water, holding in solution a small quantity of casein, kreatin, lactic acid, grape sugar, and saline matter; and therefore resembling very dilute serum.

The *uses* of the *liquor amnii* are varied and important. It is not very probable that it serves as nutriment for the fœtus in the early period of intra-uterine life; though it has been found in the stomach of those young animals which had been purposely frozen in their membranes, and then dissected; portions of the hoof epithelium have also been discovered in the fœtal stomach. It preserves an equable temperature for the young creature;

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maintains the integrity of its exterior before the skin is covered by the peculiar sebaceous coating; favours its movements and its development, by removing it from unequal pressure; diminishes the impression from sudden external movements and shocks, thus preserving it from injury; and allows it to obey the laws of gravitation. It also protects the mother from injury by the fœtus, towards the termination of gestation. During parturition, it protrudes the membranes; is the primary agent in dilating the os uteri; shields the fœtus from the direct action of the uterine contractions, whose violence might compromise its existence; renders the dilatation of the *os* easy and prompt; and, finally, by lubricating the vagina, causes the passage of the fœtus through it to be more gentle and expeditious than it would otherwise be.

Differences in the Amnion of other Animals.

Ruminants.

The amnion in Ruminants is similar to that of the Mare. It is easily separated into two layers, and shows on its inner surface, particularly near where it invests the umbilical cord, a large number of white or yellowish-white bodies. In the Cow these are sometimes elongated in the form of papillæ; at other times they exist in flattened, slightly raised patches, about one-fourth of an inch long. Sometimes they are single; occasionally they are in clusters. They consist of large, flat, nucleated cells, resembling a squamous epithelium; it is concluded that they are the seat of formation of a glycogenic material. Up to a certain period of intra-uterine life, they increase in size and then degenerate: their organisation and development being in inverse relation to the development of the liver, whose function they assume, with regard to glycogenation. Externally the amnion is altogether in contact with the allantois and chorion.

Pig.

It does not differ in the Pig.

Bitch and Cat.

In the Bitch and Cat the amnion is entirely covered by the amniotic layer of the allantois, to which it adheres in the same manner as in the Mare; the two membranes are only separated by the umbilical vesicle, and there is no trace of the pouch and vascular plexus seen in that animal. In the amniotic liquid, crumbs of meconium are found towards the end of gestation.

Allantois.

The *allantois* arises on the front part of the posterior extremity of the mucous layer which is closing to form the intestine, as a growth of the intestine, which proceeds very rapidly. It passes out where the ventral laminæ are still unclosed, in the region of the umbilicus, and reaches, either mediately or immediately, the inner surface of the exochorion. By the constriction of the umbilicus, it is separated into two portions which communicate: that within the body of the embryo is the sacculated urinary bladder, with the *urachus* or tube of communication. It receives its vessels from the hypogastric artery; these are spread out as a vascular layer, especially upon that portion of its surface which faces the exochorion. The vessels form a distinct layer—the endochorion. As a membrane it lines the inner face of the chorion, and is reflected around the point of insertion of the umbilical cord, to be spread over the outer face of the amnion; in this way it transforms the

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chorionic sac into a kind of serous cavity, in which the amniotic sac is enclosed like a viscus.

The inner, or amniotic layer, is so loosely united to the amnion, that a slight dissection or inflation will readily detach it. When inflation is practised, the separated membrane presents a wavy appearance, from the presence of numerous cellular attachments it has with the amnion; as the inflation is forced these bands tear with a noise like the crackling of parchment, and with care the whole of this portion, which is equal in extent to the amnion, may be removed. The chorial allantois adheres much more firmly, and in some parts it can scarcely be dissected away. Inflation, however, demonstrates its existence and continuity with that on the amnion; for if, after opening the allantoid sac by cutting through the chorion and the layer covering it, we introduce a tube between the two membranes—which is easily done near a large vessel, a slight inflation causes the air to penetrate

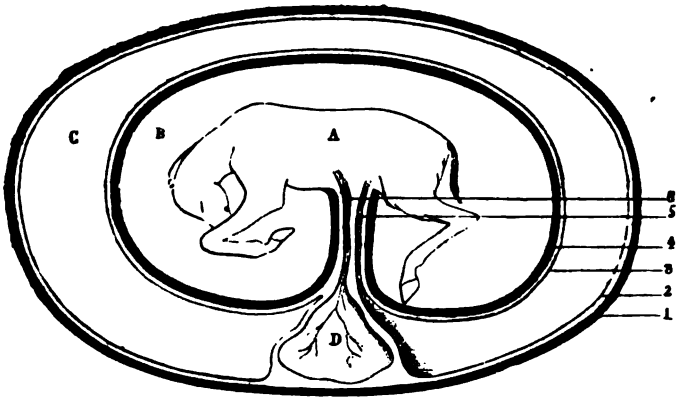

Fig. 40.

PLAN OF THE FŒTAL ENVELOPES IN THE MARE.

A, Fœtus; B, Cavity of the Amnion; C, Cavity of the Allantois; D, Umbilical Vesicle: 1, Chorion; 2, Chorial Layer of the Allantois; 3, Amniotic Layer of the Allantois; 4, Amnion; 5, Urachus, the expansion of which forms the Allantois; 6, Pedicle of the Umbilical Vesicle.

between the allantois and chorion, though only in the track of the vessels of a certain size, where the adherence is slight; a more powerful inflation will cause the air to follow the smaller vascular ramifications, and render the membrane still more apparent, but not at the points where the vessels have almost become capillaries. If, instead of forcing the air towards the ramifications, it is sent in the contrary direction, it will be seen to pass to that portion of the membrane covering the umbilical cord, and insinuate itself between the amnion and the layer of allantois covering it, thus proving the continuity of the membrane.

As has been stated, the cavity of this sac is in communication with the interior of the bladder by means of the *urachus:* a narrow canal in the amniotic portion of the umbilical cord, and which widens at the origin of the allantoidean portion, where its walls are continuous with the amniotic layer of the membrane, as well as the chorial layer, after being prolonged as a sheath around the cord. These arrangements show the allantoid cavity to be

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a kind of urinary reservoir or dependency of the bladder, the fundus of which is prolonged in an infundibular manner as far as the umbilicus, to constitute the urachus, which follows the umbilical vessels in the amniotic portion of the cord, and ends by forming the allantoid cavity.

The structure of this membrane is slightly fibrous, with a layer of epithelium; it is thin and pellucid, and appears to be destitute of vessels at a late period of fœtal life. It bears on its surface the umbilical vessels, from the umbilicus to the chorion.

The allantois contains a fluid—the *allantoic liquid*—the quantity of which, like that of the amnion, is greatest at an early period. It is then colourless or slightly turbid; but with the growth of the fœtus it gradually assumes a yellowish hue, until near parturition, when it is brown. It presents somewhat the same physical properties as the liquor amnii, and contains albumen, osmazone, a nitrogenous mucilaginous matter insoluble in alcohol, a particular principle named *allantoïne*, which appears to be the urate of urea, with lactic acid, lactate of soda, and phosphates of soda, lime, and magnesia. Allantoic acid is not found in this fluid in solipeds. In addition to the large per centage of water, there is a notable proportion of sugar at an early epoch of fœtal life; this, however, gradually and finally disappears towards the termination of gestation.

It is probable that before the fœtal circulation is fully established, the allantoid fluid serves to nourish the young creature, but that towards the end of gestation it is a product of the urinary secretion of the fœtus. It is certain that as gestation approaches its termination, the renal excretion of the young animal passes from the bladder along the urachus, and deposits near the allantoic orifice of that tube a thick fluid of a reddish colour, and possessing an urinous odour; it contains uroerithrin and hippuric acid.

The fluid contains, besides, whitish filaments, and small oval or discoid masses of a brownish colour from the size of a pea to that of a hen's egg, either floating about in the cavity or attached to the allantois by a narrow pedicle. Sometimes they are very numerous, and at other times there is only one. From the fanciful notions attached to them in ancient times, they were named the "*hippomanes*." Usually they have the consistency and elasticity of gluten, are flattened, and are thinner at the border than the centre. Those attached to the allantois are generally pyriform, and their pedicle is narrower as they are more developed: proving that the loose bodies in the fluid were originally appendages of the allantois. It is not improbable that they are inspissated parts of the allantoic fluid which were originally deposited upon the membrane. They contain much oxalate of lime.

Differences.

Ruminants.

In Ruminants the allantois is different to that of the Mare, being less complex. It represents a very elongated cavity, the middle portion of which is not extensive, and receives the insertion of the urachus; while its extremities, which are unequal, are prolonged into the cornua of the chorion, where they are attached by a small ligament. This sac is in reality an expansion of the urachus; it is always thrown back on one of the sides of the amnion. In the completely developed fœtus, even at birth, the allantois still communicates directly with the bladder by means of the *urachus*. Frequently in the Sheep this membrane exceeds the chorion, and in the case of twin embryos, although the two chorial sacs unite by one of their cornua, there is only a

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simple external union between the two allantoid membranes, the cavities remaining isolated.

Laminated deposits, like the *hippomanes*, are found in the allantoic fluid of ruminants, though not very frequently. These deposits are less dense, smaller, and of a lighter colour.

Pig.

In the Pig the allantois does not offer any marked difference from that of ruminants, except that it is less sacculated, and shows at the extremity of each cornua a small portion projecting beyond the chorion, which it seems to pierce, while it is strangled by a kind of rings formed by that envelope. In the gelatinous tissue connecting the allantois to the chorion, are numerous small, white, spherical bodies, each possessing a distinct capsule; they are composed of multitudes of circular cells, the size of lymph corpuscles, and quantities of granular particles—being, in fact, histologically the same as the *hippomanes*, with which they are probably homologous.

Bitch and Cat.

In the Bitch and Cat it is disposed in the same fashion as in solipeds. Its external layer adheres less closely to the chorion, except at the part corresponding to the placenta, where it is more intimately united.

UMBILICAL VESICLE.

The *umbilical vesicle, saccus intestinalis,* or *vesicula alba,* is a small fusiform or pyriform pouch lodged in the infundibulum at the extremity of the umbilical cord. Its fundus adheres to the chorion, while the opposite end is prolonged to a certain length in the substance of the cord, being even continued, in the very young fœtus, to the abdominal cavity by a narrow canal that communicates with the terminal portion of the small intestine.

This pouch has a red colour, due to its great vascularity, its walls receiving a special vessel from the anterior mesenteric artery; the terminations of this vessel give rise to a corresponding vein that terminates in the vena portæ. These are the two omphalo-mesenteric vessels. The umbilical vesicle in solipeds is constantly present as a normal formation in the earlier months of fœtal development, being formed from the extra-fœtal portion of the internal layer of the blastoderm. It is connected with the intestinal canal of the fœtus; being in reality the vitellus surrounded by the blastoderm upon which the embryo is first formed; and it bears a perfect analogy to the yolk of the egg, except that it is not ultimately enclosed within the fœtal abdomen. It is a transitory organ, and in the last months of fœtal life, though in solipeds traces of it continue until parturition, it is always more or less atrophied, its cavity has disappeared, and nothing is left of it but a small reddish-brown cord, adhering to one of the sides of the infundibulum. Its vessels also atrophy in the same manner, the artery being nearly always found reduced to the dimensions of a thread.

Its use is evidently to contain nutriment for the fœtus, before the development of the placenta; though it may also serve other purposes. It is the first organ which elaborates and supplies blood to the fœtus. In some instances the chorion has been found perforated at its junction with the umbilical vesicle, which was therefore in communication with the cavity of the uterus.

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Differences.

Ruminants and Pig.

In Ruminants and the Pig, the umbilical vesicle is longer than in solipeds; it also bulges in the middle, and its ends terminate in a canal. It is longest about the twenty-fifth day, and disappears very early; no traces of it can be observed between the second and third month, after the abdominal parietes have been formed.

Bitch and Cat.

In the Bitch and Cat, however, it remains very developed up to the time of parturition, and in form resembles the allantois of the Pig. It is a transversely elongated sac (Fig. 38, *d*), extending into the pointed cornua (*ff*) comprised between the amnion, the inner layer of the allantois (*h*), and the placenta (*b*); it is provided at its middle part with a narrow pedicle (*g*), which is prolonged into the umbilical cord and has very vascular walls.

The Placenta.

The *placenta* varies extremely in different species. In solipeds it is constituted by a multitude of short villosities or filiform papillæ, which are spread in a uniform manner over the whole external surface of the chorion (*diffused villi* or *placenta*, constituting a *chorion frondosum*); though there is sometimes observed a tendency to bare patches, one especially being noticed opposite the os uteri, where there is no mucous membrane for the villi to penetrate. These villi are received into corresponding depressions or follicles in the lining membrane of the uterus. The villi are very red in colour, and consist, like the chorion itself, of an epithelial and a vascular layer, they being, in fact, the terminal ramifications of the vessels of the umbilical cord. They are slender and easily torn; and each is composed of a small quantity of delicate nucleated connective tissue, covered by a simple epithelial layer, enclosing the capillary vessels, which are arranged in loops made up of a principal arteriole and two veins, there being generally only a single, or at most, a double, capillary loop.

The villosities of the fœtal placenta, penetrating the newly formed crypts in the uterine mucous membrane, bring the capillary systems of mother and fœtus into the closest relationship: only the very thin coats of the vessels and the epithelium intervening in the two circulations. There is no fusion, vascular continuity, or direct communication between the maternal and fœtal systems, as was at one time taught; all the important changes that occur taking place through the walls of the capillaries by virtue of osmotic force.

The function of the placenta, then, is to administer to the nutrition and development of the fœtus by means of its intimate relations with the uterine vascular system, until the time has arrived for the expulsion of the young animal. Notwithstanding their close apposition, the adherence of this papillary layer of the chorion with the inner surface of the uterus is so slight, that this organ can scarcely be opened without more or less destroying it. A small quantity of a brownish fluid is found between the two.

At an early stage of gestation there is no placenta; a temporary mass of albuminoid substance accumulating around the ovum in the uterus, affords material for its nourishment until the vascular intussceptive relations between the chorion and uterine lining is established. When gestation is terminated, the placenta becomes remarkably rigid, the vessels are obliterated and transformed into fibrous tissue, and the external face of the chorion is wrinkled and withered-looking.

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Differences.

Cow.

In Ruminants, there is an important difference in the arrangement of the placenta from that just described. In the Cow, the villi of the chorion are developed and agglomerated in large numbers at certain points of its surface, to constitute a *multiple* or *tufted* placenta, which is composed in this way of from sixty to eighty *placentulæ*, or "fœtal cotyledons." These are of a bright red colour, of various sizes, and generally oval in shape; they correspond to the prominences on the lining membrane of the uterus from which the deciduous maternal parts of the placenta grow, and which have been already described as the "maternal cotyledons" or "placentæ'; into these latter the fœtal processes are received. The maternal cotyledons are nothing more, as has been stated, than appendages or thickened points of the mucous membrane, whose utricular follicles, more numerous than elsewhere, have become enor-

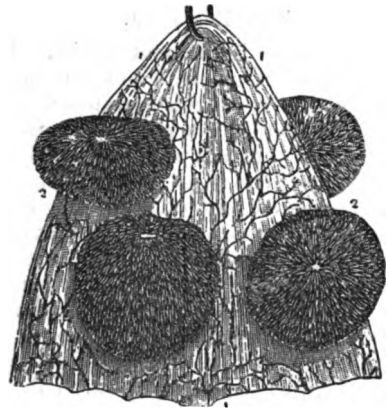

Fig. 41

Portion of Chorion with Placentulæ: Cow.

1, Chorion; 2, Placentulæ.

mously enlarged, and crypts have been formed. They are permanent, as before conception they are certainly present on the inner surface of the uterus, and traces of them may be already found in the fœtus of four or five months; observation also appears to have demonstrated that they may be increased in number, or regenerated, when accidental circumstances render those in existence insufficient.* They have been discovered in the fœtus in process of formation, and regularly disposed, beside the ordinary cotyledons.

* In the *Journal de Méd. Vétérinaire de Lyon*, M. Strebel, of La Tour, Switzerland, gives an instance in which there was absence of the uterine cotyledons in a Cow, and the placenta was like that of the Mare. Conception took place, gestation went on favourably, and parturition was normal.

Chauveau's experiments have proved, that after all these placentulæ have been extirpated from the uterus of the pregnant Cow, sterility does not necessarily follow; but if, on the contrary, the animal survives the operation, it is still capable of breeding. In such circumstances, accessory cotyledons are developed upon the surface of the uterine mucous membrane, where previously none existed. Chauveau has also stated, in the same journal for 1851, that during pregnancy the number of cotyledons is increased; and Colin, in his *Physiologie Comparée*, makes a similar statement. Professor Franck, of Munich, in his dissections of the gravid uterus of bovines, has found, in a large number of instances, a more or less abundant quantity of accessory

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When gestation has commenced, the surface of the maternal caruncles, previously smooth, becomes convex, and is covered with reticulate processes which border the crypts, and give it a finely cribbled appearance. The largest are found in the body of the uterus, and they become smaller as they approach the extremity of the cornua. They spring from the uterine surface by a somewhat narrow pedicle, through which they receive their bloodvessels, and their colour is nearly always dark yellow; altogether, in shape, hue, and general appearance, they are not unlike a morel mushroom.

The "fœtal" or "chorial cotyledons" repeat the disposition of the maternal cotyledons. They are bright-red concave patches, each exactly fitting into the sinuses of the corresponding uterine processes, with which they strikingly contrast in hue; on their surface they offer a multitude of long, conical, ramifying or branched villi, measuring from 4 to 6-10ths of an inch, which are received into the depressions of the maternal cotyledons. This ramifying or racemose disposition of the chorial villi is peculiar to the bovine and ovine

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caruncles (*karunkeln*) on the mucous membrane, and which had no corresponding relations with the chorion. In one instance the ordinary cotyledons were entirely absent in an unimpregnated cornu, and in their stead were thousands of the accessory processes grouped together in small clusters. The whole of the lining membrane of this cornu had a peculiar mossy or velvety appearance. In a number of instances Franck has observed, in the immediate neighbourhood of the os uteri, where cotyledons proper were absent, groups of the so-called accessory cotyledons, in their form representing a *placenta prævia*. Certainly, this kind of *placenta prævia* in cattle has not the disadvantages it offers in woman; for although a premature delivery may occur, a sufficiency of the placenta always remains to maintain the nourishment of the fœtus. Serious hæmorrhage is likewise little to be apprehended in such cases; and even the disconnection between the placenta fœtalis and the placenta uterina in the Cow, causes no injury. This is not the case with the human female and the Bitch. Small hæmorrhagic streaks at the summit of the finer tufts, or on their upper surface, are often noticed in the uterus of Cows which have been slaughtered and bled. Birnbaum attributed these streaks to a plethora *ex vacuo* (*Untersuchungen über den Bau der Eihäute der Saugethiere*, p. 90).

The accessory placentulæ are, both in shape and situation, as well as in development, different from the cotyledons proper; for while the latter, and of course also the fœtal cotyledons, are arranged in four regular rows, in the gravid uterus, through the rapid increase of the amnion towards the poles of the ovum, they lie somewhat closely together, and the accessory processes are placed between these rows in an irregular manner. In their highest development, the latter are so disposed as to constitute a variable-sized felt-like patch; the largest and widest are usually observed behind the ordinary cotyledons, and their form is very irregular, but normal. As a rule, the largest are not so big as a walnut, and they are widest at their base. In structure they resemble the ordinary cotyledons, their bloodvessels being arranged in the same manner, while they are covered externally by a sheath of epithelium. In the early period of pregnancy—about the second or third month—they are found in largest number on the entire upper surface of the chorion, also likewise on the parts between the ordinary cotyledons and the finest caruncles. It may here be mentioned that the ovum of the Cow, in the first week of pregnancy, is smooth. Franck has never been able to discover the vascular semi-detached caruncles which are afterwards developed through the prolongation of the bloodvessels; though they are found in the canine species. He has, however, observed definitely-formed vascular chorion-cotyledons between the fourth and sixth weeks of pregnancy. The interposed cotyledons observed by Franck have been noticed by other anatomists. Birnbaum mentions them, but he is in error with regard to their development, inasmuch as he believed that they arose from the uterine glands, which is certainly not the case. The chorial tufts penetrate the uterine mucosa by four digitations, fixing themselves in the so-called simple follicles, according to Franck (*Deutsche Zeitschrift für Thiermedicin*). This excellent authority also points out, with regard to this circumstance, that in the vicinity of the uterine glands there are found small follicles which are nearly always unobserved. The connection between these chorial tufts and the uterine mucosa is extremely slight.

At a later period of pregnancy, there appear other caruncles in the form of fœtal tufts and cotyledons, which the previously developed and prominent maternal cotyledons and caruncles lie opposite to and in contact with. The reason for this fact is to be sought for in the circumstance, that the fœtal caruncles pass into the most developed uterine cotyledons, and in consequence bring the larger tufts of the allantois into contact with the opposite parts of the chorion. The intermediate caruncles become entirely wasted. Nevertheless, with isolated tufts, sometimes in a great many, we find an increased development, which gives rise in the corresponding uterine mucosa to a similar formation, and a close co-aptation, or even an inter-penetration of these accessory fœtal and maternal cotyledons.

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species. The chorial cotyledons are attached to the chorion by a very short, thick, and vascular pedicle; between them and the maternal cotyledons there is always to be found a small quantity of thick, white, milky-looking fluid—the so-called "cotyledonous" or "uterine milk."

According to Schlossberger, this uterine milk should be considered as a fluid analogous to milk or chyle. It contains 88 per cent. of water, 1·5 of fat, 0·7 of salts, and 9·6 of a protein substance. In the cotyledonal fluid, as well as in that on the surface of the uterine mucous membrane of a Mare

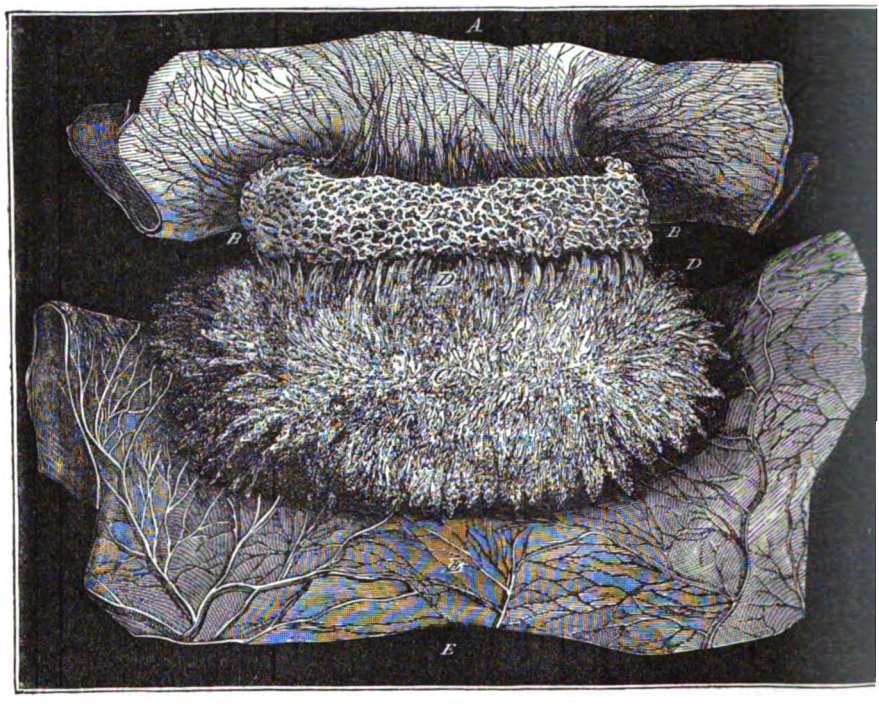

Fig. 42.

MATERNAL AND FŒTAL COTYLEDONS OF THE COW.

A, Pedicle of the Maternal Cotyledon; BB, Maternal Cotyledon; C, Fœtal Cotyledon; D, Placental Villi; E, Chorion.

towards the end of pregnancy, Ercolani has demonstrated the presence of albumen; in the same fluid he has also proved the existence of amidon, dextrin, and sodium chloride.*

* We must not overlook the fact, that the existence of the "uterine milk" in the living pregnant animal has been denied by M. Colin (*Traité de Physiologie Comparée des Animaux*, 1872, vol. II. p. 870), who states that this fluid is simply a product of cadaveric decomposition, and is not found during life; as he has assured himself in the most evident manner, by opening the uterus of a pregnant Mare and Cow. It is not found immediately after death, as he has demonstrated on many occasions in Cows and Sheep slaughtered in the abbatoirs at all periods of gestation; it is not even observed six, twelve, or twenty-four hours, or longer, when the surrounding temperature does not favour decomposition. It is only when the placentas spontaneously separate, or are disunited by slight traction, at a greater or less time after death, according to cir-

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The reticulated surface of the maternal cotyledons is homologous with the *decidua serotina* of other mammals; but it possesses a firmer texture, and usually remains attached until the termination of gestation—allowing the fœtal villi to be withdrawn from it at birth; it is afterwards shed or disappears in some obscure manner, and the caruncle again assumes its smooth surface.

As in solipeds, there is no direct vascular communication between the maternal and fœtal cotyledons, the villi of each being distinct, though in close contact; being only separated at points by the lactescent fluid just alluded to. This fluid, which is present in all the domesticated animals, can be readily discovered by carefully withdrawing a chorionic tuft from the alveolar cavities of the uterine cotyledon.

Sheep and Goat.

In the Sheep and Goat the arrangement of the placenta is essentially the same as in the Cow, except that the maternal cotyledons are deeply concave

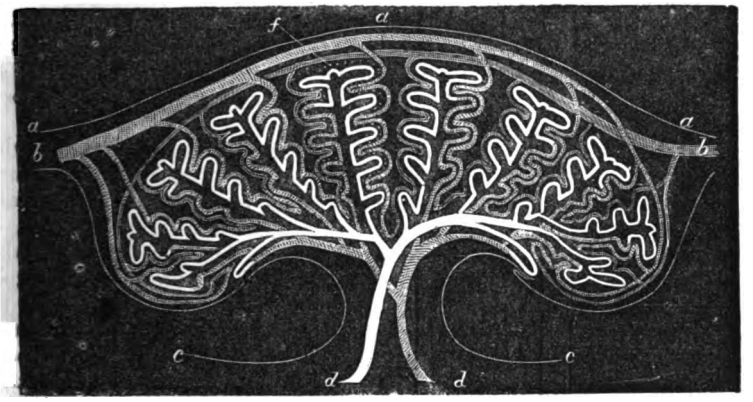

Fig. 43.

COTYLEDON OF A COW'S UTERUS.

aa, Surface of Fœtal Chorion; *bb*, Bloodvessels of Fœtal Chorion; *cc*, Surface of Uterine Mucous Membrane; *dd*, Bloodvessels of *ditto*; *f*, Secretion from Utricular Glands —Cotyledonous Milk—between Maternal and Fœtal Vessels, and which is necessary to the Mutual Interchange of Gases, and Nutrient, Effete, and other Matters between Parent and Offspring.

or cup-shaped in the middle, and into this cavity the fœtal placentula is received and closely retained. This placentula is not so wide as that of the Cow, though it is thicker and the villi are more delicate. The mode of termination of the placental vessels in the Sheep is villous; in the Goat it is pilose.

Pig.

In the Pig the placenta may be designated as "diffused," not "polycotyledonary" as in Ruminants; though the tufts do not form a continuous layer as

cumstances, that the white or yellowish-red coloured fluid appears between the chorion and uterine mucous membrane. In proportion as decomposition has advanced, the fluid is abundant. Colin therefore concludes that it is a product of softening and progressive dissolution of the uterine mucous membrane and its cotyledons, as well as the placentæ themselves.

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in the Mare, the papillæ being collected in small but closely-grouped clusters, which give the chorion a mottled aspect. When uninjected they appear as white masses or spots scattered over the external surface of the chorion, thus giving it a mottled aspect, caused by the presence of feebly vascular and non-vascular areas; but when the allantoic veins are filled, these are seen to form plexuses in the centre of each spot. The uterine veins have a corresponding disposition, and the arterial capillaries form a fine network, the meshes receiving the villosities which carry the fœtal arterial capillaries; whence it might seem that the nutrition of the fœtus was effected principally at the points of contact of the fœtal with the maternal venules, while the respiratory process took place at the surface of contact between the fœtal and maternal arterial capillaries. The chorion is destitute of these villosities at the extremities, which are in contact with the chorion of other fœtuses in the uterus.

Bitch and Cat.

In the Bitch and Cat the placenta forms a thick annular band or zone, about one or one and a half inch wide, passing round the middle of the chorion; it is therefore said to be "zonular." This zone is concave within, of a mixed grey-and-red colour when uninjected, livid or dark brown during gestation; its fœtal surface is lobulated, and the zone is limited at each side by a dark green border, the colouring matter of which can scarcely be removed by repeated washings.

The placenta is studded with ramified villi of a leaf or plate shape, which are implanted in the uterine mucous follicles. The mucous membrane in which these are situated, and which corresponds to the placenta, presents a kind of vascular fungus development that appears after parturition, but which at an early stage of pregnancy has a quantity of fluid along its margin; the maternal placenta, or *serotine decidua*, is present during gestation, and can be separated as a distinct layer. There cannot be a doubt that the uterine mucous membrane in carnivora secretes a kind of plastic lymph, which forms this caducous lining or *membrana decidua;* but it is only present at a certain period of fœtal life, and forms the base of the uterine placenta.

FUNCTIONS.

The functions of the placenta are obvious: it is the nutrient and respiratory apparatus during a portion of intra-uterine existence; and for the accomplishment of these functions it must rely upon its intimate and healthy relations with the uterine surface. The special and temporary processes of development being completed, and the task of providing capillary superficies being terminated, whether on the part of the mother or fœtus, the placenta of the latter disappears, as well as the decidua; though they may not be thrown off together, and the maternal decidua may not be shed all at once, but in successive portions. The long period of gestation necessary to endue the young of defenceless hoofed animals with sufficient strength before birth, is perhaps a reason for the firmer texture, better organisation, greater extent, and more persistent character of their "deciduous" formations.

The comparative study of the disposition of the different kinds of placentæ, may furnish valuable indications as to the procedure which ought to be adopted in artificial delivery; the surgical manipulation necessarily varying with the extent and arrangement of the points of union existing between the uterus and the fœtal envelopes.

It has, therefore, been thought useful to arrange the domesticated animals into two groups: those with a single placenta, and others with a multiple

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placenta; the first group being again subdivided according as the placenta is "diffused or "localised." This arrangement and subdivision may be expressed as follows:—

Single Placenta	Diffused	Horse. Pig.
	Localised	Cow. Sheep. Goat.
Multiple Placenta	Zonular	Dog. Cat.

Umbilical Cord.

The *umbilical cord, funis,* or *navel-string,* is a collection of vessels which forms the means of communication between the mother and fœtus, during the uterine existence of the latter, and which loses its functions when birth occurs. It is visible at the earliest period of pregnancy, and is formed by the vessels which convey the blood between the fœtus and its envelopes—chiefly the placenta. It is divided, for facility of description, into two portions: an *amniotic,* the longest, always twisted on itself like a rope, and covered by the amnion, which passes along it to become continuous with the skin at the umbilicus; and an *allantoic* portion, much shorter, less twisted, and covered by the sheath that continues the two layers of the allantois until it is inserted into the upper wall of the chorial sac, between the two cornua.

Three vessels enter into the composition of the cord: two *arteries* and a *vein,* which are embedded in embryonic connective tissue (*Whartonian gelatine*) that makes them appear more voluminous than they really are. This "Gelatine of Wharton" consists of a mucus basis, in the substance of which is fibrillar tissue. The umbilical arteries arise from the internal iliac artery, and pass along the sides of the bladder; reaching the umbilicus, they pass through it and arrive at the terminal extremity of the amniotic portion of the cord, where they give off some branches to the amniotic sac, and then continue to the end of the allantoic portion, where they terminate by an expansion of placental branches. The *amniotic divisions* of these arteries are extremely flexuous and few in number; they are included between the allantoic layer and the membrane of the amniotic sac, within which they are prominent.

The *placental* or *chorial* divisions are infinitely more numerous and larger, and starting from the terminal extremity of the cord, pass in every direction between the chorion and the external layer of the allantois, beneath which they can be seen. By their anastomoses they form a beautiful network, whence proceed the capillary vessels that form the placental villosities. As we have already stated, these capillaries have no direct communication with the maternal vessels, but after attaining their finest dimensions pass into the veins which finally constitute the umbilical vein. This vessel, then, owes its origin to the capillary radicles of the placental villosities; which radicles, by their union between the chorion and amnion, form a voluminous network whose richness is even greater than the arterial arborisation. Two chief trunks finally issue from this plexus, and these soon join to form a single trunk, which accompanies the two corresponding arteries in the cord. On reaching the umbilicus, this vessel, now the *umbilical vein,* bends forward on the inner surface of the abdominal wall, where it is covered by peritoneum, and on gaining the liver enters that organ to open directly into the vena portæ. Owing to this junction, it happens that the two vessels com-

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pose, in the interior of the liver, a single canal, from which proceed the hepatic veins. In other animals than solipeds, this single canal sends off a particular vessel of considerable size—the *ductus venosus*—that passes directly into the posterior vena cava. The umbilical vein has no valves.

Besides these three principal vessels, the cord contains, in its amniotic portion, the duct of the umbilical vesicle, the *urachus*, and the *omphalo-mesenteric* vessels, as well as the extremity of the fœtal intestine at an early period. The *urachus* is an irregularly bulging canal, continued from what is eventually the fundus of the bladder, and on reaching the umbilical opening it passes between the chorion and the amnion to form the allantois.

After birth it rapidly contracts, especially at the fundus of the bladder, until it is quite closed, and nothing is left but the fold of peritoneum that sustained it, and which now becomes the middle ligament of the bladder. It sometimes happens, however, with the foal, but more frequently the calf, that it persists, the urine in this case escaping by the umbilicus.

The *omphalo-mesenteric vessels* are an artery and a vein. The first is given off from the anterior mesenteric artery, and passes to the amniotic extremity of the umbilical vesicle; while the vein arising from this vesicle terminates in the vena portæ. These two very thin vessels become obliterated with the vesicle.

Differences.

Ruminants.

In Ruminants, the two veins passing from the chorion remain separate in the umbilical cord until they enter the umbilical ring, where they become one vessel. There are, therefore, two veins and two arteries; the latter unite at the umbilicus, the resulting vessel entering the vena cava and vena portæ, between which it establishes a communication by means of the *ductus venosus*. The chorion and the amnion being in immediate contact over a wide surface, the umbilical vessels are reflected over the inner face of the first-named membrane on their leaving the amniotic sheath; they do not have a fold of allantois, as in solipeds. No traces of the omphalo-mesenteric vessels have been found.

Pig.

In the Pig the arrangement of the cord is the same as in ruminants.

Bitch and Cat.

In the Bitch and Cat the cord resembles that of solipeds, in having an allantoic portion, but it is extremely short, and enveloped in a large fold of allantois. The omphalo-mesenteric vessels are very apparent until the end of gestation, and are proportionately larger than in solipeds; this is due, in all probability, to the persistence of the umbilical vesicle. These are an artery and a vein; the former arises from the anterior mesenteric, descends in nearly a direct line to the umbilical opening, and is expended in the umbilical vesicle. The vein originates from the terminal divisions of the artery, passes towards the abdomen, and terminates in the *vena portæ*.

The dimensions of the umbilical cord vary with the species of animals. Compared with that of the human fœtus, it is short in solipeds and ruminants. At the commencement of gestation in the Mare and Cow, it is not so long as at a later period, though it is thicker; towards the termination of gestation, it is at least as long as the young animal is tall. Its length in the Mare has been variously estimated. Immediately before birth it has been

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found to measure three feet four inches long, and three and a half inches in circumference (three-fourths in diameter). Daubenton found it to be in one instance, from the umbilicus to the amnion, eighteen inches, though the period of gestation is not mentioned. Bourgelat gives it as about two and a half feet; Blaine, from two to two and a half feet. Goubaux found it to measure, when untwisted, at six months' pregnancy, thirty-four inches; but it was so very twisted (twelve turns) that in this state it was only twenty-nine inches in length.

In the Cow, Vitet gives it as from nine to ten inches; but Goubaux, in a Cow at the eighth month of pregnancy, found it to be about sixteen inches; while Colin, in another Cow at the same period, gives eighteen inches.

In the Sheep, at two months' gestation, it has barely measured one inch; Rainard, at the end of gestation, gives it at from three-fourths to one and a quarter inches. Daubenton says it is two inches at parturition.

In the Pig it is comparatively very long, sometimes stretching the whole length of the Pig. Daubenton found it to be one inch in length in a fœtus measuring three inches and three lines from nose to anus.

In the Bitch and Cat it is very short, and measures from one to two inches at birth; or about two-fifths of the length of the body.

In the early days of fœtal life, the cord contains a portion of the intestines, but as the cavity of the abdomen is formed and closes, the viscus is retracted within it. Very rarely, however, this retraction is not complete, and hernia of the intestines exists at birth, or even some time after that event.

With regard to the curious torsion of the cord on itself, it has been held by some authorities that this is only accidental, and depends on the movements of the fœtus during the latter stages of gestation, or the displacement it undergoes on leaving the uterus; consequently, that the spiral twisting of the vessels is not normal. Examination of non-displaced fœtuses proves that it is far from being constant.

At birth, the umbilical cord is usually torn or gnawed through, at a short distance from the umbilicus of the fœtus; the remaining portion drying up, dying, and falling off in a few days.

SECTION III.—DEVELOPMENT OF THE FŒTUS.

Having studied the conception and partial development of the young creature, and described the envelopes which surround it, we will proceed to notice the various changes which occur in it until gestation is completed and parturition is about to take place.

This division of our subject is of much importance in several respects, but more especially with regard to the relation it bears to *teratology*—the branch of science which treats of congenital malformations and monstrosities.

The transition from the condition of the embryo, when the young animal has scarcely assumed a definite form, to that of the fœtus, when it presents the lineaments of the species to which it belongs, is very gradual.

The *dorsal cord*, as has been stated, is a cylindrical body developed above the primitive furrow, with slightly attenuated extremities, and at each side small opaque quadrangular masses, the *vertebral laminæ*, which are in reality the *protovertebræ*, or first rudiments of the vertebræ. Each of these masses is perforated by a small opening, and is resolved into three portions: the *protovertebral cavity*, the *muscular lamina*, situated above the cavity, and the *protovertebra* placed below the cavity. The *muscular laminæ*, increasing in volume, are inflected upwards and at last unite on the median line of the

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back, chiefly forming the muscles of the vertebral furrows; they also send off prolongations downwards, which concur in the development of the intercostal and abdominal muscles, as well as those of the limbs. The *proto-vertebræ* bend upwards and downwards on each side, so as to enclose the protovertebral cavity or spinal canal, and the dorsal cord; the upper ring represents the rudiments of the annular portion of the vertebræ; while the lower ring and the dorsal cord constitute the vertebral bodies and the discs uniting them.

The *lateral laminæ* arise from the portion of the middle layer of the blastoderm placed on each side of the vertebral laminæ. In the region of the trunk, these laminæ are separated for a certain time from the latter; but in the cephalic region they are always adherent to them, and at this part they are usually designated the *cephalic laminæ*. The *proper lateral laminæ* are divisible into two layers, external and internal, united by a *middle layer*; they comprise between them a space which becomes the *pleuro-peritoneal cavity*, after the formation of which the lateral are joined to the vertebral lamina. The *internal* or *fibro-intestinal layer* envelops the deeper portion of the blastodermic layer or intestinal furrow, the umbilical vesicle, and the allantois; it constitutes the fibrous and vascular parts of these membranes, and carries the vessels to the inner face of the chorion. The *external* or *cutaneous layer* is developed in two ways: above, it glides between the muscular laminæ and the fœtal portion of the external layer of the blastoderm to form the cutaneous envelope on the back; below, it separates into two leaves which receive between them the prolongations of the muscular laminæ destined to constitute the intercostal, abdominal, and other muscles of this part of the body. Of these two secondary leaves, the external forms the skin of the trunk, and the internal the parietal layer of the peritoneum. The cutaneous laminæ also furnish an extra-fœtal prolongation—the fibrous layer of the amnion.

The *middle* or *mesenteric laminæ* join at the median line, and in their substance are developed the Wolffian bodies, or antecedent deciduous kidneys, and the principal vessels of the trunk.

The *cephalic laminæ* always remain adherent to the vertebral laminæ, and are inflected inwards with them to form the anterior part of the cephalo-intestinal cavity, which is divided into two compartments—the pharyngeal and œsophageal cavities. The pharyngeal cavity opens externally by the mouth, and is partly enclosed on the sides by the pharyngeal arches. The œsophageal cavity soon shows a diverticulum, which is not long in communicating with the pleuro-peritoneal cavity, and subsequently contains the heart; it is therefore named the *cardiac cavity*. The cephalic laminæ also form the derm of the cranium, and the fibrous layer in which are developed some of the cranial bones.

The Nervous System.

The development of the *nervous system* comprises the growth of the *brain*, *spinal cord*, and *nerves*. The initial steps in the development of the brain and cord have been already indicated. At each extremity of the medullary cavity, which is a modification of the median furrow, is a slight bulging. From the posterior, or *rhomboidal sinus*, the sacro-lumbar nerves are given off, while the anterior gives origin to the brain. This anterior enlargement appears as three successive dilatations named the *cerebral vesicles* or *cells*, which are distinguished as anterior, middle, and posterior. They are filled with fluid, and the middle slightly surmounts the other two, which gives the

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whole the figure of a small triangular mass. The vesicles increase irregularly in volume, and their walls, in developing, form the nervous tissue; while their cavity persists and becomes the space observed in each portion of the encephalon. The *anterior vesicle* represents the cerebral hemispheres, the *thalami optici* and the lateral ventricles. The *middle vesicle* forms the *crura cerebri*, *corpora quadrigemina*, and the *aqueduct of Sylvius* or middle ventricle. The *posterior vesicle* gives rise to the *medulla oblongata*, *pons varolii*, cerebellum, and fourth ventricle. The middle vesicle increases more rapidly in volume at first than the others, but it soon stops and allows the anterior cell to develop; from this time the encephalon assumes its oval shape, with predominance of the anterior part.

Towards the end of their first third of intra-uterine life, nearly all the parts of the encephalon are distinct; the two hemispheres are separated by the development of the *septum lucidem*, and the convolutions are apparent on their surface; while the *corpora quadrigemina* and *crura* are well defined. At a later period the cerebellum is seen, as well as the *pons varolii*, *corpora restiformia*, and *corpora pyramidalia*.

With regard to the development of the *spinal cord*, we have observed that the medullary canal is the first trace of this part. It occupies the whole length of the vertebral stalk, and its cavity communicates anteriorly with the fourth ventrical. When the spine is developed, the cord only increases longitudinally to a certain degree, and appears to ascend in the canal; it stops at the middle of the sacrum in the equine fœtus, but ascends higher in the other species. During this apparent ascensional movement is developed the *filum terminale*, and the nerves of the tail of the Horse (*cauda equina*). The parietes of the medullary canal are at first very thin, but increase in thickness with the appearance of the nervous substance of the cord, and soon divide into two layers: an internal, the *epithelium* of the central canal; and an external, the *grey substance* of the cord. Gradually the canal contracts, and the cord shows longitudinal furrows. At the end of the first month the inferior roots of the nerves are in existence, as well as the spinal ganglia, which are developed at the expense of the protovertebræ; the superior roots are not distinguishable for some time after. The *envelopes* of the nervous centres are furnished by the protovertebral laminæ, and are developed after the sixth week, following the formation of the parts they are destined to cover.

The *nerves* are not so definite in their development, and some obscurity prevails with regard to them. It would appear that the motor roots originate in the cord, but that the ganglia are formed separately in the protovertebræ, and perhaps become the point of departure of the sensitive roots. The nervous ramifications grow from elongated ramified cells, which are joined by their extremities. The nuclei of the cells, joined to the periphery, become the nuclei of the sheath of Schwann, and the nerve tissue is afterwards deposited gradually between the axis-cylinder and the envelope. The great sympathetic nerve is perceived at an early date as a nodulated cord; it is probably developed in the same manner as the other nerves.

The Organs of Sense.

The principal portion of the *organs of sense* belong to the nervous system, and are, of course, developed with it; the other portions belong to the external epithelial layer, and to the derm or germinative layer. With regard to the *organs of vision*, two tubulous prolongations arise from the anterior cerebral vesicle and passing forward terminate in the *primary ocular vesicles*, traces of the ocular globes; the hollow prolongments forming the optic nerves,

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and the vesicles furnishing the choroid and retina. The crystalline lens, vitreous body, cornea, and sclerotica are derived from the external blastodermic layer. The part of the integument not required to form the lens constitutes the envelope of the globe. The latter forms the sclerotica and cornea; while the epiderm furnishes the epithelium to the latter, which becomes distinct from the sclerotica in about the fourth month. A slit occurs at the lower part of the fibrous envelope of the globe; this is related to the development of the vitreous humour, a prolongation of the derm passing through this slit and entering between the lens and the anterior wall of the secondary ocular vesicle which appeared shortly before. There this prolongation becomes developed and transformed into the vitreous humour, which at one period is surrounded by vessels, but shows none immediately before gestation. It exhibits in its centre a transverse canal, which lodges a branch of the arteria centralis of the retina.

The *optic nerve* is developed in the pedicle connecting the ocular vesicle with the anterior cerebral vesicle, and the *retina* is formed by the inner layer of the secondary ocular vesicle; it extends to the lens in changing its character in front. The *choroid* coat is constituted by the posterior layer of the ocular vesicle; it extends as far as the lens, and is then inflected in front of that body to form the iris. The borders of the pupil embrace the vascular envelope of the lens, and the anterior face as well as this pupil are covered by a very vascular membrane, the *membrana pupillaris;* behind it is the equally vascular covering, the *membrana capsulo-pupillaris*, that passes through the pupil to the lens to envelop it in a kind of sac that disappears towards the end of gestation. Previous to this time this aperture is very wide; but as the iris is developed the pupil contracts, and the vessels of the vascular or pupillary membrane diminish in size and number, until at last only a few are seen crossing the transparent membrane.

The protective and motor apparatus of the eye are gradually developed around the globe. The eyelids are small cutaneous folds which are formed in the first third of uterine life, and grow and unite by their margins until a short time before or after birth, according to the species, when they separate. They are maintained closed by a thin membrane, which disappears in solipeds, ruminants, and the Pig, before birth; but in carnivora it remains until some days (eight or ten) after that event. So long as the lids are closed, the conjunctiva is only a sac communicating with the lachrymal canal. The crystalline lens in the fœtus and new-born animal distinctly shows the three septa peculiar to it; three diverge from each pole at angles of 120°. The lachrymal gland is an appendage of the epithelial layer which is intruded above the globe; at first compact, it becomes gradually excavated into cavities, from which arise the excretory ducts.

The *auditory apparatus*, consisting of the internal ear, auditory nerve, and middle ear, is developed separately. The labyrinth appears in the form of a vesicle which is not in direct relation with the posterior cerebral cell, but is constituted by a depression of the epidermic layer—the *auditory fossa*—that becomes more and more marked until it is finally a closed cavity. At this time the wall of the labyrinth is only a simple epithelial membrane; but this is soon increased externally by a connective membrane which vascularises it, and then gives rise to three layers: an internal, which adheres to the epithelium to form the membrane of the labyrinth; an external, that lines the labyrinthic cartilage; and a middle, whose soft embryonic connective tissue disappears and is replaced by a fluid, the *perilymph*. At the same time that these changes of structure are taking place, the vesicular shape of the laby-

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rinth is modified, and shows the *cochlea*, *semicircular canals*, *utriculus*, and *sacculus*. The *middle* and *external* ear are formed by the first pharyngeal slit, which is never completely closed, while the others disappear. At first there is a cavity communicating externally by the pharynx; this cavity contracts, then divides into two portions by a septum in its middle; this septum becomes the *tympanum*, while the inner cavity forms the *middle ear* and *Eustachian tube;* and the external portion the *external auditory canal* or *meatus*. The *ossicula auditûs* are at first cartilaginous, and appear towards the third month; after which they gradually ossify, and have nearly assumed their definitive shape at birth.

The *concha* is developed beneath the integument after the second month.

The *organs of smell* begin by two depressions in the epidermic layer, analogous to the crystalline lens and auditory fossettes. These two olfactory fossa appear below the ocular vesicles, and, becoming deeper, their depth is further increased by granulations which spring up on their borders. Behind, they communicate with the pharynx, and the formation of the palate separates them in front from the buccal cavity. From this time the nasal fossæ are constituted and completed by the development of the bones of the face. The *olfactory lobes* and *nerves* are at first tubular, and are related to the anterior cerebral vesicle. In the young fœtus the nostrils are formed by a collection of mucus and epithelium; they open towards the middle period of gestation.

The Skin and its Appendages.

The *skin and its appendages*, which might be designated the *tactile apparatus*, are developed by the epidermic and middle layer of the blastoderm. The cutaneous laminæ, by the modification of their elements, form the *derm*, in which vessels are readily seen after three months. In the *epiderm* it is not long before the mucous and horny layers can be distinguished; in the first, pigment cells are observed at the commencement of the fifth month in the larger quadrupeds. The epiderm is easily detached from the derm; it forms a peculiar, white, completely-enveloping pellicle on the surface of the latter, apparently separated from it by the growing hairs. Frequently we find the integument covered by a special coating that looks like varnish (the *vernix caseosa*); this would appear to be intended to protect the epidermic epithelium from the destructive solvent action of the alkaline amniotic fluid. It is very abundant on the human fœtus at all periods, but is not found on that of animals so long as the skin is glabrous. As soon as the hairs begin to appear, the epiderm is partially detached in the form of the thin pellicle just alluded to, and the decomposition of which gives rise to an appearance like varnish. It is best seen in the fœtal Pig, the hairs on the skin appearing all at once over the body; in the other domesticated animals they are only developed successively, and consequently the shedding of the epiderm occurs partially and in patches, which are insensibly confounded with the normal epidermic layers. Microscopically, these flakes offer the same characters as epidermis removed by a vesicant; the points where the hairs have passed appear as regular infundibuliform openings. When the fœtus increases in volume, the epiderm desquamates and the *débris* floats in the amniotic fluid.

In the third month, the hairs are perceptible on the fœtus of the Mare and Cow. Hair follicles have been observed in embryos of the Pig which did not measure more than two inches in length. They first appear about the eyebrows, lips, and joints of the limbs, and the whole of the body is covered at the sixth or seventh month; they are usually observed in the

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fœtus of the Mare and Cow, around the lips, towards the eighteenth week of gestation. The hair may be shed and renewed before birth; for it has been found in the amniotic fluid and in the stomach of the fœtus. Each hair is developed in a prolongation of the epidermic layer which is imbedded in the substance of the derm: which prolongation is constituted by a bottle-shaped mass of cells. In the centre the cells are modified and heaped up, so as to form a small cone whose base covers the growing papilla; this cone elongates, until it touches the superficies of the epidermis, when it becomes bent in the effort to push itself through; but finally it issues beyond the surface, where it may grow freely.

The *sebaceous* and *perspiratory* glands are developed in a similar manner, at the middle period of uterine life. The horny productions, such as the *claws, hoofs, ergots,* and *chesnuts*, are apparent at an early stage. Towards the end of the second month there can be perceived in the fœtus of the Cow, at the extremity of each digit, a small, pale, and transparent conical tubercle; this is the rudiment of the claw. The hoofs of solipeds appear towards the twelfth week, and about the commencement of the fourth month they are more developed; their texture has become firm and opaque, whereas before it was gelatinous and transparent, and has assumed a fine yellow tint. They are always soft, however, until birth, in order to guarantee the integrity of the fœtal envelopes. At mid-term, brown or black patches appear in it, if the coronet is provided with pigmentary stains; but it is not until about the end of gestation that the horn begins to show the greenish tint proper to it when destitute of pigment; though the remainder of this production, particularly its lower part, preserves its yellow colour until the young animal is born. In solipeds the chesnuts are seen at mid-term, in the form of thin brownish plates, which soon become darker. The structure of the hoof is not tubular until after birth, when the fœtal hoof, gradually disappearing, the horn that replaces it is fibrous and tubular, and much more consistent.

The corneous substance is developed at the expense of the blastema which the capillaries of the modified derm throws out on its surface. In this material appear nucleated cells which, pressing against each other, become at first polygonal in shape and flattened, then lose their nucleus and are confounded with each other. At a later period, cells of a new formation are moulded on the papillæ of the coronary cushion and plantar surface of the foot of solipeds and ruminants, giving it that fibrous appearance which is so striking during extra-uterine life.

The Locomotory Apparatus.

The development of bone, and with it the locomotory apparatus in general, next demands our attention. Bone is developed in the blastema or primitive basis—a transparent glairy mucus matter containing numerous minute corpuscles. This progressively acquires increased firmness; sometimes assuming a membraneous or ligamentous condition, usually a gristly consistence, before its conversion into bone. The change into cartilage is noted by the appearance of minute nucleated cells, which increase in number and size, and are aggregated in rows, with intercellular tracts where the ossification is about to begin. These rows, in the cartilaginous basis of long bones, are vertical to its ends; in that of flat bones they are vertical to the margin. The cells furthest from the seat of ossification are flattened and in close contact: nearest that seat they become enlarged and separated. The first appearance of bone is that of minute granules in the intercellular tissue. Canals are next formed

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in the bone, by absorption; these ultimately receive bloodvessels, and become the "vascular canals." The immediate nutrition of bone is provided for by the production of minute "plasmatic canals," "lacunæ," or "bone-cells" from the vascular ones. Ossification begins at the centre of round bones, and proceeds towards the surface; in flat bones it extends between two membranes, and from a central point towards the periphery; in short bones, towards the circumference; and in long bones, from a central point or *diaphysis*, towards another centre—the *epiphysis*, situated at each end. Particular parts or processes are furnished with a separate centre of development, named the *apophysis*. Length occurs at the extremity of the diaphysis, and bulk by deposition on the surface, the medullary canal of certain bones being due to internal absorption.

The *spinal stalk* is the first portions of the skeleton observed in the embryo, it being represented by the *chorda dorsalis*, which is composed of a mass of cells in the interior of a transparent sheath. The protovertebræ appear on each side of the cord, and ultimately enclose it and constitute the spinal canal; in this way results the *external sheath of the cord*, and the *superior uniting membrane*. The vertebral stalk now exists as a membraneous axis, but not for long; as it becomes segmented in order to form the vertebræ, and these segments are gradually converted into cartilage. Each persistent vertebra does not correspond to a protovertebra, the latter dividing into two portions to constitute two vertebræ. The body of the vertebra is developed more quickly than the spinous portion; at the end of the second month all the vertebral bodies are cartilaginous, while the laminæ are yet in a membraneous condition. In the third month ossification commences, and during this process the dorsal cord disappears, except between the vertebræ, where it is developed to form the intervertebral fibro-cartilage.

The *face* and *cranium* are formed by a membrane that envelops the encephalon, and which is due to the protovertebral laminæ. This cranial membrane become partly cartilaginous and partly fibrous, the cartilage existing at the base of the cranium, and appearing to be a prolongation of the bodies of the vertebræ: indeed, there is a resemblance between a vertebra and the cranium, in so far as the latter can be resolved into four portions, each corresponding to a vertebra. This cartilage is slowly transformed into bone; while the fibrous part, answering to the roof and sides of the skull, pass directly into the osseous state. The bones of the face are formed by the *pharyngeal, branchial*, or *visceral arches:* a name given to four laminæ which, springing from the anterior extremity of the dorsal cord, curve downward to meet those of the opposite side; the spaces between them are named the "pharyngeal clefts." The upper jaw, mouth, and nasal cavities—composed by the nasal, maxillary, and palate bones—come from the first pharyngeal arch; while Meckel's cartilage, which passes from the handle of the malleus towards the lower jaw, is also an appendage of it. This cartilage disappears about the sixth or seventh month. At first the mouth communicates with the nasal cavities; the palate is developed in two portions, which advance towards each other, but remain for some time apart; so that during this time the young animal has a cleft palate.* The second pharyngeal arch forms the stapes, the petrous portion of the temporal bone, the styloid arch and the

* This cleft condition of the palate would sometimes appear to persist after fœtal life. In April, 1876, at the Middle Park Stud, in Kent, I saw a thoroughbred foal with a cleft palate. It was being suckled, and a portion of the milk, instead of passing down the œsophagus, escaped from the nostrils. It was this unusual course of the milk which led to the detection of the imperfection.

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hyoid branch. The third originates the hyoid bone with its cornua, while the fourth only constitutes the soft parts in this region of the throat.

The *thorax*, consisting of the ribs and sternum, is an appendage of the protovertebral laminæ which incline towards the lower face of the vertebral spine. The true ribs are developed most rapidly, and before attaining the middle line they unite by their inner extremity to form a moiety of the sternum. A fissure at this part separates the ribs of one side from those of the other; this gradually closing, ends by disappearing altogether, and then the sternum is constituted. The ribs are, after the petrous portion of the temporal bone, the parts of the skeleton which ossify most promptly; ossification begins in the middle bones. The ribs do not belong exclusively to the dorsal vertebræ, but have a tendency to be developed along the length of the spine; it is not rare to see a small cartilaginous nucleus attached to the lumbar vertebræ, and which is soon lost in the substance of the abdominal parietes; in birds this body assumes large dimensions on the last cervical vertebræ.

The shape of the thorax differs with species, being round in some and oval in others, but it is always less developed in the fœtus than in the young or adult animal.

The *limbs* do not appear until after the formation of the vertebral spine, the pharyngeal arches, and the thorax. They show themselves as four small prolongations from the pelvis and chest, slightly thickened at their origin and contracted in the middle. Their free extremity is flat, and is either simple or divided, according to the foot of the species. In these prolongations the cartilaginous segments are formed, which, when ossified, at a later period, constitute the bones of the limbs.

The *muscles* are divided into four groups, after their origin. They are the *vertebral muscles*, which arise from the muscular laminæ of the protovertebræ; the *visceral muscles* for the thoraic and abdominal cavities, the neck and jaws, and having the same origin; the *cutaneous muscles*, which originate from the cutaneous laminæ of the middle layer of the blastoderm; and the *muscles of the limbs*, whose development is not fully understood.

It was believed at a certain period, that the muscular fibres are formed by the joining together at their ends of several elongated cells. It is now known that each fibre is constituted by a single cell which extends in length, and whose nuclei are multiplied and placed at the surface; while the contents are transformed into a substance that presents all the characteristics of contractile tissue. The sarcolemma is formed after the fibre, by a modification of the connective tissue surrounding it.

The locomotory apparatus of the majority of the domesticated species of animals is so developed at birth, that immediately after that event the young creature can move with more or less alacrity. With the larger herbivorous quadrupeds, the limbs of the new-born animal are long to enable it to reach the teat, as well as to enable it to escape by flight should danger be apprehended.

The Circulatory System.

The development of the circulatory system is not apparent until some days after the appearance of the embryo in the blastodermic layer, there being no trace of vessels in the germinative space. It is not long, however, before the central organ of circulation and some vessels appear in the middle layer, and canals also spread to the surface of the umbilical vesicle. While the contents of the vitelline vesicle are being imbibed by the embryo, the heart is in course

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of formation; bloodvessels are increasing and extending, the allantois is completed, and, finally, the placental circulation is established and continues until birth.

The pleuro-peritoneal cavity in the embryo shows a diverticulum in front —the *cardiac cavity*, in the interior of which the heart is developed. This organ is at first a small mass of cells, the innermost of which separate in order to leave a little space, and to create blood globules. As soon as it appears, the heart contracts and relaxes alternately, the movements being very

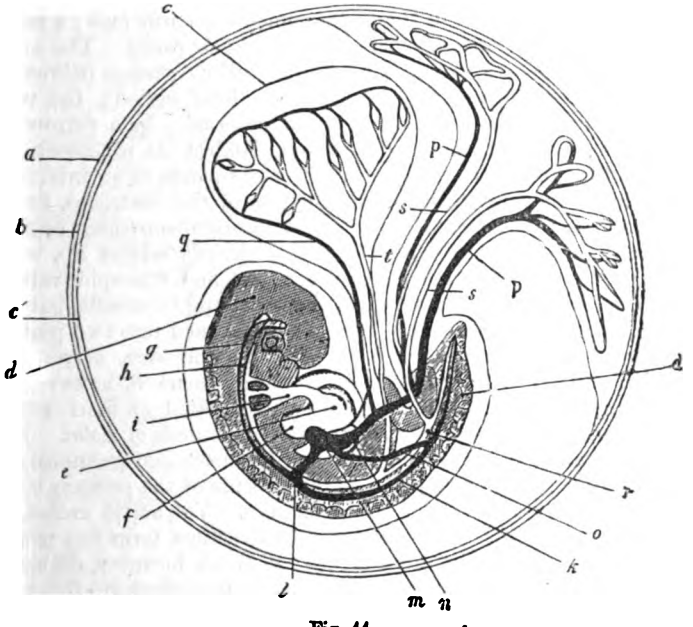

Fig. 44.

FŒTAL CIRCULATION IN A TRANSITION STATE.

*a b c*¹, Circle or Envelope resulting from the Fusion of the Vitelline Membrane, External Layer of the Blastodermic Vesicle, and the Transformation of the Allantois; *c*, The Diminishing Umbilical Vesicle; *d*, Cephalic Portion of the Embryo; *d*¹, Caudal Portion; *e*, Ventricle of the Heart; *f*, Auricle of the Heart; *i*, Aorta, forming the Aortic Arches; *h*, Trunk Representing the Thoracic Aorta; *g*, Vessel which becomes the Anterior Vena Cava; *k*, Vena Azygos; *l*, Confluents of the two Veins *g* and *k*; *m*, Confluent of all the Veins at their Entrance into the Auricle of the Heart; *n*, Vessel Resulting from the Union of the Allantoid Veins *p p*, and the Omphalo-Meseraic Vein *q*; *o*, Posterior Vena Cava; *p p*, Allantoid Veins; *q*, Omphalo-Meseraic or Umbilical Vesicle Vein; *r*, Posterior or Abdominal Aorta; *s s*, Allantoid Arteries; *t*, Omphalo-Meseraic Artery.

slow, though they gradually become accelerated. Towards the twelfth day the organ has the shape of a cylindrical contractile tube. From its anterior part arise two branches, the *aortic arches*, which at first proceed towards the head of the embryo, but afterwards are bent backward and downward. These arches join to form the *single aorta*, which in its turn divides into two branches—the *subvertebral* or common aortas,—which run parallel along the lower surface of the embryo, giving off four or five branches, the *omphalo-meseraic* arteries, which ramify in the germinative area and end in a vein—the *terminal sinus*. From this ramification and sinus arise two vessels, the

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omphalo-meseraic veins, which return to the posterior extremity of the heart. The circulation in the umbilical vesicle is very ephemeral in several species, while it is as persistent in others; varying, of course, with the duration of the vesicle itself.

The heart, from being merely a cylindrical tube, undergoes considerable modifications before it arrives at its complete development, passing through all the different forms which characterise the organ in the various vertebrate animals. The first change consists in an inflexion, by which the inferior part becomes the superior; then it dilates at three distinct points: one anterior and superior, at the origin of the aorta, named the *aortic bulb*; a middle one, the *ventricular cavity*; and a posterior, the *auricular cavity*. The constriction between the auricle and ventricle is named *Haller's passage* (*détroit*).

These two cavities are single only for a brief period; the ventricular first divides into two—a division marked externally by a furrow which is visible on the surface of the heart of a fœtal lamb at the nineteenth day, and the twenty-fifth in the foal. This furrow corresponds to an interventricular septum which arises insensibly at the bottom of the ventricles, and reaches the auricles, where it concurs to form the *auriculo-ventricular orifices*. The borders of the openings are furnished with a slightly salient lip, which at a later stage develops, and constitutes the mitral and tricuspid valves. The heart now contains three cavities, two ventricles and an auricle, but it is soon to have a fourth; for the auricle becomes partitioned into two portions, and externally this division is marked by another depression, corresponding to the septum formed in the cavity. It is to be remarked, however, that the partition remains incomplete during the whole period of uterine life, being perforated by an opening—the *foramen ovale* or *foramen of Botal*. The aortic bulb now contracts and forms two vessels—the aorta and pulmonary artery.

The *arteries* are developed, partly at the expense of the primary circulation, and partly in the vascular layer of the embryo. The aortic arches, situated at the inner face of the first two pharyngeal arches, form five new vessels, which are placed within the other arches; all these, however, do not exist at the same time, some becoming atrophied while the others are forming. For instance, the first two completely disappear; the third form the carotids; the fourth, the axillary artery and the arch or cross of the aorta; the fifth is atrophied on the right, but on the left forms the pulmonary artery, the *ductus arteriosus*, and the aorta. The latter is continued along the spine by the fusion of the two primitive aortæ, and shows at its posterior termination the small pelvic vessels and the large umbilical arteries.

The peripheral vessels originate, independently of the central vessels, in the interior of the vascular layer. They appear as solid cellular branches, which soon become hollow in their interior, and free cells become visible. As these new channels are developed, the omphalo-meseraic vessels gradually diminish and disappear, until at last only one or two pass to the umbilical vesicle.

The *umbilical veins* are developed immediately after the formation of the omphalo-meseraic veins, and join these; as the ramifications of the latter diminish in size the former increase rapidly, and when the liver is formed around them they throw into it those branches which are the rudiments of the hepatic plexus. Between the portal and hepatic veins, the umbilical vein communicates with the vena cava by the *ductus venosus of Aranzi*, which does not exist in the fœtus of solipeds in the last month of gestation. The embryonic veins form four chief trunks: two anterior, the *anterior cardinal veins*; and two posterior, the *posterior cardinal veins* The veins on

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each side unite in pairs to form the *ductus Cuvieri*, which opens transversely into the omphalo-meseraic trunk near the auricular cavity. The anterior cardinal veins issue from the cranium, forming the jugular veins, and communicate by a transverse anastomosis between the right and left veins. Below this the left vein gradually atrophies, as does the ductus Cuvieri of the same side; while the right vessel enlarges, and is ultimately the anterior vena cava.

The posterior vena cava appears in the liver about the fifth week; it re-

Fig. 45.

FŒTAL CIRCULATION: ADVANCED PERIOD.

A, Placentulæ; B' B', Umbilical Veins, with their Common Trunk, B; D, Vena Portæ, and its Anastomosis, C; E, Ductus Venosus; F, Posterior Vena Cava; G, Right Ventricle of Heart; H, Pulmonary Artery; J J, Aorta; I, Ductus Arteriosus; K, Umbilical Arteries, with their Anastomosis at the extremity of the Umbilical Cord.

ceives the veins of the kidneys and the Wolffian bodies, and behind it anastomoses with the cardinal veins. The middle portion of the latter disappear and are replaced by the *vertebral veins*, the right of which forms the vena azygos. There, then, only remain two cardinal veins for the two extremities: the anterior which enters the ductus Cuvieri, and the posterior which constitutes the hypogastric and crural veins. It therefore happens that the venous system of the fœtus, which was at first symmetrical, becomes asymmetrical in the adult animal.

As a result of these successive developments, the placental circulation is

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instituted, and continues the same until the end of gestation, the heart being the organ which circulates the blood in the fœtus. This fluid, carried by the arterial vessels, reaches the umbilical arteries, and from them is distributed to the placenta. There it is respired, depurated, or *arterialised*, through indirect contact with the blood of the parent, and is returned by the umbilical veins. In the texture of the liver it is mixed with the venous blood of the intestines and the hinder part of the body, conveyed by the *ductus venosus*, and is finally thrown into the right auricle, then into the ventricle, whence it is expelled by a contraction of that cavity. Instead of entering the lungs, which do not act during fœtal life as respiratory organs, the blood is forced into the *ductus arteriosus*, and thence into the aorta. So that the organs of the young creature are never supplied with pure blood, but with a mixture of arterialised and venous blood; this mingling taking place through the *foramen ovale*, in the aorta by the *ductus arteriosus*, and in the liver by the *ductus venosus*. The head and neck receive the purest blood, a circumstance which probably explains the predominance in size of the upper to the lower parts of the body of the fœtus.

At birth the conditions of existence being suddenly changed, very marked modifications occur in the circulation. The lungs then become the organs of respiration, and rapidly increase in capacity, while the thorax enlarges in a commensurate degree; the pulmonary artery also dilates to admit the increased flow of blood, and the ductus arteriosus is obliterated to prevent the mixture of arterial and venous blood. The ductus venosus also aids in the isolation of the two kinds of blood by becoming atrophied, as does also the occlusion of the foramen ovale. This opening, however, not infrequently remains intact in young animals; though, as a rule, this does not greatly affect the circulation, for when the heart contracts the auricles are isolated by the narrowing of the orifice and the elevation of a valve.

The Respiratory Apparatus.

There is an absence of unanimity as to the mode of development of the respiratory apparatus, and particularly the *lungs*. Some assert that the latter are derived from two little distended cellular masses attached to the anterior part of the intestinal tube, and which afterwards become perforated with numerous ramifying cavities, that communicate with the trachea; while others describe them as commencing by a median enlargement, which is hollow, and opens into the œsophagus. The walls of the orifice of communication with the digestive passage become considerably lengthened, and afterwards form the trachea and larynx; while the vesicle or enlargement representing the lungs divides into two pyriform sacs, each of which is greatly subdivided to constitute the pulmonary lobes, with their vesicles and infundibula. The *trachea* is completed through the formation of the cartilaginous rings in the tube that attaches the lungs to the œsophagus; the larynx is developed in the same manner, at the pharyngeal opening of the tube. This organ, however, is not very distinguishable during fœtal life, and only assumes its definitive form and volume at puberty.

Up to birth the placenta retains the function of the lungs, which, though ready to act, only come into play when the creature is born. Previous to this event they are of a dark red colour, firm and compact, heavier than water, and apparently destitute of alveoli; though these latter exist, but are filled with embryonic elements, and their walls are in contact. A moderate insufflation is sufficient to distend the air-vesicles, when the lungs become crepitant and enlarged, have a rosy colour and spongy appearance, float in

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water, and the air cannot be completely expelled from them. The same change immediately occurs in these organs when the young creature is born alive; the external atmosphere, acting upon the surface of its body, causes it to inspire deeply, the chest dilates, the air rushes into the lungs, and respiration commences, only to cease with life. This alteration in the colour, texture, and specific gravity of the lungs enables us to decide, in certain cases, whether or not an animal has been born alive.

The *thymus gland* first appears towards the second month, as a growth from the respiratory mucous membrane, near the larynx; it then descends gradually along the trachea until it reaches the thorax, where it is situated between the layers of the anterior mediastinum. It increases in size until birth, after which it remains stationary for a short time; then it gradually diminishes and disappears at a period which varies according to species, and even individuals. Exceptionally, it has been found in horses three years of age. It is a gland in structure, though it has no excretory canal. Its uses are unknown, though it is surmised that it plays a part in the nutrition and hæmatosis of the fœtus and young animal. It may be that, like the spleen, it assists in converting the white corpuscles of the blood into red corpuscles.

The Digestive Apparatus.

The development of the digestive apparatus comprises the formation of the alimentary canal and the organs attached thereto. The *alimentary canal* begins to appear after the first outlines of the nervous centres and the vascular apparatus have been manifested. We have already described the manner in which the intestinal cavity was formed from the inner lamina of the blastoderm. This cavity, for convenience of description, may be divided into three portions: the *anterior intestine*, which originates the pharynx and œsophagus; the *middle intestine*, which becomes the stomach and intestines proper; and the *posterior intestine*, which constitutes the rectum. The chief, or middle intestine, is at first a cylindrical uniform tube, the diameter of which is afterwards modified to constitute the organs comprised between the œsophagus and rectum.

The *mouth* begins by a depression or *cul-de-sac*, which is limited by the maxillary tubercles; it increases as it dips towards the pharynx, from which it is only separated at last by a thin membrane; this is eventually absorbed, and the mouth then communicates with the commencement of the digestive canal. Towards the third month the mouth is confounded with the nasal fossæ, but after this the palatine bones appear, and finally isolate the two cavities.

The *tongue* is at first only a small protuberance from the maxillary tubercles, but is completed by the addition of a little growth from the second branchial arch. Its epithelium and glands are derived from the external layer of the blastoderm; they are apparent at the third or fourth month.

The *pharynx* and *œsophagus* lengthen and widen as the fœtus grows; the latter at first communicates with the trachea, but it gradually closes, and ends by separating entirely from that tube.

The *stomach* is formed by the dilatation of the anterior part of the middle intestine. This dilatation is fusiform, its larger axis being longitudinal; but it soon curves on itself, and then this axis becomes transversal.

In ruminants the stomach is single when it first appears, though it is not long before furrows are observed on its outer surface; while internally the particular septa are seen as in adult life. In the fœtus the stomach is small, but its volume increases rapidly after birth, when the animal commences to take solid food. During the sucking period in ruminants, there is a pre-

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dominance of the fourth over the other gastric compartments; but as soon as the young animal begins to consume fibrous aliment, the rumen increases rapidly, until it is by far the largest cavity.

The *intestines* are at first of uniform calibre, though in a short time it is easy to distinguish the different sections of which they are ultimately composed. In hoofed animals the cæcum appears very early; it is situated near the omphalo-meseraic duct, which is detached from the extremity of an intestinal loop that is drawn towards the umbilical ring; while the latter is becoming obliterated, this loop ascends in the abdominal cavity. The intestines are quite smooth on their inner surface during the first two months, and towards the third month show the villi and glands of Lieberkühn; the Brunnerian glands and the follicles are only seen later.

The *rectum* arises from the posterior intestine, and is developed like the other portions.

With regard to the *anus*, there is observed towards the caudal extremity of the fœtus a depression analagous to the buccal *cul-de-sac*. This becomes deeper, and joins the rectum and genito-urinary organs; later, it separates from the last, and then belongs exclusively to the alimentary canal.

The ANNEXES OF THE ALIMENTARY CANAL are the salivary glands, teeth, liver, pancreas, and spleen. The *salivary glands* are developed in a solid cellular tubercle, which is connected with the epithelium at the upper part of the digestive apparatus. With the growth of this tubercle, it is converted into a series of cavities having the form of glandular *culs-de-sac*. The submaxillary gland appears first, and it is entire in a fœtus of only twelve lines in length; the parotid gland is the last formed.

The *teeth* are developed in the interior of a cavity called the "dental follicle" or "sac," by means of the elements of three germs corresponding to the anatomical constituents of the teeth—enamel, ivory, and cementum. The follicle is an oval cavity whose wall comprises two layers: an external fibrous sac, and an internal gelatinous lining, at the bottom of which is the *ivory pulp* or *germ*. This is a prominence detached from the bottom of the sac, and has exactly the shape of the tooth. It is composed of a mass of delicate cellular tissue provided with vessels and nerves, and on the surface a layer of elongated cells. At the summit of the follicle, facing this pulp, is the enamel pulp, which fits accurately on the dental pulp like a cap. This is made up of a small quantity of mucous cellular tissue, covered by a layer of cylindrical cells connected with the buccal epithelium by the *gubernaculum dentis*. The *cement organ* manifestly exists in the foal, being found at the base of the ivory germ, though it disappears quickly after having performed its function. It is unnecessary in this place to enter into a consideration of the development of the teeth.

The *liver* commences to be formed at an early period in all animals, appearing at the surface of the duodenum in the shape of one large tubercle or two small ones, according to the number of lobes in the organ of the adult. To these external tubercles, corresponding internal ones arise from the intestinal epithelium; the first increase and enclose the omphalo-meseraic vein, while the second ramify in their interior and form the biliary ducts.

The liver grows rapidly and when about one-third of the period of gestation has elapsed it nearly fills the abdominal cavity. At a later date this increase is less marked, although when gestation is nearly terminated the gland is proportionately more voluminous than in the adult.

The *pancreas*, like the salivary glands, is first seen as a solid cellular tubercle, which is subsequently hollowed out by ramescent cavities.

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The *spleen* is developed about the second month, on the great curvature of the stomach; it would appear to be formed at the same time as the pancreas, in a band extending from the stomach to the duodenum; but it is separated from the pancreas and becomes attached to the stomach, where its elements assume the character of splenic tissue.

The Genito-urinary Organs.

The genito-urinary organs are related to each other in their development, and have some parts in common. Immediately after the formation of the intestines, these organs are anticipated by the *Wolffian bodies* or *primordial kidneys.* These are glandular organs extending in front, or one on each side, of the vertebræ, from the heart to the pelvis. They are composed of small transversely disposed tubuli filled with a white fluid, and opening into a common duct running parallel to the spine, which again enters, inferiorly, that portion of the allantois which becomes the bladder. The duct is formed before the tubuli, and is one of the earliest developed structures in the embryo. Placed behind the peritoneum, the Wolffian bodies are attached by two folds of serous membrane: one, the anterior, named the *diaphragmatic ligament of the Wolffian bodies;* and the other, posterior, the *lumbar ligament of the Wolffian bodies.* These organs secrete at first a fluid resembling

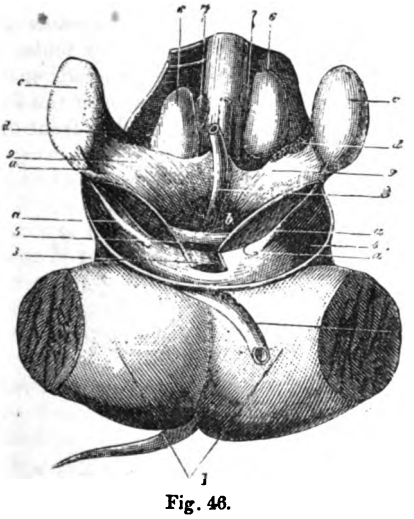

Fig. 46.

MALE FŒTUS OF THE MARE AT FIVE AND A HALF MONTHS: THE ABDOMEN OPENED AND TESTICLES EXPOSED.

1, Thighs; 2, Penis, neither Scrotum nor Prepuce are yet formed; 3, Bladder, with the two Umbilical Arteries; 4, Abdominal Parietes; 5, Douglas' Foramen, with the two Afferent Canals, *b*, *b*^{1}; 6, Kidneys; 7, Supra-renal Capsules; 8, Rectum; 9, Mesorchis or Spermatic Cord: *a*, Gubernaculum Hunterii; *a*^{1}, Internal Inguinal Ring; *b*,*b*, Efferent Ducts; *c*, *c*, Testicles; *d*, *d*, Pampiniform Plexus.

wine, though their function is soon greatly modified, as they are not long in becoming atrophied; then a portion serves for the development of the genital organs, while another gives rise to organs whose use is not exactly known, such as the Rosenmüller organ, which is very developed in the equine fœtus, and the canals of Gaertner visible in the Cow.

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With regard to the URINARY ORGANS, we have mentioned how the allantois was derived from the terminal portion of the intestine; it only now remains to add that the *urinary bladder* is derived from the abdominal portion of the allantois, which is merely a dilatation of that sac. During fœtal life, the bladder is extended by the *urachus* to the umbilical ring; but after birth this canal is obliterated, and the bladder retires to the bottom of the pelvic cavity.

The *kidneys* appear a long time after the Wolffian bodies. They show themselves in the form of two *culs-de-sac*, constituted by the upper wall of the small vesicle of the allantois. These small cavities become ramified, and are ultimately replaced by solid tubercles, in whose interior are developed the tubuli uriniferi and the Malpighian tufts. According to some observers, the kidneys only subsequently communicate with the ureters, which are developed separately in the middle lamina of the blastoderm, and terminate *in* the pelvic portion of the allantois.

The genital organs of the *male* and *female* offer, at the commencement of their development, the greatest analogies. For a certain time it is impossible to distinguish the sexes; so that some authorities propose to term this the "indifferent" state of the genital organs. Afterwards the sexes become defined, and at this stage the organs may be studied as internal and external. The indifferent stage begins about the sixth week, when there appears *on* the lower face, and near the inner border of the Wolffian body, a small white cord, which, in keeping this position, increases in volume. This is the *genital gland*, which is fixed to the body by folds of the serous membrane, and is composed of a collection of young cells enclosed in an envelope. The development of this gland is coincident with the formation of *Müller's duct* or the *genital canal*, which lies inside and in front of the Wolffian duct.

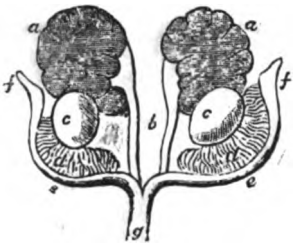

Fig. 47.

GENITO-URINARY ORGANS OF A FŒTAL SHEEP.

a, a, Rudimentary Kidneys; *b*, Ureters; *c, c*, Testes; *d, d*, Wolffian Bodies; *e, e*, Excretory Ducts of Wolffian Bodies or Sperm Ducts; *g*, Oviduct with its openings *f, f*.

Müller's duct is at first a solid cellular column, but is afterwards hollowed out into a cavity; it terminates in a *cul-de-sac* at its upper extremity, and opens below into the bladder, near the Wolffian duct. From these modifications of the genital gland and the ducts of Müller, it results that the *testicle* arises from the gland, which shortens and widens a little, while its tissue is transformed into the *tubuli seminiferi*. The *head* or *globus major of the epididymus*, is formed by the middle portion of the Wolffian body; the *tail* or *globus minor*, the *vas deferens*, and the *ejaculatory canal*, are derived from the Wolffian duct. Lastly, the *vesiculæ seminales* and the *commencement of the urethra* are formed by the posterior extremity of the ducts of Müller, which joins the urogenital sinus—the very short canal communicating between the

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bladder and cloaca: The developed testicle remains in the abdominal cavity, maintained there by a peritoneal fold, the *plica gubernatrix;* or descends by the inguinal canal into the scrotum. This descent is preceded by the appearance of a preparatory structure—the *gubernaculum testis*—consisting of a central axis of soft gelatinous substance containing many nucleated cells and surrounded by fibrous tissue, which soon exhibits the striped characteristics of voluntary muscle. Some of these fibres spring from the bottom of the scrotum and traverse the abdominal ring, while others arise from Poupart's ligament: the whole, enclosed by connective tissue and connected by a fold of peritoneum to the psoas muscle, extending to the testis. This gubernaculum, in shrinking or contracting, draws the testis below the kidney to the abdominal ring, where it rests for a brief space; after which it reaches the scrotum, where it is found after birth with the remains of the scrotal part of the gubernaculum. The iliac and pubic portions of the muscular tissue now become the "cremaster" muscle, while the sac of peritoneum carried down with the testicle is converted, by obliteration of the neck, into the *tunica vaginalis testis.*

In solipeds the testicles do not usually descend into the scrotum until six months after birth; when one or both do not appear, as sometimes happens in the male domesticated animals, and remain in the abdominal cavity during life, the gubernaculum, or what corresponds to it, is reduced to a small thin cord, without a trace of cavity, and showing only some few pale fibres of the atrophied cremaster muscle. In the foal they are voluminous, and somewhat reddish in colour; they are occasionally found in the scrotum at birth; but they soon ascend into the abdomen, to redescend during the first year. With some animals, however, as has been already mentioned, and far more frequently with the Horse and Pig than any others, the testicles remain in the abdomen during life, or only one descends to its natural situation. When they remain in the abdominal cavity, the animal is said to be "anorchid" or "cryptorchid;" and it has been shown that, although such animals have the sexual propensity well marked, yet they are unproductive; their semen does not contain any spermatozoa.

When one testicle has migrated to the scrotum, leaving one in the abdomen, the Horse is "monorchid," and possesses the power of reproduction unimpaired.

In ruminants the testicles are small, and are in the scrotum at birth, where they remain. Sometimes there is a strange malposition of the testicles, and especially in the Pig; they having been found beneath the chin, in the flank, and elsewhere.

In the female, the *ovary* is derived from the genital gland, whose anatomical elements are disposed so as to form the stroma, Graafian follicles, and the ova.

In fœtal solipeds the ovary is of an immense size, especially about the middle of gestation, and its stroma is red and extremely soft. In other animals, and particularly ruminants, this disproportion is not observed.

The *Fallopian tube* and its pavilion are formed by the anterior portion of Müller's duct, the extremity of which presents a small linear orifice. The *uterus* and *vagina* arise from the posterior part of these ducts, which approach each other, and finish by amalgamating posteriorly to form a single canal. This fusion originates the vagina and body of the uterus, the two diverging portions of the ducts comprised between the point of union and the Fallopian tubes forming the uterine cornua. The uterus and vagina are at first continuous and without any sign of demarcation, but towards the sixth month the neck of the uterus begins to become apparent.

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The external organs of the female in their indifferent state, demand notice. The intestine terminates in the *cloaca*, a cavity into which not only this tube but also the bladder enters, through the urogenital sinus. This arrangement

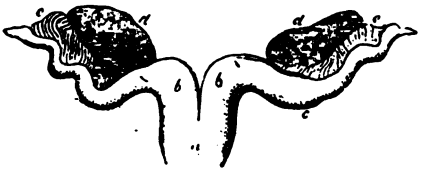

Fig. 48.

FEMALE ORGANS OF A FŒTAL DEER.

a, Uterus; *b*, *b*, Cornua; *c*, *c*, Oviducts; *d*, *d*, Ovaries; *e*, *e*, Wolffian Bodies.

ceases somewhat suddenly, by the development of a transverse septum that divides the cavity into two portions: the anal opening, and the urogenital orifice. At the lower end of the latter appears the *genital tubercle*, the rudiment of the penis or clitoris, and which is surrounded by cutaneous ridges

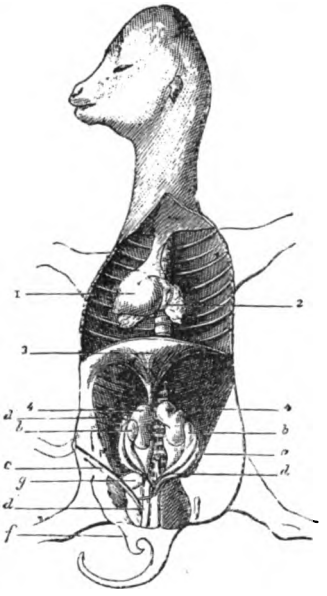

Fig. 49.

FEMALE FŒTUS OF THE COW (NATURAL SIZE).

1, Heart; 2, Lungs; 3, Diaphragm; 4, Kidney: *a*, Wolffian Body; *b*, Germinal Gland; *c*, Wolffian Duct; *d*, Müllerian Duct; d^{I}, Uterus and Vagina; d^{II}, Abdominal Opening of the Oviduct; *f*, Clitoris; *g*, Round Ligament of the Uterus.

—the *genital folds*. This tubercle increases in size, and is traversed by a groove or fissure passing from behind forward. Up to this time the sexes cannot be distinguished.

The male sex is marked by the rapid development of the genital tubercle,

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which becomes the penis, whose extremity is enlarged to constitute the "glans." The furrow or groove is closed behind, and forms the urethra; while the genital folds, meeting each other below the penis, join to complete the scrotum. Owing to these changes, the digestive are separated from the urino-genital organs, and the urethral canal is connected with the bladder and the excretory ducts of the testicle.

The organs in the female also soon indicate the sex. The urogenital sinus forms the *vulvular cavity* or *vestibule of the vagina*, so marked in the lower animals. The genital tubercle becomes the *clitoris*—the homologue of the penis. The cutaneous folds constitute the *labia of the vulva;* while the genital groove is closed at one part of its extent to form the *perineum*. The *mammæ*, appendages of the generative organs, appear in the early months of uterine life, and the teats are perforated very soon. They are also seen very distinctly in the male fœtus in the early months.

In certain malformations of the generative organs, more or less of their primitive conditions are retained; the most frequent of these malformations is hermaphrodism. Examples of this are by no means uncommon among the lower animals, and the annexed drawing gives a good example of the organs of a hermaphrodite goat, with the male parts predominating.

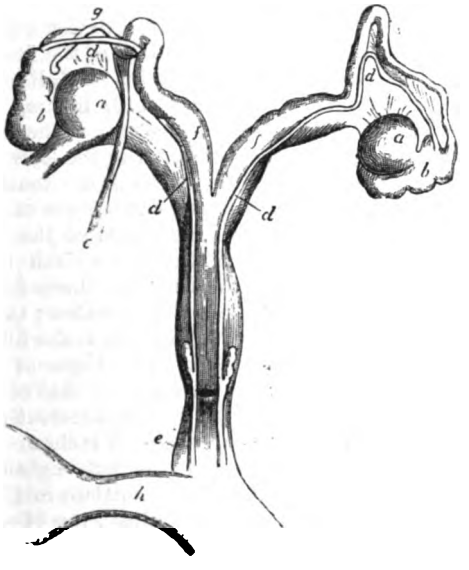

Fig. 50.

GENITAL ORGANS OF A HERMAPHRODITE GOAT, THE MALE PARTS PREDOMINATING.

a, *a*, Testes; *b*, *b*, Combination of Epididymis with Abdominal Ends of Müllerian Ducts; *d*, *d*, Vasa Deferentia; *e*, Body of Uterus and Vagina; *f*, *f*, Uterine Cornua; *g*, *g*, Fallopian Tubes.

SECTION IV.—PERIODS OF DEVELOPMENT.

Thus far we have traced the development of the young creature in the uterus; but as our description may appear a little confused from our having described the growth of individual organs, rather than the fœtus as a whole, it may be advisable to adopt the plan of dividing this bodily development

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into periods, which will also give an approximate idea of its age. From conception to maturity, utero-gestation may therefore be divided into seven periods or stages, as follows:—

First Period.—Towards the second week after conception, the ovum or germ has passed from the ovary into the uterus; it is then about a line in diameter (one-twelfth of an inch).

Second Period.—In the third and fourth weeks of gestation in the Mare, Ruminants, and Pig; the third week in Carnivora; there appear the first traces of the embryo, and the head, body, and limbs can be distinguished. Towards the twenty-eighth day, the embryo of the Mare measures about six lines, and that of the Cow four lines; that of the Sheep at twenty-five days is four and a half lines; and the Bitch at eighteen days two lines.

Third Period.—This is from the fifth to the eighth week with the Mare and Cow; the fifth to the seventh with the Sheep and Goat; and the fourth to the sixth with the Pig. The embryo of the Mare has acquired a length of rather more than 2 inches; that of the Cow 1¾ inches; that of the Sheep and Goat 1¼ inches; that of the Pig 1¼ inches; and that of the Bitch 11 to 12 lines.

Fourth Period.—This is from the ninth to the thirteenth week with the Mare; the ninth to the twelfth with the Cow; the seventh to the eighth and ninth with the Sheep and Goat; the sixth to the eighth with the Pig; and the fifth week with Carnivora. The length of the fœtus of the Mare is 6 inches; that of the Cow 5½ inches; that of the small Ruminants 3½ inches; that of the Pig 3 inches; and that of the Dog 2½ inches.

Fifth Period.—This extends from the fourteenth to the twenty-second week in the Mare; the thirteenth to the twentieth in the Cow; the tenth to the thirteenth in the Sheep and Goat; the eighth to the tenth in the Pig; and the sixth week in Carnivora. At this stage the fœtus of the Mare is about 13 inches long; that of the Cow 12 inches; that of the Sheep and Goat 6 inches; that of the Pig 5 inches; and that of the Bitch 3½ inches.

Sixth Period.—From the twenty-third to the thirty-fourth week in the Mare; the twenty-first to the thirty-second in the Cow; the thirteenth to the eighteenth in the Sheep and Goat; the eleventh to the fifteenth in the Pig; the seventh to the eighth in Carnivora. The fœtus of the Mare in this period has acquired a length of more than 2 feet; that of the Cow is about the same dimensions; the fœtus of the Sheep is more than a foot; that of the Pig about 7 inches; and that of the Bitch 5 inches.

Seventh Period.—From the thirty-fifth to the forty-eighth week—up to parturition, in the Mare; the thirty-third to the fortieth in the Cow; the nineteenth to the twenty-first in the Sheep and Goat; the fifteenth to the seventeenth in the Pig; the ninth week in the Bitch; and the eighth in the Cat.

A newly-born foal measures about 3½ feet long; a calf 2 feet; a lamb 1½ feet; a pig about 9 or 10 inches; a puppy 6 to 8 inches; and a kitten about 5 inches.

In this study of the evolution of the young animal *in utero*, one cannot fail to be struck wich the slowness with which development progresses for a certain period, and its rapidity afterwards. The slowness in growth may be accounted for by the extreme minuteness of the ovum at the moment of impregnation, and its containing within itself alone the elements upon which the primary steps of evolution depend, there being at first no direct connection between the embryo and the uterine vessels. The parts which in reality grow most rapidly in the early period of gestation, are the enveloping mem-

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branes and the fluids they contain. In the Sheep, towards the end of the first quarter of gestation, the membranes alone weigh from five to nine times more than the fœtus; while the allantoic and amniotic fluids are from eight to ten times as heavy. These fluids increase in an absolute manner from the commencement, until within perhaps a short time of parturition. Rapid at first, towards the middle period their secretion abates, and then begins the more active development of the fœtus, with a relative diminution in the proportion of the fluids; until about the end of the fourth month they only represent something like a third of the weight of the fœtus. In the Sheep a few days after the fifth month, or about birth time, they are a sixth of the weight of the young animal.

The development of the fœtus is so tardy at first, that the fœtal lamb at the fortieth day has scarcely acquired the 300th part of the weight it has at birth; at two months it has only a 60th, but now it grows more rapidly; so that at the expiration of the fourth month, the fœtus has gained more than one-third of its total weight.

The inequality in the growth of the different organs is also very notable; those whose functions are most required, such as the nervous centres, liver, etc., attaining considerable proportions very quickly. The *brain*, for instance, soon acquires a marked predominance over the other organs. In the fœtus of the lamb at the fifty-seventh day, the proportion of the entire brain to that of the body in weight is as 1 to 15; at the seventieth day it is as 1 to 55; and at birth as 1 to 65. At mid-term with the calf, its weight is to that of the body as 1 to 53, and at birth as 1 to 120.

The *spinal cord* does not follow the same progression in growth. In the calf at mid-term it is only the 421st part of the weight of the fœtus, and at birth the 470th part. In the lamb at birth, it is equal to the 340th part of the body.

The *heart*, which appears so early, is more voluminous in the embryo than towards the termination of gestation and after birth. The heart of a calf at mid-term equals 125th of the weight of the body; that of a lamb at birth the 120th; in the adult bull it is only the 264th part.

The *lungs* have, relative to the total bulk of the fœtus, a variable weight according to age. In those of the Sheep at fifty-seven days, they are equal to a 20th part of the weight; in a calf at mid-term, the 33rd; in another at eight months, the 34th; and at birth, the 35th and 55th; in a foal a little more than eight and a half months, they were the 33rd; in lambs and goats at birth, they averaged from the 24th to the 61st part of the whole weight.

The development of the *thymus gland* also varies considerably according to age and species. In a calf at mid-term, its weight was the 137th part of the body; in another at seven months, it was the 197th; in a foal at birth, the 200th; in a goat at the same period, the 130th; and in a lamb eight days after birth, the 228th part. It is always proportionally more voluminous in ruminants than solipeds, and in them and the Pig it extends in front nearly to the larynx. In the Dog it does not get beyond the anterior mediastinum, and is small, though more persistent. It has in rare cases been found in Horses more than three years old, but as a rule in the adult animal it is only represented by a small and variable quantity of adipose tissue.

The *liver* is extremely voluminous in the early period of embryonic and fœtal life, but decreases proportionately as gestation approaches its close. In the fœtus of a lamb at the fifty-seventh day it has been found equal to 1-6th of the body in weight; in calves at mid-term and birth to 1-29th; with the foal at birth 1-21st, and 1-24th in lambs at the same period. In the adult horse it has been found to represent 1-75th of the total weight, and 1-83rd in the ox.

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The *intestines*, during fœtal life, do not grow in length so as to attain the proportionate dimensions they offer in adult life. In an equine fœtus of eight or nine months, the small intestines measured about 15 feet, the cæcum 6 7-10 inches, and the large intestines 3½ feet, or a total of about 20 feet: about 1-5th of their length in after life. Shortly after birth they acquire 1-3rd the length to which they attain when fully developed. The calf at mid-term has only 1-10th the length of the adult intestine: being only sixteen times the length of the body, instead of twenty times. The lamb and kid at birth have 1-3rd of their intestines complete: their length is seventeen to eighteen times the length of the body, instead of twenty-seven times in adult life.

The general proportions of the body, and especially those of the skeleton, are not in fœtal life what they are after birth. The bones are, relatively to the other parts, more voluminous as a whole, and notably at their extremities, than in the adult. The limbs in particular, and this more so in solipeds and ruminants, have attained a length which is not at all proportionate to that of these parts when their growth is completed. And several bones of the limbs, such as the radial, tibial, metacarpal, and metatarsal bones, are almost fully developed in their dimensions at birth. The following interesting table exhibits the comparative weight of the different bones in the *foal* and the adult horse.

The weight is given in grammes (15·432 troy grains).

Species.	Cervical Region.	Dorsal Region.	Lumbar Region.	Sacro-Coccygeal Region.	Scapula.	Humerus.	Radius.	Carpus.	Metacarpus.	Digital Region: Anterior.	Coxæ.	Femur.	Tibia.	Tarsus.	Metatarsus.	Digital Region: Posterior.
	grs.	grs.	grs.	grs.	grs.	grs.	grs.	grs.	grs.	grs.	grs.	grs.	grs.	grs.	grs.	grs.
Foal at Birth–	315	390	130	383	195	188	243	59	238	139	227	232	262	66	271	17
Foal at Birth–	370	350	135	226	190	205	250	40	240	131	245	254	280	62	275	173
Foal two days old –	-	-	-	-	159	170	224	-	218	-	-	223	246	-	255	-
Adult Horse: large size –	-	-	-	-	370	310	36	45	240	170	450	390	360	70	280	180

SECTION V.—PHYSIOLOGICAL PHENOMENA IN THE FŒTUS.

With regard to the physiological phenomena which occur during fœtal life, we cannot presume to speak in detail in this place. It is, however, interesting, and perhaps necessary, to allude briefly to several of the most important, in order to complete this portion of our subject.

Nervous Functions.

The development of the *nervous functions* is one of these phenomena worthy of attention. It appears certain that the young creature is formed and developed without the direct intervention of the nervous influence of the parent, as there is no communication between the nerves of the uterus and the *fœtal* envelopes; and it has not been shown that there are nerves either in the latter or yet in the umbilical cord. The progressive animation of the new creature cannot, therefore, be derived from immediate nervous propagation or direct extension of the nervous activity from the mother to its offspring; and

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we must look upon this animation as originating in the embryo, and becoming developed under the influence of inappreciable causes. At the very commencement of embryonic life, the nervous system, which, in extra-uterine existence, holds under its control the organic functions, appears now to have no possible influence on the phenomena that gradually manifest themselves. The primary changes in the ovum occur before the earliest traces of the nervous system are apparent; and while its rudiments are forming, those of other parts are also being developed. Even when the nervous system has attained a somewhat considerable growth, it does not appear to have assumed those controlling powers with which it is so largely endowed at a subsequent period.

In the homogeneous plasma of the ovum, in the common blastema, coincidently or successively, a multitude of different parts are being formed independently of each other, as if each contained within itself the why and wherefore of its formation and ulterior perfecting. The nervous system itself seems to be submitted to the same general laws: it does not appear to be dependent upon any other part, neither does any part depend upon it; even when it is fully formed, the phenomena pertaining to growth are evidently effected without its stimulating intervention. Besides, it is well known that the monstrosities which are sometimes seen destitute of brain and spinal cord, may yet reach the end of their fœtal development. True, certain facts have appeared to demonstrate that the formation of parts was dependent on nervous action. In certain monstrosities, organs have not become developed when the nerves which should have been distributed to them were absent; in others, several organs have become fused together when their nerves were similarly aggregated; while an organ has been divided into fractions corresponding to the accidental development of its nerve. The muscles of the posterior part of the body of the fœtus of the Cow and Pig have been observed to be absent when the corresponding portion of the spinal cord was, with its nerves, very imperfectly developed. But these facts do not prove that the absence of the nerves was the cause of the non-development of the muscles; for in such cases there is a correlation between the non-formation of the nerve and the absence of the muscle; the same cause which has hindered the formation of the one in a certain part of the body has also prevented the growth of the other in that part. And the same, to a certain point, with the relative development of vessels and the increase of the parts to which they are distributed. In the original homogeneous plasma, there were developed the diverse elements of an organ at the same time as its vessels, and the force which created the connective, nervous, and muscular tissues, created also the elements of the vessels—arteries, veins, and capillaries: they are closely related to each other, and their growth goes on concurrently. If the vessels do not carry a sufficient supply of formative material, the development of the part is tardy or ceases; and, on the other hand, if the latter from some cause becomes feeble and cannot assimilate this material, the vessels gradually cease to carry it; consequently both become atrophied when they cease to grow.

When the nervous system has arrived at a certain degree of development, it begins to assume its functions; though the first manifestations of its activity are very obscure, and probably limited to mere tactile impressions, evinced by movements more or less appreciable. It is well known that in the pregnant Mare and Cow, after their ingestion of a large quantity of cold water, the fœtus, towards the end of the second third of gestation, and more particularly in the later months, executes movements which are at times so

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marked that they can be felt if the hand is applied to the abdominal parietes, or even seen in the region of the flank. It is very probable that these automatic or reflex movements may produce torsion of the umbilical cord, and in this way become a predisposing cause of abortion. Colin, having had occasion to lay open the abdomen of a living pregnant Mare within two or three months of parturition, saw the fœtus, immediately after the incision in the abdominal walls, jumping about in the uterus in a very lively manner without any external stimulus being applied; it moved the whole of its body, or withdrew its legs or head when pinched through the uterus and the envelopes. In a quarter of an hour after removal from these and the mother, it no longer moved. The human fœtus at five months has been seen to flex and extend its limbs when removed from the uterus.

Towards the termination of gestation, there can be no doubt that the fœtal movements are somewhat energetic, for at this period the fœtus changes its position preparatory to passing through the pelvis. Thus the young soliped, during the whole of its intra-uterine existence, lay with its abdomen turned upwards and the posterior limbs lodged in the largest of the two cornua; but it now turns over on its belly, with the legs downwards and the umbilical cord passing across one of its sides.

The movements connected with *deglutition* also appear to be performed at an early stage of development, for some of the hairs which are so often observed in notable quantity floating in the amniotic fluid, have been discovered in the fœtal stomach.

Absorption.

The phenomena of absorption play a considerable part in the development of the young animal. As soon as the microscopic ovule reaches the uterus, its vitelline envelope or pellucid zone becomes studded with delicate, hair-like prolongations—villosities without vessels—which, steeped in the fluid thrown out on the uterine surface, transmit this to the laminæ of the blastoderm. At first this absorbent surface is very small, and the growth of the embryo is consequently slow; nevertheless, this trifling absorption is sufficient to increase the ovule to forty or fifty times its original volume before the blastodermic laminæ and the germinative space are completed.

Later, when the umbilical vesicle is formed at the expense of the vascular and mucous laminæ, its vessels absorb the soluble matters that are added to the mass of elements necessary for the growth of the embryo. And, finally, when the chorion is at last organised, and furnished with its myriads of vascular papillæ in the form of disseminated or agglomerated placentulæ, absorption goes on with exaggerated activity over the whole uterine surface and texture, in order to supply all the nutrition required for the now rapid development of the fœtus.

The nutritive elements are absorbed by the vessels of the placental villosities, transformed into blood, and conveyed to the young creature by the umbilical veins. This extra-fœtal absorption is supplemented by that which is taking place in the fluid of the envelopes, and also in the organs and tissues of the fœtus itself. It is certain, however, that the placental absorption is by far the most important, and that the rapid development of the fœtus is mainly, if not altogether, due to the nutritive elements obtained there; while it is not improbable that the amniotic fluid found in the stomach and intestines may act as a dilator of these, modify the action of the bile accumulated in the latter, and perhaps yield a small amount of nutriment: though it must be remembered that it does contain much of the

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nutritious elements, and that the fœtus, which is unprovided with a mouth, and therefore cannot swallow, is nevertheless as well developed as one that does ingest this fluid.

Nutrition.

It has been shown that the fœtal vascular system is quite distinct from that of the mother, the isolation of the two systems being complete, and only brought into contact at the placenta or placentulæ. There the maternal blood is conveyed by certain arteries into particular sinuses or receptacles of the uterus containing the ultimate radicles of these vessels, which emerge into veins; while the fœtal vessels, extremely attenuated, dip down into these receptacles and are bathed in the blood of the parent, as the "gills" or branchiæ of aquatic creatures are in the water in which they live. But the actual blood of parent and offspring never meet: they are only brought into indirect contact; and between them are the thin coats of vessels, basement membranes, and cells. This indirect contact is sufficient to permit the venous fœtal blood to become arterial, by enabling it to part with its carbonic acid, and also to get rid of excrementitious matter derived from the different processes connected with the growth of the fœtus, and whose retention in the blood of the young creature would doubtless be a source of injury to it. This arrangement of the two systems of vessels also, as has just been said, allows certain nutritious elements of the maternal blood—its fluid portion only—to be taken up into the system of the fœtus. In this way, as has been pointed out, these vascular rootlets of the placenta closely correspond to the villi of the mucous membrane of the intestines; and the analogy is rendered more complete when we know that the nutrient material is selected and prepared by two sets of cells, one of which—the maternal—transmits it to the other—the fœtal—in the same manner as the epithelial cells of the intestinal villi seem to take up and prepare the nutrient matter that is destined to be again assimilated by the cells which float in the circulating fluid. No other communication between the two vascular systems exists; and the fact that the blood corpuscles of each are different in size, conclusively demonstrates that they must be distinct. Nevertheless, the special function of the placenta, and the intimate relation existing, through it, between the fluids of parent and offspring, renders it evident that the maternal blood may become impregnated with substances, or impressed with attributes, which will affect the development or modify the constitution of the fœtus; while pernicious matters generated in the latter, may prove more or less noxious to the mother.

Circulation.

In order that the nutritive matters absorbed by the placental villi may reach the fœtus and be circulated in its body, it is necessary that a determining and regulating power should be brought into play at an early period in the existence of the fœtus. This power appears with the formation of the contractile organ which has been named the *heart*. From the moment when this important organ appears in the form of a cylindrical tube at the commencement of embryonic life, it dilates and contracts alternately, first to receive the venous blood, and then to propel it into the arteries.

The fluid which is at first received and propelled by the heart is transparent, colourless, and destitute of morphological elements, and the organ itself exists in its most primitive form. As has been stated, the situation of the heart and the course of the principal trunks of the vascular area, are early

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visible, and are marked by the peculiar disposition of the aggregations of cells from which these organs are to be developed. It was shown that whilst the outer portions of these aggregations were transformed into the *walls* of the respective cavities, the inner portions appeared to deliquesce, and partly to remain as isolated cells floating in the resulting fluid. These isolated cells are supposed to be the first blood corpuscles. They are large, colourless, vesicular, spherical cells, full of yellowish particles of a substance like fatty matter. Many of these particles are quadrangular and flattened, and have been called stearine-plates, though their composition is not ascertained; each cell has a central nucleus, which is not at first very distinct, and the development of these embryo-cells into the complete form of corpuscles is effected by the gradual clearing-up, as if by division and liquifaction, of the contained particles, the acquirement of blood colour and of the elliptical form, the flattening of the cell, and the more prominent appearance of the nucleus.

In tracing the development of the red-corpuscles of the blood, it is found that at first their nuclei have no envelope, but contain nucleoli; that they present all the characters of pale elementary cells, whilst they are so numerous as to give the blood a whitish hue. When more fully developed they acquire a cell and a reddish tint, and at a later stage are circular, thick and disc-shaped, full-coloured, and about 1-2500th of an inch in diameter; their nuclei are central, circular, very little prominent on the surface of the cell, and apparently slightly granular or tuberculated.

When the liver begins to be formed, the multiplication of blood-cells in the entire mass of the blood ceases, and in a short time all trace of the development of the red from the original colourless formative cells is lost; whilst, on the other hand, there takes place in the vessels of the liver a new production of colourless nucleated cells, which are formed around free nuclei, and which undergo a gradual change, by the production of colouring matter in their interior, into red nucleated cells. This new formation of blood corpuscles in the liver continues to take place during the whole period of fœtal life; but whether these nucleated cells themselves undergo transformation into the non-nucleated discs which constitute a gradually increasing proportion of the corpuscular components of the blood during the latter period of embryonic life, or whether these are formed only by the metamorphosis of lymph-corpuscles, has not yet been determined.

From the manner in which the circulation is carried on during fœtal life, and which has been adverted to, it is seen that the chief propelling power is centred in the right side of the heart; the force of the left heart being mainly spent in effecting a due supply of blood to the head and upper extremities. And the structure of the heart proves this to be the case, for the walls of the right ventricle have been found as thick as those of the left; while the walls of the right auricle are even thicker and more muscular than those of the left auricle: a condition which persists for a short time after birth.

The isolation that exists in the two circulatory systems, might lead to the inference that there was no relation between the contractions of the heart in the fœtus and those of the maternal organ, and experience proves this to be the case. Naegelè has noted that there is no relation between the beats of the heart of the human fœtus and those of its mother's heart. By auscultation he was able to distinguish the two sounds of the fœtal heart, and found it beat on an average 135 times per minute: never more than 180, nor less than 90; and he remarked that the beats were sensibly the same from four and a half months when they are first perceptible, until birth. And Hollmann, in

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resorting to the same mode of investigation in Cows, ascertained that, in one which was advanced eight and a half months in pregnancy, and whose pulse was 64 per minute, the fœtal beat was 124; in another Cow, but which was ill, the pulse was from 70 to 112, while that of the fœtus was 113 to 128.

Colin opened a living Mare which had been pregnant for nine or ten months, and a Cow whose gestation dated about three months. When the uterus of the Mare was opened, and the contained envelopes incised to extract the fœtus, the latter moved actively and respired deeply, though at rare intervals. The umbilical arteries and vein yielded some blood, from the small punctures made through their walls; the first throbbed with a certain amount of force, and the pulsations were rapid. When the cord was divided and tied, the fœtus appeared to be dead: there were no more spontaneous movements, and the respiration had ceased. The thorax and the abdomen were now thrown open, and it was observed that the heart contracted spontaneously and strongly, and the pulsations of the aorta and umbilical arteries could be very distinctly felt. At first the contractions of the auricles regularly alternated with those of the ventricles, as in a normal condition; but soon, as occurs in expiring animals, the auricles contracted several times for one contraction of the ventricles, as if it required several systoles of these to fill the ventricular cavities. At each contraction the auricles diminished much in volume, became nearly empty, and looked very pale, but assumed their reddish-violet colour again during their diastole. At last the rhythmical movements became altogether perverted; the auricles and ventricles contracted simultaneously and quickly, but more and more feebly, and finally ceased altogether half an hour after the thorax had been opened. The Cow in which the fœtal circulation was studied, had its flank widely incised, and one of the cornua of the uterus withdrawn through the opening. Some of the placentulæ were removed with difficulty from their cotyledons, and both bled a good deal. When the umbilical cord was exposed, the beating of its very tense arteries could be distinctly felt; and when compressed, these enlarged between the fœtus and the point where the pressure was applied. On removing the fœtus from the uterus, it did not make any perceptible movement, but then it was only three or four months old. The thorax having been opened, the action of the heart was observed to resemble that of the other fœtus; there were 31 pulsations in the first minute, 18 in the third, 11 in the fourth, and 21 in the fifth. The beats ceased in about twenty-five minutes. In these two experiments, as well as in others made on smaller animals, M. Colin found it impossible to perceive any difference in colour between the blood of the umbilical arteries and that of the veins, both fluids showing a tint intermediate to that of the arterial and venous blood of the adult.

Secretion.

With regard to *secretion* in the fœtus, it is worthy of remark that several glandular structures at an early period and during fœtal life exhibit a remarkable degree of activity; and more especially is this the case with those of the stomach and intestines, the liver, the mucous membrane of the air-passages, and the kidneys. The glands of the mouth and œsophagus only furnish the mucus that covers the membrane lining these parts, but it is not long before the stomach is filled with a white or colourless viscid fluid, in which is a large proportion of epithelial cells and nuclei. Colin has found as much as 22½ grammes of this fluid in the stomach of a foal at birth, from 150 to 180 in lambs at the same period, 200 to 300 in calves towards the

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middle of gestation, and 500 to 600 in those at birth. It is neutral or slightly alkaline, and contains, more especially in the fœtuses of solipeds and ruminants, a very large proportion of sugar, with mucine and salts. This fluid can scarcely, however, be looked upon as a gastric secretion, but rather as a mixture of this with the amniotic liquid swallowed by the fœtus; and it appears certain that though the mucous glands are active, yet that those which elaborate the pepsine are inactive. The stomach of a fœtal calf twenty weeks old, digested for eight days in milk at a temperature of 20 degrees (Cent.), transformed that fluid into a gelatinous mass, but did not coagulate it.

The secretory function of the pancreas is so obscure, that it has not yet been determined.

The biliary secretion soon appears, and is remarkably abundant. In the fœtus of the Cow at birth, a small quantity of clear bile having a slight greenish tint is found in the gall-bladder; and at the fourth month of gestation, the large intestines of this creature and the fœtus of solipeds are filled with meconium, which is recognisable through the walls of the tube by its green hue. The fœtal bile becomes thicker and deeper-coloured as birth approaches; it is insipid and alkaline. M. Lassaigne analysed that of the fœtus of a Cow six months old, and found two colouring matters, mucus, the carbonate and chloride of sodium and phosphate of lime, but no picromel.

Mixed with the fluids thrown out by the intestines and the other matters entering them, it forms the meconium, which is composed, according to Simon, of cholesterine 16,00; extractive matter and biliary resin 10,40; caseous matter 34,00; picromel 6,00; green colouring matter 4,00; and epithelium, mucus, albumen 26,00. This meconium is scanty in the first periods of fœtal life, and has been found to be white in fœtuses destitute of a liver, as well as in others whose intestine was obliterated below the entrance of the biliary duct. It is very consistent and plentiful in the intestines at birth. In those of a foal whose stomach contained 229 grammes weight of the white viscid fluid above mentioned, there was found 216 grammes of greyish meconium in the small intestines, and 559 of green in the large intestines. This product is frequently expelled in certain quantities towards the end of gestation, and is found in the liquor amnii, which owes its yellow colour to its presence; it is swallowed with this fluid, and is then observed in small masses in the stomach.

The liver appears to be engaged, during fœtal life, in the depuration of the blood, as appears from this accumulation of meconium, which is chiefly altered bile; but at the same time, as has been stated, it is serving as a blood-making organ, and this is probably its principal function before birth.

The secretion of urine is somewhat active during intra-uterine life, and appears to be effected by the Wolffian bodies before the kidneys begin to act. It is not, however, until the end of gestation that a notable quantity of urine is found in the bladder, and urea in the allantoic fluid of the Cow. It is certain, however, that this fluid is not altogether the urine of the fœtus, as its proportion is relatively larger at an early epoch of fœtal life, and the communication betweeen the bladder and allantois is more limited towards parturition.

With regard to the function of the thyroid and thymus "glands," as they have been termed, and the spleen and supra-renal capsules, during fœtal life, there is but little positively known. It appears, however, to be admitted that the office performed by these ductless or vascular glands, is to restore to the circulating current any substances which they may withdraw from it, and

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that their action is subsidiary to the process of sanguification; being exercised, perhaps, chiefly upon that portion of the nutrient materials which did not pass through the absorbent system when first introduced, but was taken up directly by the bloodvessels.

SECTION VI.—WEIGHT AND DIMENSIONS OF THE FŒTUS AT BIRTH.

The various phenomena connected with development having been completed, so far as uterine existence is concerned, it may be useful to note what has been ascertained with regard to the *weight* and *dimensions* of the fœtus at birth: the latter being of much importance from an obstetrical point of view, though it is a subject which has not received all the attention it merits from veterinary obstetrists.

With regard to *weight*, we find, as might be expected, that this varies considerably, according to the size, breed, and condition of the parents, and other circumstances which more or less influence growth.

For the *Horse* species, Boussingault estimated that foals from parents weighing from 400 to 500 kilogrammes, weighed at birth 51 kilogrammes.* According to a table drawn up by Saint-Cyr, it appears that a foal at birth may vary in weight from 30 to 60 kilogrammes, according to breed and individual peculiarities; though between 38 to 42 kilogrammes may be accepted as the average weight.

With regard to the *Bovine* species, Tisserant has stated that calves weigh at birth from one-thirteenth to one-sixteenth of the weight of the Cow; whereas Riedesel gives it as one-tenth. Magne mentions that calves vary between 20, 25, 45, and 50 kilogrammes. Saint-Cyr alludes to the observations made at the Agricultural School of Saulsie, France, where Cows of the Ayrshire breed were chiefly kept. The animals were maintained in good condition all the year round, and though they were only middle-sized, their weight varied between 400 and 650 kilogrammes. The Cows were regularly weighed, as were the calves immediately after birth, and the register for 1868 gave the following results. The weight varied from 31 to 35 kilogrammes—the average being 32½ kilogrammes. The males were a little heavier than the females. In twenty-eight instances, the average weight of the calf compared with that of the cow was as 2 to 31.

The average weight of one hundred *lambs* weighed at the Alfort pens, is given by Magne as about 4 kilogrammes for both sexes. The males were heaviest.

With regard to *dimensions*, Saint-Cyr justly regrets the paucity of observations which have been made on this important point. It is of course well known that, in a general way, the fœtus is larger than the pelvic opening through which it has to pass at birth, but we have to ascertain how much larger it is than that canal, and what is the amount of reduction in volume to which it has to submit in passing the outlet of the pelvis. Rainard merely states that some measurements he had made, gave the diameter of the thorax of calves, from withers to sternum (vertical) as from 10¼ to 11 inches; and the diameter from side to side (transversal) as 6¼ to 7 inches. Saint-Cyr, anxious to arrive at some definite conclusion in the matter, in order the better to understand the mechanism of natural parturition, as well as to gain a knowledge of how to surmount the difficulties of protracted labour, undertook some researches in this direction. His object was to ascertain the

* The kilogramme is equal to 2·205 pounds avoirdupois.

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depth and width of the chest, and width of croup of the fœtus, these being the dimensions which it is most important to compare with the different diameters of the pelvis of the mother, so as to understand how the former may accommodate themselves to the latter. He gives the name of *sterno-dorsal* line to the verticle measurement taken from the summit of the highest dorsal spines to the sternum, and *biscapulo-humeral* line to the distance measured from one scapulo-humeral articulation to the other; while the *bicoxo-femoral* line is the measurement of the croup from one coxo-femoral articulation to the other. From the measurements in the Horse species, we find that a Mare measuring a trifle over fifteen hands in height, and whose pelvis was nearly nineteen inches in width, brought forth a foal weighing slightly less than thirty pounds, and whose sterno-dorsal measurement was nearly twelve inches, biscapulo-humeral line 7⅛ inches, and bicoxo-femoral line nearly 8 inches. The other measurements of Mares and foals yielded similar results, and give an idea of the expulsive efforts the uterus must make to expel the fœtus. In the case first cited, it may be admitted that the pelvis of the Mare had, approximately, the following dimensions: inlet of the pelvis—sacro-pubic diameter, 9 inches; inlet of the pelvis—bi-iliac diameter, 8¾ inches. In comparing these dimensions with those of the foal to which it gave birth, it is obvious that the biscapulo-humeral and bicoxo-femoral diameters of the latter could be easily accommodated by the bi-iliac diameter of the mother, as they are less by 1¼ and ¾ inch; but it is not the same with regard to the sacro-pubic diameter, which is less by nearly three inches than the sterno-dorsal line of the fœtus. It is therefore evident that in order to pass through the pelvis, this line must be diminished at least by three inches.

With regard to the Bovine species, nine Cows were tabulated. The first, the smallest, was 11¾ hands high, and the width of the croup 18½ inches; the weight of the fœtus was about sixty-two pounds, the sterno-dorsal diameter 10⅓ inches, the biscapulo-humeral $6\frac{7}{10}$ inches, and the bicoxo-femoral $7\frac{3}{10}$ inches. Another Cow was 12⅛ hands high, the width of croup $18\frac{9}{10}$ inches; the weight of the fœtus was about seventy-three pounds, the sterno-dorsal diameter 10¼ inches, the biscapulo-humeral 6 inches, and the bicoxo-femoral $8\frac{7}{10}$ inches. With a Cow 12¾ hands high, and croup 18 inches in width, which had experienced a protracted *accouchment* in consequence of the size of the calf, and which had aborted the previous year, the weight of the fœtus was sixty-six pounds, the sterno-dorsal diameter 15 inches, the biscapulo-humeral 7¾ inches, and the bicoxo-femoral 8⅛ inches.

CHAPTER V.

Gestation.

GESTATION, or *pregnancy*, comprises the period during which the female animal carries its young while this is undergoing development. Its consideration is of much moment, and we will, with regard to it, study it in this chapter from a normal physiological point of view: noticing the anatomical and functional alterations attending it, the mode of recognising it, its duration in various species of animals, and the exceptional departures from the *usual* law, with respect to the number of young produced.

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SECTION I.—MODIFICATIONS IN THE UTERUS DURING PREGNANCY.

With the development of the fœtus, the *uterus* undergoes important anatomical and physiological modifications, while the system of the mother also participates more or less generally in the phenomena which mark the period of gestation. The modifications and phenomena are worthy of attentive notice, not only from the importance they hold with regard to the reproduction of animals, but also from the practical issues involved in the study.

The anatomical changes in the uterus are those relating to its *volume, structure, form, situation,* and *direction.*

Volume.

With regard to *volume,* we have seen that during and after copulation the uterus is congested, and that, when conception has taken place, the thin pulpy secretion corresponding to the *decidua* of the human female covers its internal surface. The vessels, distended with blood, gradually enlarge to a great size: from the smallest to the largest forming most intricate and beautiful plexuses on and in the texture of the organ. The coats of the arteries are thickened to compensate for their distention, and the additional labour they have to perform; while the veins are still more enlarged in calibre. The lymphatics are likewise augmented in number and dimensions; and the nerves, which were comparatively small in the unimpregnated state, enlarge and anastomose so freely as to compose a network similar to that of the vessels—the increase taking place in the nerve termina, not in the nerve substance.

Structure.

These changes add to the thickness and density of the uterus; but there are others still more remarkable. While the organ is increasing in volume, becoming rounder, acquiring a greater capacity, and its cervix widening, its proper *structure* is exaggerated to an extraordinary degree. This exaggeration, however, does not occur equally throughout; it is most marked in the cornua of multiparous creatures at the points where the young are fixed; in ruminant animals at the situation of the cotyledons; and in solipeds at the part of the body of the uterus corresponding to the fœtal placenta. So that, at least in the early months of pregnancy, it is thinnest towards the cervix. The increased thickness of the organ, however, never equals that observed in the human female, compared with which the walls of the uterus of the domesticated animals are thin.

The firmness or density of the organ is always most conspicuous in the cornua, and in the operation of "spaying," or castration of the female, this serves as a useful guide in enabling the operator to distinguish between the cornua and the intestines, which they so closely resemble in appearance.

But during pregnancy this density seems to diminish, as the organ becomes more vascular, and the cervix assumes a much softer condition than usual. For instance, in the fœtal cornu of a Cow advanced three months in pregnancy, the thickness of the wall was only 2·5 millimetres, while in the other horn it was four millimetres. In another Cow at five months, it was two millimetres in the fœtal horn and five millimetres in the vacant one. The mucosa is thicker, redder, more pulpy and vascular, than before impregnation; the longitudinal rugæ it then exhibited gradually disappear; the epithelium covering it usually loses its columnar form; the utricular glands enlarge—they are longer and their orifices wider, and their secretion, as well

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as that of the other glands, is increased; the interglandular tissue is largely and rapidly augmented by multiplication of the cells of the surface epithelium, and proliferation of the corpuscles of the sub-epithelial connective tissue, so that the glands are more widely separated; while the uterine cotyledons grow quickly, and there can be no doubt that new ones appear. Rainard speaks of examining the uterus of several calves and lambs, and finding only thirty or forty cotyledons; while after parturition he has counted more than a hundred; and more recent observers have testified to this fact. In the uterus of a six months' pregnant Cow, Franck found that the horn containing the fœtus had forty-seven cotyledons and weighed 3,54 zollpfund; while the

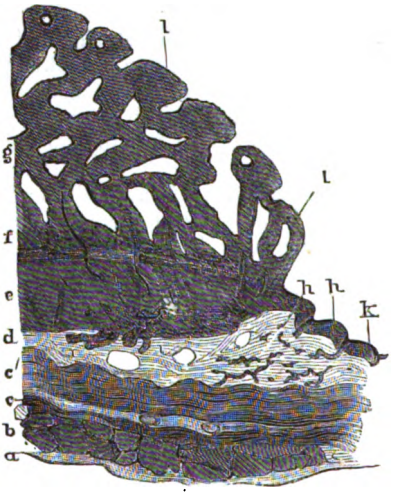

Fig. 51.

VERTICAL SECTION THROUGH A PORTION OF THE UTERINE COTYLEDON OF A COW IN AN EARLY STAGE OF PREGNANCY.

a, Serous Membrane; *b*, Section of Longitudinal Muscular Layer; *c*, External, and *c'*, Internal Layers of the Circular Muscle; *d*, Submucosa, with Vessels; *e*, Adenoid Tissue of the Cotyledon; *f*, New Tissue of the Placenta Uterina; *g*, Section of the Mucous Layer of the Cotyledon, with the Interspaces into which the Fœtal Cotyledons are inserted; *h h*, Utricular Glands passing under the Side of the Cotyledon; *i i*, Large Cotyledonal Vessels; *k*, Uterina Mucosa; *l l*, Epithelial Layer of the Cotyledon.

other horn had only forty-two placentæ, and weighed no more than 0,22 zollpfund.

In addition to these supplementary appendages of the mucous membranes, a new glandular apparatus, of which no trace was to be found previous to gestation, now makes its appearance in the form of a large number of small openings in the mucosa, each leading into a depression which was for a long time regarded as the dilated mouth of the tubular or utricular glands, but which is really a "crypt" formed in the hypertrophied tissue of the uterus—a kind of open follicle placed in the interglandular part of the mucous membrane. These crypts are new structures, formed during pregnancy, and are for the lodgment of the villi that project from the chorion of the fœtus—being, in fact, the maternal cotyledons or maternal portion of the placenta. They are small straight depressions, lying more or less closely together through-

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out the whole of the uterine mucous membrane of the Mare, their cavity being lined by a layer of tessellated epithelium, and a very fine capillary network surrounding each. In the Cow, these crypts are assembled on the surface of the projections designated cotyledons, of which they constitute nearly the entire mass during pregnancy. In the Bitch, they are only developed where the ovule is fixed, forming then a glandular layer occupying the contour of the uterine cornu.

The utricular glands do not open directly into the crypts, nor is their secretion poured into them, but on a definite surface of the mucous membrane between the crypts, the size and areas of which correspond, of course, to the size and arrangement of the fœtal tufts.

Between the fœtal and maternal placentæ, there is always a layer of epithelial cells of varying thickness, which represents the *membrana decidua* or *serotina* of woman. If not during parturition, at least afterwards, all placental mammals are "deciduate," more or less. With the Cow and Sheep, for example, large quantities of cells, possessing the character of epithelial cells of the pits and crypts of the maternal cotyledons, have been found, mingled with the villi of shed fœtal cotyledons, in the fluid extruded during and after parturition: showing that a portion of the maternal structure is carried away at this time. The crypts possess the structural characters of secreting organs; and, indeed, we cannot but look upon the maternal placenta and the remarkably modified mucous lining of the uterus as a great secreting organ.

In addition to the mucous membrane, the outer or serous membrane is also hypertrophied, the broad ligaments are increased in every direction, but especially in length, and muscular fibres are abundantly developed between their layers, in order to give them sufficient strength to sustain the weight of the uterus. In the Cow, the fibres even form very distinct intercrossing fasciculi.

The greatest increase of all noted in the texture of the uterus, occurs in the middle or muscular tunic. There appears to be a vast multiplication of the fusiform nucleated fibres going on during pregnancy, as well as an immense increase in the volume of those already existing. This tunic gradually becomes redder as well as thicker, and the muscular fasciculi more distinct, and visibly more numerous. The inner layer, composed of circular fibres, is most conspicuous in the cornua of carnivorous animals, and there they contract in the interspaces between the young, so as to form well-marked constrictions. The connective tissue which unites the muscular fibres also increases during pregnancy, and becomes markedly fibrous.

Sensibility.

With the increase in volume, weight, and capacity, the uterus likewise acquires a higher degree of *sensibility*, doubtless from the development of its nerves. So that between the cervix, the body, and the cornua, there is established a sympathetic relation that is sometimes not advantageous; for irritation of the cervix, howsoever produced, may bring on violent contractions of the whole organ, and lead to the premature expulsion of the fœtus. This expulsion, as is well known, sometimes follows copulation; though, as a rule, animals usually do not seek to copulate during pregnancy if left to their own natural instincts. It may also be a consequence of manipulation by the hand of the explorer.

This contractility of the uterus is sometimes evidenced before parturition, when animals have been killed and quickly opened. Colin has witnessed well-marked movements in the uterus of a Cat which contained five young—

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three in one horn and two in the other; these contractions were most energetic at the constricted spaces between the fœtuses. The same talented veterinary physiologist has seen similar phenomena in Sheep at different periods of gestation; the cornua contracted and dilated alternately, approached or withdrew from each other or the body of the uterus; the movements persisting sometimes for forty or fifty minutes after the animal's death. In a pregnant Cow opened when alive, the same contractions were noted; they became more active and stronger under the influence of a slight irritation; the cornua changed their form in contracting; they shortened sensibly, and became twisted on themselves at their anterior extremity. In a Mare identical contractions were seen.

Haller had long ago remarked that, even in the unimpregnated animal, these uterine contractions were present—though they were most energetic in the pregnant Bitches, Cats, and Rabbits he opened, the movement being spontaneous and peristaltic, like that of the intestines, and that it continued in the organ, even when it was removed from the body. Those veterinarians who have had occasion to insert their hand into the uterus of one of the larger animals, to adjust the fœtus or for any other object, must have been astonished, and frequently embarrassed, at the firmness with which the arm was grasped at the cervix during the expulsive efforts the creature made.

These uterine contractions are very powerful, and in all probability their rhythm is analogous to that of the intestines; extending from the extremity of the cornua towards the cervix in a peristaltic manner, particularly in those animals which, like the Bitch and Pig, have very long cornua, and the young arranged one after another in them.

This increase in sensibility, which the uterus acquires during gestation, must be considered as the organic cause of its contractions; the sensibility and contractility gradually diminishing after parturition, during which it reaches its apogee. Its contractility, which signifies also its retractility, enables it to contract on itself after delivery, and to nearly obliterate its cavity. This rapid diminution in the capacity of the organ closes the orifice of the vessels which open on its internal surface during the act, and thus prevents fatal hæmorrhage.

Its main function, however, appears to be concerned in the expulsion of the fœtus, and then, as at other times, it is entirely independent of the will. Besides, its intensity is not always related to the strength of the animal; pain deadens and paralyses the contractile force, as is seen in primiparous creatures. When the contractions have been vigorous, the uterus rapidly diminishes; but if they have been slow and weak, the organ slowly contracts on itself. When it does not contract quickly after delivery it is said to be inert, and the cause is to be found in the expenditure of its contractile power, either through excessive distention, a delivery too prompt or too slow, or general weakness of the maternal system. By long exercise, like voluntary muscles, those of the uterus become weakened; so that when the act of parturition has been protracted, the contractions of the organ become slow and feeble, or cease altogether. Opiates and narcotics generally produce the same effect, and are therefore successfully administered when the contractions are too energetic or painful during delivery, or before abortion. The contractions are stimulated by irritation of the cervix or body of the uterus: such as is produced by retention of the whole or a portion of the placenta, titillation of the cervix by the finger, frictions on the belly, the application of cold to this part, or the administration of ergot of rye.

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Form.

The uterus, after conception, begins to change in *form* as well as in volume and structure; this alteration, like the others, proceeding *pari passu* with the development of the fœtus. The body becomes round, and in the carnivora, as already described, the cornua elongate and show the alternate

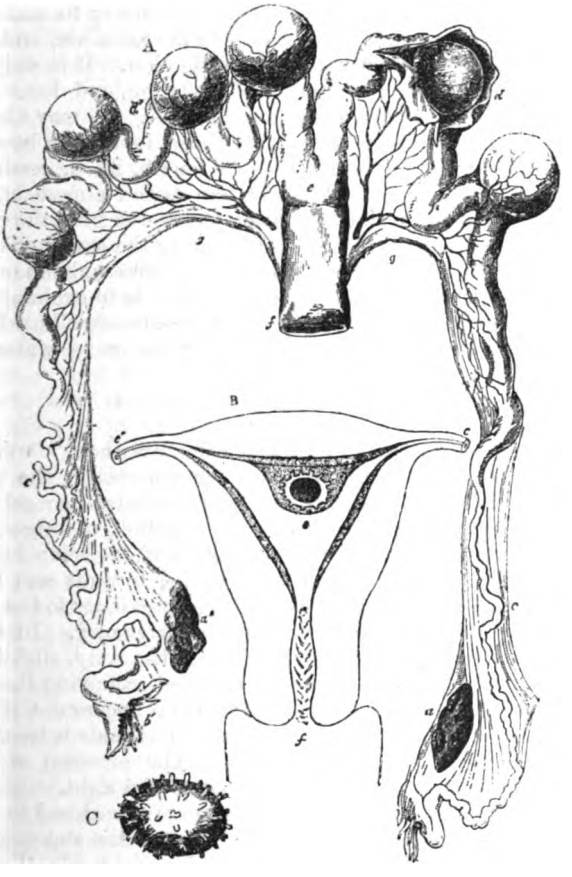

Fig. 52.

THE GRAVID UTERUS OF A MULTIPAROUS AND UNIPAROUS ANIMAL.

A, Multiparous Uterus: *a*, *a*^{1}, Ovaries; *b*, *b*^{1}, Fimbriæ of Fallopian Tubes, *c*, *c*^{1}; *d*, *d*^{1}, Cornua of Uterus—that on the left contains four Embryos, on the right two, one of which is exposed; *e*, Body of Uterus; *f*, Vagina; *g*, *g*, Mesometry or Ligament of Uterus. B, Uniparous Uterus: *c*, *c*^{1}, Fallopian Tubes; *e*, Body of Uterus, containing early Uterine Ovum; *f*, Vagina. C, Early Uterine Ovum.

dilatations and constrictions due to the presence of the young in their cavities. In the Mare, Cow, and Sheep, if there is but one fœtus, a single horn is enlarged—usually the right—to contain the posterior limbs, and the other is relatively smaller and contracted, and looks a mere appendage. When a carnivorous animal contains only one fœtus, it is developed in the horn, and not in the body of the uterus, and it is not until parturition com-

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mences that it descends into the latter; should the creature die before delivery, the offspring will be found there. In this species each horn generally contains one or more young; should there be only two, one occupies each cavity; but when there is only one fœtus, it is then in one of the cornua.

The changes taking place in the cervix of the uterus during pregnancy have not been accurately ascertained in the domesticated animals; as in the smaller species there is usually no occasion or necessity to make an examination; and in the larger the risk of injury to the examiner, and of abortion in the animal, militates against such an investigation. It is only known as a fact, that it widens at the termination of gestation, and loses its cervical character, as well as its longitudinal mucous folds. It may also be noted that, from being firm and dense at ordinary times, its texture becomes gradually soft and elastic; while it diminishes in length, its projection into the vaginal cavity is lessened, and indeed at a late period almost effaced, it appearing merely as a kind of ring separating the uterus from the vagina, and which is sometimes a little open. Not infrequently the cavity of the cervix is filled with a thick, adherent, glutinous matter, sometimes so abundant that it also occupies the vagina, and forms an unpleasant obstacle to exploration, though it does not interfere with parturition. We have already alluded to the sensitiveness of the cervix. The cornua, also, in becoming wider lose their inferior and posterior curves.

Situation.

The uterus cannot change its form and volume without altering its *situation*. Before, and until a certain time after conception, the body of the uterus is contained in the pelvis, but as it and the fœtus increase the position changes, and this causes an alteration in the situation of other organs. In the Mare it gradually displaces the pelvic flexure of the colon lodged in that cavity, and passes forward below that intestine, towards and beyond the umbilicus, to rest on the floor of the abdomen, in proximity to the diaphragm, stomach, and liver, towards the termination of pregnancy. In its development it is situated chiefly in the middle line of the body, slightly inclining to the left, because of the large mass of the colon occupying the right flank.

In Ruminants, the uterus pushes the rumen and cæcum out of the pelvis, presses the mass of intestines to one side, and extends between the right sac of the rumen and the abdominal walls. The presence of the rumen in the left flank causes it to deviate somewhat to the right.

In *multiparous* animals, in which the young are placed end to end in the cornua, the latter rest on each side of the floor of the abdomen and curve upwards; in the Pig they incline somewhat to the right side, though in both each cornu lies above its corresponding mammary line.

While these changes are taking place, the broad or lateral ligaments are facilitating them by becoming unfolded and lengthened, and the uterus in its increasing bulk extends backwards as well as forwards. The cervix, firm and resisting, approaches the vulva, and to such a degree sometimes that, in certain breeds of cattle—particularly those which have the pelvis wide and inclined posteriorly, and bear large calves—the posterior portion of the vagina appears between the labia of the vulva a month or more before parturition, and especially when they lie down.

With other Cows, however, whose abdomen is very pendent, the opposite occurs; for the uterus, in passing forwards and downwards, carries the posterior portion of the vagina behind it, and this cavity becomes lengthened

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and constricted posteriorly, while the cervix is shortened, and the vulva appears to be deeply buried between the tuberosities of the ischium.

Direction.

With regard to the *direction* of the uterus, it is to be noted that its horizontal position in the domesticated animals obviates those lateral displacements which are so frequent in woman, its weight and that of its contents maintaining it in an antero-posterior direction, and in a line with the body of the animal. This direction rarely varies to any appreciable degree, and it is only in a case of hernia at the flank, which is very uncommon, that it inclines to one side. The only marked inclination it assumes is forward and downward in Cows whose abdomen is very wide and pendulous. Otherwise, the uterus keeps its normal direction. Rainard draws attention to a form of abdominal hernia which gives the uterus a particular direction; it is that which takes place in the Mare or Cow, in the vicinity of the crural arch, when the uterus, or one of its horns containing the fœtus, descends behind the corresponding mammary gland, or into the subcutaneous connective tissue of the inguinal region, forming a large tumour in which the limbs of the young animal can be felt.

Another change in the direction of the uterus, which it is most important to consider in the larger animals, is the more or less complete rotation or twisting on its axis of this organ: its upper face becoming the lower, or again become superior after describing an entire circle; for this torsion occasions serious changes in the form of the cervix and the direction of its cavity. The position of the cervix is the inverse of that of the uterus, being always found on the side opposite to that of the new direction of the organ itself; it is directed upwards if the uterus is downwards, and if the latter twists to the right or left the cervix goes to the left or right. Cases are mentioned in which torsion of the cervix itself has been found; and though it has been argued that the lateral ligaments would not permit this malposition, yet there can be no doubt as to the fact. Lecoq of Bayeux, cited by Rainard, found in a Cow that had died through non-delivery, the upper face of the uterus turned downwards to the floor of the abdomen, the rotation having taken place from right to left; the utero-vaginal portion was twisted on itself, and the suspensory ligaments were themselves twisted around this part. Numerous cases are recorded which incontestibly prove that during pregnancy, the uterus perform a half or even a complete revolution, on itself, producing torsion of the cervix and the posterior part of the vagina, and consequent strangulation of the organ near the neck by the suspensory ligaments; so that spontaneous delivery of the young animal by the natural passage is impossible.

Influence on and Alterations in Position of Neighbouring Organs.

The alterations occurring in the uterus necessarily bring about others in the neighbouring organs with which it has mechanical relations. The changed position of the organ in the abdominal cavity has been alluded to. In the Mare and Cow the horn in which the limbs of the fœtus is lodged becomes extended and displaces the intestines, pushes the stomach more to the left, rests on the liver, and is an obstacle to the free movements of the diaphragm. The suspensory ligaments of the uterus retain that organ and the cornua *in situ;* but when they, in the early stage of gestation, begin to extend forward, the vagina is lengthened, until at a later period, when the size of the fœtus forces the uterus backwards into the pelvic cavity, that

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canal is also pushed back and forms a circular enlargement in the vulva. Its lining membrane, owing to the compression and the increased circulation of blood through it, assumes a violet or dark-brown tint, and appears to become thickened, while it secretes a larger quantity of viscid mucus.

The pressure the gravid uterus exercises on the bloodvessels of the hind limbs and the vulva and rectum, retards the venous and lymphatic circulation; so that towards the end of gestation, and especially in the Mare, there is considerable œdema of these parts. This œdema is all the more marked, in the Cow as well as in the Mare, when the compression is greatest at the posterior parts of the abdomen, towards the commencement of the saphena and mammary veins.

The œdema is always greatest in those cases, somewhat rare, it is true, in which there is a giving-way of the abdominal parietes near the crural arch above one of the mammæ, when the uterus forms a hernia beneath the skin; then there is seen an enormous swelling at the upper part of the limb.

The udder increases notably in volume, and it and the teats are tense. In the carnivora, the prominences of the mammæ, especially the ventral ones, are increased by two rows of elevations on each side of the linea alba, which correspond to the portions of the cornua in which the young are being developed, and where they form projections on the wall of their sac.

The increase in volume and the various changes which the gravid uterus undergoes, bring about alterations in and frequently derangement of certain functions in the animal. Fortunately, however, these alterations are slow and gradual; so that the different organs concerned generally adapt themselves to their changed condition without much inconvenience. The animal becomes lazy and slower in movement, and is more desirous of quiet and tranquillity as gestation advances. These indications are observed at an early period. At the same time the abdomen enlarges and changes its shape: it becomes rounded and projects below, and on each side beyond the crural region, while the flanks become hollow, the croup and thighs wasted-looking, and the sacrum and external tuberosities of the ilium more salient.

In the domesticated animals there are not observed those disturbances in the digestive organs so marked at the commencement of pregnancy in woman. On the contrary, immediately after conception, possibly because œstrum has disappeared, the appetite is increased, digestion is easier, and all the formative phenomena seem to acquire increased activity; more use appears to be made of the food in the economy, and there is a notable tendency to fatten. This tendency has been taken advantage of by breeders and feeders of animals which are destined more for food than reproduction; and those intended for slaughter are usually rendered pregnant, and fed until about the middle period of gestation, when they have reached their most favourable condition: as towards the last period this tendency vanishes, and wasting is more apparent, due to the increased demands of the fœtus and the enlargement of the mammary glands.

In some cases, however, and particularly with the Cow, the appetite becomes somewhat depraved, the animals eating soil, gnawing the walls or woodwork of their stable, drinking foul water, etc.

With the increased bulk of the uterus, as has been observed, the abdominal and thoracic organs experience more or less the effects of the compression it exercises on them. The diaphragm is pushed forward, and diminishes the capacity of the thorax, and the expansibility of the lungs; the ribs, encumbered by the weight of the fœtus, are raised with difficulty by the muscles of inspiration, so that respiration is frequent and shallow, and the

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creature is readily "blown" and fatigued. Digestion is a little impaired and tardy, and slight constipation is not rare. The strain induced by the uterus on the vagina, and indirectly on the neck of the bladder, causes attempts at micturition to be more frequent; while the compression on the liver, vena portæ and vena cava, explains the mechanical obstruction to the circulation and consequent œdema, particularly in the Mare.

In addition to all this, the blood is more or less modified. Its absolute quantity is not diminished; on the contrary, it may be increased to a certain extent; but its corpuscles diminish in number in a very perceptible manner, giving rise to a serous plethora more allied to anæmia than anything else.

SECTION II.—POSITION OF THE FŒTUS IN THE UTERUS.

The position of the fœtus in the uterine cavity is pretty well constant in the same species; and this position it retains more or less during intra-uterine existence, and until parturition occurs, when it is changed.

Brugnone, cited by Rainard and Saint-Cyr, writes: "If the uterus of a Mare is opened longitudinally at the ninth or tenth month of gestation, we find the fœtus with its head directed backwards, and bent in such a way that its lower jaw touches the throat and its mouth the breast. It forms an arc of a circle; the neck being in contact with the sacrum, and the spine being bent round is turned towards the right or left side of the lower part of the abdomen. The limbs are flexed: the fore ones in such a manner that the knees reach the middle of the head and the feet the umbilicus; while the hind limbs are doubled under the abdomen. The croup and haunches are at the bottom of the uterus, in the vicinity of the stomach."

Colin states that towards the termination of pregnancy, the fœtus of the Mare lies with the belly upwards, the hinder limbs in the longest of the uterine cornua, and the anterior limbs and head directed towards the cervix uteri.

In the Cow, according to Saint-Cyr, the uterus is curved downwards, the superior convexity of the body being prolonged forward by the cornu in which the fœtus is partially developed. When the uterus is opened, the fœtus is discovered with the head bent back, the body much inclined and looking as if almost lying on one side or other, and pressing on the empty cornu, which is considerably less developed than that of the opposite side, and which also is lower. Otherwise, like the foal, the calf is curved *en arc*, the head more or less near the sternum, and the limbs flexed and close together (Fig. 36).

According to Colin, the belly of the fœtus is downwards in ruminants, and towards the concavity of the cornua, the head being directed backwards.

In multiparous animals, the fœtuses are distributed in the two cornua, one after the other, the head being usually turned toward the cervix uteri, sometimes to the opposite side, and the abdomen lying towards the concave portion of the cornua, where the broad ligaments are attached and the vessels enter. In the Sow, however, it has been noted that the young lie in a contrary direction; the head, instead of being presented to the cervix uteri, is turned towards the ovarian extremity of the cornua, though the abdomen and limbs always correspond to the concave border of the horns, as it is there the placenta is situated.

In forty-three Cows and Sheep, Colin found in twenty-five the fœtus in the right cornu, and in the left cornu in eighteen. At first sight it might be sup-

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posed that the preference for the right cornu was due to the impediment offered to development in the left by the large digestive organs of these animals; but this difference cannot have any influence on the function of the ovaries, the dehiscence of the Graafian vesicles in the right being apparently more frequent than in the left. In multiparous animals, the fœtuses are rarely equal in number in both cornua, though neither of the latter has a constant advantage over the other in this respect.

The position of the fœtus towards the termination of gestation may vary occasionally, and even frequently, owing to the active reflex movements which it performs; and to these energetic movements, it cannot be doubted are due the difficult presentations which the fœtus offers so frequently (at least in some species) at birth.

SECTION III.—SIGNS OF PREGNANCY.

Having traced thus far the process of utero-gestation, we have now to study the signs by which this process reveals itself. This study is very important, in several respects, to the comparative pathologist, or rather to the veterinary surgeon, whose science extends beyond pathology, and who is frequently called upon to give an opinion as to whether an animal is or is not pregnant.

The signs which announce pregnancy are numerous and varied, though they are not all reliable, and several are very deceptive, and not peculiar to gestation. Indeed, it has frequently happened that animals whose condition was not at all certain have brought forth young, and others have done the same without giving rise to any suspicion that they were pregnant; though it must be remembered that at first there is nothing present to guide one in forming an opinion as to the animal having conceived.

Nevertheless, in order that a correct opinion may be arrived at, the most equivocal signs must be taken into consideration, as well as those which are, so to speak, unequivocal: indeed they ought to receive, for this very reason, more than ordinary attention; as it is a matter of much moment, and particularly in cases of jurisprudence, that the veterinarian should be able to speak positively as to the presence or absence of pregnancy.

The diagnosis of pregnancy is not always easy, and it is all the more difficult as the stage is early.

In order to study the signs of pregnancy conveniently, it is usual to divide them into three categories as follows: 1. The *rational, physiological*, or *subjective signs;* 2. The *material* or *objective signs;* 3. The *sensible signs* which are derived from *observation* and *manipulation* to ascertain the presence of the fœtus. In this study, of course the larger animals will be more particularly referred to, because of their relatively higher value and importance, their longer period of gestation, and also because the veterinary surgeon is most frequently consulted as to their condition.

Rational Signs.

There are several *rational signs* due to the modifications brought about in the economy of the pregnant animal, and manifested by alterations in temperament, character, and aptitudes.

The *cessation of heat* or *rutting* is, perhaps, the earliest subjective, though it is certainly not the most certain sign, of gestation, and may even lead to mistakes. It is usually manifested soon after conception has taken place (six or eight days), by a diminution in the venereal excitement which marks the

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period of œstrum; the animal is comparatively tranquil and does not exhibit any desire for themale, neither does she neigh, paw, or show the usual concomitant symptoms of "heat." If the male approaches, the sexual desires are not excited, and in refusing him the female may even resort to aggressive movements. So that it has usually been held as a sign of conception, if the female refuses the male soon after copulation, and particularly if a month or two has elapsed, and the Mare is in good condition and well fed. But in some cases the symptoms of "heat" persist for some time after this act, and the erethism of the generative organs is not allayed, although in reality impregnation has taken place; and in very exceptional instances the "heat" will return after having disappeared for a certain time. Some Mares pregnant for two or three months, and especially those which have been put to the stallion early in the year, will exhibit indications of œstrum when the weather becomes warmer and the pastures afford more nutriment. When in this state the female may again receive the male, and it may even happen that a second fecundation takes place at this time; thus occasioning those somewhat unusual conceptions which give rise to superfœtation—though if pregnancy is somewhat advanced, it is dangerous and may occasion abortion. A story is told of a Mare in the Saint-Leger stud, France, which, after being pregnant for some months, yet showed symptoms of "heat." Louis XIV., who was more inclined to favour the desires of the animal than to listen to the opinion of Garsault, the famous equestrian of that period, ordered her to be put to the stallion. This was done, copulation took place, and the Mare aborted.

Stallions exclusively employed for covering, frequently refuse to approach pregnant Mares in which the "heat" persists or reappears; though this is not always the case, particularly with young stallions.

In the Cow, as in the Mare, œstrum may continue or reappear after fecundation; though as a rule, I believe, the male refuses to copulate again when the female is in this condition. "Very often," says Grognier, "the Mare and Sheep, as well as the Cow, manifest signs of 'heat;' but the Bull, better than the Stallion or Ram, knows the indications of gestation, and abstains from having intercourse while they are in this state." M. Magne remarks that the Bull accustomed to consort with pregnant Cows, smells at them as it does at others going with it, but without being excited by their emanations. Exceptionally, however, it must be noted that Cows have been known to manifest œstrum regularly, and to receive the Bull, even a month before parturition. But these instances are very rare. For cattle, therefore, it is an almost certain sign of pregnancy when the Bull refuses a Cow, though the latter may be in heat.

With Sheep œstrum may continue after fecundation, and the Ram may copulate.

In general terms, then, it may be said that the cessation of œstrum before its regular period, and soon after copulation, indicates that conception has taken place; that its persistence or reappearance in the Mare and Sheep some time after the first copulation, does not absolutely imply that impregnation has not occurred, even though the male again consorts; but if it frequently appears it is a presumption that the female is not only not pregnant, but that fecundation is not readily induced.

It has been generally observed that a change takes place in the character of the animal which has conceived, and this sometimes almost immediately after conception; the change being something analogous to that produced after castration. Mares which were previously vicious, troublesome, or unsteady when in "heat," are nearly always gentle and tractable when in foal;

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the genital excitement which caused their capriciousness or viciousness being allayed, they are no longer under its influence. This change, when occurring after copulation, is a valuable sign of successful impregnation; and though it may sometimes fail, yet when present, it can scarcely lead to a mistake. If, on the contrary, the animal has not been fecundated after one or more coverings, its vices become exaggerated when again put to the Horse.

In the Cow a similar phenomenon may be remarked, though it is not so frequent or prominent as in the Mare.

The other animals are seldom so irritable in their disposition as to lead any one to notice a similar change in them.

A tendency to fatten is such a notorious consequence of impregnation, that with the Cow and Sheep graziers usually resort to it in order to get these animals in good condition for market, when they are intended for slaughter. But this aptitude is most marked in the early months of gestation; for in the Cow towards the last three months, and in the Sheep and Pig at the last month, when the mammæ begin to enlarge, there is a tendency to lose condition. According to the butchers, there is less internal fat, and the animals altogether are not so heavy as they appear externally, when gestation has advanced. It often happens, particularly with Cows, that the appetite is depraved, the animals eating earth, drinking filthy water, licking walls, and gnawing innutritious substances.

Coincidentally with the progress of gestation those animals employed in labour for speed or draught, lose their vigour somewhat, particularly towards the end of gestation; they become "soft," and their paces slower and heavier, requiring more urging to make them perform a certain amount of work. They, if Mares, trot, gallop, and jump with more fatigue, and yield themselves far less readily to inordinate exercise than before: either because their temperament alters, their instinct urges them to preserve their progeny, or the fœtus itself physically embarrasses them in their movements.

But this is not always a sure sign; for sometimes, though rarely, Mares will perform their work with the same energy and speed as before conception, even up to a very brief period before parturition commences. Taken with other signs, nevertheless, this may afford assistance in diagnosing gestation.

At pasture, Cattle and Sheep are more tranquil, and rest much; as do also Pigs and Bitches during this period.

Material Signs.

The *material*, *physical*, or *objective* signs are those depending upon the change in *volume* of the *abdomen* and the *mammæ*, the appearance of the *milk* in the latter, alterations in the composition of the *urine*, and increase in weight of the animal.

The abdomen enlarges in every direction, and at the same time changes its shape. It descends or "drops," becoming larger inferiorly; the flanks become hollow, and the spine appears more concave in the dorso-sacral region; while the lateral portions of the croup sink so much as to make the sacrum and haunches towards the root of the tail, look more salient. These phenomena are progressively developed as gestation approaches its term, when they are very evident. In the Mare they are irregular in their appearance, commencing three or four months after conception, and do not possess the same value in every instance; for there are some animals in which the abdomen is scarcely at all unusually developed, and particularly the Mare, which is primiparous, until near parturition; and others, generally those at pasture, or which have had a number of foals, that always have the belly considerably developed and

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pendulous, and in which it is difficult to perceive any increase, even when they are in foal.

Besides, some diseased conditions—as ovarian dropsy, uterine polypus, hydrometra, ascites, etc.—may give rise to amplification of the abdomen; and it must not be forgotten that Mares fed on poor fibrous forage not unfrequently have the belly enlarged. So that of itself this is not at all a sure criterion of pregnancy.

Taken in connection with the other signs, however, the increase in the abdomen—most marked towards its inferior third, and becoming evident towards the fifth or sixth month of pregnancy—has a certain value. It is most noticeable, perhaps, in looking at the animal from behind; though repeated examinations at various intervals may be necessary to ensure certainty, and in important cases recourse may even be had to measurement of the abdomen.

The *enlargement of the mammæ* is a sign which varies considerably in different species, according to the condition of the females. In primiparous animals, as the Mare and Cow, they begin to increase soon after conception—towards the second or third month. The udder is more prominent and firm to the touch, loses its wrinkles, and the teats are more visible. This appearance is generally only ephemeral and partially disappears, to reappear again more markedly after some weeks; then to subside and show itself several times during the process of gestation.

Besides this mammary enlargement in the primiparæ, and which may be accepted as a certain indication, these glands furnish, towards the last third of the period of gestation, a yellow, viscid, transparent liquid—the colostrum—similar to white of egg, and which can be easily extracted from the teats by milking. In the last weeks of pregnancy this liquid sometimes becomes white and opaque, as well as less viscid, and is then milk. When the animals have bred several times, the increase in the size of the udder is only remarked in the last days of gestation. In milch Cows, and particularly in those which are not good "milkers," another sign is to be found in the diminution of the lacteal secretion, and the shrinking of the gland some time after conception—usually about the twentieth day.

In the pregnant Mare which still has a foal running with her, the secretion of milk also ceases some time before parturition, and the animal appears to be aware of this, for it weans the foal generally between the sixth and eight month.

In the smaller animals, the enlargement of the mammæ and the appearance of the milk are usually remarked earlier, and more regularly, than in the larger creatures.

Though, in a natural state, the mammary glands are only intended to furnish aliment to the young creature until it is sufficiently strong and active to find its own food, when they suspend their function; yet domestication has greatly modified their secretory power in some species—as with the Cow, Goat, and sometimes the Ass and Sheep—and the secretion of milk becomes an almost permanent office. Not only this, but at times the secretion, as observed in the unimpregnated Bitch, is very anomalous and unnatural. In the non-pregnant female of various species—not excepting the human species—the secretion may appear naturally or be induced by mulsion or frequently repeated suction of the teats, even in very young creatures, a short time after birth; and what is more astonishing, male animals have, in rare instances, assumed a function which is always looked upon as specially characteristic of the female sex at the maternal period. So early as the days of Aristotle—

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who mentions a he-goat which yielded milk, this strange phenomenon has been at times observed; and M. Lecoq testifies to an ox, in process of fattening, having the four rudimentary mammæ increased in volume and yielding milk which furnished cream, and became casein when an acid was added to it.

Certain alterations in the *composition of the urine* have been reported by M. Keiner of Gunsback, which, with other circumstances, might, if found to be trustworthy, be valuable as an aid to the diagnosis of pregnancy. He has discovered that the salts of lime in the urine diminish in proportion as the fœtus requires these for the formation of its bones; and his discovery has been tested by a chemist whose analysis of this fluid, obtained from a pregnant Mare, shows that the lime lessens very much as the time for parturition draws nigh. At the fifth or sixth month it is diminished fifty-five per cent., and to seventy per cent. from the sixth to the ninth month.

It has been proposed to *weigh* animals which are suspected to be pregnant, at certain intervals; an increase in weight being an evident accompaniment of growth in the fœtus. In this direction, Rueff has recorded that Mares, towards the fourth or fifth month of pregnancy, have shown an average increase in weight of more than eleven pounds in eight days, and he particularly recommends this aid to diagnosis, which appears to be most useful at mid-term.

It may be noted as an additional aid to diagnosis, that with the progress of gestation the mucus membrane lining the vulva and vagina becomes swollen, and assumes a red or bluish-red hue, instead of its usual pink colour; and towards the termination of pregnancy, the secretion of vaginal mucus, particularly in the Cow, is largely increased.

All these numerous signs are by no means to be implicitly relied upon, however, as they are not infallible in proving the existence of pregnancy in every case; some of them are only noticeable at a late period, while others may be absent. It is necessary in taking them into consideration, to distinguish those animals which are kept at pasture and destined for breeding, from those which are kept in the stable and used for various purposes. With the first, the cessation of œstrum and the refusal of the male are almost certain indications of conception; while, with the latter, the same phenomena may be the result of fatigue or bad food and management.

With regard to fattening, change of temper, etc., it is evident that they may depend upon other causes than gestation; and the obesity can only be very conspicuous in primiparous animals, or those which are not rearing young; for Mares or other creatures put to the male a few days after parturition, are not likely to accumulate fat and rear their progeny at the same time. When, however, all the above signs are manifest in an animal, they establish a very strong presumption, though not an absolute certainty, as to its condition. It is not until a later period, when the abdomen begins to increase more rapidly in volume, the animals become sluggish, and the mammæ enlarge and secrete the oleaginous fluid just described, that the existence of pregnancy might safely be affirmed.

The chances of error in diagnosing pregnancy in the first half of the period are numerous, and even up to a later stage—until parturition, in fact—these indicative signs may be absent. I know of an instance in which an unfortunate Mare was ridden to hounds until the day before it gave birth to a dead foal, and died itself.

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Sensible Signs.

To obviate as much as possible the risks of error in diagnosing pregnancy, various expedients have been devised and resorted to, in order to ascertain with certainty the presence of the fœtus in the uterus. Some of these are as barbarous as they are stupid. One especially merits the strongest condemnation; this is pouring water into the ears of the Mare or Cow, under the supposition, that if the animal is not pregnant it will shake its whole body to get rid of the fluid, but if pregnant that it will only shake the head and ears. Another cruel and dangerous test is causing these animals, but especially the Mare, to run very quickly for a certain time, and to give them cold water to drink or oats to eat immediately afterwards, in order to excite inordinate movements in the fœtus. It will readily be understood that these, and other vicious practices, are very likely to produce abortion, and that they should therefore be discountenanced and discontinued. The only useful and practicable means that can be resorted to, are those which appeal to the senses of touch, sight, and hearing. But it must be remarked that these have fewer opportunities for their exercise, and are more limited in their application, in animals than in woman.

To feeling or touching, watching the movements of the fœtus as they are manifested externally, and auscultation, we must mainly rely, and these afford, with the other signs, the only conclusive evidence we can obtain.

The indications obtainable by manual exploration are through the *abdominal, rectal,* and *vaginal* touch. The *feel* of the abdomen does not yield equally certain results in all the domesticated animals. In those which are small, as the Bitch and Cat, a little careful manipulation will render the presence of the creatures *in utero* very evident towards the middle period of gestation; but in the larger animals—the Mare and Ass on the one hand, and the Cow on the other—there exist considerable differences, as pointed out by Trasbot.

With the Cow, after the fifth or sixth month, the presence of the fœtus can be readily ascertained by this means; but in solipeds, it is not until the seventh or eighth month that the same information can be derived; and, besides, it is not always easy to apply this mode of investigation to these animals, from their fidgetiness. It is better to examine the animal when it is standing, as the signs are not so perceptible when it is recumbent. The examiner stands on the right side of the Cow, the left of the Mare, with his back towards the animal's head, and applies the palm of his right or left hand against the abdomen, immediately below the flank, and about eight or ten inches in front of the stifle, and just above the udder, pressing moderately, the other hand resting on the back. At this part of the abdomen a hard voluminous mass can be felt in the uterus, while the movements of the fœtus are perceptible, as it stirs at irregular intervals, and causes the jerks and shock of its displacements to be communicated to the walls of the abdomen. These movements are strongest in the morning, and are more distinct if the mother is eating or drinking, especially if the water is cold, or immediately after feeding. Some old authorities recommend that, to render the movements of the fœtus more perceptible, the Mare should be trotted, then put in the stable and given some food, and then, by placing the hand on the before-mentioned region, the foal will be felt if it is there. The dilatation of the stomach by food compresses the other abdominal organs, and especially the uterus, and the inconvenient displacement excites the young creature to movement. The ingestion of fluids does the same, and particularly if they are cold; for then they powerfully affect the fœtus by the uncomfortable sensation they

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give rise to. Cold water thrown against the belly, or the application of the cold wet hand, will produce a similar effect. In the Cow, smart compression of the abdomen with the closed fist, at the part just indicated, so as to push the uterus upwards and allow it to return with a little force, is also a good method of ascertaining the presence of the fœtus, and will prove successful when simple application of the flat of the hand will fail. It is most likely to succeed when there is not much food in the stomach and intestines; as the uterus is then much easier displaced. When this compression has been made with some energy, the uterus strikes the abdominal wall immediately afterwards, and then there can be perceived a firm voluminous mass; this is the uterus containing the fœtus.

At a more advanced period, in the last two months, the movements of the fœtus can be easily remarked as it jumps about briskly, striking the interior of the abdomen at brief intervals. This, and the other signs appreciable at this time, leaves no doubt as to the existence of pregnancy. The fœtal movements are never more marked and precipitous than immediately before abortion, at a late period of gestation; they are then energetic, and to all appearance convulsive.

With the smaller animals the same methods of exploration may be resorted to, and with the same, or even more marked results. The perceptible movements of the fœtus of course settles the question as to pregnancy and the vitality of the young creature; but their absence is not conclusive as to the contrary, for it has not unfrequently happened that the fœtus remained insensible to this kind of excitation, and yet was alive at birth. The tests should be applied more than once in these doubtful cases.

It may be noted that the "feel" of the abdomen distended by the uterus, is very different when the distention is caused by fluid, flatus, etc. The uterine tumour is firm, hard, elastic, and defined, preserving its form in all positions of the body; whereas in ascites the defined tumour is wanting, there is no repercussion on compression at the flank of the Cow, the fluid obeys the laws of gravitation, and the abdomen has not the same firm, elastic feel. Percussion will aid in distinguishing between pregnancy and tympanitis. In certain diseased conditions of the uterus, however, a diagnosis is very difficult, and the next means of exploration will have, in some of these embarrassing cases, to be adopted.

Rectal exploration, as well as that by the vagina, can only be successfully carried out in the larger animals, because of the small dimensions of these passages in such creatures as the Bitch and Cat. The risks attending this mode of examination have been at times much exaggerated, and there is really but little danger to the animal so long as reasonable precautions are taken not to produce injury; the fœtus has even been pushed gently about in the uterus without any accident to it or the parent. After the third month it will afford an indication of pregnancy.

To examine an animal *per rectum* it should be standing, and, if dangerous or irritable, the twitch may be applied to the nose, or for safety to the operator the hind limbs must be secured; with the Cow the nose seized by one hand of an assistant and a horn by his other hand, will be sufficient. The bowel should be emptied of the fæces it may contain, so as to allow the oiled hand and arm of the explorer to be introduced and freely moved about. When the abdomen is large and pendulous, it is useful to place the animal higher before than behind, and to have the lower part of the belly raised by assistants on each side, by means of a sheet or sack, or even their hands joined beneath, so as to throw the uterus backwards and upwards; though in the

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majority of cases these measures are not necessary. The hand being passed into the rectum to beyond the brim of the pubis, it is opened and the palm placed on the lower surface of the intestine and gently pressed downward, towards the floor of the abdomen; when there will be felt, if the animal is pregnant, a hard irregular mass, more or less voluminous according to the stage of gestation, and capable of being displaced to a certain extent—even partially brought into the pelvis, if parturition is near. In this case, the head or other parts of the fœtus can be distinguished through its envelopes and the uterine and rectal walls. But if pregnancy is not so advanced,—say only at the sixth month, the fœtus cannot be so readily felt, and it may happen that at this period it is situated low down in the abdomen, or well forward in one of the horns of the uterus, and lying to one side of the mesial line (nearly always to the right in the Cow); so that an inexperienced or careless examiner might miss it altogether at the first exploration. This error can be avoided by carefully moving the introduced hand to the right and left as far as the intestine will permit, with the animal's body inclined backwards and the belly raised by assistants, as just described. The fœtus should be excited to move, if possible, so as to guarantee its presence.

The difficulties are greater if it is desired to know whether the fœtus is alive or dead. Sometimes we may at once perceive the movements of the young creature in the uterus; but at other times it is motionless, and cannot be made to exert itself except by moving and pushing it several times. This, however, is not commendable, unless performed with the greatest gentleness and care; and if there is nothing urgent, it would be preferable to make an examination at another time, rather than incur the dangerous results that might follow this manipulation.

The prominences of the fœtus might be mistaken for the hard masses of fæces lodged in the intestines; but a distinction can generally be made by the rapidity with which these prominences appear and disappear through the sudden movements of the young creature, compared with the slow, regular, peristaltic motion of the intestine and its fæcal contents.

Vaginal exploration, as mentioned, can only be practised on the larger animals. It is not attended with any more danger than the rectal examination; but though it is of great value in woman, especially when *ballottement** is resorted to, yet it is not nearly so useful in animals; for in consequence of their horizontal position, this repercussion is not possible. Neither is it so valuable as the exploration *per rectum*. It is practised with the animal in the same position as for the last-named examination, and the hand, well lubricated with soft soap or, better still, with olive oil, is inserted into the vagina as far as the cervix uteri. In the first months of gestation the uterus descends into the abdomen; consequently, the vagina is longer and more inclined downwards in front: while the fœtus is beyond reach of the hand. Towards the fifth or sixth month, the uterus, in expanding in every direction, approaches the vulva, and the canal of the vagina being shortened, it can be perceived in the pelvic cavity. The same manipulatory manœuvres as were practised in the rectum, may be employed in the vagina

* The *ballottement* or repercussion to ascertain the presence of a fœtus in woman, is produced by the operator placing his patient in the upright position, or if in bed, raising her shoulders. The forefinger is then introduced into the vagina and placed on the cervix uteri, while the other hand is employed to keep the uterine tumour steady; then suddenly but slightly jerking upwards the point of the introduced finger, a sensation is experienced of something having receded from it, and which he will perceive to fall again on the point of his finger in a moment or two. The jerk of the finger upon the head of the fœtus causes it to float upwards a little in the liquor amnii, and its weight makes it descend again. We have seen that a kind of external, or flank *ballottement*, can be practised in the Cow.

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at this time, but the results are far from being so satisfactory; the vaginal examination should, therefore, never be preferred to that by the rectum.

Ballottement may be resorted to in the smaller animals, by placing them in a vertical position; but the other signs of pregnancy are usually so manifest in them, that generally there is little difficulty in diagnosing their condition.

Auscultation has not been much employed in the diagnosis of pregnancy in the lower animals, though its value in woman is undeniable; as since its introduction by M. Mayor, of Geneva, in 1818, its utility has been frequently and successfully put to the test, not only to ascertain whether there was a fœtus, but also whether it was alive. In woman, either the uncovered ear or the stethoscope is applied to the abdomen; the latter is generally preferred, as by it the sound is limited, as well as defined.

The *pulsation of the fœtal heart*, or *double battement*, consists of a rapid succession of short, regular, double pulsations, differing from those of the adult heart in rhythm and frequency; the sound being like the muffled ticking of a watch, or the pulsations of the heart of a new-born child. In addition to the sounds of the fœtal heart, there is also the *uterine souffle* or *placental bruit*, caused by the blood passing through the greatly enlarged vessels of the uterus, particularly at the part to which the placenta is attached; it is an intermittent whirling sound, heard at an early period of pregnancy, and usually regarded as one of its most unequivocal signs. There is, in addition, the *pulsation of the umbilical cord* or *funic souffle*, heard in certain favourable positions of the fœtus; it is synchronous with the fœtal pulsations.

In the larger animals, ascultation of the abdomen for the purpose of discovering the existence of these sounds is generally unsuccessful, because of the intestinal walls, the rumblings and noises of the intestines, and those of the rumen in the Cow, which entirely mask the *bruits* of the fœtus; so that it is seldom, if ever, resorted to. Lafosse and others, however, have resorted to it, and apparently with satisfactory results. Lafosse states that, on several occasions, he heard the pulsations of the fœtal heart very distinctly in Cows which were six months pregnant; though he also asserts that they cannot always be perceived on auscultation. Hollmann likewise mentions that he has often heard these fœtal beats, which varied from 113 to 128 per minute, those of the Cow being 64 to 70, and were not markedly influenced by the state of the mother's health; he acknowledges that they cannot be heard in every instance, even towards the end of pregnancy. Saake, using the stethoscope in the right iliac region, in front and a little above the crural arch, recorded the number of beats of the fœtal heart from the twenty-fifth week up to two hours before birth, though he was certain, from their distinctness, that they might have been heard earlier. In number they varied from 126 to 128 per minute, the mother's pulse being 68 to 84.

Rainard, Trasbot, and others, have not succeeded in detecting these sounds; and I have on several occasions practised auscultation on pregnant Mares, but have failed to distinguish the fœtal pulsations.

But there is no reason why, as suggested by M. Trasbot, the uterus should not be auscultated from the cervix, by a long special stethoscope—or rather "metroscope"—introduced by the vagina, and its wide end resting on the cervix. The intestinal noises would be evaded in this way, and the fluids surrounding the fœtus being good conductors of sound, the beats of its heart should be distinctly heard, if it is alive. Nauche, so long ago as 1826, and Verardini, in 1871, have spoken strongly in favour of this *intra-vagina* auscultation in the human species.

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From what has been said of the signs of pregnancy, it will be perceived that, in the early period of this condition, there is but little more than supposition to guide us, the presumptions becoming stronger as the physical and other indications are more marked. It is only, however, towards the middle period, when all the rational and physical signs are present, and when the condition of the uterus has been ascertained by the exploratory manœuvres above described, that we can affirm, without the danger of error, the existence of pregnancy. And when a doubt chances to prevail at this stage, it is well to remember that this condition may exist without being accompanied by very evident signs, and that a hasty conclusion must not be drawn. When, for instance, some rational signs present give rise to the presumption that an animal is pregnant, but no physical indication reveals this state, the examinations must be repeated before a final decision is arrived at. The value of experience and observation, when added to theoretical knowledge, is well displayed in this branch of veterinary science. Not unfrequently the diagnosis of pregnancy is surrounded by great difficulties, and a guarded opinion must be given.

SECTION IV.—DURATION OF PREGNANCY.

The *duration of pregnancy* varies considerably in different species of the domesticated animals; and even in the same species, there are individual variations which, though not very great, are yet important. From the doe Rabbit, which carries its young only twenty-eight to thirty days, to the female Elephant, whose period of pregnancy is, according to report, two years, there are a number of intermediate terms; and it is scarcely possible to establish a satisfactory relationship between the duration of gestation and the other conditions of organisation—such as size or longevity. In closely allied species, and which may couple and produce hybrids—as the Horse and Ass, Sheep and Goat—the period is pretty nearly the same.

With regard to breeds, Wilhelms has remarked that the Hungarian Cow averages ten days more than the Dutch Cow. With a male fœtus, the duration of gestation is greater than in the case of a female. It has even been remarked that the male parent may have an influence in this direction. For instance, a Mare which has been put to a thorough-bred Horse will be longer pregnant than when impregnated by a common-bred stallion; and the Mare which has been fecundated by a stallion Ass goes longer than when put to a Horse. The duration of pregnancy also depends upon the age of the female, and her strength and condition; a weakly or worn animal does not go so long as one which is strong and well fed.

The differences in individuals of the same breed or species may be partly accounted for by the fact, that impregnation is possible at any time during œstrum—a variable period; and if coitus has taken place several times during this condition, it is impossible to predict when conception took place. And even when contact has only occurred once between the male and female, fecundation does not necessarily coincide with this intercourse; as the ovule may meet the spermatozoa in different regions of the uterine system, and may therefore only be fertilised some days after copulation. The time required for the ovule to pass through the Fallopian tube also varies in different animals. In the Rabbit and Guinea-pig, for instance, it takes three days; in Ruminants from four to five days, and in the Bitch from eight to ten days.

And, as has been remarked, various circumstances may retard or accelerate the development of the fœtus; not only this, but with some animals it

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may apparently remain for a number of days in the uterus after it is ready for birth, without inconvenience to the mother or itself, just as it may be born several days before the ordinary period without compromising its safety.

For these reasons, the period of gestation can only be approximately fixed, though there are of course limits beyond which Nature, ever provident and watchful for the preservation of species, cannot go with ceasing to be natural.

Mare.

The usual period of gestation with the Mare is *eleven months*, though it may vary between ten and twelve.

From the observations of Winter, Brugnone, Tessier, and Grille, in 284 Mares, it results that the shortest period of gestation in this animal was 307 days, and the longest 394 days—or a mean duration of 346 days.

Gayot, in 25 instances noted at the *Haras* of Pin, France, found the average to be 343½ days; the shortest being 324 days, and the longest 367 days.

A writer in the *Journal d'Economie rurale belge* for 1829, cited by Rainard, gives as the minimum 322 days, maximum 419 days, the average being 347 days.

Colin gives the average as 345 days, though birth may occur at the 330th to 365th, and sometimes to the 380th day.

Dieterichs gives the shortest period as 307 to 317 days, and the longest as 409 to 419 days—the average being 336 to 342 days. Baumeister and Rueff give a minimum of 330 days, or eleven months, the maximum as 420 days, or fourteen months*—the average as 340 days, or 11⅓ months.

With regard to the influence of breed on the duration of pregnancy, we have the researches of Baumeister and Rueff; from these it appears that, with pure-bred Persian Mares, the gestation period was 341 days—343 for male foals, and 338 for females; in thorough-bred Arab Mares, the average was 338 days—339 for males and 337 for females; in high-bred Russian Mares, some of which belonged to the Orloff race, the average duration was 341½ days—341 for males and 342 for females. With English Mares, they found that in half-breds the average was 339⅓ days—340 for males, and 339 for females.

Saint-Cyr, referring more particularly to Gayot's observations, arrives at the following conclusions:

1. That in the Mare, the normal duration of pregnancy may be fixed between 340 to 350 days—this being the interval in which the majority of foals are born.

2. Some foals may be born alive from the 300th to the 310th day, but this is rare.

3. Births are frequent between 325 and 340 days;

* Hamon (*Recueil de Méd. Vétérinaire*, 1867) alludes to the case of a Mare seven years old, which went beyond her ordinary period of pregnancy, only manifesting at the usual time the customary signs of foaling; though these soon ceased, but recurred again in fifteen days, only to disappear in a short time. After this interval the animal appeared to be quite well, feeding and working as before. At the seventeenth month of pregnancy she was in the same condition; but on the fifteenth day of the eighteenth month, she was seized with serious symptoms which continued during four days, when death ensued. Hamon examined the body in the presence of many people, who were much interested in the case, and discovered a foal which weighed 75 kilogrammes, and was as fat and fresh-looking as if it had been extracted at the normal period. The tongue protruded from the mouth, the eyes were almost gone, the muscles were well developed but somewhat bloodless, and the position of the fœtus was natural. The umbilical cord had the same aspect as in ordinary cases, but there was no blood in its vessels, and it was ruptured at five or six centimetres from the abdominal walls. The fœtal envelopes were hypertrophied, their total thickness being four to five centimetres: otherwise they were healthy. The *cervix uteri* was of a great thickness and very rigid; when dilated it would only allow the passage of the fist. The *liquor amnii* was reddish-coloured.

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4. They are not rare from 350 to 365 days, but they are indeed so after the latter period.

5. We may consider 300 to 400 days as the extreme limits within which normal gestation occurs in the Mare; below or beyond these it ceases to be natural and really physiological.

6. According to the researches of M. Gayot, pregnancy is often a little longer for a colt than a filly; and though this conclusion is certainly not founded on a sufficiently large number of observations, it nevertheless acquires a certain degree of probability from being in conformity with what is observed in the bovine species.

It is also generally admitted that pregnancy is longer in the Ass than the equine species.

The average duration of pregnancy with thirty-three thorough-bred Mares which foaled at the celebrated Middle Park Stud, Eltham, in 1876, I find on examination to be 335½ days—the shortest periods being 316 days (one instance), and 318 days (one instance); and the longest 354 days (one instance), and 348 days (one instance). Between the 320th and 330th days, there were only 5 instances; between the 330th and 340th days, there were 11 instances; and between the 340th and 348th days there were 15 instances. Owing to some of the Mares having been put to the Horse more than once, and in some cases at intervals of several days, the averages may not be absolutely correct, as the last coitus has been the one which is reckoned from. But with one Mare (Entremet) put only once to the stallion (Rosicrucian), the period was 324 days; with another (Hilda) put to the same stallion, the period was 332 days; and with another (Imogene) and this stallion, it was 342 days.

With regard to sex, there were sixteen colts and seventeen fillies: the average gestation period of the former was 336½ days, and the latter 334 days. The shortest period (316 and 318 days) was with fillies, and the longest period was also with fillies (354 and 348 days). The ages of the Mares ranged from five to nineteen years; there being three at five, two at six, three at seven, two at nine, two at ten, six at twelve, four at fourteen, four at fifteen, two at sixteen, one at seventeen, one at eighteen, and three at nineteen. In the first group, pregnancy averaged 340 days; in the second 350½ days; in the third 328⅔ days; in the fourth 340½ days; in the fifth 336 days; in the sixth 337½ days; in the seventh 336½; in the eighth 333 days; in the ninth 340½ days; in the tenth 324 days; in the eleventh 330; in the twelfth 325. These figures would go to prove that the period of gestation decreases with age; and indeed we find that the shortest pregnancies occurred in Mares nineteen years old (316 and 318 days), and the longest in six and nine years old Mares (354 and 348 days).

The animals were of course kept in the most favourable conditions for breeding; and this, with their splendid qualities and precocity, doubtless shortened the period of gestation, which is below the ordinary average.

Cow.

It is commonly believed that the Cow is pregnant for the same length of time as woman, and this is to a certain extent correct, so far as the average period is concerned; but there are variations which must be taken into account, and which will be apparent if we look at the published results of various observers. Of 1062 observations made at the Agricultural School of Saulsaie, and by Blaine, Tessier, Grille, and Fürstenberg, we find that 15 were pregnant for less than 241 days, 52 from 241 to 270 days, 119 from 271 to 280 days, 544 from 271 to 300, 230 from 281 to 290 days, 70 from

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290 to 300 days, and 32 beyond 301 days. So that it would appear that, with the Cow, parturition is very rare before the 241st day; not so rare after the 300th day; somewhat common from the 240th to the 270th day; and quite common between the 280th and the 290th day; the average duration of pregnancy being about 283 days. Colin gives an average of from 280 to 285 days, though birth may occur at the 250th to the 300th day, and even later.

Dieterichs gives the shortest period as from 210 to 226 days; the longest between 326 and 353 days—average, 286 days; while Baumeister and Rueff give the shortest they observed as 240 days, and the longest 330 days—average, 285 days. The average of the Bernese Simmenthaler breed at Hohenheim was 280½ days: male calves 283, and cow calves 278 days.

Earl Spencer has furnished notes of 764 observations, which would go to prove that no calf can be born alive before the 220th, nor after the 313th day, and that it is impossible to rear those born before the 242nd day. Those births which occurred before the 260th day he considered as decidedly premature, while those which took place after 300 days were classed as irregular. In 314 instances, 310 calved after the 285th day, three went on to the 306th day, and one to the 313th. The average given is 284 to 285 days. Among the calves born between the 290th and 300th day, there was a decided preponderance of males; all those produced after the 300th day were females.

In the *American Journal of the Medical Sciences* for 1845, the result of observations on 62 Cows gives the longest period as 336 days, and the shortest as 213 days: the average for the male calves being 288 days, and females 282 days.

Cattle-breeders, we believe, generally entertain the notion, notwithstanding Earl Spencer's observations, that gestation is longer for a male than a female calf.

Sheep and Goat.

The Sheep and Goat go with young about *five months*. M. Magne carefully noted the pregnancy of 429 Sheep at the Alfort Veterinary School during a period of eight years, with the following result:—

2	instances of	143 days	57	instances of	150 days
15	„	144 „	49	„	151 „
22	„	145 „	23	„	152 „
30	„	146 „	13	„	153 „
55	„	147 „	7	„	154 „
68	„	148 „	7	„	155 „
80	„	149 „	3	„	156 „

From this list we observe that the difference between the longest and shortest period was only three days, by far the largest number of births occurring between the 147th and 151st days. The average duration of pregnancy was about 149 days. Gestation was longer with the female than the male lambs, and this Magne attempts to explain by the greater development and weight of the former, which rendered parturition more difficult and slow.

Colin says the average period in the Sheep is 151 to 152 days, though parturition may take place from the 145th to the 160th day.

Dieterichs gives the shortest period as 146 days, the longest 157—average, 151 days; and Baumeister and Rueff state the shortest period in the Sheep and Goat as 135 days, the longest 160—average, 144 days; the male lambs requiring, as usual, the longest period. With regard to breed, these authorities found that the period of gestation in Merinos averaged 150·3 days; while with Southdowns it was only 144·2 days, or six days less.

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In the Merinos, for the male lamb the average period was 151·1 days, female lamb 150·6 days, and twins 149·9 days; and in the Southdowns, for the male lamb 144·7 days, female lamb 144·1, and twins 144 days.

Magne asserts that the Goat goes a little longer than the Sheep—the average being five months and some days.

Pig.

The Pig is usually pregnant *four months*, or according to some authorities *three months, three weeks*, and *three days*. Baumeister and Rueff give the longest period as 130 days, the shortest 110—average, 120; while Dieterichs gives 109 days as the shortest and 133 as the longest—average, 115 to 116 days; and Magne says that it is rarely less than 109 or more than 120 days. Rainard noted the period of gestation in 65 Pigs, and reports it to be as follows:—

2	instances	104 days.
10	,,	110 to 115 days.
23	,,	116 to 120 days.
27	,,	121 to 125 days.
2	,,	126 days.
1	,,	127 days.

The average was, therefore, 119 days, the interval between the longest and shortest periods being 23 days.

Bitch.

The Bitch goes with young about *two months*, or from 58 to 65 days; the average being 63 days or nine weeks. Baumeister and Rueff state the shortest period to be 55 days, and the longest 70—the average being 60 days.

Cat.

The Cat is pregnant from 50 to 60, 62, or even 64 days, the average being 55 days or eight weeks.

SECTION V.—GEMELLIPAROUS, PLURIPAROUS, OR MULTIPAROUS GESTATION.

Among the domestic animals there are species which are naturally *uniparous*—produce only one at a birth; and others which, in a normal or physiological manner, bring forth two, three, or more at a time, and are therefore designated *gemelliparous* or *multiparous*, gestation being known as double, triple, quadruple, etc. As examples of *uniparous* animals, we may give the Mare, Ass, Cow, and Sheep; while we may cite the Pig, Bitch, and Cat as *multiparous* creatures. As multiparity is normal with the latter, we shall not refer to them, but will allude to those creatures which, naturally uniparous, sometimes bring forth more than one descendant at a time.

It is seldom that twins are produced by the larger domesticated animals, and particularly by the Mare and Ass, though instances are recorded of these; while in the Cow, Sheep, and Goat the occurrence of twins, triplets, or even more young creatures at a birth, are not so rare.

The causes of *multiparity* are not well ascertained. It may be due to simultaneous ripening of two or more Graafian vesicles, which, rupturing at the same time, allow the escape of the ovules they contain, and which may become impregnated at a single *coitus*. Or a Graafian vesicle may contain two or more ovules, as Bischoff has witnessed in woman; and these arriving together in the uterus, may be fecundated at one time. Or it may even happen that the vitelline membrane contains two yolks, as sometimes occurs

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in the fowl's egg; and as the vitelline mass is the essential part of the egg, it is evident that when this contains two of these masses, they ought, if fecundated, to produce two embryos.

In the first case, as Saint-Cyr points out, each fœtus has ordinarily all its annexes distinct and completely independent; or it may be that the two chorions are fused together, in which circumstance the two fœtuses will then have a common envelope. In the second hypothesis, this fusion of the chorions appears to be the rule, although the envelopes may also be independent; and in the third case—that of the two vitelluses contained in the same vitelline membrane—not only the envelopes, but also the fœtuses may become united more or less closely, and thus give rise to *double monsters*.

Finally, it is also possible that two ovules may become detached from the ovarian cluster, though not simultaneously, but successively; and be fecundated, one after another, at two consecutive copulations within a brief period. Occurrences of this kind, by no means rare, have been wrongly adduced as instances of superfœtation.

Mare.

Of all the domestic animals, the Mare is the one which least frequently brings forth more than a single creature at a birth; and Saint-Cyr has only been able to collect fourteen instances, though we have been more fortunate. Rueff admits that one case of gemellar gestation may occur in this animal in every 250 normal cases; but that the young are nearly always born dead, or die soon after birth. In the register of a stud, only one instance of twins was found in every 236$\frac{3}{7}$ births.

Demoussy, cited by Saint-Cyr, observed an example of double gestation; but the foals, though alive when born, perished soon after. Lemaître gives a similar instance; only that one of the fœtuses was expelled at four months, while the other was retained, was foaled alive at the usual time, and survived. Trélut has seen a Mare which, at the tenth month of pregnancy, cast two well-formed foals. She had been put to the stallion five times—on April 23, May 4, 16, and 25, and June 5; she aborted on March 15. Her abdomen was enormously large, and some time before abortion she had received a kick in the flank.

A fourth example of double gestation is related by Goux. The two foals—a colt and a filly—were alive when born, and continued to thrive. Saint-Cyr's father, an agriculturist, witnessed an analogous occurrence, the progeny also surviving; and Saint-Cyr himself saw a twin birth in a Mare, one of the foals, which was born dead, weighing 25 kilogrammes; the other, which lived, weighing nearly 26 kilogrammes.

In the *Veterinarian* are found a number of instances of twin foals in this country. Mr. Millington (vol. iv., p. 424) gives three cases of this kind, the foals being born alive. In vol. ix. (p. 450) an account is given of a Mare which died of hydrops uteri, in which were twin foals; in vol. xii. (p. 288) is another account of two born dead, and in vol. xvii. (p. 177) a similar instance.

A most unusual case of twin-birth is related in the *North British Agriculturist* for May 17th, 1876:—A Mare, the property of Mr. Chapman, farmer, Halnaby, gave birth to a colt and filly foal on the 2nd March, 1875, both living. On the 16th March, 1876, she brought forth two filly foals, thus giving birth to four foals—one colt and three fillies—in less than thirteen months.

The *Field* (May 10, 1873) reports a Mare in Devonshire, which produced twin foals three times within three years. The Mare went full time in each instance, but only one foal (they were all colts) lived for any length of time. According to the *Liverpool Mercury* (July 23, 1845) a Mare at Abringhall, fifteen years old, brought forth *four* colts in the space of fifteen months!

Raabe, in 1852, witnessed a *triple* birth in a five-year-old Mare; the three foals were born alive, and were completely developed, but they soon died.

Two instances of triple birth are given by Saint-Cyr, the most remarkable being that recorded by Paugoué. This occurred with a Mare which, put to the Horse *only once*, on February 17th, 1843, aborted during the night of September 27-28, two foals being found in one chorion; on the 25th of the following February, it produced a third foal perfectly formed, and which lived. In the second case, related by Devilliers, the Mare had been put to the stallion several times in May, June, and July. On

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March 10th it produced three properly-formed but dead foals, one having apparently ceased to live some days before.

In the *Veterinarian* for 1875 (p. 334) allusion is made to an agricultural Mare in Norfolk, eight years old, and not known to have been previously bred from, producing three foals at a birth. The first was dead, and appeared to have been so for several days. The second was born alive immediately after the birth of the first, but only lived about half an hour. The third was born dead seven hours after the second, but its condition showed that at the time parturition commenced it was alive. The foals were all of the same colour—bay—and were perfectly formed. The Mare made a good recovery. In the same journal for 1867 (p. 595), Mr. Newman, of Havant, reports the birth of three fine, well-developed foals, two of which were born alive and lived. The Mare, of the cart-breed, had gone the full period of pregnancy.

The most numerous instances of twin or triple gestation in the Mare are, however, to be attributed to two successive fecundations, of which Saint-Cyr has collected eight examples. In all of these, strange to say, the Mares had been put to a stallion of the equine and asinine species in succession, and brought forth each a foal and a mule. In the majority of these instances, the two fecundations were within a brief period—the one succeeding the other immediately, or, at any rate, within the same day; though in one instance there was an interval of fifteen days. Which was the elder of the two foals in these births—the one first born or the one first conceived? Though in the human species such a question might have some importance, with animals it has only a physiological interest; but the order in which they were born would, nevertheless, be the only rational assignment.

The female Ass more frequently brings forth twins than the Mare; but even in this animal such an occurrence is rare. In an average of thirty she-Asses, kept for the production of milk by a man at La Chapelle Saint-Denis, only four had twins in a period of seventeen years.

Cow.

Double, and even triple, births are not so unusual in the Cow, the former being far from uncommon. Indeed, it is so frequent in some breeds, and with individuals, that it has been suggested to produce by selection a breed of Cows which would habitually have twins.

Mr. J. Macgillivray, of Banff, in an excellent little "Manual of Veterinary Science and Practice," published in 1857, writes:—"A neighbour of mine, Mr. Peter Low, had a Cow, a splendid animal, of the cross breed, which had twin calves yearly for six successive years. Two of her female progeny have had twin calves repeatedly. Mr. Low kept one of her male twins, a bull; to him two Cows have had twin calves, and there are a number of Cows in calf to him just now. From this and other similar cases, I think there is no doubt but, by proper selection and management, a race of twin-bearing cattle might be established." And again he says:—"From a paper now lying before me, I shall record what I believe to be a unique case of a calf-producing Cow. I am indebted for the particulars to Mr. James Stephen, Balfluig Cottage, Alford. 'Memorandum regarding a small Cow of the black Polled breed, which belonged to the late Mr. Alexander Stephen, Farmton, Alford:—

Year.	Number of Calves at a birth.
1842	... 1—first calf.
1843	... 3—came to maturity.
1843	... 4—one died; seven in one year.
1844	... 2—came to maturity.
1845	... 3—came to maturity.
1846	... 6—died prematurely.
1847	... 2—came to maturity.
1848	... 4.'"

Rueff says that, with the Simmenthaler breed of cattle at Hohenheim, during an interval of ten years, there were four per cent. twin births.

Triple gestation is of course much more uncommon, but the instances on record are numerous.

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Dupuy mentions a very unusual instance of fecundity in a Cow which, at three births in successive years—1817, 1818, and 1819—brought forth nine calves, only two of which were not reared by the mother; these calves afterwards had only one offspring at each birth. Rainard speaks of one of his pupils delivering a Cow of three calves in the neighbourhood of Lyons; and Roche-Lubin gives two similar instances. In one of these the first two calves were born alive and reared by their mother, but the third, which was in a bad position, was removed dead six days later. In the second instance, the Cow, after producing a living and properly-developed calf, continued to strain and make fruitless efforts to get rid of the other fœtuses, until she died five days afterwards, when two calves attached to each other by the sternum were found in the uterus. Sperling records the case of a Dutch Cow which produced three calves; the first was a male, the second a heifer, and the third a heifer in a wrong position. In England Mr. Snowdon has seen a Cow which brought forth a living calf some hours after a dead one, and in a few minutes an anidian monster.

In the *Ipswich Journal* for October, 1875, mention is made of a Cow which produced six calves in twenty months, all living: first three fine calves, then one, and again two.

The *Liverpool Mercury* (April 9, 1847) mentions a Cow which produced sixteen calves in eight years—two calves at six births, three at one birth, and one at another birth. The *Mark Lane Express* (May 11, 1852) alludes to a Cow which brought forth three calves at a birth—making eleven calves before she was seven years old. The *Chester Chronicle* (February 18, 1865) reports the birth of three full-sized calves by a Cow, all of which did well; and the *Shrewsbury Chronicle* (July 5, 1844) gives a similar instance, but the calves, born during the night, were found dead in the morning. In the *Field* for June 17, 1876, the birth of three calves—a Bull and two Cows—is reported. They were alive and doing well.

Quadrigemellar gestation is also sometimes observed in the Cow.

Rainard gives two instances; and Hamon mentions a little Breton Cow which, in 1858, produced four calves—two male and two female, the last two dying soon after birth. Gellé gives a remakable instance of a Cow which, in 1837, had three calves, in 1838 two, in 1839 two, in 1840 two, and in 1841 four! One of the last was a heifer; all were well-developed and successfully reared, and the last four, at five weeks old, weighed about forty-five pounds each.

The *Veterinarian* (vol. xiii., p. 579) gives an account of a delivery, with assistance, of four dead calves. This journal also (vol. xiv., p. 15) records a case in which, with assistance, a Cow was delivered of four calves—two dead at birth and two alive, though these soon expired. They were properly developed, and appeared to have been healthy up to parturition; they weighed, respectively, 25½, 24, 17¾, and 17¼ lbs. From the structure of the placenta, it was concluded that each fœtus had been contained in a separate membrane and fluid. The birth was premature by two months and nine days. In the same journal (vol. xvii., p. 424) another quadruple birth is described; the calves were well developed and all born alive, though they soon after died.

According to the *Chester Chronicle* (March 5, 1847), a Cow brought forth three calves, and in three days a fourth. All died soon after. The *Field* (December 7, 1872) describes the birth of four calves by a Cow about four years old, and which had twins at a previous calving. One calf died, but the others did well. The *Liverpool Mercury* (March 28, 1845) reports a Cow as having produced four calves—full-sized, but dead. *Eddow's Shrewsbury Journal* (July 29, 1846) alludes to a Cow which gave birth to four bull-calves, three of which lived.

Mr. Cartwright, of Whitchurch, gives an instance of four calves at a birth. The Cow and calves died soon after.

The *Revue Vétérinaire* of Toulouse (February, 1876) gives a case of quadrigemellar parturition in a Durham Cow, aged twenty-two months, near Rochefort. Birth occurred naturally in an hour; two cow-calves were first born, then two males; three did not live beyond an hour, the other survived thirty-six hours.

Quintuple pregnancy is very rare in the Cow.

In the *Giornale di Veterinaria* for June, 1855, Professor Lessona, of Turin, describes a quintuple birth in a Cow in Piedmont. The animal was twenty days from its full time. The abdomen was very voluminous, but beyond the premature delivery there was nothing unusual attending the birth. The progeny consisted of three females and two males, and each weighed about 37½ pounds. They were healthy and fully developed; but the mother, either through her premature delivery or from age, was unable to suckle them, and they were put to another Cow whose milk proved unsuitable for them, as they had an attack of indigestion, and in about eight days after birth all were dead. Lessona thinks two were lodged in the same envelope in each horn, and that the fifth fœtus, with a single placenta, occupied the body of the

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uterus with its proper envelopes. A singular fact was their being all presented for delivery in a normal position—a very extraordinary circumstance. The Cow had produced twin calves the preceding year.

In the *Veterinarian* (vol. xxxii., p. 200), Mr. Forbes, of Reigate, mentions a Cow, six years old, which at her third calving produced—three weeks premature—five calves at a birth—four bulls and one cow. Three of the calves died in a few hours, the fourth in a day, and the fifth two days after they were born. Still more remarkable is the case recorded in this journal, by Mr. Garrard, as having occurred at Repton. A Cow, cross-bred and eleven years old, and which had never previously brought forth more than one calf at a birth, produced five living healthy calves, all of which, when he wrote some days afterwards, were alive and vigorous, and had every appearance of continuing so. They were all nearly of one size, and were larger and stronger than might have been supposed. Four were bull-calves, and during parturition the first four presented in a natural position, but the fifth was a breech presentation.

The *Chester Chronicle* (February 11, 1854) reports a Cow, between ten and eleven years old, producing five calves—four males and one female—all of which lived. The calves were nearly of the ordinary size, and were strong and lively. In *Eddow's Shrewsbury Journal* (September 9, 1874), mention is made of a Cow which had been purchased as barren, but which in due course produced a dead calf, on the following day another, and so on until four were born. The Cow then died, and on being opened a fifth calf was found. Mr. Litt, of Shrewsbury, in the same journal gives the particulars of the case of a Cow which died within a fortnight of calving, and on being opened no fewer than five fully-developed calves were found in the uterus. They were nearly uniform in size, and with the exception of one, which was rather emaciated, they were in a remarkably well-nourished condition. They consisted of four females and a male, and were very little smaller than ordinery calves at birth, being about the usual size of twins. Mr. Litt was of opinion that, had they been born at the proper time, they would have lived. The Cow had not thriven so well as its companions for some time, but up to the morning of the day previous to decease, it appeared to be in perfect health. Death was probably due to the excessive drain upon the animal's system produced by so many young.

Schumann, in 1854, reports a quintuple birth—all males, and dead-born. Rueff records another, in which all the calves lived—and one which occurred at Havingen, in a five-year-old Cow. Baron also refers to a similar instance. Mr. Garrard, of Ticknall, however, has a more favourable report of a birth of this kind. In 1854 a Cow gave birth to five living healthy calves, all of which were, when he wrote (a week after birth), alive and vigorous, and likely to continue so. They were nearly all of one size, and larger and stronger than could be supposed. Four were bull-calves. The Cow, by no means a large one, was eleven years old and of a mongrel breed, and had never produced more than one calf at previous gestations. She did not manifest any unusual symptoms of exhaustion; the first four calves presented naturally; the fifth was a breech presentation.

Kurds speaks of a Cow which aborted seven fœtuses; while Kleinschmeid (*Magazin für Thierheilkunde*, 1857) mentions having found fifteen embryos in the uterus of an animal of this species!

Sheep.

With the Sheep, twins are a very common occurrence; and it is a saying that in a good flock there should be as many lambs as Ewes, the double births compensating for the losses. Instances of extraordinary fecundity are also by no means rare, and would appear to pertain to particular breeds. Daubenton states that, in the counties of Julliers and Clèves, every Sheep brings forth two or three lambs twice a year—five Sheep producing twenty-five lambs in twelve months. In French Flanders, according to Magne, who cites Corneille as his authority, there is a very prolific breed of Sheep, each ordinarily producing three, sometimes four, five, and six, rarely seven lambs, at two births during the year. Tessier, speaking of this breed, while admitting that twin lambs are not an ordinary occurrence with Sheep, assures us that in a flock composed of 371 Ewes, there were 22 double births; and he mentions having seen a Sheep that was twenty years old, which had bred every year. A Ewe at Hohenheim, in 1845, brought forth one lamb, the first; in 1846, two; in 1847, five; in 1848, four; 1849, three; 1850, two—in all seventeen lambs at six births. Four of these were males, and thirteen females.

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In our own country such fecundity is not very uncommon.

For instance, in the *Chamber of Agriculture Journal* for March, 1871, there is a notice of extraordinary prolificacy related by Mr. Angus, of Lowthorpe, Hull, who says :—"Last year one of my Ewes of the Lincoln breed, brought forth six lambs, all living. I had great difficulty in persuading my neighbours to believe this, although the fact was quite clear and well attested. I gave her a private ear-mark, and last Michaelmas a separate red mark also. As we saw this spring that she was getting heavy, we kept her quite separate from the rest of the Ewes, and last Thursday she produced another six lambs. Some of these will not survive, as they were a few days before their proper time ; but all are complete and well formed, and the Ewe is now suckling one lamb." "The especial wonder about this woolly mother," adds the editor of the journal, "is that she belongs to a breed in which it is rare for a Ewe to drop more than three lambs, while good luck among the Lincoln flocks is 'one half pairs,' with occasionally a three."

The *Carmarthen Journal* (March, 1844) alludes to four Ewes in that county, which in one week yeaned fourteen lambs ; one had five lambs, and these all did well. The *Chester Chronicle* (May 25, 1867) mentions that a little Welsh Ewe at Birkenhead had two lambs in the spring of 1864 ; in 1865 three, all alive ; 1866 four, all living ; and in 1876 five, four of which lived, and were in good health. *Bell's Weekly Messenger* (June 29, 1844), states that a farmer in Kent had a Ewe which dropped the extraordinary number of six lambs, four of which it reared, and the other two were brought up by hand. The previous season the same Ewe produced four lambs, all of which were reared and turned out well. According to the *Chester Chronicle* (April 11, 1868), a farmer at Otley, Yorkshire, had a Ewe, five years old, which had produced fifteen lambs. When one year old it had two, at two years four, at three years two, at four years four, and at five years three. The *Salopian* (April 6, 1872) speaks of a Ewe at Wem, Salop, which gave birth at one time to five lambs the previous year, and these were all reared, and in this year six were born, five of which lived. The *Chester Chronicle* (April 19, 1873) alludes to a Ewe which produced an annual average of three lambs for seven years ; the animal itself was one of three. The *Shrewsbury Chronicle* (June 26, 1874) reports that a Shropshire Ewe lambed twice in six months, producing twins each time ; and the *Field* (May 12, 1873) gives an instance of a Ewe having five lambs, one of which died in a few days, but the others did well. The *Oswestry Advertiser* (October 2, 1872) instances a Ewe which gave nine lambs in two seasons—three and six—all fine lambs, and in perfect health. And in the *Cambrian* newspaper for the same month, it is mentioned that "Mr. J. M. Harding, of the Town-Hill Farm, Swansea, has just had an extraordinary piece of good luck in lambing. From a small flock of seventeen Ewes, he has had no less than thirty-seven lambs, all alive and doing well. Every Ewe has brought 'doubles,' and three have brought 'triplets.' It is not only the number of lambs, but they are all strong and healthy. . . . There is no reason to doubt that the remainder of the flock will be equally prolific."

In the *Nottingham Journal* for 1846, it is stated that a Ewe in that locality brought forth five lambs at a birth, all alive and likely to continue so.

Mr. Litt, already quoted, mentions the case of five Ewes which had been attacked with symptoms of brain disorder shortly before lambing, and soon died. Each, when opened, was found to have four lambs, making twenty in all.

The *Lynn Advertiser* for February, 1872, states that a Ewe in that locality lambed on the 11th of that month, the lamb living twenty-four hours ; again on June 28th, and on January 21st, 1872, bringing forth twin lambs on the last occasion. The Ewe thus lambed three times in a year and ten days.

In 1875 Mr. Robert P. Greenhill, of Elmbridge, near Droitwich, was in possession of a Ewe, seven years old, which had produced no fewer than 20 lambs—a small flock. In the first year she gave birth to 2 ; in the second, 1 ; third, 3 ; fourth, 3 ; fifth, 4 ; sixth, 4 ; and seventh, 3.

And at Shaftesbury, it is recorded in May, 1876, that a farmer had some Ewes fatting, and a neighbour's ram got with them ; consequently, 13 of them proved to be in lamb, and produced no less than 31 lambs, all born alive (a few dead since), as follows :—

1 single	... ...	1
8 twins	... ...	16
3 threes	... ...	9
1 five	... ...	5
13 ewes.		31 lambs.

Other and similar instances might be quoted.

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It may be remarked, that extraordinary fecundity in Sheep is seldom observed in the highest-bred races, which are usually uniparous; it appears to pertain more to the common breeds. Not only this, but certain years are more remarkable than others for double, treble, and quadruple births in this species.

Goat.

The Goat is generally considered a uniparous animal, but it would appear that this is a mistake, as double and triple births may be said to be the rule; not at all infrequently four are produced. But usually with the three or four at a birth, one or more are feeble or born dead. It is looked upon as exceptional for only one kid to be produced at a birth.

The question has been much discussed as to whether these multiple births in animals ordinarily uniparous, are the result of one or successive copulations. The majority of the authorities in such matters are certainly of opinion that a single copulation will suffice to fecundate several ovules, and they doubt if, after a fruitful copulation, it is possible for the spermatozoa to reach the ovary, supposing a second ovule to be developed, unless the second impregnation takes place very soon after the first, and before the fertilised ovule had descended into the uterus. The well-authenticated instances of superfœtation, though rare, nevertheless rather militate against this opinion; and it would appear to be impossible to explain why one animal among several hundreds, perhaps thousands, should alone bring forth "doubles" or "triplets," while all the others, placed in the same hygienic conditions, have only one offspring. It is a fact, however, that with certain breeds of Sheep an abundance of nourishment and plentiful years dispose to these multiple births.

What has been said of uniparous animals does not at all apply to those which are multiparous; for although the latter may be impregnated at a single copulation, and bring forth several young, yet, as a rule, they are fecundated more than once, and in fact do not cease to seek the male until after several copulations.

In these cases of multiple gestation in creatures naturally uniparous, one of the fœtuses occupies the ordinary situation of single gestation: the head towards the cervix uteri, the larger portion of the trunk in the body of the uterus, and the hind quarters and limbs in one of the cornua. The second fœtus occupies the whole of the other cornu; with the head turned back, or, as occurs not infrequently, in the opposite direction, and so on.

The duration of gestation in these cases is generally shorter than that of single pregnancy in the same animal, probably in consequence of the unusual distention, as well as derangement of the principal functions in the mother. The weight of the young, individually, is usually less than the average; but, collectively, it may be very much greater than that of one young creature produced at a birth. Thus in the quadruple birth recorded by Magdinier, each fœtus weighed ten to eleven kilogrammes; in that by Bouchard they only weighed from eight to nine kilogrammes; in the quintuple birth described by Cassina, each calf weighed seventeen kilogrammes, or eighty-five for the entire birth—an enormous weight. Lignana, another Italian veterinary surgeon, mentions that in a double birth in a Cow, one of the calves which was born dead, though at full time, weighed twenty kilogrammes; and the other calf, which was alive, weighed forty-three. In the double birth observed at Saulsaie, in which both calves were born alive, one was twenty-eight kilogrammes and the other thirty-one.

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Free-martins.

A curious fact in connection with this subject in the *bovine* species, is that when the young are of both sexes, the *female* is in general unproductive. This fact is well known in many countries, where the female calf receives a particular designation: as "Free-martin" in Britain; in Holland, "Queenen;" in Germany, "Zwitter," or "Zwilling;" in Swabia, "Zwicker;" in Piedmont, "Mugne;" in France, "Loures," "Taures," etc. The old Roman agriculturists knew these animals as "Tauræ." It is very rare, indeed, that the male is infecund. Baumeister, however, gives an instance in which a Bull—a twin—was put to a hundred Cows, none of which produced a calf. In Switzerland it is the belief, that when the cow-calf is born first, it will not be sterile; and that when, on the contrary, the male is born before the female, it will be unproductive. The female twin is generally a hermaphrodite, and in form more of a male than a female; the vulva is excessively contracted, and the vagina a *cul-de-sac*. The mammæ are also feebly developed, sometimes appearing as a mere trifling fold of skin, at others as a voluminous sack. The animal is usually long-legged, with muscular hind quarters. Internally, in some instances the uterus is undeveloped; in others, the ovaries are absent, and instead of them there are testicles. With others, again, there is no trace of a uterus, the vagina ending in an infundibulum: a condition which is readily ascertained in the living animal by introducing the finger. The clitoris is sometimes enormously developed, and not unusually the urine is expelled powerfully backwards. Ordinarily the "free-martin" does not evince any sexual desire.*

The rule does not always hold good, however, as to the infecundity of this twin calf, as instances are on record in which it has bred. For instance, in the *Veterinarian* (vol. ix., p. 22) there is an authenticated case in which the female of a twin birth, when five months old, became pregnant, and in due course produced a calf. The next birth was *twin* calves.

Diagnosis of Multiple Pregnancy.

The *diagnosis* of *multiple pregnancy* in animals ordinarily uniparous, is not very certain. It is usual to say that the signs are only those indicative of a single fœtus, but exaggerated. The belly is more voluminous than when there is but one, especially in the early months; the respiration is more than usually embarrassed; the animal lies frequently, and soon moves lazily and heavily, while the posterior limbs become œdematous. These signs, it will be remarked, are obscure, as a large foal or calf may occasion the disproportionate size of the abdomen and alteration in breathing; so that at best they only afford a vague presumption as to the condition of the mother. It is also

* One of the latest recorded examinations of these creatures is given in the *Œsterreichische Vierteljahresschrift* for 1875 (p. 78), and was brought to the notice of the Gresnter Land and Forest Society of Austria, the veterinary surgeon to which furnished the anatomical details. The Society purchased the calf three and a half years previously, and it had never exhibited any signs of sexual instinct during that period. It was therefore killed. It was in good condition, and of the Mürzthaler breed. The head and physiognomy had a most singular appearance, resembling that of a monkey, though the horns were strongly developed. The udder was little and hard, and the vulva small and contracted, although normal; on opening the labia no trace of a clitoris could be found. The vagina was nine to ten centimetres in length, and instead of extending forward to the cul-de-sac, which is often very dilated in Cows, it terminated abruptly in a funnel-shaped aperture, and here the genital organs ended; for the cervix uteri was absent, as was the uterus and Fallopian tubes, and it was only in the vicinity of the external angle of the ilium that were found small ovaries closely and curiously enveloped in fat, so that they could scarcely be recognised. The glands of Bartholin in the vagina were almost as large as an egg, and were full of blood; instead of the valve in the vagina there was a small impermeable opening. On incising the mammæ the gland substance was found to be absent, and in its stead was fibrous and adipose tissue. In fine, this twin was destitute of uterus and oviducts, and the vagina was short and constricted.

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said that the belly is larger on the side on which it is usually least enlarged—the left; in others, both sides are enlarged at the same time, and there the movements of the young are most evident. But this sign, in addition to being far from constant, depends upon the relative position of the progeny; as when there are two one may occupy the body, the other the cornu, of the uterus. Neither does an examination *per rectum* or *vaginum* afford any certain indication of a multiple gestation; as the number of young, supposing there are more than one, cannot be sufficiently distinguished.

Auscultation, if it could be successfully applied to the larger animals—which are usually uniparous—would doubtless greatly aid in diagnosing whether a gestation was single or multiple. The distinct pulsation of the fœtal hearts, especially if at a distance from each other, and if the number of pulsations were different in the respective situations, should be conclusive proof of multiple pregnancy. It would, of course, be important to note the different situations of the pulsations, as the action of the fœtal hearts might be at times synchronous. Care would also have to be observed not to confound the beating of the maternal heart with that of a fœtus.

Position of the Fœtuses in Multiple Pregnancy.

The *relative position* of the young in the uterus in the cases already briefly alluded to, is important to remember. With regard to each other, it may be said that they usually occupy four different positions: 1. Each fœtus may be isolated and enveloped in its own proper membranes; 2. If there are two fœtuses they may have a common envelope in the chorion, and otherwise have a second separate sac; 3. Both may be developed in the same cavity and the same amniotic fluid, their membranes being common, and no partition existing between them; 4. One fœtus may be contained within the other by "inclusion," as in some of the monstrosities of which we will speak hereafter. It may be necessary, however, to state that the included fœtus may be contained in the abdominal cavity of the other individual, constituting deep and abdominal inclusion; or it may be enveloped in a subcutaneous tumour —when it is superficial and cutaneous.

In the first variety of gestation, the envelopes, where they are in contact, adhere together by means of a fine connective tissue; the placentæ are often confounded (in ruminants), or united by a kind of membranous connection, though their circulation remains distinct. In such a case the young may be expelled from the uterus together—a frequent occurrence in the Goat, according to Rainard; but more commonly, after the birth of the first fœtus, the uterus contracts on itself, enclosing the remaining progeny, which may not be born until some days after—long enough sometimes to give rise to the belief that it is a case of superfœtation. This apparently prolonged retention of the second fœtus is generally due to the fact, that the first is expelled prematurely, because of the excessive distention experienced by the uterus; this organ, having thus got rid of its embarrassment, and become relieved, can then maintain the second fœtus until the usual time expires. An illustrative case is given in the *Memoires de la Société du Calvados* for 1831-32. A Mare gave birth to a dead foal after four months' gestation, and at the ordinary time a living foal.

If one of the foals dies in the uterus, the other being contained in a separate envelope, may continue to live and grow. In somewhat rare cases, the dead fœtus remains in the uterus, becomes desiccated, and is not expelled until the birth of its companion at the usual period; or, which is more com-

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mon, it acts in the uterus as a foreign substance whose presence is irritating, and by inducing contractions of that organ it is extruded, while the living fœtus is retained and grows until the normal time for delivery.

The fœtus that has died during gestation may be kept in the uterus for a long time, through close adhesions existing between that organ and the placenta. A case is on record in which a fœtus was retained in this manner for two years. Rainard gives an instance of a Mare which retained a dead fœtus for a year; the animal was then fecundated again, but having perished while pregnant with the second foal, an examination of the uterus was made, and the two young creatures were found—the first being mummified.

Death of the fœtus in these multiple cases appears to be due either (1) to the stronger vitality of the one which lives, and which, by attracting to itself

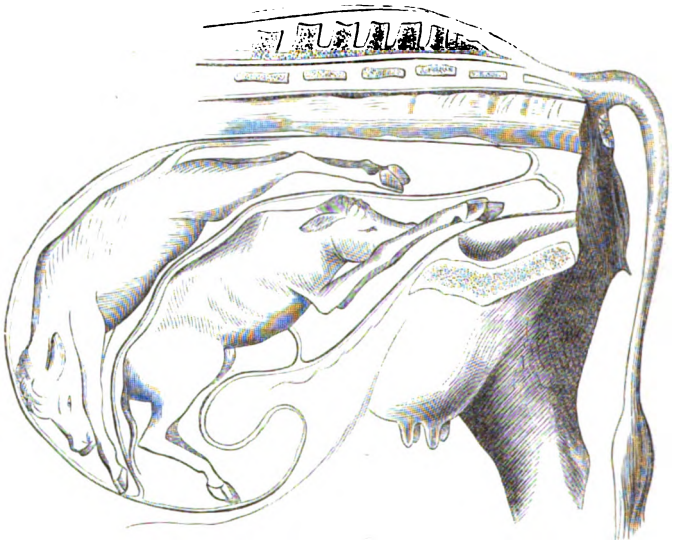

Fig. 53.

TWIN PREGNANCY: COW.

a larger share of nutriment, starves the other; (2) to the too considerable increase in volume of one fœtus, which compresses and atrophies the other; (3) or to the separation of the fœtal from the maternal placentæ, which, of course, causes an interruption to the circulation of the young animal, and a suspension of nourishment and the decarbonisation of its blood.

In the second variety of gestation, in which the chorion is common to the two fœtuses, but which are yet separated by the amnion, there is only one placenta; the two having a circulation in common, through their placentæ and the umbilical vessels communicating by their vascular ramifications. In this case the expulsion of one fœtus necessarily brings about that of the other. This also occurs when both are contained in the same envelopes.

I believe only two instances are on record of inclusion: that of the first mentioned variety, in which one fœtus was found in the abdominal cavity of the other. Bartholin, the celebrated anatomist, at the commencement of the seventeenth century described the case of a Mare which brought forth a mule,

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in the abdomen of which was found another; and Gurlt (*Magazin für Thierheilkunde*, 1869, p. 347) mentions an instance in which one fœtus was developed within the abdominal cavity of a calf, and consisted of an incomplete left hind leg, a membraneous organ representing the uterus, and the skin and some vessels. It may be remarked, however, that Rainard witnessed an instance of this abdominal inclusion in a goose. The egg was double the ordinary size, and it had another inside of about the ordinary dimensions; each had a perfectly formed shell. The subcutaneous tumours of young animals, containing either a whole fœtus or portions of a pre-existing one, are common in animals.

CHAPTER VI.

Hygiene of Pregnant Animals.

THE hygienic measures to be observed in the management of animals during gestation are, in general, those which should prevail always, irrespective of this condition. But besides these general principles, there are a few particular precautions to be attended to, in order that this period may be safely and successfully passed through, and these precautions are all the more necessary as the period of birth approaches. Unlike the human female, pregnant animals do not require those careful, numerous, and minute attentions so essential to her health and the welfare of her offspring; indeed, too much nursing and pampering, by removing animals further from their natural condition, is unnecessary, and likely to do more harm than good.

When an animal is believed to have been fecundated, it should not be allowed near the *male* again; as in the artificial state in which domesticated creatures are usually kept, attempts at coitus may do harm; though it must be confessed that among Cows the bull often remains in the same pasture with them, and they calve as regularly and as safely as if they were not so exposed.

With those animals which are employed in labour—as the Mare, and sometimes the Cow—it is well not to work them severely nor fatigue them much, and particularly as pregnancy is advanced; and, on the other hand, absolute repose is pernicious. *Exercise* is most beneficial, and the most difficult cases of parturition occur among animals to which this is denied. The pregnant Mare will accomplish ordinary and accustomed work, particularly if it be slow, without any harm, perhaps with benefit, until the seventh, eighth, or ninth month, when more care must be observed; but moderate exercise should always be allowed up to the period of parturition. Harness is preferable to saddle work for pregnant Mares; and fast trotting, galloping, jumping, travelling over broken ground, or severe and sudden exertion, injuries, or shocks of any kind, are to be avoided—in fact, extremes should be guarded against.

If the animal must be employed for riding, the use of spurs should be interdicted, because of the sudden contraction of the abdominal muscles which their application induces, and which may lead to abortion.

Should the animal not be usefully employed in this way, then it ought to be regularly exercised in hand, or placed in a paddock provided with shelter from inclement weather.

The Cow, if employed in labour, may be worked moderately until the sixth or seventh month. If kept for milk production, the milking should

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also cease about this period; though with well-fed Cows it is often prolonged until near parturition. Nevertheless, there can be no doubt that this practice is prejudicial to the fœtus, by arresting or retarding its development, through diverting into the mammary glands the materials which should be disposed of in the uterus.

Exercise at pasture is beneficial to all animals, even the Pig and Bitch are greatly benefited by movement.

The *food* of pregnant animals is an important consideration. Creatures in this condition should be well fed, and especially if they have to accomplish a certain amount of labour or yield milk. The appetite is generally increased, and there is, as has been already observed, a tendency to fatten. This tendency should be somewhat guarded against, as it may prove troublesome; particularly if it is allowed to proceed to an extreme degree, when it may retard the development of the fœtus, induce abortion, cause difficult parturition, or give rise to serious after-consequences. This precaution is more to be observed in the second than the first half of pregnancy, when the food should be plentiful, but not in excess, and flesh more abundant in the animal than fat.

The *food* should also be of good quality, very nutritive, easy of digestion, and not likely to induce constipation.

Indigestion should be carefully guarded against, and unaccustomed, hard, damp, bulky, fermentable, mouldy, or otherwise hurtfully altered food, should be avoided, as it is likely to prove indigestible, occasion tympanitis, and produce other injurious results.

Grazing on pastures is favourable to the pregnant condition of herbivorous animals, and especially if the land is not too broken, or sloping, and the herbage is good; as they take their own exercise, and breathe a purer atmosphere than that of stables or sheds. But it must be remembered that they should, if possible, be protected from damp, fogs, cold rain, stormy weather, etc. If the herbage is not sufficiently abundant and nutritive, it should be supplemented by an additional allowance of food.

In connection with food, it may be well to observe that, besides the ordinary saline matters which it is beneficial to add to the ration, especially when it is prepared for the animals, in those regions where inflammation of the joints of young creatures, and other morbid conditions due to the deficiency of certain mineral constituents in the economy, are noted, it may be necessary to add these constituents to the food of the pregnant animal.

The phosphates so necessary for the formation of certain tissues of the body, for instance, may be deficient in the herbage; and this may be compensated for by giving, in addition to bran, meal, oil-cake, etc., and even properly-prepared bone-dust.

The *water* should be pure, and plentiful at all times; as then the animals will drink only moderate quantities, and when necessary.

A point to be particularly attended to, is not allowing pregnant animals to drink very cold water, nor eat food at a low temperature. We have seen that the fœtus is extremely susceptible to the action of cold, and abortion is by no means unusual through the operation of this susceptibility.

Very cold water, frozen food—such as roots, or herbage covered with white or hoar frost—should therefore be withheld from pregnant animals, as they are likely to induce abortion, metritis, and other serious accidents, either through their direct action upon the fœtus, or indirectly through the derangement they may set up in the digestive apparatus.

With regard to *dwellings*, the hygienic rules which should always be ob-

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served in buildings in which animals are kept, ought to be rigorously enforced with regard to those in which pregnant creatures are lodged. Cleanliness is, above all things, necessary to be observed. Near foaling time—three weeks or a month—the Mare should be kept apart in a roomy loose-box, and when convenient, within sight of the other horses with which it has been accustomed to associate. The Cow is usually allowed to remain in its ordinary stall in the cow-shed; but overcrowding and want of space should not be allowed, and every Cow, towards the end of gestation, ought to have plenty of room in its stall, if a separate box cannot be allotted. Stables, sheds, and loose-boxes should have wide doors, to prevent injury to the females. With stalls, the floor should slope very little indeed, from before to behind; as if the inclination is at all marked, the weight of the gravid uterus is thrown backwards, and this may lead to abortion, prolapsus of the vagina, and even eversion of the uterus. The cow-shed ought to be kept very clean and free from bad smells, and have plenty of fresh air. The stalls should have plenty of litter, so as to prevent the Cows soiling themselves. Should a case of abortion occur in a stable or shed, among pregnant Cows, the one which has aborted ought to be removed at once, and the place it occupied thoroughly cleansed and disinfected, every trace of the accident being most scrupulously obliterated.

Cows which afford indications of approaching abortion, ought also to be removed from the vicinity of other pregnant animals, and kept apart from them so long as there is any vaginal discharge; the same precautions which must be adopted with regard to thorough disinfection and cleansing, are likewise necessary here. It is not advisable to have Cows bring forth among others, whose period of gestation has not arrived.

The *cleanliness* of the animals themselves is not to be overlooked; as neglect of grooming and freeing the skin from dirt, must operate perniciously not only on the mother, but on the fœtus.

Mental and physical *tranquillity* are essential conditions of successful gestation. Harsh or cruel treatment on the part of grooms, cow-keepers, shepherds, and others, should be sternly suppressed; and fear, generally produced by young dogs hunting the animals, and particularly pregnant Sheep, is especially to be averted, if possible. It is not wise having animals of other species in the same field or pasture with those which are pregnant, more especially towards the period of parturition.

With an irritable or timid primipara of the larger animals, it is well to be gentle, and to accustom it to manipulation, particularly about the udder, in order that it may the more readily allow its progeny to approach it without danger.

Surgical operations, and medication in general, should be proscribed as hurtful during this state, unless they are urgently needed for the cure of disease. Above all, it is necessary to guard against the use of drastic purgatives, or even laxatives, for the relief of constipation which may not exist; as with some animals these agents, by increasing the peristaltic action of the bowels, indirectly excite contraction of the uterus. If there is constipation, suitable diet is a safer remedy than purgatives. Powerful narcotic, sedative, and other medicinal agents, if they do not injure the mother, may imperil the life of the fœtus.

We have no sufficiently trustworthy facts to prove that female animals are amenable to those mental influences which, in the human species, and known as "maternal impressions," have such a marked effect on the development or characteristics of the fœtus.

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BOOK III.

PATHOLOGY OF GESTATION.

THE *pathology* of gestation may be said to include those diseases and accidents which constitute deviations from the regular or normal series of physiological phenomena characteristic of this condition. These deviations are somewhat numerous and various, and we will follow Saint-Cyr in classing them under three distinct heads: *anomalies*, *diseases*, and *accidents*. We will study these in this order.

CHAPTER I.

Anomalies in Gestation.

THE anomalies occurring in gestation are *superfœtation*, *extra-uterine pregnancy*, and *spurious pregnancy*.

SECTION I.—SUPERFŒTATION.

The term *superfœtation* (*fœtus super fœtum*—one fœtus on another) has been employed to designate these cases of conception in which an animal, already pregnant, has been supposed to conceive a second time before the termination of the primary gestation. In ordinary double or triple gestation, the same copulation has produced the young at once; but in superfœtation they are supposed to be formed at a more or less wide interval of time, and of course by different copulations.

The belief in the possibility of such an occurrence in woman was common among the old writers, and cases are adduced in support of this view; but its correctness has been much disputed by some recent authorities.

Aristotle admitted the likelihood of superfœtation taking place in woman, because during pregnancy she was always with her husband; but he denied its possibility in the Mare, although he was aware that it might receive the male several times. In all probability, he imagined that the instinct of the Mare would repel the stallion after impregnation. The naturalists and hippiatrists who succeeded him, have also denied that such an abnormal occurrence could take place in the Mare; because, they declared, after conception the orifice of the uterus is closed, so that the semen of the male cannot be introduced; every double birth, they also maintained, was due to two ova being impregnated at the one copulation.

But numerous facts recorded by competent authorities, would go to prove that superfœtation is not only probable, but possible; and that if, generally, there is only one successful copulation possible, on the other hand there are instances well vouched for, in which two successive copulations have been followed by two independent impregnations. In *uniparous* animals such cases have been frequently observed, the most convincing of which is the production of a mule-foal and a horse-foal by the same Mare at one birth.

An occurrence of this kind is mentioned in the *Memoires de l'Académie Royale des Sciences* for 1753; a Mare at Châtillon-sur-Sèvre brought forth a horse and a mule foal. Demoussy speaks of a M. Maillard, a wealthy farmer and breeder of horses, who had occasion to observe a similar occurrence.

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In the *Journal Vétérinaire Pratique* for 1826, there is an account of a Mare which, covered on the same day by a male-ass and stallion, brought forth in eleven months a well-formed, though weak mule foal, and a full-developed, but dead horse foal. In the same journal for 1836, there is another case of this kind recorded. A Mare had been put to an Ass stallion at St. Maixent, and was shut up in an enclosed space; into this, however, a Horse stallion, two years old, broke, and covered this animal several times in the course of the same day. The Mare obstinately refused to be covered when afterwards put to the Horse, according to custom. At the usual period of parturition it produced two foals, one evidently belonging to the equine species, and the other a well-characterised mule. These two young creatures, when three months old, were presented to M. de Vaublanc; they were then being suckled by the Mare, and were in perfect health. The fact was verified by the Mayor of the Commune, and communicated to the administration of the Stallion depôt of St. Maixent.

In Moll and Gayot's "Connaissance General du Cheval," Ayrault states that in Poitou, France, a Mare was put to a stallion Ass on March 7, 1855, and on the 28th, being still "in season," was put to a Horse. The following year, during the night of April 14-15, this Mare produced a colt foal at eight o'clock, and a filly mule at eleven o'clock; so that the oldest fœtus was born three hours after the youngest.

In the *Journal des Vétérinaires du Midi* for 1859, Dr. Chabaud relates that in the Commune of Verniolle (Ariège), a Mare was put to a stallion Ass. As œstrum continued, it was put to a stallion fifteen days afterwards. Nothing unusual occurred during gestation, and when parturition took place, a fine healthy foal was born, and after ten minutes' straining, to the astonishment of the owner, a good well-formed mule. The Mare suckled the two, and they did well.

In the *Journal des Vétérinaires du Midi* for 1864, M. Gilis gives a similar account of a Mare that had been covered by a stallion, then some minutes afterwards by an Ass, and in twelve months had two foals, perfect in their conformation—one, a mule, died soon after birth, and the other, a horse foal, did well.

Lanzillotti-Buonsanti mentions a Mare which, on March 28, 1851, was put to an English stallion, and on April 5, to a Barb; on February 28, 1852, it produced two foals, each resembling one of the stallions. Lessona speaks of a Mare which was put to a Horse in 1852, and sixteen days afterwards to a Persian stallion; at eight months' pregnancy it dropped a horse foal, and in two hours after a mule foal.*

In the *Veterinarian* (vol. xxx., p. 78), Mr. Evans refers to a Mare which was put three times to the Horse, about six weeks intervening between each time. Two months prior to the ordinary period of parturition from the last coitus, two foals were produced, one alive and full grown, the other so immature that it died immediately. The same journal (vol. xxxix., p. 444) contains another instance, in which a Mare was put to a Cart-Horse on May 20, but showing symptoms of œstrum subsequently, was again put to him on June 19. At the commencement of the following April, two fœtuses were born, each being in a different stage of development, and one of them apparently a month older than the other. The same Mare had aborted the previous year.

In the *Journal Vétérinaire Pratique* for 1828, there is an instance given of what was supposed to be superfœtation. A fine-wooled ewe, impregnated at the usual season in 1823, evinced in the following year, at the period of parturition, the ordinary signs of giving birth; but these subsided without any produce being born, and the animal quite recovered. The fœtus was in the abdomen, and could be easily felt. In 1824, this ewe was again impregnated; in the early days of March, 1825, the mammæ contained milk, and soon after the symptoms of parturition became manifest; but, as before, they disappeared without any result. The animal then lost condition, became gradually weaker, and was not long in succumbing. On opening it, a perfectly developed lamb was found in the right horn of the uterus, and in the left another well-formed fœtus of the male sex was discovered. The latter, with its envelopes, as well

* All these instances are paralleled in the human female, by various authorities. Buffon, quoted by Foderé and Churchill, mentions a woman at Charleston, South Carolina, who, in 1714, was delivered of twins within a very short time of each other, the one being black, the other white. On examination, the woman confessed that on a certain day, immediately after her husband had left her, a negro entered her room, and by threatening to murder her in case of refusal, obtained connection with her. Dr. Moseley alludes to the case of a negro woman who brought forth two children at a birth, both of a size, one of which was a negro and the other a mulatto. On being interrogated upon the cause of their dissimilitude, she said she perfectly well knew the cause of it; which was that a white man belonging to the estate came to her hut one morning before she was up, and she suffered his embraces almost instantly after her black husband had quitted her. Similar illustrations are quoted by De Bouillon, Trotti, Guerarde, Delmas, Dunglison, and others.

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as the uterine cavity, were normal, except that a portion of the fluid had escaped and the fœtus was dead; the cervix uteri, however, was constricted by the presence of a newly-formed mass of matter, which was so hard that it could scarcely be cut through —a circumstance that appeared to explain the impossibility of delivery.

Hering (*Repert. für Thierheilkunde*, Jahrgang ix., p. 1), alludes to instances of superfœtation in the Cow and Sheep.

In the *Memoires* of the Veterinary Society of Calvados, vol. ii., M. Lemaitre describes the case of a Mare which aborted on December 2, and on the following June brought forth a foal which continued to live. Trelut, in the *Journal des Vétérinaires du Midi* for 1844, mentions a Mare, eleven years old, which was put to the Horse on April 23, on the 4th, 6th, and 25th of May, and again on June 5, 1845. In December this Mare received some kicks on the belly and flank from a Horse, but this did not impair her health. On March 1 it slipped up, and on the 15th it aborted two foals without suffering any ill effects. The first foal had the tongue protruding from the mouth, the mucous membranes were very pale, the hair of body and mane and tail were present, the eyes were closed, the skin was colourless and looking as if macerated, and the hair was easily removed; the bloodvessels only contained a few drops of pale blood; and the muscles, pale and flaccid, did not show any signs of decomposition. The second foal had the skin smooth and shining, but no trace of hair; the eyes were open; the mucous membranes bright red; the muscles firm and red; and the heart and vessels filled with red blood.

Cauzit, in the *Journal de Méd. Vétérinaire de Lyon* for 1859, gives an instance of superfœtation in a Mare, fecundation having occurred at an interval of eight days; and Chabaud, in the *Journal des Vét. du Midi* for 1859, mentions another case, in which fecundation must have occurred at fifteen days' interval.

One of the most recent cases is reported from the United States of America.

On the 20th of February, 1876, a five-year-old Mare belonging to William Driesbach, of Sparta, N.Y., foaled a dead colt, fully developed and otherwise promising in those points which go to make up a good Horse. The Mare appeared to be well, and to the surprise of her owner, on the 2nd of April following, six weeks after the birth of her foal, gave birth to another colt, which was sound, healthy, well developed, and in all respects as promising a colt as could be found in the State.

From the facts already accumulated it may, then, be concluded that superfœtation in the Mare may occur, and indeed has occurred, several times. It has been argued against these facts that superfœtation is impossible, because a Mare that has once conceived would be exceedingly liable to abortion if submitted to a second copulation; but it is more than doubtful that abortion should be the inevitable consequence of repeated copulation; and we have the human species to adduce in proof of the comparative innocuousness of sexual intercourse during pregnancy. So far as researches have gone, however, it must be confessed that these double conceptions have only occurred in uniparous animals by successive copulations on the same day, or within a few days; and we are therefore without any indication that this could occur in them at longer intervals. This, it will be evident, is no very strong proof of superfœtation having taken place; for in the case of the mule and horse foal, it only proves that a double conception may occur from intercourse with two different animals within a very short period. If a longer period—say three or four months—intervened, then superfœtation would be admissible, and would perhaps be undeniable, provided there was nothing abnormal in the uterus—such as a double organ.

Rainard remarks that torsion of the neck of the uterus in the Cow, though preventing the birth of the fœtus, may nevertheless permit new conceptions. With inversion of the uterus and torsion of the cervix, parturition is impossible; so that instead of attempting to deliver by a sanguinary and dangerous operation, the success of which is very doubtful, the animal, if not killed for

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consumption as food, is generally left to the efforts of nature; should the season be favourable it is allowed to remain at pasture, and frequently after some suffering the creature regains its condition, even becomes fat, and may then be advantageously sold to the butcher. Towards the spring-time, such an animal might conceive again without having been delivered of the first fœtus.

In *multiparous* animals there can scarcely be a doubt that superfœtation may take place, and perhaps of all those which have been domesticated the Rabbit furnishes the most striking example. With this creature a new fecundation may occur in the middle of pregnancy. This, of course, can be accounted for by the anatomical disposition of the generative organs, the two cornua of the uterus opening into the vagina independently; so that a primary fecundation may occur only from one ovary in the corresponding horn, the other remaining open and unoccupied.

In the Bitch, many observers have assured themselves that superfœtation is by no means unfrequent. Rainard, Blaine, and others speak of it. Blaine says, "I am disposed to think that Bitches are capable of superfœtation; that is, they conceive more than once. If this is the case, a Bitch may copulate to-day, and become impregnated, and in a day or two she may copulate again, and again become impregnated. This is not frequent, I believe; but it certainly does happen, or we could not account for the different periods at which the progeny sometimes appear. I have known a week, and in one case even ten days, intervene between the puppings; but one or two days is not at all uncommon. As a still more convincing proof, the whelps often appear of different kinds."

It must be remembered that the Bitch remains in "heat" for three or four days, and will seek for repeated intercourse with the male during that period. It must, therefore, either be concluded that the last intercourse was the successful one, or that one or more ova were impregnated at each copulation.

So far as our knowledge at present extends, we can neither positively negative, nor absolutely admit, the possibility of superfœtation in the larger domesticated animals. The cases recorded have not been sufficiently investigated to convince those who deny the likelihood of two conceptions taking place after a certain interval; and it must be admitted that a true explanation of such a singular occurrence has not yet been offered. A lapse of time occurring between the birth of two animals is no strong proof of a second impregnation during conception; for, as we shall see hereafter, when twins are conceived from the same intercourse, it may and does happen that one ovum does not attain maturity so soon as the other, and is either rejected or retained after a more or less lengthened interval—a circumstance which might mislead. And again, with regard to the size of twins, it is not at all unusual to find one larger and more developed than the other, though both were produced at the same period. Putting aside the question of superfœtation in animals, the anatomical disposition of whose generative organs evidently permits such an occurrence, a little consideration will show that usually there are physical obstacles which offer an insurmountable barrier to a second impregnation, after conception has been achieved for a short time. Soon after that event has taken place, the entrance to the uterus is closed by the shut sac enveloping the embryo, and which adheres closely to the inner surface of the organ throughout its entire extent—covering the orifices of the os uteri and Faliopian tubes. In addition to this, the canal of the cervix is during gestation rendered still more impervious by the thick viscid mucus secreted by its glands. Such being the case, it will be obvious that a second impregnation cannot occur, if it be necessary for this purpose that the

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spermatozoa pass into the uterus, or even to the ovaries; for the whole is hermetically sealed after a certain time. For a second impregnation to be accomplished during conception, fecundation must take place before this closing-up of the uterus and Fallopian tubes—an interval too brief after the primary impregnation to make much difference in the respective developments of the young animals. In cases in which there is a double uterus, or in which conception occurs in only one horn, superfœtation is possible, and one parturition may not be followed by another for some considerable time.

SECTION II.—EXTRA-UTERINE PREGNANCY.

In studying the development and progress of the ovule, after its escape from the ovary and impregnation by the spermatozoa of the male, we saw that a peculiar arrangement existed in the presence of the fringed border at the extremity of the Fallopian tube, which grasped the ovule and permitted it to be conveyed into the canal on its way to the uterus. From certain causes which are not yet clearly understood, it sometimes chances that the ovule, instead of taking this its normal course, either remains in the ovary, is arrested in its progress through the tube, or, escaping the fimbriated extremity of the latter, falls into the peritoneal cavity, or glides between the folds of peritoneum constituting the broad ligament, or between the serous and mucous membrane of the uterus; in all of which situations nature makes an effort to afford space and nutrition for the embryo, and thus supply the place of the uterus. This effort, however, as might be anticipated, is only partially successful, and after attaining a more or less imperfect development, the fœtus perishes from lack of nourishment.

This abnormal deviation from ordinary gestation, happily very rare in the domesticated animals, has received various names: such as *Extra-uterine pregnancy*, *Exfœtation*, *Conceptio vitiosa*, etc. The first is that usually employed; and the different varieties are commonly designated from the situation the ovum occupies. Thus we have (1) *Ovarian fœtation*, when the ovum is detained in the ovary; (2) *Ovario-tubal*, when lodged partly in the Fallopian tube and partly in the ovary; (3) *Tubal*, when the tube is the situation; (4) *Interstitial*, when the ovum enters the parietes of the uterus at the termination of the tube, but is arrested between the fibres before it can reach the cavity of that organ; (5) *Utero-tubal*, a compound of the two, the ovum being partly in the tube and partly in the uterus; (6) *Utero-tubo-abdominal*, when the fœtus is in the peritoneum, the umbilical cord passing through the tube to the uterus; (7) *Tubo-abdominal*, when the fœtal envelopes are fixed in the tube, but the fœtus is developed in the peritoneal cavity; and (8) *Ventral* or *abdominal fœtation*, when the embryo is formed and develops in the abdomen.

Extra-uterine pregnancy is not at all common in the domesticated animals, and appears much more rare in them than in woman; and several of the varieties just enumerated have never, to my knowledge, been observed in them. This may be fully accounted for by the different disposition of their generative apparatus, the much less tendency of these to disease, functional disorder, or deformity, and also, doubtless, to their function being only that of reproduction. With regard to anatomical arrangement as averting, to some extent at least, this misplaced gestation, we may point out that of the Mare as typical—though the same indication is applicable to the case of the other large animals. In this creature, the escape of the ovum into the abdominal cavity can only occur through some malformation or anomaly in

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the conformation of the fimbriated extremity of the tube, which, in the normal condition, is applied to the base of the ovary, and envelops it during the genital excitement. Neither is it likely that its course through the cavity of the tube can be checked, as this is short and direct; and the comparative thinness of the uterine walls almost precludes the probability of the ovum lodging itself in them.

Ovarian fœtation has very seldom been observed, so far as my researches have led me; though its occurrence in the domesticated animals is far from being impossible. It has been divided into two kinds: *internal ovarian*, when the embryo is developed in the Graafian vesicle or interior of the ovary; and *external ovarian*, when the ovum has left the vesicle and grows beneath the envelope of the ovary. The only instances on record are given by Rohlwes, Gurlt, and Plot. The first observed this rare form of gestation in a Mare which had been pregnant twenty-one days. The ovary was greatly enlarged, and contained a small embryo in a vesicle. Plot observed it in a Cow, and also in three Sows.

Tubal fœtation, in which the embryo is developed in the Fallopian tube, is also exceedingly rare, if the paucity of cases reported is any criterion. Rohlwes mentions having found the bones of a fœtus in the left Fallopian tube; and Carus says this form has been noted in the Rabbit. Carsten Harms speaks of it causing fatal internal hæmorrhage, by rupture of the tube, through the incapacity of the latter to distend sufficiently for the development of the fœtus.

In *interstitial fœtation*, the embryo is developed between the membranes forming the walls of the uterus; the muscular fibres, at the point where this occurs, are separated, and the cyst containing the embryo is situated between the serous and mucous membrane. This variety has not been noted in the lower animals, I believe; neither have the remaining forms, except the *abdominal*, some very rare cases of which are on record.

Abdominal or *ventral fœtation*, may present two varieties: the ovum may graft itself, after escaping from the ovary, directly in the cavity of the abdomen, and there be developed; or it may be developed at some other point—the ovary, Fallopian tube, etc., and fall into the abdomen after rupture of the pouch which contained it. In the first instance it is named *primary*, and in the other *secondary abdominal fœtation*. Extremely rare though both varieties are in animals, yet perhaps the first variety is less frequent than the second.

The following cases of abdominal fœtation are given as examples:—

M. Mollard, in the *Recueil de Méd. Vétérinaire* for 1838, gives the case of the fœtus of a Goat, which was found in the abdomen of its parent by a butcher. The uterus was perfectly intact, and did not exhibit any trace of gestation; the fœtus itself was attached to the umbilical region of the mother by vessels and very short ligaments, and was enclosed and much compressed by an envelope somewhat resembling the omentum; this membrane was adherent, throughout its extent, to the skin of the young animal. In this instance there is an absence of anatomical details which detracts from the interest and certainty of the case. In a more recent, and perhaps the only sufficiently attested instance of primary abdominal fœtation on record, we find these details very satisfactorily furnished by the able director of the Belgian Veterinary School at Brussels, M. Thiernesse, in the *Bulletin de l'Académie Royal de Médécine*. A third year veterinary student was at home with his parents in April, 1871, when a fat Pig was killed for food. On its abdomen being opened, there were found, floating among the convolutions of the intestines, two fœtuses, which were detached from the lumbar region, where they were each suspended by a vascular peduncle about three inches long, behind the great mass of the intestines, and between the two cornua of the uterus. These were sent to Professor Thiernesse immediately, with the information that the Pig had been at least

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two years old, and in September, 1870, had given birth to three well-formed young ones; after which, in consequence of being considered a bad breeder, through having brought forth such a small litter, it was laid up for fattening. Until it was killed it exhibited no signs of functional derangement, and manifested the usual indications of rutting every three or four weeks; being kept apart, however, it had no opportunity of satisfying its desires. It was certain, then, that these two fœtuses were of the same conception as those born in September, and they must have lived until their parent was sacrificed; as they did not show the slightest alteration. They were closely contained in a complete membranous envelope of an ovoid shape, provided at one point with a vascular pedicle whose extremity, detached from the abdominal parietes of the mother, resembled a red spongy cord not unlike the ovary in form, and which Thiernesse believed it to be, fancying that the impregnated ovum had fixed itself there and grown. This was not the case, however; for dissection proved it to be a simple vascular parenchyma —a kind of cotyledon organised on the peritoneum of the young creature; and the student had seen the two ovaries in the Pig, after the removal of the fœtuses. This vascular body at the extremity of each fœtal pedicle was therefore a new formation, formed at the same time as the fœtus, and by a hæmatosic elaboration necessary to the latter. Consequently, there was here a case of *primary abdominal extra-uterine gestation*, concomitant with a *normal uterine gestation*. On examining the fœtuses, they were found to be females: the least developed weighed about 23½ ounces, and measured, from the snout to the base of the tail, about 12 inches; and from the dorsal spine to the distal extremity of the thoracic limb, 5 inches. The other was a little larger, weighed 29½ ounces, and was 14 inches long and 7 inches high. Their conformation was symmetrical, and development complete. Each had four teeth well grown up in each jaw—the canine and lateral incisors; and in the largest fœtus the middle incisors of the lower jaw were equally developed, while the two first molars were being cut in both jaws. Those two fœtuses were, then, even a little beyond the ordinary development of those whose natural gestation is about to terminate. Each was attached by an umbilical cord to the membranous sac containing it; which sac, applied immediately to the velvety skin, and even adhering to it at some points, was composed of a thin chorion, provided, for a small extent of its external surface, with a very thick vascular placenta, and responding by its inner face to a complete amnion, as well as a very small allantois whose cavity was, like that of the latter, destitute of fluid, but communicated with the bladder by a very distinct urachus. All the organs of these creatures were fully formed, and there was nothing anomalous observed. On this case Thiernesse remarks, that it would appear that the glandular arrangement of the uterus is not indispensable to the formation of the embryo, and that absence of these glands may be efficiently compensated for by an organ developed on or in any other in the abdominal cavity where the impregnated ovum may graft itself; that under the stimulating influence produced by the contact of the ova, this new organ constitutes a kind of extra-uterine cotyledon analogous, up to a certain point, to the maternal placenta resulting from the hypertrophy of the uterine mucous membrane, and which acts very well as such, though with less functional energy. This is evidenced in the development of these two fœtuses, which required about ten months to bring them to their present growth—a period more than double that of ordinary gestation in the Pig.*

A few other instances of abdominal fœtation will complete what we have to offer in the way of illustration of this abnormal pregnacy.

The first case is reported by M. Simon, of Yonne, France. A celebrated sheep-breeder in his canton had a Sheep which, though carrying a dead lamb for two years, yet produced another at the end of this period, and which lived. It appears that the Sheep was seven years old, and had been put to the ram with the others of the flock to which it belonged. At the usual period of lambing, the animal made attempts at delivery, but was unsuccessful; and an examination made by a veterinary surgeon proved that the fœtus could not be extracted; it was therefore predicted that the Sheep would for the future prove sterile. At this period the mammæ were enlarged for five or six days, and fever was present; then all the general symptoms of this condition gradually disappeared, the appetite returned, and the animal was well. The fœtus could be felt at the lower part of the belly. Two years afterwards, to the great astonishment of the owner, the Sheep brought forth a lamb, which it suckled, and which grew up. The mother was then put by for fattening, and when ready for the butcher it was examined by M. Simon. By taxis, he distinctly felt, a little to the right of the lower part of the abdomen, an elongated, hard, irregular, insensible tumour, slightly curved shape, and presenting along the curvature very prominent asperities, which were dis-

* "Annales de Méd. Vétérinaire de Bruxelles," 1871, p. 420.

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tinguished as those of the vertebral column of a dead fœtus. The animal being killed and opened, the uterus was found contracted, and situated in the upper region of the abdomen; it offered no signs of gestation. The intestines were then removed and the right side of the rumen lifted up, when the tumour was discovered which had been felt externally; it was firmly attached to the abdominal wall, and consisted of a pouch containing the fœtus. No particular mention is made of the condition of the walls of the uterus, and the fœtus and its envelopes having been sent to M. Renault, then director of the Alfort Veterinary School, unfortunately no report as to the anatomical peculiarities of these was published. The case would, however, appear to be one of primary extra-uterine abdominal fœtation.*

The second case is given by S. Della-Rovère, veterinary surgeon of Angliano (*Archivio della Veterinaria Italiani*, 1868), who was called to give his attention to a Cow in parturition, and which had been already in the hands of an empiric for some time. It was aged 14 years, and was very emaciated. By a vaginal exploration the os uteri was found completely closed, so that torsion of the uterus was at first apprehended; but it was soon discovered that such was not the case. During the examination the expulsive movements continued, and Della-Rovère felt under his hand the limbs of a fœtus pressing against the margin of the vulva. Withdrawing his arm, by palpation along the floor of the vagina he satisfied himself of the presence of the two forelimbs and head of a fœtus. An incision was consequently made through the vaginal wall at the point corresponding to the fœtal limbs, and by the opening so made he extracted a living healthy calf, which was given to another Cow to rear. Some minutes afterwards, the straining persisting, another exploration was made, when a second calf, much smaller and dead, was removed. The Cow died three days after this operation. Unfortunately, the veterinary surgeon could not make a careful examination, as when informed of the death of the animal, it had already been cut up; so that he was unable to ascertain by what means the fœtuses were nourished, and how the umbilical cords were attached. The uterus was quite contracted and small, with numerous folds in the interior, as if the animal had not bred for several months; on the left side of the organ, at its lower third, was a long irregular cicatrix, with a small round opening at its inferior extremity, through which a goose quill could scarcely be passed. From inquiry, it was ascertained that the Cow had been overturned by another while at pasture during the early months of gestation; but it never showed any signs of inconvenience from this accident, and was regularly worked in the plough.† This is an example, probably, of the second form, the fœtuses having escaped through the walls of the uterus by a tear made in that organ. Other instances of the variety will be given hereafter.

In the *Veterinarian* (vol. vii., p. 606), Mr. Berry mentions a Cow which, being pregnant, exhibited all the signs of approaching parturition at the usual time; and after showing symptoms of fever and uneasiness from distended udder for some days, was at last examined *per vaginum*, but no calf was found in the uterus, though it could be "touched" above the flank. Being satisfied that it was a case of extra-uterine gestation, the Cæsarean operation was performed; but the animal was so exhausted that it died before the business was completed. The operation brought to light "a mass of fungous matter, weighing not less than seventy pounds, in the centre of which lay a remarkably fine heifer calf, fully matured, and evidently a very short time dead. The most minute examination was instituted, but no connection appeared between the womb and the part enclosing the calf, except by external adhesion."

In the same journal (vol. xiii., p. 66) Mr. Metherell, of Spalding, describes a fœtus which was found in the lumbar region, behind the left kidney, of a Sheep, and attached to the peritoneum.

In this journal also (vol. xv., p. 103), Mr. Green, of Fareham, writes of an examination he made of the body of a full grown Ewe. On making an incision along the linea alba, through the abdominal and recti muscles, there was presented to view a fœtal lamb in the cavity of the abdomen, wholly deprived of its membranes, its back lying on the abdominal muscles, the support or attachment being formed on the off-side, and effected by means of intervening bands of lymph from the cheek, and continuing backwards to the antero-spinous process of the ossa innominata, wholly enveloping the off-fore extremity. The union formed between the fœtus and the peritoneal covering, at the inner surface of the right abdominal muscles in the umbilical region, was its head, the posterior parts extended as far back as the ensiform cartilage, and the uniting medium was very firm. The left side, from the third cervical vertebra to the tail, was imbedded in the omentum. The hind extremities

* "Recueil de Med. Vétérinaire," 1857, p. 298.
† "Journal des Vétérinaires du Midi," 1869, p. 189.

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were firmly fixed to each other, also to the abdomen: being, in fact, quite immovable. The fore extremities were attached to each other as far down as the carpus, and thence by bands of lymph to the lower surface of the neck. The nose of the fœtus was twisted to one side; there were no eyes; the ears were small, and fixed to the occiput, being in texture like the parotid gland; the spine was curved, and the tail fixed between the hind legs; the anterior maxillary bones were alone covered with wool; the abdominal muscles were very thick; the spleen, pancreas, kidneys, and bladder, as well as the rectum, were all absent, and the sex could not be distinguished. It weighed within an ounce of five pounds. In the Ewe, the cervix of the uterus was obliterated by small excrescences, "of the character and appearance of the inner surface of that organ. The animal had never exhibited any unusual symptoms, except that she had proved barren in the previous spring; having been with the ram before then."

The same journal (vol. xxix., p. 344) alludes to a good-sized, fully-formed lamb, found in what appeared to be a tumour or bag attached to the rumen of a fat Sheep killed for food. The skin of the fœtus was covered with wool where it had not been torn in process of removal from its adherences. The uterus of the Ewe was small, and there was no evidence of rupture.

Gurlt (*Pathol. Anatomie*, 1831) describes an instance of abdominal gestation in a Sheep, in which the maternal placenta was attached to the mesentery; and Plot alludes to a similar occurrence in a Bitch, the fœtal membranes adhering to the mesentery and kidneys; while Fornari mentions a placenta formed on the rumen of a Goat. Below gives a detailed description of a mummy (*lithopœdion*) weighing 1870 grammes, which was found in the abdominal cavity of a Sheep.

A very interesting notice, one of the most recent, is given by Baillet (*Recueil de Méd. Vétérinaire*, 1875, p. 26). As inspector of the abbatoir at Bourdeaux, his attention was called to the carcase of a six-year old Cow, in very fine condition, which had just been slaughtered. On opening the abdomen, an ovoid mass, not unlike in appearance the manyplus of the stomach, appeared at the anterior part of the right sac of the rumen; it had formed adhesions with the omentum, rumen, diaphragm, liver, and right hypochondrium. When detached it measured 18 by 14 inches in diameter, and weighed 45 pounds. It was of a nacrous white hue, and provided with numerous firm, membranous prolongations of a red colour; a hard rounded body could be felt within it. When cut, it was found to be a sac, the wall of which was about one-fifth of an inch thick, and firm and resisting. No trace of vascularisation could be made out on its inner surface, which adhered to a dead fœtus so tenaciously, that some degree of force was required to destroy the intimacy existing between it and the hair on the dorso-lumbar region of the calf. A small quantity of turbid, yellow, colourless fluid, in which floated some *débris* of horn and some hairs, occupied the bottom of the sac. There were no proper fœtal envelopes, and the creature appeared to have been grafted on the inner face of this fibrous chamber. It was a full time fœtus; though by its general development it looked as if arrested by the limited space in which it had been enclosed. Bent longitudinally, its head was fixed between the fore legs. The surface of the body was covered by slightly humid hair, which was easily removed, particularly within the arms and thighs, where the skin was of a light yellow colour. The compression it had undergone had produced a general flattening of the muscles; the eyelids were quite distinct, though there was not a vestige of eyes; a shred of umbilical cord, black and withered, still remained. There was no unpleasant smell, even when the body was opened. The viscera were dry and looked as if macerated; the muscles were pale, but firm; and the bones were intact, their extremities being provided with a cartilaginous covering. The uterus of the Cow, though carefully examined, offered no evidence in explanation of this abnormal gestation. Some *corpora lutea* led to the supposition that it had been bred from, or at least that its ovaries had been the seat of the process which accompanies fecundation. There was nothing in the condition of the Cow's carcase to indicate that this strange state had caused it any suffering or inconvenience.

Professor Stockfleth, of Copenhagen, describes another instance (*Tidsskrift for Veterinärer*, 1875) of a Cow in which, after it had been slaughtered for food, a large round tumour was found in the abdominal cavity. This tumour was attached by a cord to the abdomen, and it contained a fœtus covered by a dense white membrane, through which the dark-brown epidermis retaining the hair appeared, but which came off with the covering. The calf lay rolled up with its head and feet together, and was in every respect normal. The uterus of the Cow was contracted in a natural manner, and one of the ovaries, which was somewhat larger than usual, contained a corpus luteum. There was no connection between the uterus and the membranes surrounding the fœtus, neither had the membranes any cotyledons.

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The length of time during which these extra-uterine fœtuses may be retained, varies according to circumstances. In the human species, a case is recorded in which the fœtus remained in the abdomen for fifty-six years; and a great many instances are published in which retention has continued from three months up to the last-named period. In animals, this retention of the misplaced fœtus may also continue for a long time; and though death usually occurs if delivery is delayed much beyond the usual period of pregnancy, yet development appears to progress in the ordinary manner, and subject to the laws of normal gestation. It is indeed astonishing to find the ovum fix itself, and become developed into the embryo and fœtus, by drawing nourishment in the strange situation in which it chances to fall: the placenta, cord, and envelopes being present just as if it had found its way into the natural receptacle. It does not appear to be quite decided whether the ovum, in primary abdominal fœtation, receives an additional covering analogous to the decidua; though it is very probable that it does, and that this membrane may perform a similar office in the nutrition of the fœtus. The part of the abdominal or other surface to which the ovum adheres, receives an increased vascular supply for the occasion, its vicarious function being as actively carried on as if it were the lining membrane of the uterus.

Not unfrequently, retention is brought to a termination by the death of the parent, through the disordered state of health induced by the living fœtus, or through absorption of the septic matter it engenders, if putrefaction sets in after its decease. On other occasions, and these are comparatively not very unfrequent in the lower animals, an effort is made by nature to get rid of what really in time becomes a foreign body, by artificial openings. In these cases the fœtus may be passed whole or by fragments through the abdominal parietes, the intestines, or the vagina—in almost every case the former, owing to the quadrupedal position of the domesticated animals. Several occurrences of this kind are to be found in the literature of Veterinary Science; but we will notice only the following in this place.

M. Drouard (*Recueil de Méd. Vétérinaire*, 1842) reports that a Sheep which had lambed the preceding year without any accident, was, at its second gestation, seized with sudden but unavailing throes of parturition. Nothing appeared; the os uteri remained closed, and the waters did not escape. The animal continued in this state for three or four days, after which the symptoms subsided, and in a month they had disappeared. About this time, however, the appetite became lessened, rumination began to be irregularly performed, the strength was diminished, and the animal often lay for a long time. For fifteen days it remained in this state, very dull, the eyes sunk in their orbits, the respiration frequent, and the pulse almost imperceptible. An œdematous swelling appeared beneath the belly, and the skin at this part was cold and brown coloured. Scarifications made in it permitted the discharge of a foul-smelling sanguineous fluid, indicative of gangrene. Finally, ulceration set in over this swelling, and soon a fœtus covered with wool showed itself; this was extracted after enlarging the opening. It was in an advanced stage of decomposition, and in the abdomen of the mother it lay with the head and fore limbs towards the pelvis, the croup being inclined towards the diaphragm. It was extracted by the fore part of the body, and the opening was closed by suture, leaving only an orifice for the escape of the pus; a retaining bandage around the body to support the sutures, applications to the skin, and diffusible stimulants internally, was the treatment. As the appetite did not return for eight days, tonic and nourishing draughts were administered. After this period it rallied, but there was an abundant discharge of pus; the orifice through which it flowed enlarged, and at last gave exit to the after-birth, as well as a portion of the omentum which was of a deep reddish-brown tint, and had to be excised. The gangrenous condition of the wound also demanded attention; the margins were pared, and new sutures employed. By attention and careful nursing the wound had cicatrised by the forty-fifth day, and in six months the animal was fat again. Unfortunately, it was sold to the butcher without the veterinary surgeon being allowed

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the opportunity of examining its carcase after it was killed; as it would have been interesting to note whether this was a case of primary or secondary abdominal fœtation. Probably in this instance peritonitis was averted by adhesions being formed around the part to which the fœtus was attached—the whole mass becoming encysted immediately over the abdominal surface where ulceration took place.

Coquet (*Instructions Vétérinaire*, vol. ii.), so long ago as 1784, mentions that a farmer at Neufchâtel bought a Cow that appeared to be ill, in the hope of being able to cure it. Instead of amending, however, it became worse, and a profuse diarrhœa set in of serous and putrid matters. It was soon noticed that these ejecta contained hard substances, which were recognised as bones. The farmer brought several of these to Coquet, among which was a cannon-bone, a calcis, several ribs, a portion of a lower jaw, several fragments of the knee and hock, and a maxillary bone. Coquet thought at first that these could only come from the uterus; but the owner positively assured him that they were passed with the fæces. As the case appeared to be hopeless, the animal was let alone; it died in about a month, and the following lesions were noted: the colon was much enlarged from its last flexure to the commencement of the rectum—about two and a half feet, and its walls measured more than an inch in thickness; they were very dense, dark-coloured, inflamed, and gangrenous; the inferior surface was perforated; and the intestine contained at that part a considerable quantity of bones, similar to those which had been voided, but more voluminous and irregular, like the pelvic bones and those of the spine and head. The uterus was a little larger than in the non-pregnant state, but its fundus, which corresponded to the diseased and perforated intestine, was likewise engorged, indurated, and very thick, though there was no appearance of a cicatrix. The cervix was so contracted that a stylet could not be passed into it, and its cavity, which was empty, could scarcely be discerned. The peritoneum and mesentery in the neighbourhood of the affected parts were swollen and inflamed; while the serosity effused into the pelvic cavity was sanguinolent and putrid. The other viscera were healthy.

Haubner reports a case recorded by Janke, of a Cow five years old, when in its seventh month of pregnancy, gradually losing its appetite, while the size of the abdomen increased. It was supposed to be affected with ascites, and was therefore killed; when a fœtus, contained in its envelopes, was discovered in the abdominal cavity. The uterus had the same appearances as in the non-pregnant state. The same author mentions the case of a Sheep which had not lambed at the usual time, but which, two months afterwards, exhibited a tumour on the abdomen in which the fore limb of a lamb could be felt. The tumour was opened, the lamb extracted, and the wound closed by suture. The Sheep recovered and remained in good health.

Benz and Bagge, of the Copenhagen Veterinary School, found in the abdomen of a little Bitch, aged thirteen years, a fœtus which appeared to occupy the mesentery of the small intestines. All the soft parts of the creature had disappeared, and it looked like a skeleton. The Bitch did not show any signs of suffering during life.

Saussol (*Recueil de Méd. Vétérinaire*, 1828) reports that a Ewe, three years old, had been with the Ram like the other Ewes, but never exhibited any signs of pregnancy. About two months after being with the Ram, the shepherd observed a hard tumour about an inch behind the umbilicus, and which gradually increased in size, until, fifteen or sixteen months after it was first seen, Saussol was called in. The tumour was then the size of a goose's egg, and felt like an abscess. It was punctured, when a quantity of pus escaped, and with it the bones of a fœtus. These bones were separated from each other, and were discoloured; the head, however, was entire, and less altered than the other parts. The first incision being enlarged, it was found that the abdominal muscles were nearly double their ordinary thickness, and at this particular point formed a pouch in which the fœtus was lodged, but covered only by the skin. No communication existed between the pouch and the abdominal cavity. The opening was closed by suture and soon healed, but the animal did not thrive and was sold.

Dickinson, in the *Veterinarian* (vol. xxviii., p. 196), relates the case of a Sow which he was called in to attend. The animal had been ill for some time, and its period of gestation had expired four weeks previously; though as no indications of approaching parturition were noticeable, it was supposed a mistake had been made in the date. The symptoms were: loss of appetite, obstinate constipation, a peculiar or painful grunt, and lying on the left side with a limb extended, as if to relieve the abdomen from the weight. When standing it would support itself by leaning against the wall, and then gradually drop down as easily as possible. A hard mass could be distinctly felt on manipulating the abdomen, especially towards the left side; the pain on pressure was intense. Medical treatment was of no avail, and on the fourth day it succumbed. At the autopsy, the peritoneal membrane was found to be inflamed, the visceral portions being most affected. The uterus had been seriously injured, evidently

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by the operation of "spaying." The right horn and its ovary, with a portion of the body of the uterus and vagina, were absent. A mass about the size of a man's head, enveloped in false membranes, was situated in the left iliac region, and connected with the left horn of the uterus, which was still continuous with its ovary and the vagina. On dissecting the tumour, the osseous remains of seven Pigs were discovered, enclosed in separate cavities. Seven heads and all the bones were collected. They were, however, denuded of all soft parts, as if they had been subjected to maceration.

Symptoms, Course, and Terminations.

We have already to some extent indicated, in recording the history of several of the most interesting cases of extra-uterine pregnancy mentioned in veterinary literature, the character of the symptoms, and the terminations which mark this accident. The symptoms are generally those of conception and gestation. The ovum grafts itself on some part with which it chances to be in contact; an embryo results, the placenta being attached to the neighbouring textures and developing with the increase of the young creature; these changes being accompanied by the ordinary external signs of uterine pregnancy. In the majority of cases, when parturition should occur in the usual course, the premonitory indications of that phenomenon are very slight or altogether absent; though the animal may now and then make expulsive efforts, which continue perhaps for a few days, and then subside gradually, or recur at intervals. In the most favourable cases, when the fœtus perishes, it becomes enkysted and mummified; the fluids and soft parts are absorbed, and the remaining portions become dry and parchment-like; or the creature may undergo a process of calcification by the deposition of carbonate and phosphate of lime in its tissues, which preserve its shape, and convert it into a "lithopædion" or "osteopædion." In this condition the fœtus may remain for an indefinite period in the abdomen of the mother, without causing much, if any inconvenience: indeed, a most perfect state of health may exist, and the animal become remarkably fat, or it may conceive and bring forth as favourably as if nothing abnormal existed; the indications of anomalous gestation being only discovered by chance when the animal dies from some disease which has no relation to this accident, or is killed for food.

Such a happy result of the accident is, however, very far from being the rule, and the chances are many that a fatal termination will be the consequence of extra-uterine gestation. Expulsive efforts or other causes, may lead to rupture of the kyst in which the fœtus is contained; and this, with the fluids and *débris* of membranes, falling into the abdominal cavity, may give rise to such a severe form of peritonitis that death will ensue in one or two days. In other instances the kyst inflames, and suppuration is established, with putrefaction and partial solution of the fœtus; and if the mother does not at once succumb to pyæmia or septikæmia, adhesions and communications are formed between the kyst and neighbouring organs, and the remains of the young animal, chiefly the bones, are expelled either directly, as by ulceration of the abdominal walls after the development of an abscess, or indirectly, as through the intestine, etc. After the foreign matters have been completely, or even only partially, eliminated in this way, the fistulous openings by which they escaped cicatrise after a variable period of suppuration, and the female recovers—as has been observed in Sheep and Goats.

More frequently, however, it loses condition, becomes emaciated and feeble, and perishes in a state of marasmus; or it succumbs to hectic fever, septikæmia, or one of the many accidents which the presence of such a body may produce. The course of external ovarian gestation, which has been stated by Gurlt to occur in the domesticated animals, appears to be as follows: the envelopes of

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the ovary rupture towards the second or third month of the embryo's development, when the latter fall sinto the abdominal cavity, where it constitutes what we have termed "abdominal" gestation, leaving only a cicatrix on the ovary. With regard to internal ovarian pregnancy, the ordinary termination is rupture of the organ, and fatal hæmorrhage.

Diagnosis and Treatment.

There is absolutely nothing in the early, or even in the later stages of extra-uterine pregnancy, especially ovarian and tubal, to indicate the existence of any deviation from normal gestation; and when at length the animal enhibits indications of approaching parturition, there may be grave doubts as to the actual state of affairs, though the absence of certain signs may give rise to suspicion. The animal is uneasy and strains, yet the vulva is not enlarged, and the flow of mucus observed in the preliminary stage of ordinary parturition is not apparent. Exploration of the cervix uteri by the vagina, will prove the absence of induration or morbid tumefaction, as well as dilatation or contraction of the os, notwithstanding the length of time that has elapsed and the expulsive efforts. Palpation and inspection of the abdomen may also furnish certain information with regard to volume, and the situation of the enlargement. Careful exploration of the abdominal cavity by the rectum, will be found advantageous in cases of abdominal gestation uncomplicated with uterine pregnancy. Not only can the condition of the uterus be satisfactorily determined, but perhaps a tumour independent of that organ may be discovered, and in which a fœtus, or parts of one, can be felt. In such a case, efforts must be made to check the attempts at parturition, though it must be confessed that they are not likely to be successful. Sedatives, large doses of opium, chloral, hot water applications to the abdomen, and other measures of this kind are indicated. If the diagnosis is well established, and the animal can be utilized for food, it is generally better to have it destroyed if in fair condition. In cases in which the period of parturition has passed, and when the animal has been unwell for some time: exhibiting loss of appetite, with marked depression, quickened pulse and increased temperature, and nothing else to account for these symptoms, then we may suspect the existence of extra-uterine gestation and putrefaction of the fœtus.

In the smaller animals—such as the Sheep, Goat, Bitch, etc., abdominal palpation can be readily resorted to, and often with most satisfactory results.

When elimination of the fœtus has commenced in any of the modes just described, active interference may or may not be necessary, according to circumstances. The fistulous openings which may be occasioned by the eliminative process, must be dealt with as ordinary fistulæ. Should the fœtus chance to be alive, it is scarcely possible that it can be removed by operation without greatly endangering the life of the mother. If in abdominal gestation a tumour, simulating an abscess, forms on any part of the abdomen, this may be carefully opened, and the fœtus extracted with a successful result. The accessory treatment, such as careful nursing and hygienic measures, must not be neglected.

SECTION III.—SPURIOUS OR PSEUDO-PREGNANCY.

Spurious pregnancy is a designation applied by veterinary obstetrists to certain accidents, characterised by the development of special pathological productions, which may probably be due to a previous conception, and which, more or less, simulate normal pregnancy. They are far from common, and

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the principal of them are described as *moles*, *uterine kysts*, and *hydrops uteri*.* These we will allude to.

Moles.†

Moles, or more correctly speaking perhaps, *anidian monsters*, are more or less voluminous fleshy masses constituted by a blighted embryo, the membranes of which have continued to perform their function, and to nourish the abnormal growths. They are, as a rule, met with only in ruminants, and especially the bovine species, though Roell mentions their occurrence in the

Fig. 54.

A Mole.

Mare; and in nearly every case they appear to be one of twins, the development of which has been arrested at a certain period.

The *mole* (*mola cruenta*) is more particularly characterised by the persistence of an umbilical cord which, though degenerated, yet seems in the majority of cases to maintain relations between the tumour and the uterus. With regard to the tumour itself, it is generally easy to distinguish the distorted remains of an embryo—such as skin, bones, muscles, and even organs of sense in some cases. These anidian monsters have not attracted much attention; so we will venture to give a short analysis of some instances recorded in the annals of Veterinary Science.

† In the *Recueil de Méd. Vétérinaire* for 1828 (p. 370), Saussol describes the case of a Cow three months in calf, and which, when harnessed to a carriage, fell on its abdomen

* I am not aware that the curious and obscure form of pseudo-pregnancy occurring in woman and designated *pseudo-cyesis* by the late Dr. Simpson, has ever been observed in animals.

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with great force against a stone. After this accident it lost condition, pined away, and at last died. When opened, instead of an ordinary fœtus, there was found an oval-shaped consistent fleshy mass, of a reddish violet colour, floating in a rusty-tinted fluid, and which had obtained its nourishment by means of a single cord—no doubt emanating from some cotyledon. This tumour contained the skeleton of a fœtus, the bones of which were normal and not displaced, being held together by means of ligaments.

Léaux (*Journal de Méd. Vétérinaire de Lyon*, 1846) states that a Cow seven months pregnant, after two days' violent straining, ejected a dead fœtus and a large tumour, and died immediately afterwards. The tumour weighed five kilogrammes, was of no particular shape, was reddish-brown in colour, soft, but very vascular and covered by a fine, apparently pseudo-membranous, envelope. No trace of peduncle or uterine adhesion could be detected. The whole mass was of a fibrous texture, and composed of a multitude of small vesicles containing an amber-coloured serosity.

The *Recueil de Méd. Vétérinaire* for 1858, contains the description of an anidian monster found in a Sheep which had given birth to a dead lamb, and was sacrificed. This monster had neither head nor tail, was about two feet long, and sixteen inches broad at the widest part. The limbs were rudimentary, without any trace of digits, and there was neither anus, vulva, or scrotum. A protuberance took the place of the neck and shoulders; while in the centre of the mass was only a cavity filled with serum, in which floated a rudimentary stomach and intestines. There was no trace of liver, spleen, kidneys, diaphragm, heart, or lungs, and there were a few bones, supposed to be misshapen ribs; the remainder was composed of infiltrated connective tissue.

Mr. Snowdon, in the *Veterinarian* for 1856 (p. 218), states that on January 30th a Cow produced a healthy female calf. Nothing unusual was observed during the day, but about six p.m. the animal appeared to be in pain, when Mr. Snowdon was called. He found a membranous sac hanging from the vagina, to nearly as low as the Cow's hocks. This was punctured, but only a small quantity of fluid escaped, though a mole appeared, which was attached to the placental membranes by an umbilical cord. This was divided, and the animal continuing in pain, an examination was made *per vaginam*, when another calf was found in the uterus. This was delivered, when it was discovered to be a male calf, well developed, but dead. The Cow did well afterwards. The anidian monster was in shape a flattened ovoid, about two inches in thickness, and six inches by four in size. It was covered with long red hair; though at the border, where the umbilical vessels enter, was a hairless spot. On the opposite border was the rudiment of a lower jaw, containing four well-developed incisor teeth, three of which had cut the gum. Above this was a small cartilaginous ear, and near it something like an eyelid. Several bones were contained in the mass, one of which had the shape of the bones of the skull; though, as a whole, it felt spongy and elastic. Its weight was fourteen ounces.

In the *Annales de Méd. Vétérinaire* for 1859, May mentions having delivered a normal calf, and afterwards the Cow expelled an oval mass the size of a child's head, covered with a fine velvety skin, and showing at one point an umbilical cord. This skin enveloped a vascular spongy tissue, mixed with muscular and glandular portions, and in its centre was a small soft bone about an inch in length.

Lavocat (*Journal de Vét. du Midi*, 1866) relates that having delivered a Cow of a well-formed calf, and before the removal of the membranes, a kind of downy ball was expelled, which was only attached to the latter by a vascular prolongation, comparable to an umbilical cord. The mass was oval in shape, as large as a lamb's head, everywhere covered with hair, and at the middle was what appeared to be a regularly-formed umbilical cord. At one of its extremities was a shallow cavity terminating in a *cul-de-sac*, the irregular margin of which bore the incisor teeth projecting beneath the gums. There was no trace of thoracic or abdominal cavities or organs; neither was there brain, spinal cord, or nerves. Some bony fragments were found, among which were the rudiments of a lower jaw bearing the teeth already mentioned. The remainder of the tumour was made up of very vascular cellulo-adipose tissue, the meshes of which were filled with serosity.

In the *Veterinarian* (vol. xliv., p. 275), Mr. Creswell describes an anidian monster produced by a white short-horn Cow, two hours after delivery of a healthy and well-developed bull-calf of a roan colour. This monstrosity was round, and about the size of the crown of a hat (?). It weighed eighteen ounces some time after it had been found, but was much larger and heavier when first expelled; it was thickly covered with long fine *white* hair, which was longest and thickest on one side; at the part where it was thinnest there was a nude spot at the point of attachment of the placental membrane, and near the external border other two bare places which were deeply concave and red coloured, one having a slight eminence in the centre. The entire

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mass was soft and pulpy, as if the interior was composed of cells containing fluid. No traces of bone could be felt, and as it was decided to keep the specimen intact, nothing more of its structure was reported.

Rainard and others mention having found fibrous moles (*mola racemosa*) in the uterine cornua of the Bitch, Pig, and some other multiparous animals during gestation; and most frequently in the last dilatation of one horn, rarely in both; and sometimes between two of the dilatations which contain living fœtuses. They are spheroidal, soft, irregular in shape, and look like flesh; they appear to be composed of fibres running in every direction. In the dilatation of the horn containing them, traces of a zonular uterine placenta have been observed. Rainard was of opinion that they were embryos whose development was checked by disease.

Demoussy states that the presence of a fœtal mole in the Mare gives rise to the same phenomena as real pregnancy—enlargement of the abdomen, sinking of the croup and flanks, sluggish gait, and altered respiration; and that the diagnosis is the presence or absence of movement in the fœtus.

Uterine Kysts.

Uterine kysts are pathological productions, somewhat analogous to the vesicular degeneration of the human placenta, in which the placental villi are distended with fluid, enlarged, elliptical, transparent, and loosely connected, while their vessels become obliterated and disappear. This constitutes what has been designated a "vesicular mole."

Liautard (*Journal de Méd. Vétérinaire de Lyon*, 1859) was called to assist a Cow in parturition, on January 28, 1854. The animal was eight months old, and its abdomen had, within the previous eight days, assumed unusual dimensions; while the very violent expulsive efforts it made were followed by no result. When the hand was introduced into the vagina, the os was found to be moderately dilated, and in it was found a fluctuating tumour which was at first thought to be the bag of the waters. At each expulsive effort this tumour was much protruded, but labour did not progress. Another more thorough exploration resulted in pushing the tumour back, and passing the hand through the os into the uterus; then it was discovered that the tumour was not formed by the fœtal envelopes, and that it adhered by one of its extremities to the inferior surface of the uterus, at the point where the mucous membrane entered the os. Its shape was oblong, and in size it was as large as an ostrich's egg; it was a uterine kyst. While this obstacle was being pushed forward, a sudden effort made by the Cow carried into the os, then into the vagina, and at last externally, the bag of the waters, which on rupturing exposed the fore feet of a fœtus; this was withdrawn by a few gentle pulls, but it was dead, and appeared to be about seven months developed. On the hand being re-introduced into the uterus, the kyst was soon found; it had been compressed during delivery, but now it had assumed its original size, and was lying in front of the internal orifice of the os. Exploring still farther, two other, but smaller and more circumscribed, tumours of the same character were felt in the middle of the body of the uterus. In consequence of this discovery, the owner of the animal was recommended to have it sold to the butcher as soon as it had recovered sufficiently. This advice was not followed, however, and the Cow appeared to be quite well soon after, yielding, as it did, twelve litres of milk daily. In two months it was put to the Bull, and in time was supposed to be pregnant, as the abdomen gradually became more voluminous. Nevertheless, it remained emaciated, its quantity of milk diminished, there was tympanitis at intervals, and this appeared to be relieved only after an abundant emission of urine. When eleven months had elapsed since the previous abortion, and the period for parturition had arrived, it was so wasted that Liautard was again called in. It was then observed that the Cow almost every instant brought its limbs together under the body, arched its back very much, and made feeble but long-continued expulsive efforts, which were immediately followed by the escape of a small quantity of odourless serum. From time to time, also, there appeared in the right flank a variable-sized tumour, which did not look unlike the transient prominences the fœtus makes during the later period of pregnancy; this appearance was accompanied each time by a *glou glou* sound. Abdominal exploration did not discover the fœtus in this tumour; but direct exploration,

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which was easily made, proved that the kyst recognised eleven months previously had become considerably increased; while the rupture of some fibrous bands during this investigation, allowed the escape of some dozen litres of fluid. No fœtus could be discovered in the uterus, but there were numerous kysts, some agglomerated, others isolated, and which made the interior of the organ feel lumpy at various points. Several of these kysts were doubtless ruptured during the manipulation, for when the arm was withdrawn there was an emission by the vulva of another dozen litres of fluid. This condition of the uterus accounted for the apparent pregnancy. No treatment was attempted, and eight days afterwards, the Cow having died, an examination was made

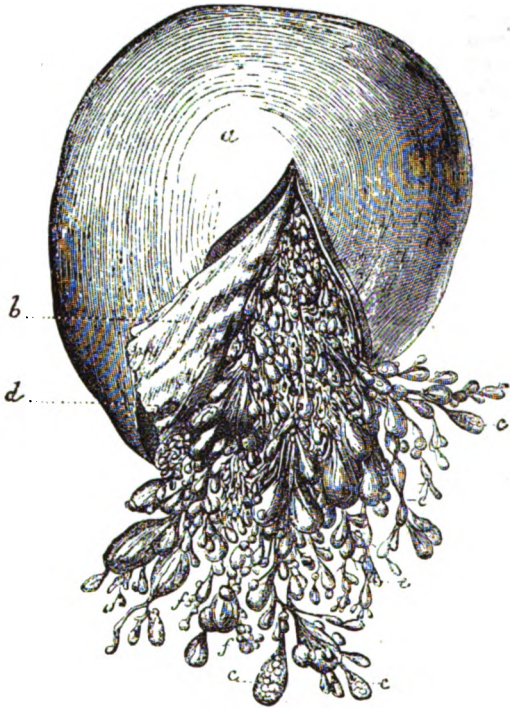

Fig. 55.

HYDATID KYST OR MOLE: HUMAN.

The Kyst, which filled the Uterus, has been opened, and gives exit to a number of Hydatid Vesicles. The Section shows two Membranous Layers, the first of which, *a a a*, is external, and is analogous to the Epichorion or Decidua; while the second, *b b b*, is a fine transparent Membrane, apparently the remains of the Chorion. *c c c*, Granular Vesicles; *d d d*, White Vessels, some of which appear on the Surface as Granulations, and others act as Pedicles to the Globules at their extremity; *e e e*, Oblong Vesicles which appear to be Constricted or Dilated Vesicles; *f f f*, Budding Vesicles.

of the carcase, when the following lesions were noted: On removing the digestive organs the uterus appeared as an enormous irregular mass, measuring from the cervix to the extremity of the horns three feet seven inches; an incision made in its lower face gave exit to about fifteen litres of fluid. There was no fœtus; the mucous was separated from the muscular layer by the infiltrated connective tissue, and the knife had opened four large kysts, the most voluminous of which was situated towards the middle of the body of the organ, and was as large as the head of a child. All the

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kysts contained an abundant serous fluid, and they all offered the same organisation: being formed by strong septa into several compartments, which were in reality so many smaller kysts enclosed by a common envelope—the mucous membrane. On the upper wall of the uterus were three more kysts, all resembling the others, though they were less voluminous. The cotyledons were abnormally developed.

This is a good example of uterine kysts producing the appearance of pregnancy, and also offering an obstacle to parturition.

In January, 1807, Rodet (*Recueil de Méd. Vétérinaire*, 1824) was called to see a Mare which was believed to be pregnant, and which appeared to be suffering from tedious labour; and the symptoms—among which were those of violent colic, and energetic expulsive efforts—might certainly have afforded good reason for the supposition. Rodet's first attempts to relieve the Mare having proved unsuccessful, in three hours he made an exploration per rectum, and discovered that the uterus was as largely developed as at the full period of gestation, though its contents did not feel like an ordinary fœtus. Making a vaginal exploration, he was astonished to find, instead of an unformed fœtus or mole, several somewhat large excrescences moving about in the uterus, the interior of which they appeared to fill. Thinking that these were true polypi with a wide base, and covered and maintained by the mucous membrane, he submitted the animal to medical treatment. This was attended with good results; the animal recovered, and during the three months it was under observation there was no relapse; after that period it was lost sight of.

Hydatid kysts have been mentioned as occurring in the domesticated animals, and simulating pregnancy; but the authorities who allude to these instances have not offered any details. They appear to be related to conception and pregnancy, and in some instances they may be a deformed embryo.

The *Veterinarian* (vol. xx., p. 187) gives an interesting account of an immense tumour in the uterus which, in the living animal, led to the belief that the Mare was in foal.

Hydrops Uteri or Hydrometra.

Hydrops uteri, as the designation implies, is a collection of fluid in the uterus; though it may not be of a serous character in every case, but may sometimes be purulent. There are many instances of this condition recorded in British and foreign veterinary literature, as occurring in the Mare and Cow—the animals which most frequently receive attention, though the Sheep and Bitch sometimes suffer from this disease. This condition appears to be related to gestation; it is allied to mole pregnancy, and sometimes closely simulates real pregnancy. It may also be due to injury to the uterus.

Rainard says: "When this collection is forming, the abdomen gradually enlarges as in ordinary gestation; the animal looks healthy, and there is scarcely any difference between this state and that of pregnancy before the second-third, or even the second-half of gestation. It is rare that these collections persist more than five or six months without being evacuated at least once, and it is usual to see this evacuation take place every month, or at least every two months. The fluid is greyish coloured, and it is often as much as an ordinary bucketful."

Saint-Cyr, in alluding to the cases recorded since Rainard wrote these lines, remarks that it is usually after a copulation which is supposed to be successful that these collections form. The collections are gradually developed, and are accompanied by all the signs of ordinary gestation, with the exception, of course, of the movements of the fœtus. Then, at a certain time, there appear the precursory indications of parturition or abortion: expulsive efforts—certainly less energetic, painful, or prolonged, as a rule, than those of natural parturition, and rather resemble those of micturition or defecation. The cervix

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uteri slowly enlarges, though the hand introduced into the vagina discovers it—the os—to be almost impervious, and neither fœtus nor membranes can be felt; when it is dilated, there is at once a gush of fluid, the aspect and quality of which varies. It is often greyish-coloured, thick, and more or less fœtid; though it may also be clear and serous. Its evacuation may occur at very variable periods—as at one hundred and eighty days, five and a half months, thirty-two weeks, or forty-six weeks, after the supposed successful copulation, according to the various writers who have described these cases.

Many instances are on record (see the *Veterinarian*, vol. xlvi., p. 562); but we will only quote one, which is the most recent:—

Suchanka (*Œsterr. Vierteljahr. f. Wissenshaftliche Veterinärkunde*, 1875, p. 76) was summoned, on February 11, to give an opinion as to whether a certain Cow was in calf. The animal was five years old, and had been put to the bull on April 21, 1874; it should therefore have already calved. Many persons had declared that it was in calf; but the owner was doubtful, and as the animal was unprofitable, he determined to kill it. Suchanka explained that, according to all experience, the Cow should have calved long before, and that it would be impossible for him to give a decided opinion unless the owner gave his consent to an examination of the Cow, which entailed some risk. This consent being given, the examination was made. The general health of the animal was not disturbed; œstrum had ceased; the abdomen was distended, and the temperature was normal. On "touching" the lower part of the right flank, there was a perceptible rebound, and on percussion a hollow sound was elicited; there was slight swelling of the vulva, with other indications which might lead one to expect that a calf would soon be dropped. On making an exploration *per rectum*, the uterus was discovered to be much distended in the right flank and fluctuating; but nothing of a fœtus could be detected. On examination *per vaginam*, that cavity was found to be filled with a yellow gelatinous matter, which on being removed permitted the open os uteri to be felt. The latter symptom, the fluctuation, and the absence of any trace of a fœtus, led Suchanka to doubt whether the case was one of normal pregnancy, and to believe that he had to deal either with an abnormal embryo or disease of the uterus. He recommended that the Cow should be killed. This being done, the uterus was found to be of enormous size, and more especially towards the right cornu; this distention being due to the presence of twenty-five to thirty litres of a thin, reddish-brown, but somewhat glutinous fluid.

There was nothing solid in the uterus, the walls of which were very thin and flabby, and the cotyledons flatter than in health; the mucous membrane was smooth, though thickened in the left cornu, of an unhealthy colour, and covered with a watery mucus. This was the first case of the kind which fell under Suchanka's observation, and in the absence of anything to show that it was the result of abortion, he was of opinion that it was an instance of hydrops uteri.

There are two forms of hydrometra—*œdematous hydrometra* and *ascitic hydrometra*. The former exists when the walls of the uterus are infiltrated with serum, and may acquire a thickness of four or five inches; the latter is an accumulation of fluid in the cavity of the uterus. Hydrometra has been observed in the Mare, Cow, and Bitch; rarely in the Sheep.

Recovery has often followed the evacuation of the fluid, when it has been in the uterine cavity; in some cases the condition has become so aggravated as to cause death, or necessitate the destruction of the animal.

The *diagnosis* is arrived at by manual exploration, and by the absence of some of the most characteristic indications of pregnancy.

When the condition is diagnosed, and there is reason for interference, the indications for *treatment* are plain: carefully dilate the os, evacuate the contents of the uterus, and inject astringent and antiseptic lotions (as carbolic acid 1 to 20) at intervals into its cavity Give gentle laxatives frequently; guard against retention in the bladder, from which the urine may be removed by means of a catheter, if necessary; and give nourishing food, with tonics.

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CHAPTER II.

Diseases of the Pregnant Animal.

Owing to animals being kept in a more natural state, generally, than the human species, when pregnant they are much less exposed to the risks and inconveniences of that condition than woman. The difference in the attitude of the body may also tend much to obviate those serious accidents, and prevent those unpleasant consequences, which so often attend gestation in the human female.

Nevertheless, notwithstanding this immunity, pregnancy in animals brings about certain modifications in the female organism which may sometimes call for serious notice, either when it leads to a morbid predisposition, or in its influence on the progress of certain diseases already existing at the time of conception, or which have developed during gestation. There are also maladies which are peculiar to this condition, some of them of great importance.

SECTION I.—INFLUENCE OF GESTATION ON ORDINARY DISEASES.

The influence of pregnancy on the course of the ordinary diseases of animals has not yet been well ascertained, though it has been long observed that such an influence exists, and has often been productive of marked effects.

And these may have been due, directly or indirectly, in some cases at least, to the condition of the blood in the female, the red globules of which are greatly diminished, and the proportion of albumen is also notably decreased, while the serum, on the contrary, is much above the normal standard. The amount of fibrine likewise varies, though this variation is neither so constant nor so uniform as in the other constituents; but it generally increases towards the termination of pregnancy.* Owing to this decrease in the solid portion of the blood, and particularly in the red globules, the pregnant female is more anæmic than plethoric. It is none the less exposed to inflammatory attacks, however, owing to the excess of fibrine; but as Saint-Cyr justly remarks, these phlegmasiæ assume a particular physiognomy, and run a very different course, to those observed in ordinary conditions, and more especially with regard to depletive measures, which have to be carefully resorted to—or, we might say, abstained from.

The mechanical effects of the fœtus, and the immense volume of the uterus, must also produce disturbance of most essential functions, and more especially those of the abdominal and thoracic organs. Therefore it is, that during pregnancy such affections as indigestion, colic, tympanitis, enteritis, or pneumonia, are so frequently followed by abortion and slow convalescence, or death of the animal.

Chronic diseases have in general but little influence on gestation. It has been imagined that "broken wind" in the Mare is much relieved during pregnancy; but some observations would go to prove that it is rather aggravated—though the troublesome cough does not appear to militate against the fœtus reaching its full period.

* In woman, it has been noted that the normal proportion of *red* globules is from 125 to 127 per 1000, and that during pregnancy this proportion falls to 120, 115, 95, 90, and even 87 per 1000 of the total mass of the blood; while the albumen descends from an average of 70½ to 69, 66, and 62 per 1000.

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Acute diseases are more serious, and especially those of an epizoötic kind, which often cause abortion or induce premature labour. Contagious pleuro-pneumonia of cattle, for instance, often produces abortion, and death is more frequent as pregnancy is well advanced. Sheep-pox is also more serious, more often fatal in pregnant Sheep, and most frequently followed by abortion.

A number of observers—among them Saint-Cyr, Bouley, Röll, Lafosse, and Reynal—have remarked that the cattle-plague does not appear to have any very particular influence on gestation; and the same has been said of eczema epizoötica ("foot-and-mouth disease"). But this Continental experience does not harmonise with that relating to these two diseases in our own country. Abortion has been a notorious sequel of both maladies, and more especially of "foot-and-mouth disease," in which the losses from this cause have sometimes amounted to twenty, thirty, fifty, and even more, per cent.

Painful and nervous diseases are also more serious during pregnancy than at other times. It would, however, seem to be an error to attribute the non-appearance of certain disorders during gestation to the influence of this condition; as Spinola has done, with regard to rabies, etc.

SECTION II.—DISEASES PECULIAR TO PREGNANCY.

As has been already stated, the diseases peculiar to the pregnant condition are fewer, not so frequent, and usually much less serious in animals than in the human female. The chief maladies or morbid conditions which have been noted in animals are *cramp*, *pica* or *malacia*, *constipation*, *œdema*, *hydrops amnii*, *paraplegia*, and *amaurosis*, *cough*, and *albuminuria*.

Cramp.

Cramp—by which is meant a tonic, involuntary, and extremely painful contraction of one or more voluntary muscles—is sometimes observed in the Mare during the second half of gestation, the muscles of the thigh, and chiefly the principal extensor of the metatarsus, being almost exclusively involved. When affected, the animal either suddenly and rapidly flexes and extends the limb—striking the ground hurriedly and energetically with the foot, as if a fly had settled on the leg, or the whole limb is gradually and rigidly elevated without flexure of the joints, except those of the phalanges, which are half-flexed, the anterior aspect of the hoof being directed towards the ground; at the same time the muscles of the leg are hard, tense, and painful to manipulate, and the animal betrays the torture it experiences by its expression and attitudes. This manifestation is increased if the Mare is compelled to walk, its first steps being extremely difficult; while the limb is maintained in a perfectly rigid condition, and the indications of pain most marked. In a short time these symptoms disappear, and movement is restored. The cramp may pass from one hind limb to another alternately, and appears to be due to the compression exercised on the sciatic nerve in its course over the sacro-ischiatic ligament. This cramp has much analogy, in its symptoms, to luxation of the patella; from this it may be distinguished, however, by the latter occurring most frequently in young animals, by the displacement of the patella, and by the total inability to flex the limb until the patella has been replaced.

Cramp is of no moment, and can be relieved by walking the animal for a few paces, or by smart friction. It disappears altogether after parturition.

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Pica.

We have already noted that the appetite of pregnant animals is sometimes depraved, and that they will ingest foreign matters: such as plaster licked from the walls, wood gnawn from their stable-fittings, earth, etc.

When depending on derangement of the digestive functions, this depraved appetite may be corrected by the careful administration of tonics, antacids, and attention to the quantity and quality of the food. The herbivora should be allowed common salt in their food, or to lick.

Constipation.

Constipation is, of course, due to many causes, some of which have no relation to pregnancy. This condition, however, is not at all rare, particularly in the carnivora during gestation; and in all animals it may be largely remedied, or altogether removed, by suitable diet and exercise. Purgatives should be avoided, and only mild laxatives resorted to if necessary. For the Bitch, which appears to suffer most frequently from constipation, Saint-Cyr recommends the administration, every day for eight or ten days, of five to eight grammes of white mustard. Castor or linseed oil, or even boiled linseed, answer well for the larger animals.

Œdema.

The infiltration of serosity into the connective tissue of certain parts of the body of pregnant animals—almost exclusively the Mare—is somewhat allied to the *anasarca serosa* of woman. The period at which it is manifested depends much upon breed, conformation, and individual temperament, as well as upon the season and hygienic conditions. With common-bred, lymphatic Mares deprived of sufficient exercise, it appears at an early period—from the eighth month of gestation, and sometimes earlier—particularly in winter. With better bred animals it is later, and in summer may not appear at all in those which are well-bred. It commences usually at the inferior part of the hind limbs, gradually ascending to the hocks, or higher; the fore limbs are also attacked, though not so markedly; and the swelling extends to the lower surface of the abdomen. Here it commences by a soft tumour in front of the udder; this increases in size and spreads over that gland, as high as the vulva, down the inner surface of the thighs, and towards the chest, sternum, and fore-arms. It readily disappears or diminishes with exercise, and is probably due to the pressure exercised by the fœtus on the pelvi-crural vessels, as well as, perhaps, to the anæmic condition of the system. The exemption of the Cow from œdema has been ascribed to the great development of the mammary veins in this animal, and their free communication with others, which permits a ready return of the blood from the hind limbs.

There is nothing serious in this œdema of pregnancy, as in nearly every case it can be counteracted by exercise or hand-rubbing, and it disappears in a day or two after birth.

If it causes inconvenience, frictions with soap or turpentine liniments, bandaging, or even slight scarifications, may be employed; but the occasions for these must be very rare indeed.

Hydrops Amnii.

When there is an unusual secretion of the amniotic fluid, it constitutes what has been termed "dropsy of the amnion" (*hydrops amnii* or *hydramnios*): a condition which, when very marked, is serious for the mother as

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well as the fœtus. A number of cases have been recorded, and Saint-Cyr has enumerated thirteen, ten of which occurred in the bovine, two in the equine, and one in the caprine species. Gierer, who has published an interesting account of several cases, observes that it is most frequently met with in poor, badly-fed animals—and particularly in Cows, in which improper hygiene has produced a morbid excitement of the generative organs; the result of which is that the act of exosmose and endosmose does not take place equally through the walls of the placentæ and placentulæ.

Symptoms.—It is not until the fifth or sixth month of pregnancy, or even later, that indications of this condition are evident. Then the abdomen rapidly enlarges, especially to one side—generally the right; and in a short time it has acquired a greater volume than it has towards the end of gestation. At this period the health becomes deranged, and colic, with or without tympanitis, is not unfrequent. General debility is so marked, that the animal can scarcely, if at all, stand; the appetite is lost, rumination is suspended, defecation and micturition are irregular, œdematous swelling of the limbs and abdomen ensue, with dyspnœa, which increases so quickly in intensity that asphyxia is often imminent. The muscular parietes of the abdomen have in some cases been ruptured, and the entire mass of the uterus, with its contents, has formed a subcutaneous hernia. The ordinary period of gestation may be completed; or abortion may occur at the seventh or eighth month, when all the indications of such an occurrence are present. The uterine contractions, owing to the relaxed condition of this organ, and its distended and paralysed fibres, are weak, the pains feeble and unsustained, the os does not dilate, and the act of parturition is consequently tedious.

Diagnosis.—The state of the abdomen might lead to the supposition that the case was one of tympanitis or twin pregnancy. Abdominal percussion, and the "touch," as well as auscultation, should aid in diagnosing this condition. Rectal examination will reveal the immense size of the uterus, which forms a great globular mass in the abdominal cavity, and almost completely fills the pelvis, though nothing of a fœtus can be detected; while vaginal exploration discovers the cervix uteri effaced, the os closed, and the posterior part of the uterus projecting more or less into the vagina; pressure on this prominent portion proves that it contains fluid, though usually no fœtus can be felt, as it is beyond the touch, and almost lost in the small ocean of fluid surrounding it. In rare cases the os is partially dilated, and the fœtal membranes protruding more or less into the vagina; usually, however, scarcely one or two fingers can be introduced into it.

Results.—The occurrence of hydrops amnii is nearly always fatal to the fœtus. In none of the thirteen cases alluded to by Saint-Cyr was it alive; in a certain number it appeared to have lived up to the period of parturition or abortion; in others it had been arrested in its development, and was dead for some time. In a Goat, the two fœtuses were in a state of general anasarca, and completely infiltrated.

The mother may or may not survive. Of the above cases three perished from the disease; one was killed as incurable; another recovered after a long time; one was subsequently sold for food; five got well so rapidly and completely as to be bred from again. The results have, as a rule, been more favourable as assistance has been prompt and early.

After death the uterus is found excessively dilated, pale in texture, with

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ecchymoses on its surface. The fœtal membranes vary, sometimes being thickened and dense, and at other times attenuated and friable. The *liquor amnii* has been found contained in alveoli, or cells, formed by the processes uniting the allantois to the amnion; so that the membranes might be torn in several places without all the fluid escaping—in this respect resembling the vitreous humour of the eye. The *liquor* is usually limpid and transparent, or of a pale citron colour, with a slightly sweetish taste; its quantity, as has been remarked, is always considerable: as much as 50, 70, 100, 120, 150, and even 180 litres having been found.

One example of this condition will suffice. It is given by Mr. Cartwright, of Whitchurch, and the subject was a thorough-bred racing Mare, whose extreme "size" while pregnant was ascribed to the presence of twin fœtuses, and also, it would appear, to an excessive quantity of fluid in the uterine cavity. The period for parturition arrived without any signs of milk-secretion or relaxation of the pelvis, and the abdomen measured thirteen feet in circumference. Symptoms resembling slight colic appeared, which were not relieved by medicine, and the abdomen became so tense and hard that it was feared the muscular parietes would give way; strong bandages were, therefore, placed round the body, though through these having been fastened too tight, the Mare fell apparently asphyxiated. However, on their being loosened recovery took place, and her sufferings subsided so much that food and water were taken, and general amendment seemed to have set in. Next morning, however, the unfortunate creature was found with an extensive rent in the right iliac region, from which the small intestines escaped. It was destroyed, and on opening the abdomen the uterus alone, with the exception of some portion of the small intestines, was the only organ visible, it being of extreme dimensions, and very pale and flaccid; it contained about twelve gallons of serous fluid, as well as two dead, but perfectly developed, colt fœtuses. These were of such a size, that it was surmised parturition could not have been safely accomplished, even had there been no dropsy.

INDICATIONS.—The chief indication is to evacuate at least a portion of the fluid, by rupturing the membranes, as medical treatment has always proved inefficacious. It must be remembered that the fœtus is always dead; and even if alive, with the view of saving the life of the mother, it should be sacrificed. Though opening the amniotic sac, and removing a certain quantity of the liquor, need not necessarily compromise the existence of the fœtus; as a case has been published by Lhomme (*Journal de Vétérinaire du Midi*, 1869), in which a portion of the fœtal membranes, protruded beyond the vulva, was excised without interfering with the ordinary progress of gestation; as when parturition occurred three months afterwards, a well-formed mule was born and continued to live.

The chances of success are greater as intervention takes place early, and before the abdomen is excessively distended, the respiration not seriously affected, and debility not great.

The evacuation should be effected through the vagina, though it has been made through a puncture in the flank. If the membranes are in the vagina, they may be ruptured by the fingers there; if not, and the os is sufficiently dilated for the admission of the hand, they may be ruptured in the uterus; if it is closed it should be gently dilated, and the envelopes punctured, if necessary, by means of a trocar and canula. As soon as the membranes are pierced, a gush of fluid takes place, the abdomen diminishes in volume, the uterus becomes retracted, and in this retraction the fœtus and membranes are sometimes expelled. Should this expulsion not take place soon, they must be removed in the ordinary way. Afterwards, the animal is to be carefully attended to and generously fed.

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Paraplegia.

Paralysis of the posterior extremities during gestation, is not rare in the Cow, especially when near parturition, and often even when that act has commenced; it is also witnessed in the Sheep and Goat. Generally, however, it appears six, eight, ten, or twenty days, rarely a month or six weeks, previously, and attacks animals in the most diverse hygienic conditions—those which are well fed and tended, as well as those which receive the opposite treatment. As Saint-Cyr remarks, it is not rare to observe, in a cow-shed, two or three cases occurring a short distance from each other, and even in a locality we may, in certain years, meet with a number of cases; then several consecutive years may elapse without any being noted, though it would be a manifest exaggeration to say that it was either an epizoötic or enzoötic malady. It must not be confounded with what has been termed "parturient fever," in which we have paralysis, but from which it differs greatly, as the symptoms and results will show.

The paralysis of gestation generally appears suddenly and without any premonitory symptoms, manifesting itself with the same intensity at the outset as at a later period; though in rare cases, the animal shows a weakness and unsteadiness of the posterior part of the body and hind limbs for a short time before it drops, and the tail hangs disjointedly and flaccid. When paralysis has really set in, the Cow is forced to lie, but it does not appear to suffer; the decubitus is natural, the head carried as usual, the eye bright and clear, the muffle damp and cool, and rumination in the majority of instances is not suspended; the pulse, respiration, and appetite are unaltered, and sensation does not seem to be impaired, even in the hind limbs —it may even be exalted. Constipation is frequently present. It is only when the animal attempts to rise that its condition is evident; the fore limbs and neck can be moved to accomplish this, but the hinder extremities are powerless.

Ordinarily, the paralysis persists until parturition, when it disappears; though Saint-Cyr mentions an instance in which a Cow became paralysed twenty-eight days before that event, and lay on the litter for two days after calving, without being able to move its hind extremities, but which arose spontaneously on the third day, and did well. The same authority, however, states that he has occasionally witnessed the paralysis persist for a longer time after calving, and either cause death or necessitate slaughter. I have seen a Sheep which eventually died from this ante-parturient paralysis.

The cause is somewhat obscure, but is supposed to be due to compression, or rather straining, of the nerves and vessels of the posterior extremities by the heavy uterus. In five or six cases there has been found on *post mortem* inspection, infiltration of the dorso-lumbar and gluteal muscles, and discoloration of the muscular fibres. The spinal canal has also contained a large quantity of serum, and the membranes of the spinal cord are injected. From the rapidity with which recovery generally takes place, it is obvious that the lesions cannot be serious.

Treatment.—In the majority of cases, and especially before parturition, but little treatment is necessary. The principal indication is to avert or get rid of constipation by means of luxatives and enemas, and to pay attention to the diet and cleanliness, while enjoining quietude. Should the paralysis continue for any length of time after parturition, then more energetic treatment may be adopted. In these cases, the subcutaneous injection of strychnine is nearly always attended with success.

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Artificial removal of the fœtus is not to be recommended, except in very exceptional circumstances.

Amaurosis.

The only instances of amaurosis occurring in connection with pregnancy, are two given by Riss (*Recueil de Méd. Vétérinaire*, 1831).

A Mare, nine years old and in good condition, when advanced in pregnancy became blind. On the eyes being examined by Riss, the humours and lens were found to be quite healthy, but amaurosis was complete. A blister was applied to each cheek, and other treatment adopted, but without success. The day following parturition, which occurred about a month afterwards, vision was perfectly restored.

A seven-year-old Mare, when near parturition, and which had never exhibited anything the matter with its eyes, suddenly became blind from amaurosis. Remembering the other case, Riss abstained from treatment. The Mare foaled in thirteen or fourteen days after loss of sight had been noted, and on the third day after this occurrence it was able to see as well as ever.

Cough.

We have mentioned hydrops amnii as a cause of disturbance in the respiration, the obstacle to which is often a marked symptom of that condition. But even without the existence of this kind of dropsy, the breathing is not unfrequently impeded in pregnant animals, and this obstruction is sometimes accompanied by a very harassing nervous cough, which, in the larger animals, and particularly in the Mare, may lead to injury. For the relief of this cough, Zundel recommends the cyanide of potassium.

Albuminuria.

The existence of albuminuria in pregnant women has long been known, and Zundel gives it as one of the complications or accompaniments of gestation in animals; though he does not look upon it as a pathological condition. Saint-Cyr, on the contrary, thinks that this is a matter well deserving further investigation; for as various kinds of paralysis—eclampsia, paraplegia, amaurosis, etc.—are probable consequences of albuminuria in the human female, there is no reason why they may not be so in animals.

CHAPTER III.

Accidents of Pregnancy.

Though a distinction between the diseases and accidents of pregnancy cannot always be readily drawn, yet for convenience we follow Saint-Cyr, in allotting to a separate chapter those conditions or diseases which may be due to accidental causes, operating either externally or internally. These are *prolapsus of the vagina, hernia of the uterus, rupture of the uterus, metrorrhagia, abnormal retention of the fœtus*, and *abortion*.

Ante-partum Prolapsus of the Vagina.

Prolapsus vaginæ, or *inversio vaginæ*, has only been observed, so far as I can ascertain, most frequently in the Cow and Sheep; rarely in the Mare or Bitch. It consists in the protrusion of the vagina by the uterus and its contents during pregnancy, the tumour it forms appearing between (*inversio vaginæ incompleta*), or external to (*inversio vaginæ completa*), the labia of the vulva. It must not be confounded with *post-partum* prolapsus. This accident

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is peculiar to pregnancy, and may occur in well-shaped Cows, but whose tissues, and especially those of the genital organs, are soft and relaxed: animals of a lymphatic temperament, good milkers, with a wide pelvis, and which are fed on an abundance of bulky but innutritious food. Keeping such Cows on a floor sloping too much to the rear, as well as falls, injuries of different kinds, distention of the rumen, fatigue, etc., are all likely to lead to this accident in such animals, when pregnant. It is observed, though very rarely, in primiparæ, and occurs most frequently after the third or fourth gestation, the period of its appearance during that state varying: in certain Cows manifesting itself so early as the fifth month (though this is rare), and oftenest at the end of the seventh or eighth month, and even so late as twenty or fifteen days before delivery.

The occurrence of the accident is made known by the appearance, at the vulva, of a circular, bright-red tumour, depressed in the centre, and of a variable but gradually increasing size, as gestation advances, or the exciting causes remain in operation—from the volume of a fist to that of the head of a child or man, or even larger. At first it is only visible when the animal is lying, and disappears when it gets up; but when of considerable volume it never entirely vanishes in the latter attitude, and even when reduced by the hand the vulva remains larger than usual.

This prolapsus, in the majority of cases, does not appear to cause the slightest inconvenience to the animal, and offers no obstacle to parturition—indeed, it has been noted that such Cows calve more easily than others; neither does it predispose to chronic eversion of the vagina, as has often been supposed. After calving, the vaginal tumour disappears without any treatment being required.

With some young, fidgety Cows, however, when the tumour is voluminous, often recurs, and the animal is feeble, expulsive efforts increase its size and irritate it; and thus give rise to more or less derangement of health, constituting a serious accident. Loyer has noted three deaths in thirty-six instances recorded by him.

According to Cox (*Veterinary Journal*, vol. i., p. 267), Sheep, when heavy in lamb, frequently evert a double fold of the vaginal mucous membrane. This happens when they are in a recumbent position, and it is in some animals of such frequent occurrence as to cause excoriation and ulceration.

Treatment.—The first thing to be done, if the floor of the stall is lower behind than in front, is to level it, or even raise it a little behind. This may be readily accomplished by means of the litter. The diet may also require attention, giving that which contains sufficient nutriment in small bulk; constipation should be guarded against or remedied. This treatment will be sufficient in the majority of cases. In others, a bandage, to be hereafter described, may be required, and especially if the tumour is liable to become soiled and irritated when the animal is lying.

In serious cases, when the tumour is large and the Cow strains, and spontaneous reduction does not occur in the standing position, the mass must be returned. This is readily enough accomplished; but it sometimes happens that reduction does not prevent a continuation of the straining, and even with the bandage the everted vagina again appears. This is due to the mucous membrane, which, not having been properly smoothed down when introduced into the pelvic cavity, is ridged, and these rugæ give rise to an uncomfortable sensation, and induce expulsive efforts.

It is necessary, therefore, in reducing the part, to smooth the vaginal mucous membrane by gentle pressure forward as far as the cervix uteri, in order to

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efface any folds which may excite uneasiness. After this the bandage may be applied with a view to keeping the vulva closed, until its labia have retracted somewhat. Wire sutures through these have been recommended, but they are very rarely required.

In very exceptional instances, we may have not only complete prolapsus vaginæ, but also partial protrusion of the uterus itself. Then the case is very serious, owing to the weight and bulk of the fœtus, which has to be returned beyond the inlet of the pelvis. Death is often the result of such an accident; and to prevent a fatal termination, it has been suggested that artificial delivery should be effected without delay. Premature delivery has been counselled in those cases in which the Cow continues to strain and evert the vagina, notwithstanding bandages, sutures, and other means, and when grave consequences are likely to follow; more especially is this advice to be adopted when pregnancy has reached the 260th day, and the calf is alive.

With Sheep, according to Cox, it is a common custom to return the partially prolapsed vagina, and to tie the wool across the vulva; on other occasions a truss, similar to that used for cattle, is employed. Both methods frequently fail, and in these cases nothing answers so well as the ring-shaped pessary.

Hernia of the Uterus (Hysterocele).

Hernia of the uterus is not uncommon in the domesticated animals, and has been observed in the Mare, Cow, Sheep, Goat, and Bitch. In the latter animal the organ is often displaced before conception, and the fœtus is developed in the hernia; but with the larger creatures the empty uterus is too far removed from the abdominal parietes to escape from the cavity; and it is only when its volume is increased as gestation advances, that it may form a hernia, should there exist an *accidental* opening in the muscles which enclose the cavity. In the Bitch the hernia may be inguinal; in the other animals it is always accidental and ventral, and usually towards the inferior part of the abdomen, on the right or left side, or in the pubic region.

Its ordinary cause, when accidental, is due to the natural or spontaneous relaxation of the abdominal aponeuroses; or to traumatism, as contusions or strains, the viscus being generally only covered by the skin. It is rare in young animals.

In the Cow it is not at all unusual to observe the hernial tumour in front of the pubis, towards the attachment of the recti muscles, and near the udder; here it may be of a great size, extending as low as the hocks, pushing the mammary gland to one side, reaching as far forward as the floating ribs, and containing, in addition, other of the abdominal viscera than the uterus and its contents. This tumour impedes movement; the hind limbs are kept widely separated, and the animal is much inconvenienced.

With the Bitch, ventral hysterocele has been noted in two regions—above the mammæ, where it might be mistaken for a scirrhus tumour; and in one of the labia of the vulva, beneath the skin.

In the larger animals, the fœtus may sometimes be felt in the tumour, and its movements may be noticed; though, owing to its being so low, it cannot be reached from the rectum.

Very often, excepting the inconvenience to the female, hysterocele does not interfere with gestation, nor give rise to any serious symptoms; though, in some cases, it may render parturition laborious and protracted, if not impossible. In other cases this act may be accomplished without difficulty or extraneous aid; Cows which have been ruptured from the perineum to the ribs have calved easily enough; and Leconte alludes to a Mare which had a

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uterine hernia nearly as extensive as this, and yet brought forth four living foals in succession.

Nevertheless, it is somewhat of a risk to attempt to breed from such animals. When treating of difficult parturition, we shall have occasion to return to this subject. In the meantime, it is only necessary to say that in order to obviate serious consequences, the hernia should be supported by a wide bandage until the uterine contents are expelled. Should circumstances render it necessary, abortion may be artificially induced, or hysterotomy may be performed.

Ante-partum Rupture of the Uterus.

Rupture of the uterus may happen before and during parturition, or in attempts to reduce the organ when inversion has occurred during that act. The accident is not very common before gestation has terminated, and the symptoms by which it can be diagnosed are not very reliable. Spontaneous rupture of the uterus usually occurs at the anterior part of the organ, between the two cornua, or even in the cornua themselves; the direction of the rupture generally depending on the direction of the muscular fibres—being sometimes diagonal, at other times transversal, and more rarely longitudinal. The size of the rupture also varies considerably; though it must be remembered that in the dead animal ruptures only appear in their original dimensions when the uterus had lost its contractility before death, and immediately after their production; when the organ has contracted after the accident, the extent of the laceration is much diminished. The lips of the wound are in some cases thin and ragged, in others swollen and inflamed. The texture of the uterus itself, in the vicinity of the rupture, may be quite healthy, or it may be inflamed, softened, or gangrenous; while the peritoneum is normal or inflamed. The blood effused into the abdominal cavity may be in large quantity or scarcely noticeable, and it may or may not be decomposed.

According as the tissue of the uterus is more or less completely torn, the ruptures have been divided into those which are "complete" and "incomplete." In the first, the cavity of the organ communicates freely with that of the abdomen; while in the second, the peritoneum, or sometimes a portion of the muscular layer, is intact.

Symptoms.—The symptoms of rupture of the uterus are not well defined. If there has been straining, in the majority of cases this ceases altogether or diminishes; sometimes blood or blood-coloured fluid flows from the vagina, though this symptom is rare. The physiognomy of the animal changes; at the same time it becomes restless, often the limbs are cold, the pulse small or imperceptible; a cold perspiration covers the body; the animal sighs or moans, is affected with dyspnœa, is greatly agitated, and intense debility sets in. The symptoms are violent and marked as the accident is sudden and severe. If the fœtus has passed into the cavity of the abdomen, it may be felt there; and there may also be an alteration in the shape of the abdomen. Vaginal exploration generally reveals alterations of a distinctive character—sometimes even the rupture may be detected, and the absence of the fœtus from the uterus noted. When the rupture is small and takes place gradually, the symptoms are sometimes little marked, and a diagnosis is more difficult.

Results.—Rupture of the uterus is sometimes followed in the gravid state by fatal hæmorrhage, peritonitis (particularly in the Mare), or the results described in extra-uterine gestation. Recovery may occur either by

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surgical interference, or by the aid of nature alone. When the organ contracts the dimensions of the rupture are reduced, and tears in the upper portions are very much less serious than those in the lower surface, for obvious reasons.

Saint-Cyr has given an analysis of some published cases, to which I have added others more recent.

1. In 1808, Anfri (*Correspondence sur les Animaux Domestiques*, par Fromage de Feugré, vol. iii., p. 179) was called upon to attend a Cow which had been attempting to calve for two days. When he saw it, its efforts had ceased, and it was greatly prostrated; the hand introduced into the uterus could not discover the fœtus. Death occurred on the night of the third and fourth day, without anything having been detected which could have prevented delivery. On examination of the body, the fœtal fluids were found in the abdominal cavity, as well as the fœtus itself. They had escaped by a large oblique rent in the fundus of the organ; while the left cornu was also torn for one half of its length. The cause of the mishap could not be ascertained; the animal had been straining violently for two days, and a quack had attempted to deliver it.

2. Vatel (*Journal Pratique de Méd. Vét.*, 1827) reports that a Cow in a very bad state, was sent to the Alfort School on April 25. It could scarcely walk, and there escaped from the vulva glairy, blood-coloured, odourless matter; the condition of the animal was serious. On manipulating the abdominal wall, there was felt a hard resisting body. The Cow did not strain, and gradually became weaker until the night of the 28th, when it succumbed. The abdomen was found to contain about 15 litres of blood-tinted serosity; the omentum was greatly thickened, *and adhesions were observed on its visceral surface corresponding to the processes of the placenta;* the peritoneum showed traces of intense inflammation; while the fœtus lay on the floor of the abdomen, from which it was only separated by the omentum and its own membranes, which were not ruptured. Two large unaltered clots of blood were discovered between the anterior extremities of the uterus and the fœtal membranes. The uterus maintained its natural situation, but it was contracted, and rent from its cervix to the middle of its left cornu. The borders of the rupture were red, swollen, and rounded: but the interior of the organ did not exhibit any trace of inflammation.

The cause of the accident was unknown.

3. On June 8, 1843, Arnal (*Journal des Vét. du Midi*, 1843, p. 331) was summoned to attend a Cow which had been ill since the previous evening, when, about half an hour before it was noticed to be unwell, it had playfully jumped a wide ditch, though it was advanced in pregnancy. Soon after it voluntarily returned to its stable, covered with perspiration. In consequence of there being no straining, the case was supposed to be merely one of "chill," though the creature was very ill indeed. Next day it was worse; the vulva was swollen, and there was slight straining. The hand introduced into the vagina discovered the "water-bag," in which the head of a fœtus could be readily distinguished. On the membranes being ruptured, only about half a litre of fluid escaped; the fœtus was alive, and in a vertebro-pubic position, the limbs being doubled on the chest. These were placed in a favourable direction, and by means of moderate traction the calf was born alive.

The Cow appeared to be much better, and it was hoped that recovery would ensue; but all at once its condition became most serious, and in spite of every measure it perished on June 11. When opened, the abdomen was found to contain about ten litres of sanguinolent serosity, and the peritoneum was much injected; while the uterus, whose walls were considerably thickened, showed at its lower surface, near the cervix, a rupture four centimetres in circumference, the border of which was red and violet in colour, and greatly tumefied. The uterine mucous membrane was reddish-brown, and studded with ecchymoses. The vagina and vulva did not offer anything unusual.

4. Presseq (*Journal des Vét. du Midi*, 1849, p. 358) saw a Cow on March 4, 1846, which the owner said could not calve. There was nothing, however, to indicate that parturition was near: the vulva was not swollen, the gluteal muscles had not sunk, the abdomen was round, the flanks were full as high as the transverse processes of lumbar vertebræ; and when the hand was introduced with some difficulty into the vagina, the os uteri was found to be hermetically closed. Presseq concluded that the animal was not near calving, and promised to see it again next day. It died during the night. At the autopsy, the first thing which attracted Presseq's attention,

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on opening the abdomen, was a fœtus, with its envelopes, lying on the walls of that cavity, and but recently dead, as the hair was intact and adherent, and the liquor amnii very limpid. On examining the uterus, he noticed only a small perforation about four centimetres in diameter, the margin of which was so completely cicatrised, smooth, and even, as to give it more the appearance of a natural than an accidental opening. The body of the uterus was contracted, and had lost much of its capacity. Presseq learned that, two months previously, this Cow and another had drawn a load of barley to the neighbouring market, and in passing a stall they took fright and ran away, and were not stopped until the cart was upset. But the animal did not appear to be any the worse until this illness set in. The other Cow gave birth to a fine calf. To this accident two months before, Presseq attributed the rupture of the uterus, and the escape of the fœtus into the abdominal cavity.

5. Boizy (*Recueil de Méd. Vétérinaire*, 1863, p. 272), called to see a Cow on February 8, 1863, noted the following symptoms: general tremors, colic, incessant pawing, slight tympanitis, inappetence, frequent groans, and fæces very hard and covered with mucus. He diagnosed enteritis, complicated with indigestion. By suitable treatment the animal appeared to recover, but on March 8 it had a relapse; the more urgent symptoms were allayed by similar treatment, but it never quite recovered, and lost condition. On the 28th of the same month this Cow, whose time for calving was April 4, evinced the first signs of parturition. On the 29th, Boizy found it straining most violently, and a portion of the fœtal membranes extruded from the vulva. Exploring the vagina, no calf could be felt, and supposing it had been already born, search was made for it among the litter and in the shed, but without success. Boizy again examined the vagina and uterus, and was struck by a circumstance which he had not before remarked: the internal capacity of the latter organ was not one half what it should have been, had delivery occurred only a short time previously. He began to separate the maternal and fœtal cotyledons on the lower surface, and on reaching the upper part, a little to the right, he was much astonished to encounter a sinuous ring the size of a fist, directed obliquely forwards and from right to left, and measuring about twenty centimetres in length; to this the chorion was attached in the closest fashion, and the membrane extended from it in a folded manner, like a half-open fan. This was the opening by which the fœtus had passed into the abdominal cavity. The removal of the membranes was given up as useless, and the abdomen was examined externally. The "touch" of the right flank did not reveal anything, but that of the left discovered a hard voluminous body, which was surmised to be the missing fœtus. The Cæsarean operation was proposed by Boizy, but the owner would not allow it. The Cow died and was buried, but Boizy had it exhumed three days afterwards; though the autopsy was not so satisfactory as he could have desired, owing to this interval. He could only note that the fœtus was in the abdomen, and that, notwithstanding this change of domicile, there were indications that it had continued to live as long as the Cow; it had long frizzled hair, two incisors were apparent, and the horn of the hoofs was of a greenish colour. The cause of the accident could not be discovered.

6. Dupont (*Journal des Vét. du Midi*, 1849, p. 497) informs us that a farmer bought a pregnant Sheep, which soon after purchase showed signs of abortion, though the fœtus was not expelled. In two months, a considerable tumour formed a little to the right of the umbilicus; this suppurated, and from the abscess the four limbs of a fœtus, *minus* the pasterns, were expelled; then the wound cicatrised. Three and a half months later, another tumour appeared at the same place, and this likewise opened, but it only gave exit to fæces. The Sheep was then given to Dupont, who kept it for some time, then had it killed in order to study the lesions. On opening the abdomen, the cæcum was found to be very much enlarged, had somewhat the shape of a horse's stomach, and was closely adherent to the abdominal muscles; it offered four openings, the first of which was at the middle of the lower part, corresponding to the opening in the abdomen, and from which the fæces were passed. Two other openings were in the intestine only, but the fourth communicated with the right cornu of the uterus, which adhered in the most intimate manner to the cæcum. The uterus contained a small quantity of greyish-coloured foul-smelling fluid, in which floated some small bones, chiefly the first phalanges of the fore limbs. The vagina was completely twisted from left to right, and Dupont was of opinion that this was the cause of the lesions described. The cause of the vaginal torsion, however, could not be ascertained.

7. Legrain (*Annales de Méd. Vét. de Bruxelles*, 1865, p. 124) relates that a labourer having quarrelled with his employer, revenged himself on a poor she-goat which was pregnant, by kicking it violently on the belly. In consequence of this injury, the animal lost its appetite, passed blood *per vaginam*, was ill for ten days, and then all

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the phenomena of gestation disappeared; the milk was suppressed, there were alternations of appetite and inappetence, and the creature became terribly emaciated. Nevertheless, in six months the health was so far re-established that œstrum appeared. It was put to the male, though without result, and it did not again manifest "heat." A year subsequent to the accident, Legrain was asked to look at it, as "it had a hole in front of the teat." There, undoubtedly, was a circular opening about ten centimetres in width, through which this veterinarian extracted two incomplete fœtuses in process of decomposition. A sponge steeped in cold water was introduced into the sac whence they had been withdrawn, the wound was cleaned and dressed in the same manner on the following days, and in three weeks the animal had recovered, though the udder remained atrophied.

8. Schmelz (*Annales de Méd. Vét. de Bruxelles*, 1859, p. 382) mentions the case of a Cow which was eight weeks beyond the period of calving, and was constantly lying, without making any attempt to get up. It was killed, when all the viscera were discovered to be healthy, and a fully-developed fœtus, surrounded by its membranes, lay in the abdomen. The uterus was completely detached at about six centimetres from the cervix, and the margin of the wound was already cicatrised. The fœtus, envelopes, and detached uterus exhaled a most offensive odour, and were putrefied. There was no trace of liquor amnii. The reason for this rupture of the uterus could not be discovered.

9. On May 21, 1874, Vernant (*Recueil de Méd. Vétérinaire*, 1874, p. 924) attended a Cow eight years old, which had arrived near the termination of gestation, and could not eat, groaned constantly, and was tympanitic. It lay on the right side in a natural way; the belly was enormously large laterally, but the tympanitic distention was on the left; loss of appetite, continual groans heard at some distance, eyes sunk, pulse imperceptible, and the skin and limbs hot; the fœtus felt at the lower part of the abdomen on the left side, but no movement perceived in it; constriction of the cervix uteri, which, in consequence of the tympanitis, was only about four inches from the vulva; the animal could not get up. Fifteen days previously it had been treated for supposed indigestion by quacks, but it gradually became emaciated and weak, and lost its appetite. A few days before Vernant was called in, the owner was astonished at the apparent, but gradual, descent of the fœtus in the left flank, and this, coupled with the condition, caused him to think that calving was about to take place. Seeing that the tympanitis was producing serious effects, the rumen was punctured and a quantity of gas escaped; the animal was relieved, but the groaning did not cease, and the pulse did not appear. Another exploration *per vaginam*, proved that it was impossible to induce parturition, as only one finger could be introduced into the os. Twenty-four hours afterwards, another exploration was made, when Vernant was surprised to find the os so dilated that he could feel some cotyledons, which led him to believe that he could effect delivery. On introducing his right arm deeper, however, he was astonished to discover it enveloped by the membranes only, without meeting with any trace of the fœtus; exploration of the horns did not discover it, and it was only by a most careful investigation that he satisfied himself that the membranes were displaced, tense as if something was hanging to them, and that there was no liquor amnii; while the cavity of the uterus itself would scarcely contain a man's head. Vernant then surmised that this was a case of extra-uterine gestation; though he was not quite satisfied, as the presence and development of the fœtal membranes rather proved the contrary. In order to solve the enigma, the inextricable mesh of membranes was torn, and the cavity of the uterus reached; then, at the part which offered most obstacles, he contrived to pass a finger, and then his hand, into a diverticulum or rent, through which the membranes passed. Following these, the hand went into a large cavity in the left flank, where nothing could be felt. Turning over the animal on the right side, with external assistance he managed to feel the head, a fore limb, and then the abdomen of the fœtus, which was in a transverse position—the head in the left flank of the Cow, and the belly at the pelvic inlet. He drew the head and limb towards him, but could not reach the other fore leg; to do this would have required an arm four or five feet long. Diagnosing a rupture of the uterus, and seeing that the Cow was about to succumb, the butcher was sent for. Next day the carcase was examined. There was an enormous male fœtus, weighing 65 kilogrammes, and as large as a two-months' old calf, with an extraordinary large head, neck, and belly, and deformed pelvis; in its stomach was about 20 litres of clear fluid like water, and odourless; the abdomen contained a considerable quantity of sanguinolent serum, and putrefaction was commencing in the viscera. The uterus of the Cow was remarkably contracted, and at the commencement of the left horn, near the body of the organ, the outer border showed a somewhat regular rent more than three inches long, with red infiltrated edges. The cotyledons appeared to be healthy and were everywhere covered by their placentulæ. The origin of the accident was ascribed to the large size of the fœtus, which, lodged in one of the horns, deranged

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the digestion, and the walls of the part becoming thinner, at last ruptured to a slight extent; the weight of the fœtus gradually dilated the rent, through which it slowly passed, until it fell into the peritoneal cavity, carrying with it the fœtal membranes, which maintained their relations with the maternal cotyledons. The uterus must have retracted immediately, and thus masked the rupture during the exploration. The fœtus, too, must have lived for some time after its change of location; though it is not improbable that, in its struggles, it swallowed a large portion of the liquor amnii.

10. In the *Veterinarian* (vol. vii., p. 39) Mr. King describes a case of rupture of the uterus, and the escape of the fœtus into the abdominal cavity. The cause of the rupture was supposed to be the swollen and "puffed-up" condition of the fœtus.

11. In the same journal (vol. xix., p. 624) Mr. Cox states that he visited a Cow in a serious condition; there was a peculiar heavy groaning, particularly when the animal was lying; tympanum of the rumen and abdomen; the fæces were liquid, black, and offensive, and voided with tenesmus; mouth cold, and rigors; mucous membranes pallid. The animal died, and when opened the calf was found among the intestines, the uterus ruptured, and the peritoneum inflamed. It was within five weeks of calving; the fœtus was healthy and well developed, and appeared to have been alive up to the time of the rupture. No cause could be discovered for the accident. The same veterinarian alludes to a similar accident occurring in a Mare, through unusual exertion in draught when within a month of foaling. She died in twelve hours from internal hæmorrhage.

12. Macgillivray (*Veterinary Journal*, 1876, p. 249) was requested to visit a two-year-old Cow in the seventh month of pregnancy, which was very uneasy, and showing slight calving pains. He found immense distention of the abdomen, with a slight but thick reddish-brown discharge from the vagina. From the symptoms, it was supposed that a dead calf was about to be expelled, and a vaginal examination was accordingly made. The os was slightly dilated, and a portion of the fœtal membranes as large as the fist lay in the vaginal canal; on rupturing and removing this, it was discovered to be part of the chorion with two placentulæ attached. Very little fluid escaped, and the "pains" were scarcely at all present. The os only admitted three fingers, and it could not be dilated; one finger pushed through it came in contact with a fœtus. Exploration of the cervix afterwards did not produce any straining, and the os remained rigid. The case being deemed hopeless, the animal was killed. When the abdominal cavity was laid open, an extraordinary quantity of a nearly transparent and slightly yellow-coloured fluid escaped. There was an immense rupture in the fundus of the uterus, towards the left cornu. One fœtus had escaped from the uterus altogether, and was found, destitute of membranes, in the right hypochondriac: another fœtus was yet in the uterus—towards the right cornu, and part of the intact amnion enveloping it protruded through the rupture. The two fœtuses did not appear to have been long dead, as there was no putrid smell about them or the membranes. The walls of the uterus were apparently healthy; the external surface of the liver and intestines was bleached, and near where the disengaged fœtus lay the peritoneum was blanched. Macgillivray was of opinion that hydrops uteri must have existed for a considerable time, as the animal had been large-bellied and uneasy for some days; though three or four days before he was called in, it was supposed that she had sustained an injury from another Cow, and that then or afterwards the rupture had occurred.

Saint-Cyr refers to what the Italian veterinarians designate as *semi-mobile uterus*, and which he believes to be allied to rupture. This is a condition in which the uterus has been completely divided across, either at the body or the cornua, and remains floating in the abdominal cavity, being only suspended by the broad ligaments. The most singular fact connected with these cases is, that although the uterus is torn in this manner, its contents—the fœtus and membranes—do not escape; the section cicatrises, and the organ appears as a large kystoid tumour. Ercolani, Veterinary Professor at the Bologna University, has met with four instances of this extraordinary accident, the pathological specimens being deposited in the museum of that institution. Their history and description are as follows:

1. The uterus of a Cow which contained in one of the cornua a fœtus beyond its term, and in the other horn such a great quantity of mucus that, so far as volume is concerned, it would be difficult to say which cornu was the largest. This uterus is completely divided at the cervix and floats in the abdominal cavity, being attached only by the broad ligaments, which are thin and distended. The detached portion of the

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uterus has a globular form, and its perfectly smooth surface is everywhere covered by peritoneum; where the separation has taken place, the organ is closed by the cicatricial union of the border of the rupture. The mucous membrane in the left cornu of this portion is loose, and shows numerous radiating cicatrises; the fœtus in the right cornu is indurated, and appears to have lived beyond the ordinary period of gestation, to judge by the hoofs, as well as the teeth, which are cut. The nose did not correspond to the opening of the cornu, as the head was doubled on the left side of the neck. The vertex and occiput were turned upwards, and closed a vast circular opening resulting from the destruction of the partition separating the two cornua. The head adhered to the entire border of this opening—unequal and ragged as it must have been; and all that portion which projects into the left cornu presents a large *tonsure*, where not only is the skin absent, but even the periosteum itself. Lying flat on one of its sides and curled up, the limbs twined towards the head, and the muffle placed between the thighs, the fœtus represents a kind of great discoid body.

2. Cornu of the uterus of a pregnant Cow, containing a completely developed fœtus, markedly indurated. This cornu, perhaps ruptured during parturition, is detached, and hangs almost free in the abdomen; while the rupture has cicatrised, and there is formed a large kyst, everywhere closed, and containing the fœtus. The walls of the uterus are for the most part fibrous, and the fœtal envelopes coriaceous. Like the preceding case, this specimen was found in a Cow which had been slaughtered by the butcher; the cornu fell on the ground, after some few fibrous bands which attached it to the sub-lumbar region had been cut through.

3. The uterus of a Sheep arrived at the termination of pregnancy; the organ has been torn in the vicinity of the vagina, and remains free in the abdominal cavity. In this instance, also, the uterus forms a completely closed kyst, which contains a very much indurated lamb. In detaching this organ, an irregular cicatrix is seen, which leads to the supposition that the accident was due to torsion of the cervix.

4. Posterior portion of the body of a Guinea-pig, which shows the right horn of the uterus detached and cicatrised where separation has occurred. This horn, which was half free, was filled with fluid blood; the distention caused by the blood has been so great, that the horn is ruptured in the middle, and the fœtus must have died from hæmorrhage.

With regard to these curious and very interesting cases, Saint-Cyr is of opinion that, to allow the fœtus to remain in the detached portion of the uterus, the separation must have taken place slowly and gradually, and that cicatrisation must have been going on in the portion already separated—the work of union and disunion being simultaneous.

TREATMENT.—When it is possible to diagnose rupture of the uterus, the indications are obvious: extract the fœtus as promptly and easily as possible, and if need be by gastro-hysterotomy. We shall refer to the treatment of these cases when describing this accident as a consequence of parturition.

METRORRHAGIA.

Accidental hæmorrhage from the uterus during pregnancy, appears to be rare in animals, judging from the paucity of instances recorded. Carsten Harms (*Lehrbuch der thierärztlichen Geburtshülfe*, p. 60) has observed this accident in cattle; it was accompanied by a small discharge of blood from the vagina, particularly during micturition, and resulted in the death of the fœtus. Other observers have not noticed this discharge; the blood always remaining in the uterus, where it has been sometimes found, as a clotted mass, to the amount of more than four gallons. In the majority of cases it would seem to be occasioned by a spontaneous separation—more or less extensive—of the placental capillaries from the uterine surface. Zundel has seen it occur in an animal which showed signs of œstrum while pregnant. The following cases may, to some extent, illustrate this accidental uterine hæmorrhage.

Egli was called to see a Cow which staggered about in walking, and did not eat. He found it lying, and had great difficulty in getting it up; when it kept alternately

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lifting the hind legs. The pulse was slow and very weak, and the heart's beats were loud. There were no other symptoms. It was bled, but during the operation it staggered and trembled; the bleeding was stopped. It then lay down without appearing to suffer, and was dead in a few minutes. At the autopsy the uterus was observed to be considerably distended and of a violet colour, and an enormous quantity of blood was effused between the muscular and serous layers, so that the wall of the organ was about six inches thick; there was no extravasation, either in the abdomen or the cavity of the uterus. No cause was ascribed for the accident.

Zundel (*Journal de Méd. Vét. de Lyon*, 1861) describes the case of a Mare which suddenly presented the following symptoms during pregnancy: Anxious countenance, drooping head, rigidity of the loins, staggering gait and lameness of the left hind leg, as if from a sprain; the respirations 36 per minute, and pulse 60 and small. Treatment was of no avail; prostration gradually set in, the animal appeared extremely anxious, soon it could not stand, and when it fell, death ensued almost immediately without much agony. There were never any symptoms of colic or discharge of blood *per vulvam*. On examination, a five months' old fœtus was discovered in the right cornu, and the placenta was detached nearly throughout. The left horn was the seat of sub-acute inflammation, and its volume exceeded that of the right; an enormous blood-clot, measuring about four gallons, occupied this horn and the body of the uterus. The bloodvessels were nearly empty. Zundel asks whether the lameness, which had already been noted as a symptom of metrorrhagia by some German authorities, may not be explained by the arrangement of the lumbar plexus, which sends nerves to the limbs and the generative organs.

In a pregnant Mare, Schmidt (*Annales de Méd. Vét. de Bruxelles*, 1862) witnessed the following symptoms: Sudden inappetence; head low and "beneath the manger;" reeling gait; extreme feebleness, and hind limbs widely separated; looking first towards one flank, then the other; pulse 110, regular but sinking; heart's beats quite audible, and venous pulsation in neck; mucous membranes very pale, and the body temperature low. Dark-coloured blood flowed in a passive manner from the uterus. The Mare died on the same day, and an autopsy revealed all the organs, except the uterus, almost bloodless; that viscus was found to be considerably distended with blood—nearly two pailsful—which was partly coagulated. It contained, in addition, a seven months' fœtus surrounded by the liquor amnii, and entirely separated from the uterine walls.

When there is no escape of blood externally, the diagnosis of this accident is most difficult; but when the hæmorrhage is apparent, then artificial delivery should be attempted, and the same treatment adopted as for *post-partum* hæmorrhage (*which see*).

Abnormal Retention of the Fœtus.

It was remarked, when speaking of the normal period of gestation, that this varied within considerable limits, and that the fœtus might remain in the uterus for a comparatively long period beyond the ordinary time, without any serious inconvenience to itself or its bearer. But when, from any special cause, delivery cannot take place, then very grave results may, and indeed nearly always, follow.

Cases of abnormal retention of the fœtus were observed in the last century by Boutrolle (*Le Parfait Bouvier*, 1766),* Gervy (*Instructions Vétérinaire*, vol. iv., p. 256), and Huzard, senior and junior; the latter exhibited to the Society of the Faculty of Medicine of Paris, in 1815, the uterus of a Sheep containing a fœtus which had been there for three years. Since that period

* Boutrolle writes: "There are Cows which are not 'open,' that is to say, which have not sufficient passage for the calf, which remains in the Cow and becomes dried-up like a ball. The Cow does not die for all this, if it is well cared for; but many perish when, instead of drying-up, the fœtus becomes a mass of corruption. The Cow which carries its dried-up calf in the uterus does not seek the Bull. . . . It is necessary to take care of these Cows for ten months or a year, and to feed them well, especially when the calf dries, for they eat little and become extremely emaciated for fifteen days. In about ten months or earlier, if there is any herbage, these kind of Cows are put out to pasture, and they fatten like others; the butchers find the calf dried up in the calf-bag."

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the literature of the subject has become very extensive, nearly forty instances being recorded in English veterinary journals alone. All the domesticated animals are exposed to this abnormal retention of the fœtus, but the Cow far more than any other creature: the frequency in this animal being as twelve to one in the Mare, and ten to one in the Sheep.

Symptoms and Terminations.—The symptoms at first are, of course, those of pregnancy, until the period of normal parturition, or even during pregnancy when abortion is about to take place. At this period we have nearly all the signs of parturition: enlarged mammæ, swollen vulva, pendulous abdomen, restlessness and anxiety. Then straining begins, but the os uteri remains closed, and no fœtus appears. This condition may persist for only a brief period, and be so little marked as to pass unobserved in some cases; in others it may continue for two, three, or four days, the expulsive efforts gradually diminishing in force and frequency until they altogether disappear. The animal then regains its ordinary state, and, if a Cow, the secretion of milk goes on as if there was nothing the matter. Health may never be impaired from this cause, and the condition of the animal may not be suspected until, if a Cow or a Sheep, it has been fattened and slaughtered by the butcher for food, when the fœtus is discovered. It has been observed that œstrum does not appear in such animals, as a rule. The exceptions are rare; but Rossignol mentions a Cow which retained its fœtus for twenty-seven months, but which yet gave an abundance of milk, often exhibited œstrum, and went to the bull, and was at last killed because it became too fat!

In other instances, after the ordinary period of gestation has been exceeded by several months, signs of parturition are again manifested, and delivery may then be safely accomplished, either without aid, which is rare, or by careful manipulation; the young animal may even be born alive if too long a period has not intervened since the normal time of delivery.* Parturition in these cases is generally difficult; and the favourable termination of such a condition is due to the membranes of the fœtus remaining intact, and the os sufficiently contracted and close to exclude the atmosphere. Even under these circumstances, as Saint-Cyr points out, the retention of the fœtus may not have so fortunate an ending. Very often, after fruitless straining, the animal continues unwell; it has little or no appetite, languishes, becomes feeble: hectic fever appears; it falls into a state of marasmus, and dies after a more or less prolonged period of misery.

When, at the usual time of parturition, the straining of the animal has ruptured the fœtal membranes and the liquor amnii escapes, air at the same time obtaining access to the uterine cavity, the case is in nearly every instance very serious. The fœtus soon perishes and begins to putrefy, and in a short time the decomposing mass causes inflammation of the uterus (metritis), accompanied by frequent and exceedingly severe straining; low

* In the *Newcastle Journal* for January 18, 1840, there is the description of a calf which was born on the 365th day (fifty-two weeks and one day). It was alive when dropped, but died soon after. It was of great size, though born without assistance; it was a male.

Strange to relate, in the *Veterinarian* for 1850 (p. 148), a Mr. Tatam, of Horncastle, records a case of abnormal gestation in a Cow in his locality, in which not only was the period the same (fifty-two weeks and a day), but the calf was a male, as extraordinary in size, and excited a similar degree of wonder, as the above! Mr. Tatam saw the calf; had he seen the other one?

I have some instances of 300 days' gestation, the calves being born alive.

In the Mare, prolonged gestation is not so frequent, though it sometimes occurs, the fœtus being retained a month, or even a little longer, without prejudice to the foal's existence.

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fever supervenes; a foul-smelling putrescent fluid escapes from the vagina, and the creature finally succumbs to metritis and putrid infection. In other instances the termination is not so rapid. The animal remains unhealthy; the secretion of milk is suspended; horribly fetid discharges are passed *per vaginam*, containing pus, broken-up decomposed tissues, and even bones of the fœtus; these discharges are increased by the straining which sometimes takes place at intervals. In the meantime, the creature loses condition, emaciation becomes extreme, and death ensues from debility and marasmus.

With the Cow we may, nevertheless, have a vaginal discharge, due to the presence of a putrefying fœtus, and for a long time, without any such serious result. Figuier, quoted by Saint-Cyr, removed from the uterus of a Cow the entire skeleton of a fœtus which had been there for more than *five years*, without giving rise to any other symptoms than a very disgusting intermittent vaginal discharge. The animal quite recovered. Thierry reports the abortion of a Cow at the fifth month of gestation, and the retention of the putrefied fœtus for more than three months afterwards, without any harm ensuing; Gervy also removed the head of a fœtus which had lain in the uterus of a Cow for eighteen months, without the animal suffering much inconvenience during that time. In the *Veterinarian* (vol. ix., p. 454) there is an instance of a Cow carrying a decomposing calf for two years with impunity; and another (vol. xxix., p. 577) for ten months.

It is not the same with the Mare, as death has been the usual termination; but it would appear that retention of the fœtus is very unusual indeed in this animal, the best recorded instances being one by Hamon, in which death took place after seventeen months' pregnancy; and another by Hammond, when the same result followed after twenty-two months.

The period during which a fœtus may be retained in the uterus varies from a few months to five years.

We have mentioned that in these cases of retention, the fœtus may live for a certain time, provided the membranes are not ruptured when the symptoms of parturition first manifest themselves; it may even continue to develop, as is evidenced by its size, its bony framework, hoofs, teeth, etc., which often cause it to look like an animal which has been born for two, four, or six months. But in other cases, there can scarcely be a doubt that the fœtus perishes when the first ineffectual expulsive efforts are made by the mother, or even at a period anterior to the ordinary occurrence of parturition; as is proved by the absence of hair, and the small size and weight of the creature; while, again, it may live for some hours after rupture of the membranes, provided it can breathe, or the placental connections are intact.

In all cases, as a rule, if the air does not obtain access to the uterine cavity, putrefaction does not ensue; and when the uterus is examined after death, it is found to be closely contracted on its contents, its mucous membrane healthy or slightly ecchymosed here and there, with the cotyledons pale, wasted, and separated from the placentulæ. Sometimes between the inner surface of the uterus and the chorion there is a gelatinous mass, which covers the fœtus and conceals the placental cotyledons, these being decayed, spongy, and sometimes completely destroyed. The liquor amnii has also been absorbed; so that the membranes are in close contact with the fœtus, and may even have become adherent to it in places. The fœtus itself is dessicated by absorption, and its skin is hard and dry as if tanned, or it is wrinkled and shrivelled; while the flesh, if any remains, is either perfectly white, or pale and faded-looking in colour, and emits a kind of rancid odour. Other organs are pale and bloodless, and more or less undergoing fatty degeneration. When

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the retention has continued for a long time, all the soft textures may disappear, and nothing remain but the bones; in other instances the fœtus and its membranes become the seat of calcareous infiltration, and constitute what has been termed a *lithopœdian*.

It is sometimes extraordinary how perfectly a fœtus is protected from decay in the uterus. For instance, in the *Veterinary Journal* (July, 1876), Mr. Taylor mentions one which had been retained for seven months beyond the normal period; and yet with the exception of absorption of the eyes, it did not present indications of having passed more than a few days in excess of the usual term in the uterus.

When the envelopes have been ruptured, however, and the liquor amnii has escaped, we have a different pathological condition. Then, through the partially dilated os the air has been admitted, and if immediately before this the fœtus was alive, it may then die and rapidly submit to the putrefactive process, its soft parts decomposing and macerating and forming a most foul-smelling mass; so that when the uterus is opened, we discover a grey or greyish-red fluid emitting a most disgusting odour, and containing portions of matter resembling adipocere, and perhaps bones which may yet be covered by soft parts and held together by ligaments, or entirely disunited and decaying. The uterus itself shows evidence, in the majority of cases, of chronic metritis; sometimes abscesses have been formed in its texture, or it has become adherent to other organs—as the intestine, or tissues—as the abdominal walls, with which it has established fistulous communications, and through which portions or the whole of the fœtus may be passed.

Causes.—Various causes have been assigned for the retention of the fœtus, several of which are no doubt quite sufficient to offer an obstacle to normal parturition. Among these causes may be cited: a diminution or loss of contractile power in the uterus itself to expel its contents, and the absence of assistance when attempts are made; adhesions of an unusual character between the uterus and placenta; malposition of the fœtus; displacement of the uterus; deformed pelvis; fibrous induration or spasmodic contraction of the cervix uteri; torsion of the uterus, or adhesion of its ligaments, etc.

The following cases are given as examples.

Mr. Cartwright (*Veterinarian*, vol. x., p. 243) refers to a Cow that was at full time of calving in May, and showed signs of parturition, the udder being of great size, and two of the feet of the fœtus being seen in the vagina. As the animal could not be assisted just then, a day or two was allowed to elapse, when exhibiting no signs of uneasiness a further interval ensued. But no indication of calving was again noticed, the Cow only moaning for a few days. Four or five days afterwards she was milked, though the yield was scanty at first, and only became moderately plentiful at a later period. It was sold in October, though it had not appeared to be quite well for some time after the proper period of calving had passed, and there was no œstrum. At first the abdomen was very large, and then gradually subsided. The calf could be felt all the time.

The same excellent observer relates (*Veterinarian*, vol. xi., p. 16) that a farmer, at shearing time, discovered that one of his Sheep, a fine four-year-old Cheshire Ewe, had not lambed, and that the fœtus was "coming out at the bottom of the belly." Mr. Cartwright's examination revealed the existence of an opening at the umbilicus, sufficient to admit two or three fingers, from which hung a little hair, and matter oozed. The fœtus could be distinctly felt at the lower part of the abdomen, and seemed hard. Many pieces of hair and skin, also one fore leg as high as the shoulder, and a portion of another limb, were removed. No more could then be got through. The wound gradually closed, and the animal improved in condition until about six months afterwards, when, being exposed to much wet weather, it began to decline, and it was

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deemed advisable to send it to the butcher. The abdominal wall in the region of the wound was thickened, and portions of bones projected from and pressed around the orifice, which was the width of a finger. The vagina and os uteri were pervious and natural; but in front of the cervix the uterus, for a foot in length, was no thicker than a thin pipe stem, and very similar in appearance and structure to one of the ureters; it would only admit a probe. Then it became wider and more muscular, and divided into two passages, in which were contained a few small bones. From this part the body of the uterus expanded to half the size of a man's head (the two short cavities opening into it), and was attached anteriorly to the diaphragm, and laterally to the abdomen, for several inches around in every direction; it contained the remains of a fine fœtus, now reduced in a great measure merely to bones and a little putrid matter. The sac thus formed by a part of the uterus was, inside, in an apparently diseased state, being necessarily of a darkish colour in consequence of the uterus firmly clasping the bones, and becoming injured by their rough projections, as it was completely wedged full. There were attachments formed on its peritoneal layer with the small intestines and thin mesentery, but they were sound. The Ewe should have lambed two years previously, at which time it showed uneasiness. The owner thought it would have done so had it been assisted.

M. Caillier (*Recueil de Méd. Vétérinaire*, 1847, p. 690) was called to attend a seven-year-old Mare, which had been put to a stallion Ass. The animal's abdomen was very large and pendulous, there was loss of appetite, the surface of the body was cold and skin unhealthy, membranes pallid, frequent yawnings, often looking back at flank, head continually agitated, sinking of hind quarters, and unsteady gait. The fœtus appeared to be dead. The Mare had been ill for two days, though it had not been exposed to anything likely to cause abortion; its period of gestation had expired, and the movements of the fœtus had been lately observed. On the previous evening the usual signs of approaching parturition were noted; there were expulsive efforts, a discharge of glairy matter, considerable dilatation of the vulva, filling of the udder, and sinking of the abdomen. An exploration *per vaginam* discovered the cervix uteri to be rigid and the os completely closed, which gave rise to a suspicion of the existence of scirrhus. Three days afterwards glairy discharges had been passed, but the udder and abdomen appeared to be diminished in size. Another examination proved that the index finger could not be introduced into the uterus, but was opposed by a hard tumour. The owner not assenting to an operation for the relief of the Mare, affairs were left to take their course; for two months there was no amendment; then the animal was put to pasture, when improvement began, and on the return of the season it was put six times to a Horse. Ten days afterwards it died. Examined immediately after death, the uterus was found to be a hard voluminous mass, which, when opened, was discovered to contain the body of a well-formed mule in a perfect state of preservation, the hair even being quite firm. The nose was fixed in the os, and it had become elongated and the nasal cavities obliterated. There was nothing unusual about the uterus itself or the membranes, except at the cervix, the texture of which was yellow, swollen, and scirrhus, and so hard that it was with difficulty cut. The Mare had gone twenty-three months with foal, and the retention was due to the diseased condition of the cervix uteri.

At the Obstetrical Society of Edinburgh, in 1872, the mummified fœtus of a Cow was exhibited; it had been expelled, without any effort, two years and three and a half months after insemination. In July, 1865, this Cow, which was of a celebrated breed, was put to the Bull; but in December it was attacked with the rinderpest, when no doubt the fœtus died, though the mother recovered. There were no signs of labour when the fœtus perished, nor yet at the ordinary period of parturition. The animal was fed for the butcher, and on October 18, 1867, in the course of the extreme fattening which it underwent, the almost forgotten pregnancy was brought to recollection by the expulsion, probably due to the accumulation of fat in the omentum and elsewhere, of the lithopædian.

In the *Veterinarian* (vol. xli., p. 88) Mr. Wilson describes a case of what he designates "retention of a fœtus" in a Cow, which was evidently some time beyond the usual period of parturition. On being killed and opened, all the viscera of the pelvis and posterior part of the abdomen were observed to be bound up *en masse* by more or less thin, transparent, and loose tissue. Removing this, the left tibia, fibula, and patella of a fœtus were found within a double of the intestine. The bones were fully formed, but black, and matted with short hair. The intestine of the Cow presented no morbid appearances, but the contents were liquid at that part only. The animal had been attacked with transient diarrhœa three days previously. The body of the uterus was affected with anasarca, and in the cavity of the organ was another lot of bones of the same appearance as the others. The cotyledons were entirely absorbed,

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and the texture of the walls was like basil leather. There were three distinct tubular passages between the fundus of the organ and the colon, the largest of which was not less than three inches in diameter, and through this the bones in the intestine must have passed. The Fallopian tubes appeared to constitute two of these ducts. The cervix uteri was cartilaginous, and no os could be found.

A very interesting case is recorded in the *Veterinarian* (vol. xlii., p. 391) of a Cow which had aborted towards Christmas, 1868, and until the following May had been in thriving condition; when in that month it began to lose appetite, and commenced to strain. Then the vagina became discoloured, and a peculiar offensive discharge flowed from it. On examination *per rectum* nothing could be discovered, but on exploring the generative organs it was found that the os uteri would admit the index finger, and that the discharge, which was fæcal in character, was proceeding from the uterus; hence it was surmised that the irritation and straining at the commencement of the animal's illness, might be accounted for by the large quantity of fæculent matter escaping by the vagina. The diagnosis was that a communication existed between the uterus and bowels, probably as the result of abscess. The Cow was destroyed, and on cutting down on what appeared to be an enlarged portion of intestines, some of the bones of a calf were come upon; it was also noted that several communications existed between the uterus and bowels. The uterus appeared to possess three, instead of two, cornua; and in one of these, and partly covered by a thick layer of the mucous membrane, several bones of a fœtus, including some belonging to the head, were found. An adhesion existed on the outer side of the cavity containing the fœtal remains, and the peritoneal surface of the intestines. The continuous pressure of the sacculated bones had led to the production of fistulous openings into the bowels, through which, apparently, several of the bones had ultimately passed into the intestinal canal. This Cow may have been pregnant with twins, and only one had been aborted.

TREATMENT.—The treatment of fœtal retention must greatly depend upon circumstances. When the owner of an animal that has reached the termination of gestation and begins to be in labour, perceives that the efforts are weak and irregular, and not sustained, so that birth does not take place after twenty-four, thirty-six, or forty-eight hours, and even when the symptoms of colic are slight and the condition of the creature otherwise satisfactory, the attendance of the veterinary surgeon should not be delayed. The latter will inform himself as to the history of the case, and also its present condition by careful external examination and internal exploration. By the latter he will ascertain, in all probability, the character of the obstacle to parturition, and be in a position to decide whether delay is necessary, or if he is to promote immediate delivery. In some instances it will be difficult to arrive at a decision. Some practitioners of note recommend abstention from interference, and the adoption of expectant treatment, so long as the os is not sufficiently dilated or the fœtal membranes are not ruptured; and they insist on this course, even when there is a material obstacle present—such as torsion of the uterus or degeneration of the cervix—which renders spontaneous or natural delivery impossible.

This treatment is based on the relative innocuousness of the fœtus in the uterus, even for a very long period, so long as the liquor amnii has not escaped and the air has not penetrated. This course is no doubt most judicious in some cases, and is followed by successful results. All that has to be done is to keep the animal very quiet, in a darkened place if possible, and to administer opium or chloral in full doses, both in draught and enema if need be.

But Saint-Cyr is of opinion that in the majority of cases, if not in all, it is more preferable to resort to active measures. The expectant method, he says, was all very well when art found itself disarmed in the face of certain accidents, such as torsion of the cervix, which rendered spontaneous delivery impossible; but it cannot be urgently insisted upon now, when we are in possession of methods which enable us to overcome these accidents. There-

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fore he thinks that, as a rule, it is the duty of the obstetrist to terminate as soon as possible the act of parturition, when it has once commenced. In compliance with this advice, the veterinarian, after informing himself as to the nature of the obstacle opposed to delivery, should act according to the rules applicable to each particular case—rules which will be alluded to hereafter.

When the membranes are ruptured, then delay may be out of the question, and intervention might require to be prompt, if serious consequences are to be averted. Attempts to effect speedy delivery should be resorted to at once, in the majority of cases, if not in all. Nevertheless, even here we find excellent practitioners recommending abstention, at least for some hours, according to circumstances. For instance, Dupont, of Bordeaux (*Archives Vétérinaires*, June, 1876), a good authority, does not at all agree with the generally received opinion that death of the fœtus must necessarily immediately follow rupture of the membranes, as he has met with many cases in which it has lived for a long interval—twenty-four to thirty-six hours—after the escape of the liquor amnii; and he does not hesitate to affirm that respiration commences with, and is continued after, the evacuation of this fluid, especially if the young creature is in a natural position—the fore-limbs and nose in the os. He will not say so much for all the positions of the fœtus, though he has effected delivery in them fifteen to twenty hours after escape of the liquor, and the creature has respired and lived. He thinks that the popular opinion is due to the fact, that the attention of the obstetrist is solely directed to preserving the life of the mother, and that the fœtus is killed through the violent compression it sustains in a narrow pelvis, from the powerful contractions of the uterus, without the intervention of other causes.

When some time—days, for instance—has elapsed since this stage in parturition was reached, and labour has completely subsided, the case is difficult, and it will again depend upon circumstances whether expectant or active treatment shall be adopted. An exploration should certainly be made, and if it can be ascertained that the membranes are not ruptured, while there is no straining and the condition of the animal is satisfactory, then it will be advisable to wait until indications of labour are once more manifested. If the state of the animal is not so favourable, and delivery is decided upon; should the os be impermeable, or not sufficiently dilated to allow the passage of the fœtus, then it must be opened either by careful manipulation, uterine douches, the uterine dilating bag, or other modes which will be alluded to when treating of dystokia.

When a long period has intervened, and the general and local disturbance in the animal necessitates active interference on the part of the veterinary obstetrist, then of course the first and most urgent indication is to remove the cause—the putrefying fœtus—from the uterus. When the os is not sufficiently open to admit the hand and the withdrawal of the fœtus, then the case is one of difficult labour, complicated by the death of the fœtus and its state of decomposition. If the os should chance to be contracted, it must either be dilated by the means we have named, or if these do not succeed (though they often do) then the cervix must be incised. In very exceptional cases, gastro-hysterotomy has to be performed if the fœtus or its remains are to be got rid of; and in some instances, owing to the emphysematous condition of the fœtus, its shape or size, or the deformity of the genital passages of the mother, embryotomy is called for.

When the uterus is emptied of all the matters, solid and fluid, it contains, it may be thoroughly cleansed by repeated injections or washings with

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tepid water, and finally with some anti-putrescent fluid—weak solutions of chloral, or carbolic or salicylic acids. General treatment may also be necessary, and this must be regulated according to the indications. In all the manipulative operations subsequent to delivery, it will generally be found that care and patience, and, above all things, an absence of undue haste, are commendable, and particularly with regard to the removal of the membranes, especially in primiparæ. The danger of septic infection may be largely averted by intravaginal emollient douches, and serious consequences may often be avoided by abstaining from premature and violent interference.

When portions of the fœtus are expelled through fistulous openings, even then surgical interference might be successfully invoked.

Abortion.

When pregnancy is interrupted by the expulsion of the ovum, or of the fœtus at a stage when this has not attained sufficient development to live external to its parent, *abortion* (*partus immaturus*) is said to occur. But when the fœtus is expelled before the ordinary period for parturition, yet with all its organs sufficiently perfected to enable it to exist for at least some time in the external world, this is designated *premature birth* (*partus præmaturus*). In the first instance, the young creature is either dead when expelled from the uterus, or dies immediately afterwards; and in the second, it may be weakly and immature, and succumb after a variable period; or it may continue to live and thrive. In practice, there is no accurately defined limit between abortion and premature birth, and especially when the latter has been brought about by some of the causes which produce the former.

Abortion may be said to take place in solipeds, when the fœtus is expelled forty days before the normal period; in the bovine species, thirty-five days; in the Sheep and Goat, twenty days; in the Pig, fifteen days; and with the Bitch and Cat, seven days. Saint-Cyr says that it may be acknowledged that abortion has taken place, when the fœtus is expelled in the Mare before the 300th day of gestation, in the Cow before the 200th, in the Sheep before the 140th, and in the Pig before the 100th day.

There is not the same tendency or readiness in all the domesticated animals to abort. The Bitch and Cat rarely do so, even after serious injuries; and the Pig retains its fœtuses almost as tenaciously; but the Sheep and Goat are rather liable to this accident. The Cow and Mare, but more especially the former, most frequently lose their fœtus. In what proportion abortions occur is not ascertainable from any documentary evidence. For the Cow, Baumeister and Rueff state that in France, in a dairy containing Durham Cows, and numbering 100 pregnancies, there were 17 abortions; and at Hohenheim, from a register kept for thirty years, it appears that one-fifth of the Cows aborted. Among 5864 Sheep of various breeds at the same establishment, there were only 26 abortions, or 0·433 per cent.

Abortion may occur at any period of gestation within the limits above named, though it is much more frequent during the first than the second half of pregnancy, and especially with the Mare. When this accident occurs at a very early stage, it may produce no appreciable disturbance of health in the female, and the ovum escapes intact, and often unperceived. The accident is more serious when it happens at a late period; as it then not only causes the loss of the young animal, but may compromise the existence or value of the mother.

Abortion may be either *sporadic*, or *enzoötic* or *epizoötic*. When cases occur here and there over a wide extent of country, without any relationship as

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to causation, they are *sporadic* or *accidental* abortions; and though they must be reckoned as losses, yet they rarely attract much attention from the damage they inflict, and because of their isolated, and by no means unusual, occurrence. But when, on the contrary, the pregnant animals—say Cows, Ewes, or Mares—on a farm, in a village, or over a large district or country, miscarry in large numbers, and the mishap is evidently due to the same cause or causes, then it is indeed a grave misfortune, as it entails serious damage—present and prospective—to the interests of agriculture. This is *enzoötic* or *epizoötic* abortion: an occurrence far from uncommon, and the etiology of which has attracted the attention of the most distinguished European veterinarians for many years.

Sporadic Abortion.

Causes.—The causes of sporadic abortion are very numerous; they may act either directly or indirectly, and produce their effects in an evident or an obscure manner. They may be ranged as *external* or *internal*.

1. *External Causes.*—Atmospherical influences, bad weather, or irregular seasons, have been cited as causing abortion. There can be no doubt whatever that cold, and especially when suddenly applied to the skin, may produce this result, and hence it is that the abrupt setting in of cold weather is often marked by miscarriages among animals exposed to it. Many observers have noted that the continued and severe cold of winter is far less frequently productive of abortions than when one cold wet, or frosty night in autumn succeeds a fine warm day. Cold rain is sometimes very damaging in this respect.

With regard to food and ingesta in general, there can be no doubt that here we often have an undoubted cause. Food of bad quality, indigestible, or containing injurious ingredients, is well known to be dangerous. After unfavourable seasons, when forage has not been well dried and made, abortions are far from uncommon. Indigestible food, or that which has a tendency to collect or ferment in the stomach, may, by exerting pressure on the uterus, produce this accident.* On the other hand, too great an abundance of easily-digested and stimulating food, by inducing plethora, and consequent congestion of the uterus and loosening of the placentæ, has been set down as another cause. Frozen food or water, when taken in immoderate quantity, and especially if the digestive organs are nearly empty, as well as forage or herbage covered with snow or frost, are also injurious in this respect to all the larger animals when pregnant, and abortion often follows immediately.† Filthy putrid water

* Delwart has given a good illustration of this. "For twenty years all the Cows in a herd of thirty aborted each year, and if by chance one calf reached its term, it was so puny and deformed that it died in a few days after birth. The cause of these abortions appeared to me to lie in the too large quantity of grains and balls of cereals with which the animals were fed; the rumen and second compartment of the stomach formed a compact mass which weighed on the fœtus, prevented its development, and ended by killing it. These Cows were put under our care, and submitted to a different kind of alimentation; roots replaced the innutritious food previously given, and which gave rise to permanent indigestion. This régime was seconded by the administration of a decoction of linseed, five or six bucketfuls in the day, and a draught of a pound of sodium sulphate to each Cow. . . . Success was complete; the destructive scourge entirely disappeared, and twenty-eight healthy calves were born at the proper time."

† Saint-Cyr mentions that Gellé has witnessed nearly one-fifth of a flock of Sheep abort immediately after drinking from a pond, the ice on which had to be broken to water them. Audoy reports an exactly similar occurrence; and Delorme, who has also observed analogous accidents, adds that they are most likely to happen when the Sheep have been deprived of water for several days. Huvellier mentions a rich grazier of Merlerault who owned ten brood Mares, one half of which aborted every year, because they were sent three times a day to drink cold water. Often, after quenching their thirst, they trembled, were seized with colic, and aborted. The régime was changed; the Mares received water at morning and mid-day in the stable, a handful of bran

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has also very frequently a pernicious influence on gestation. Some plants—such as the horse-tails (*Equisetaceæ*), sedges (*Cyperaceæ*), etc.—and the leaves of beet-root, readily induce abortion, according to several authorities. Rue, savin, ergot of rye, and other ecbolics will, of course, cause expulsion of the fœtus more or less readily; and toxical substances, such as cantharides, which act upon the uterus, will do the same. Purgatives, especially those of a drastic kind, are a fertile cause; and opium, digitalis, and some other drugs have to be administered with caution. Food or herbage altered by the presence of cryptogamic vegetation, has long been known to cause abortion. Ergotised grasses and grains have often produced wide-spread losses from this accident.*

Excessive muscular exertion and unusual travelling, and especially if there is a predisposition to abortion, is very likely to produce it; if the exertion is sudden and severe, or even moderate, but coming after a long period of rest, it is all the more certain. Contusions to the abdomen by kicks or falls, or squeezing through a narrow doorway or passage, railway or steam-boat travelling, blows and shocks, keeping the animals in stalls with very inclined floors, are all so many causes. A case came under my observation recently, of a little Bitch, extremely fat, which aborted at a late period of gestation, through frequently ascending and descending a steep staircase.

Access of the male not unfrequently produces a miscarriage; and exploration *per vaginam* by the expert, has also been blamed, as well as surgical operations performed on pregnant animals—bleeding, for instance, or throwing an animal down to be operated upon.†

Carrying a rider, in the case of the Mare, and especially if spurs are used, is attended with much risk.

Excitement, fear,‡ sudden surprise, or anger, are also causes. Heavy thunder has sometimes been serious in this way; and the fear produced by Dogs leads sometimes to heavy losses among Sheep—foxhounds running near or among pregnant Cattle or Sheep often cause considerable damage, especially among nervous animals.

Certain odours are said to cause abortion, and contagion is supposed to play an active part.

2. *Internal Causes.*—Badly-fed and neglected animals sometimes miscarry,

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being put in the water; and only in the evening were they allowed to be watered outside, after the stable-doors had been opened for an hour. The abortions ceased. Flandrin relates similar accidents occurring to the Mares belonging to the Prince of Condé, and from the same cause.

* The *Veterinary Journal* (vol. i., p. 422) alludes to an occurrence of this kind in New Zealand in 1875. It appears that this accident was comparatively rare in that colony until the introduction of rye-grass on the pastures, after which it was common, and a cause of great loss when the rye became ergotised. The same journal (vol. ii., p. 51) contains an account of serious abortions among Mares in Germany, due to rust (*Trichobasis rubigo*) on the straw on which they were fed. In *Animal Plagues* (London, 1871) many interesting notices are given of similar occurrences.

Haselbach reports that in a cow-shed where maize infested with its parasitic fungus (*Ustilago maïlis*) was given to the cattle, eleven aborted within eight days. The food was changed at once, and the other Cows escaped the accident. A certain quantity was administered to two pregnant Bitches, and they both expelled their young.

† Professor Bouley performed the operation of castration on three pregnant Cows; they aborted in two days after, and one died. Nevertheless, Chanel has seen a castrator operate on a Sow about two months pregnant. Three fœtuses, the size of the middle finger, were removed with the portion of cornu in which they were contained. The poor beast lost much blood, and was very ill for six or seven days; yet in more than two months afterwards it brought forth five young pigs, which it suckled.

‡ The Cat rarely aborts, and instances are on record in which they have fallen from a considerable height without this accident occurring. Nevertheless, they are liable to miscarry, and a friend who lives near Chatham had a favourite Cat heavy in kitten, that aborted immediately after being pursued by a strange Dog, which, however, did not seize it. The accident in this case was evidently due to fear.

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but not nearly so frequently, perhaps, as those in the opposite condition and extremely fat. It is generally admitted that with some animals there is a special predisposition to abort, and that a very trifling cause, and sometimes no appreciable cause at all, will induce this accident; while other animals never lose their fœtus, though exposed to the influence of apparently most powerful causes. This predisposition is not manifest externally, and sometimes it disappears as age advances.

A more constant and potent cause, however, is to be found in the presence of grave diseases, and especially those which affect the system generally, producing more or less derangement of all the functions. The various serious epizoötic maladies, enteritis, and all those abdominal disorders which give rise to restlessness, tympanitis, cough, and those diseases which induce cough—as bronchitis, pneumonia, asthma, etc.—pleurisy and other affections and injuries accompanied by great pain; as well as nervous or convulsive derangements—such as tetanus, epilepsy, vertigo, etc., are all set down as causes. Disease of the uterus will, of course, be very likely to lead to the premature expulsion of the ovum or fœtus. Metritis, abnormal conditions of its mucous membrane, as well as new formations—such as fibroid and carcinoma, and other alterations by which the enlargement of the organ is hindered—as enormous tumours in the abdomen, ovarian dropsy, etc.—will predispose to or excite abortion, as will also every condition which leads to hyperæmia of this viscus.

Abortion has not unfrequently been ascribed to some defect or other influence in the male, though in what these consist has not been explicitly stated; unless they are to be found in the debility arising from too frequent usage, or other causes related to the animal's state of health. There is strong and abundant evidence that a male enfeebled by too much use, is very likely to be a cause of abortion in the females to which he has been put. This accident has also been said to occur frequently when the male was larger and more powerful than the female. Various injuries and diseases of the fœtus or its envelopes, may lead to the same result. External violence may not only injure the uterus itself, so as to produce abortion, but the fœtus even may sustain damage. Cauvet, cited by Saint-Cyr, has remarked in a case of miscarriage in a Mare brought about by kicks on the abdomen, that the fœtal membranes exhibited at the corresponding point an enormous ecchymosis, and behind the shoulder of the fœtus, which was in relation to this extravasation, was a large brown-coloured exudation. Another observer has witnessed an adhesion between the skin on the cranium of a fœtus and the fœtal membranes, as well as depression of the cranial bones—all evidently due to external violence.

In acute febrile diseases of the mother, the fœtus may perish from the abnormal accumulation of heat; or chronic or acute anæmia in the female may prove fatal to the fœtus, by causing asphyxia in it.

Certain virulent disorders affecting the female may likewise cause the death and expulsion of the young creature *in utero*. The fœtus of a Cow affected with contagious pleuro-pneumonia, has been found with its lungs affected in a similar manner;* and to prove that the transmission of these diseases can be effected in this way, Sheep which were in the uterus when their dam was affected with variola (sheep-pox) were found to resist inoculation with the virus of that very malignant malady. Hydrocephalus, ascitis, anasarca, and

* Barrier describes an abortion epizoöty among Cows, in which nearly all the calves were expelled alive at the fifth to the seventh month, but died within eight days afterwards. The principal symptoms were a more or less loud râle, the discharge of rusty-coloured mucus from the nostrils, and constant loud bellowings. At the autopsies the "lungs were tumefied, red, and fleshy, and the bronchia filled with the saffron-tinted fluid that flowed from the nostrils."

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chlorosis, may also lead to the death of the fœtus, which in nearly every case is not only the most frequent predisposing cause of abortion, but is almost a certain determining cause of its expulsion. Hydramnios, and other morbid conditions of the fœtal membranes, or faulty formation or relations between the placentæ, are other causes; as well as congenital malformations of the fœtus, malposition, or exaggerated volume. The presence of several fœtuses often leads to abortion in uniparous animals.

Symptoms.—The symptomatology of abortion is extremely varied; being in some cases so trifling that, as already said, the accident may be unperceived, so far as the female is concerned; while in others the symptoms indicate a very serious condition. This usually depends on the period of gestation at which the accident occurs.

Generally, abortion takes place without any premonitory indications, and the animal may be as well and lively as usual up to the moment when the fœtus is expelled; and the expulsion itself is so sudden, so prompt, and accomplished with so little visible effort or disturbance, that the accident in most cases receives very little, if any notice. It often occurs during the night, and wonder is often expressed at finding in the morning the aborted fœtus, generally contained in its intact envelopes, lying behind an animal which, on the previous evening, looked perfectly well, and even now is so cheerful and unaltered, and its functions so unimpaired, that it can scarcely be believed that it has been the subject of such a mishap. Even the sentiment of maternity, which is so strongly developed in animals, as Saint-Cyr justly remarks, is not awakened in favour of the expelled fœtus, and the mother shows the utmost indifference to it, even treading on it as if it were in no way related to her.

When this simple abortion has taken place during the day, it has been noted that the flanks fall in a little, the abdomen descends, the vulva and vagina slightly dilate, and there escapes from them a glutinous, sometimes sanguinolent, fluid, with which the fœtus is passed almost without effort. We have said that the ovum or fœtus is generally expelled in its intact membranes; this more frequently happens at an early stage of pregnancy. Sometimes, however, the amnion ruptures at the commencement of the abortion, and the embryo or fœtus escapes with a small quantity of liquor amnii, the envelopes being rejected soon after, or in some instances they may be retained in the uterus, and thus constitute a source of danger, the animal not making any effort to get rid of them. This *complicated* abortion occurs more frequently at the later stages of pregnancy, and more resembles normal birth than *simple* abortion, which is more often witnessed in the first half of gestation. Nevertheless, we have the latter happen so late sometimes as the seventh or eighth month in the larger animals. It is observed more particularly in those which are debilitated from any cause; but, at the same time, animals which appear in the very best health are often the victims of simple abortion.

So little disturbance does this kind of abortion cause, that the animal can be treated in every way as if nothing had happened; though it is more judicious to give it a little extra care for some hours at least.

In what has been termed *laborious*, *difficult*, or *complicated* abortion, which is often due to external causes, such as injuries, the precursory symptoms are generally well marked, and vary somewhat according as the fœtus may be dead or alive. The animal suddenly appears dull and peculiarly dejected; or it is restless, uneasy, and continually moving about; if pregnancy is advanced

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and the fœtus is alive and strong, its movements are, on watching the abdomen attentively, perceived to be frequent, violent, and disordered, but they soon become feeble and unfrequent, and cease altogether when the fœtus has succumbed. The appetite is lost, a plaintive neigh in the Mare, moan in the Cow, or bleat in the Sheep, is emitted every now and again; the pulse is quick, small, and hard as in hæmorrhage; progression is difficult and unsteady; the physiognomy is anxious, and respiration hurried. When the fœtus is alive there is perhaps less prostration; and, more particularly with the Mare, there appears to be much abdominal pain. The animal often looks anxiously towards the flanks, paws with its fore feet and stamps with its hind ones, moves from side to side, perspires at the flank, breast, and elsewhere, lies down and gets up again, whisks the tail incessantly, and exhibits every indication of increasing restlessness. At the same time the abdomen loses its round shape, and drops; if the animal is in milk, the mammæ become soft and diminish in size more or less rapidly, while the secretion diminishes; but if it is not yielding milk, then, on the contrary, they enlarge and become turgid; the vulva is tumefied, and from it escapes a tenacious mucus, serous, or sero-sanguinolent, and, if the fœtus is dead, more or less fœtid fluid, according to circumstances. Then follow symptoms analogous to those which characterise normal parturition: the uterus begins to contract, and the expiratory muscles act simultaneously with it; the expulsive efforts, or "labour pains," acting more or less energetically and continuously, according to the suddenness of the abortion and the strength and health of the animal. The first result of this straining is the evacuation of the bladder and rectum; the next is the dilatation of the os uteri and protrusion of the membranes into the vagina, then through the vulva, where they appear externally as the "water-bag;" this may rupture and the liquor amnii escape, and the pains becoming more powerful, the fœtus is at last expelled either nude or covered by the membranes. This act occupies a variable period—from a few to many hours, according to the strength of the animal; and it may even require human intervention to bring it to a successful termination. In other instances, however, the fœtus is not expelled immediately after it is dead, but after many of the premonitory symptoms just described have been manifested; with the cessation of the movements in the fœtus the animal regains its ordinary tranquillity, appetite, and liveliness, and all the symptoms disappear for one or more days, when they again set in, and the fœtus may be rejected without any apparent effort, or after much straining.

And in some cases of what might be termed "violent" or "acute abortion," when it suddenly sets in, and nothing being prepared for its being carried to a successful termination, neither on the part of the fœtus nor of the mother, the latter is exhausted by ineffectual efforts, and soon passes into a critical condition.

Abortion differs from normal parturition chiefly in the state of the cervix uteri. Towards the termination of pregnancy, this part of the uterus becomes gradually shortened and softer; but in abortion we do not have these progressive changes which are so favourable to the passage of the fœtus from the uterine cavity outwards; the cervix is long and rigid as in the non-pregnant condition, and its dilatation is therefore slower, more difficult, and more incomplete than when gestation has reached its termination; and especially as the muscular fibres of the uterus have not acquired either their full development or contractile force. To counterbalance this, there is the small size of the fœtus, which does not require so much space for its passage as if it were full grown; so that the difficulty in removing it is less on this account,

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though the other difficulties the obstetrist has so often to encounter in parturition may all be present.

Results.—Abortion is always a serious accident, if only from the loss of the fœtus. It is frequently complicated by hæmorrhage, which may primarily have been the cause of uterine action; it may also result in rupture of the organ, from the efforts the animal makes to overcome the resistance offered by the cervix; indeed, we may have the usual complications that attend parturition. But in many cases the complications are few and trifling, the animals scarcely experiencing any inconvenience, and retaining all their useful qualities unimpaired. When the accident occurs in the Cow at an early period—before the fifth month—the secretion of milk is generally interrupted, often for a year, as the mammæ have not had time to experience the reflex or sympathetic influence which stimulates them into activity; when, however, it takes place in the last half of pregnancy the secretion may be established, though the yield is usually diminished, and the glands do not furnish their ordinary quantity until the next pregnancy.

Abortion may produce prolapsus of the uterus and vagina, and sometimes even of the rectum. At an early period of gestation, as we have mentioned, when the fœtal and uterine attachments are not very close, the ovum or fœtus may be expelled with the whole of the membranes; but as the process has advanced, this result is less probable, and particularly with the Cow. The membranes are frequently retained, wholly or partially, when the fœtus comes away; and owing to the condition of the cervix and its rapid contraction, they are included in the uterine cavity and constitute what is termed "retention of the placenta:" often a serious complication of abortion in the Cow after the first third of pregnancy, the membranes decomposing and giving rise to putrid infection and other alarming pathological conditions.

In the simplest cases, œstrum appears in the Cow in from one to two weeks after the miscarriage, as after parturition, and conception may occur then; but not unfrequently impregnation does not take place until after several returns of this condition, and often a whole year elapses. In other instances, œstrum does not appear until the full interval of regular pregnancy has elapsed, and then the animal conceives almost as readily as before the mishap. Another very common result is a more marked disturbance in the generative functions, in which there is a tendency to abortion after every conception; and with other animals there remains an excitability of the generative organs, which is manifested by an almost persistent state of œstrum, giving rise to nymphomania, and accompanied by sterility.

Pathological Anatomy.—The lesions occasioned by abortion are varied, according to circumstances. In the majority of cases, and especially when pregnancy has been well advanced, the maternal organs are in a similar condition to that observed after normal parturition. The os is dilated or closed, but in general the cervix is a little softer than in the unimpregnated state. The uterus is more or less contracted on itself and looks congested, its vessels being voluminous, varicose, and filled with blood; its cavity contains a certain quantity of blood-coloured mucus, and often all the characteristic indications of placental retention and decomposition; its mucous membrane is red and thickened, and there may be traces of inflammation in it and the cotyledons, as well as evidence of the cause which produced the accident, if due to injury.

The appearance of the fœtus varies also, according to the period at which

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it is expelled, the cause or causes which led to its expulsion or death, as well as the period of its decease. At page 105 we have enumerated everything known that is likely to lead to a knowledge of its age. Whether it is expelled or is found in the uterus on examining the carcase of an animal that has died or been destroyed, the body of the fœtus may be in a more or less perfect state of preservation. If it has perished recently, it is little if at all altered; its skin is firm, white, elastic, and even; and its flesh white, rather firm, and odourless. But when death has taken place some days previously, and the air has had access to the uterine cavity, then there are indications of putrefaction—all the more marked as the interval is prolonged since death occurred. The fœtus is swollen and emphysematous, and exhales a putrescent odour, while the hairs, and even the hoofs, are easily removed. When the air has not entered the uterus, the fœtus may present a withered, wrinkled, mummified appearance.

Saint-Cyr draws attention to a fact which we have already alluded to on several occasions, but which is worth alluding to again. It is that, as a general rule, the death of a fœtus brings about its expulsion in a short time; and not its own expulsion alone, but also, in multiparous animals, that of all the uterus may contain. This rule, however, is far from being absolute. We have already seen that a dead fœtus may be retained for a very long time; and at the autopsy of such multiparous creatures as the Bitch, Cat, and Sow, which have died or been killed while pregnant, it is not rare to find, between two perfectly healthy and well-developed fœtuses, one which has been arrested in its growth, and has evidently been dead for a long time, and yet its presence has occasioned no disturbance. Besides, Bitches and Sows, and even the uniparous Mare and Cow, at the usual period of parturition will bring forth, along with well-developed and living young, one or more dead fœtuses whose general appearance testifies that they have ceased to live for a long time. These facts prove that the diseased condition, or even the death, of one or more of the fœtuses in an animal does not always prevent gestation from following its regular course.

Diagnosis.—The diagnosis of abortion, easy in some cases, is in others difficult and complicated; and as an error in distinguishing this accident may result in serious consequences to the veterinary obstetrist, no less than to the animals confided to his care, as Saint-Cyr properly remarks, it is well that it should receive attention. This excellent authority judiciously presents the problem in three different aspects: 1. Prognosticate a possible, but not yet imminent abortion; 2. Distinguish an abortion taking place from other accidents or diseases with which it might be confounded; 3. Recognise that an abortion has taken place.

1. *Prognosticate an Abortion.*—Suppose the owner of a pregnant animal asks such a question as, "Will this creature carry its young the full time?" this must be answered by another question, "What leads you to think it will not?" For there can be no doubt that, as has been already asserted, there is a special predisposition in certain animals to abort from the most trifling cause, and indeed without any evident cause at all; and yet they offer no visible indication of this tendency. In this aspect of the question, it is always judicious to remember certain maxims, the most important of which is that relating to several previous miscarriages, before giving an opinion as to the probability of such an accident; and this opinion should be based on exact knowledge of the causes capable of compromising the issue of pregnancy to which the animal has been or is then exposed. The inquiry

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should be as complete as possible, and then an opinion ought to be carefully given; as many of the causes of abortion are so very imperfectly known, and so many circumstances may modify the predicted result, that in the majority of cases it is only permissible to hazard presumptions which, after all, are more or less uncertain.

2. *Recognise an Actual Abortion.*—Here we have to distinguish an abortion in process of accomplishment; and at first sight nothing would appear more easy, and, in fact, nothing is so easy if time be allowed until all the characteristic symptoms attending the expulsion of the fœtus are plainly developed. But when the obstetrist is consulted at the commencement—during the premonitory period, it may he very embarrassing to give a decided opinion. In many cases, indeed, impending abortion is only announced—even for some days—by such vague signs as an indefinable *malaise*, a peculiar dulness, inappetence, laziness, perhaps a little fever, with pawing now and again, agitation of the tail, and symptoms which might be taken for those of slight colic. Saint-Cyr has known many good practitioners deceived by these signs, and who have diagnosed either indigestion, gastro-enteritis, or some other malady which disappeared—after the expulsion of the fœtus! Such a mistake is unfortunate for the reputation of the veterinarian, as well as for the owner of the animal, whose interests suffer; as if a miscarriage had been diagnosed in proper time it might have been prevented, and pregnancy allowed to run its normal course.

To prevent such an error, it is well to know that a mistake is possible; so that if called in to attend an animal offering some of the above-enumerated symptoms, the first inquiry should be as to whether it is pregnant; then the external organs of generation—the vulva and mammæ—ought te be examined with the greatest care, and the actual symptoms thoughtfully analysed. This being done, it will often be found that this is a case of threatened abortion; and that, when taken in time, the accident can be averted by rational treatment.

3. *Recognise that an Abortion has taken place.*—It may happen that information is required as to whether abortion has occurred in an animal; though this information is far less likely to be sought from the veterinarian than the human obstetrist. In the absence of the fœtus or its envelopes, such a question is not easily answered with regard to animals; and the difficulty is increased if the fœtus is undeveloped, and a long interval has elapsed since the presumed date of the suspected abortion. Saint-Cyr is of opinion that, as a rule, it is impossible after fifteen days to assert with absolute certainty that such an accident has occurred, the generative organs having at that date resumed their ordinary physiological condition. For it is only by an early inspection of these that we can enlighten ourselves as to what may have taken place. In this inspection is included that of the *mammæ*, which are always a little tumid, hard, and painful, and often yield a small quantity of milk after a recent abortion; the *tail*, the hair of which is soiled and matted by blood, mucus, and the liquor amnii; the *vulva*, which is swollen and dilated, and the mucous membrane of which often presents, in addition to its uniform and more or less deep-red colour, ecchymoses due to the rubbing or bruising it experiences during the passage of the fœtus. On careful vaginal exploration, if the cervix is found to be softer than usual and the os partially open, and, better still, if the hand can be introduced without much difficulty into the uterine cavity, and a quantity of sanguinolent or sanious fluid, or remains of membranes is discovered in it, it may be concluded that a fœtus has been recently expelled.

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TREATMENT.—The treatment is *preventive* and *remedial*. With regard to preventive treatment, this must mainly depend upon a knowledge of the causes which produce abortion—which we have seen are numerous, and care in avoiding or modifying these. This pertains to the chapter on the hygiene of pregnancy (p. 149). With regard to animals which have a predisposition to abortion, they should not, if possible, be bred from. Should it be desired to breed from them, if they are bovines, they must not be put frequently to the male, and certainly not before eighteen months or two years have elapsed since the last miscarriage. If the accident has been due to irritation of the generative organs, then these should receive appropriate treatment. When pregnancy has again occurred, every precaution should be observed to continue it to a successful termination, by avoiding or removing those causes which previously induced the accident, and attending to the general health —combating plethora on the one hand, or anæmia on the other; guarding against constipation by administering mild laxatives, and against irritation, whether general or uterine, by doses of chloral or opium given by mouth or by rectum; and allowing only gentle exercise towards the end of gestation.

When abortion appears to be imminent, active intervention generally becomes necessary in order to avert it; and therefore it must be accurately diagnosed. We have already alluded to the symptoms and means by which this accident may be distinguished. If the veterinarian is fortunately called upon in good time, and he is able to assure himself that the fœtus is still alive, that the membranes are not ruptured, and labour pains have been few and not severe, the accident may be checked or prevented by the administration of narcotics, and keeping the animal in the most perfect quiet possible—alone in a darkened place, with doors and windows closed, if convenient. The narcotic may be opium (in the form of tincture if desirable), chloral hydrate, or chloroform. Saint-Cyr recommends laudanum (one to two and a half drachms for large animals) administered every half-hour or hour, in very small enemata (not more than a wine-glassful at once), which he thinks preferable to draughts, but which may, nevertheless, be employed concurrently. Zundel prefers chloroform, which, he asserts, has yielded extraordinary results in his hands in these cases, by suddenly arresting the straining. He gives it in doses of about three drachms to the Cow, in the form of draught in oil or mucilage, repeating them every hour. Carsten Harms recommends camphor, or camphor and opium, and Rueff assafœtida.

The abdomen should be gently rubbed for some time, and the stall well littered; and if the animal will eat and drink, easily-digested food in small quantity, and gruel, may be given until all danger has passed—generally for one or two days—when it may be gradually put upon ordinary diet, and allowed to resume its usual occupation.

When abortion is inevitable—indicated by rupture of the water-bag and escape of the waters—and there is no means of preventing the expulsion of the fœtus—the object must then be to favour the latter in some cases as speedily as possible, and remove the membranes, should there be any likelihood of their being retained in the uterus. In the majority of cases, active intervention is of little value here, and is only to be recommended when the labour is tedious, and the animal is becoming exhausted by fruitless straining, or when the labour is altogether suspended after rupture of the membranes. Then, having emptied the rectum, the oiled hand is to be cautiously introduced into the vagina, and if the os is contracted or not sufficiently open, it must be gently dilated by the index and other fingers, until the in-

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terior of the uterus can be reached, when the fœtus is to be seized and removed in the usual way; should it be in a wrong position, or should there be any obstacle to its egress, then we must proceed according to the directions given for overcoming such obstacles when they occur at the normal period of parturition. In abortion or premature labour, however, the fœtus being smaller, the difficulties are less.

If it should happen that the sphincter of the cervix is contracted, and shows no sign of yielding to gentle manipulation, then after a sufficient time has been allowed measures should be adopted to relax it. Belladonna ointment (one part to four of lard), introduced into the vagina and applied around the cervix by the hand or any suitable instrument, may be used with advantage. Mr. Cox, of Ashbourne, also recommends rugs dipped in hot water and applied over the pelvic region. Injections of mucilaginous fluids or glycerine into the vagina, may be resorted to if the passage has become dry after the escape of the amniotic fluid; and, internally, extract of belladonna, chloral, or æther or alcoholic draughts should be administered, particularly if the animal is exhausted; when gruel, beef-tea, milk, or other strengthening fluids may likewise be required. The ergot of rye is of little value in these cases occurring in the larger animals, and its use is rarely to be prescribed.

If the membranes come away with the fœtus, there is little more to be done; but in the contrary case, which is by no means unfrequent in abortion or premature birth, the membranes are strongly adherent to the uterine placentæ, and their retention, particularly in cattle, is often troublesome. Some practitioners in these instances prefer to remove them immediately and mechanically by the hand, carefully separating the placentulæ one after another; and though this is easily enough done so long as the os is dilated, which it usually is for three days after delivery, yet others are content with some simple precautions, and then prefer to wait. When they find the membranes firmly adherent, and their separation from the uterus likely to be attended with inconvenience, they only partially detach them, then collect and twist them into a rope-like form, and leave this mass in the vagina; so that should the cervix contract, it may not be imprisoned in the uterus. Others tie them together with a piece of tape, which is allowed to hang out of the vagina. In a short time the placenta has become loosened, and can then be wholly removed. A few experienced obstetrists rely on internal medication for the separation of the fœtal placenta. Zundel, for instance, has long and successfully administered powdered laurel berries in an infusion of fennel, giving $1\frac{3}{4}$ ounces three times a day, with an ounce of sodium bicarbonate in half a pint of fennel infusion. The membranes always come away on the second or third day, particularly if plenty of mucilaginous fluid has been given in the interval. Rychner employs a decoction of the meal of linseed-cake in doses of about twelve pints a day, when this result ensues about the ninth day.

An animal which has aborted requires attention after the delivery of the fœtus. It should be kept clean, fed on gruel and easily-digested food, though not in excess, kept from draughts of air, particularly in cold weather, and otherwise nursed for some days. The complications which sometimes accompany this accident will be alluded to hereafter, as they are usually those of ordinary parturition. The animal should not be allowed to become impregnated at the next œstrum, nor yet perhaps at the succeeding period.

Relaxation of the genital passages in the Bitch generally follows immersion

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in a warm bath (112° to 114° Fahr.) for a few minutes; it must not be prolonged after the respiration becomes hurried or the animal looks distressed; and the creature should be well dried and kept comfortable.

Epizoötic, Enzoötic, or Infectious Abortion.

What has been named *epizoötic* or *enzoötic abortion*, but which we have designated "infectious," differs in its etiology and some other features from abortion occurring in isolated or sporadic cases, but more particularly from its attacking all, or nearly all, the pregnant cattle (for it is more particularly observed in Cows, seldom in Sheep, and more rarely among Mares) on a farm or pasture, in a village, over a wide district, or even throughout an entire country, for perhaps a succession of years—thus constituting itself a veritable scourge to agriculture; and more especially as it only too frequently defies all precautions to prevent its occurrence, and eludes the most careful search for its exciting cause.

Epizoöties of abortion have been recorded from the earliest times;* but it was only towards the end of the last century, when Flandrin, Barrier, Pelé, and other French veterinary authorities undertook their investigation, that we discover the damage they inflicted. The observers in this century are very numerous, but space forbids our alluding to them; it may be sufficient to state that Continental authorities are agreed as to the destructiveness of this accident or disease, as well as to the obscurity which attends its development. For instance, Heuzé mentions that in the Nievre (France) in 1869, the loss to certain agriculturists amounted to 30, 40, and even 50,000 francs; in South Germany, in 1851-52, according to Rueff, it was very serious; Zundel mentions that it is frequent in North Germany; and, according to Harms, it is is very prevalent in Hanover.

Causes.—If we attempt to study the causes which have been alleged as operating in the production of epizoötic abortion, we are baffled among conflicting statements and opinions. Many authorities have adduced those causes which have been already enumerated as producing sporadic or accidental abortion; while others have taken into consideration those influences which may give rise to the accident, as well as those which may propagate the disorder. Among the latter is Zundel, who has made a conscientious study of this important subject, and throws considerable light upon it.

With regard to *general causes*, it is remarked that the disease is most frequent, enzoötic, in wet years, as it was in South Germany in 1852, when inundations were common (Rueff), and in Haute-Saône frequently (Trelut), and in other countries, when it is probably due to anæmia, as well as to forage damaged by moisture, ergotised, or otherwise altered. This adynamic condition of animals, brought about by the weather and food, is, in the opinion of Zundel, particularly favourable for the multiplication of microphytes, micrococci, and bacteria in the genito-urinary mucous membrane, and these have been spoken of as the principal local cause of this kind of abortion. He also adds that it is possible that, among the fungus or parasitic elements which infest forage in wet seasons, there may be some which act, like the ergot of rye, directly on the uterus. But in addition to the influence of

* Those occurring up to A.D. 800 are described in *Animal Plagues*. We need only allude in this place to the human "Abortus epidemicus" of B.C. 278; to that observed in Germany in 1777, in which Cows and Pigs were involved; and that at Chalons in 1784, in which nearly all the Cows and Mares aborted.

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seasons, there is also an influence of locality—the disease fixes itself in particular places and spares others. For instance, Heuzé remarks that in the department of the Nievre, France, abortions are very few in the arrondissement of Clamecy, while in other arrondissements there is scarcely a calf.

With regard to local conditions or causes, it is certain that the régime to which animals are subjected cannot be adduced as in operation; for the abortions occur under every kind of régime, and as frequently with poor as with lean stock, and irrespective of age, breed, or constitution.

So long ago as the end of the last century, contagion or infection was believed to play the principal, if not the sole part; for it was observed that when a Cow aborted in a place where other pregnant Cows were kept, these would abort in succession until all, or nearly all, had miscarried. Not only this, but it has often happened that a newly-purchased Cow-in-calf has been introduced into a farm where the Cows had always calved favourably at the proper time; and when the stranger has aborted, first one, then another, then a third, and so on, of the others have experienced the same misfortune, and the malady has persisted in the place for consecutive years. It is not always the pregnant Cows next to the one which has aborted that are first seized, but rather animals some distance from it.

Again, when pregnant Cows which were living in a place where the disease had not existed, have been introduced into a stable where it prevails, those that are at the end of gestation calve regularly and normally soon after arrival; while if they are a certain time in the infected stable before this period is reached, they abort like the others.

So that the presence of an infecting element, if not absolutely proved, is at least admissible, after the very numerous observations of the most competent veterinarians—especially of Darreau, Cruzel, Félizet, Bouley, and Lafosse in France; and Rueff, Haubner, Franck, and Roloff in Germany. The insalubrity and bad hygiene of cowsheds and stables appear to have no influence in the pathogenesis of the accident, as it appears quite as severely and readily in those which are well ventilated and cleansed as those in the opposite conditions; in fact, nothing can explain the occurrence of enzoötic abortion except the presence of a *contagium* or a *miasmatic infection*.

The existence of a contagium would appear to be proved by the result of an experiment performed by Franck, of the Munich Veterinary School. It has been established by microscopical investigation, that on the lining membrane of the vagina and that of the vulva, there is constantly found, as on the buccal mucous membrane, a minute fungus mixed with the mucus, in every respect similar to the *Leptothrix buccalis*, which, according to Hallier, is only an allotropic condition of the ordinary moulds, such as the *Penicillium glaucum* or *Aspergillus*—being, in fact, a kind of bacterium. Towards the period of parturition, these bodies become extraordinarily abundant, and they appear to concur in the decomposition of the fœtal membranes and their expulsion; when the membranes are retained and putrefy in the uterus, they are extremely numerous, as are the micrococci. Franck has shown that, by smearing the vaginal canal of a pregnant animal to a certain depth with the matter from the expelled membranes of one which has been delivered, abortion can be induced.

So that, says Zundel, it is sufficient to introduce into the vagina micrococci or bacteria, which multiply there, and, penetrating to the uterus, commence their work of decomposition, of which abortion is the consequence.

Roloff has also ascertained that abortion is due to something which finds

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admission to the uterus by the vagina; that a certain amount of redness and tumefaction of the lining membrane of the latter always precedes this accident; and that this viruliferous or miasmatic matter is found on the articles soiled by the delivery of a Cow which has aborted, as well as in the drains of the stable, on the litter, etc.

It has been remarked that, in general, the fœtal membranes are liable to be retained in Cows which abort, and that when not removed artificially they only come away when decomposition sets in. The influence of these putrefying membranes has been noted by several veterinarians—Pelé, Barrier, Cruzel, Bouley, Rychner, Haubner, and others—who imagined that the putrescent emanations infected the economy of the animals breathing them; but Zundel thinks it more probable that direct infection takes place by the genital mucous membrane. In support of this opinion, he quotes the observations of Roloff, who asserts that he always saw the disease or accident developed in stables where the distance between the mangers and drains was small, or where the drains did not have sufficient fall, whereby the hind quarters of the cattle were readily soiled by the excreta in them.

Without, then, going further into the question, and without taking into consideration other agencies which may cause extensive abortion—such as ergotised grasses—it may be concluded that this kind of miscarriage is transmissible through the medium of some infectious or virulent principle, which is really specific in its nature: for it is not necessarily allied to putrefaction of the fœtal membranes; and it always produces the same effect—abortion—without any other apparent efficient cause being in operation.

Symptoms.—It is rare that this kind of abortion occurs before the third or fourth month of gestation; more frequently it is at the fifth, sixth, or seventh month, or even later. There are no premonitory symptoms, except perhaps a trifling uneasiness for a few hours previously, with sinking of the flanks and descent of the abdomen; the animal generally looks well and hearty, and yields its supply of milk as usual; and soon after the fœtus is expelled, apparently without any effort or inconvenience, and along with its membranes, if these are not ruptured, with or without them when they are. It is rare, however, that the ruptured membranes are rejected immediately after the fœtus; as a rule they are nearly always retained, particularly when gestation is advanced; and they putrefy in the uterus, being got rid of only in shreds at intervals. Then the animal loses its appetite and condition, goes off its milk, and sometimes perishes, as a consequence of this placental retention. If it recovers, œstrum appears unnaturally often, though conception is unfrequent and sterility common; and on the other hand, there are some animals which expel the membranes quickly, conceive soon after, but again abort as readily—perhaps three times in the course of a year.

The fœtus is usually dead, though when it is expelled (in the Cow) after the fifth month it may be alive; but it is weakly and soon dies, even when born near the termination of pregnancy. Barrier mentions that these calves make a rattling noise when breathing, accompanied by the discharge of a rusty-coloured mucilaginous fluid from the nostrils; that they bellow continually, and are always emaciated and flabby, the gums and palate being pale, and the umbilical vessels livid and withered-looking. The dyspnœa and great weakness evinced by them shows that they are not properly organised. Those which are dead when expelled exhibit indications of having ceased to live a short time previously.

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As has been stated, all the animals on a pasture or in a shed where the disease prevails, do not abort at the same time, but at intervals, When one aborts, another—its neighbour perhaps—appears to prepare for the event, which occurs in about eight days; then some days after this it is the turn of another, and so on until two-thirds, or perhaps even all, of the pregnant Cows beyond three months' gestation have miscarried.

It has also been mentioned that it is only after being some time in sheds in which the disease is present, that newly-purchased pregnant Cows are attacked; those which have passed their eighth month and are near calving escaping abortion.

Darreau alludes to instances in which a pregnant Cow, leaving a shed in which abortions prevailed, and transferred to another where the accident had not been seen, would remain all right for some time, then suddenly miscarry, and in the course of about fifteen days other abortions would occur in this shed—testifying to the danger of keeping pregnant Cows in contact with or in proximity to those which have miscarried in this way. It has also been stated that an animal which miscarries has always a tendency to do so again. But it has been observed that if Cows are well fed, the period of gestation after each abortion is often longer; so that if a Cow aborts the first time at six months, it will do so again at the seventh month, and the third time a little before the ninth month, reaching its full period in three pregnancies.

TREATMENT.—If the malady is suspected to be due to any one particular cause, or if there exist predisposing causes, then the indications for the prevention or cure of the diseased condition are obvious. The atonic state which seems to favour the occurrence of infectious abortion in or after certain rainy seasons, should be remedied by good food and tonics—and especially preparations of iron. Tonics are particularly serviceable when abortion is due to ergotised food; though Zundel recommends the internal administration of carbolic acid.

If, however, we admit the most common and efficient cause to be infection—that abortion is due to the presence of an agent transmissible from an affected animal, or something which has belonged to it, to another in health—then the first and fundamental indication is to remove or isolate the source of the mischief.

When, therefore, abortion occurs, and there is reason to believe that this accident is in its nature infectious, the fœtus and all pertaining to it should be removed as promptly and completely as possible from the shed or place in which the animal is located. The Cow itself should also be removed, and either kept altogether isolated, or at least away from all other pregnant cattle, with a special attendant employed to look after it; this attendant should not go near the unaffected cattle, and the excreta from the Cow should also be carefully kept out of their way.

The shed from which the Cow has been moved, and which contains other pregnant cattle, ought to be immediately cleared of all manure and other matters of an objectionable kind, the drains and the floor—particularly that of the stall which had been occupied by the Cow—being thoroughly swilled with water, and sprinkled with some good disinfectant; a good layer of straw may then be laid down, and the cattle replaced.

The shed should be kept clean and well ventilated for a number of days, and the drains well flushed and disinfected.

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The animal which has aborted must also be at once attended to. If the membranes have not been discharged—which is most frequently the case—they should be removed as early as possible, and not allowed to putrefy; their removal should be effected by the hand, and a weak solution of carbolic acid, permanganate of potass, or salicylic acid ought to be injected into the vagina and uterus. The membranes themselves should be destroyed or buried, and the Cow should not be allowed to go near others which are pregnant so long as there is any discharge *per vulvam:* for safety, the period of isolation should extend to from eight to fifteen days. The animal may require good nursing in the meantime; and it should not be put to the male until every trace of irritation in the generative organs has disappeared.

When Cows show any symptoms of impending abortion, they ought to be promptly removed from the vicinity of others which are in calf.

When this accident continues in a stable or shed, Saint-Cyr thinks it necessary to recommend disposal of all the Cows therein, and before introducing others into it, to thoroughly cleanse and disinfect it by removing all excreta; renewing the soil or flooring, washing and scraping the mangers, racks, and walls and wood-work, making more air-apertures if necessary, and leaving it empty, with the doors and windows open, for a month or six weeks.

Should epizoötic abortion be traced to the food—ergotised or otherwise damaged fodder, of course the use of this must, if possible, be prohibited, and a change resorted to. If the pasture grasses are ergotised, then the pregnant animals must be removed from them, and placed in more favourable conditions with regard to food. Ergotised or mouldy dry forage may be rendered safe for consumption by scalding it with boiling water or steam, or pickling it in salt.

Whenever or wherever the accident occurs—whether at pasture, straw-yard, or in shed—it must not be forgotten that the greatest possible care should be taken to isolate the animal, if it is with other pregnant creatures of the same species, and to bury everything—fœtus, membranes, etc., as well as to destroy all traces of discharges from the patient.

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BOOK IV.

NORMAL PARTURITION.

Normal, natural, physiological or *spontaneous parturition* or *birth*, is the expulsion of the fœtus at term from the uterus, through the maternal passages, by natural forces, and when it is sufficiently developed to live external to its parent. This act is designated "foaling" when occurring in the Mare, "calving" in the Cow, "lambing" in the Sheep, "pupping" in the Bitch, etc. It receives the designation of "normal," "natural," etc., when it is accomplished in a manner favourable to the parent and offspring without extraneous assistance, and by natural forces alone; and "abnormal," "pathological," "difficult," or "abnormal," when it cannot be so accomplished, and when the aid of man is required to relieve the parent and release the progeny. Though eminently a physiological act, it is nevertheless one of the most difficult; the interval between normal and pathological parturition is sometimes extremely brief, the one being often transformed into the other in a remarkably short time. It is also said to be "premature" when it occurs before the usual period, and the young creature is born in a viable condition; while it is "prolonged" birth when pregnancy extends beyond the ordinary term. We have already spoken of these terms, and alluded to their diversity; and we have only now to note that these variations do not appear to have any influence on the physiological act of parturition.

CHAPTER I.

Physiology of Parturition.

The act of parturition, notwithstanding its special object, is distinguished from all other physiological acts or functions by certain peculiarities; for while the latter are normally accomplished without disturbing in any way the well-being of the individual, parturition, on the contrary, even when natural, is accompanied by pain, general disturbance and uneasiness, and violent efforts. And during birth nature does not appear to obey those immutable laws so strictly as in the accomplishment of the other physiological acts, but makes frequent and wide deviations; though these do not often compromise the final result. We never find two births exactly alike, but each offers something peculiar when attentively observed. We need only refer to the duration of the act as a whole, as well as to each of its periods or stages. Sometimes it only occupies a few minutes, in other instances days are required to complete it; in some cases the first stage is long and the second short, and in others it is the reverse. The labour pains, or contractions, present as notable differences with regard to intensity, duration, and frequency, as well as in the pain they cause and the influence they exercise on the other parts of the body; while the amount of allantoid or amniotic fluid is as variable, though no ill effects may result from this. And, finally, the fœtus may present itself for expulsion in a variety of positions, which, though they may not impede birth, yet prove that parturition is an extremely variable act.

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SECTION I.—CAUSES OF PARTURITION.

Though parturition only occurs at the end of pregnancy, nevertheless this act is being prepared for from an early period in the development of the ovum, as we have shown when speaking of the anatomy and physiology of the generative organs. During the evolution and development of the ovum, the uterus increases in a corresponding manner, and its muscular layer is proportionately augmented. When, towards the termination of gestation, the ovum has reached maturity, and the organs necessary for the independent existence of the fœtus are completely developed, certain alterations occur, both in the uterus and the fœtal connections with it, which bring about the expulsion of the young creature.

These alterations would appear to consist in a gradually increasing fatty degeneration of the decidua, by which the organic connection that had existed between the peripheral portions of the ovum and the uterus is gradually destroyed, by a regressive process in the cells lying between them; while the blood which was sent to the organ is now diverted towards the mammæ, for the secretion of milk. The exchange of materials between the uterus and fœtus is lessened, and the latter becomes like a foreign body in the cavity of the former. At all the places where the cell degeneration has reached a certain stage, the terminations of the nerves are irritated. But to obtain a reflex action, and consequent contraction of the uterine muscles, as Schroeder observes, a certain amount of continuous irritation is necessary. This sum once obtained, a reflex action takes place in the form of a contraction, which, however, is slight at the beginning. Then a pause follows, until the sum of the irritation is again sufficient to cause a contraction. By the increase in intensity of the contractions, the uterine wall is removed from the envelopes, and this separation becomes a new source of irritation to the uterine nerve-fibres. The reflex action, in the form of labour-pains, becomes more and more powerful, until these follow at last in rapid succession and complete the expulsion of the ovum. This irritability of the uterine nerves progressively increases with the advance of pregnancy, and explains the regular setting in of labour, as well as the not unfrequent retardation of the pains in cases where the separation of the membranes has been premature.

The sympathetic nerve is in all probability that which is most concerned in the uterine contractions, as it is the motor nerve of the organ; and its influence is called forth by the irritation just mentioned as being produced on the terminations of the nerves on the inner surface of the uterus by reflex action, the irritation being transformed into involuntary motor activity. It is surmised that the sacral nerves are merely inhibitory.

SECTION II.—THE EXPELLING POWERS.

The expulsive force by which parturition is effected resides in the unstriped muscular fibres of the uterus, which cause the organ to contract in a rhythmical and somewhat peristaltic manner, the contractions of the abdominal muscles and diaphragm being merely auxiliary. These contractions of the uterus may take place although the organ does not contain a fœtus, and have been noted in extra-uterine pregnancy, when they probably occur through sympathy. They have been observed in the false gestation of the Bitch which has not really conceived, but whose mammæ enlarge, and which makes its bed and exhibits other indications of approaching labour; as well as in pregnancies prolonged beyond their ordinary limit.

As the uterine contractions which lead to expulsion are usually ac-

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companied by a painful sensation (due to the pressure exercised on the terminations of the nerves within the muscular fibres), they are in common parlance designated "labour pains" (*dolores ad partum*); while the resistance they have to overcome is centred in the fœtus and its envelopes, as well as in the passages these have to traverse in order to reach the external world.

Expulsion is not effected by one contraction, but by a series of contractions; between each of these there is an interval of apparent repose, during which the organ seems to be gathering strength for a new effort. As in almost all unstriped muscular fibres, the reflex action following upon an irritation is slow and gradual, and, according to the degree of irritation, of varying intensity and duration. At the commencement, corresponding to the slight irritation, the contraction is feeble and short, and the time required to obtain the necessary sum of the persistent irritation for a new reflex action as comparatively long; though the uterine walls are not relaxed on their contents, but are maintained in a certain state of contraction by the tonicity of their muscles.

When the pains are regular, there is also a certain gradation in each individual contraction. Feeble at its commencement, it gradually increases, the uterus becoming harder until the maximum of contraction has been reached; this persists for some time, and then as gradually subsides.

As parturition progresses, and the separation between the uterus and fœtus increases, the irritation becomes stronger, and the intervals between the contractions shorter, while these latter augment progressively in intensity and duration. The necessity for these intermissions, particularly in the early stage of parturition, is obvious. They allow the animal time to recover, to some extent, from the exhaustion they occasion, and permit the genital passages to become gradually prepared for the exit of the fœtus through them; while the latter can also recover from the inconvenience it may suffer from the interruption between it and the uterus during the pain, and especially towards the termination of the act.

During each regular pain the whole of the uterus contracts, though the fundus does so most energetically; and the longitudinal fibres of the organ are more particularly brought into play at the initial and middle stage of parturition. The cornua likewise contract, are twisted on themselves anteriorly, are shortened through the action of the longitudinal fibres, and are brought nearer the body of the uterus, which is also shortened; and as this shortening is always taking place in the direction of the cervix, it is here that the sum total of the expelling force is centred; and it is this force, commencing to operate at the fundus of the organ, and exerted on the incompressible liquor amnii, which gradually opens the os for the extrusion of the fœtus. The latter, with its envelopes, first acts as a stimulus to the uterus, but they soon begin to play quite a mechanical part in the dilatation of the already greatly shortened cervix. The latter becomes thinner as the contractions force the bag of waters against it; so that the os is gradually widened, and the cervix becomes a part of the uterine cavity. As soon as the os is slightly opened, the bag of waters enters it and acts as a mechanical dilator; then the lower parts of the fore limbs, succeeded by the head of the fœtus, are introduced, and from their combined shape act like a wedge, until, by the eccentric pressure, the chest is passed in, and the cervix being drawn over the presenting parts, the os is of the same diameter as the vagina, which then, with the uterus, constitutes one common cavity. Every part of the cervix being acted on by the longitudinal fibres, the aperture of the os is perfectly circular at this stage; as is observed in the Cow and Goat when the uterus is

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pushed back, and its orifice is visible at the vulva. Irregularity in the contractions, however, and particularly when they are rendered so from a transverse position of the fœtus, delays the dilatation, which is otherwise rapid according to the force and frequency of these contractions. At first the dilatation occurs very slowly, especially in primiparæ; when the fœtus presents by the croup, or when the body of the uterus inclines too much downwards, causing the cervix to bend up towards the sacrum, it is also very tardy. As soon, however, as the mechanical action of the water-bag and fœtus come into operation, it makes rapid progress in natural parturition.

If the uterus of animals usually uniparous contains two fœtuses, the two cornua are about the same size, each having a fœtus in the same position as if there was only one in the uterine cavity. In general, the two fœtuses present anteriorly, although it sometimes happens that the second, or the first, or even both, present posteriorly; not unfrequently the second makes a malpresentation. When there are twins, parturition is more difficult and slower than when there is only one: possibly because the great distention of the uterus diminishes its contractile power. Another feature in twin pregnancies is that parturition often occurs before the ordinary time; and even when this has been reached, one or both fœtuses are smaller and weaker than when there is only a single fœtus.

When twin parturition sets in, the uterine contractions commence almost simultaneously in both cornua, which are much less apart than in the non-pregnant state; but as the two fœtuses cannot be born together, that which is most advanced is delivered first, the other, which is behind it, mechanically aiding in its expulsion. In the Mare, the interval between the birth of twins is rarely more than ten minutes; with the Cow it may be one or two hours; and with the Ewe half an hour. When the position of the second fœtus is favourable, it is usually expelled more rapidly and easily than the first; and when they are of a different size, the largest is ordinarily born before the other. When the number of fœtuses is greater, they are also expelled successively at intervals of some hours.

In cases of superfœtation, if such an occurrence can take place in animals other than in those the cornua of whose uterus opens into the vagina, the uterine contractions must be limited to the cornu containing the fœtus whose period for birth has arrived; otherwise, the other fœtus would be expelled at the same time, and there would then be a birth and an abortion.

With the small multiparous animals, in which the fœtuses are expelled one after the other, it may be admitted that each fraction of the uterus corresponding to a fœtus contracts in its turn—at first the segment of one of the cornua nearest the cervix, then the next segment, and so on until the one in proximity to the ovary is reached, so as to get rid of all successively: one cornu expelling a fœtus alternately with the other; the uterine contractions, although general, being most energetic at the portions intermediate to the fœtuses.

The uterine contractions are very powerful, as any one can testify who has had occasion to introduce his hand into the uterus during parturition; and their force is not always related to the general physical power of the animal; though they are always more energetic in the Mare than the Cow, as well as more continuous. Not unfrequently they are more powerful in weak-looking animals than in those which are robust and vigorous; and their energy depends evidently upon the development of the muscular structure of the uterus, and the potency of the sympathetic ganglia which stimulates it. Their energy and frequency also often depend upon the dura-

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tion of the pains, and the existence of mechanical obstacles to the birth of the fœtus.

After the complete dilatation of the os, the third stage of delivery begins, and the manner in which the uterus contracts is modified. The resistance is no longer at the cervix, but in the uterus itself, being due to the presence of the fœtus; and now the circular as well as the longitudinal fibres come into action simultaneously, in order to diminish the uterine cavity and quite expel its contents. In this they are greatly aided by the abdominal muscles and the diaphragm, which until now could assist but little; though the participation of these does not appear to be absolutely indispensable, for birth may take place without it. Nevertheless, it is a fact that in diminishing the abdominal cavity, and pressing on its contents, these muscles concur in pushing the fœtus in the direction in which least resistance is offered—towards the pelvic cavity; and as their contractions are effective, so do those of the uterus, which are coincident with them, become increased in power and frequency. The animal "strains," as in defecation or micturition, but with all its force; and these throes, which are involuntary to a great extent, and in which nearly all the muscles of the trunk share, soon bring the act to a termination.

The fœtus itself has been sometimes regarded as the chief agent in parturition, from the fact that this act is longer and more difficult when the creature is dead, and that it has been expelled after the mother has ceased to live. But it must be remembered that the movements of the fœtus are very trifling, and of little importance when compared with the resistance to be overcome at birth; so that the young creature must remain almost, if not quite passive during the act. And if this act is tardily accomplished when the fœtus is dead, the delay may be due to the absence of stimulation or irritation in the organ, to the uterus not having a fixed point to act upon, or perhaps even to a local septosis or paralysis from the decomposition of the fœtus.

With regard to expulsion of the fœtus after the death of the mother, it must also be remembered that all the organs do not cease to live at once, and that many continue to contract for some time after the mother's heart has ceased to pulsate. Leroux has felt this organ contracting a quarter of an hour after death, and after gastro-hysterotomy on the dead human body it has been seen to contract as in the living woman; Haller has witnessed the contraction of the cornua of the Cat's uterus, even when the organ was detached from the body; and Colin states that he has observed the uterus of Sheep to contract for forty and fifty minutes after death.

As we have said, the resistance which the expelling forces have to overcome is constituted by the fœtus and its membranes, and the genital passages —the os uteri, vagina, vulva, as well as the pelvis and soft parts covering and lining it. The fœtus participates in the resistance by its volume, its form, its manner of presentation, its position, the conformation and texture of the tissues which unite it to the mother, etc.; while the genital passages offer resistance from their form, width, extensibility, and softness. The fæces accumulated in the rectum, or urine in the bladder, sometimes increase the resistance to be overcome.

In order that birth may be possible, the expelling force must be greater than the resistance, and it is upon the relation between these that the manner in which the fœtus is expelled will more particularly depend, as well as the difficulty attending its expulsion and the time required for the act of parturition.

We have only now to allude to the influence of the expelling force on the fœtal membranes. We have seen that these, which we may now, with their

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contents, designate the "water bag," assist in dilating the os, and that the uterine contractions propel them farther into the vagina in the form of an elongated bladder partly filled with fluid. This soon appears between the labia of the vulva as a round distended tumour, at the moment a pain occurs, but flaccid in the interval; and not long afterwards as a somewhat voluminous pediculated tumour, to which each pain adds a little more fluid, until at last the membranes cannot resist the strain, and rupture, when the allantoic, and then the amniotic fluids escape from them, leaving a variable quantity in the uterus; some of this is discharged into the vagina at the termination of each pain, and assists in lubrifying the mucous membrane and aiding in the passage of the fœtus.

It may be remarked that numerous causes influence the period when this rupture occurs. In the Mare the membranes are thicker, more resisting, and much less adherent to the uterus than in the Cow; so that rupture is later in taking place, and it not unfrequently happens that the foal is born in them; though the calf, I believe, never is. But there are individual differences in this respect even, and in some instances it will be found that rupture takes place at the commencement of parturition, in others towards the end; though when this takes place late it is more favourable than when it occurs early, as the amniotic fluid preserves the fœtus from undue compression by the uterus, while it powerfully aids in the progressive and regular dilatation of the os and vulva, and lubrifies the passages, thus diminishing friction and protecting the maternal organs from injury. When rupture occurs too early, and before the fœtus has been sufficiently expelled, the parts become dry, and labour is always longer, and more painful and difficult for the mother, while it is often fatal to the fœtus.

SECTION III.—SYMPTOMS AND COURSE OF PARTURITION.

The physiological phenomena just alluded to, and by which the fœtus is born, are collectively designated as "labour." The entire period of labour is, for facility of description and study, divided into a certain number of stages or periods—usually three or four. These are: 1. *Preliminary stage;* 2. *Dilatation of the os uteri;* 3. *Expulsion of the fœtus;* 4. *Expulsion of the membranes.*

1. *Preliminary Stage.*—Various precursory signs announce the approaching termination of pregnancy and the advent of labour. These may be observed some hours, sometimes even for days, before that event occurs.

One of the most important signs is the enlargement and increased sensibility of the mammæ, to which the excess of blood no longer required in the uterus is directed. These glands become voluminous, hard and tender; and this phenomenon is more particularly remarkable in those animals whose milk is not utilised after the young have been weaned. The mammary glands then become soft, flaccid, and small, and cease to secrete. In such animals as the Mare and Ewe, these glands, ordinarily small and scarcely perceptible, before parturition become so remarkably developed as to cause alarm in people who do not understand the cause. With the Mare especially, the development of the mammæ is sometimes so considerable, that the engorgement extends beneath the abdomen and simulates œdema, or it ascends between the thighs as high as the vulva as a prominent ridge, while the skin in this region is reddened. At a later period, the teat yields a serous fluid on pressure, or this constitutes a crust around it; this fluid afterwards becomes somewhat lactescent, and finally appears as the "colostrum" or first milk.

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Another premonitory sign is the tumefaction of the vulva, increase of the space between the labia, which become soft and flabby, while their lining membrane is reddened, and a viscid glairy mucus covers it. This mucus, derived from the vaginal lining membrane, soon becomes so abundant that it is discharged in long filamentous streams, particularly in the Cow, and soils the tail and hocks; it is destined to lubricate the genital passages, and facilitate the extrusion of the fœtus.

With these changes, the abdomen falls, or rather becomes more pendent; the croup looks hollow, as do the flanks, due to the relaxation of the broad ligaments. The spine, particularly in the lumbar region, becomes more horizontal and rather inclines downward, as if yielding to the weight of the abdomen. The haunches appear to be wider apart, and the gluteal muscles to subside, owing to the falling in or modification of the sacro-ischiatic, as well as the sub-ischiatic, ligaments, from serous infiltration.

The animal walks sluggishly and unwillingly, and if grazing with others, does not appear to care about following them. Sometimes, as has been mentioned, there is swelling of the limbs, particularly the hind ones.

If very careful vaginal exploration be made at this time, it will be found that the cervix uteri has become a part of the uterine cavity and is almost completely effaced, being reduced to merely a thin circular ring; its tissue is soft, and the os is slightly open in those animals which have previously had young.

As parturition draws nearer, these phenomena are more marked. The animal also begins to be restless, and continually agitated; if feeding, it stops for some moments, as if listening to some sound only audible to itself, or as if experiencing some strange internal sensation for the first time, and which may certainly be the preparatory or commencing contractions of the uterus. Not unfrequently the animal lies down and gets up again, as if suffering from colic. Some are quite mute, though anxious and uneasy; while others, in addition to exhibiting restlessness and distress, utter a half-stifled cry of pain. The Mare whisks its tail, the Cow bellows, the Ewe bleats, the Bitch often whines, and the Cat emits a low cry as if in suffering. If the animal is at liberty, it seeks a remote quiet place in which to bring forth its young; while some—such as the Bitch, Cat, Sow, and Rabbit—prepare a special nest.

2. *Dilatation of the Os Uteri.*—The limit between this stage and the former is not so well marked as our division would indicate. Nevertheless, it is meant to imply that the stage of dilatation of the os terminates pregnancy and ends with complete extension in width of that uterine passage. It is marked by increasing uneasiness of the animal: pawing, lying down and rising frequently in a kind of objectless fashion, while the expression of the physiognomy betrays suffering. When the uterine contractions really commence, the creature suddenly stops, as if surprised by the pain; its eye looks animated and expresses anguish; the skin is hot, pulse quickened, visible mucous membranes injected; the abdominal walls are rigid and contracted, the flank is tense, and very frequently fæces or urine are voided. During this pain, if the cervix uteri is explored, it will be found that its attenuated border has a tendency to become hard and prominent. When the pain has passed, calm succeeds; the cervix becomes thick and elastic, and the os is markedly enlarged. Each pain lasts for some seconds to two or three minutes, the interval of quiet continuing to about fifteen minutes at first; though it diminishes when the contractions become more frequent, more energetic, and more prolonged, and dilatation of the os progresses. Then the fœtal mem-

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branes begin to be detached from the inner surface of the uterus and enter the os, whence they pass into the vagina and between the labia of the vulva, where they appear externally as the "water-bag." In the meantime, the fore limbs and the nose and head of the fœtus enter the os, and dilate it to its fullest extent, when the cavity of the uterus forms a canal continuous with the vagina.

3. *Expulsion of the Fœtus.*—The pains become more severe, frequent, and sustained, and to the uterine contractions are added those of the diaphragm, and abdominal and other muscles. If the animal is standing, it brings all its limbs under the body, arches the back, elevates the tail, slightly flexes the hocks, makes a deep inspiration, closes the glottis to imprison the air in the chest, and by a powerful contraction of all the muscles of the trunk, it brings such an amount of pressure to bear on the fœtus as to propel it into the pelvic cavity, and rupture the chorion. At each contraction the "water-bag," formed by the allantois and amnion, protruded beyond the vulva, increases in volume. It varies in different animals; being in the Cow about as large as the bladder of a Pig, and in the Bitch the size of the carp's swimming bladder. When it is very large in advanced parturition, it is reckoned a good sign; though it may not indicate a good presentation of the fœtus, nor an easy birth.

The water-bag soon ruptures, and its contents partly escape; that behind the thorax of the fœtus being retained, and voided only in small quantity as the uterus contracts. When the membranes are thinner and weaker than usual, they may rupture before the os is completely dilated, and then the fluid escapes in a small quantity at a time; this frequently happens with primiparæ, though it is sometimes observed in protracted labour, which is the most painful. In general, however, no harm results from this premature rupture if parturition is not too long delayed; indeed, in some cases it may be useful, as when the uterus is over-distended with fluid in hydramnios, when its discharge allows the organ to contract more freely. In other instances the membranes are remarkably strong and resisting, and withstand the contractions for a long time after they have been extruded beyond the vulva; their artificial rupture may even be required. Sometimes they do not rupture at all, and the fœtus is born in them, or even after them, as has occurred in the Cow. The rupture usually occurs at the most dependent part of the bag, at the uterine orifice, towards the os, or in front of it. Then succeeds a brief interval of quiet—the fœtus being meanwhile retained in the uterus—during which the organ is closely applied to the body of the fœtus, and is preparing itself for a final effort, which is soon made. The contractions are most energetic and rapid, and every time they are made the waters flow in small quantity, moistening and relaxing the parts; the fœtus passes on until the fore feet and muzzle, forming a kind of cone, appear at the vulva, the orifice of which is opened by them. When the head has cleared the vulva, there is usually a short pause, as if to allow the tissues of this region to become accustomed to the distention, and to prepare them for the still greater strain which is yet to be imposed on them. The thorax and shoulders of the fœtus have now arrived at the inlet of the pelvis, and as they form the deepest and most difficult part of the young creature's body, the contractions which ensue for its complete expulsion, though most powerful and continuous, only impel it slowly towards the outlet, on arriving at which a more energetic and painful effort than all the others pushes it through. The act may now be said to have terminated; as to expel the croup requires only a few comparatively weak throes, and the weight of the anterior part of the body of the fœtus,

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hanging beyond the vulva, greatly aids them. It is rare indeed that the croup offers a serious obstacle to expulsion.

During this act the creature betrays evidence of pain, especially if it be a primipara : and this is particularly marked when the head of the fœtus passes through the still incompletely dilated os, and still more so when the chest and shoulders distend the tissue of the vulva and perineum to the utmost. Then the pulse is hard and frequent, and the skin hot—sometimes covered with perspiration—or the body is rigid. The Bitch and Cat often utter a cry of pain as the head and chest pass through the vulva.

After the young animal is expelled, the umbilical cord is torn, and the liquor amnii remaining in the uterus escapes, accompanied or followed by a little blood resulting from the sudden separation of the placentæ.

The *position* assumed by animals during parturition is somewhat variable. The larger animals which usually only bring forth one at a birth, such as the

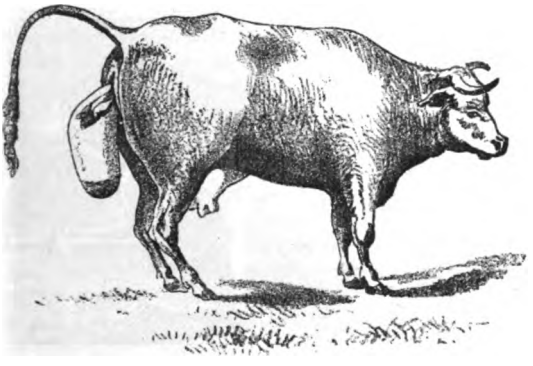

Fig. 56.

Cow in the Act of Parturition: Standing Position.

Mare, Cow, and Sheep, ordinarily do so standing; and this position has the following advantages : the vertebro-sacral angle is effaced, and the obstacle that its projection might offer to the passage of the fœtus into the pelvis is diminished; the auxiliary muscles—abdominal and diaphragmatic—can act more energetically ; the young creature, being sustained by the umbilical cord when it has cleared the vulva, glides gently on the half-flexed hocks of the parent, and so reaches the ground without injury (Fig. 56).

Such an attitude, however, is far from being constant with these animals ; and very often, especially with the Cow, they bring forth in a reclining position—maintained from the very commencement of the act, and only rising when birth is completed (Fig. 57). These cases, which are quite natural, though debility may be present, offer nothing particular in the position of the female ; it being merely that assumed on ordinary occasions, though, of course, parturition is more difficult.

The animal rests on the sternum, the body inclined to the right or left side, the fore limbs flexed beneath the chest, and the hind ones beneath the abdomen. In this attitude labour is carried on somewhat as when standing. The creature reclining on the breast and partially on the quarter, arches the

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back in straining, slightly raises itself on the hind feet, and drops again when the pain has subsided.

It is rare indeed that these animals lie full length on one side of the body during parturition, and when it does occur it nearly always indicates a long, difficult, exhausting labour.

Multiparous animals—as the Bitch, Cat, and Sow—always assume the recumbent position, and lie reclining on one side, with the body disposed in a semicircular fashion, the head towards the tail. This position appears to be very favourable to birth, the sacro-vertebral angle being effaced, and the young being spared the risk of falling; in addition, each fœtus as it issues from the vulva is within reach of the mother's mouth; so that it can, without disturbing itself, remove the membranes from it, divide the umbilical cord, clean it with its tongue, put it in a proper position, and even direct its head towards the teat, in order to get it soothed while another is born. It

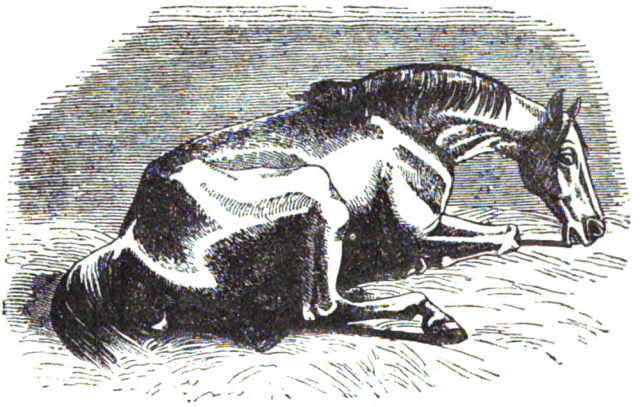

Fig. 57.

MARE IN THE ACT OF PARTURITION: RECUMBENT POSITION.

may be remarked that, with the Sow, the young creature is expelled with such force from the vulva, that it often turns a somersault. It may also be observed, that with the small multiparous animals the "water-bag" usually only appears with the first of the litter, the others being preceded or followed by their ruptured membranes.

The total *duration* of parturition is, of course, extremely variable, not only according to accidental circumstances, individual peculiarities, and species, but even in the same animal at different births. With the Mare it is usually brief, and is ordinarily accomplished in about ten minutes, sometimes in five; though it may extend to a quarter or half an hour, rarely more. This rapidity appears to be due to the fact that the placenta is detached from the uterus during the early pains, and consequently the fœtus cannot live long after this occurs—three hours being supposed to be the limit—unless it can breathe by the lungs. The duration in the Cow is, on the average, one to two hours; though it may only be about half an hour, or be extended, without injury to the calf, to one or two days. With Cows at pasture or which do no work, it is sometimes only fifteen minutes. With the Sheep the period is also brief,

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being about fifteen minutes. If there are several lambs, there is usually an interval of fifteen minutes to two hours between them: the second and succeeding births being always quicker than the first.

With multiparous animals—Sow, Bitch, and Cat—there is ordinarily a period of ten or fifteen minutes, half an hour, an hour, or even more between each birth. Not unfrequently the Sow brings forth ten young ones within the course of an hour.

We have mentioned that with those animals which are delivered in a standing position, the *umbilical cord is ruptured* when the young creature reaches the ground, and usually close to its abdomen. If the mother is recumbent when the offspring is born, the cord is torn as she gets up, which is usually immediately after parturition. The circulation in and by the cord being incomplete shortly before and during labour, its texture appears to undergo a kind of softening that favours rupture; while owing to the vessels being reduced in size, and the way in which their rupture occurs, hæmorrhage is trifling. Sometimes, however, the cord is sufficiently strong and elastic to resist spontaneous rupture, and the young creature is born with the membranes attached to it by means of this bond of union. The mother then, by a remarkable instinct, in cleansing the young creature with its tongue, gnaws through the cord and sets free its progeny. The Mare and Cow have been known to do this at times; otherwise, it is usually done by the carnivora.

Whether the cord be ruptured spontaneously or gnawn through by the parent, there is nothing to be feared from hæmorrhage from either the fœtal or placental end; for, contrary to what is observed in the human species, the blood has very little tendency to flow from the umbilical vessels, and the laceration and cold soon check any slight escape. But it may sometimes happen that it is necessary to divide the cord at a short distance from the umbilicus, and this is usually effected either by scraping, torsion, or cutting directly through it by the bistoury or scissors. Even here there is little to apprehend from bleeding. Rainard, in thirty years' experience, and other authorities, have never observed any harm to result; and the cases in which there was danger are certainly very few. Rainard quotes from Brugnone, that Bèranger of Carpi has seen Horse and Ass foals perish from hæmorrhage through the cord having been cut and no ligature applied; and Peuch has witnessed a case of umbilical hæmorrhage in a new-born calf from which, notwithstanding a thread tied round the cord, the blood escaped in drops; another ligature placed above the other did not check this escape, and it was necessary to fix a compress, steeped in perchloride of iron, along the course of the cord before the hæmorrhage could be checked. It must be borne in mind that similar accidents are possible, if a ligature is not applied an inch or so from the umbilicus. Whether it be tied or not, the portion remaining attached to the umbilicus soon becomes dry and withered, and falls off in a few days after birth; the other end most frequently hanging to the fœtal membranes, which immediately after parturition protrude from the vagina.

4. *Expulsion of the Membranes.*—The expulsion of the fœtal membranes, or "afterbirth," as they are sometimes designated, may occur at birth, immediately after, or be delayed for a variable period: this depending not only upon accidental circumstances and individual peculiarities, but also upon species, and, consequently, the placental connections.

Immediately after the fœtus is expelled, the uterus contracts energetically on itself, and its internal capacity rapidly diminishes; consequently, the placental villosities are detached from their alveoli, the uterine and chorionic surfaces become wider apart, and the placenta is ultimately separated from the

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uterus. The same contractions which loosened them, are also instrumental in forcing the membranes through the gaping flaccid os into the vagina; and the auxiliary muscles, being again stimulated by their presence here, as they were by the head of the fœtus in the same passage, add their powerful contractions; so that these new pains, aided by the physical weight of the extruded portion with its appended umbilical cord, soon bring the whole mass away. The contractions of the vagina have probably little, if anything, to do with this expulsion, which is rarely followed by hæmorrhage in animals; though in woman, owing to the *inertia* of the uterus, this accident is not at all uncommon. Sometimes the expulsion of the membranes is expedited by the young creature, as it descends from the vulva.

With the Mare, owing to the disseminated placenta and the slight adherence of the placental villi, the separation of the membranes takes place rapidly; indeed, the foal is not unfrequently born in the intact envelopes. But generally only a few minutes elapse before the afterbirth is detached. Retention of the placenta is therefore exceedingly rare in the Mare, though it is very dangerous; as in attempting to remove it there is great risk of hæmorrhage.

With the Cow, because of the multiple placentulæ, the number of which may be over a hundred, the adhesion between the uterus and fœtal membranes is very intimate; while the small volume of the cotyledons offers but little surface for the uterine contractions to act upon. So that while it happens that the calf is never born in its intact envelopes, it also occurs that the afterbirth is only slowly and tardily extruded: two, four, or more hours, or even days, being required; and, indeed, it is not at all rare for retention to take place in this animal, and the envelopes require to be removed artificially.

Multiparous animals get rid of the envelopes as they expel the fœtuses, the birth of the first being followed in a very brief space by its membranes; after which comes the second fœtus, then its envelopes, and so on; so that only those of the last fœtus may be retained—an accident which sometimes occurs. In these animals, the membranes appear to be expelled without any difficulty; the Bitch, for instance, runs into a corner, and assuming a position as if about to micturate, expels the secundines of the last puppy, devours them, and returns to the other puppies.

With animals usually uniparous, but which sometimes bring forth two or more young, the envelopes of each fœtus are expelled immediately after it is born, so long as they do not offer an obstacle to the passage of the next fœtus; so that in a double birth in the Cow or Ewe, a fœtus being lodged in each horn, the second may be born without the envelopes of the first having been discharged.

We may here note the strange instinct which impels not only carnivorous and omnivorous, but also herbivorous animals—Bitch, Cat, Sow, Cow, and even sometimes the Mare—to devour the membranes as soon as they are expelled, if they are not quickly removed from beyond their reach; at times they even devour them as they are being extruded, and the work of delivery is thus hastened. However unnatural and disgusting this propensity may appear, and though the cause for it is unknown, it does not occasion any visible inconvenience to the creature.

It has been already remarked, that when the young creature is expelled in its intact envelopes, the mother, if at large, frees it from them by gnawing them through; more rarely does the progeny release itself by its own efforts. If the mother should chance to be tied up, as in a stall, assistance may be required to cut the umbilical cord and extract the young animal from its im-

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prisoning membranes, as it may become asphyxiated. This peculiarity is most frequently observed in the Mare, with which birth is always rapid, and the chorion strong and easily detached from the uterus. Rueff states that it is not unusual in the Sow.

CHAPTER II.

Presentations of the Fœtus and Mechanism of Parturition.

In addition to, and to a certain extent independent of, the physiological phenomena of gestation and parturition, there are in the latter certain physical and mechanical acts which have been, as Saint-Cyr truly remarks, hitherto very imperfectly studied in veterinary medicine, but whose consideration is, nevertheless, very important in a practical point of view.

These acts are related to the manner in which the fœtus presents at the pelvic inlet for passage through the outlet, and the way in which this passage is effected; they belong, in fact, to the presentations and positions of the fœtus, and the mechanism of parturition.

The presentations and positions of the fœtus during parturition, as well as the mechanism of that act, are of much practical importance to the veterinary obstetrist, and demand careful consideration. We have repeatedly alluded to the position of the fœtus in the uterus during gestation, and have stated that this position is changed as parturition draws near. What the agency or influence may be which induces this change, has not been ascertained; but it has been surmised that it is due to an instinctive tendency of the fœtus to assume, towards the termination of pregnancy, the position most favourable for its exit through the pelvic cavity; though it is indeed very questionable whether the instinctive faculties of the young creature are already sufficiently developed to bring about this result, which may, after all, be due to some reflex action. However this may be, it is certain that the fœtus is very far from being always in this favourable position, and that the resources of art are often needed to remedy the false positions the young creature may have assumed at the termination of gestation.

In studying the various positions and attitudes the fœtus assumes at birth, and the consequent presentations it offers towards the anterior opening of the pelvis, there is to be considered (1) the region of its body which is first presented to the pelvic inlet, and (2) the relations of, or correspondence between, this region and the shape and dimensions of the pelvic cavity itself.

The first has been designated the *presentation*, and the second the *position* of the fœtus; and the *inlet*, instead of the *outlet*, of the pelvis is considered in this respect, because it is the most important in practice, and the position may be altered either spontaneously or artificially during labour; indeed, this alteration has often to be effected by the obstetrist in order to render birth possible.

SECTION I.—PRESENTATIONS.

The *presentation* results from the part of the fœtus which first offers itself at the pelvic inlet—that region of the young creature which the hand of the obstetrist immediately meets on being passed into the os, and which is directly opposite the inlet. In this sense the head, fore feet, hind feet, croup,

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etc., are said to be presented, according as one or other of them first offers itself on exploration.

These presentations are extremely variable, as any part of the fœtus may occupy this situation; though so far as description and comprehensibility are concerned, their study can be greatly simplified. As Rainard says: "The fœtus, when covered by its envelopes, is oval shaped, or like an olive, which it is desired to pass down the neck of a bottle, and which may be presented to this in three ways—either by one of its two ends or by its middle." These ends are the anterior part of the chest in front, and the croup behind; and it is these parts on which the classification of these presentations is based. This classification gives two longitudinal, and an anterior and posterior presentation; and as the fœtus may also offer itself across the long axis of the uterine cavity, we have a *transverse presentation*, which may again be *dorso-lumbar* or *sterno-abdominal*, according to the side of the fœtus which presents. These four fundamental presentations are, therefore:

1. *Anterior Presentation.*—The chest of the fœtus presents towards the inlet, and is preceded, accompanied, or followed by the head and fore limbs: the situation and direction of which may vary without altering the essential features of the presentation.

2. *Posterior Presentation.*—The croup or breech is facing the inlet, and the presence or absence of the limbs there only constitute varieties of the presentation.

3. *Dorso-lumbar Presentation.*—Any portion of the *upper* part of the body opposite the inlet. Lecoq and Rainard admit presentations of the withers, back, loins, shoulder or haunch, as distinct presentations; but I agree with Saint-Cyr in declaring the distinction to be practically useless. On exploring the pelvic cavity, no matter what part of the back is first touched, the hand always encounters the spine of the fœtus, either directly in the axis of the pelvis, or obliquely and at some distance from it. All these varieties may, therefore, be reduced to the one now named, and which may be either direct or oblique, according as the case may be.

4. *Sterno-abdominal Presentation.*—The limbs in this are in reality first touched, and we may have all four, or only three or two; these, however, are not the fixed point of the presentation, which is the inferior part of the body—or sterno-abdominal region—hence the designation.

These four principal presentations may be divided into *natural* or *normal*, in which spontaneous or unaided birth is possible; and into *unnatural* or *abnormal*, in which parturition is impossible without the intervention of man. The longitudinal presentations alone comprise the first, although they are not always *normal:* as a wrong direction of the head or limbs may prove an obstacle more or less difficult to overcome, and may require the aid of art. So that, taking this view into consideration, the presentations may either be *simple*, or more or less *complicated*, according to circumstances.

SECTION II.—POSITIONS.

The presentation being determined by the part of the fœtus which offers at the pelvic inlet, it must be evident that this part, whichever it may be, may vary considerably in its relations to the circumference of that passage. If, says Saint-Cyr, the chest of the fœtus first enters it, the *attitude* of this region may be very different in different cases; in one the withers may correspond to the sacrum of the mother, and the sternum to the pubis, or the reverse may happen; in another the fœtus may be lying on the right side,

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the sternum corresponding to the right branch of the mother's ilium, and the withers to the left ilium, or *vice versâ*. So that here are four different positions in the same presentation—the *anterior;* and it will readily be understood that it should be the same, or nearly the same, for the other presentations.

The *position* has accordingly been defined to be the relation of a determinate point on the surface of the fœtus, to an equally determinate point of the pelvic circumference. The points, so far as the mother is concerned, may be determined once for all, and they will always remain the same for every presentation; they may be, for instance, the sacral region above, the pubic below, and the two ascending branches of the ilium at the sides. If, with the fœtus, we select any region—say the withers—and put this part in relation

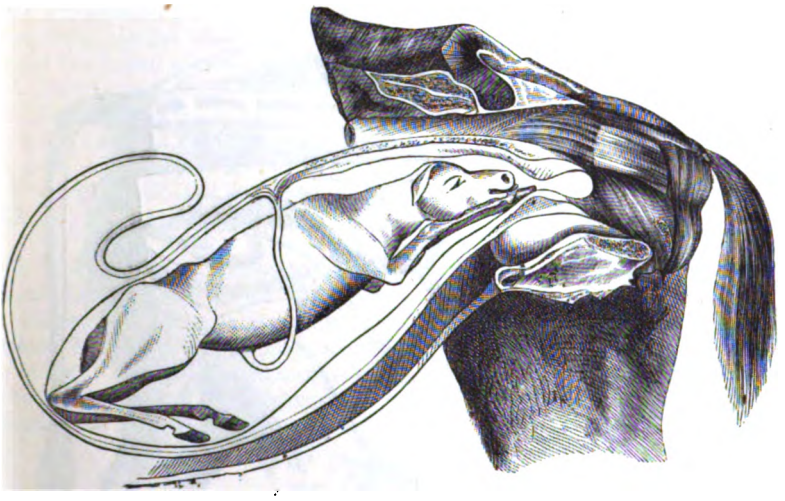

Fig. 58.

VERTEBRO-SACRAL POSITION OF THE FŒTUS.

with any of these four points of the pelvic circumference, we shall have four successive and easily recognised positions. If, therefore, we first give the name of the region in the fœtus, and next that of the pelvic circumference with which it is in relation, we have a ready means of designating the positions: describing the fœtus to be in a *vertebro-sacral position*, for instance, when its *vertebral region* is in relation with the *sacrum* of the mother. The fixed points may be invariable in the latter; but they cannot be so with the fœtus, as they will vary with each presentation.

With regard to the anterior and posterior presentations, Rainard has selected the fixed points as follows: for the first, he has taken the spinous processes of the dorsal vertebræ in the region of the withers; for the second, the lumbar vertebræ. For the positions in the other two presentations, he has not been so fortunate in a designation, in the opinion of Saint-Cyr, who has very judiciously proposed others which are more explicit and comprehensible. The latter gives the various positions which should be recognised in each presentation, as follows:—

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A. ANTERIOR POSITION.—The chest of the fœtus is at the pelvic inlet, and it is desired to make known what relation this part has to the pelvic circumference. The determinate point on the fœtus is the vertebræ of the withers; and these may be in relation with the sacrum above, the pubis below, the right ascending branch of the ilium on the right side, and the left *ditto* on the left. From this we have four positions, named by Saint-Cyr as follows:—

1. *Vertebro-sacral Position* (*Fig.* 58).—This is the most favourable and the most frequent of all, and is said to be the only natural position. The vertebræ of the fœtus correspond to those of the mother, its withers touching the sacrum of the latter, the belly corresponding to the abdominal parietes, and its sternum to the pubis. This is sometimes named the *first anterior position.*

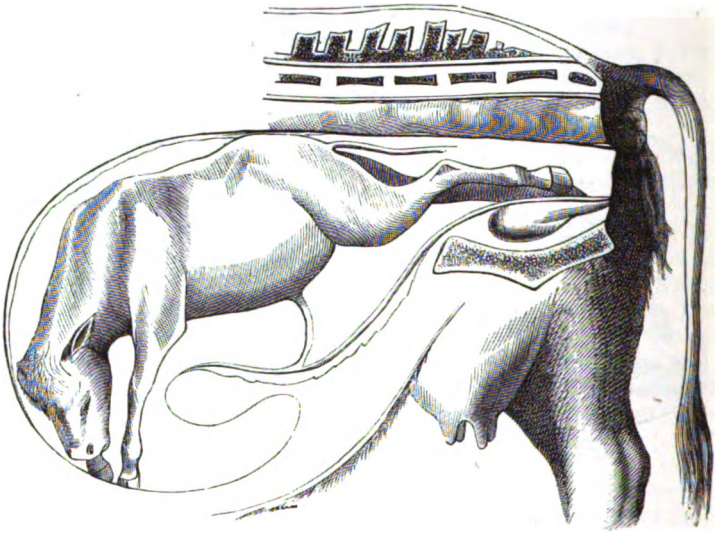

Fig. 59.

LUMBO-SACRAL POSITION.

2. *Vertebro-pubic Position.*—This is exactly the inverse of the first: the fœtus lying on its back, its withers towards the pubis, and the sternum opposed to the sacrum of the female. This is also named the *second anterior position.*

3. *Left Vertebro-ilial Position.*—The fœtus lies in the right flank, its head to the left side of the mother, the neck being in the same direction, and, when passing through the pelvic cavity, touching the ascending branch of the left ilium. The feet, when they are not in the pelvis, must, of course, be sought for on the opposite side, towards the right flank of the mother.

4. *Right Vertebro-ilial Position.*—This is exactly the reverse of the last-described position, the withers corresponding to the right ilium.

The two last are sometimes named the lateral positions. They are less frequent, as primary positions, than the first two, and are sometimes met with as secondary positions after the reduction of a mal-presentation—chiefly the dorsal or ventral.

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B. Posterior Presentation.—In this the croup or breech first presents at the pelvic inlet. The lumbar region of the fœtus, which is the determinate point, may be directed towards the sacrum, the pubis, or the right or left branch of the ilium of the female. Hence we have four positions, as in the preceding presentation. These are :—

1. *Lumbo-sacral Position.*—The fœtus is in what some authorities have called a "natural" position, but which is asserted by others to be unnatural. The loins are towards the sacrum of the mother, the right coxo-femoral articulation towards the right ilium, and the left articulation towards the left ilium. This is sometimes named the *first posterior position.*

2. *Lumbo-pubic Position.*—Some practitioners designate this the posterior reversed position. The fœtus, in fact, is lying on its back, its croup and loins corresponding to the pubis of the mother, while the limbs are towards the sacrum, against which they are more or less pressed. This is sometimes termed the *second posterior position.*

3. *Left Lumbo-ilial Position.*—The fœtus is lying on its left flank, its croup and *loins* opposite the ascending branch of the left ilium of the female, and the limbs towards the right flank, where they must be sought for if they do not present in the pelvis.

4. *Right Lumbo-ilial Position.*—This is exactly the reverse of the preceding position.

C. Dorso-lumbar Presentation.—Here the fœtus is presented across or *transverse,* and it may lie on one or other of its sides, its head towards one of the maternal flanks, and the body curved like that of a Dog asleep. In this we have two distinct positions, according as the fœtus lies on one side or the other. But it may also assume a third and almost vertical position—the croup on the floor of the abdomen of the mother, and the creature in the attitude of a Dog sitting.

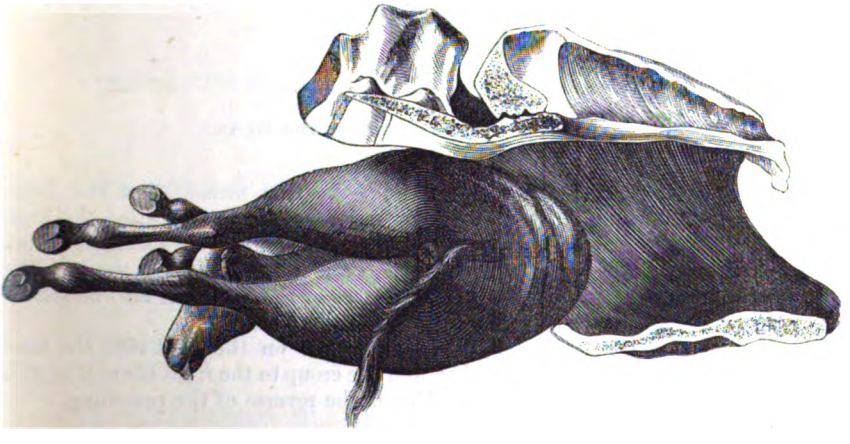

Fig. 60.

Right Cephalo-ilial Position of the Fœtus.

The important consideration in these three positions is related to the situation or direction of the head; as if this is known, we may easily infer

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that of the other parts of its body, and thus appreciate the indications for delivery to be followed in this pathological presentation. According to the direction of the head, the three following positions are described :—

1. *Right Cephalo-ilial Position.*—The fœtus is on its right side, which rests more or less directly on the abdominal walls of the mother, the head in the right flank, the croup towards the left flank, the body more or less curved, and the dorso-lumbar region towards the pelvis, in which it presents (Fig. 60).

2. *Left Cephalo-ilial Position.*—This is the reverse of the preceding.

3. *Cephalo-sacral Position.*—In this position the fœtus is presented by the back, and in an almost vertical attitude: the croup resting on the floor of the mother's abdomen, the head more or less depressed, and directed forward towards the sacro-lumbar region—the creature being seated, as it were, on the udder of its parent (Fig. 61).

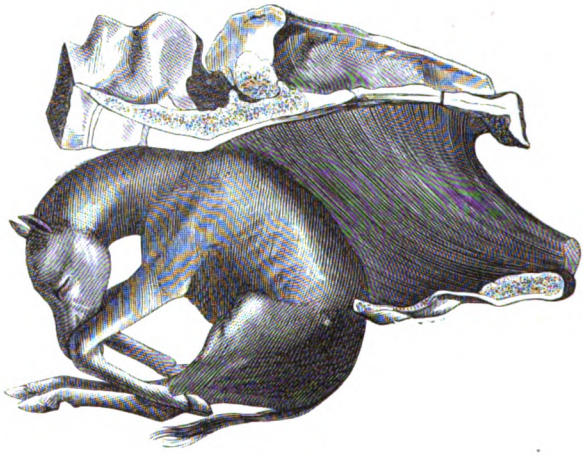

Fig. 61.

CEPHALO-SACRAL POSITION OF THE FŒTUS.

D. STERNO-ABDOMINAL PRESENTATION.—In this presentation the fœtus offers the abdomen to the inlet of the pelvis, and on exploration the hand first meets this part, and two or more of the limbs, but always at least a hind and fore one. The head may be found, or it may be out of reach. The sternum and other parts on the lower surface of the body can also be felt.

In this presentation there are two principal positions :—

1. *Left Cephalo-ilial Position.*—The fœtus lies on the right side, the head towards the left ilium of the mother, and the croup to the right ilium (Fig. 62).

2. *Right Cephalo-ilial Position.*—This is the reverse of the preceding.

Saint-Cyr, who has mainly followed Rainard in the definition of these presentations and positions of the fœtus, insists on the necessity for studying them carefully, as by so doing those who commence the practice of obstetricy will be greatly enlightened as to the difficulties they may encounter, and the readiest and most scientific way of overcoming them; while this study will enable the skilled practitioner to describe his interesting cases with more clearness and precision. To render what has just been stated

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more convenient, the following table is given, in order to show at a glance the different presentations and positions.

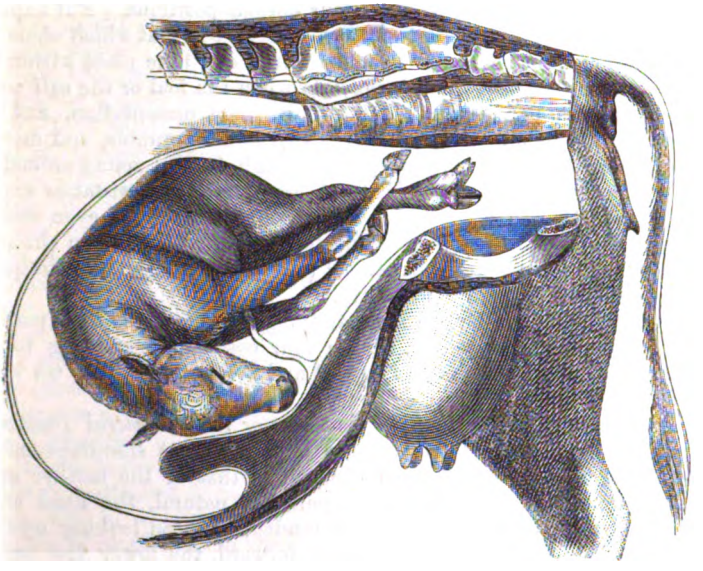

Fig. 62.

[STERNO-ABDOMINAL POSITION OF THE FŒTUS.

PRESENTATIONS AND POSITIONS OF THE FŒTUS.

Anterior Positions	1. Vertebro-sacral. 2. Vertebro-pubic. 3. Right Vertebro-ilial. 4. Left Vertebro-ilial.
Posterior Positions	5. Lumbo-sacral. 6. Lumbo-pubic. 7. Right Lumbo-ilial. 8. Left Lumbo-ilial.
Dorso-lumbar Positions . . .	9. Right Cephalo-ilial. 10. Left Cephalo-ilial. 11. Cephalo-sacral.
Sterno-abdominal Positions . .	12. Right Cephalo-ilial. 13. Left Cephalo-ilial.

SECTION III.—MECHANISM OF PARTURITION.

Under normal conditions, it may be said that the pelvis itself does not offer any obstacle to the passage of the fœtus, and that it is the soft parts alone which oppose its exit.

Of the different presentations we have enumerated, the anterior—in which the fore feet, head, and chest present simultaneously—is the only one we may designate as "natural," especially with the larger animals and primiparæ.

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Fromage de Feugré was the first to point this out, though Rainard was of opinion that the posterior presentation should also be looked upon as normal; while Desplas gave three natural positions—head and fore limbs, head only, and hind limbs only; and Delwart gives four normal positions. But experience abundantly proves that the first we have described is that which alone merits the designation, as it is the one in which birth can take place without artificial aid. It is true that birth is possible when the foal or the calf presents posteriorly at the pelvic inlet; but this is a rare presentation, and under the most auspicious circumstances it is much less favourable, and more difficult for the mother, while it is very often death to the young animal (especially in the Mare). In the majority of cases, without assistance expulsion proceeds no further than the hocks, and the fœtus dies; and even sometimes with assistance much force is necessary to deliver. Whereas, in the anterior presentation, the cases are exceptional (and these chiefly in primiparæ) in which even slight traction is necessary.

We will follow Saint-Cyr in first studying the mechanism of parturition in this presentation, in which, of the four positions pertaining to it, the *vertebro-sacral* is by far the most frequent and favourable. This we will now notice.

1. *Mechanism of Parturition in the Anterior Vertebro-sacral Position.*—In this position it has been stated that the fœtus presents simultaneously with the head and fore limbs, the back directed to that of the mother and the withers towards the sacrum. When perfectly natural, the head and fore legs first enter the inlet; the head is extended, forehead looking upwards to the sacrum, chin towards the pubis, nose forward, the lower jaw resting on the outstretched limbs, the feet of which extend a little beyond the nose. Then comes the neck, and after it the chest and shoulders, which arrive at the inlet when the nose and feet show themselves at the vulva.

In this course it will be observed that, so far as the head and limbs are concerned, there is no difficulty, as the pelvic diameter readily admits them when the soft parts are sufficiently relaxed. With the chest, however, there is difficulty, as its diameter is greater than that of the pelvis; and the question is, therefore, how it is got through the canal. In 1870, Saint-Cyr saw four well-bred harness and saddle Mares give birth to foals at the Lyons Veterinary School. Gestation had been regular, and parturition, which was easy and favourable, did not exceed the ordinary duration. In taking the diameters of the maternal pelvis by the method already described, and those of the fœtus (dorso-sternal, biscapulo-humeral, and bicoxo-femoral), it was found that in these four instances the biscapulo-humeral diameter—the largest in the chest—was easily accommodated in the bis-iliac diameter of the female pelvis, which was greater by 42, 45, 48, and even 52 millimetres (from 1½ to 2 inches); while the sterno-dorsal diameter of the young creatures exceeded that of the sacro-pubic region in the mothers by 28, 85, 87, 88 millimetres (from 1 to 3½ inches). This part of the body of the fœtus had, therefore, to undergo a corresponding reduction in a vertical direction before it could clear the inlet; and even if we take into account the excess of the lateral diameter of the pelvis, it will be found that the thorax and withers of the fœtus still notably exceed in size the opening through which they must pass. That they do pass through it, and with ease in the majority of cases, without injury to the mother or the young creature, is a matter of daily experience; but the mechanism by which the reduction is effected has been much discussed.

Lafosse endeavoured, in the last century, to describe it, and came to the

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conclusion that the head once through the inlet, the shoulders of the foal, which exceed the withers, pass by their upper part in front of the neck, thus forming a kind of channel which glides along the maternal sacrum; also that the spinous processes of the withers, which are almost cartilaginous, bend back on each other, and to right and left of the spine, thus preventing too great compression of the chest. Altogether, he concluded, that the foal, in its passage, becomes moulded in such a manner that the chest has the form of the keel of a ship gliding on the stocks, and in every way corresponds to the mother's pelvis, whose internal contour it assumes.

Rainard, however, takes a slightly different view of this matter; for while admitting, with Lafosse, the inclination backward of the dorsal spines as a first cause in diminishing the vertebro-sternal or perpendicular diameter of the thorax, he cannot admit that the upper border of the scapulæ lie against the neck, but states that the shoulders, on arriving at the pelvic entrance, come in contact with the ascending branches of the ilium, and are thrown back somewhat, leaving the front part of the chest free, and thus diminishing its diameter. He also adds that the withers first enter beneath the sacrum; that the sternum below is pushed back by the anterior border of the pubis, and the chest in this way submits to a process of elongation which notably diminishes its vertical diameter.

Saint-Cyr agrees with Rainard in this interpretation of the real mechanism of parturition in the Mare. The sternum in being carried backwards, also pulls back the ribs attached to it, and this not only diminishes the chest in a vertical, but also in a horizontal direction, as is witnessed in studying the mechanism of respiration in the living animal, in which, during expiration, the chest decreases in width and depth. When the chest is so altered during parturition, the fœtus becomes, as it were, elongated by this part being depressed: an alteration which occurs all the more readily, from the bones composing the thorax being soft and supple, and the organs they enclose (the lungs) not being so developed as they are immediately afterwards; so that a moderate amount of pressure, provided it is not too long continued, may be borne with comparative impunity.

In the larger animals, the pelvis cannot undergo any sensible increase in size during the passage of the deepest portion of the fœtal body through the inlet, which is, in the Mare, an absolutely inextensible bony girdle. Lafosse has sawn through the pubis of Mares about to foal, and he found that during parturition there was only a space of two lines between the sawn margins. So that it is the body of the fœtus which has to accommodate itself to this part of the passage at this stage of delivery.

When, however, it has passed through the inlet, extensibility of the maternal tissues can, and does, take place, and permits an enlargement of the canal. The wide sacro-ischiatic ligaments which enclose the pelvis laterally, are softened and more elastic during birth; the sacro-iliac and sacro-lumbar articulations are increased in mobility; and even the posterior part of the ischio-pubic symphysis may become slightly relaxed. So that when once approaching the outlet the progress of birth is more rapid, and this progress may be aided if, as is pointed out by Lafosse, the tail of the animal is well elevated.

A slight check to expulsion is observed (especially in the Mare) when the croup arrives at the inlet, as this part nearly corresponds in diameter to this opening, being, if anything, slightly less. However, notwithstanding this, in consequence of the croup being less susceptible of diminution than the chest, and although the bones may yield to some extent, friction will occur, more particularly if the croup is largely developed, which it is in some foals. One

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haunch may pass into the inlet before the other, however, and thus facilitate the passage.

With the Cow, the mechanism of parturition in this presentation is similar to that in the Mare. Saint-Cyr shows, from actual measurements of Cow and fœtus, that the head of the calf can easily pass into the inlet, owing to its less diameter; and that the principal difficulty is encountered by the fœtal thorax, which is slightly larger in every sense than the inlet.*

The bicoxo-femoral diameter of the croup slightly exceeds the bis-iliac diameter of the pelvis; but it is possible that the pelvis of the calf being more cartilaginous and supple than that of the foal, may be submitted to a slight temporary compression. It is to be remarked, however, that the progress of the calf through the pelvis must be more protracted than that of the foal, owing to the greater length of the maternal pubic symphysis, and the more considerable extent of the pelvic walls, as well as the peculiar curve in the floor of the pelvis; though these disadvantages are somewhat compensated for by the greater mobility of the sacrum. And, as we have seen, such is really the case, the duration of parturition being shorter in the Mare than in the Cow.†

With regard to the other animals, the same remarks will apply. We may just note that with the common-bred Bitch, which has a more or less elongated muzzle, when fecundated by a Dog of the same conformation and size, and which in due course brings forth from five to eight young, there is usually no difficulty in delivery. The conical form of the muzzle of the puppies, and the softness of their tissues, permits their entering the inlet in this presentation, and passing easily through it under the influence of the uterine and abdominal contractions. But when the Bitch is of small size, and is fecundated by a young, vigorous, and larger Dog, and especially if the muzzle of either or both parents is short, then the head of the puppies is usually large and round, with the forehead high, and the presentation offers grave, and frequently insurmountable difficulties. This is more especially the case if the puppies are few in number, when they are usually larger. This will be alluded again to when we come to treat of difficult parturition.

2. *Mechanism of Parturition in the Anterior Vertebro-pubic Position.*—In this position, the same diameters of the fœtus correspond to those of the maternal pelvis; though in practice it is found that this position is less favourable, and that delivery is always more difficult and longer than in the first anterior position. This appears to be due to the fact that in the latter the dorsal spines, or withers, the most prominent part of the fœtus, glide along the vertebral column of the mother in the kind of channel formed by the psoas muscles, and is naturally directed towards the pelvis; while in the vertebro-pubic position, it comes against the brim of the pubis, where greater, more frequent, and more continued contractions are needed to raise it to this kind of step leading to the inlet. And when it has cleared this obstacle, the fœtus still passes with difficulty through the canal, as the curve of this passage is exactly the reverse of that offered by the body of the fœtus; all the articulations of the vertebræ, but particularly that of the atlas with the occiput, and those of all the limbs, being flexed downwards, or in a contrary direction to the curve of the sacrum. Consequently, in order to accommodate themselves to this curvature, all these articulations must be forcibly extended—an unfavourable condition; while the pres-

* Saint-Cyr in these observations measured the thorax after the birth of the young creatures, and when the lungs had become expanded. He does not appear to have made any allowance for this expansion, which of course makes a difference in the size of the thorax after birth.

† The fact that parturition is more quickly performed in the Mare than any other quadruped was well known to Aristotle: *Equa, omnium quadrupedem, facillimè, parit.*

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sure and friction must be considerable. And not only is progress through the pelvic canal slower and more difficult, but the maternal organs are also exposed to injury, and sometimes receive serious damage: the feet of the fœtus having a natural tendency to be carried upwards, may squeeze the vagina against the sacrum, or press against the perineum, etc., when we may have lacerations of the vagina, vulva, perineum, or other part.

3. *Mechanism of Parturition in the Anterior Vertebro-ilial Positions.*—These lateral positions—two in number and symmetrical—are, according to Saint-Cyr, rarely primary, but, as Rainard remarks, are sometimes found as *secondary positions*, due to the reduction of some mal-presentations. The latter authority asserts that spontaneous birth is impossible in these positions, because the chest of the fœtus presents its greatest diameter to the smallest diameter of the pelvis of the mother. This, however, is an exaggeration, as Saint-Cyr points out that the bis-iliac diameter is sometimes equal, or even superior, to the sacro-pubic diameter; so that it is not always absolutely impossible for delivery to occur spontaneously in these positions; though it is very true that it is *always* more difficult, and *sometimes* impossible, if the position is not altered. Independently of the disproportion between the diameters of the pelvis and the corresponding diameters of the fœtus, here also we find the two salient parts of the latter—the sternum and dorsal spines—jamming against the two resisting parts of the pelvic circumference—the ascending branch of each ilium, and it will be readily seen that in some cases these will prove an insurmountable obstacle. Nevertheless, as a general rule, this obstacle may be easily turned by merely causing the body of the fœtus to rotate on its axis, in such a manner that its greatest diameter will be brought opposite the oblique diameter of the inlet, which extends from the ileo-pectineal ridge to the sacro-iliac articulation on the opposite side. Then its entrance into the pelvic cavity, and complete expulsion, is rendered possible.

4. *Mechanism of Parturition in the Posterior Lumbo-sacral Position.*—Of the four positions in which we may have a breech or posterior presentation, only one, in the opinion of Saint-Cyr, is compatible with spontaneous delivery—the *lumbo-sacral;* though even this is denied by other authorities. The fœtus is presented by the breech, the loins towards the sacrum of the mother, the hind limbs in complete extension and entering the inlet, so as to open the passage for the body; and though this position may appear to be favourable for the expulsion of the young creature, yet it is far less so than the first anterior position. The croup of the fœtus is a rounded voluminous mass which does not admit of much compression, and the diameters of which —particularly the transverse—are nearly equal to those of the pelvis; it is, therefore, not well disposed for passing through the latter, and, in addition, its upper part presses against the sacro-vertebral angle; while the stifles, which are salient, press against the edge of the pubis, and the hip joints against the branches of the ilium. Entrance into the inlet must therefore be slow, difficult, and painful for the mother, and when this first obstacle is overcome and the croup is in the pelvic cavity, the chest has to follow, and to submit to the same compression at the inlet as in the anterior presentation. But this part of the fœtus is much less favourably disposed for such a reduction of dimensions in this position; as the resistance offered by the walls of the maternal pelvis has a tendency to erect the dorsal spines, and to carry the ribs and sternum forward—all this going to increase the diameter of the fœtus in every direction. It is only, then, by direct compression or crushing, that the necessary diminution in the diameters of the young creature can be

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effected, and not by a kind of physiological decrease, as in the anterior presentation.

There is also the obstacle offered by the hair of the fœtus, the "set" of which is against the direction of movement; and this obstacle will be greatly increased if the fluids have escaped for some time, and the parts are more or less dry.

Taking all these considerations into account, it will be seen that in this position, even when birth is possible with extraneous assistance, labour must be long and exhausting, and that the young creature incurs the greatest danger. Labour, however, is more likely to be successful and less tedious if the haunches of the fœtus present one after the other at the inlet; so that a slight obliquity in the presentation makes a great difference; and it is just possible that when birth takes place in this position without aid, this obliquity may have been present.

In the Cow, the calf is more frequently born alive in this position than the foal, and birth is easier; a circumstance which is, in all probability, due to the smaller dimensions of the croup in the young of the bovine species.

CHAPTER III.

Necessary Aid in Normal Parturition.

ALTHOUGH, as a rule, parturition is generally effected in animals in what we have designated a "spontaneous" manner (without the intervention of man), and without danger or prejudice to the mother or offspring; and although these do not require that minute and scrupulous attention bestowed on woman, even when birth has been easy; yet from the nature of this act and the unfavourable consequences which are sometimes noted, certain precautions should be observed by the owner of the animals at this period, and especially if these should happen to be valuable and very artificially kept. These attentions and precautions should be entrusted for their carrying out to competent persons selected by the owner; as it is seldom that the veterinarian is called in unless something serious has occurred. The mother as well as the offspring require watching, and more or less nursing.

SECTION I.—ATTENTION TO THE MOTHER.

With the smaller animals, except perhaps the Bitch, but little preparation is needed, and the act of parturition is accomplished without any trouble. But with the larger and more valuable creatures—such as the Mare and Cow, and even the Sheep—certain precautions should be adopted. With the Mare and Cow particularly, this function is accompanied by pain, restlessness, and a certain amount of excitement, which necessitate attention. For instance, an animal tied up in a stall among other animals of the same or different species, is more exposed to accidents than one which is in a place by itself, or which is at liberty in a pasture or meadow. Therefore, the Mare about to foal should be allowed a roomy loose-box, well supplied with soft litter; and the Cow should, if possible, be similarly provided. If either animal must be kept tied, then the fastening should be of such a kind that it can readily be undone when required. The Sow should have a separate sty, and even the Sheep may need a separate allotment. If kept in a dwelling, the temperature should be comfortable and the ventilation good.

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A. During Labour.—When parturition commences, it is rare indeed that anything requires to be done during at least the two first stages—those of preparation and dilatation of the os. Therefore, the animal should be allowed perfect quietude; and if the light in the stable is too bright, it may be partially excluded. A trustworthy person may remain with it, in order to avert accidents; but he should keep himself out of sight, and meddle with the animal as little as possible. Some creatures, and particularly primiparæ, are rendered peevish and fidgety if they see any one present during parturition.

Unless something irregular or abnormal occurs during this act, all should be left to nature. The irregularities are few in number, the principal being *hurried* and *protracted parturition*, they being only modifications of natural labour; the difficult cases coming under the head of *dystokia*, to be treated of in another division of this volume.

Whether called in to a case of irregular or abnormal parturition, the first care of the veterinary surgeon will be to assure himself as to the state of the animal and the progress made in the act. In this direction, it must be remembered that for the accomplishment of this function in a physiological manner—*i.e.*, by the forces of nature only—and without prejudice to the mother or offspring, there is required a definite action, proportionate to the constitution of the former, of the forces destined for the expulsion of the latter. The labour-pains should be normal, the act should neither be hurried or abrupt, nor yet too slow; and the mother should not exhibit any constitutional weakness or physical debility. In addition, the fœtus should be normal as well as its membranes; and the genital passages of the mother ought to be in a properly formed and healthy condition. The fœtus should be alive and natural in form and size, particularly with regard to the volume of the head and thorax; and it ought to be in such a position that it can be expelled without assistance. The fœtal envelopes should possess a certain degree of thickness and resistance, so that they may not rupture too soon, nor yet resist the action of the uterus too long. The pelvis of the mother should have a convenient shape and capacity; the genital passages soft and elastic; the os, vagina, and vulva properly formed and extensible; and the other pelvic organs in a normal state.

If the act of parturition is not sufficiently advanced, and the soft parts through which the fœtus has to pass are not enough dilated, time should be allowed for this to take place. As a rule, there should be no hurry to interfere with the progress of the case, as a somewhat long period is often required for preparation; and if this is accelerated by the intervention of art, accidents are more likely to occur than if the labour had been long and protracted.

Vitulary or parturient fever has been remarked as more common in Cows which have calved quickly or abruptly; and in such instances it has also been noticed that the uterine contractions do not sufficiently detach the fœtal membranes.

In parturition, there is as much wisdom shown in remaining a spectator sometimes, as in interfering at other times when circumstances require it. It is only when obstacles, insurmountable by the natural efforts of the animal, offer themselves that aid must be rendered. So long as the course of parturition remains normal, nothing should be done, under ordinary circumstances.

With the Mare, however, delay should not be pushed too far, as the fœtal placenta is very easily detached from the uterine surface, and the fœtus may perish of asphyxia or inanition.

The intelligent owner of an animal which is about to bring forth, should himself be able to ascertain the position of the fœtus, and decide as to

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whether parturition may terminate in a natural manner, or if the existing obstacles are easy to overcome. If they are not, he certainly should not venture to attempt delivering the animal himself, or to pull about the mother or fœtus; as this may only tend to aggravate the accident, and render relief more difficult. The veterinary surgeon should be sent for, as his knowledge and practised manipulative skill will, in the majority of cases, bring the most complicated labour to a prompt and happy termination—preserving the mother, and often the produce.

This appeal to the veterinarian is not always made, however, until the owner, his servants and neighbours, or the empiric, have done great damage, and caused the loss of valuable time; then he is sent for, but now the case may be one of extreme difficulty or hopelessness, from exhaustion or injury.

We shall only notice in this place what has been designated *abrupt, tumultuous, disordered,* or *false labour* (*partus præcipitatus*), and *protracted labour;* both due to anomalies in the expelling forces.

1. *Tumultuous Labour.*—In this kind of labour the act of parturition is deranged and precipitate; and though the pains are excessive and frequent yet no progress appears to be made, the parts not being prepared, and the cervix is often in a state of spasmodic contraction, rigid, and painful. Otherwise the maternal organs are well formed, the passage roomy enough, and the fœtus in a good position.

Sometimes the uterus itself is in a state of contraction, the contractions assuming the opposite direction of those occurring in healthy labour,—commencing at the cervix they pass towards the fundus of the uterus.

This condition, in which the phenomena are at first alarming, is most frequently observed in young, well-fed, vigorous, irritable animals, and especially primiparæ, which are excited and troubled at the first pains, and give themselves up to violent expulsive efforts which hinder the natural course of parturition.

In the majority of cases, amendment is ensured by diverting the animal's attention, in walking it about for a short time, wisping the abdomen gently, and keeping it in a quiet and dark place. If, however, the pains are violent, and the agitation great and persistent, other measures must be resorted to. Some authorities recommend bleeding, but this should, if possible, be dispensed with. Blankets steeped in hot water should be applied to the loins and abdomen, warm enemas should be administered, and, if deemed necessary, chloroform, æther, opium, or chloral given in draught or in enema—the latter being generally preferable. Not unfrequently good results are produced by injecting tepid water into the vagina, and raising the animal's hind quarters; and at other times, when the cervix is in a state of spasm, relief is soon obtained by applying a little extract of belladonna to it. With small animals, a few drops of laudanum, either in draught or enema, and a warm bath, are usually sufficient.

Quiet, soothing, and simple treatment will generally bring about a normal state of affairs; the agitation and irregular straining subside, and easy parturition occurs in six, twelve, or twenty-four hours.

2. *Protracted Labour.*—Protracted labour, due solely to the inability of the uterus to expel its contents, or to pathological weakness of the expelling forces, is rare, except in those cases in which exhaustion results from violent and long-continued attempts to overcome some material obstacle to birth. Then, most commonly, the membranes have ruptured, the waters have entirely escaped, and the uterus, in a state of general tonic contraction—*tetanus uteri*—is closely applied to the fœtus, but makes no effort to expel it.

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This usually, if not always, happens when the fœtus is dead. But primary inertia, as Saint-Cyr remarks, due to constitutional weakness, and in the absence of any material obstacle to the extrusion of the fœtus, is not common.

It is observed, nevertheless, in emaciated, puny, and frequently old animals, which are debilitated from lack of sufficient and good food, prolonged lactation, overwork, or worn by chronic wasting diseases. It may also be due to congenitally feeble development of the uterine muscular fibres, and to diminished contractility of these by over-distention of the uterus during pregnancy, or by disease.

The symptoms in the Mare and Cow are: comparatively shallow and repeated inspirations, feeble and unfrequent straining, weak pulse, restlessness and symptoms of suffering, extremely slow progress in birth,—parturition in the Cow being extended to twenty-four, and even forty-eight hours, though the fœtus may be in a good position, of ordinary size, and the passage clear. If the hand is introduced into the vagina, it will be discovered that the uterine contractions are weak.

There is no urgent danger to the mother in this condition; though the life of the fœtus is often imperilled, as the placenta may be detached more or less from the uterus, and this may lead to fatal consequences.

An examination is of course necessary, in order to ascertain whether there is any obstacle to parturition. Should such not be found, then stimulants may be given; and such ecbolics as rue, saffron, savine, and particularly ergot of rye, have been recommended by various writers. These may be useful, but it will generally be found that active intervention is preferable, and more especially as there is little, if anything to prevent the fœtus being easily reached; for should the os be insufficiently dilated, it may readily be made wide enough for the hand to be passed into the uterus. Moderate and judicious traction on the parts which present, when the mother makes expulsive efforts, will bring the fœtus into the pelvic cavity, and through the vulva.

Death of the Fœtus.—When parturition is retarded, it is often a question whether the fœtus is dead or alive, and to answer it correctly is sometimes difficult. Auscultation in the larger animals cannot, as it may in the human species, furnish any certain evidence in this respect. The fœtor of the liquor amnii has been held to prove the death of the fœtus; but though it is a good, yet it is not an infallible sign. When decomposition has, however, well advanced, and the fœtus is emphysematous and its hair easily removed, then there can be no doubt as to its being dead. The coldness of the parts external to the vulva of the mother, when well marked, is also a sign of death. Of course, so long as the fœtus displays active movements, it is alive; but the absence of these is not an absolute proof that it no longer lives; for sometimes when it is partly in the pelvis and the waters have escaped, so that the uterus encloses it firmly, though still living it remains immovable, and cannot be stimulated to movement. Should the presentation be anterior, then passing the fingers into its mouth and titillating the tongue will prove a test of its vitality, as the jaws and tongue are almost certain to move if it lives; but the absence of movement will not be infallible, though it will constitute very probable, evidence of death. If the umbilical cord can be reached and seized between the thumb and index finger, slight compression will discover whether or not the arteries pulsate. The absence of pulsation affords a strong, but not in every case a sure, presumption that the fœtus is dead.

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Gellé, many years ago, gave an empirical test which, he asserted, was constantly successful; though it is difficult to say why it should be. This method consists in passing a blanket or sheet under the belly of the Cow, and lifting it up by assistants at each side. If the fœtus is not dead, the Cow exhibits dislike of the pressure; but if dead, then it rests on the sheet.

Another authority states that, with the Mare, the expulsive efforts cease for the time being as soon as the foal is dead, and if it has not entered the pelvic inlet; if it has passed into this, the pains continue as usual.

The causes of death of the fœtus during parturition are not numerous, and may be enumerated as follows:—1. *Knots* on the umbilical cord, which, though not unfrequent in the human fœtus, appear to be very rare in animals; 2. *Twists* of the cord around the body, neck, or limbs of the fœtus, and which may be sufficiently tight to interrupt the circulation in the umbilical vessels; 3. *Premature rupture of the membranes* and escape of the whole of the liquor amnii, which, if parturition is not soon completed, exposes the fœtus to great danger from immediate pressure of the uterus upon it; 4. *Disunion*, more or less complete and extensive, between the uterus and fœtal envelopes, by which the vital connection between the mother and fœtus is interrupted, and if the latter is not quickly expelled it must die from asphyxia. Owing to the difference in the placentation of the various animals, it happens that this fœtal asphyxia is not equally common in all; a fact which experience and clinical observation have abundantly demonstrated.

Many veterinarians, and among them Saint-Cyr, have been struck by the fact, that no matter how soon they were called in to a case of difficult parturition in the Mare, nor how trifling the difficulty might be and rapid the delivery, a *living* foal was never produced; while in cases in Cows, though incomparably more difficult, and requiring manipulation for more than an hour, living calves were the rule. So common is this experience, that a very distinguished French veterinary surgeon—Donnarieix—has laid it down as a maxim that the foal does not live more than three hours, often less, in the uterus after the first expulsive efforts; while the calf in the same conditions can live much longer—sometimes for several days—after the commencement of labour. The explanation he gives, and which we think is correct, is based on the manner in which the fœtal placenta is inserted into the uterus. In the Cow, the placentulæ, multiple and independent of each other, adhere firmly and closely to the uterine cotyledons, so that the placental circulation may persist for a long time, notwithstanding the energy of the uterine contractions; while in the Mare, the placental apparatus being everywhere distributed over the chorion, adheres but feebly to the uterine mucous membrane, and gives way as soon as labour commences, so that fœtal asphyxia is imminent if birth be not prompt.

It was, and still is, believed by many that the fœtus plays an active part in delivery, and particularly in rupturing its membranes; while others consider that its death increases to a marked degree the difficulties of parturition, because it does not then stimulate the contractions of the uterus, and its flaccid tissues do not afford that resistance to the uterine muscles which they do when it is alive. But Saint-Cyr denies that the death of the fœtus renders parturition slower or more difficult; though he admits that if, at the commencement of this act, there may chance to be any trifling irregularities in presentation or position, these may be rectified to a certain extent by the automatic or more or less instinctive movements of the living fœtus. He concludes, that though the death of the fœtus has certainly a great import-

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ance, so far as the interests of the breeder are involved, as well as with regard to obstetrical operations in difficult cases; yet it has little or none so far as parturition itself and its results to the mother are concerned.

In the expulsive period, or third stage in parturition, it is usual to consider such matters as when to rupture the water-bag, and when to use traction on the fœtus. We will follow this custom, and notice these points.

Rupture of the Water-bag.—This should not be artificially ruptured too early; indeed, in the Cow, it should never, as a rule, be opened artificially, as it is always spontaneously ruptured at the proper time, and not unfrequently sooner than it might be. Besides, the want of tenacity in the membranes, their thinness, and the firmness of their adhesion to the uterus, renders this non-interference all the more necessary.

With the Mare, however, matters are different. In this animal the fœtal membranes are thick, firm, and feebly adherent to the uterus; so that the foal is sometimes born completely enveloped in them. It is, therefore, well to incise them when the water-bag appears as a large tumour beyond the vulva; until this happens nothing should be done, unless the os is completely dilated, and the head and feet of the fœtus are well in it. The membranes may be torn by the fingers, or cut by scissors or a knife, care being taken not to injure the foal.

When the water-bag is ruptured too early, the uterus contracts on the fœtus, as has been said, and becomes moulded on it; this is opposed to birth. Besides, the genital passage becomes dry and adherent, and this is an additional obstacle. To remedy this, recourse must be had to injections into the vagina of mucilaginous fluids, milk, glycerine and water, oil, lard, bran and water, or even simple tepid water, which may be introduced by a funnel, the Cow's hind quarters being slightly raised.

Traction on the Fœtus.—When the membranes are once ruptured, the natural expulsion of the fœtus should be waited for. In some instances, however, this expulsion may be conveniently assisted by judicious traction on the fœtus. If it is in the anterior vertebro-sacral position, gentle traction may be made on the pastern of each fore leg when these and the head have cleared the vulva, the tractions coinciding with the throes of the mother, which they should supplement, but must not supplant. They ought to be made in a slightly oblique direction downwards, towards the hocks of the mother, so as to allow the body of the fœtus to follow the curve of the pelvis; inclining the traction a little to the right and left, will also aid in passing the shoulders and afterwards the haunches. The head and neck, when they are clear of the vulva, should be supported. If the fœtus is in the vertebro-pubic position, the direction of the feet must be watched and directed, as they have a tendency to press against the sacrum, and may seriously injure the passage. They should therefore be seized while they are yet in the vagina, and brought gently outside the vulva along with the head, when traction may then be employed. This should at first be made upwards, so as to clear the withers from the brim of the pelvis, against which it sometimes jams. When this is effected, then the same procedure as in the other case is to be adopted.

In the vertebro-iliac positions, it is always useful, when they are recognised in time, and before the chest has entered the pelvis, to attempt to modify them by converting them into one of the preceding positions, and particularly the vertebro-sacral; though this modification requires the manipulative skill of an experienced veterinary surgeon. If the fœtus is already in

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the canal, delivery must be attempted according to the principles already indicated: directing the feet towards the centre of the passage and outside the vulva, and employing moderate traction on the limbs.

When the fœtus presents posteriorly, in the lumbo-sacral position, with the croup towards the maternal sacrum, the only way in which birth can be effected naturally is when the feet of the hinder extremities lead and dilate the os. This position is recognised by the coronary and pastern joints being bent upwards, and by the hocks, which are deeper situated, are flexed in the opposite direction, and are distinguished by their broad flat sides and the blunt point of the calcis, which points in a contrary direction to the flexure of the joint. In this position, the two limbs are to be seized at the pastern, and traction exercised at first slightly upwards, in order to carry the stifles over the brim of the pubis, which sometimes checks them; then downwards, to bring the croup below the sacrum; and lastly, an alternate movement from right to left and left to right, to free the haunches, one after the other. It is well to see that the tail of the fœtus is in a right direction before traction has been much practised.

The other positions will be referred to in the second division of this work.

We may remark, however, with regard to gemellar parturition, that this kind of pregnancy is not usually recognised in uniparous animals until birth takes place. The escape of only a small quantity of liquor amnii, and the small size of the creature first delivered, when compared with the size of the mother's abdomen, are not infallible indications that more young will be produced. Soon, however, another water-bag appears, and another fœtus presents at the vulva. Not unfrequently, when the position of the two fœtuses is natural, they present one after the other successively, and without any assistance being required. This is the case more particularly with the Sheep and Goat—animals which so often produce twins. But sometimes, and especially with the larger animals, the two fœtuses present themselves simultaneously at the pelvic inlet, and neither can pass through. In such a case, which it must be confessed is rare, it is necessary to push back the one least favourably presenting, and to keep it away until the fore limbs of the other are engaged in the passage. If the two fœtuses chance to be in an unfavourable position, the anterior extremities of one should be sought for (recognised by the knees, and to a certain extent by the pasterns), or the hind limbs (recognised by the pasterns and hocks) if they are convenient for the purpose, and traction exercised as in the case of a single fœtus, and according to the directions given above, taking care to keep the other fœtus out of the way. Should it not be possible to extract this fœtus, it may be that certain parts of the other stop its progress, or that the expulsive forces are expended on the latter, although it is farthest from the os. It is then necessary to push back and turn the former, and endeavour to extract it by the extremity opposite to that which was first tried. But if the fore limbs have been got into the passage, as well as the head, the position need not be changed, the procedure being then the same as for a fœtus disproportionately large.

Another remark is with reference to the operator. In exploring the genital passages, gentleness and tact should be scrupulously observed, and the hand and arm should be well oiled, the nails of the fingers being cut at least moderately short. It requires some experience to be able to ascertain, by the sense of touch, what parts of the fœtus present, and those which are an obstacle to birth; as well as knowledge to guide one in placing the parts in a favourable position, and particularly in one which approaches what we have

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designated the "natural" presentation. The time chosen for exploration should be the interval between the labour pains, and care must be taken not to rupture the membranes, should they still be intact. The exploration may be made while the animal is standing or lying; both positions have certain advantages, though the first is generally preferable, and is certainly less fatiguing.

It must not be forgotten that, when traction is required, this should be slow and moderate, and only applied when the animal itself makes expulsive efforts. In many cases the resistance to be overcome is often very slightly superior to the forces exerted by the parturient animal. Violent and sudden traction is to be deprecated, as it may inflict serious injury, while doing little, if anything, in aiding delivery; and even should this be effected, it must be remembered that the contractile power of the uterus is deranged when the contents of the organ are attempted to be suddenly and forcibly removed. The simplest and safest traction is that made by the hands of the operator—for both hands may, in some cases, be introduced into the vagina. Should he not have sufficient strength or purchase, an assistant may clasp him around the chest and pull at and with him—gradually and steadily during the throes. But we shall recur to this subject again.

B. After Labour.—The attention to be paid to the mother after parturition will differ not only according to the species to which it belongs, but also according to its temperament, strength, and the kind of labour which it has undergone. When this has been natural, and the animal is vigorous and not much fatigued, simple hygienic measures are all that is necessary. It should be kept comfortable, with plenty of pure air, but away from draughts. If it has been perspiring, the body, and particularly the belly, should be well wisped if it is a larger animal; indeed this friction is always to be recommended, as it often allays the restlessness which sometimes persists after delivery, regulates the circulation, and appears to hasten the retraction of the uterus. It may be necessary to cover the body with a blanket, as the animal is very susceptible to cold at this period. A gallon or so of nourishing, tepid gruel, or even soup, may be given; after which the diet should be moderate and easily digested. Clean dry litter should be plentifully supplied, and the animal left alone for half an hour or so, after which it may be visited, offered more gruel, and the offspring assisted to the teat, if it has not already found it. From three to eight, or even fifteen days' rest should be allowed, according to circumstances; and in order to permit lactation to be fully established, and the animal quite recovered.

When parturition has been protracted, and the animal has suffered much, and especially if the generative organs have been bruised and inflamed, nursing should be continued longer, and greater precautions adopted. Every care ought to be taken to prevent metritis or metro-peritonitis; and with this object in view tepid vaginal injections, to which may be added a little per-manganate of potass or chloral, may be employed: warm cloths being applied to the loins, the animal allowed light diet, with small doses of sulphate of magnesia, and kept clean in a good stable, and in a pure atmosphere.

When the animals are old, weak, or exhausted by protracted labour, or if there has been hæmorrhage, stimulants should be administered, and strengthening food. Sometimes the debility is so extreme, that the animal scarcely gives any indication of life. There is then all the more need for careful nursing and quietude. Friction to the surface of the body, clothing, and a

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good bed are particularly necessary; and as lactation is established with difficulty in these cases, this must be attended to. It must be borne in mind that cold and damp are dangerous immediately, and indeed for some time after parturition. Therefore, when turned out to pasture, care should be taken to afford protection in bad weather, and damp cold localities should be avoided.

With regard to Ewes, if the weather is mild and the situation favourable, protection is not required; but if cold winds and wet prevail, then shelter is necessary. When more than one lamb is likely to be produced, the first should be kept warm and receive a little Cow's milk diluted with water, until the Ewe has finished lambing. Twin lambs may easily be reared by a strong mother, if supplied with a sufficiency of suitable food; but, as a rule, if there are more than two, they should be put to another Ewe or reared artificially. In order to overcome the repugnance so often manifested by the Ewe to a strange lamb, if its own lamb has died, the foster-lamb may be rubbed with the skin of the dead creature, or the two may be placed together during the night, or even put into a dark shed along with a Dog, which will induce the Ewe to protect and take to the lamb.

The Goat is more exposed to long and difficult parturition than the Sheep, and not unfrequently requires assistance. The same care is necessary as for the Sheep.

The Sow generally suffers from weakness and prostration after parturition, and requires plenty of nourishing and easily-digested food. When this is given there is less likelihood of the animal not devouring its young, and all the more so if it is not irritated by the presence of people.

The Bitch should not be allowed to rear too many puppies, and warmth, a dry abode, and good food must not be withheld. Bitches do not readily take to strange puppies; sprinkling these with some of its milk has been sometimes successful. Constipation is not unfrequent after parturition, and this may be removed by castor-oil or manna.

SECTION II.—ATTENTION TO THE OFFSPRING.

No special rules can be laid down for the management of new-born animals, as this must vary more or less according to the species. However, there are some general rules which it may be well to observe, and these we will refer to.

With regard to the foal or other creature which may be born in the fœtal membranes, it is evident that it must be freed from them immediately, or it will perish from suffocation; as through having no longer any communication with the mother by means of the umbilical cord, the blood cannot be oxygenated. If the umbilical cord is not ruptured, it may be double ligatured about two inches from the umbilicus, and then divided between the ligatures; or it may be may be severed by scraping it through with a jagged knife.

Immediately after delivery, and having removed the mucus which sometimes clogs the mouth and nostrils, and hinders respiration, the young animal should be examined to ascertain whether it be strong or weak, whether all the natural apertures exist—such as the eyes, mouth, anus, vulva, urethra—and if any of them chance to be absent, to make artificial ones soon, if possible, by a kind of puncture, enlarging afterwards by the knife and sound, and preventing union by pledgets of lint, etc.

Suspended Animation.—Whenever the connection with the mother is interrupted by rupture or occlusion of the umbilical cord, the young creature

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must breathe, respiration being now carried on by the lungs, through the nostrils.

The establishment of respiration is a purely reflex act. The fœtus, hitherto maintained at a certain and always uniform degree of warmth in its liquid bed in the uterus, is suddenly ushered into the cold and dry air of the outer world; and this transition operates chiefly on the skin, producing a peculiar impression—such as we ourselves experience in being suddenly immersed in cold water; this impression is at once transmitted to the cerebro-spinal centre, whence the reflex influence of the spinal cord is called into play, and the respiratory muscles are excited to movement by the centrifugal nerves issuing therefrom. All these muscles contract simultaneously, the chest is dilated, and the air rushes into the air-passages and lungs, distending the air-cells in the latter, and instituting the process of respiration, which is only to cease with the death of the creature. This reflex act may also be produced by pressure on the umbilical cord, or anything which hinders the oxygenation of the blood in the fœtus; hence it has been inferred that the excess of carbonic acid in the circulating fluid acts as a stimulus to the medulla oblongata.

It sometimes happens that the young creature is in a state of syncope when born, or very soon after, and gives no sign of life; and observers have distinguished syncope from weakness, in which the animal is cold and does not breathe, the mucous membranes being pale and the body flaccid; and syncope from plethora or cyanosis, when the mucous membranes are of a livid blue tint, the lips and tongue swollen, and the eyes injected.

In the first form, resuscitation is to be attempted by pouring cold water on the head, beating the body with a cloth dipped in cold water—particularly about the face and chest—dry-rubbing the limbs, titillating the nostrils with a feather, puffing tobacco-smoke into them, imitating the respiratory movements, as in a case of asphyxia, and inflating the lungs by means of a pair of bellows, acting through the nostrils. So long as the heart pulsates there is a probability of restoration to life.

In the second form, allowing a little blood to flow from the umbilical cord, and even cutting this or fomenting it with hot water to induce hæmorrhage, is very useful, in conjunction with cold water to the head and cold water enemas. But, as a rule, death is always imminent in these cases of syncope.

General Care.—With the larger animals, the newly-born creature should be placed before the mother, if it is not near her; and it generally follows that she instinctively licks off the viscid matter which covers its skin; and in doing this the cutaneous circulation is excited, and, by sympathy, the other organs of the young animal. Consequently, it becomes revived, soon endeavours to get up, and though it may fall several times, yet it generally quickly succeeds in maintaining itself on its limbs, and instinctively seeks the maternal teat. It is very rare that the mother does not voluntarily, and at once, commence to cleanse its progeny; nevertheless, there are exceptions, chiefly among the primiparæ, and especially when the labour has been long and painful. But it will generally be found that sprinkling the young animal with a little flour, bran, or salt will excite the attention of the mother and induce the cleaning process. Should it not do so, then the creature must be well dried and rubbed with a sponge, hay-wisp, or a cloth, and kept warm. This is more particularly necessary when the mother is indifferent to it, which sometimes happens with primiparæ when people are present. Indeed, some Mares become quite savage after parturition, and will not allow their foal to come near them, and will even kill it; though this most frequently happens

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when they are tormented by spectators. Other Mares, vicious before parturition, sometimes become remarkably quiet when they have a foal by their side. When they exhibit any aversion to their progeny, it is well to leave them quietly together for some time.

If the foal or calf is weak, and cannot reach the teat within half an hour or so after birth (for in uniparous animals the mammæ are inguinal, so that the young are always suckled in a standing posture), it will be found necessary to assist it by bringing it to the mother, and applying the teat to its mouth, at the same time caressing and soothing the parent if disinclined to it by temper or painfulness of the udder. This coaxing and handling should be performed by some one accustomed to the animal. It may be necessary to have a second person at hand to hold the Mare by the head or lift up its fore foot.

Sometimes from weakness or inexperience of the foal, and temper of the Mare, the former runs the risk of perishing from starvation. The Mare should be safely secured, and two persons ought then to push and support the young animal behind by joining one of their hands, while the other hands are employed in directing it towards the teat, which it should be allowed to use for two or three minutes. After one or two attempts of this kind, the foal begins to find its way to the udder by itself, while the Mare becomes reconciled to it. When the foal exhibits great debility, it may be preferable to feed it for a day or two with the milk of the Mare, which has been drawn by hand.

With the Cow, these difficulties are seldom present, and if an animal will not take to its calf this is generally transferred to another Cow, or it may be artificially reared. The foal may even be reared in this manner, though not so easily as the calf. The milk of the Cow or Goat will suffice, and there is generally little difficulty in teaching it to drink it by at first pouring a little into its mouth while the finger is inserted therein; or a piece of cloth steeped in milk, or even a bottle and tube may be used.

Calves are often harshly treated after birth; they are not allowed to suck, even for a number of days, for fear of damaging the Cow, but are kept apart and fed on drawn milk. Calves intended for slaughter may be artificially fed, and especially if nutritive substances are added to the milk; but for those intended to be reared, it is a mistake to separate them from the Cow during the early days of their existence.

Lambs, when able to stand, and if they do not readily find their way to the teat, should have a little milk from it pressed into their mouth. With twin lambs, if the Ewe is in good condition, the udder well filled, and the weather and pasture favourable, both may be suckled; in the opposite conditions it may be necessary to remove one. If the Ewe does not yield sufficient milk, this may be largely remedied by giving a liberal supply of good food.

Multiparous animals, such as the Bitch and Sow, usually lie when suckling their young; so that there is seldom any difficulty with them. The only care generally required in the case of young pigs, is to prevent their being crushed by the Sow in the act of lying down or moving. If the litter is large, plenty of good food is necessary.

It is well to remember that if a Sow has more young in the litter than teats, unless watched the weakest will die of starvation. Each young pig has its own particular teat, to which it is persistently attached; and if the creature is ill and does not suck, or if there is not a claimant for the teat, the gland there will cease secreting milk. The pectoral teats and glands are the largest and most active, and the weakest of the litter should be put to them.

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In general, a Sow should not be allowed to rear more then ten in a litter. Cleanliness and warmth are required for young pigs.

Puppies do not require any special care beyond a warm, clean, and dry abode.

After the first milk has been taken, there is usually an abundant evacuation of black resinous matter—meconium—from the intestines of the young animal, caused by the "colostrum," as this milk is named; and it is well to notice if this evacuation occurs, as when it does not, serious constipation may ensue. With new-born animals which, for some reason or another, are deprived of this colostrum, a mild laxative—such as castor-oil, or honey and water—should be administered to obviate this condition.

At birth the feet of hoofed animals are covered with a soft yellow horn, which in some countries it is the custom to remove, from a belief that this removal hardens the succeeding horn. It is unnecessary to state that this is a popular fallacy, and that it is really injurious to deprive the foot of this temporary protection.

The young, with their parents, should be kept apart from others—for some time at least, and especially the equine species; and it must not be forgotten that a mild dry temperature is most favourable for all young creatures.

Gentle exercise is as necessary for the foal or calf, as it is for their parents, a few days after birth. Therefore it is that a meadow is preferable to a stable, as, in addition to the more favourable nature of the food, sufficient exercise is afforded. Indeed, with the Mare light and regular work may be imposed a short time after foaling, and with much benefit to it and the foal. The latter will follow its dam, provided the pace is not too fast, and a halt be frequently allowed for it to get to the teat. It is astonishing sometimes to observe how well foals travel soon after birth, even over bad roads and during inclement weather, and for great distances, provided the journey is short each day. Huzard has seen buffalo calves, born during the night, follow their mother next day, and make a daily journey of six or eight leagues without appearing fatigued.

It is not rare to find newly-born animals, particularly when parturition has been laborious, injured more or less, from the manipulation of the obstetrist during birth, the lesions being more or less serious. The most frequent injuries are those due to obstetrical instruments and appliances. The wounds may be dressed with cold water, with slightly alcoholised water, or some dilute tincture—such as that of arnica; but salts of lead, or other poisonous salts, should not be employed. Abrasions, which are generally superficial, may be treated with glycerine and water, to which a very little carbolic acid has been added; or by lard, or any mucilaginous substance. Sprains should have cold water irrigation if possible, refrigerant lotions, or friction with soap liniment. Wounds and lacerations, if very severe, must have appropriate surgical treatment.

CHAPTER IV.

Sequelæ of Parturition.

We have stated that gestation and parturition are physiological processes, and we may now add to these the *puerperal state*. But though in one respect eminently physiological, the puerperal condition is marked by special features,

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which distinguish it from other physiological states, and which, occurring under other circumstances, would be more allied to pathological changes. We refer now more particularly to the functional and organic alterations which take place after delivery. True, we do not have in animals such important, nor so many, sequelæ as are noted in women at this period, some of which are really pathological. Nevertheless, we have certain phenomena occurring during the return of the economy and the generative organs to the condition they were in previous to pregnancy, which are not only very characteristic, but are worthy of serious attention. These phenomena have been divided into *functional* and *organic*.

SECTION I.—FUNCTIONAL MODIFICATIONS.

The functional modifications include the *after-pains, lochia, milk-fever*, and *lactation*.

1. AFTER-PAINS.—These are the painful sensations in the abdomen, indications of which are frequently observed in animals, and which persist after the expulsion of the fœtus and the secundines. They are due to the contractions of the uterus, which go on for some time, and which eventually reduce the organ to its ordinary volume and diminish its cavity. After an easy labour, there are generally few or no symptoms of these pains; and when they are present the only indications are whisking of the tail, at which time, according to Saint-Cyr, the abdomen appears to be harder. They seldom continue longer than twelve or twenty-four hours in these cases, and do not require special treatment.

In other cases, however, and particularly when birth has been very sudden and rapid, they persist longer and are more severe. The animal paws and exhibits suffering; it also stretches as if trying to micturate, arches the back, contracts the abdominal muscles, and strains. The access of these attacks is not regular; and when they are frequent, severe, and continue beyond twenty-four hours, we may apprehend the retention of a portion of the fœtal membranes in the uterus, or commencing inversion of that organ. This will necessitate an exploration, in order to discover the cause; which, when ascertained, should receive appropriate treatment, to be hereafter described.

2. LOCHIA.—The term *lochia* has been given to the sanguinolent, sero-sanguinolent, and muco-purulent, and finally mucus vaginal evacuations occurring after parturition, and generally persisting until the uterus has regained its ante-pregnant condition. The existence of this evacuation, so marked in woman, has often been denied in animals; but there can be no doubt whatever as to the fact of its presence. It has been witnessed by several veterinarians in the Mare, Cow, Sheep, and Bitch, and we have noted it repeatedly in the Sow and Cat. But it is considerably less in these animals than in woman, and does not flow continuously as in her, but at irregular periods; the discharge accumulating in the uterus, and only escaping when the animal undergoes exertion, and in defecation or micturition. In the Cat, however, we have witnessed this discharge—very slight—flowing constantly for four days after parturition; and with the Bitch we have a sanguinolent, then a mucus discharge persisting almost continuously for several days subsequent to that event.

In the larger animals, this discharge can be seen about the inferior commissure of the vulva; it sometimes accumulates about the thighs and tail in

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flakes and patches, as well as on the litter; and when the animal has been lying it forms small pools on the ground.

When we remember that the uterus has for a long period nourished one or more fœtuses, we can scarcely wonder that it cannot all at once cease its secretory function, and that its mucous membrane should continue in a hyperæmic condition until the lacteal secretion in the mammæ is fully established. As much as seven to eight quarts of sero-sanguinolent fluid have been removed from the uterine cavity of a Mare which had foaled three days previously.

When not mixed with blood, this discharge is albuminous and chylous-looking; it is rarely purulent, and then probably only from traumatic causes; neither does it have a bad odour, unless the uterus or vagina is the seat of some pathological process, or a portion of the placenta is retained. According to some authorities, the average duration of the discharge is from two to three weeks; but Saint-Cyr believes that when it is prolonged beyond five to eight days, it is no longer a physiological, but a pathological process. This is about the period which is necessary, in the larger animals, for the return of the vulva to its normal dimensions and ordinary form.

Of the importance of the lochia there can be no doubt. By them the uterus is relieved from its physiological hypertrophied condition, and of the excitement of which it was the seat during pregnancy and parturition. But it cannot have the same importance as in woman, in whom the lining membrane of the uterus is thrown off pretty nearly after every delivery. It is not so with animals, as we shall see hereafter.

One or two veterinary authorities have attached so much importance to the lochia in animals, that to their suspension or suppression they attribute such serious results as: sanguine plethora, articular rheumatism in the Cow, laminitis in the Mare, metro-vaginitis, cystitis, nephritis, peritonitis, mammitis, inflammation of the intestines or spinal cord, coryza, vitulary fever, etc. But there is evidently exaggeration in this; and we are inclined to think that, at the most, the untimely cessation of this discharge can only cause, as has been stated, dulness, indifference of the mother to its progeny and surroundings, inappetence, suppression of milk, slight fever, with dry erect coat, and constipation.

To avoid this untimely cessation of the lochia, it has been recommended that, with the larger animals, before and after parturition the food should be sound and nutritive, but moderate in quantity, and such as will not predispose to plethora or congestion; not to travel or fatigue animals towards the end of pregnancy; to shelter them at this period; not to hurry labour, and only to render assistance when necessary; and after delivery to attend to the removal of the secundines, which are sometimes retained in the Cow for an abnormal period, but should not be allowed to remain longer than four or five days.

3. MILK-FEVER.—In woman the establishing of the lacteal secretion after delivery—generally forty-eight hours—is usually accompanied by a general febrile condition, in which this fluid changes from colostrum to ordinary milk. This is the so-called "milk-fever," a pathological condition said by some authorities to be present in animals, and denied by others. The latter assert that, when parturition has been quite normal, there is only observed a little dulness, lassitude, the pulse fuller and quicker than usual, and less appetite for the first day—all consequences of the suffering undergone during even the easiest parturition. In a day or two, however, all this has disappeared,

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except perhaps a little weakness, which soon vanishes also. But when parturition has not been altogether natural, and complications arise, then there may certainly be fever, though this has nothing to do with the change of the colostrum to milk—a gradual process; indeed, when traumatic fever sets in this secretion is diminished or suspended.

Saint-Cyr is disposed to deny the existence of this so-called "milk fever" in animals, and he quotes eminent *accoucheurs*, who are inclined to doubt the existence of this fever in woman as related to the lacteal secretion, but as due rather to traumatism from injury to the genital organs during child-birth. His own observations on Cows are certainly not favourable to the existence of this fever in these animals; and even among those who believe in it, there are many who admit that it is scarcely perceptible.

Rainard, for instance, accounts for its being so little marked in animals, by noticing that in woman the uterus receives its blood from the abdominal (inferior) aorta, but the mammæ from the pectoral (or anterior) aorta; but in animals, uterus and mammæ are supplied by the posterior aorta. In woman, when lactation is established, there is an alteration in the circulation, and consequently a general disturbance which has been hitherto designated "inflammatory" or "angiotenic fever;" but in animals this change in the circulation does not occur. Therefore, this "angiotenic fever" should not be present.

4. Lactation.—Before parturition, preparation for the secretion of milk is already being made in the mammary glands, and shortly before that event a thin serous or milky fluid can often be expressed from the teat; while immediately after delivery, the œdematous tumefaction which had been observed in these glands for some time, begins to disappear as they increase in volume, become firmer, tenser, and more sensitive, and receive a larger quantity of blood. Then their activity is suddenly brought into full operation, and their secretion reaches its maximum. At the same time this fluid is modified in quality in a notable but gradual manner, so that it is very different three or four days after parturition from what it was on the first or second day—being colostrum at the early period, and milk subsequently.

Colostrum.—The first milk, or "colostrum," secreted after delivery is a viscid, dirty-white, or yellowish fluid, sweet, though unpleasant to the taste, and of a greater density than that of ordinary milk, being in the Cow 1·063. It is very rich in solid elements, these varying according to individuals, and even breeds. The fat globules are present only in comparatively small number, and are less in size than in milk at a later period; but there are numerous colostrum corpuscles—bodies of a large size, spherical or ovoid in shape—often agglomerated in masses by a tenacious viscid matter, and among them many leucocytes endowed with movement.

Boussingault gives its composition in the Cow as follows:—

Water - - - -	75·8
Albumen and casein - -	15·0
Butter - - - -	2·6
Milk-sugar - - -	3·6
Salts - - -	3·0

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Dumas gives the colostrum of various animals as below :—

	Cow.	Ass.	Goat.
Water - - -	803·3	828·4	641·0
Fat - - -	26·0	5·6	52·0
Albumen - -	150·7	116·0	245·0
Mucus - - -	20·0	7·0	30·0
Sugar - - -	traces.	43·0	32·0

It is admitted that milk is due to a fatty degeneration of the epithelial cells of the gland follicles, in which they are greatly multiplied and developed during lactation. These cells rupture, and nothing remains but the fat globules of the milk.

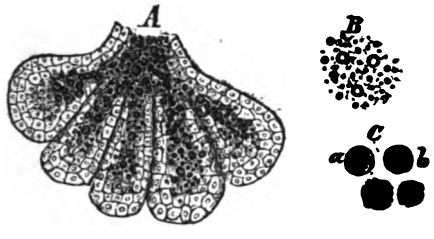

Fig. 63.

MAMMARY GLAND DURING LACTATION.

A, Lobule of the Mammary Gland filled with Cells; B, Milk or Fat Globules; C, Colostrum. *a*, Cell filled with Fat Granules and with a visible Nucleus; *b*, Cells from which the Nucleus has disappeared.

But in the colostrum the epithelial cells have not undergone this change; their wall is intact, and they still contain their oil granules, and consequently constitute the colostrum corpuscles. Colostrum is coagulable by heat, and it may be said that the albumen takes the place of casein; but soon after parturition the former disappears and the latter is present. Towards the end of lactation, however, if the animal is pregnant, the milk again loses its casein, and becomes very albuminous; consequently, coagulable by heat. Its sugar also diminishes or disappears altogether. The leucocytes seem to be increased in number in the colostrum, as the animal is disturbed or its health deranged; and as the young creatures are often attacked by diarrhœa, this is ascribed to the presence of these particles.

Milk.—Towards the fifth or sixth day, or even longer, after parturition in the Cow and Mare, earlier with some of the other animals, the colostrum disappears, and then we have the ordinary milk. This is an opaque, pure white, or slightly yellowish fluid, possessing a sweet taste, and a faint odour somewhat resembling that of the animal from which it is obtained; it is unctuous to the touch, has an average density of 1032 to 1041, according to the species and other circumstances;* and is composed of three essential parts

* Cow's milk of good quality, according to Voelcker, has a specific gravity of about 1030; Woman's milk, 1020; Goat's and Ewe's milk, 1035; Ass's milk, 1019.

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—water, butter, and casein. We have in addition albumen, milk-sugar, and mineral matters.

The three principal constituents are easily separated—the fat or cream by allowing the fluid to stand at rest for some time; by pressure the casein is separated in a solid mass; and the remaining portion contains the water.

The milk varies considerably, as has been said, according to species, breed, age, food, the period of lactation and milking, climate, state of health, etc. In herbivorous animals it is generally alkaline; in carnivorous, acid.

Vernois and Becquerel give a comparative table of the composition of the milk of various animals, as below :—

	Woman.	Cow.	Goat.	Sheep.	Camel.	Mare.	Ass.	Sow.	Bitch.
Specific Gravity	1032·67	1033·38	1033·53	1040·98	—	1033·74	1034·57	—	1041·62
Weight of Water	889·08	864·06	844·90	832·32	—	904·30	890·12	854·90	772·08
Weight of Solid Parts	110·92	135·94	155·10	167·68	134·00	95·70	109·88	145·10	227·92
Fat	26·66	36·12	56·87	51·31	36·00	24·36	18·53	19·50	87·95
Casein and Extractive Matters	39·24	55·15	55·14	69·78	40·00	33·35	35·65	84·50	116·88
Milk-sugar	43·64	38·03	36·91	39·43	58·00	32·76	50·46	30·30	15·29
Salts (by incineration)	1·38	6·64	6·18	7·16	—	5·23	5·24	10·90	7·80

Doyère furnishes us with another interesting analysis, which we cannot omit publishing here :—

Constituents.	Woman.	Cow.	Goat.	Sheep.	Llama.	Ass.	Mare.
Water	87·38	87·60	87·30	81·60	86·60	89·63	91·37
Fat	3·80	2·20	4·40	7·50	3·10	1·50	0·55
Casein	0·34	3·00	3·50	4·00	3·00	0·60	0·78
Albumen	1·30	1·20	1·35	1·70	0·90	1·35	1·40
Sugar	7·00	4·70	3·10	4·30	5·60	6·40	5·50
Salts	0·18	0·70	0·35	0·90	0·80	0·32	0·40

The salts contained in the milk varies with the character of the food, and also according to the time that has elapsed since parturition; this fluid being particularly rich in inorganic elements during the first third of the period of lactation. According to the analyses of Haidlen and Furstenberg, there is in it 1000 parts of ash; 475 phosphate of lime, magnesia, iron, etc.; 219 carbonate of lime and salts, which are more especially combined with the casein; 343 of sodium salts, with traces of sulphur and flouride of calcium. Milk also contains such gases as carbonic acid, oxygen, and nitrogen, in solution.

In the Cow the flow of milk becomes very plentiful in about a week after calving, but after a month or so it gradually diminishes in quantity for about ten months, when the animal, as a rule, "runs dry." In the first and second months after calving, when the yield is abundant, it is generally more watery than after the fourth or fifth month; and the further the diminution in quantity proceeds, the better it becomes in quality, other circumstances being equal.

It will be seen from the above table, that the milk of the Cow closely approaches that of woman, and this accounts for the readiness with which it can be substituted for the latter without injury to the child. It is, when

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compared with that of Solipeds, more rich in casein and fat. The milk of the Goat is the most nutritive, and contains more casein; but it is viscid and has a peculiar odour, something like that of the cutaneous transpiration of this animal, and particularly during the rutting season; this odour is not so powerful in white goats, nor in those without horns, if they are properly kept. The milk of the Sheep contains more fat than that of the Cow and Goat, while the casein is in larger quantity, but is also viscid. It has less water than that of the Cow, and altogether is particularly rich, especially soon after lambing. This is well seen in the subjoined analysis, and it will explain the difficulty which is experienced in bringing up a lamb when the Ewe has died soon after parturition :—

	Ewe's Milk Three Weeks after Lambing.	Ewe's Milk Six Weeks after Lambing.
Water - - - - -	75·00	86·70
Fat - - - - -	12·78	3·67
Casein - - - - -	6·58	4·44
Milk-sugar - - -	4·66	4·00
Mineral Matters (Ash) -	·98	1·19
	100·00	100·00

The milk of the Mare appears to contain the largest proportion of water and the smallest quantity of fat, the milk of the Ass coming next to it in these constituents. This contains little casein, scarcely any fat, and a small quantity of ash. On the other hand, it is comparatively rich in milk-sugar, which is, according to Voelcker, a very digestible material and a good aperient, particularly for children. But of all animals, the carnivora have the richest milk; the casein and fat being particularly abundant, and no other food will at all compare with it in these constituents. Solid butcher's meat contains less real nutriment and more water than this description of milk. This explains at once the extreme difficulty of bringing up a puppy by hand. No kind of food is sufficiently concentrated adequately to provide for the nourishment of a puppy, strong beef-tea being perhaps the best substitute for that purpose. The milk of carnivorous animals has another peculiarity, in the very small proportion or entire absence of milk-sugar. This substance is very abundant in the milk of herbivorous animals; and when carnivorous creatures are put on more or less of a vegetable diet, it appears in their milk, and increases as this diet is increased; whereas, by feeding them entirely on flesh, the sugar vanishes. The proportion of salts is also comparatively large.*

According to the richness of milk in fixed constituents, Colin classes that of animals in the following decreasing order :

Bitch	Sow	Woman
Ewe	Cow	Ass
Goat	Camel	Mare

* According to a French medical journal, Montbrun-les-Bains, in the Drome, is celebrated for nurses, who continue to give the breast for two years and more. When one of these women loses her nursling, she takes a puppy-dog instead, which then becomes one of the family. But it has been observed that all these dogs become affected with rickets, and this has led a medical man to conclude that woman's milk is deficient in some principle contained in dog's milk, and that consequently the latter might be a cure for rickets. An observation published by him would seem to confirm this view.

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Milk is a typical food, and when healthy and in sufficient quantity, contains all the constituents for the maintenance and growth of the young creature.* This is particularly noted immediately after birth, and before it begins to seek at all for other food. It is at this period, also, that growth is most rapid; and it has been observed that puppies double their initial weight in six days only. Colin has stated that, in thirty days, ten puppies —reduced to nine on the twenty-fifth day—living on the milk of the mother alone, except for the last ten days, showed a total increase of 35½ lbs., the entire weight having been trebled since birth. A similar increase may be observed in other young creatures while being suckled. When, from some cause or another, the progeny cannot obtain milk sufficient in quantity or proper in quality, it is necessary that this be remedied. A calf can be readily artificially reared in an ordinary establishment, if it has had one or two days colostrum; or a substitute for the mother in another Cow may be procured. It is not so with the foal, which is much more difficult to rear, and another Mare, even if procured, will not always readily play the part of nurse. Nevertheless, many animals can be reared by judicious and patient management, and if artificial food must be resorted to, this should come as near as possible, in chemical composition, that furnished by nature.

In some instances, the mammary secretion may become a source of embarrassment, or even of danger, when it is too abundant or is not withdrawn when secreted. This happens more particularly with the Bitch, Cat, Mare, or other animal which is suddenly deprived of its young by death, or for special reasons; and the retention of the milk is often a cause of discomfort and disturbance, culminating not unfrequently in inflammation of the gland. In such cases the milk should be withdrawn until its secretion is diminished or altogether ceases, and mild diuretics or purgatives may be administered to hasten this end. Camphor, in small and frequent doses, has been recommended with this object, as well as an infusion of walnut-leaves and powdered white agaric.

Whatever general treatment may be adopted in such instances, local treatment must not be overlooked; and in addition to removing as much of the contents of the mammary glands as possible, these may be kept healthy, or cured when congested or inflamed, by suitable treatment. Soothing liniments or embrocations should be timeously applied by friction to the skin covering them.

SECTION II.—ORGANIC MODIFICATIONS.

Gestation and parturition being completed, it is necessary that the genital organs should return to their non-puerperal state. Indeed, this return to their ordinary physiological condition is commenced in the uterus even during labour, and remarkable modifications occur more particularly in the uterus and its membranes then, and for some time afterwards. These changes are connected with the diminution of the uterus in volume, alterations in its mucous membrane, and the reforming of its cervix.

The powerful contractions of the uterus during parturition, undoubtedly tend to use up the contents of the cells of the non-striped muscular fibre

* The mammary secretion may be present in animals without these being in the pregnant or parturient state, or ever having been so. We have already alluded to Bitches yielding milk without having puppies. Rabbits have done the same without having been fecundated, and have reared the young of other Rabbits; Bitches have done the same. Virgin or barren Ewes have also yielded milk, as have likewise Mares—Mule and Horse—and Fillies.

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composing its middle coat; the simultaneous compression of the capillaries and afferent vessels preventing the expended protoplasm from being replaced. After the expulsion of the fœtus and its membranes, this wasting or oxidation of these fibres continues: the uterus still contracting at intervals, and producing those sensations known as the "after-pains,"—the contractions being slow, gradual, and continuous, and lasting until the whole of its inner surface is more or less in contact, and its cavity has regained its ordinary dimensions. In this process the muscular fibres continue to undergo alteration, the contractions of the organ diminishing in force as this change goes on; and this change is essentially related to the conversion into fat of the albuminous substance of the protoplasm of which their cells are composed. The fibres become degenerated and absorbed, and it is some time before they are replaced by others which have much smaller cells. The bloodvessels of the organ also undergo similar alterations, after the uterine contractions have more or less suspended the flow of blood in their interior. They become wrinkled and sinuous, and gradually less permeable to the circulating fluid, and the walls of the veins and capillaries are attacked by fatty degeneration, and are absorbed in large numbers.

This gradual interstitial absorption occurring after parturition, brings about a considerable reduction in the weight and volume of the organ. Thus the uterus of the Cow, which, immediately after delivery, will weigh from thirteen to fifteen pounds, will be no more than seventeen to twenty-one ounces when this process is completed; and the uterus of a Ewe will be found reduced to a twelfth or thirteenth of its weight at parturition.

At the same time, the mucous membrane lining the organ is undergoing corresponding, but perhaps less profound, modifications to those observed in woman after the uterus has got rid of its contents. When treating of the physiology of gestation, we described the manner in which this membrane became enormously thickened, either wholly or partially, to constitute a most important glandular and vascular structure for the development of the young creature. But after parturition, fatty degeneration attacks this structure and completely destroys it, and this destruction takes place in a remarkably brief period in some animals. With the Bitch, Cat, and Rabbit, as with woman, the whole of the glandular layer of the membrane corresponding to the insertion of the fœtal placenta—the *decidua vera*—is completely detached and eliminated.

In Ruminants the cotyledons, which had gradually acquired such large dimensions during pregnancy, shrink, their follicular receptacles contract so as to be scarcely visible to the naked eye, and many of these maternal placentæ even appear to subside altogether, or to be reduced to exceedingly small proportions. With Solipeds and the Sow, which have a diffused placenta, the follicles which received the placental papillæ of the chorion also disappear; and the membrane, greatly thinned, assumes its ordinary ridged appearance, though the ridges or folds are larger and more numerous than before conception. In a Mare killed eighteen or twenty hours after parturition, Ercolani found the maternal portion of the placenta reduced to one-half its thickness; its colour, instead of being a dull red, had become yellowish; the follicles, from being one to two millimetres in length, were reduced to one and half a millimetre, and the capillary network around them was no longer visible.

The evacuation of the detached elements is accompanied by an apparently large mucous secretion, which, often sanguinolent, constitutes what we have described as the "lochia."

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Finally, a new epithelium is formed in the place of that which has been shed, and the uterine interior presents the appearance it had before impregnation. According to Friedlander, the formation of the new mucous membrane takes place in the following manner:—All that has remained behind of the cellular layer richly infiltrated with blood, as well as the upper portions of the glandular layer, gradually exfoliates and is discharged in the lochia. The flatly compressed glandular tubes situated close to the muscular coat are opened up, and their cylindrical epithelium forms the new mucous epithelium of the internal surface of the uterus. The connective tissue situated between the tubular glands, accordingly proliferates, and becomes reorganised. In consequence of the increase in thickness of the mucous membrane, the previous shallow depressions of the epithelium are deepened, and in that way the uterine glands are also reformed in the new mucous membrane.

Coincidently with this return to small proportions, the uterine cervix also regains its former shape. During the passage of the fœtus, in process of dilatation the os and vagina form a continuous canal without any interruption, and the cervix is effaced. Immediately after the fœtus has passed through, however, the latter reappears, the os is closed, and the uterus and vagina are again separated by the sphincter-like ring which the uterine neck exhibits in the cavity of the latter. The cervix is at this time soft and flabby, and the os, not entirely closed, is readily dilated by the fingers. But it gradually contracts and closes, as its texture becomes firmer, and in doing so it elongates towards the vagina, into which it projects, until it has regained its natural form and consistence; though it is always shorter and less regular in shape, particularly at the os, in animals which have had several young, than in those which have never been pregnant. The uterus itself does not completely assume the dimensions it had in non-pregnant animals, but is always larger after it has contained one or more fœtuses.

It may be noted that the broad ligaments of the uterus become shortened after parturition, and consequently raise the organ towards the lumbar region, and in the direction of the pelvis; while their muscular fasciculi undergo fatty degeneration and absorption.

Such are the organic modifications the genital organs undergo after labour, when everything occurs regularly. But it sometimes happens that the muscular layer of the uterus appears to be struck with paralysis soon, or even immediately after birth; so that it remains distended and its cavity so large that the arm can easily be introduced into it. This inertia is not so much to be dreaded in animals as in woman, though it is often troublesome and sometimes serious in them. The *débris* of the decidua vera, and other effete matters, accumulate in its cavity, and the os being always more or less patent, the air obtains admission, putrefaction commences, and grave results may follow. An exploration will discover a variable quantity of sanious, and more or less foul-smelling, matter in the cavity of the organ; and until this is removed, and the organ made to contract on itself, danger may be apprehended.

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PART SECOND.

DYSTOKIA.

GENERAL CONSIDERATIONS.

In studying the physiology of parturition, we saw that a favourable termination of labour depended on two factors, one of which was a proper degree of activity of the expelling powers, and the other a normal condition of the obstacles to be overcome by these powers. When these are out of proportion to each other, then we have difficult parturition or Dystokia (δύς, *difficult*; τοκος, *birth*). Difficult parturition may be due to too feeble pains, or to an obstacle which the unaided efforts of the animal cannot surmount except after an unusual period of labour, or not at all.

We have already alluded to the nature of and variations in the expelling forces, and also to the causes of protracted labour. We have now to treat of the difficulties attending parturition, with their consequences—proximate or remote, and the means to be adopted for overcoming, preventing, or remedying these. This involves a study of the necessary obstetrical operations, the accidents attending or following parturition, and the diseased conditions more or less related to the puerperal state—all of which may be included under the head of "pathology of parturition."

The difficulties attending parturition depend upon the resistance opposed to the expelling powers, and this is determined by the relation of the object to be expelled—the presenting part of the fœtus—to the maternal genital passages. Consequently, an exaggerated resistance may be due to abnormal conditions of the parturient passages, or to some unnatural condition of the young animal. In the first we have *Maternal Dystokia*, and in the second *Fœtal Dystokia*. These necessitate particular operations, some of which demand much study, address, and manipulative power on the part of the obstetrist. In addition, we have dangerous accidents sometimes occurring during parturition, which, if they do not happen to interfere with the mechanism of that act, may nevertheless require the highest degree of surgical skill to remedy. And, finally, there are the maladies which accompany the parturient state, some of them being serious, and needing great clinical knowledge for their successful treatment.

These difficulties, accidents, and diseases do not occur with the same gravity, nor with the same frequency, in all the domesticated animals; indeed, with regard to the latter, some species appear to be altogether exempted from at least one or more of them.

Cases of dystokia are much more frequent in the bovine species than in any other;* and least so, perhaps, in the equine species. These two species

* The Camel, and particularly the Bactrian, which is characteristic of Mongolia, appears generally to require assistance during parturition. At least we may infer this from the statement of Colonel Prejevalsky, who, in speaking of the Mongolian Camel, says:—"The males become vicious during the rutting season, which is in February, and they will then fight with one another, and sometimes attack mankind. The interference of man is needed to bring the sexes together. The period of gestation is thirteen months, at the expiration of which the dam gives birth to one, or, as an exception, two, foals. Human assistance is also required at the time of

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are those which the obstetrist is generally called upon to attend during protracted or difficult parturition; and every practitioner who has had any experience in this matter, will testify that for one case in the Mare or other animal there will be at least ten in the Cow. Two Danish veterinarians, Nielsen and Tallich, have estimated, that while they have had ten cases in the Mare, the first has had 190, and the second 159 in the Cow; and yet these writers practised in a district where more Horses than Cows were reared.

We have already said that the Mare is, of all quadrupeds, the one which brings forth its young most easily—a fact noted by Aristotle. But this remark only applies to normal parturition in that animal; in abnormal cases there is, as a rule, more urgency and danger than in the Cow, as well as more difficulty in affording relief. Indeed, a very able veterinarian, Donnarieix, who has had an extensive experience in obstetricy, declares that obstetrical operations in the the Mare are a labour of Hercules; while in the Cow they are, comparatively, child's play. This experience will not quite accord with that of every practitioner; as in both animals difficulties in parturition will be sometimes encountered, which baffle the skill of the most competent, and often prove insurmountable. One of these difficulties in the Mare is related to the difference in the vitality of the foal and calf when parturition has commenced—a difference which we have before pointed out as due to the particular arrangement of the maternal and fœtal placentæ in each species, and which it is of great importance to remember in choosing the means to be employed in overcoming obstacles to parturition in either the Mare or Cow. The following comparison has been drawn by Donnarieix, between parturition in the Mare and Cow, and fairly accounts for the differences in each animal:—

Mare.	Cow.
1. Delivery is often followed by insuccess.	1. Delivery always terminates favourably.
2. A wound inflicted on the genital organs is generally fatal.	2. A wound of these organs rarely causes death.
3. Inversion of the uterus is nearly always irremediable.	3. Inversion of the uterus is often curable.
4. Mares nearly always succumb to penetrating wounds of the abdomen during parturition.	4. This accident is not generally fatal in Cows.
5. Delivery of the most simple kind is occasionally followed by bad results. In abnormal and laborious parturitions not unfrequently Mare and foal succumb.	5. Delivery, even in the most complicated cases, generally proves comparatively easy, and obstetrical operations successful.
6. Difficult parturition proves a Herculean task to the operator.	6. Such parturitions are not of much account to a practitioner skilled in the necessary operations.

parturition. The new-born Camel is the most helpless creature imaginable; it must be lifted by hand and placed under the mother's teats; but as soon as it can walk, it follows her about everywhere, and the latter is so attached to her offspring, that she cannot bear to be separated from it. The female Camel is granted its liberty for a whole year after parturition; so that it only foals every other year."—*Mongolia, the Tangut Country, and the Solitudes of Northern Tibet*, vol. i., p. 124. London, 1876.

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Mare—*continued.*	Cow—*continued.*
7. The duration of the life of the fœtus in a case of abnormal labour, does not extend beyond the fourth hour, on account of the young animal having to maintain its independent existence, as if already born.	7. Under the same circumstance the calf may live four or five days *in utero*, as life is maintained by the placental connections. These differences are explained by the mechanism of fœtal life in the two species of animals, as well as by the anatomy of the uterus and fœtal membranes.
8. The neck of the foal being very long, the head is usually found deeply buried in the flank whenever it is turned backwards. The operator has very great difficulty in reaching the head with his hand; indeed, it is often impossible to bring it into its natural position. The loop slips off the neck of the lower jaw, and has constantly to be replaced; it is scarcely possible to fix a cord there, this portion of the jaw being so short and the fœtus having no teeth.	8. The neck of the fœtus being shorter and thicker, the head is less twisted, and the operator can with greater ease bring it back into its normal position. In addition, there are teeth in the lower jaw, the neck of which is narrow; so that the slip-knot does not leave it, and straightening of the head and neck becomes an easier affair.
9. When once the amniotic fluid has escaped, the introduction of the hand is difficult, owing to the genital organs becoming dry; this dryness causes an efflux of blood to the mucous membranes. The resistance made by the fœtal membranes to manipulation, when made to ascertain either the position of the fœtus or for correcting the position, together with the struggles and violence of the Mare, which now and then drops as if dead, are all difficulties to be overcome.	9. The genital organs are continually lubricated by a mucus fluid which, while it facilitates the introduction of the hand, renders easy any necessary correction of position, and favours parturient operations. Besides, any movement made is not, in general, of much consequence.

Presentations which, in the Cow, owing to its phlegmatic temperament, intervals of quietude, and more gentle and tractable nature, are common, and as a rule adjustable, are yet most difficult in the Mare, and if not quickly attended to, rapidly lead to a fatal termination. With regard to difficult parturition in the other domesticated animals, the Goat and Ewe come next to the Cow in the order of frequency; though cases of dystokia are not so often noted in them as in that animal. It is to be remarked, however, that assistance is not so easily rendered them, owing to the introduction of the hand into the uterus not being always possible. In the Goat the act is sometimes very prolonged, though on account of the multiple placentæ the fœtus may live as long as in the Cow. With the Ewe the same occurrence is observed, but in this creature it is sometimes possible to introduce the hand into the genital passages. It is rare indeed that the obstetrist is required to attend upon the healthy Sow, this animal appearing to be almost exempt from difficulties in parturition. In cases of rachitism, however, there is sometimes so much

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deformity of the pelvis, that aid is required. Notwithstanding the narrowness of the passages, the hand or fingers may be passed into them.

Cases of dystokia are not unfrequent in the Bitch, and particularly if it is of small size, or belongs to a breed with a large round head and short nose. Numbers of Bitches perish every year from non-delivery of their puppies; these latter may also succumb before the decease of their parent, as it often happens that the death of one entails destruction on the others. Cats are sometimes subjects of difficult parturition, from the same causes as Bitches.

A very great disadvantage under which the veterinary obstetrist labours in cases of dystokia, is the late period at which his services are generally called into request, and often after serious and even irreparable injury has been done by unskilful hands; and this in instances in which a little scientific manipulation and some surgical knowledge would have, perhaps, made all right and safe in a few minutes. Saint-Cyr justly says, in commenting on some remarks made with regard to the services a veterinary surgeon may render in difficult parturition, that these can be beneficial only on the *absolute* condition that he is present in good time. Called upon too late, when the "waters" have escaped for a long period, and the neighbouring empiric has exhausted his science, aggravated a bad presentation, irritated the generative organs by manipulations, tractions, and violent means; then all the ability of the most experienced practitioner may be useless. He will find the passages dry, burning, swollen by inflammation, the fœtus more or less advanced into the pelvic cavity, where it is, it may be said, "wedged," or like a nail driven into wood; with the uterus spasmodically contracted on itself, and so closely applied to the body of the fœtus that it is almost impossible to pass the hand between them. How is it possible to manipulate in such a place—how change the vicious position of a fœtus which the greatest efforts can neither make advance or retire? How can a sharp instrument be carried into the uterine cavity, and used with safety, when the hand alone can scarcely be made to enter it?

It is in these circumstances that a practical knowledge of obstetricy is most valuable, and renders he who possesses it a very great acquisition to an agricultural or pastoral district. And this knowledge may be said to be special; for obstetricy is not like the other branches of veterinary surgery, in forming a portion of every veterinarian's practice. On the contrary, it is rarely practised in towns or cities, but is almost exclusively limited to animal-rearing localities; there alone is to be found the school in which the practitioner may be initiated into all the difficulties of this complex art, and the best and readiest means of surmounting them. And it must be confessed that the practice of this art is not particularly alluring, and is attended with many more inconveniences, hardships, and difficulties than fall to the lot of the human obstetrist: indeed, we know of no more arduous and anxious occupation than that of the country practitioner in a cattle-breeding district, and he requires physical endowments which are certainly not needed by the attendant on woman.

Veterinary accouchments are generally difficult and perplexing, as well as fatiguing, says Zundel. Long and powerful arms are necessary, as well as much address in using them and the fingers; bodily activity is above all essential, in order to go about an animal, to place one's self in the most favourable position for exploring and operating, and to avoid injury from the creature. The veterinary obstetrist should also be gifted with presence of mind, coolness, and fertility of resource; so as to take into consideration all the circumstances of the case, devise his method of procedure, and carry it out promptly.

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The conditions under which the veterinarian has to perform his task are not favourable or encouraging. It is anything but easy to practise the necessary manipulations in the larger animals—such as the Mare or Cow—in such a great cavity as the abdomen, and in the uterus which lies deep in it, and contains a voluminous fœtus. In practising these manipulations, the operator has to contend with the struggles and disordered movements of the animal, which sometimes, in the midst of its sufferings, does not hesitate to use its feet, horns, or teeth as weapons of offence, or to crush its medical attendant against the adjoining wall. In addition, the violent contractions of the uterus, and especially of the cervix, fatigue the operator extremely. Sometimes these manipulations are continued for hours, until the various obstacles to delivery are successively overcome, or the creature is doomed to perish.

Add to this, that Cows and Mares during parturition often inhabit close foul stables, with a poisonous atmosphere, destitute of light, and perhaps also cold and damp. Here the veterinarian must do his duty—cold, wet, and dirty, exposed to draughts and every kind of discomfort. Most frequently, too, he is left to his own resources; for it is rare that intelligent and obedient assistants can be found in such places. And all this after driving long distances, often at night and in bad weather. How different to the accoucheur of woman!

All the inconveniences, risks, and hardships of the veterinary obstetrist do not end here. After manipulations, sometimes long continued, in a uterus containing infective matter resulting from retention of a dead fœtus, or fœtal membranes in process of decomposition, he is exposed to the most serious septic diseases, and may even lose his life. A cutaneous eruption indeed often appears on the arms of the operator, only through having manipulated for some time in genital organs, the mucous membrane of which was only irritated and inflamed, or simply swollen and bruised—no putrefaction or suppuration being present. Most frequently the disease is merely local, and is sometimes a simple, limited, erythematous redness which disappears in twenty-four hours; at other times it is a trifling eczema without pustules, but with intense itching; frequently it is a pustular, sometimes confluent, ecthyma, the crusts on which are occasionally not detached for months; in other cases there are furuncles, abscesses on the arm, or even over the body. In the majority of cases, the affection is accompanied by fever, anorexia, great uneasiness, and pains so acute that sleep is impossible; there may also be tumefaction of the axillary glands. The course of the disease is generally irregular, relapses are common, and it is a long time before its effects pass off. Death sometimes occurs, and amputation of a portion of the arm has been necessary.* Such are the difficulties and risks of the veterinary accoucheur. We will now refer more particularly to his line of conduct in practice.

Proprietors of animals should, in their own interests, suffer no delay to occur in sending for the veterinary surgeon as soon as they perceive that parturition is not progressing regularly; and they should carefully abstain from any violent handling of, or traction on, the fœtus which might render irremediable a difficulty often easy to surmount at the commencement, by any one sufficiently acquainted with obstetrics.

On his part, the veterinarian should not lose time in giving his services; as every minute's delay may render the case more difficult, and tend to compromise the life of not only the young animal, but also that of the mother,

* *Veterinary Journal*, vol. ii., p. 218.

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as well as the interests of the owner and his own reputation. It is essential that he should be provided with certain instruments, as obstetrical operations are partly performed by means of these, as well as by the unarmed hand, which is, after all, the most perfect instrument, and should always be preferred to instruments when possible. Some operations, however, can only be undertaken with instruments, and it is therefore necessary that the obstetrist be provided with at least those which are most useful and indispensable: such as one or two knives, cords, hooks, Schaack's head-collar or some other pattern, etc., and these should be so portable as to be carried in a leather or canvas bag, or a small box.

On reaching the patient, all information concerning it should be gathered at once, and an examination immediately made into its condition. The period when labour commenced; if the "water-bag" has ruptured, and when; if the animal has gone its full time, or exceeded it; if it is a primipara, or, if not, if its previous parturitions were favourable; all these and other useful points in its history should be obtained.

The examination should comprise: the general appearance of the animal; whether weak or strong; the character of the pulse; and the nature, frequency, and intensity of the expulsive efforts; as well as the condition of the mammæ, and external genital organs. After this, if further examination is necessary, direct exploration of the internal genital organs should be made. We have already described the mode of procedure to be adopted in this exploration; but because of its importance, we will again notice it.

If possible, the Mare and Cow should be examined in a standing attitude, as this is the best. If, however, the animal is lying, and from exhaustion or paralysis it cannot get up, then of course the examination must be made in this position; indeed, it may be advantageous to examine in both positions.

When standing, it should be approached gently and coaxingly, and rigorous restraint is seldom necessary; for the pains of labour usually render the most vicious animals tractable. With the Mare it generally suffices to have one of the fore feet held up by an assistant, while the examination is made; if young and dangerous, it may be necessary to employ a side-line on a hind pastern, or hobbles on both hind pasterns, and perhaps a twitch on the nose. With the Cow, a strong man holding the animal's head is sufficient to make it stand quiet.

Lateral movements may be prevented by placing the animal against a wall or partition on one side, and a powerful man at the other side; or a man at each side. The operator must be on his guard against the animal suddenly dropping, which would expose him to serious injury. When the floor inclines from the tail towards the head of the animal it is most favourable for an exploration, as the mass of intestines is thrown forward against the diaphragm; so that they do not press on the uterus, which is then more free and better adapted for manœuvres in its interior.

When the operator has to explore in the lying position, he finds it much more fatiguing and difficult, as he has then to kneel, and to accommodate himself to the animal. In the decubitus, it is still more necessary that the croup should be higher than the front part of the body, in order to get the digestive organs out of the way; the lateral pressure of the viscera should also be diminished by having the spine higher than the limbs; and it must be borne in mind that the more an animal is raised above the ground when it is lying, the easier is the manipulation. For the same reason, the smaller animals should be raised as high as the operator's hand: the Sheep, Sow, and Goat on several bundles of straw; the Bitch and Cat on a table covered

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with straw or a cloth. The two latter animals must be so secured that they will not bite or scratch the operator.

To compel a Cow to get up, Schaack recommends that a small Dog be introduced into the stable, and made to bark at and excite the animal.

The coat must be removed, and the shirt-sleeve rolled as high as the shoulder; indeed, with large animals, when there is a likelihood of much manipulation being required with the cavity of the uterus, it has been recommended to remove the shirt and underclothing from the arm and shoulder altogether.

My friend, Mr. Cartwright, of Whitchurch, employs a large, thick, and long woollen sleeveless vest that buttons close up around the neck; this is very suitable for such cases, as it not only admits of the shirt being removed, but, besides keeping the operator's clothes clean, it prevents him catching cold. Other operators wear a long gown, like a dissecting-room gown.

The back of the hand and arm should be well smeared with oil, grease, or even butter, not only to render their introduction into the genital passages more easy, and less irritating to the lining membrane, but also to some extent to prevent the operator becoming infected. It is scarcely necessary to add that rings should not be worn on the fingers. The right hand is usually introduced, but it is well to be able to use both hands; certain manipulations being more easily executed with the left than the right hand; and, besides, in protracted operations one hand relieves the other.

Before commencing the examination of the genital passages, it is well to empty the rectum, and if possible the bladder. While emptying the former viscus, useful information may be gleaned in ascertaining the condition of the uterus through its walls, as well as of the pelvis and pelvic cavity.

The fingers being gathered together in a cone-like form, the hand—which should not be cold—is inserted carefully and steadily into the vagina at a moment when the animal is not straining: the outer margin (little finger) being downwards, thumb towards the rectum, and pushed gently inwards by a slight rotatory movement; but the advance of the hand must be momentarily checked if the straining is at all severe, or until the animal, if irritable, has become reconciled to it. When once through the vulva, more room is found in the vagina, and the hand and fore-arm can then penetrate with ease as far as the cervix uteri.

The object of exploration being to ascertain, in the first place, the condition of the genital passages, as well as the state of the pelvic cavity in general, the operator has to satisfy himself whether the vagina is empty, or if it already contains some portion of the fœtus or its membranes, and what these are; if there is any abnormal condition or contraction of the vagina, or any tumours either within or external to that canal, as well as the seat of these, and if possible their nature. He has also to satisfy himself that the pelvis is wide, regular in form, or more or less deformed and diminished in size from exostoses, fractures, or other causes.

The state of the soft parts will likewise engage his attention, and he must learn whether the vulvo-uterine canal is dry, or contains sufficient mucus to facilitate manipulation or delivery, as well as its temperature. Having satisfied himself on these points, the fingers are again brought together, and their extremity pushed as far as the cervix uteri, the condition of which is carefully studied. The chief points to be noted are: whether it still projects into the vagina, or if it is completely effaced; whether the uterus has descended on the floor of the abdomen, or is yet in its ordinary position; whether the os is closed or open, and the extent of its dilatation; whether the texture of

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the cervix is hard or soft, healthy or altered by morbid degeneration, and if it lies in the axis of the vagina or deviates therefrom, or is more or less twisted. Passing the hand into the uterine cavity, if necessary and possible, and with all care and gentleness, the explorer will meet with the "water-bag," if it is not already ruptured, and the fœtus, if he has not already encountered it; at the same time the energy and frequency of the labour pains can be ascertained. If the membranes are ruptured, the hand must be passed into them in order to discover the situation of the fœtus—the kind of presentation and position, the manner in which the limbs are disposed, and any complications which may be present. If the membranes are not ruptured, and it is deemed necessary to open them—which not unfrequently happens when an exploration has to be made, and labour is advanced, the pains being well marked, the os dilated, and the water-bag in the vagina—the hand may be passed between them and the uterus, the palm being towards the fœtus; or it may not be required to pass so deeply.

When the membranes are tense, pressure against them with the end of the index finger during a throe is usually sufficient to open them; if, however, they are flaccid, a portion is seized between the thumb and middle finger and torn by their nails, or by the nail of the first finger against that of the thumb. Sometimes the fingers alone are not sufficient, as when the envelopes contain but little fluid; then a pair of scissors, a small trocar, or even an ordinary pen will effect this object.

In examining for presentation and position, each region of the body of the fœtus should be familiar to the touch, as it can be distinguished by its own proper characters. Under ordinary circumstances, the hand of the operator first meets with the limbs of the fœtus; if they are the anterior limbs, and the plantar surface of the feet is turned downwards, then the fœtus is in the natural or vertebro-sacral position, anterior presentation; but if the plantar surface of the feet is inclined upwards, and they really belong to the fore limbs, then it is in the vertebro-pubic position. To distinguish the fore from the hind limb, the shape of the joints and their mode of flexion must be taken into account—the fetlock and knee of the former bend in the same direction, while in the latter the fetlock and hock flex in opposite directions; the knee, in addition, is large, round, and rather flattened in front, while the hock is flattened on each side, and offers the calcis as an unmistakable guide. There is also a difference in the shape of the feet.

The explorer should take time to assure himself of the real state of affairs, and conduct his examination with all the care, attention, and gentleness possible. The fœtus may present in a variety of positions, in which hind and fore limbs may offer first, either alone or together; and in the case of twins or monstrosities, the limbs of different creatures may be encountered at the same time. If the presentation is anterior, the head will be met with, and this is distinguished by the presence of the mouth, eyes, and ears; if it is a posterior presentation, then we have the rounded croup, tail, hocks, and external genital organs. In other presentations, the neck is recognised by the mane, if it be a foal, in addition to its shape, whether foal or calf; the shoulders by the acromion processes and withers; the chest, by the ribs and intercostal spaces; and so on. In addition to all this, the obstetrist should judge at the same time of the volume of the fœtus and its proportions. This is particularly necessary in the case of monstrosities; and in some instances it is most difficult to decide what the hand may light upon in such an examination. Kopp alludes to the case of a Mare which he examined during parturition, when he found a fœtus affected with hydro-

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cephalus to such a degree that for a long time he thought its head was the thorax.

It cannot be too strongly impressed upon the minds of those who are commencing obstetric practice, that such an examination should be so complete as to furnish all the requirements of a sound diagnosis, on which the indications for affording assistance can be readily based; and this exploration can only be said to be complete when the obstetrist is as well acquainted with the position of the fœtus and the obstacles to its birth, as if he had scrutinised the whole with his eyes.

Then he can decide as to the measures which are indicated by his diagnosis, in order to bring the young creature into one of the best positions for delivery—either natural or artificial—so that this may be effected with certainty and rapidity.

These measures being decided upon, a methodical procedure is as necessary in carrying them out, as in exploring the vagina and uterus. The required assistants should be selected, and to each should be allotted his share in the operation, in which he ought to be instructed briefly and clearly; the instruments, cords, and other apparatus ought next to be placed in readiness; and then the task may be begun. When this is once commenced, it should be conducted with prudence, and yet with decision, all irrational and unnecessary manœuvres being avoided; while every precaution being at the same time observed, there should be no fear of irritating the organs or textures by manipulation, as they appear to be endowed with a greater amount of tolerance at this than any other time.

In such cases, the operator should bear in mind that his task consists in removing or overcoming everything which suspends, hinders, or interferes with the natural course of parturition, and to bring this as near as possible to a normal termination. He should understand and appreciate the part Nature plays in this act; only seeking to second her efforts so long as she is competent to attain the desired end, by removing any obstacles in the way. When Nature's efforts cease to be effective, they should be imitated as closely as possible; and no more ought to be attempted than Nature herself would have accomplished under more favourable circumstances. Art should never undertake what Nature can effect; and remembering this, the obstetrist will not only seek to learn and appreciate the powers of Nature, but will be in a better position to calculate how far he should himself interfere.

Whatever is necessary to be done should be accomplished without delay, so as to spare the animal pain and exhaustion. Sometimes parturition is difficult because of the insufficiency of the expelling forces, as we have already noticed, and this may be remedied by hygienic and therapeutic means; but more frequently, while the expulsive efforts are normal, there is undue resistance. To increase the expelling forces in the latter instances would evidently be unwarrantable and injurious, and we must attack the resistance by various means, according to its character. Obstacles in the genital passages must be overcome either by altering the position of the fœtus by manipulation, in changing the position of the mother, or by other means; and it often happens that we must combine extraneous force with the expulsive efforts of the mother, in order to extract the fœtus artificially. At other times the size of the fœtus must be reduced by embryotomy, and in extreme cases an artificial passage has to be made for it by hysterotomy; though these dangerous operations may be occasionally averted by causing artificial abortion, at a period when the fœtus is sufficiently small to be safely expelled through a contracted pelvis.

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There is no occasion, in veterinary obstetrics, to hesitate in sacrificing the life of the fœtus in serious cases; and in this respect the practitioner is in a different position to the *accoucheur* of woman-kind. With animals there is only a material loss to be looked at, and the fœtus must always be greatly inferior in value to the mother; therefore, in order to save the latter, it is more profitable to sacrifice the former.

Such are the general principles which we believe to be applicable to all cases of dystokia. These cases, as Saint-Cyr observes, are numerous and various—more varied even in animals than in woman; and in order to study them beneficially, it is advisable to classify them in a methodical manner. We will follow that authority in arranging and studying them in the order given below.

SYNOPTIC TABLE OF THE CAUSES OF DYSTOKIA IN THE PRINCIPAL DOMESTICATED ANIMALS.

- **Dystokia**
  - **Maternal**
    - Pelvic Constriction.
    - Displacement and altered relations of the Uterus.
    - Morbid alterations of the Maternal Organs.
  - **Fœtal ...**
    - Independent of the Presentations, by:
      - Excess in Volume.
      - Diseases.
      - Monstrosities.
      - Multiparity.

      } Of the Fœtus.
    - Dependent on the Presentations:
      - Anterior.
      - Posterior.
      - Dorso-lumbar.
      - Sterno-abdominal.

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BOOK I.

MATERNAL DYSTOKIA.

THE pathology of parturition, as has been mentioned, includes disturbances produced by excessive or tumultuous pains and too feeble pains, and derangement caused by too great an obstacle to birth. We have sufficiently described the first; and we have now to deal with the second, in so far as the mother is concerned. The maternal obstacles to parturition are related to the too great resistance offered by the parturient passages, either in their hard or soft parts. These obstacles have been grouped in the preceding table under the head of *pelvic constriction, displacement or change in relations of the uterus,* and *morbid alterations of the maternal organs.*

CHAPTER I.

Dystokia by Pelvic Constriction.

DYSTOKIA from constriction of the pelvis is sometimes observed in animals;* though less frequently, perhaps, than in woman, in whom constitutional causes and the different position (vertical) of this region, operate largely in producing diminished dimensions of its cavity. Any alteration in the dimensions or shape of the pelvis, whether general or partial, is a more or less serious cause of dystokia, and in some cases may render delivery absolutely impossible. A pelvis generally reduced in all its dimensions is sometimes noticed in the large, as well as the small domesticated animals.

On the Continent of Europe, this has been observed more particularly among some of the small common breeds of cattle—such as the *Bretonne,* and certain of the grey Swiss breeds, as the *Fribourgeoise.* These cattle have the ischia pointed and the tail attached high above them. Leconte has observed this conformation in animals the produce of a cross between large Norman Mares and pure-bred Horses—animals with a sharp croup. There is often a relative narrowness of the pelvis in animals of small size which have been put to larger males. This has been witnessed in the Mare and Bitch; and as the young are proportionately larger than the pelvis can accommodate in parturition, we have here a cause of dystokia.

An abnormal inclination of the pelvis has been supposed by some writers to exercise an unfavourable influence on parturition, but this has been denied by others. Provided the other conditions of normal parturition are present, no difficulty should be experienced in delivery; but if, added to this state, there is a narrow pelvis, then obstetrical operations would certainly be rendered more serious.

Deformities which occasion irregular constriction of the pelvic cavity, are various. They may belong to the bones of this region, or to its connective

* A naturally wide pelvis—or rather an excess in width—observed more particularly in animals of a lymphatic temperament, and especially in Cows, along with an extraordinary suppleness and laxity of the soft parts in this region, has the inconvenience of rendering parturition too easy, it would appear. For this facility is supposed, and not without reason, to bring about such complications as eversion of the vagina and uterus, placental retention, and even predisposes, according to some authorities, to vitulary fever in the Cow and metritis in the other animals.

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tissue; and they always more or less diminish one or more of the dimensions of the parturient canal, and offer an obstacle to the passage of the fœtus. These cases, however, are somewhat rare; they are generally found to be due to *complete deformity of the pelvis*, *exostoses*, *fractures*, or *tumours*.

Complete Deformity of the Pelvis.

As has been observed, complete deformity of the pelvis is very rare among animals. When due to rachitism, it is most frequently noted in the Pig. In this animal the pelvis is sometimes greatly distorted, and not unfrequently there is accompanying deviation in the vertebral spine. This condition is seldom seen in other creatures.

Saint-Cyr informs us that in the Museum of the Lyons Veterinary School, there is the pelvis of a Mare and another of a She-Ass, which present a very remarkable degree of general constriction, and which must have offered a very serious obstacle to parturition if the animals had ever been pregnant.

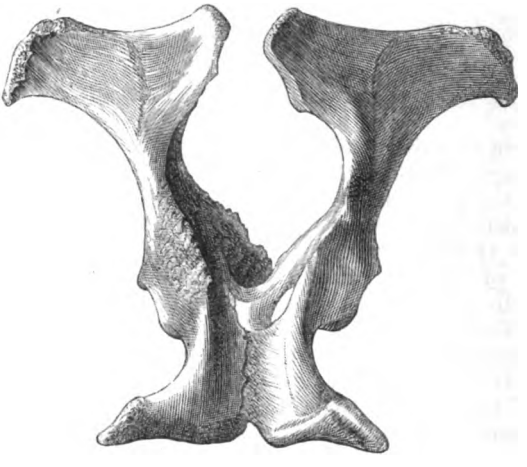

Fig. 64.

Completely Deformed Pelvis: Mare.

That of the Mare (Fig. 64) is singularly depressed on both sides, the ischia, and especially the pubis, being atrophied with respect to size. The oval foramina and cotyloid cavities are close together, the floor of the pelvis is extremely contracted and angular, and the pubic arch is hypertrophied. In this specimen there is a very notable diminution in the different diameters of the pelvic cavity; the supero-inferior, instead of being about $8\frac{1}{2}$ inches is only about 6, and the bi-iliac diameter is but $4\frac{1}{4}$ instead of being $7\frac{1}{2}$ to 8 inches.

According to Saint-Cyr, the diagnosis of this deformity should not be difficult, especially when it is so marked as in this instance. Vaginal exploration should soon discover it, and the diminution in size may be approximately determined by spreading the fingers, and in this way measuring the two diameters. The diagnosis may not be so easy, however, when the canal is partly or wholly occupied by the fœtus.

Denoc gives the following case of a Cow, which had been four days making fruitless attempts at delivery (*Recueil de Méd. Vétérinaire*, 1845, p. 9). The os was dilated and the fœtus in a good position; the head and feet could be brought into the passage,

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but the creature could not be extracted. In exploring the cavity, after pushing back the fœtus, it was discovered that there was hypertrophy of the symphysis pubis, and an abnormal rugged production thereon, forming a kind of ossified ridge which extended beneath the bladder. Forceps proved useless, as this ossific deposit was an insurmountable obstacle; so the animal was killed for food. On examining it afterwards, in addition to the bony alterations, there was a double twist of the uterus.

Gellé has published a case in which the narrowness of the pelvis appears to have been the sole cause of difficulty in parturition; there did not seem to be any appreciable deformity, and probably the youth of the animal—two years old, and a primapara—and a large calf, occasioned the non-delivery, as the fœtus was extracted by embryotomy. The Cow did well afterwards.

Another kind of deformity which has been described by several authorities, consists in a depression of the sacrum (*lordosis*), which is recognised externally by an abrupt hollow existing towards the posterior third of the croup. By rectal exploration, the sacrum is found to constitute a projection in the roof of the pelvis, at the lower face of the bone, and this diminishes the supero-inferior diameter of the cavity to an extent corresponding to the protuberance.

Schaack gives an account of two cases of dystokia in Cows, arising from this deformity. In one, the fœtus was of ordinary size and making a good anterior presentation, but it was wedged between the floor of the pelvis and the exostosis above. It required the united efforts of four men for half an hour to extract the calf, and at the moment when the most voluminous part of its body was being dragged through the depressed point of the sacrum, a noise was heard similar to that produced by breaking a bit of dried wood. When the calf had been got through, it was then perceived, by the mobility of the end of the sacrum and the root of the tail, that the Cow had sustained a fracture at this part. The Cow recovered, and was again sent to the bull at the ordinary period. When next it calved, Schaack had to assist it in a laborious parturition, but a living calf was produced. In the second case the calf perished, and the Cow was sent to the butcher.

Canu (*Recueil de Méd Vétérinaire*, 1837) reports that in May, 1831, he was sent for to see a Mare which, for seven or eight hours, had been vainly attempting to foal. The fore limbs were properly presented, but when it was observed that the head did not follow, those who had been endeavouring to assist the animal ceased to pull at them.

The animal was seven years old; it was continually straining, was covered with perspiration, and appeared to be much distressed. Canu introduced his arm, but could not find the head of the fœtus, as a hard round mass closed the pelvic inlet, and compelled him to withdraw his hand. Shortly afterwards, however, he made another attempt, and with more success. Having contrived to insert the whole of his arm in the direction of the obstructing mass, he at length touched the tip of the ears of the fœtus with the extremity of his fingers. It was in vain, however, that he attempted to change the position of the head or to turn the neck in the slightest degree, as the fingers could not be introduced between the latter and the shoulder. The owner was then informed that he must not reckon upon the foal being extracted alive, and that the Mare itself was in imminent danger.

Not seeing any way of saving the mother but by extracting the foal by force, the owner's consent was obtained to this; a cord was placed on the fore limbs that were presented, and three assistants were posted at this, while two others, with a girth placed between the thighs held the Mare, which was in the recumbent position. The assistants at the cord were then ordered to pull, and by exerting all their strength the fœtus was extracted dead, with the neck bent to one side on the ribs. All attempts to have brought the head into the natural position must have proved unavailing, according to Canu, as the right side of it, flattened, and even crushed, perfectly fitted a concavity in the right flank.

The vulva was a little torn at its upper part; it was much swollen, and its lining membrane was extremely congested.

The Mare lay during three days before attempting to get up; but by appropriate treatment it eventually recovered.

It was subsequently ascertained that, although only seven years old, the animal's croup had become altered in form; it was depressed, and the attachment of the tail

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was low, while the ligamento-cartilaginous substance which united the sacrum to the ossa innominata had been partially torn, causing the croup to approach almost two inches nearer to a horizontal position.

Exostoses.

Exostoses on the pelvic bones, and particularly when they project into the pelvic cavity, or encroach on its openings, may become a more or less serious obstacle to the passage of the fœtus.

Favre, of Geneva, states that bony tumours situated beneath the croup, at the inner and upper surface of the pelvis, render parturition difficult, even if they are not large and near the root of the tail. He adds that such cases are not rare in old Mares.

Fractures.

Like the exostoses, more or less completely consolidated fractures of the

Fig. 65.

Pelvic Exostosis.

sacrum or coxæ, which have been united by an irregular callus, may, for the same reason, prove an obstacle to birth. As animals suffering from a fracture of any of the bones of this region are often destroyed, laborious parturition from such a deformity is not so frequent as from some other causes; nevertheless, it does occur now and again.

It must be remembered that fractures of the pelvic bones are somewhat frequent in animals, and may occur at any part. The most common seat of fracture is perhaps the external angle of the ilium; and the least frequent, the posterior part of the ischium and the pubis. Fracture of the sacrum and the internal angle of the ilium is also very rare. Simultaneous compound fracture of the two coxal bones has been observed in two cases by Lafosse; in one case by Crepin, and in another by Philippe.

D'Arboval has witnessed a fracture of the pubis in a Dog; and Carsten Harms alludes to fractures of the ischium occurring in the Mare and Cow. The latter authority has likewise found the two iliums of a Goat united at

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their posterior angle by a mass of bone as thick as a finger. Professor Ercolani has well described twelve important cases of pelvic fracture exhibited in the Pathological Museum of the Bologna University.* The first of these is a compound fracture of the ossa innominata, the solution of continuity involving all the border of the foramina ovale in the pelvis of a Mare; the second is a fracture of the left ilium near its neck, and extending to the cotyloid cavity, also in the pelvis of a Mare; the third is a compound comminuted fracture of the left innominate bone in a Mare, the piece being divided into six principal portions; the fourth is a compound fracture of the right ilium of a Mare, extending to the arch of the pubis on the left side; the fifth is a longitudinal fracture of the right ilium of a Filly; the sixth, a fracture of the external angle of the right ilium and the left ischiatic tuberosity of a Mare; the seventh is a slightly oblique fracture of the ilium extending to the cotyloid cavity of a Mare; the eighth is a compound fracture of the pelvis of a

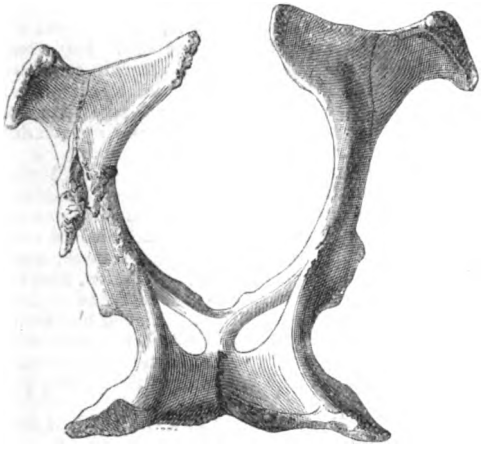

Fig. 66.

FRACTURE OF THE PELVIS.

Mare, involving the internal angle of the ilium, the external part of the ischial tuberosity, the arch of the pubis, and the union of the pubis with the ischium; the ninth is a fracture of the superior and posterior crest of the ilium of a Mare; the tenth is an oblique fracture of the neck of the left ilium of a Mare; the eleventh is a compound fracture of the right coxa of a Mare, the cotyloid portion being completely isolated from the ischium, ilium, and pubis; the twelfth is a fracture of the external angle of the ilium. Lanzillotti-Buonsanti states that the Pathological Museum of the Milan Veterinary School contains a coxa, which shows a fracture of the neck of the ilium, with overlapping of the disunited portions; and also a pelvis in which the pubic portion of the symphysis has sustained a comminuted fracture.

Much will depend, of course, upon the nature and the seat of the fracture. When it is only the outer angle of the ilium (point of haunch), and even when the fractured bone is displaced by the action of the small oblique

* Descrizione Metodica dei Preparati del Museo di Anatomia Patologica Comparata della R. Università di Bologna. Memoria I. Bologna, 1867, p. 38:—*Fratture della Pelvi.*

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muscles of the abdomen and the fascia lata, producing great external deformity, no great effect can be produced on the act of parturition, as this part has nothing to do with the pelvic cavity. But when the whole of one side of the haunch is lower that the other, delivery is then undoubtedly interfered with, and perhaps to a most serious extent; inasmuch as some one of the parts which concur in forming the pelvic cavity is implicated in the fracture, and consequently the external deformity corresponds to an internal diminution and irregularity in its diameters, from displaced fragments of bone, overlapping of fractured ends, the approach of the sacrum to the pubis, and consequent lessening of the inlet of this cavity, as well as to the more or less voluminous deposit of bone around the fractured portions. Many cases are on record of difficulty in parturition from this deformity.

Gohier (*Mém. sur la Chirurgie et la Méd. Vétérinaire*) mentions a Ewe which was brought to him, and which for twelve hours had been making ineffectual attempts to give birth; the cause of delay appeared to be narrowness of the pelvis. Traction on the fore limbs of the fœtus only resulted in tearing them away from the thorax. Delivery being impossible by the natural way, Gohier performed the abdominal Cæsarean operation, but the animal died next day. On examination, it was discovered that the pelvis was very narrow and irregular, in consequence of an old fracture of the ilium. The coxa of that side was at least half an inch shorter than the other from the cotyloid cavity to the sacrum, which gave a very marked obliquity to this part; and it was this, as well as the slight exostosis protruding there, which prevented the top of the lamb's head from passing through.

Chretien (*Journal Prat. de Méd. Vetérinaire*, 1826, p. 225) was called to attend a Cow which could not calve. Two legs of the fœtus protruded, but nothing more could be extracted. By exploration it was found that there was a hard tumour between the vagina and uterus, which filled up one-third of the pelvic cavity. On inquiry it was ascertained that the animal had been treated, a year previously, for a fracture of the ilium, near the coxo-femoral articulation, and that the fracture had united, though the Cow remained lame, and rested this side of the body more than the other. Delivery being impossible, the calf was removed by Cæsarean operation. The Cow recovered, and on being killed by the butcher some time after, Chretien examined the pelvis, when he found a very voluminous bony tumour or callus, and noted that the inferior part of the ilium had not united fairly, but projected a good deal inwards.

Rainard speaks of a large Anglo-Chinese Sow which died during parturition, its owner being unable to extract any of the young. Two months previously it had sustained a fracture of the ascending branch of the ilium, near the cotyloid cavity, from which it had always been lame. When Rainard examined the pelvis, the callus was not yet solidified; it formed a considerable prominence within the pelvis.

Fractures of the pelvis are by no means unfrequent with animals, and are due to falls, crushing, blows, or other causes; and, as the above instances testify, they may prove insurmountable obstacles in parturition. Female animals which have sustained an injury of this kind, should not be employed for breeding purposes, unless a careful examination has shown that it has not altered the pelvic diameters in such a way as render delivery difficult.

Such an alteration may be diagnosed by depression of the haunch or croup, and lameness to a more or less appreciable extent; while rectal or vaginal exploration will discover the presence of a variable-sized hard tumour forming part of the bone, and projecting into the cavity. The previous history of the animal may also aid in confirming the diagnosis.

Fractures of the pelvis may also take place during parturition, and Rueff mentions two instances in which they have occurred spontaneously during very violent labour pains.

In the latter instances, there may have existed a predisposition due to a diseased condition of the bones—a predisposition not uncommon in breeding animals.

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Tumours in the Pelvic Cavity.

Tumours of various kinds, in addition to those of a bony character due to injury—such as fibromata, melanotic, and cancerous tumours—may prove a cause of dystokia; abscess may also co-exist with pregnancy, and be a source of difficulty in parturition. But that form of melanosis which appears in grey animals, and particularly manifests itself in the form of tumours at the root of the tail, around the anus, and in the connective tissue of the pelvis, should offer the most frequent obstacle to delivery.

One case has occurred in my own experience, in which an aged Mare, nearly white, belonging to a friend, was, on my recommendation, taken by a farmer, who attempted to breed from it; but at the termination of pregnancy, and during parturition, it died without giving birth to a foal.

When opened, it was found that delivery could not take place, owing to great masses of melanotic deposit in the pelvic cavity. When given to the farmer there were only a few small nodular masses observed about the tail and vulva.

Leconte (*Mém. de la Société Centrale de Méd. Vétérinaire*, vol. v., p. 180) was consulted with regard to a Mare, about twelve years old, and about five months pregnant, which had such a large melanotic deposit around the anus that defecation was impossible without assistance. Rectal exploration discovered a very voluminous tumour situated at the left side of the pelvis, in the centre of which a slight fluctuation could be perceived. With a view to accelerate the maturation of the tumour, vesicatory agents were applied to the left flank and croup; five days later the tumour was larger and more fluctuating, and it was punctured, when about two pints of a dark, purulent, but almost odourless fluid escaped. On the hand being introduced into the softening mass, a portion was found about the size of two fists, and partially detached; this was removed, and weighed nearly seven pounds. In twelve days the wound had cicatrised; and in five and a half months, gestation being nearly completed, another melanotic tumour, situated somewhat deeply towards the right side of the pelvic cavity, was also removed. Cicatrisation took place rapidly, and delivery occurred without any difficulty.

Indications for Surgical Treatment.

The surgical treatment of those cases in which dystokia is due to any of the causes just enumerated, will greatly depend upon circumstances, not only with regard to the kind of treatment, but also as to its expediency at all.

For instance, if total or partial deformity of the pelvis is present to such a degree as to endanger the life of the animal during parturition, or if there exist obstacles dúe to fractures or tumours, and which cannot be removed, then it may be advisable, if the animal be fit for food and in good condition, to send it to the butcher; or if it be pregnant and in inferior condition, to produce abortion at a sufficiently early period. But if parturition has already commenced, then, of course, surgical or obstetrical treatment must be had recourse to; and the nature of this will depend upon the constriction of the pelvic cavity, and the kind of obstacle which causes the diminished space. The indications are: *to forcibly extract the fœtus through the narrowed passage; to widen the passage; to diminish the size of the fœtus; or to make an artificial passage.* But as *artificial abortion* may be necessary during pregnancy, should the veterinarian be consulted, and from examination be led to conclude that parturition will be dangerous or impossible, we shall include this as one of the indications, and commence with it.

1. Artificial Abortion.—Artificial abortion may be rendered necessary not only during pregnancy, when the condition of the pelvic cavity leads to the supposition that delivery at full term is dangerous or impossible, but also in metrorrhagia, serious inversion of the vagina, hydramnios, debility, or exhaustion, etc.

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Artificial abortion may be produced in several ways, and is generally more successful with the Mare than the Cow, because of the greater excitability of the cervix uteri, and the readiness with which it can be dilated in that animal. Three modes of procedure have been adopted with the domesticated animals, each being attended with success, and each offering special advantages in particular cases. These are: *irritation of the cervix uteri by the hand; puncture of the envelopes;* and *vaginal irrigations.*

Digital Irritation of the Cervix Uteri.—This is accomplished in the following manner: The hand is introduced into the vagina, and first one finger, then two are insinuated into the os by a semi-rotatory movement, and finally the whole hand is inserted, as the part dilates. If the operation is repeated several times, labour pains soon ensue. As the manual exertion is rather fatiguing, the sponge tent, elastic bags, or other dilators of the os uteri may be employed. A better and more successful mode is the introduction of a long elastic catheter, strong pieces of catgut, or even a quill, between the fœtal membranes and the uterus. Labour may be promoted by passing the hand through the os, and separating the membranes from the uterus.

This procedure is to be recommended for Mares, the uterus of which is so irritable that abortion sometimes occurs after manipulations in the rectum for some time. In ordinary cases, the expulsion of the fœtus occurs in from six to twelve hours. It is not applicable to cattle, Harms having once manipulated a Cow in this manner for a whole night without producing any result; neither is it to be recommended for smaller animals.

Puncture of the Fœtal Envelopes.—The envelopes are punctured by pushing a long, and more or less pointed, sound through the os uteri, into the "water-bag;" the liquor amnii soon escapes, and the uterine contractions begin. Expulsion of the fœtus follows in from twelve to forty-eight hours. This method is particularly efficacious with cattle.

Vaginal Irrigations.—Irrigation of the vagina with cold water (or water at a temperature of about 90° Fahr.), made by means of a syringe or injection-tube, and continued for a quarter of an hour every three hours, will induce labour pains about the fourth injection, and effect the expulsion of the fœtus towards the second, third, or fourth day. This method is more particularly adapted for the smaller animals; though it will also succeed with the larger. The only danger to be apprehended from it is an attack of metro-peritonitis.

2. Forcible Extraction.—As Saint-Cyr well remarks, the first impulse which presents itself when the fœtus meets with any obstacle to its passage through the pelvis, is to "force it through;" and it is this impulse which is carried into execution by unscientific people. Too frequently, however, it happens that by this procedure some portion of the fœtus is so tightly wedged in the pelvis that no amount of force is capable of moving it farther, and renders absolutely impossible those other operations which might be the means of saving at least the mother or offspring, or perhaps both. For this reason it is, that the owner of an animal in this condition should not himself, nor suffer others to, pull at the fœtus, or attempt any similar manœuvre, until the arrival of the veterinarian. And the latter has a difficult task before him in solving the problem, as to whether he ought to extract the fœtus forcibly, or resort immediately to the other measures prescribed. This will render a careful examination necessary, in order to ascertain the nature, seat, and degree of constriction.

The animal is making excessive, nay violent, efforts, and the fœtus may

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be in a favourable position, but it does not advance through the pelvis. The creature is restless and sighs deeply; the flanks are covered with perspiration, and sometimes, through sheer exhaustion, it falls, utterly prostrated by its efforts. As the uterine contractions generally increase in violence in the presence of obstacles to birth, there is the gravest danger to mother and offspring.

In such a case, the veterinarian, having introduced his hand into the pelvis in the ordinary way, endeavours to discover if the obstacle is there. With this object in view, he closes his hand to try if he can move his shut fist about in every direction, and with ease. Then stretching out the thumb, he can approximately judge the distance which intervenes between opposite points of the pelvic circumference, and in this way appreciate to a certain degree whether a moderate-sized fœtus could pass through. For if the pelvis is so contracted that the closed hand can scarcely move about in it, it will be needless to attempt forcible extraction, as the fœtus cannot be brought through.

Saint-Cyr has calculated that the closed hand of an adult man represents an irregular mass measuring between three and four and a half inches in diameter; but the head of a calf, in its supero-inferior diameter, measures from seven to ten inches, and four to five inches in transverse diameter. It is therefore obvious that the head of a calf could not pass through an aperture in which the hand cannot move freely; and much less the chest of a foal, which is at least twelve to thirteen inches in depth.

It is also necessary to take into consideration the cause of dystokia. If this is due to a complete deformity of the pelvis, then the case is serious, and there is little hope of traction alone overcoming the difficulty. If it is due to a tumour, and localised, then it must be ascertained if this is of a bony character, arising from an exostosis or fracture; or if it is movable and independent. If the latter, the case is not so serious, and especially if the tumour is connected with the sacro-sciatic ligament; as it may be pushed out of the way of the fœtus and birth take place.

As Saint-Cyr insists, all these considerations should be weighed before deciding to terminate parturition by mechanical traction; for if the impossibility of accomplishing it by this means is discovered when too late, the other operations are rendered more difficult and dangerous, in consequence of the ineffectual attempts at forced extraction.

If extraction of the entire fœtus is discovered to be practicable, and the position is favourable, then there should not be much difficulty in effecting delivery, which may be achieved as in ordinary circumstances. It will be much facilitated, should the fœtus and the passage be dry and tenacious, if these are smeared with oil or soapy fluid.

If, however, the fœtus has become wedged in the passage and cannot be pulled through, it may be useful to push it back a little into the uterine cavity, and then lubricate it and the vagina with some oily matter to assist movement, before another attempt is made.

3. Enlargement of the Passage.—This is nearly always impossible in practice, unless the cause be a tumour which can either be excised, or moved temporarily out of the way so as to effect delivery.

4. Diminution of the Size of the Fœtus.—With the domesticated animals, as we have repeatedly said, there are no moral considerations to oppose us when it comes to a question of sacrificing the fœtus to save the

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life of the parent. And with the Mare there should be no hesitation in this direction, when a careful examination has proved delivery of the living or entire fœtus to be impossible; and particularly when we remember that the young creature soon perishes.

With the Cow, however, the case is somewhat different, as when delivery is unsuccessful this animal may be killed and utilised as food. Embryotomy is, nevertheless, often resorted to before the case is considered hopeless; and not at all unfrequently with good results, so far as the Cow is concerned.

We shall treat of embryotomy hereafter; but it may be useful to mention here that, in an anterior presentation, removal of one or both of the fore limbs at the scapula of the fœtus, will often allow the remaining portions to be removed by traction. With a posterior presentation, excision of one hind leg is frequently sufficient to permit the body of the fœtus to be drawn through the passage.

5. ESTABLISH AN ARTIFICIAL PASSAGE FOR THE FŒTUS.—When all the preceding means have been recognised as impracticable or too dangerous, there yet remains another, which, though it may place the life of the mother in great jeopardy, and should be considered only as a last and a most serious expedient, may be resorted to: this is the Cæsarean section, or gastro-hysterotomy—an operation to be described hereafter. It may only be noted in this place, that a formidable operation, such as this is, should be resorted to early, and before the female is much exhausted by inefficacious manipulations and impotent labour pains.

CHAPTER II.

Dystokia by Displacement or Changed Relations of the Uterus.

DELIVERY may be rendered difficult by displacement or altered relations of the organ containing the fœtus—the uterus, either from *hernia* of that organ through a natural or accidental opening in the abdominal parietes; from *deviations* in the direction of the uterus, whereby the os is no longer in the axis of the pelvis; and *torsion* of the organ, which is due to its having made a revolution or become twisted on its own axis—a singular displacement that well merits attention.

HERNIA OF THE UTERUS—HYSTEROCELE.

Every description of ventral hernia may be viewed as more or less tending to dystokia, from the important share the abdominal muscles assume in the act of parturition; and when there is a tendency to hernia of any of the organs in this cavity, or when a hernia really exists, this is likely to be increased during labour, and may complicate delivery. But the case is generally all the more serious if the displaced organ is the gravid uterus itself.

Hernia of the uterus is certainly not a very common accident; nevertheless, it is far from being rare, if we are to judge by the instances recorded in veterinary literature, and it has been observed in the Mare, Cow, Sheep, Sow, Goat, and Bitch—in all the more important domesticated animals, in fact, and has often proved a very serious obstacle to parturition.

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Origin and Symptoms in Uniparous Animals.

The *symptoms* and other features of this accident rather differ in uniparous and multiparous animals. In such uniparous creatures as the Mare and Cow, hernia of the uterus is generally not observed until pregnancy is pretty well advanced—towards the eighth or ninth month, or even later in the Mare, and the seventh or eighth month in the Cow. This delay is evidently due to the circumstance, that in the non-pregnant animal the uterus is small, and closely fixed by its ligaments to the sub-lumbar region; so that if there is a breach in the abdominal walls, it is either the intestine or omentum which passes through it. When, however, pregnancy is advanced, the great size of the organ, together with its weight, brings it in contact with the parietes of the

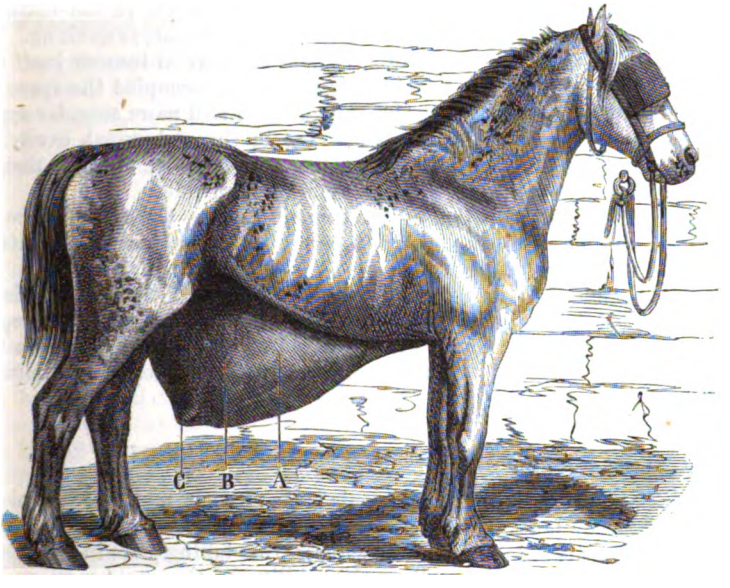

Fig. 67.

UTERINE HERNIA: MARE.

A B, Hernial Tumour; C, Teat carried down by the Tumour.

peritoneal cavity, and if there happens to be a weak part or a rupture, however slight, the heavy uterus gradually forces itself through, and may in time escape altogether from the abdomen, along with other viscera.

It would appear that laceration of the abdominal walls may occur in other ways than through external traumatic influences, or any appreciable occasional cause; and it would also appear that, in some animals, there is a kind of predisposing relaxation or softening of the abdominal muscles, which leads to their being unable to support the gradually increasing strain thrown upon them by the heavy uterus, and its oftentimes very lively and energetic inmate. The muscles are stretched and attenuated, their fibres are separated and some of them may rupture, and in this way is formed a rent which gradually enlarges from the increasing pressure. Then a tumour appears externally and towards the lower part of the abdomen, though always a little

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to one side—usually the left in the Mare, the right in the Cow, and not unfrequently in front of the pubis in the mammary region. This tumour, when first noticed, is about the size of a child's head, and not clearly defined; but it rapidly enlarges, and in a few days may acquire prodigious dimensions: descending as low as the hocks, or even nearly to the ground, pushing the mammæ to one side or carrying them with it, and extending almost as far forward as the sternum, giving to the abdomen a singular appearance (Fig. 67).

These extraordinary herniæ are most frequently witnessed in Cows, though several veterinarians—among others, Lecoq, Binz, Leconte, Serres, Lafosse—have seen them in Mares. In very many instances they are due to violent efforts, kicks, blows, and other external injuries.

When the hernia is recent, and especially if it occurs in the mammary region, it is generally surrounded by a considerable œdematous swelling. This swelling disappears after parturition, though the hernial tumour itself does not diminish in volume, the digestive organs having occupied the space previously held by the fœtus. Then the animal has a still more singular appearance, perhaps; for owing to this emptying of the abdominal cavity, the belly is wonderfully retracted and the flanks are so drawn together that the fingers may be made to touch through them on each side.

Before parturition, palpation of the tumour enables the fœtus to be distinguished, the head, limbs, and body being felt, while its movements are perceptible to the eye or hand.

As a rule, and contrary to what might be surmised, this uterine hernia does not appear to cause any loss of condition or inconvenience except in progression, which it interferes with, and causes the animal to move with its hind legs wide apart. Aptitude for labour is also somewhat impaired, as may be imagined.

Origin and Symptoms in Multiparous Animals.

As has been mentioned, uterine hernia is observed in multiparous animals, but its manner of production, according to Saint-Cyr, would appear to be different to what it is in uniparous creatures, this taking place in the interval between gestations. The length and mobility of the cornua in such an animal as the Bitch, together with their close proximity to the abdominal walls, sufficiently explain how they may pass into an opening in these. There is formed, at first, a small tumour, the size of a pigeon's or hen's egg; this tumour is soft, indolent, more or less easily reduced, and which, attracting perhaps little or no attention while the animal is unimpregnated, remains stationary. After impregnation, however, it daily acquires larger dimensions; one or more ovules have descended into the hernied portion, localised themselves there, and become developed into fœtuses without the Bitch showing much, if any, disturbance.

The usual seat of the hernia is in the mammary region, to the right or left of the *linea alba*, though it may be also inguinal, or even vulvular. An example of inguinal uterine hernia will be given hereafter; we will now briefly allude to a case of vulvular uterine hernia described by Rainard. In this instance, the uterus, which had been apparently carried through the inguinal ring, was pushed backwards through the connective tissue, and appeared as a tumour at the vulva. The owner of the animal, not knowing what the swelling contained, opened it by means of a penknife; in this way there was formed a fistulous wound from which a viscid fluid escaped. Rainard

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incised this fistula, and found beneath the skin a second membrane having some analogy to it, and which afterwards proved to be the uterus; to the inner face of this there adhered a reddish-brown vascular network, which was the placenta, and which was easily detached by the finger, and within it appeared a transparent bladder—the amnion—already slightly perforated, and looking like the envelope of a kyst. Having opened this, there escaped a quantity of fluid, and a fœtus apparently three or four weeks old. The Bitch died next day.

When the hernia occurs in the abdominal region, it usually appears as an indolent tumour, the skin covering it being destitute of redness and not attenuated in any way; the tumour itself being soft and fluctuating at different points where the *liquor amnii* is, but firm and resisting at others where the fœtus chances to be.

It may be noted here, that we may have other herniæ of the uterus than ventral. For instance, Gellé describes a case of hernia of one of the uterine cornua, which contained a calf, and which had passed through a rent in the mesentery. And Rainard has observed several cases of this kind in the Bitch.

Diagnosis.

The *diagnosis* of uterine hernia in the larger animals is not difficult in the great majority of instances, and especially if labour has commenced. In the first place, it is usually known to the owner that the animal is pregnant; and in the second place, if parturition has begun there can scarcely be any mistake made as to the nature of the expulsive efforts. Besides, there is the abdominal tumour with its peculiar characteristics, and by manipulating which the fœtus can be detected. It will also be discovered that the tumour does not adhere to the abdominal parietes, and that it may be reduced by taxis.

But it may be necessary to ascertain the presentation and position of the fœtus, and if it cannot be born, what the nature of the obstacle is which prevents delivery. In such a case vaginal exploration must be resorted to; and from it we may learn that the os is not dilated from one of several causes to be hereafter discussed; or the non-dilatation may be due to the uterine contractions not pressing the fœtal mass directly against the cervix, in consequence of the altered direction of the uterus, or the margin of the hernial opening strangulating the fœtus and hindering its advance. These obstacles must be combated by appropriate measures.

In consequence of the fœtus lying so far below the pubis, the hand introduced through the os cannot feel it, even when the whole length of the arm is inserted; in which case, if the animal is standing, the abdomen may be raised by means of a sheet or blanket, so as to bring the fœtus within reach. If the animal is recumbent and cannot rise, then it should be placed on its back and secured in that position, the croup being raised by bundles of straw. The tumour may then be examined by external palpation, as well as by rectal and vaginal exploration, and the position of the fœtus determined.

As a rule, the position is never completely normal. In the most favourable cases, the head is found to be directed backwards and near to the pubis—sometimes partly in the pelvis, with the face upwards and slightly forwards; the fore feet being more or less doubled back against the body, which lies deep in the tumour, the buttocks resting on the mammæ of the mother—the fœtus being altogether in the recumbent female in the position of a sitting dog.

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The state of the borders of the hernial orifice should be carefully ascertained, and their rigidity and tension, together with the degree of constriction they exercise on the body of the fœtus, noted. This important examination should be made before any traction is exercised on the fœtus; for on the information gained by it will depend the choice of means to effect delivery.

With the Bitch uterine hernia is frequently most difficult to diagnose, and errors are far from unfrequent; the most common mistake is fixing on the tumour as a cancerous mass. But mammary tumours are very different to that of hernia; they are generally nodulated, very hard, and the skin is closely adherent to them; whereas the uterine hernia has not the fluctuation of a kyst or abscess, neither has it the resistance of a carcinoma, fibroma, or adenoma, while the skin covering it is smooth, supple, perfectly natural, without ulcerations, discolorations, and other signs which mark the presence of mammary enlargements. The uterine tumour can also be reduced by taxis or manipulation, while the fissure in the abdominal wall can be felt. This, together with the fact that it is only developed rapidly after impregnation, and without any local or general inflammatory symptoms, or disturbance of the general health, should settle the question.

However, should any doubt yet remain, or if it is desired to ascertain the exact state of affairs, a more careful examination will be necessary, it being always borne in remembrance that this hernia in the Bitch appears in different regions. Vaginal exploration cannot be resorted to with this animal because of the smallness of the pelvis—unless the Bitch is a large one, and then the fingers are too short to explore to any depth.

An external examination must, therefore, be relied upon, and this is easier and more certain than with the larger creatures. By it the size of the abdominal rent will be ascertained, and also whether the fœtus can be passed through it into the abdomen; though this is rarely possible, owing to the hernia occurring when the uterus was empty, and when it could pass through an opening which will not be sufficient for a fœtus when fully developed.

All manipulatory operations on the Bitch should be practised with as much tact and gentleness as possible, as the young are readily killed, while the female itself is very liable to metritis.

Indications.

Animals suffering from uterine hernia sometimes bring forth their young spontaneously, and without any bad results to themselves or their progeny; thus proving that the uterine contractions alone will expel the fœtus, and that the aid of the abdominal muscles is not absolutely necessary. And more especially is this the case with the larger animals. Leconte mentions a Mare whose career he traced for five years, and which, notwithstanding the existence of this condition, brought forth four living foals: three without assistance, the fourth being in a wrong position. Cows which had most alarming herniæ, have even brought forth twin calves spontaneously.

But, as a rule, with these larger uniparous animals, parturition is always more protracted and difficult than in ordinary circumstances, and the assistance of the veterinary obstetrist is needed to effect delivery; and this, after all, is in some instances impossible, and the mother and offspring are lost. This is more particularly the case with multiparous animals, and especially the Bitch, in which it is generally all but impossible to reduce the hernia or remove the fœtuses by the natural passage. Röll has, nevertheless, described the case of a Bitch suffering from uterine hernia, which brought

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forth its progeny in a natural manner; and Prange, in 1844, published the history of another Bitch that, unaided, gave birth to three puppies which had been lodged in a hernia of this kind. Kopp, as we will see presently, removed three puppies by gastro-hysterotomy from a uterine hernia, which he afterwards reduced, when another puppy was born naturally. And Chanel reports that a sow brought forth young after a portion of one of the uterine cornua containing two fœtuses, and which had been hernied, was amputated.

Notwithstanding these instances, however, the assistance of the obstetrist is necessary to effect delivery, for which a careful examination, as in diagnosis, will indicate the means.

Previous to parturition, the hernia should be supported, when possible, by a truss or retaining bandage, and care should be taken to prevent over-exertion or straining.

With the *larger animals*, delivery by the natural passages is, of course, the chief object to be attained. In certain cases, the simplest measure, and which is sometimes all that is necessary, is to elevate the hernia by means of a sheet or blanket passed under it, and raised by an assistant at each side of the animal. Manipulation *per vaginam* may supplement this support, and in the majority of such cases may even be absolutely necessary to complete delivery.

In other instances, however, the fœtus cannot be removed from the hernial sac without placing the female in a recumbent posture. Either lateral or dorsal decubitus may be resorted to, according to circumstances; but the preference is usually given to the latter position; though when lateral decubitus is tried, the animal should be placed on the side opposite to that in which the hernia exists.

In the dorsal position, the weight of the fœtus and uterus is removed from the floor of the abdomen; consequently, the abdominal muscles are relaxed, and the borders of the hernial opening are not so tense; while the uterus and its contents, by their own weight, have a tendency to escape from the hernia and fall into the abdomen; at the same time the fœtus is more accessible to the hand of the obstetrist.

Should the os be contracted, it must then be dilated by the hand; if the membranes are intact, they are to be ruptured; should the fœtus make an unfavourable presentation, which is not very frequent in these cases, this can be rectified; and if the creature is dead, which is nearly always the case when assistance has not been rendered sufficiently early, and the membranes are ruptured, it can be all the more easily removed.

When the fœtus presents anteriorly and the head can be seized, this should be brought into the pelvic inlet, and cords attached to the lower jaw, or Schaack's head-collar forceps (to be hereafter described) may be employed; then having secured the head, the fore limbs are sought for, and brought into the passage one after the other, where they are also secured by cords around the pasterns. Sometimes these limbs cannot be found, owing to their being bent back against the body of the fœtus, and this will certainly render delivery more difficult.

Should the fœtus present posteriorly, the case is more unfavourable; though if the hind limbs can be found and brought into the vagina, then delivery may soon be effected if there are no other complications.

Cords being fastened to the pasterns, sufficient and well directed traction should be employed on them, the hand of the operator remaining in the pelvis if necessary, in order to guide the passage of the fœtus. Saint-Cyr suggests that an intelligent assistant may at the same time be directed to make

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methodical pressure on the hernia, in order to complete its reduction, which is effected when the contents of the hernia are returned to the abdomen.

At times this reduction is easy, and at other times it is extremely difficult. In the latter instances, all the more care is necessary that the external manipulations are not too forcible, if it is desired to have a living fœtus. Should the resistance prove greater than the means which may safely be employed to overcome it, then a surgical operation must be determined on. When the muscles of the abdomen prove an obstacle to the escape of the fœtus from the hernial sac, and produce a kind of strangulation, an incision may be made through them in the most convenient part, as in the operation for strangulated hernia of the intestine.

In other cases the Cæsarean operation may have to be resorted to, and speedily, if the mother or progeny, or even both, are to be saved. Recourse to this formidable measure will only be had in particular instances: as when the mother or fœtus are valuable, and other means have failed or are not likely to succeed.

And in uterine hernia this operation is undertaken in far more favourable conditions than in some other circumstances which necessitate its adoption. In this accident only the skin, and perhaps also occasionally the *tunica abdominalis*, has to be cut through to expose the uterus, which has not to be sought for among the mass of intestines and laboriously withdrawn from their midst; indeed, it generally occupies the whole of the hernial tumour, and so closely, that there is no danger of the intestines escaping during the operation. A simple incision—no larger than is necessary—through the organ, a larger one through the fœtal membranes, and the prompt extraction of the fœtus therefrom, pretty nearly complete the task.

If the Cæsarean operation is timeously resorted to, the chances are greatly in favour of delivering a living fœtus; with the Cow, as Saint-Cyr has stated, a living and perfectly viable calf is almost certain to be obtained, even a long time after labour is commenced and the "water-bag" has ruptured. And even with the Mare it is not at all impossible to rescue a living foal, if the operation is resorted to before rupture of the membranes.

The chances in favour of the mother are, of course, fewer than with the fœtus; for under the most favourable conditions, after removal of the progeny, there will still remain the great hernial sac, which it will be most difficult to keep the intestines from occupying, and still more difficult to cure in a radical manner: judicious trussing and bandaging being nearly all that can be done to palliate the effects of the accident.

All these considerations should, of course, be duly estimated by the veterinary surgeon in undertaking the treatment of such a case; and it is scarcely necessary to say that, with the Cow more especially, the butcher will frequently have to be called in when the question of risk and expense has been fairly discussed.

It need hardly be pointed out that it is generally very injudicious to attempt to breed from an animal affected with hysterocele, or an abdominal hernia of any description, notwithstanding the fact that this condition may not militate against gestation and parturition in every case.

With the *smaller* animals, and especially the Bitch, the Cæsarean operation has usually to be resorted to for various reasons, the chief of which are the small size of the creature, the difficulty in reaching the fœtus or fœtuses and extracting them by the natural passages, as well as the irreducible nature of the hernia, which is often extremely constricted at the neck, and attempts at reduction are often followed by death. Besides, the Bitch withstands very

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serious operations in the abdominal region better almost than any other animal, the entire uterus having been frequently removed by abdominal section without a fatal termination. In this animal the operation is also very simple, and demands only ordinary care and manipulative skill.

Everything is therefore in favour of gastro-hysterotomy in the uterine hernia of the pregnant Bitch; but in order to ensure whatever success may be possible, it must be performed early, and before serious injury has been done by attempts at reduction or delivery in other ways. It has been argued that it might be preferable to open the sac, divide the constriction which prevents reduction, and return the gravid uterus to the abdomen, when delivery might be effected in a natural and spontaneous manner. And it has been shown that this mode of operating is rational and possible, and may be followed by success should there be no adhesions between the misplaced uterine cornu and the hernial pouch. The experience gained in such cases, however, does not testify very markedly in favour of this procedure, and the evidence is certainly in favour of the Cæsarean operation, and particularly when adhesions exist.

The dangers to be apprehended from gastro-hysterotomy are inflammation and strangulation of the imprisoned cornu and of the uterus, which at this time is so vascular, impressionable, and particularly susceptible to the influence of the air on its internal surface. To avert these dangers, it has been proposed to remove the uterine horn altogether; and we are certainly of opinion that, in certain cases, the proposal is worthy of a trial.

We will describe the Cæsarean operation in another place.

At a recent meeting of the Medical Society of Strasburg, M. Kopp (*Gazette Médicale de Strasbourg*, 1875,) exhibited the uterus and its appendages belonging to a Bitch upon which he had operated in order to extract a fœtus which was lodged in one of the uterine cornua. The animal had been restless for some twenty-four hours when Kopp was called in to examine it; he found every indication of approaching parturition, but notwithstanding these, and the considerable volume of the abdomen, the os uteri was almost closed—a circumstance which decided him to wait. During the night the Bitch gave birth to a dead puppy, and on the following day the diminished distention of the abdomen enabled him to discover, beneath the skin, the presence of three fœtuses. On inquiry, he ascertained that for some time the animal had been suffering from an inguinal hernia on the left side, and this information led him to adopt active measures. The skin was incised over the isolated hernial sac, as far as the inguinal canal; then, after largely opening the tumour, as well as the uterine cornu it contained, he was able to remove the three dead fœtuses and their membranes. The prolapsed uterine portion having been carefully cleansed, was closed by suture and returned to the abdominal cavity, and a strong ligature placed round the sac. The inguinal canal had been widely incised; but notwithstanding this, the reduction of the uterus and its annexes offered some difficulties, in consequence of the great mass of fat in and upon the broad ligaments surrounding them. Everything appeared to be going on favourably until the ninth day, when the animal suddenly succumbed. Death was attributed to purulent absorption, produced through the agency of a small abscess on the broad ligament, which had been abraded during the operation of reduction. There were no traces of metro-peritonitis, and the wound in the uterus, as well as in that portion of the sac which had been ligatured, was cicatrising most satisfactorily. According to Kopp, this was an instance of intra and extra-abdominal pregnancy at the same time; and in proof of this, he pointed to the narrowness of the inguinal canal, and the presence of the uterine hernia previous to impregnation.

Three of the fœtuses were developed in the cornual hernia, and the fourth in the body of the uterus.

Pathological Anatomy.

The pathological anatomy of uterine hernia is not without interest to the obstetrist; and as it has been studied in animals which have died during

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attempts at parturition, or have been slaughtered after that act, the evidence is as plentiful as it is reliable.

According to Saint-Cyr, the chief and essential lesion is of course to be found in the abdominal parietes. The fleshy or tendinous fibres of the oblique muscles may be merely separated, especially at the commencement; though most frequently some of them are ruptured. The great rectus muscle always shows a solution of continuity, the rupture being sometimes as clean and sharp as if it had been made by a knife; though at other times it is irregular and lacerated. In every case there results a variable-sized opening, more or less circular, oval, or triangular, its larger diameter corresponding to the axis of the animal's body; Rodet has seen an opening of this kind measure nearly twenty inches.

The seat of the rupture varies; sometimes the rectus muscle is perforated at its pubic insertion, as Favre has seen it; in other cases it is elsewhere, but in every instance it is inferior, posterior to the umbilicus, and to the right or left of the *linea alba*. The latter structure is at first never involved; but when the hernia increases largely in size, it may in its turn give way; so long as it remains intact it forms a kind of cord extending from the pubis to the sternum, and by partially dividing the tumour, gives it a bi-lobular appearance.

In a few cases the *tunica abdominalis* resists the strain imposed on it, being only extended, and in this way the hernia has another covering, in addition to the skin; but in many instances it tears like the muscles. Delplanque has shown that the peritoneum may escape rupture, stretch and, accompanying the descending viscera, constitute a serous tunic to the hernia; most frequently, however, it gives way, the uterus passes through it, and then there is no hernial sac.

In a recent hernia, the connective tissue surrounding it is greatly ecchymosed and infiltrated, and the muscular fibres broken-up and separated; the tendinous fibres are also separated and torn, and numerous red and partly discolorised blood-clots lie among their interstices. At a later period no extravasated blood is found between the skin and the uterus, but the parts are uniformly red; and, later still, attempts at repair are evidenced by cicatrisation of the borders of the rupture, which have then a rounded, thickened, and fibro-tendinous aspect, and are dense and resisting. The connective tissue beneath the skin is condensed into a kind of smooth membrane, continuous with the margin of the rent, and forms a second tunic to the hernia.

Before parturition the hernia is occupied exclusively, or nearly so, by the gravid uterus, which is wholly or in part lodged in this accidental diverticulum. After delivery, however, the uterus often, though not always, ascends into the abdominal cavity; but whether it does so or not, other viscera—such as the rumen with the Cow, and the colon and small intestine with the Mare—find their way into the pouch; Rodet has even found the uterus and the entire intestinal mass included in it.

Deviation of the Uterus.

By the term *deviation*, when applied to the uterus, is meant a change in the direction of the organ, by which the cervix and os no longer correspond to the axis of the vagina. This change of direction in the vaginal opening of the uterus may be productive of more or less difficulty in parturition.

Changes in the position of the uterus are somewhat common in woman, whose vertical uterus may easily deviate in any direction, producing those

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flexions and versions which not unfrequently offer serious obstacles to delivery. With quadrupeds, however, in which the uterus is horizontal, the veterinary obstetrist has but to deal with one kind of deviation of the uterus, the only one possible—that of *inferior obliquity*, which appears to be extremely rare, and corresponds to the anteversion of the human female.

According to Schaack and Garreau, who have more particularly studied it, this change of position may, in certain circumstances, become a very serious cause of dystokia.

The accident has, up to the present time, only been observed in the Cow; and this circumstance is believed to be explained by an interesting feature in the anatomy of this animal, which has been recently brought under notice by Professor Goubaux, of the Alfort Veterinary School.

It would appear that, in bovines, the abdominal muscles are not attached to the anterior border of the pubis as in solipeds, but are inserted into a thick ligament found at the external and inferior part of the pubic bones, and which strengthens the symphysis pubis. It consequently happens that, at this border of these bones, the floor of the abdomen is on a lower plane than that of the pelvic cavity; so that there is a kind of step between the two cavities, the height of which varies in different animals, but has been found to be as much as three, four, and even five inches. Dissection has demonstrated that the peritoneum lining the lower surface of the abdominal cavity, on arriving at the pubis ascends this step, in covering it like a carpet, to line the upper surface of the pubic bones and the pelvic cavity.

From this anatomical peculiarity, it may happen that the fundus of the gravid uterus, instead of being directed forward, will incline directly downwards and lie on this pelvic step, not passing beyond the umbilicus, behind which it may even rest sometimes. At the same time, and as a consequence of this arrangement, the other end—the cervix—is tilted upwards in the direction of the sacro-vertebral angle, and it may even compress the rectum against that part. It will be obvious that, through this great deviation in the direction of the cervix, the os no longer corresponds to the axis of the vagina, the canal following, of course, the same oblique ascending line as the cervix. Such an alteration in the position of the uterus entails a similar change in the attitude of the fœtus, which, instead of being placed almost horizontally, is now more or less vertical—the head towards the sacrum, and the buttocks resting on the pubic step.

During parturition, as Saint-Cyr points out, we may easily understand how affairs are changed with regard to the performance of this act. The uterine contractions are no longer directed towards the cervix; the os only dilates slowly or not at all, according to the degree of uterine obliquity; the animal is exhausted with ineffectual attempts to expel the fœtus; and if assistance is not rendered, it may succumb without being delivered, or the uterus may rupture. Garreau has observed that labour may be suspended altogether; the fœtus dies, becomes mummified, and is retained for perhaps a very long time.

Diagnosis.

The diagnosis of this deviation does not appear to be attended with much difficulty. The long duration of labour, and the inutility of the expulsive efforts, prove that some obstacle to delivery must be present. Consequently, vaginal exploration is resorted to, and when the hand is passed into that canal it reaches a kind of imperforate *cul-de-sac*, at the bottom of which is a large round tumour into which no opening can be found. This tumour is

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the lower face of the uterus which, pressed against the corresponding wall of the vagina, projects into the pelvic inlet. Raising the hand towards the sacrum, the os will be discovered much removed from its normal position, and situated above and in front of the uterine tumour just alluded to.

Sometimes the os is completely closed, in other cases it may be more or less dilated. When in the latter condition, there is frequently formed at this point a kind of membraneous transverse fold, raised in the form of a valve which has been compared to a fleshy band analogous to that which forms the sacculations of the large intestine; this band is stretched across the lower part of the os, and it has to be surmounted before the hand can touch the fœtus. The latter is lodged in a kind of pouch or excavation situated beneath the band, and constitutes the tumour met with at first at the bottom of the vagina.

Complications.

To Saint-Cyr, Garreau, and Schaack, we are indebted for our description of the condition we have been describing, and to the two latter are also due the knowledge we possess of certain complications which are worthy of notice.

Garreau has found the cervix in this uterine deviation, thickened, indurated, and the os closed. Delivery was impossible, and the fœtus remained for three months in the uterus without causing any great inconvenience to the Cow. At the end of this period the calf was extracted by Cæsarean section, and with perfect success; as the Cow quite recovered, and was sold at a good price eight months afterwards.

In one of the cases described by Schaack, the fœtus was in the vertebro-sacral position, and the limbs and head having been secured by cords, delivery was accomplished by strong traction. In a quarter of an hour afterwards, however, the Cow lay down, trembled all over, the muscles of the limbs and the eyes contracted in a convulsive manner, and death rapidly ensued.

At the autopsy, which was made six hours after death, a quantity of blood, in the form of a large clot, was found in the abdomen, and the textures about the pubis were infiltrated with that fluid. The uterus had resumed its ordinary form, and its mucous membrane was intact; but at the inferior part of the organ, there was a large triangular tear, about six inches long and four wide; and it was noted that this laceration had caused the rupture of two good-sized arteries, which of course led to the hæmorrhage that caused death so rapidly.

Indications.

The indications for treatment in this deviation are simple: raise the fundus of the uterus, lower the cervix, and bring the os on a line with the vagina. When this is accomplished, the uterine contractions will act directly on the cervix, and if this is healthy, dilatation of the os will soon take place; then the fœtus, pushed towards the vagina, instead of against the sacrum, will enter the passage, from which a little judicious manipulation will in all probability remove it, and thus complete delivery.

Several modes of procedure have been recommended for adoption in carrying out these indications. Indeed, Saint-Cyr states that when the deviation is inconsiderable, and the valvular band we have mentioned as obstructing the os is not present, reduction is often spontaneously effected by mere decubitus.

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This, in pushing upwards the fundus of the uterus, brings down the cervix to its normal position by an easily understood tilting movement. Schaack has noticed this to happen in two instances.

In such cases, says Rainard, if the animal persists in standing, it may suffice to raise the belly by means of a folded sheet or blanket, or even a plank held by an assistant on each side of the Cow; or the creature may be gently thrown down on a thick bed of straw.

In difficult cases, however, these measures will not be sufficient, and Garreau recommends the following procedure to be adopted. Introduce the right hand into the rectum and the left into the vagina; with the first press on the head of the fœtus, and push back its body (the vaginal tumour), with the second, tilting, as it were, the young creature into its natural position. This will bring the uterus into its normal situation, and consequently the os opposite the vagina.

Saint-Cyr, nevertheless, gives the preference to the method recommended and practised by Schaack in these troublesome cases, inasmuch as it is more simple, and experience has demonstrated its efficacy. This method consists merely in throwing down the Cow most carefully, placing the animal on its back, and keeping it in that position by bundles of straw. The weight of the fœtus carries the uterus down towards the spine (inferior); the fundus of the organ is depressed, and the cervix raised towards the pubis (now superior); the obliquity of the uterus is thus got rid of.

Schaack has on two occasions resorted to this mode of reduction, and in each case the abnormal valve disappeared, and parturition was rendered easy.

Professor Peuch, of the Lyons Veterinary School, states that in a case of this description, he employed Schaack's method; when the Cow was placed on its back the obliquity disappeared spontaneously, and with the greatest facility.

Torsion of the Uterus: Contorsio Uteri.

Torsion, or "twisting" of the gravid uterus on itself—and which often involves not only the cervix of the organ, but also the vagina—is an accident unknown to the pregnant human female, but for anatomical reasons may occur in animals, and particularly in the Cow, in which it has been most frequently observed. This accident is rare in the Mare; it has been observed in the Sheep and Goat, as well as in the Cat; but though in the Sow and Bitch the uterine cornua may become displaced and twisted on each other, and even become hernied by the broad ligaments, yet torsion of the uterus has not been noted in them, so far as can be ascertained.

We will first study the accident in the Cow, and afterwards in the Mare and other animals.

History.

Though torsion of the uterus is now recognised as a serious, but not insurmountable, obstacle to parturition, yet its existence may be said to be of recent discovery; for though it was clearly and explicitly indicated in the last century by Boutrolle (*Parfait Bouvier*, 2d edition, 1766), yet it was not until after much observation and discussion in this century that such a condition was proved to be possible. Boutrolle wrote: "If it is possible to pass two or three fingers into the os (*vêlière*), the hand and arm may be forced through; but if, on the contrary, a finger cannot be passed into it, and the

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opening is found to be turning, it is a sign that the os is twisted—*that it has made a half-turn on itself*—and it is impossible to enter it."

Though Veterinary Science had gained a sound footing in France soon after the publication of Boutrolle's "Perfect Cowherd," yet its students do not appear to have paid any heed to the amateur's description of the spiral twist of the *cervix uteri*, the difficulty in penetrating the *os*, and the impossibility of birth taking place through it. Indifference or incredulity may have prevailed; and it was not until painful experience had awakened attention to the existence of the accident, that the veterinarians of this century began to notice it.

Nevertheless, in France Boutrolle's "Cowherd" appears to have been carefully read and usefully studied by those for whom it was written—the country-folks or cowmen, or he may have gained his knowledge from these; for, according to Saint-Cyr, one of their great problems in cases of difficult parturition—a problem not confined to the cowherds of France only—was to discover if the calving Cow was not "barrée" (obstructed), if it had not the *torche*, *vélière*, or *portière torse*, *torte*, or *tordue* (cervix twisted), terms employed according to the localities and dialects, and which signify what Boutrolle has distinctly described.

At the commencement of this century, however, we are informed by Rainard that Maurin of Cantal, and Vieillard of Brioude, two of his pupils, had witnessed this form of dystokia.

"On January 13, 1823," says Maurin, "I was called upon to attend on an eight years old Cow which was calving. This animal, which had an enormous belly, had remained lying for four or five days, without appetite, and the pulse quick. It should have calved towards the end of the previous December; and indeed on the 26th and 27th of that month, it exhibited symptoms of pain similar to those of labour, though the 'waters' did not escape.

"These symptoms having disappeared, and everything being tranquil, the proprietor of the Cow thought that he had been deceived as to the precise period at which the animal should have calved, and believed that the pains were merely due to accidental colic, and had no relation to parturition. I endeavoured to assure myself as to whether the fœtus was alive or dead, by strong pressure on the abdomen, in order to excite it to movement if it chanced to be living; but not succeeding in this, I was convinced that it was dead. On trying to introduce my hand, I experienced my first difficulty in passing the bulb of the vagina, which was so constricted that I was compelled to dilate it. Having reached the end of the canal, I was able to assure myself that the *cervix uteri* offered salient folds; as the index finger with which I endeavoured to penetrate the os, found it contracted and plicated. As it appeared to me that the Cow must die, I recommended the owner to sell it to the butcher.

"On opening it, I found the small intestines in the vicinity of the uterus reddened for a considerable extent. The uterus itself was turned round from right to left, and the suspensory ligaments of the cornua were interlaced in one another. When the uterus was opened, the calf was found with its back towards the right flank of the Cow, its limbs being towards the left flank; the cervix formed two very salient spiral turns, which undoubtedly prevented its dilatation. The body of the fœtus did not present any traces of putrefaction, although the 'waters' had a fœtid odour."

Vieillard was able to distinguish this accident in a more evident manner than Maurin, and during the life-time of the two Cows he was called in to see. These animals had the uterus prolapsed, the cervix being external to the vulva, and the posterior part of the organ showed three markedly-spiral folds.

In France, other veterinary observers afterwards published similar cases, the first in order being Lecoq, of Bayeux, who in 1837 had occasion to note this accident. In a *Mémoire sur le part laborieux* (*Comptes Rendus de la Société Vétérinaire du Calvados et de la Manche*, 1838), he expresses his surprise at the silence prevailing among veterinary authorities with regard to this condition, which was met with from time to time, and was well enough known

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to breeders. In describing the symptoms he had noted, Lecoq says: "The hand having been introduced into the vagina, and pushed as far as the neck of the uterus, encountered a kind of valve obstructing the entrance to the latter. I was beyond the part I had taken for a valve, and had got into a narrow canal *which had the form of a screw* (*ayant la forme d'une vis*). The Cow died on the following day without having been delivered, and at the autopsy it was found that the uterus was completely turned upside-down—the superior face having become the inferior—and that this version had taken place from right to left."

The first Veterinarian, we believe, who observed—or, rather, who described—a complete rotation of the uterus (the previous cases recorded were only those of half-rotation), was Mazure, whose description is one of the best we possess. It is published in the same periodical which contains Lecoq's account. From his narrative, it appears that he was consulted by one of his colleagues with regard to a Cow, the cervix of whose uterus was so twisted that a finger could not enter the os. Mazure gave an unfavourable prognosis; but, notwithstanding, it was attempted to reduce the torsion by making an opening in the right flank in order to reach the uterus. The attempt failed, though it demonstrated that there was a quantity of fœtid serosity and fibrinous flakes in the peritoneal cavity; that the uterus had a rupture in its left posterior border, the rent being rounded in form and had a diameter of from twenty to twenty-four centimetres; and that the fœtus was dead, as had been suspected.

As nothing more could be done with the Cow, it was destroyed, and it was then discovered that the uterus had made a complete revolution on its axis; while towards the part adjoining the cervix, there were found five spiral twists, two of which, more voluminous than the others, were of a greyish colour and hard in texture. Throughout the whole extent of these twists in the uterus, the connective tissue, infiltrated with serosity, formed a swelling which rendered the dilatation of the posterior part, and the passage of the calf through it, most difficult. The fœtus was perfectly developed and intact, and did not appear to have been dead more than two or three days.

Another Norman Veterinarian, Pouchy, describes four cases, about the same period. These Cows merely suffered from loss of appetite, great distention of the abdomen, unhealthy-looking coat, a fœtid and sanguinolent vaginal discharge, and suppression of milk, for six to eight weeks; when submitted to treatment, and turned out to pasture, they recovered sufficiently to become fit for the butcher.

In Germany, about the same time, torsion of the uterus had been the subject of investigation and treatment by Dieterichs and Schmidt of Bavaria, Vix of Giessen, Fricke of Hanover, and Irminger and Schenker of Switzerland. Fricke cured a case by fastening the feet together, two by two, and rolling the animal in a contrary direction to that in which the uterus was twisted.

In Britain nothing appears to have been noticed of this accident until 1840, when Mr. Carlisle, of Wigton, under the head of "Cæsarean Operation" (*Veterinarian*, vol. xiii., p. 407), describes an undoubted case of torsion. The circumstance which rendered the operation necessary, was a severe injury the animal had received two days previously, since when it had manifested symptoms of parturition; but though several attempts had been made to extract the fœtus, delivery could not be accomplished owing to the uterus being twisted. Cæsarean section having delivered the calf and its mem-

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branes, the Cow only lived a short time. The uterus was found to be "completely rotated, even to the termination of the vagina."

After this period, torsion of the uterus attracted a large share of attention among the most accomplished Continental Veterinarians, and particularly after the observations published by Dénoc, in France, in 1845. It formed the subject of animated and interesting discussions at the Belgian Société de Médicine, the Société Central de Méd. Vétérinaire of Paris in 1853 and 1860, the Veterinary Society of Wurtemberg in 1854, and that of Denmark in 1855; and memoirs on it have been published by Bordonnat, Rossignol, Gaven, Bouley, Canu, Lemaire, Chambon, Goubaux, Chauveau, Weber, Liautard, Dagoureau, Lessona, Ollivero, Ercolani, Lafosse, Chuchu, Goron, Obig, Heu, Rocco, Marlot, Gourcy, Coquet, and many other foreign Veterinarians; while it is alluded to with more or less detail in the treaties of Rainard, Baumeister and Rueff, Zürn, Harms, Lanzillotti-Buonsanti, Cruzel, Saint-Cyr, etc.

In this country it has not received much attention, if we are to judge from the paucity of allusions to it; though there can be no doubt that the accident frequently occurs. Beyond a few notices from the pen of Carlisle, Cartwright (of Whitchurch), Woods (Wigan), Bennet, and Captain Russell, little more is recorded. These observations only refer to torsion of the uterus in the Cow. No observer in this country has noticed its occurrence in other animals, except Cox.

With the Mare, in which the accident is nearly always fatal, it has been witnessed by Belhomme, Elsen, Delwart, Hamon, Noll, Devaux, Canu, Leconte, Schmidt, and Cox.

In the Cat, it has been observed by Vivier.

Nature and Frequency.

Before proceeding to describe the symptoms and other features of this curious accident, it may be well to inquire into its nature and frequency.

As the designation indicates, the accident consists in a rotation of the uterus on its axis, by which its upper surface may successively become lateral and inferior; and lateral on the opposite side and superior, when the revolution is complete. This revolution may take place in two opposite directions; the upper face may at first be *left lateral* or *right lateral*—the first constituting *left torsion*, the second *right torsion*.

Torsion may be *incomplete* or *complete*. There may be *quarter-torsion*, *half-torsion*, *three-quarter torsion*, or *complete torsion*, according to the degree of rotation the uterus has experienced. In those instances in which the organ has made two complete turns, we have a *double torsion*.

The consequences of this rotation are easily seen. The vagina and its prolongation—the cervix uteri—because of their attachments, cannot follow the uterus, and therefore become twisted in a cord-like manner; whence arises stricture of the os—the constriction being all the greater as the rotation is complete—and utter impossibility to effect delivery of the fœtus unless the uterus is replaced in its normal position, or its contents are removed otherwise than through the os.

Incomplete torsion is by far the most frequent form encountered in practice. It is often so slight that it might rather be classed among the deviations of the uterus already alluded to. For instance, very frequently there is only a trifling displacement of the cornu containing the fœtus, and this may carry the uterus with it, giving rise to a condition which bears a certain analogy to the uterine obliquity met with in woman, in which the organ is

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inclined laterally. Schaack, Rainard, Weiss, and Zundel have often noted these cases in animals; and the latter states that they occur in largest proportion among the larger lymphatic Cows. In other instances, the torsion consists in a quarter or half-turn, the upper face of the uterus having become lateral or inferior; sometimes the gravid cornu comes to occupy the inferior region of the abdomen; and at other times, making a wider rotation, it is lodged in the opposite flank.

There are scarcely any means in practice by which we can estimate, with mathematical exactness, the degree of torsion to which the uterus may have been submitted; as what we have designated a quarter-turn or revolution only signifies that the organ has made a rotation of 90°, while the half-turn is scarcely 180°. Nevertheless, an approximation is all that can be looked for, and, indeed, is all that is necessary.

As we have already mentioned, Mazure, in 1842, had a case of complete rotation of the uterus on its axis; this was remedied by causing the organ to turn completely round in the opposite direction. Other writers have spoken

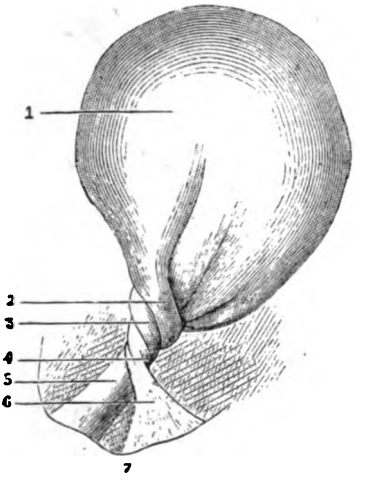

Fig. 68.

INCOMPLETE TORSION OF THE UTERUS.

1, Body of the Uterus; 2, 3, 4, Spiral Twists directed from left to right; 5, Cervix Uteri and Vagina; 6, Suspensory Ligament; 7, Pelvis.

of a complete rotation in some cases, but it may be surmised that it was only a half-turn. Double, triple, and even quadruple twists have been described; because there have been found two, three, or more spiral ridges or doubles, close together, hard, and resisting, and usually parallel to each other. But, as Zundel points out, these multiple plies are only what a somewhat long and supple cylinder makes when it is twisted.

To account for these multiple *plicæ*, which have erroneously been taken for so many complete turns of the uterus, we have only to accept the illustration offered us by Delafond, who, comparing that organ to a long stocking puts a weight in the foot of the latter, and gives it a turn in the middle,

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keeping the open or upper end fixed. Or a small body, to represent the fœtus, may be enclosed in the middle of a handkerchief—the uterus—so as to make a sac. If the end containing the body be turned or twisted on itself, the neck of the sac will have a first ply, representing one-fourth of a complete twist; a second ply will represent the half of a complete twist or turn, and will cross the other; so that when a complete turn has been made, it will be found that there are at least four plies or strands.

Notwithstanding this illusion, however, it is certain that double and even multiple torsion of the uterus may exist; but then the body of the organ and the vagina are close twisted like a cord. This multiple torsion is discovered on

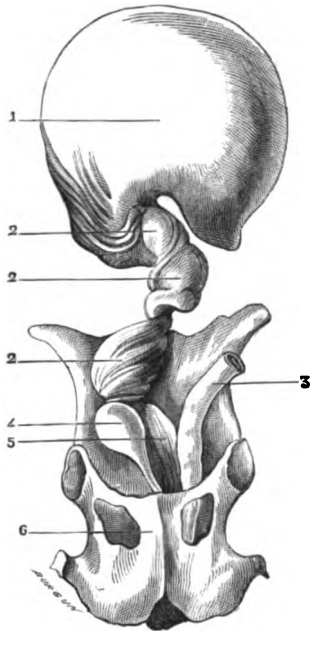

Fig. 69.

MULTIPLE TORSION OF THE UTERUS.

1, Body of the Uterus; 2, 2, 2, Torsion, involving the Body of the Organ; 3, Rectum; 4, Bladder; 5, Vagina; 6, Symphysis Pubis.

making the autopsy of an animal which has died or been killed because of non-delivery. In such a case, it requires two or more turns of the uterus to bring it to its normal position. Such a complicated condition would appear, however, to be very rare.

An important question is that relating to the possibility of such an accident occurring to an organ like this, which is attached to the pelvis by its continuation—the vagina—suspended to the vertebræ in the lumbar region by broad ligaments, and maintained *in situ*, in addition, by the neighbouring viscera, and more especially by the rumen in the Cow—the animal in which uterine torsion is observed by far the most frequently.

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This question can be answered by a reference to what we have stated with regard to the anatomy of this portion of the generative apparatus, at pages 38, 40, and 44. We have seen that, in the Cow, the concave curvatures of the uterine cornua look downwards, and that it is to these concavities the broad ligaments are attached; so that if the uterus be considered as freely suspended in the abdomen, the extremity of each cornu is turned outwards and upwards, while its base, near the body of the organ, although drawn in the same direction by the ligaments, yet retains its position, being firmly maintained in it by the body of the uterus, which also receives the insertion of the broad ligaments on its lower face. This insertion causes the uterus to project above the ligaments, which are very broad, particularly at their anterior border, and widely separated from one another in front, near their lumbar attachment. The ligaments suspend the uterus loosely in the abdomen, and allow it to become fully developed during pregnancy. At this period, too, they become greatly increased in substance and length. As gestation advances, nearly the whole of the great size of the uterus is due to the development of the one horn in which the fœtus is situated; and as the other horn retains its normal size, the twisting of this around its ligament, and consequent torsion of the cervix, can be readily understood.

Such is the explanation of the accident given by Chauveau; but Goubaux does not quite assent to it. According to him, it is not because one horn of the uterus is developed more than another, neither is it owing to one of the broad ligaments being longer than its fellow; it is in consequence of the development of the cornua during gestation, and their projecting greatly beyond their means of attachment or suspension, the broad ligaments being thrown altogether back. During pregnancy the cornua are considerably lengthened, while the ligaments do not increase in breadth, their points of attachment to the inner face of the flank or the ilium remaining invariably the same. This projection of the gravid cornu beyond the broad ligament supporting it—and which may be as much as nearly two feet—must render the production of the torsion remarkably easy. We have shown that the uterus is suspended in its ligaments as in a hammock, and if these ligaments increased in width as the gravid organ is developed in size, so as not to be overlapped by the cornua, then it might to a certain extent roll about in the hammock, but could not twist around it. Even if the uterus was suspended at the extremity of the ligaments, as in the Mare, it would be far less liable to torsion, and would swing in the abdomen like a kind of pendulum.

As it is, the projection of the gravid uterus beyond its means of suspension, the peculiar attachment of the broad ligaments to the lower face and concave border of the cornua, and a large proportion of the weight being situated high above and in front of these ligaments—all this makes us comprehend how a shock of any kind may throw the organ off its hammock, and produce incomplete, or even complete, torsion in the pregnant Cow without rupturing the hammock itself.

Rueff and Ercolani have witnessed cases in which the torsion was confined to the gravid cornu; and Stockfleth mentions its occurrence in the body of the uterus, in front of the cervix. Most frequently, however, it involves the vagina, as well as the cervix and body of the organ.

In certain cases alluded to by Zundel, the accident has been accompanied by rupture of the ligaments; and instances are recorded by Dense and Albrecht in which the rupture has extended to the uterus itself. Rueff alludes to a case in which the fœtus had even escaped into the abdominal

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cavity from a uterus thus ruptured, and, developing in the peritoneal sac, constituted an extra-uterine pregnancy.

With regard to the direction of the torsion, several authorities have maintained that it takes place from left to right. Others, however, have found it to be in the contrary direction, and there appears to be no reason why it should occur in one way more than another, as the fœtus is developed in either cornu irrespectively. Reynal, however, believes that the obliquity of the inner face of the rumen might dispose the uterus to torsion towards the right. Chauveau is, we think, justified in asserting that torsion always takes place inwards and upwards—the fœtus slipping off its hammock causes this to swing round either to the right or left.

The relative unfrequency of this occurrence in the other domesticated animals, is undoubtedly owing to the different arrangement of the uterus and its suspensory ligaments.

With regard to the *frequency* of the accident, this depends upon several circumstances, the chief of which, perhaps, are related to the nature of the country in which the animals are reared, as well as to the manner of rearing them. This will explain, partly or wholly, why veterinarians in one locality are familiar with the accident, while others with as extensive experience never witness it.

Leconte states that he has observed it about a dozen times, in between three and four hundred cases of difficult parturition. Lemaire has met with it seven times in four years; and Rocco speaks of having witnessed about thirty cases of uterine torsion during forty years' practice.

Etiology.

Torsion of the uterus ordinarily occurs towards the termination of pregnancy—about the eighth or ninth month, and its *causes* appear to be very diverse, if we are to accept the numerous opinions which have been offered on this point.

The cause which, of all others, appears to operate most frequently in producing this condition, is a *slip* or *fall*, and particularly on the hind quarters —croup or hocks.

For this reason, uterine torsion is oftenest witnessed among Cows at liberty in pastoral countries, where the ground is broken, intersected, or hilly. Therefore it is, also, that the accident is not at all uncommon in Switzerland and the hilly parts of South Germany; while it is almost unknown on the plains, and is very rare indeed among Cows kept in sheds.

Sometimes the Cow has slipped upon its hind-quarters and tumbled over, through coming in contact with another. Marlot and Liautard have seen it arise from a horn thrust in the flank by a companion Cow, the blow throwing the fœtus and the uterus round to the opposite side. It has occurred in a Cow which was often butting with others. Chambon has noted it in a Cow which was in the habit of rolling like a horse; Dagoureau reports it occurring in a pregnant Cow which leapt on others like a bull, and Liautard in another that used to get its fore feet in the manger. Rocco states that it is produced in shoeing at the forge, when pregnant Cows are either thrown down or put in the travis to be shod; and Rueff mentions a case in which it happened through casting a Cow for the purpose of performing an operation on it. In other instances it has been ascribed to falling when jumping a ditch, or slipping up when descending a steep hill.

Reynal, Mignon, Chambon, Weber, and others, appear to consider meteorism as one of the most certain and most frequent causes of uterine torsion, through

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the displacement of the viscera which the distension occasions. Either the expansion of the rumen induces unusual and inordinate movements on the part of the fœtus; or it acts directly on the uterus, and produces displacement of the organ through the changes in situation and relations imposed on the other abdominal organs. Mr. Cartwright, of Whitchurch, is of opinion that great distension of the stomach may, either of itself, or especially in connection with a fall, cause the uterus to be forced on one side, or twisted.

Other authorities, among whom we find Ercolani, attribute the accident to severe toil when Cows are worked—as in draught; others, to deformity or malposition of the fœtus; and others, again, think it may be mainly, if not exclusively, due to the spontaneous and energetic movements of the fœtus *in utero*, towards the termination of pregnancy. It is well known that these movements are sometimes very lively and powerful, and especially when induced by sudden jerks or blows inflicted on the pregnant animal, or when the abdomen is compressed, after the ingestion of cold water, etc. There can be no doubt that the movements which the fœtus executes in order to get rid of uncomfortable sensations or avoid unpleasant positions, gives rise to those various attitudes and mal-presentations which so frequently render birth difficult, if not impossible; and their occurrence may also explain how the young creature may be the means of causing the cornu in which it is contained, to roll and twist around the vacant cornu on the opposite side. In this way Colin endeavours to account for those cases in which the uterus has made several revolutions on itself when the movements persist—a very rare accident, it is true; while he admits that the quarter or half revolutions—which are, after all, most frequent—may occur without the active intervention of the fœtus, or even of the uterus, and may take place through falls or slips.

Torsion from the above cause Colin thinks is all the more feasible, as at the end of gestation the amniotic and allantoic fluids are diminished in quantity, and the membranes and uterus are therefore applied closer to the fœtus, and may follow its movements more readily.

Chambon and other veterinarians are of opinion that the irregular and often violent movements which the pregnant animals—and especially primiparæ—manifest when the labour pains commence: lying down and getting up again, throwing themselves first down on one side, then on another, and sometimes even rolling, are the most frequent cause of torsion which, according to them, only takes place at parturition. The latter opinion is supported by a case described by Landel, in which, when he made a first exploration of the genital passages at the commencement of birth, there was no obstruction; but soon after, on again exploring, he found that torsion of the cervix uteri had occurred in the interval.

Lessona and a few others believe that the accident may be due to the habit that certain Cows have of rolling themselves alternately from right to left when they are lying. On the sternum they may do this; but though among solipeds and other animals rolling on the back is a perfectly natural movement, yet it is rarely if ever witnessed in the bovine species. Sternal or abdominal rolling could scarcely produce displacement of the uterus.

Rupture of one or both of the broad ligaments, has been indicated by Leconte as always present in torsion; but this is an error, as such a lesion is found to be exceedingly rare after death. But rupture of either or both of these important suspensory bands may take place when pregnancy has well advanced, and there is a severe strain upon them. Then it can be readily understood how the uterus, rolling about among the digestive viscera and

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mainly retained by the cervix and vagina, may twist and twine on itself, and thus effectually occlude the os.

Torsion of the uterus has been witnessed by Pouchy, subsequent to a birth in which there was eversion of the vagina and this organ.

In all likelihood, the stretching of the broad ligaments, through repeated pregnancies, predisposes to it; though this cannot be the sole cause, as torsion is often met with in primiparæ.

Displacement of the uterus by the pressure of a diseased kidney, has been recorded by Rueff. The kidney was of great size, and weighed more than thirty-three pounds.

Symptoms.

We have stated that this accident always takes place towards the termination of pregnancy—from the eighth to the ninth month. But Wegerer, Benzle, and other veterinarians, assert that they have witnessed it so early as the fifth month. Without disputing the correctness of their observations, it must be admitted that, during the early periods of gestation, the means by which the uterus is retained in its situation are sufficiently powerful to prevent any displacement of this kind; and that it can only be at a late period, when the fœtus is fully developed, and, with its membranes, has attained its maximum size and weight—so far as uterine life is concerned, that such an occurrence is likely. And the existence of torsion is generally only discovered when the time for the expulsion of the fœtus has arrived; though it has been said that parturition takes place earlier when torsion is present.

As a rule, there is no particular indication of inconvenience or suffering at the moment when torsion of the uterus has taken place, if it has occurred before parturition; and it would appear that gestation may go on to its termination without any appreciable symptoms being noted, or anything like functional disturbance observed.

Even in the initial stage of parturition, when enlargement of the udder, sinking of the croup, swelling and dilatation of the vulva, etc., have become manifest, there is no sign which can be relied upon to prove the existence of torsion. Only in some instances it has been remarked that the tumefaction of the vulva is not so great as in ordinary cases, and that it remains dry, and appears to be buried more deeply between the ischial tuberosities.

Occasionally some difficulty in micturition is observed before parturition, should torsion have occurred: the urine escaping only in small quantity at a time; or there may be total suppression. This interference with the discharge of the urine is due to the compression the bladder experiences from one of the twists in the uterus.

The first labour pains, which soon appear, are usually feeble and separated by a comparatively long interval of quiet, during which the animal appears to be nothing amiss. Nevertheless, as time goes on, symptoms of colic are evinced now and again, and though the labour pains succeed each other more rapidly, and become more energetic, yet birth does not seem to advance; the "water-bag" does not show itself, and nothing appears externally. This condition may persist for six, twelve, twenty-four, or even forty-eight hours; when, if not before, the veterinarian is perhaps requested to attend.

In other instances, however, the symptoms are more marked and severe during this first period. The animal appears to suffer from the pain of intense uterine and abdominal spasms, marked by violent straining, which comes on at longer or shorter intervals; it moves about anxiously; paws energetically now

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and again; attempts to lie down; rests on its chest or sits like a dog on its hind-quarters; springs up suddenly, and often with a bound. The pulse is quickened, the skin becomes alternately hot and cold, moist and dry; and the expulsive efforts, though so violent, are of course futile.

In many instances, after a period varying from twelve to forty-eight hours, these symptoms may disappear, and the animal seems to have recovered, for the time at least, its ordinary health. To such an extent does this occur, that it might be believed the period of birth had not arrived, and that the symptoms were only those of "false pains."

In the course of from one to six days, however, this normal quietude is interrupted by the recurrence of the labour pains, and in so urgent a form that there can no longer be any doubt as to real attempts at delivery. But still the efforts are not succeeded by any tangible evidence that birth is making progress. As some obstacle to the expulsion of the fœtus now evi dently intervenes, a manual examination will probably be made by the veterinarian, if he has chanced to be called in, and after he has heard the history of the case and noted the general symptoms.

The oiled hand, on being introduced into the vagina, meets at first with no obstacle in that canal; but on advancing into it, the fingers soon encounter one or more folds or rugæ, which render the passage more and more constricted towards the cervix uteri. Towards the termination of the vagina, the fingers reach a kind of *cul-de-sac*, formed by the mucous folds, and which at this part converge in a spiral manner, their direction being either to the right or left. Although at first there appears to be no passage, yet it will be found that by turning the hand in the same spiral direction as the cavity winds, or rather the rugæ incline, the fingers will be able to penetrate to a certain depth; and if one of the most prominent ridges be followed in this way, it will be discovered that it has a cork-screw-like course.

This is the pathognomonic or distinctive symptom of torsion of the uterus, and it is not found in simple deviation or obliquity of the organ. In the latter condition there is no spiral twisting or rugæ, but merely a fold of mucous membrane passing from behind forward, in an oblique manner; while the hand can be passed with little difficulty to the cervix, the os of which is usually found dilated. It is only this fold of membrane, in uterine deviation, which prevents the passage of the fœtus through the os, by hindering uniform pressure on the cervix.

The kind of spiral infundibulum into which the hand penetrates in torsion of the uterus, varies in dimensions according to the amount of torsion. In the quarter-turn or revolution, it may be possible to get the hand into the constriction, though with difficulty, and to reach so far as to touch the neck of the uterus, which may be more or less dilated, and allow the position of the fœtus to be ascertained. In accomplishing this manœuvre, the fingers can feel a large salient spiral ring which becomes wider as the hand enters deeper into the organ, and which terminates in the cavity of the latter in a wide membranous, fan-like manner. If the torsion is to the left, this ring inclines to the right, and the membranous expansion in the uterus is directed obliquely from right to left towards the fundus of the organ. The spiral twist is in the direction of the torsion, and the uterus is carried towards the left flank. In torsion to the right, the arrangement is the reverse of this.

In the half-turn or revolution, occlusion is so marked that the fingers can scarcely be made to enter the obstacle, and the cervix cannot be reached unless the torsion is beyond it. There are always two prominent rings—two

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mucous folds which cross each other, but which, as they recede from the torsion, become wider apart and spread like a fan. We shall investigate the character of this twist hereafter.

In the complete turn, the occlusion is such that only one finger can penetrate to a very slight depth in the spiral stricture, and the direction of the rugæ is very baffling, as they seem to intersect each other, and to run in opposite directions.

In some instances, when the mucous membrane of the vagina is involved, the spiral ridge may be distinguished in the roof of that canal, and even near to its commencement.

When the hand can be introduced into the uterus, it is generally found that the fœtal membranes, as well as the fœtus, are intact, and particularly in the half and complete degrees of torsion. In the quarter revolution, the membranes are sometimes ruptured and the waters discharged for a considerable period.

The fœtus is usually alive soon after the first labour pains; but it quickly perishes, and its death is almost certain to have taken place within forty-eight hours after parturition has commenced. The period of its decease, however, will greatly depend on the intensity of the "pains."

The position of the fœtus varies, according to circumstances. Sometimes when the twist is slight and the passage sufficiently large, it partly enters the pelvis, where it may not only be felt, but seized by the parts first presenting. At other times it is entirely lodged in the abdomen; and at others, again, it may be felt towards the pubis, in a kind of pouch or sub-vaginal tumour, formed by a duplicature of the uterus beneath the inner opening of the os. In the latter case, torsion is complicated with obliquity of the organ, and the tumour not unfrequently considerably elevates the bladder and meatus urinarius.

The form of the abdomen is sometimes characteristic. The fœtus can generally be found higher in it, towards the flank, on the right or left side. This change in the position of the fœtus may also be recognised by exploration *per rectum*, which may also possibly allow the torsion of the uterus to be distinguished, as well as its direction. The uterus can be felt through the wall of the rectum as a tense hard mass, while the broad ligaments may be discovered as hard funicular bands. It may be noted, also, that occasionally the rectum itself is displaced and drawn towards the entangled uterus.

If the animal is not relieved, the symptoms above indicated persist with variable intensity, according to circumstances. The straining and attempts at spontaneous delivery continue either feebly, and with long intervals between, or they are violent and almost incessant. The animal soon ceases to eat and ruminate; it becomes dull and dispirited; fever sets in, and the pulse and respiration are hurried; rigors and grinding of the teeth are remarked from time to time; the lacteal secretion which had commenced is now suspended; the mammæ become soft and small; the eyes sink in their orbit; and extreme prostration ensues. The creature, unable to get up, constantly lies; the pulse becomes imperceptible, while the heart's beats are loud and tumultuous; and death generally occurs from the third to the tenth day after the earliest symptoms were exhibited.

Many authorities are of opinion that death is the only result that can be looked for when assistance is not rendered, and the animal is accordingly left to its fate; and, contrary to what Rainard has stated, they do not admit that the fœtus may become mummified in the uterus and the Cow live and thrive. But we have the evidence of the old French authority, Boutrolle, as well as

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that of Ercolani, Lessona, Rocco, Gurlt, Liautard, Pouchy (already quoted), and others, that this happy termination is quite possible; and indisputable cases are recorded of Cows with unreduced uterine torsions, which have perfectly recovered and fattened, and in the uterus of which, after slaughter, the dessicated or mummified fœtus has been found.

But yet these must be looked upon as exceptional cases; and while they only prove that spontaneous recovery is possible, it must be admitted that, in the great majority of instances, death is not long in appearing in torsion of the uterus, if the organ is not restored to its normal position.

Diagnosis.

The diagnosis of this accident, and the direction and extent of the torsion, are of great importance in an obstetrical point of view. We will therefore consider (1) *The presence of torsion;* (2) *The direction of the torsion;* and (3) *The degree of torsion.*

1. *The Presence of Torsion.*—To recognise the existence of torsion of the uterus is not attended with much difficulty; and in describing the symptoms we have, to a certain extent, shown the manner in which the accident manifests itself to the obstetrist.

It has been stated, that when the hand is introduced into the vagina of an animal the subject of this displacement, it is soon discovered that there is something in the way, and that this appears to be a narrowing of the passage. Passing on, the constriction seems to be increasing, until at the end of the canal there is only a very small opening into which the fingers may pass with difficulty; when inserted there, it is found that they cannot be pushed straight forward, but have a tendency to deviate to the right or left, and finally to assume a spiral course.

We have also stated that this peculiarity in the constriction is markedly characteristic and distinctive of uterine torsion, and this statement holds good in the large majority of cases; so that it is scarcely possible to make a mistake.

In very exceptional instances, however, the torsion may have occurred in front of the cervix—in the body of the uterus; and then the cervix may be easily reached, while the os may even be penetrated, without discovering any indications of the accident. Such occurrences have been recorded by Stockfleth, Ercolani, and Rueff; and these excellent authorities have also witnessed the torsion limited to the cornu containing the fœtus. Here we have neither the constriction of the vagina, nor the spiral involutions of its lining membrane, to guide us to a conclusion, and we must mainly rely on rectal exploration.

Fortunately, such cases are all but unknown in practice, and probably in ninety-nine per cent. it will be found that the twisting has taken place at the cervix, when we have the infallible distinctive sign—the spiral rugæ in the vagina.

2. *The Direction of the Torsion.*—It has been demonstrated that the uterus may revolve on itself in two different directions, and that in order to make a complete revolution, its *upper face* may become *right lateral*, then *inferior*, then *left lateral*, and again *superior;* or if it revolves in the opposite direction, it will become successively *left lateral, inferior, right lateral*, and once more *superior.*

We have casually indicated how the direction of the twist may be dis-

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covered when it has not made a complete revolution. But as Saint-Cyr remarks, the manner of discovering to which side the gravid uterus has inclined, has been one of the most debatable in the history of this accident, and has occasioned much controversy and the most contradictory interpretations; up to the present time, in fact, the problem has not met with a satisfactory solution. The confusion prevailing with regard to what appears such a simple matter, is well exemplified in the discussion which took place in 1860, at a meeting of the Central Veterinary Medical Society of Paris, at which the most opposite notions were promulgated. And yet next to assuring one's self that torsion does exist, the ascertaining of the direction it follows is of supreme importance, as on this alone depends our being able to rectify the malposition of the organ without delay. The disputation appears to have arisen solely from a confusion of terms—from neglecting to define what was meant by torsion from left to right, or right to left; and Saint-Cyr praiseworthily endeavours, and with success, to settle the question by repairing the omission.

"When," he says, "in its revolution the *left* cornu of the uterus passes *above* the *right* cornu, the upper face of the organ becomes successively *right lateral*, then *inferior*, then *left lateral* and again *superior*—thus constituting a complete revolution; the torsion is then *from left to right*, or simply *right torsion*."

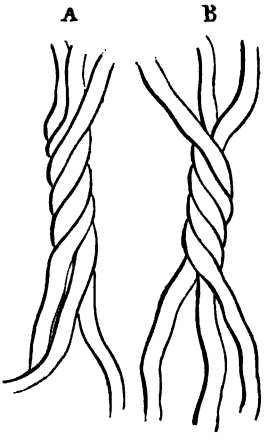

Fig. 70.

A, Cord Twisted to the Right; B, Cord Twisted to the Left.

The reverse movement constitutes torsion *from right to left*, or, better, *left torsion*.

In other words, the passing of the left cornu *over the right* produces *right torsion;* that of the right *over the left cornu, left torsion*.

Hence we have the simple, and easily remembered and understood terms, of *right torsion* and *left torsion*, which are synonymous with *torsion from left to right* and *torsion from right to left*.

This being decided upon, the next question is how to distinguish, from a purely objective point of view, a *right* from a *left torsion;* and this also, it appears, has been a source of difficulty and debate, from neglecting to define terms. Saint-Cyr again has come to the rescue, and his efforts to put the matter in a clear light must be looked upon as eminently satisfactory.

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Glancing at Figure 70, we see two pieces of cord, the strands of which exactly, but more clearly, represent the spiral plicæ of the twisted vagina or cervix uteri. It will be observed from the course of the strands, that the pieces are twined in opposite directions: cord A being twined to the *right*, and cord B to the *left*. This disposition of the strands of a rope being generally recognised as exact in the technical language of mechanics, as well as in speaking of the spiral inclination of the thread of a screw, the same application of the terms should hold good in such a mechanical deviation of the uterus as that now under consideration.

These different torsions can be imitated by the handkerchief, as has just been pointed out; and they are well represented in Figures 68 (left tor-

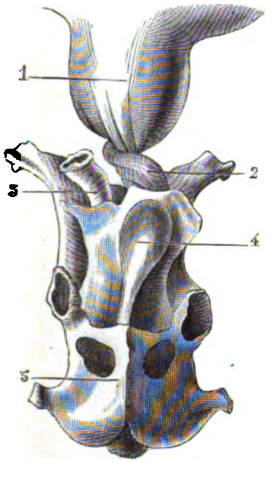

Fig. 71.

LEFT UTERINE TORSION.

1, Body of the Uterus; 2, Cervix Uteri Twisted to the left; 3, Rectum; 4, Bladder; 5, Symphysis.

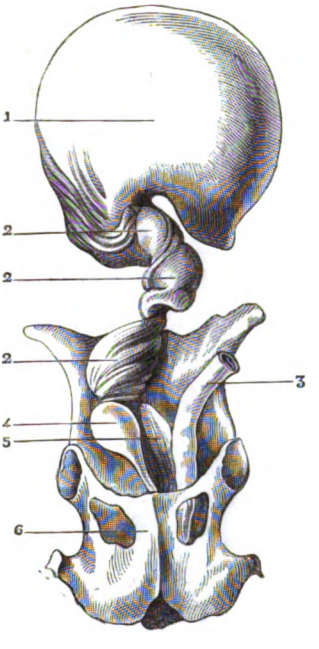

Fig. 72.

RIGHT UTERINE TORSION.

1, Body of the Uterus; 2, 2, 2, Torsion of the Cervix Uteri to the right, involving the Body of the Organ; 3, Rectum; 4, Bladder; 5, Vagina; 6, Symphysis.

sion), 71 (left torsion), 72 (right multiple torsion), and 75 (left torsion), which illustrate simple and multiple, as well as right and left torsion.

This being fully understood, we have now to demonstrate how the different torsions may be distinguished in the living animal, by vaginal exploration. In doing so, we will follow the remarkably lucid directions furnished by Saint-Cyr, to guide obstetrists in forming a diagnosis.

Supposing the *right hand introduced in a state of pronation* (palm downwards) into the vagina of a Cow supposed to be suffering from uterine tor-

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sion, it is evident that, in order to follow the direction of the spiral folds met with, it must execute a kind of rotatory or screw-like movement on the wrist. If this movement is such, that the cubital border of the hand, to the *right at first* (Fig. 73, position A), becomes *inferior* (little finger downwards—position B), then *internal*, so as to arrive at a state of *supination* (palm upwards—position C), then *the torsion is to the right.*

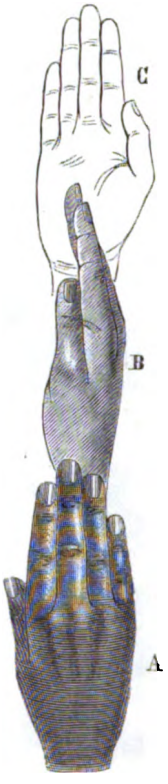

Fig. 73.

RIGHT UTERINE TORSION: MANIPULATION.

Fig. 74.

LEFT UTERINE TORSION: MANIPULATION.

On the contrary, if the hand, in following the spiral folds in the vaginal canal, rotates in the opposite direction, of course *the torsion is to the left.* For instance, as in the other case, the hand is introduced in a state of pronation (Fig. 74, position A), but instead of the thumb turning upwards and round to the right, it inclines downward to the left (position B), the little finger ascending until it is uppermost, and the palm of the hand is turned outwards (position C).

This is a very simple matter, apparently; and yet in practice it may be very important. It may be sufficient, then, if we impress upon the young obstetrist the fact, that when the palm of the hand turns to the left, or in-

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wards, the torsion is to the right; and when it inclines outwards, or to the right, then the twist is to the left.

3. *The Degree of Torsion.*—To ascertain the degree of torsion is more difficult than to discover its existence or direction; though every endeavour should be made to satisfy one's self in this respect, as the "detorsion" will be easy as the torsion is slight, and *vice versâ*.

It has been stated that it may exist as a quarter, half, three-quarter, or a complete revolution; and that it may even extend to a double, treble, or quadruple twist. But it must be always doubtful whether we can diagnose with certainty these different degrees of torsion which may be met with in obstetrical practice.

It is evident, however, that the greater the amount of torsion, so the more will the vagina be constricted, and penetration by the hand rendered difficult. We have already, in treating of the symptoms, drawn attention to the condition of the vagina and cervix uteri in the more simple cases. When, for instance, the hand can be passed without very much trouble as far as the cervix, and the os can be penetrated to such a depth that some parts of the fœtus are felt, then it may be presumed that the organ has only made about one-fourth of a revolution on itself. But if the passage is more constricted, the spiral folds closer together, and the cervix can be reached with much difficulty, perhaps only one or two fingers entering the os, we may expect that the uterus has made a half or three-quarter revolution.

In a complete rotation of the organ, we may expect to find the vagina completely occluded not far from the vulva, the fingers being only able to pass into the funnel-shaped infundibulum but a very short distance, and cannot reach the cervix. The spiral folds will also be close and numerous, and for this reason their direction will be all the more difficult to ascertain.

Prognosis.

With the Cow, torsion of the uterus must be looked upon as a serious accident; for except in a few exceptional cases, when assistance is not rendered the fœtus and mother have always perished. Nevertheless, notwithstanding its grave character, modern veterinary science does not consider it beyond remedy; and its records show that, by judicious intervention, mother and offspring may often be saved.

But in order to attain this happy result, a careful diagnosis must not only be made, and the direction and extent (if possible) of the torsion clearly ascertained, but the proper mode of restoring the uterus to its normal position must also be observed and skilfully carried out.

A cautious opinion must always be given, but its favourableness will of course depend upon the brief duration of the parturient symptoms, the degree of torsion, the condition of the animal, and whether it has been subjected to unskilful manipulation before the veterinarian has been called in.

Pathological Anatomy.

When the animal has been subjected to manipulatory manœuvres to effect delivery, or when it has been permitted to live many hours after signs of parturition have appeared, the first important alteration noted on opening the abdomen is that due to peritonitis. There is a quantity of blood-tinted serum effused into the peritoneal sac, in which float shreds of fibrin; and the lining membrane is reddened, deeply injected with blood in parts, and particularly those which have been in contact with the uterus; not un-

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frequently there is a fibrinous exudate on its surface, and this may cause adhesion between it and different organs.

On removing the intestines and the floor of the pelvis, the uterus and vagina are exposed, and the torsion is visible. This appears as a large, hard cord, composed apparently of a number of spiral strands of unequal size, the closest twined of which are in the middle of the strangulation; this cord—formed by the termination of the vagina and the cervix and body of the uterus—opens out its strands as it recedes from the densely-twined portion towards the fundus of the uterus on one side, and to the vagina on the other.

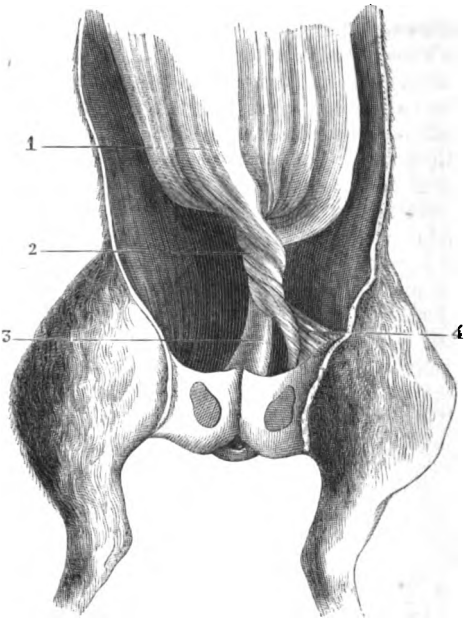

Fig. 75.

LEFT UTERINE TORSION *in situ*.

1, Body of the Uterus; 2, Twisted *cervix uteri*; 3, Vagina; 4, Left Fallopian Ligament.

The broad ligaments are sometimes compressed between the spiral folds, which they concur to form, and with which they are so intimately connected that very often they cannot be recognised until the uterus has been untwisted. In other instances, they merely envelop the twist in crossing it; so that the extent of the torsion cannot be seen until the ligaments are detached from the ilium on each side.

Rarely, as we have remarked, are these ligaments ruptured; and though some veterinary authorities have maintained that torsion is impossible without one or both being torn, yet we know that this lesion is seldom witnessed. In the large majority of cases, they are tense and greatly stretched, tightly compressing the cervix and rendering occlusion of the os all the more rigid; but when the uterus is reinstated in its natural relations, they are found to be intact.

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If the uterus be seized at its fundus, and turned in a direction contrary to that of the torsion, the strands of the latter gradually open, widen, and are effaced; while the strangulation disappears, the cervix comes into view, and the vagina assumes its normal length and width, as well as cylindrical form.

So that the hand introduced into the vagina, *per vulvam*, no longer encounters the spiral plicæ met with in the animal while alive; but passes through the canal, and even into the uterus, without hindrance. The number of turns necessary to accomplish this will indicate the amount of torsion which had taken place. Most frequently only half a turn is necessary, showing that the uterus had made half a revolution on its axis—the upper surface having become the lower. Sometimes the quarter of a turn will suffice to adjust it; while in other instances a complete turn, or even two, three, or four turns in the opposite direction to the torsion, may be needed before the obstruction to the genital passages disappears.

At times the uterus and vagina exhibit signs of inflammation, particularly towards the strangulation, and the indications of acute metro-peritonitis are frequently most marked. In exceptional instances we may have gangrene of the uterus, probably due to obstruction of the bloodvessels implicated in the torsion.

As a complication, a more or less extensive rupture, complete or incomplete, of the uterus may exist: possibly having been produced by the severe uterine contractions during the life of the animal. This rupture implicating the walls of the organ, is most frequently met with in its body, in the vicinity of the twisted portion, or at the junction of the gravid cornu with the uterus. The fœtus has been at times found partly fixed in the fissure.

With regard to the fœtus itself, its condition varies with the length of time which has elapsed since it perished, and also whether or not the external air has had access to it. In some instances, even when it has been dead for a long time, it will be found in a state of perfect preservation; in others it is in an advanced stage of putrefaction, the hair and hoofs coming off readily, and the body swollen and emphysematous, while the odour emitted is disgustingly powerful and fœtid.

In rare cases the fœtus is mummified, and this may even occur when it has attained its full development.

Such is an outline of the pathological anatomy of this accident. Numerous illustrations of the various lesions met with after death might be furnished, but we will content ourselves with quoting two or three of the very few cases recorded in this country, in addition to that published by Carlisle and already referred to.

In Carlisle's case the following lesions were noted: On opening the abdominal cavity to its full extent along the *linea alba*, the pelvic region was found to be "completely crammed with the small intestines in a far advanced state of putrefaction; as far as the anterior ridge (brim) of the pelvis at this place, the portion of intestine was completely strangulated. Anterior to this the bowels were free from inflammation, and the only abnormal appearance was the mesentery which attaches the small intestines to the spine, which was torn from the spine for a considerable length. The bladder was free from inflammation, and void of urine." On examination of the uterus, there was discovered an extensive rupture of the broad ligaments, near to the cervix uteri. "For about four inches there was a high degree of inflammation, clearly pointing out the place where it had been twisted. The other parts of the

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uterus were healthy. The vagina appeared inflamed throughout its whole length;" this condition was supposed to be due to the frequent and long-continued attempts to introduce the hand to extract the calf.

The cause of all these lesions was "the Cow tumbling into a ditch, and remaining there for some time struggling very much." "The calf and uterus were turned or twisted in consequence of the lateral ligaments giving way, which would take place during the fall, as the poor animal completely turned over before she fell to the ground. The mesentery might possibly be torn at the same time, and the intestines forced into the pelvic cavity. That part of the gut which rested on the brim of the pelvis was strangulated, from the weight of the calf resting on it; and the other portion, which was forced back, was continually under the influence of excessive pressure, from the poor creature's attempt to rid herself from pain."

Mr. Bennett (*Veterinarian*, vol. xlv. 925), called to see a Cow which had been suffering from aphthous fever, but which on recovery began to exhibit symptoms of abdominal pain, found on examination that it was near the period of parturition: the pains, indicated by the symptoms, being somewhat allied to those of labour, but were unaccompanied by any dilatation of the os uteri. The pulse was quick and tremulous, the breathing rapid, and the surface of the body bedewed with perspiration; the fæces and urine were voided during the painful expulsory efforts. Supposing the fœtus to be dead, and that in due course the os uteri would be dilated, diffusible stimulants were administered with the view of sustaining the animal's strength and assisting in the expulsion of the calf. Subsequently, on the same day, the pulse was rather more distinct; though the eyes were more sunken and the general indications of suffering more marked. On the following morning it was much worse, being almost pulseless and evidently dying, and no signs of delivery. The Cow died soon after.

On making a *post-mortem* examination, the uterus was found to be much congested, its vessels being turgid with blood, and its walls very much thickened. But what, in Mr. Bennett's eyes, was a very singular thing, was the presence of a "complete twist in the neck of the uterus; so that the uterus must, calf and all, have turned quite over in the abdomen." Whether this state of things arose from the Cow rolling or from any other cause, Mr. Bennett could not say; though, from the appearance of the uterus, he imagined the accident might have occurred forty-eight hours. He adds that, "No doubt the strangulation would lead very quickly to the complete congestion of the vessels of the womb and to the speedy death of the calf."

At a meeting of the Liverpool Veterinary Medical Association held in 1875, Mr. Woods described a case of "twisted uterus" in a Cow, the organ containing a fully developed fœtus, and the os having become hermetically sealed. The animal had been ill for some time; but it gradually recovered, and was fed for the butcher. When killed the fœtus was discovered to be quite perfect, but the membranes had disappeared through absorption.

Captain Russell, M.R.C.V.S. (*Veterinary Journal*, November, 1876), relates that he was called to see a heifer described as "straining a good deal," and had been doing so for sixteen hours, as if attempting to calve; but that "nothing was visible, nor was her time up for another month or six weeks." The Cow was lying, and evidently in great pain; it was straining violently; the eyes were sunken; the pulse was very frequent, feeble, and almost fluttering; with other symptoms denoting great exhaustion, and apparently speedy dissolution. On making an examination *per vaginam* in the usual manner, to ascertain if it was merely a case of mal-presentation of the fœtus, the hand could only be introduced about six inches, the walls of the canal feeling as if coiled from left to right; the mucous membrane seemed to be much congested, and felt "corded," hot and swollen. Twisted uterus was diagnosed, and reduction was attempted by turning the animal from right to left, but without any benefit.

The symptoms being so urgent, and as the Heifer was in good condition, it was immediately destroyed. On opening the abdomen, the entire body of the uterus was discovered to have made a rotation from left to right, the upper having become the under surface. The torsion itself was much congested and strangulated, and the pelvic cavity between the walls of the vagina and rectum, and between the former and the floor of the pelvis, was full of effused serum of a jelly-like consistence—evidently the result of long-continued straining. The fœtus was well developed, and had apparently been dead for some hours, decomposition having set in.

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How or when the uterus became displaced in this instance, could not be discovered, as the animal had been turned out to pasture with several others, and nothing had been observed amiss with it until the previous day. Then it was observed to lie down and get up frequently, and to stand with the back raised and tail elevated; straining very much in that attitude.

Treatment.

The successful treatment of torsion of the uterus had, to the great majority —indeed, to all—of the veterinary obstetrists of not long ago, evidently appeared hopeless; consequently, the animal suffering from this accident was either left to die without succour, or was consigned to the butcher if its carcase could be utilised for food. In some few instances, as we have seen, the animal has not succumbed, but recovered from the effects of the torsion, and without reposition of the organ having been effected. After fruitless efforts, the labour pains have subsided, the fœtus dies and becomes mummified; the Cow is in an ailing condition, perhaps, for some time, but rallies, and may even regain its former condition, not unfrequently even yielding a certain quantity of milk.

In other cases the Cow becomes emaciated and miserable looking, gives no milk, and generally succumbs, after a variable period, to chronic peritonitis. But in far more instances serious illness ensues at the very commencement, and we have metritis and peritonitis, gangrene of the uterus, putrefaction of the fœtus, septikæmia, paraplegia, or other grave conditions which quickly terminate life.

In British veterinary literature only two successful attempts have been recorded, and these by Mr. Cartwright, of Whitchurch, one being so late as 1875.

On the Continent, although many cures have been published, yet they only date from a comparatively recent day. Nevertheless, according to Rainard (*Traité Complet de la Parturition*, vol. i. p. 420), Vieillard long ago (1823) succeeded in one instance in saving a Cow and calf, through having recourse to vaginal hysterotomy. In this case there was inversion of the uterus, the cervix of which was extruded beyond the vagina, and showed three markedly-salient spiral rings. He experienced much difficulty in making convenient openings; the extensive incisions he was compelled to make, in order to remove the fœtus, became lacerations, and there was serious hæmorrhage. Yet the animal made a good recovery. This formidable operation has not found an imitator, and does not require one: except perhaps in a similar case, and in which there is eversion of the vagina, so that the parts to be incised are visible.

The principal—indeed, the sole—indication for the relief of this accident is to *untwist the uterus;* in doing this the cervix and os are restored to their normal condition, and the vagina rendered patent, while the uterus itself assumes its ordinary relations.

Various methods—all of which have been attended with more or less success in practice—have been devised to accomplish this object.

They are (1) *Abdominal taxis;* (2) *Vaginal hysterotomy;* (3) *Vaginal taxis;* (4) *Denoc's procedure;* (5) *Darreau's procedure;* (6) *Rotation of the Cow's body;* and (7) *Gastro-hysterotomy*, or *Cæsarean section.*

1. Abdominal Taxis.—The idea of opening the abdomen, and thrusting the hands and arms into its cavity, in order to search for the twisted uterus, then to untwist it directly by turning it on its axis in a contrary direction to the torsion, in order to deliver the animal by the natural passages, is at first

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sight an eminently rational and practical procedure, and one which, occurring independently to several minds, has been resorted to by a number of veterinary obstetrists. But, however simple and feasible it may appear, yet it is very far from being an easy or always successful method, and this for several reasons. Among these may be cited the great weight of the gravid uterus —from 112 to 180 pounds—its immense size, its convex, smooth, and slippery surface; the limited space there is in the abdominal cavity for manipulation; and the obstacles the other viscera offer to version manœuvres.

"Nothing," says Mazure, after repeatedly trying this method, "appears more simple to the mind than to seize with the hand one of the sides of the uterus, and to swing it round, and especially as it is restoring the organ to its natural position. Yet no one whom I know is competent to perform this simple movement.

"My *confrère* and I tried to swing round the uterus," writes Gosselin, "but it was in vain; all our efforts could not even cause it to change its place."

Bouley attempted this method in 1853, but did not succeed. After failing in other manœuvres to effect the detorsion of the uterus, in despair he made a large incision in the right flank, in order to try if he could not, by direct taxis on the organ itself, restore it to its ordinary condition. But he was disappointed: for the uterus, enormously distended, so completely filled the abdominal cavity that the hand could scarcely be introduced between it and the walls of the abdomen; while the surface of the uterus was so smooth that the operator's fingers could not cling to it.

Notwithstanding, this operation—which, from having been performed in the region of the flank, has received the designation of "laparotomy" (from λαπάρα, *flank* or *loins*, and τέμνειν, *to cut*)—has been practised with variable success in Germany by Fausel (1849),* Epple (1852), Kohler (1853), Diccas (1867), Lechleuthner (1868), Obich (1869), Heichlinger (1869), etc.; in France by Darreau, Garreau, and others; in Italy by Santoni and Rocco; and in Denmark by Stockfleth.

We have said that the success attending laparotomy has been variable. This is exemplified in Obich's experience (*Wochenschrift für Thierheilkunde*, 1869). This veterinarian had three cases of uterine torsion, in which he resorted to this operation to replace the organ. Two of the cases were attended with complete success; but in the third the uterus was of such an extraordinary size and weight, that he failed to restore it to its natural position. He proposed in future to facilitate the operation by using a looped cord with which to raise the organ.

Heichlinger operated successfully on a Cow in the same manner, but the animal afterwards perished through gangrene of the uterus.

It must be admitted that the operation has not been performed sufficiently often, and then sometimes in very unfavourable circumstances, to enable us

* It is worthy of note that the idea of resorting to laparotomy occurred to an excellent veterinary practitioner in Scotland, perhaps long before it did to Fausel, though for lack of opportunity it was not carried into effect. Mr. Cartwright, of Whitchurch, writing, in 1850, "On Torsion of the Uterus in the Cow" (*Veterinarian*, vol. xxiii. p. 248), and its treatment, and proposing to try rolling the animal, adds: "If I did not succeed in this way, I should proceed according to a suggestion given me by Mr. John Steel, of Biggar, Lanarkshire—viz., to make an incision between the ilium and the ribs on the right side, and try to untwist it (the uterus). If I succeeded, I should sew up the wound and allow the labour to take its natural course; but if not, I am not aware that there is any other means but that of performing the Cæsarean operation. Mr. Steel, although he has not yet had an opportunity of testing its practicability, deserves the thanks of the profession for such a suggestion, and it is one which I think very likely to succeed. At any rate, if it does not, we can but perform the Cæsarean operation."

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to draw any satisfactory conclusions as to its value. Darreau, who has been fortunate in some of his attempts, writes: "Direct taxis by an opening made in the flank has had some advantages; I have even thought for a moment after my first success that it would be the only means I should resort to for the future. But, unfortunately, new cases upset my predictions, and compelled me to seek for more efficacious means." And Faussel admits that the considerable weight of the uterus may sometimes prove an insurmountable obstacle.

The dangers attending the operation, even if reposition of the uterus is effected, are as great as its difficulties. Several good authorities have therefore recommended its abandonment, or at least its being adopted only in very exceptional circumstances.

Operation.—Different operators have different modes of operating. Some prefer the animal in a standing position; others throw it down. One selects the left flank; another, and perhaps with more reason, incises the right flank. Diccas, whose procedure appears to be preferred by Saint-Cyr, operates as follows: The animal is led into a suitable place, and secured as if to be operated upon for internal hernia. The skin and muscles of the right flank are carefully divided for about five or six inches, the opening being directed downward and slightly forward. The cord fixing the hind quarters of the animal (which is standing) is slackened a little, and the hand is introduced into the abdominal cavity and pushed *towards the left side*, passing it *above the uterus* if the torsion is from right to left; but *towards the right side* and *below* the uterus if the twist is in the opposite direction. The displaced organ is then seized, and endeavours made to bring it into its normal position by lifting and drawing it towards the incision. To prevent the hand slipping on the surface of the uterus, it is wrapped round with a piece of thin cloth. Two assistants are required, one of whom exercises a certain amount of pressure on the abdominal walls; while the other finds out, by vaginal palpation, the extent of replacement which the uterus undergoes.

When reposition is complete, the hand is withdrawn from the abdominal cavity, and the lips of the wound are brought together by four or five tape or wire sutures, and, if thought necessary, a pitch plaster may be fixed over it.

According to Obich, within eight days the wound will have healed by first intention.

2. Vaginal Hysterotomy.—We have noticed that Vieillard, so long ago as 1823, removed the fœtus from a twisted uterus by means of vaginal section. In 1856 Ercolani proposed *vaginal hysterotomy*, the opening being made through the upper wall of the vagina, for the reposition of the twisted uterus. The operation is of the same kind, and is conducted in a similar manner, as that for the castration of Cows, introduced by Charlier; except that, instead of the ovaries being seized, the uterus is grasped through the wound, and attempts made to untwist it. Rueff speaks in favour of the proceeding; but we cannot find that it has ever been carried into practice, and serious doubts may be entertained as to the likelihood of its being successful, from the weight and size of the gravid uterus, and only one hand being employed to turn the displaced mass, unless the displacement should be very trifling; in which case a simpler operation might succeed.

If attempted, not much risk may be apprehended from incising the vagina, as it has generally been found to be attended with little danger, and cicatrisation soon takes place.

3. Vaginal Taxis.—All sanguinary and serious operations for the cure of

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uterine torsion—like the two preceding—should be avoided, if possible, until the simpler means which modern veterinary science has indicated are tried. We allude more particularly to *version*, which rarely fails to bring the case to a satisfactory termination. That is, of course, on the assumption that this is resorted to sufficiently early; for it must be remembered that nothing is gained by delay in this accident, and if relief is to be afforded it must be rendered promptly, and as soon as the existence of displacement is fairly established. When delay has been allowed to take place, more or less serious consequences must ensue to either the fœtus or the maternal organs, or to both.

In certain cases of very incomplete torsion—quarter rotation of the uterus, for instance—and when there is sufficient space in the vagina for the hand to pass through the obstacle and into the os or uterus, detorsion has been accomplished by seizing the most suitable parts of the fœtus and exercising direct traction on it. Instances of success by adopting this course have been furnished by Chambon, Cann, Gaven, Darreau, and others.

The mode of procedure may be as follows:—After ascertaining the direction of the torsion, the arm is to be introduced into the uterus as deeply as possible; if the fœtal membranes are yet intact, they must be largely ruptured, and the most convenient parts of the fœtus sought for. In this respect it will be found that every part of the young animal does not offer the same advantages to the operator, for reposition of the uterus. The head is too large and does not afford sufficient hold for the hand; the pasterns and knees are too much removed from the body and too round; but the hocks and elbows are, of all parts perhaps, those best adapted for this kind of manipulation. If one of them can be reached, it should be firmly grasped, and endeavours made by it to raise the body of the fœtus, at the same time giving it a turning movement contrary to that which we would give the uterus in order to untwist it.

Supposing, for example, that the torsion is to the *right*, and that the fœtus, offering an anterior presentation, is, from the fact of the quarter revolution of the organ, in the *right vertebro-ilial position*; then the object must be to place it in the *vertebro-sacral position*.

To effect this, the right hand, in a state of *supination* (knuckles downwards, palm upwards), must be introduced *beneath* the fœtus, and, if possible, the left fore limb seized by the elbow; then the operator, turning his arm round, raises the body of the creature, at the same time turning so that the withers describe the arc of a circle from right to left—from the right flank of the Cow towards the sacrum.

Sometimes when the fœtus is alive, at the moment this manœuvre is being executed it makes a movement which greatly assists the efforts of the operator.

If the dimensions of the vagina admit of it, the limbs of the fœtus may be drawn into the pelvis, and even as far as the vulva; and while the operator is acting as described on the upper part of one of the legs, an assistant presses on the free portion, and by thus aiding in the version considerably facilitates the task.

By this procedure several obstetrists have been successful in re-adjusting the uterus, through the medium of the fœtus; the adjustment being ascertained by the disappearance of the spiral mucous folds from the vagina and the patency of the canal.

Nevertheless, it has been remarked that this operation is not so easy as one would be inclined to imagine it without testing it in practice. It requires

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much force to raise and turn the fœtus in this way; and the constricted vagina and powerful uterine contractions are formidable obstacles to the exercise of that force.

Some veterinarians, as Meyer and Losner, have succeeded in adjusting a slightly twisted uterus by introducing the hands into the vagina, and aided by assistants, who manipulated either with their hands or by means of boards or sheets applied externally to the abdomen, so as to set the organ straight. Of course, such attempts must be greatly promoted if the fœtus can be reached and used as an instrument in the manner just alluded to.

4. DENOC'S PROCEDURE.—Denoç appears to have been the first veterinarian who attempted reduction of this torsion by the simple means stated above, but applied in such a manner as to merit the designation of "original." His procedure marked a great step in advance, so far as veterinary obstetrics are concerned.

In 1845 he describes the case of a Cow (*Recueil de Méd. Vétérinaire*, 1845, p. 69) unable to calve, but whose *os uteri* was sufficiently dilated to allow him to pass his hand into the uterus, where the fœtus lay in a good position, but from which it could not be expelled, owing to a wide membranous fold extending from the cervix to the fundus of the organ.

His manner of getting rid of the torsion consisted in suspending the animal by a very narrow sack passed under its chest; and two pulleys having been fixed in the wall on the right side—one corresponding to the fore limbs, the other to the hind ones—the fore legs were tied by a cord which passed through the corresponding pulley, while the hind ones were also secured by another cord running through the posterior pulley. Five men were posted to the distal end of each of these cords, and directed to pull. When this was done, the suspended Cow was swung into a dorsal position. Then two strong men, placed on the left side, were directed to push the animal's body to the right —a movement which caused it suddenly to rotate.

An exploration with the hand led to the discovery that the uterus had changed its place, but that there was either a double torsion, or the inversion of the aninal had only incompletely turned the uterus, as the duplicature was still present at the cervix.

Another pull was given at the cords, and the previous manœuvre repeated, and this time with a good effect, as it was found that the obstructing fold had now vanished, and the uterus was in its ordinary position.

The Cow was then left alone, to await the result of its own expulsive efforts; but nothing having transpired after about an hour, a dose of ergot of rye was administered. Another hour had not elapsed until parturition was accomplished without the slightest difficulty, two calves being born.

5. DARREAU'S PROCEDURE.—Denoc's method does not appear to have been much practised, either because it was lost sight of, or was only adapted for cases of very slight torsion; and in view of the great difficulty generally experienced in vaginal taxis—which is, after all, the most reasonable, least dangerous, and perhaps the most convenient of all methods—several devices have been brought forward to render it more easy and effective. Of these none deserves more notice than that of Darreau, and which was brought before the Central Veterinary Medical Society of Paris in 1852. The improvement in vaginal taxis for this accident, mainly consists in the employment of what has been designated a "uterine retroversor" (*uterin rétroverseur*), an appliance which would appear to be very ingenious, if complicated.

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And, besides, it is only of service in those cases in which the hand can be introduced in the uterus and the feet of the fœtus seized—a state of affairs, unfortunately, not always—nor indeed very often—present in torsion of this viscus. Liautard and some others, however, while admitting that the apparatus is not very easily applied, yet testify to its utility.

The apparatus is composed of three rods (A, A′, A″; Fig. 76); of a winch (B); of a screw, with a movable screw-nut (D), pierced by three holes; and, finally, three cords (E, E′, E″) with a loop (F). The end of each rod (G), a little thickened, has a longitudinal hole (H); the other extremity (I) has a

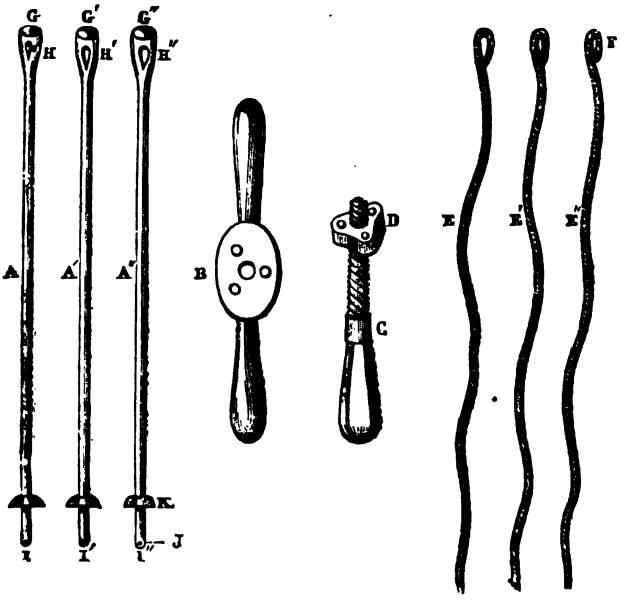

Fig. 76.

DARREAU'S RETROVERSOR.

hole punched through it, and a shoulder (K). This end of the three rods is inserted into the three holes of the winch.

The apparatus is put together for use in the following manner:—The cords are fastened by their loop (F) to the two pasterns and the lower jaw of the fœtus, and serve as points of attachment as well as conductors to the rods. With this object the obstetrist passes them, one by one, through the hole (H) in each rod; then, by one hand, he seizes the extremity (I), and with the second hand the other end (G); directing the latter towards the part of the fœtus to be pulled at, an assistant who keep the cord tense passes this through the hole (I). This done, each rod is inserted in one of the openings of the winch, the screw (C) is pushed through the middle hole, and the cords are passed through the holes in the nut (D) of the screw (C), by means of which they are made as tight as may be necessary.

The apparatus may be used either while the Cow is standing or lying on its back. By turning the handle of the winch in a contrary direction to the torsion,

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counter-torsion is at once effected without difficulty, and without causing the animal any fatigue. If the resistance is at all great, the operator entrusts the instrument to the assistant, passes his hand into the uterus, presses on the head of the calf, and in this way aids the action of the retroversor. Parturition then takes place naturally.

6. Rotation of the Cow's Body.—The methods of Denoc and Darreau are likely to be useful only in cases in which the uterus is slightly twisted; and in these instances, and others in which the torsion is much greater, the method about to be considered is so simple, attended with so little danger, and hitherto has yielded such favourable results, that it is certainly to be preferred, unless vaginal taxis can be resorted to with every chance of speedy success. This method consists in rolling the animal affected with uterine torsion, in such a manner that the twist which forms an obstacle to parturition is effaced, and the genital passages are open for the passage of the fœtus.

This method has been in vogue for a long time, and its introduction is due, according to Dieterichs, of the Berlin Veterinary School, to Fricke, a Hanoverian veterinary surgeon. At least this would appear to be the fact from what Dieterichs has stated with regard to Denoc's procedure in 1845 (*Recueil de Méd. Vétérinaire*), when he says that not only had Schmidt, Vix, Irminger, and Schenker—all German veterinarians—mentioned the occurrence of torsion of the uterus; but that Fricke, in addition, cured a Cow of the accident by tying its feet, two and two, then rolling it, taking care to move it in a contrary direction to that in which the torsion had been produced.

German, French, Belgian, and Italian veterinary obstetrists have practised this method of reduction in a very large number of instances, and altogether with most gratifying results. Mr. Cartwright, in England, has been successful in two cases. As with Denoc's rotation method, this is a version of the uterus, and not of the fœtus.

The manner of rolling the animal varies somewhat with different authorities, but in principle all are agreed. The first step, after ascertaining the existence and the direction of the displacement, is to empty the udder of its milk as completely as possible, so as to prevent the gland being injured during the operation.

While this is being done, a sufficiently roomy place should be got ready, and the floor covered with a thick layer of straw; on this the Cow is thrown on the proper side, and with all possible care, the feet being fastened together. The hand and arm are then to be introduced as far into the vagina as its condition will permit. Should the os be accessible, and dilated, some part of the fœtus must be secured, and more especially a limb; this must be firmly maintained in one position. If the fœtus cannot be reached, then nothing remains but to make the wall of the vagina the point of resistance until a better can be made available.

The assistants are then to pull at the ropes which secure the feet, so as to bring the Cow on its back; then gently, and without jerking, allow it to fall on the opposite side. This being done, the animal is raised on its chest, by the shoulder and quarter, and turned over on the side on which it was thrown. In this way it will have made a complete rotation.

While the assistants are rolling the Cow, the operator, with his hand in the vagina or uterus, as the case may be, endeavours, by pressing in the opposite direction, to keep the organ fixed and to prevent its following the movement the body is undergoing.

If the operation is well conducted, and the body of the Cow moved in the

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proper direction, the obstetrist will find, as rotation is carried on, that the genital passage is becoming wider and the obstacle disappearing, until, the spiral rings having become effaced, the hand can reach the cervix and penetrate the uterus if the os is relaxed. Generally a gush of the liquor amnii from the organ announces the termination of the operation.

If, however, the hand is more strongly compressed by the spiral folds as the animal is turned on its axis, and the vaginal canal is diminishing in length, it is a proof that rotation is effected in the wrong direction. This is remedied, of course, by reversing the movement.

Sometimes it is sufficient to make the animal execute a complete turn to bring the uterus into its usual position. More frequently, however, this rotation only relaxes the constriction and does not entirely efface the rings; so that it is necessary to continue the turning—always in the same direction—until the desired result has been obtained. Then parturition can be completed in the ordinary way.

It will be seen from this description that the method consists simply in rolling the Cow as one would roll a barrel; and the only point now to be discussed, is the direction in which it should be rolled.

This point, strange to say, has given rise to as warm and as unsatisfactory discussions as some of the other points to which reference has already been made. Some authorities have declared that, to achieve the reduction of the torsion, the Cow must be rolled in the same direction as it; others assert that the rolling should be contrary to the torsion; while others, again, pretend that both procedures are correct, according as in one the uterus is maintained fixed, while in the other it remains free in the abdominal cavity.

The confusion imported into the discussion was probably largely due to the manner in which each disputant looked at the question—or, rather, to the position in which he mentally placed himself during the supposed operation. For instance, one may have fancied an animal in a standing attitude placed before him; another, with a Cow lying on its back; another stood in front of the beast; another imagined he was behind it; and another stood at its right side, while a seventh viewed it from the left. Consequently, each discussed the torsion, and the mode of remedying it by rolling, from his own particular point of view; so that the terms they employed in the discussion could not fail to be contradictory.

Fortunately, in practice no great harm could result; as in whatever direction the torsion may have existed, and however baffling the spiral curving of the vaginal rugæ may have appeared in bad cases, the grand test and guide was the effect produced by rolling. If, when the Cow was turned to the right, the vagina became shorter and more firmly constricted, then it was evident that the animal was being rolled in the wrong direction, and rolling to the left was indicated, when the constriction would be diminished and the vagina lengthened. The procedure might be empirical; nevertheless it was invaluable.

But there can be no reason why the remedy should be empirical, or why the confusion in terms which has, unfortunately, existed should be allowed to hinder the progress of science, and even throw obscurity on the practice of such an important operation in obstetrical surgery.

Saint-Cyr had already explained as succinctly and clearly as possible the exact meaning to be attached to the terms "right torsion" and "left torsion;" and he has set himself as diligently to demonstrate what should be understood by "rolling an animal to the right," and "rolling it to the left." He supposes an animal laid on its *right side;* if it is desired to turn it on its left

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side, it is evident that this may be accomplished in two different ways: first, by rolling it on its *back* and allowing it to fall on the left side; and, second, placing it on its *sternum* and pushing it over on its left side. In both cases the result is the same: the animal lying *at first* on the right side, finds itself *at last* on the left side. And yet it is perfectly obvious that the second movement is exactly the reverse of the first; while it is not less evident that the creature in both movements has been turned from *right to left:* for this expression in its real sense simply means that the animal has been moved from its right to its left side.

But in order to give to this expression a precise signification, a conventional interpretation is necessary. This, Saint-Cyr proposes, should be as follows:—"It ought to be thoroughly understood that, in the movement of rotation impressed on the body of an animal, we should always commence by placing it on its back before bringing it on the side opposite to that on which it first lay."

In this sense, "to turn or roll a Cow from right to left," means that the animal, "laid at first on its right side, was placed on its back, then on its left side, then on the sternum, and finally on the side from which it commenced —the right."

The contrary expression of course means a precisely contrary movement: left side, back, right side, sternum, left side.

From all this it must be admitted that, in order to effect detorsion of the uterus, the Cow should be rolled in the same direction the uterus followed during torsion; and it is also clear that the uterus does not participate to the same extent as the body of the animal in the rotatory movement to which the latter has been subjected.

Supposing, as Saint-Cyr has done, that the torsion has been recognised as *left*, and as is depicted in figure 75 (page 300).

In such a case the animal would be cast on its *left side*, and turned successively on its back, right side, sternum, and left side—*it would be rolled, in fact, from left to right.*.

If one complete rotation does not suffice, then the movement must be continued in the same direction until the hand can freely pass to the cervix and into the uterus.

The soundness of these views of our estimable colleague is amply verified in the very numerous cases of torsion of the uterus which have been published during the last thirty years on the Continent, and particularly in France, of which he gives a few examples.

1. Bouley, in a very interesting and complete observation communicated to the Central Veterinary Medical Society of Paris (*Recueil de Méd. Vétérinaire*, 1853, p. 469), makes us acquainted with the following features in a case of this description: The obstacle which his hand encountered in the vagina seemed to be a spiral infundibulum, the curves of which were directed from right to left and from above downwards—there was, in fact, *left torsion*. The Cow fell on the *right side*, and was fixed in this position; the operator then, keeping the hand firmly fixed in the spiral turns, in order to make certain of his diagnosis, ordered the assistants to roll the animal *from right to left, turning it on its back*. When this was done, he found his hand strangled, as it were, in the os. He at once ordered them to roll it in the opposite direction: and when the Cow, which was lying on the *left side* at the commencement of this second rolling, had been returned to her right side by being pivoted on its back, he had it further rolled by placing it on the belly, and then on the left side again. Then he discovered that he had attained his object, for his hand could enter the uterus freely, and a gush of sanguinolent, but odourless, fluid announced that the communication between the uterus and vagina was again established.

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Here the torsion was to the *left*, and when rotation to the left was attempted the twist became increased; but when it was made from *left to right*, reduction was easy and complete.

2. Chambon has published a case of demi-torsion of the uterus (*Recueil de Méd. Vétérinaire*, 1860). The hand, on being passed into the vagina, reached a multitude of spiral folds of the mucous membrane, the *upper* of which were directed to the *right* and the *lower* to the *left*. The os could be penetrated with much difficulty, and a careful exploration led him to believe that the left cornu was higher than usual and more to the right; while the *right* cornu, which contained the fœtus, had become *inferior*. The diagnosis was *torsion of the uterus to the right*. The animal lay down voluntarily, at first on the left side, then rising with difficulty on its knees and hocks, it fell on the right side. Chambon immediately took advantage of this last position, and introduced his hand once more into the vagina, requesting his assistants to turn the animal over *on the belly* by raising the shoulders and haunch, and placing it on its left side. In doing this, he felt the constriction caused by the vaginal folds notably increased on his arm. Turning over the animal again to its original position on the right side, he had the limbs tied together with cords, and then rotated the body: placing it on the back, then the left side, belly, and right side. This revolution made the detorsion complete.

3. Heu publishes three cases of torsion (*Op. Cit.*, 1860, p. 833), one of which will be sufficient for illustration. This was a Cow suffering from uterine torsion, as evidenced by the numerous duplicatures arising in the vagina, and which converged from left to right, downwards and forwards, radiating towards a common centre—the cervix uteri—where they formed a kind of spiral arrangement. Right torsion was diagnosed. The Cow was laid on the right side, and the limbs being gathered under the body, it was turned on the left side by pushing on the withers, then on the right side by rolling on the back. The torsion increased; so it was necessary to change the manœuvre, and after a turn and a half in the new direction, the hand was no longer opposed by any obstacle, but was at once carried into the uterus, the "waters" escaping in gushes.

4. Liautard (*Journal de Méd. Vétérinaire de Lyon*, 1861) was called to attend a Cow suffering from torsion during parturition; but too late, as it died a few minutes after his arrival. Nevertheless, he took advantage of the opportunity to enlighten himself experimentally as to the procedure to be adopted in such cases. The hide having been removed, he made a large incision in each flank, through which he could easily introduce his hand to explore the uterus. He then assured himself as to the direction of the torsion, and found, by vaginal exploration, numerous folds arranged in two fasciculi, one of which—the right—passed from right to left to form a spiral series running upwards from left to right; the other fasciculus turned in the opposite direction. He noted, besides, and by means of abdominal exploration, that the *left* horn of the uterus, which contained the fœtus, had passed *over* the right horn, and that the latter, which was empty, occupied the left flank. It was therefore clear that this was an instance of right torsion. The carcase was then rolled from the *left side*, on which it lay, on its back to the right side. In doing this it was observed that the plies became tighter and closer. It was moved in the contrary direction—from the right side, on the back, left side, and sternum to the right side. At the third turn in this sense, the uterus regained its normal position.

5. Chuchu (*Recueil de Méd. Vétérinaire*, 1866, p. 705) publishes ten cases of torsion, one of which has been selected by Saint-Cyr for the purpose of illustration.

In this case it is attempted to show the comparative merits of the two procedures. It was a demi-torsion *from right to left*—or a *left torsion*, in fact; the right cornu, passing above the left, became the left. The Cow was laid on the right side, and rolled over on its back to the left side. But there was no change. It was then rolled in the contrary way; detorsion was at once effected.

All the facts collected by Saint-Cyr are unanimous in justifying the acceptance of the precept which he has formulated in the following brief and distinct manner for application in these often-times difficult cases: *Torsion to the left—lay the animal on the left side. Torsion to the right—lay the animal on the right side.* Or the same precept might be formulated in this way: *In torsion from right to left, roll the Cow from left to right; and vice versâ.*

Though this precept appears contradictory to what has been recommended

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above—in order to reduce the torsion, make the body of the animal execute an equal degree of movement, and in the same direction, as that executed by the uterus; yet the contradiction is only apparent, not real. In fact, in this manœuvre the movement of rotation does not really commence at the moment when the Cow, lying on its side, is turned on its back; but rather at the time when it is thrown on its side from the standing posture. If it is thrown on the left side for a left torsion, it really falls from right to left—or in the same sense as the uterine twist.

Since the publication of these valuable remarks, further confirmation of their exactness has been afforded by various papers published in different veterinary periodicals.

Of these we will only select two—the most recent and interesting.

1. Coquet (*Journal de Méd. Vétérinaire et de Zootechnie*, 1876, p. 66,) relates that on May 21, 1875, he was sent for to see a Cow which for several days had been endeavouring to calve. On arrival he found the animal, which was eight or nine years old, lying on its left side in a sterno-costal attitude, the head bent on the neck and the muffle resting on the litter. The pulse was small and quick—about 62 per minute—the ears were cold, and the respiration plaintive. The Cow was not making any expulsive efforts; the udder was flaccid, though somewhat voluminous; *the vulva was not swollen*, and there was no sign of secretion or discharge from it. The animal's condition was moderate.

The Cow had been purchased twenty days previously, apparently in good health; eight days afterwards symptoms of approaching parturition began to show themselves. On the 16th, expulsive efforts began to be made: the animal pawed, lay down and got up again several times, and appeared to be suffering from colic. In three or four hours these symptoms subsided, the Cow became quiet, and all seemed well again. During the following night there was some indication of colic, but less agitation than before, and the next there appeared to be nothing whatever amiss. On the 18th, the animal was dull, pawing, lying down first on one side, then on the other, making expulsive efforts at times.

The attendants kept looking out for the "water-bag," but nothing whatever appeared at the vulva. The Cow was still suffering on the 19th; it remained lying the greater part of the day and refused all food. On the 20th it was in the same condition, making expulsive efforts every now and again. The prostration was great on the 21st, and there were no labour pains; the appetite was lost, and the moans were constant.

On obtaining this information, Coquet proceeded to examine the genital organs. Oiling his right hand, he introduced it into the vagina, where he found numerous spiral folds which converged towards the bottom of the passage, where they gathered so closely that he could pass his fingers no farther forward. In following these folds, his hand, *introduced in a state of pronation*, rotated on the wrist; so that the cubital border which was at first to the *right*, became *inferior*, then *internal*, so as to bring the hand into a state of *supination*, the elbow looking downwards. He therefore diagnosed *torsion of the uterus to the right*, the torsion being complete; for notwithstanding all his efforts his hand could not reach the cervix.

The prognosis was unfavourable, because of the long duration of the torsion, as well as its extent. Nevertheless, it was determined to effect reposition of the uterus if possible; and with that object five or six men were sent for, ropes were procured, and the other articles necessary for such an operation were provided. An attempt was first made to raise the Cow, but this was unsuccessful, and it remained lying on the left side.

In this position its legs were tied together by means of a rope, and an assistant having been placed at its head, the others were told off to roll it on the litter, turning it first on its sternum, then on the right side, back, and so on. While this was being done, Coquet, with his hand in the vagina, endeavoured to fix the uterus; and as the rotation movement went on, the cervix was reached, then the os was felt to open, and when a complete turn had been made, two fingers were introduced. When two rotations of the body had been completed, the obstructing folds had disappeared, and the hand could enter the cavity of the uterus with ease. Then the membranes were ruptured, the fore limbs of the fœtus were seized—the calf being in an anterior presentation and vertebro-sacral position.

Notwithstanding the dilatation of the os, energetic traction had to be employed, as

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the Cow made no attempt to assist in parturition; five men had to pull with all their strength at the cord fastened to the limbs of the fœtus, before delivery could be effected. A living and well-developed calf was extracted; but the Cow lay extended on the litter, perfectly exhausted apparently. Immediately after the extraction of the calf, a stream of blood issued from the vulva, which necessitated plugging of the vagina by means of cloths steeped in cold water. This arrested the hæmorrhage, but the animal continued to lie motionless and perfectly indifferent to everything going on around it. Stimulants were administered, the next day it was able to eat, and soon after it perfectly recovered, regaining condition and suckling the calf.

2. On May 26, 1875, M. Dus, of Mehun (*Recueil de Méd. Vétérinaire*, September, 1876,) had to attend a young Cow of small size, which had arrived at the termination of its second pregnancy, but was unable to calve, though it had been attempting to do so for about fifteen hours. For some months the animal, although well fed, had been losing condition, and was unwell; it had not quitted the cow-shed since winter, except to go to the watering place, a short distance away, and access to which was easy. When seen by Dus, it was lying on the sternum, a little inclined to the left. From time to time it made slight expulsive efforts which had no result. The "waters" had not escaped, and nothing was to be seen at the vulva, which was much dilated and œdematous, through the manipulations of an empiric who had been previously called in. The udder was very large, and milk flowed from the teats. The appetite was lost.

The Cow was got up, and a vaginal exploration made; when it was immediately discovered that there existed at the bottom of the canal a duplicature of the mucous membrane, which was directed from left to right and downwards and forwards, leaving below an aperture through which the cervix uteri could be reached. The os uteri was dilated, but the hand could only be introduced into the organ with extreme difficulty. When so introduced, however, the feet of the fœtus could be felt, but the arm was so severely compressed by the vaginal duplicature that delivery was considered to be utterly impossible. Torsion of the uterus from left to right was diagnosed, and attempts at reduction were at once made. The animal was laid on the right side by tying its limbs together and pushing it over. The hand was introduced into the uterus to fix it as much as possible by means of the fore limbs of the fœtus, which was in a normal position. The assistants present were then told to raise the Cow's limbs, so as to turn it on its back and to the left side. After this half-turn of the body, it was found that the arm was not so compressed; and on continuing the movement of rotation on the sternum and right side again, the animal's body having now made a complete revolution, the uterus was discovered to be completely untwisted, and the "water-bag" immediately passed through the os without rupturing.

The Cow's limbs were then unfastened and it was led to its stable, where delivery was effected in a natural manner; though not without assistance, the animal being so prostrated from the previous ineffectual efforts. In a few days recovery was complete, and Cow and calf subsequently did well.

There is not much to add with regard to this "rotation" treatment of torsion. We have recommended that if the animal can be moved from its stall, and time permit, it should be thrown down on litter in a roomy place; all the limbs may be tied together at once; or first the two fore and then the two hind legs, these being fastened together afterwards, but not allowed to cross. For an ordinary-sized Cow five assistants are necessary; one of these is to be placed at the animal's head to hold it, and make it follow the movements of the body; the second should keep the limbs as close to the belly as possible, when the Cow is rolled over on them. It is very important during the operation that the hocks be kept flexed as much as possible, in order to prevent the udder being damaged, and also to avoid muscular injuries to the upper part of the hind limbs. The other three assistants should lift and roll the Cow, and aid the second in pulling at the hind legs when the animal is being placed on its back. We have already described how, and explained why, rotation should be made either in one direction or the other.

The operator need not endeavour to render the uterus perfectly immovable during the rolling, as it turns a good deal with the body of the animal, and particularly when the mass of the rumen presses with all its weight on the

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organ. This is also the reason why, according to Zundel, a half or even quarter torsion requires for its reduction at least a complete revolution of the body. It often needs a number of turns to reduce the torsion, but generally two, three, or four are sufficient.

There is, therefore, no pressing necessity for maintaining the uterus absolutely fixed while the Cow is being rolled; indeed, as a rule it is no easy matter to keep it at all near the desired position, there being a great difficulty to find a part to cling to. The hand should rather be employed to discover the effects of the version, and to find when the genital passage is patent.

An important precaution in this operation has been notified by some practitioners; and that is to roll the Cow on a slightly inclined floor, if possible. It may be observed, however, that while Wegerer and others recommend that the hind quarters of the animal should be the highest, Chambon and Liautard maintain that they ought to be lower than the rest of the body. And we can scarcely be in doubt as to the correctness of the latter opinion; for in the position indicated, the uterus falls towards the pelvic cavity, and this favours relaxation of the torsion, and the more easy introduction of the hand through the obstacle in the vagina, if it is desired to attempt to fix the organ by the hand while rolling is taking place.

Wegerer's position—the hind quarters raised—is nevertheless to be preferred if it is sought to fix the uterus by its own weight, when the hand cannot be passed into the vagina or cannot act advantageously there.

As in the majority of cases there is only incomplete torsion, and all that has to be done is simply to replace the fœtus, or rather the uterus on its bed or hammock, reposition can sometimes be effected by merely rolling the animal on its back.

In some instances, when slow steady rolling will not suffice, a quick or jerking roll may be successful; in other instances it has been found advantageous to place the animal on its back, and roll it from side to side.

Wegerer, Sacchero, Rueff, and some others have combined rolling with abdominal manipulation and compression, so as to fix the fœtus and uterus, or to push them in the desired direction for effecting detorsion; at the same time rotation is practised according to the directions laid down.

Numerous practitioners are content to roll the Cow without attempting to fix or manipulate the vagina or uterus, and many successful cases are recorded by them.

But this success appears to have been obtained at the expense of the Cow or its fœtus, as the rotation had to be carried on for a longer time than if the organ had been fixed; several turns may be necessary where one would suffice with the hand in the vagina.

If detorsion does not take place so soon as anticipated, there is no reason to despair. If the direction of the twist has been exactly made out, the rotation may be continued. Weber, Wannovius, and Fischer mention instances in which the Cow has been rolled from fifteen to twenty turns before success crowned their efforts. It is even mentioned that the rollings in some cases has occupied an hour or more. Weber writes:—"The Cow is often rolled for more than an hour. The operation is laborious, sometimes painful, to the operator; it demands an expenditure of strength which the most vigorous can scarcely boast of, and it needs a good deal of *amour-propre* to undertake such a task. The efforts required to complete it are so great, that often when a successful result has been obtained, the operator is out of breath and exhausted."

Happily, these extreme and baffling cases are rare, and they have generally

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been observed with Cows in which the fœtus was dead. It is a common remark that reposition is easier when the fœtus is alive, than when it is dead.

Unfortunately, cases will be met with in which replacement of the uterus, and, consequently, delivery of the fœtus, is impossible by this method of rotation, and these are more particularly cases of multiple torsion. Rueff says that they are sometimes accompanied by decomposition of the fœtus, when the gases which are developed in the uterus inflate the organ, and prevent its being untwisted. In other instances there is plastic adhesion between the spiral folds, or between the uterus and other abdominal viscera, or even the parietes of the abdomen.

It has often been predicted that the rotation procedure may give rise to serious accidents—such as volvulus of the intestines, herniæ, etc. But we cannot find any notice of such accidents having occurred.

If the diagnosis is correct, the nature and direction of the torsion well ascertained, and the animal not too much exhausted nor the parts involved seriously injured, a successful result may be anticipated in the large majority of cases, if the treatment above indicated is carried out.

When the uterus is replaced in its normal position, the genital passages patent and in a proper state for delivery, the Cow not much exhausted, and the fœtus in a good attitude for birth, time may be allowed for Nature to effect the expulsion of the young creature. Birth is generally not long delayed under such circumstances, and the operator has the satisfaction of knowing that he has been the means of saving the Cow, and very often its progeny, with but trifling inconvenience to both. The after consequences, so far as the Cow is concerned, are of no more importance than those of ordinary parturition.

But not unfrequently, deceived by the slight symptoms of indisposition the Cow at first exhibits, the owner does not send for the veterinarian until too late to save the fœtus, and even the Cow.

In some cases it will be found that birth cannot take place after reposition of the organ, from inertia or paralysis of its muscles: due either to the great extension the fibres have experienced, the interrupted circulation of blood in the organ, or injury to its nerves.

In such cases stimulants should be given, and friction applied to the abdomen and loins. Ergot of rye is recommended by Continental veterinarians. Should uterine action not speedily ensue, and particularly if the os is dilated and the membranes are ruptured, the fœtus must be removed by traction. If the os is impervious, and atony of the uterus continues, then steps must be adopted to deliver artificially.

When the torsion has been in existence for some time, the liquor amnii expelled, and the uterus closely applied round the fœtus, then extraction is difficult and laborious, and prolapsus uteri is not unlikely to follow. The genital canal should be lubrified with glycerine, injections of tepid water may be thrown into the uterus; and when the secundines are removed, it may be necessary to inject some antiputrescent substance, if there are foul-smelling discharges or any apprehension of septikæmia.

In serious cases, after reposition of the uterus and delivery of the fœtus, grave complications may ensue—such as metritis, metro-peritonitis, etc. It may also then be discovered that a rupture of the viscus exists.

These complications must be treated according to their indications.

7. GASTRO-HYSTEROTOMY, OR CÆSAREAN SECTION.—This operation has been recommended, when the other measures described above have failed,

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with the object of saving the fœtus, if it is still alive, or to preserve the life of the Cow. Laparotomy may be resorted to sometimes, instead of abdominal section towards the linea alba.

Rocco (*Il Medico Veterinaria*, 1863,) has twice successfully performed the Cæsarean section in torsion of the uterus, and delivered living calves. Lemaire (*Recueil de Méd. Vétérinaire*) relates a case of torsion and rupture of the uterus, in which recovery was hopeless. The Cow was killed, the abdomen immediately and widely opened, and the fœtus extracted from the uterus with all haste. The Calf was alive, and did well.

We shall describe the operation hereafter.

Torsion of the Uterus in the Mare.

Torsion of the uterus in the Mare is a rare accident. This is doubtless owing to the direction of the uterine cornua, and the manner in which the broad ligaments are attached to them, which renders rotation of the organ very difficult, unless there is some anatomical anomaly in the parts.

Nevertheless, undoubted instances of this displacement in the pregnant Mare are on record. Belhomme, in 1850, was the first to describe the accident; he was followed, in 1852, by Elsen and Delwart; in 1860, by Hamon; in 1861, by Canu; in 1863, by Schmidt; in 1866, by Jansen; in 1870, by Gierer; and in 1875 and 1877, by Cox (*Veterinary Journal*, vol. i. p. 263, vol. iv. p. 28.)

Serious doubts having been entertained as to the possibility of such an accident in this animal, the fact that it can take place was experimentally demonstrated by Goubaux in 1864.

Causes.

The cause of uterine torsion in the Mare are not well ascertained. It is not improbable that some of the causes which produce it in the Cow will also be effective, in certain circumstances, in the Mare.

Wolff mentions that he has witnessed it in a Mare which had suffered from attacks of colic four days previously, and when so affected had thrown itself down and rolled violently. In Cox's case, a few weeks before parturition, the Mare had an attack of colic, and rolled over several times.

The accident has only been seen in Mares whose period of gestation had nearly terminated. In Elsen's case the Mare had been ten months pregnant; in Hamon's case the ordinary period had expired; and the Mare which was attended by Schmidt was within a few days of foaling.

Symptoms.

The general symptoms appear to be similar to those observed in the Cow. The local symptoms, however, differ somewhat, the torsion being generally more forward in the body of the uterus; so that the spiral vaginal folds are often not so distinct, and, from Goubaux's experiments, may even not be felt at all.

Rectal exploration is recommended by Saint-Cyr in these cases, the torsion being felt as a thick, short, and hard cord. Schmidt easily introduced his hand into the rectum as far as the abdominal margin of the pubis, and there he felt under his hand an obstacle which prevented further progress, as only three fingers could be introduced beyond this. The body under his hand was hard, resisting, and immovable; whereas the contents of the colon were soft and easily indented by the fingers.

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The posterior portion of the floating colon, as in this instance, may be obstructed in the Mare by the twist formed by the uterus and the broad ligaments, and this obstruction will, of course, prevent expulsion of the fæces.

Prognosis and Treatment.

This accident must be considered more serious in the Mare than the Cow, for some of the reasons already alluded to as influencing parturition and its results in these animals.

The treatment must, of course, be similar. Belhomme succeeded, by powerful traction, and without previous reduction of the twisted uterus, in extracting a dead foal in what he describes as a case of "demi-torsion." It is probable that the torsion could not have been so great, for when it exists to this degree delivery by traction is impossible.

Elsen and Delwart succeeded in reducing the torsion in their case, by rolling the Mare in the manner we have recommended to be adopted with the Cow. In this instance, however, everything was against the success of the operation, for the fœtus had already been two months beyond its time in the uterus; it was dead and in a state of putrefaction, and had to be removed piecemeal. The Mare died from septic infection eleven days after the operation.

In Canu's interesting case the result was favourable. The Mare had been endeavouring to foal, it would appear, for ten days, and was evidently about to succumb. Canu, recognising torsion of the uterus, was proceeding to open it by force, when the animal fell with great violence, and the shock her body received had the unlooked-for result of completely untwisting the organ, so that parturition, though difficult, became possible. The foal was dead, as might have been predicted; but the Mare was saved, and continued to recover sufficiently to be put to light work, when, on the thirtieth day after the operation, it was attacked with metrorrhagia which nearly killed it. It eventually got well.

Hamon, in France, and Schmidt, in Germany, endeavoured to effect reduction of the torsion in their cases by rolling the Mares first in one direction, then in the other; but without success, as both animals died without being delivered.

Gierer observed two cases of complete torsion in Mares, in both of which the accident was complicated by a large rupture at the base of the uterus, through which the fœtus had escaped into the abdominal cavity.

Cox (*Veterinary Journal*, 1875, p. 264,) found the head and fore legs of the fœtus protruding through the inferior wall of the uterus. Exploration discovered the vaginal passage beyond these parts, but it suddenly terminated; though a small rugose opening, barely admitting two fingers, was found. The Mare died in two hours; and on examination there was noted a *double twist* of the cervix uteri, with rupture of the uterus and vagina.

TORSION OF THE UTERUS IN OTHER ANIMALS.

We need not allude to this accident in the other animals mentioned as liable to the accident, as it is scarcely possible to diagnose its existence, owing to their small size. Besides, it appears to be extremely rare in them. We may, however, refer to a case of uterine torsion in the Cat, which is, we believe, unique.

Vivier (*Archives Vétérinaires*, Sept., 1876, p. 424,) had a fine large cat, two years old,

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and just dead, brought to him. A few hours previously it had been apparently quite well. The owner, suspecting it had been poisoned, wished a *post mortem* examination to be made. Vivier found the muscles almost bloodless when the skin was removed; and on incising the abdominal parietes, he was surprised to find one of the uterine cornua suddenly escape from the opening. This cornu was deeply congested; indeed, it was almost of a violet tint, and the veins were gorged with dark-coloured blood. The other cornu was less voluminous, but offered the same lesions. It was evident the Cat was pregnant.

When the abdomen was completely opened, it was discovered that *the uterus had made two turns on itself, the twists being to the right and left;* the cervix presented the spiral appearance characteristic of torsion; the broad ligaments were intact, and had followed the uterus in its revolution. The two cornua being opened lengthways, they were found to contain a large quantity of black blood mixed with clots; in this fluid were five fœtuses (three in one cornu, and two in the other) contained in their membranes, and probably about fifteen days old.

This was, therefore, a case of double torsion of the uterus, and it was most probable that death was immediately due to the considerable hæmorrhage. Nothing could be learned as to the cause of the accident.

CHAPTER III.

Dystokia from Morbid Alterations in the Genital Organs.

Following the arrangement adopted by Saint-Cyr, we will in this chapter study the obstacles to parturition which are due to (1) *Tumours developed in, or in the vicinity of, the genital organs of the female;* (2) *Rigidity of the cervix uteri;* (3) *Morbid degenerations of the cervix uteri;* and (4) *Obliteration of the os uteri.*

1. Utero-Vaginal Tumours.

The tumours met with in the vagina and uterus differ much with regard to their nature, origin, structure, and influence on the act of parturition. Sometimes they are contained in the interior of the genital organs: in the uterus or its cornua or cervix, and on the walls of the vagina, as well as on the labia of the vulva; at other times they have their seat in the neighbouring parts or organs: in the bladder, rectum, or pelvic connective tissue. They may be constituted by degenerations or displacements of these parts, or by heteroplastic products developed there.

Their volume, form, and consistence are very diverse; and they may either adhere closely or loosely to the adjacent parts, being fixed in the one case and movable in the other. Some are attached or implanted by wide bases, others are pediculated or retained by a more or less narrow pedicle.

Tumours of the soft parturient passages are rather rare in the domesticated animals, and their occurrence has only recently been brought under observation. The first instance is probably that recorded by Jeanroy, in 1828 (*Recueil de Méd. Vétérinaire*, 1828, p. 639). Since that period a number of cases have been recorded by veterinarians in this and other countries, and as some of these are very interesting, we will give them a brief notice hereafter.

With regard to parturition, these tumours may be considered in a general manner according to their (1) *Seat;* (2) *Mode of attachment;* and (3) *Consistence.*

1. *Seat.*—The situation of genital tumours—whether in the vagina, on the

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cervix uteri, in the os uteri, body of the uterus, or cornua—will make a very great difference in the act of parturition.

Those tumours which are developed in the uterine cornua may, by altering the structure of the walls of the uterus, hinder the amplification of the organ, impair the nutrition of the fœtus, and even cause it to be expelled prematurely. If, however, they do not interfere with the regular course of gestation, birth may take place in a natural manner and without interruption. If the fœtus is situated behind the tumour, towards the body of the uterus, of course it meets with no obstruction in its passage outwards; and if it should happen that labour is longer and more difficult than usual, this can only be attributed to the alteration the pathological production has effected in the muscular structure of the uterus, and which may produce a diminution in its contractile or expelling power.

When, however, the tumour is between the fœtus and the genital passages, the case is much more serious. If it is fixed directly on the cervix, it may prevent dilatation of the os to the necessary extent, or perhaps altogether. When it is situated in front of the cervix, towards the body of the uterus, but in the immediate vicinity of the former, and is movable to a certain extent, it may be carried into the dilated os, occupy it to a greater or less extent, and render the exit of the fœtus impossible, unless the tumour is moved out of the way. If the tumour occupies the vagina, it will prove a more or less formidable obstacle, as it is large or small, hard or soft, and consequently diminishes the calibre of this outlet for the fœtus.

2. *Mode of Attachment.*—The manner in which these tumours are attached to the membranes from which they spring, has some influence on their action as obstacles to birth. They have either a wide basis of attachment, or they are sessile or pediculated.

Those tumours which have a very wide base are generally of a malignant character; and though they may prove very serious, so far as the female is concerned, yet they do not often prove a cause of difficult parturition, provided they are not situated in the vagina or on the cervix. Animals so affected do not generally breed, though they may regularly exhibit œstrum; if, however, they should chance to conceive, and pregnancy has terminated, with these exceptions parturition may not be delayed in its course.

The circumscribed sessile tumours are generally more serious than those which are pediculated; as the latter may be more or less easily displaced when they are in the way, and delivery rendered as easy as usual. Or if the pediculated tumours cannot be temporarily removed from the path of the fœtus, they may easily be altogether got rid of by a simple operation, particularly if their base is very attenuated.

3. *Consistence.*—The hardness or softness of the tumours has an important bearing on their obstructiveness. Such tumours as the fibroids are so dense and inelastic, that the strongest compression will scarcely diminish their volume or alter their shape; while others—such as the condylomatous or papillomatous tumours—readily change their form and dimensions when submitted to pressure.

We will allude to each of these morbid productions more fully hereafter.

Diagnosis.

The diagnosis of these tumours is not always so easy in the domesticated animals as in woman. In the latter, as Saint-Cyr truly says, the surgeon may sometimes have to discover the existence and to determine the nature of such growths during pregnancy; and he may, consequently, be prepared

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beforehand to overcome the difficulties which will present themselves at a later period. But with the veterinary obstetrist's patients this is not so; and it is only and always during parturition, in the midst of the trouble which inevitably accompanies a difficult birth, that he is called upon to give an opinion.

But as some compensation for this disadvantage, in animals direct exploration is easier than in woman; while the entire hand can be introduced into the genital passages of the larger creatures with facility, and explore every part; so that if the period is late for acquiring information with regard to the existence of tumours, yet these facilities enable the obstetrist to obtain most valuable notions with regard to diagnosis, prognosis, and treatment.

But this exploration should be complete and intelligent; as errors in diagnosis are easily committed, and may lead to serious consequences. Here the hand, not the eye, must be the guide, and just as the sense of touch is well developed in this organ, so it will all the more readily distinguish between a tumour, the "water-bag," or some part of the fœtus which is covered by or denuded of its membranes; as well as discover the exact seat, volume, consistence, and mode of attachment, besides something of the nature, of such pathological productions as we are now considering.

Treatment.

The indications for the treatment of these obstacles to birth will, of course, depend upon a variety of circumstances, the majority of which have been referred to. Sometimes we may be able to act directly on the tumour, and remove it from the genital passages; in other cases, from its situation and nature, it may be beyond the reach of direct action.

When in the vagina and not far from the vulva, and particularly when pediculated, it is occasionally extruded as the fœtus is expelled from the uterus, and may then be readily seized by the hand or forceps, and taken out of the way. In such a case the tumour may be either drawn outside the vulva, pushed to one side so as to clear the passage, or extirpated.

If it is situated beyond the os, and is sufficiently movable, it may be pushed in front of the pelvic inlet, and the parts of the fœtus which present be immediately brought therein: so that the tumour may be kept out of the track of the latter.

Should the growth be of the nature of a kyst or abscess, merely puncturing it by means of a bistoury, scalpel, or trocar, will evacuate its fluid contents, when it will collapse and birth be rendered possible.

When it is a pediculated tumour like a polypus, it may be got rid of at once by extirpation, if the pedicle is easily accessible. To this end the pedicle may be simply *cut* through; but this measure, though the most expeditious, is not always the best; as there may ensue internal hæmorrhage, which will be all the more troublesome as hæmostatic agents are difficult of application to the wound.

The pedicle may certainly be *ligatured*, either in mass or partially, previous to extirpation, in order to obviate the disadvantages attending simple excision. This means has been successfully employed, and though perhaps a longer and more difficult operation, it is to be preferred when possible.

Saint-Cyr recommends, before all other measures, linear *écrasement*, should Chassaignac's or any other écraseur be available. This *écrasement* should be no more difficult than simple excision, and so far as hæmorrhage is concerned, it is as safe as the ligature, while its consequences are much more

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trifling. Cartwright has most successfully removed a vaginal tumour by the écraseur.

When the base of the tumour is very small, and has but a slender attachment to the textures from which it springs, and when, in addition, it is beyond the application of a ligature or the use of the écraseur, it may be torn off, or removed by the finger-nail.

The most difficult tumours for treatment are those which are hard and sessile, and to which the foregoing measures are not applicable. It sometimes happens, however, that these formations have only a very loose connection with the subjacent tissues, and it is often possible to remove them either wholly or in part, by making incisions through them, and enucleating the divided portions by means of the fingers.

It is rare that these neoplasms developed in the labia of the vulva offer any obstacle to birth; should they chance to do so, however, it is easy to remove them by means of the scalpel or bistoury. If the subsequent œdema of the labia has not disappeared when parturition commences, and if it hinders exploration by the hand, or the expulsion of the fœtus, it may be combated by scarifications. These, however, should only be made during parturition.

There may occur cases, nevertheless, in which, either from the nature, mode of attachment, or situation of these tumours, their removal is not possible, and birth cannot be effected. In such cases it will be for the obstetrist to decide whether he will have recourse to embryotomy or the Cæsarean section: this decision being arrived at after duly weighing all the circumstances and facts relating to them.

Having completed these general considerations on utero-vaginal tumours as a cause of dystokia, and offered the above indications in the way of treatment, we will now proceed to notice each class of these formations, in so far as they have been recognised as obstacles to parturition in animals.

CANCEROUS, CARCINOMATOUS, OR SARCOMATOUS TUMOURS.

Cancer of the uterus, and other organs of generation, would appear to be rare in animals, and very few veterinary writers allude to it. Even those observations which have been published have but little interest for the obstetrist, as nearly all of them have no relation to difficult parturition. Some cases, however, have been recorded in which cancer of the cervix uteri has produced contraction of the os, and necessitated operative interference in order to effect delivery; and one or two instances are noted in which cancerous tumours have elsewhere proved an obstacle to parturition, and even when that act has been accomplished have proved dangerous from the hæmorrhage they occasioned.

When the cancer is situated at the cervix, and the os cannot be dilated by the fœtus, then treatment must be directed to effect sufficient dilatation for its passage through the canal. In nearly every instance this must be accomplished by free incision of the cervix.

CONDYLOMATOUS, PAPILLOMATOUS, AND LIPOMATOUS TUMOURS.

These tumours are met with most frequently in the generative organs of the Cow and Bitch, and particularly in the vagina. They seldom prove a serious obstacle to the passage of the fœtus.

They first appear as soft, fungoid, cauliflower-like vegetations, which bleed from the slightest contact, and are readily crushed or deformed. In the

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Bitch they sometimes completely fill the vagina, and give rise to a constant sanious, and most offensive, discharge from the vulva.

Lipomatous tumours are also most frequently noticed in the vagina of the Bitch; and in two instances observed by Oreste and Falconio, one tumour was the size of a filbert, the other of a large walnut.

The general indications for treatment are applicable to these growths.

FIBROID AND MYOMATOUS TUMOURS.

Fibroids are not at all uncommon in the generative organs, and are frequently the cause of difficult parturition. They have been observed in the uterus and vagina of the Mare, Cow, Sow, Goat and Bitch.

In *structure*, it would appear that the fundamental portion of these tumours is composed of connective tissue, which may present the histological characters of areolar, mucous, or tendinous tissue, the fibres of which, more or less closely interlaced, have connective tissue corpuscles or cells lying between them, and are cemented into a solid mass by an inter-elementary, more or less abundant, amorphous substance that greatly contributes to increase the consistency of the neoplasm, giving it a dull white or nacrous appearance, as if composed of cartilaginous tissue. The connective-tissue corpuscles composing these tumours are sometimes considerably enlarged and hypertrophied, and this is more particularly observed in the fibroids of the uterus. This arrangement has been found to exist in the uterine fibroma of a Cow examined by Ercolani in 1855; cartilaginous transformation of the structure has even been detected.

The fibroids are developed from the submucous or subserous connective tissue, or from the muscular texture of the uterine parietes. When the latter, the tumour is rarely pediculated, but nearly always remains sessile. The uterine fibroma of submucous origin is certainly at first sessile, and is covered by the mucous membrane; but as it grows it becomes pediculated.

The fibroids of the uterus, as well as those of the vagina, are sometimes covered by the mucous membrane, and at other times grow beyond it. They are sessile or pediculated, and of variable volume and consistency; their surface is either smooth or irregular, as if composed of a number of smaller tumours.

Franck mentions that the pathological museum of the Munich Veterinary School contains the uterus of a Cow, one of the cornua of which is occupied by a myomatous tumour, springing from the muscular layer of the part, and as large as a man's head.

Sometimes the pediculated fibroids of the uterus, in consequence of the elongation of their pedicle, extend beyond the os into the vagina, and even in some instances pass through the latter and the vulva, and remain suspended between the thighs. A case of this kind has been observed by Granaveri and studied by Ercolani.*

As we have observed, the presence of fibroids has a variable influence on the process of parturition, according to their situation. Of course, the larger, and particularly the submucous interstitial fibroids, only very exceptionally allow successful fecundation to take place; though in some instances, when this occurs, absorption follows. During labour they may predispose to rupture of the uterus, from the alteration they have produced in the texture of the organ.

* *Oreste and Falconio.* Studii sulle Neoplasie a Massa distinta degli Animali Domestici, p. 58.

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Submucous or superitoneal fibroids, when situated towards the fundus of the uterus, or when only of a moderate size, very frequently offer no particular obstacle to birth, and interfere but little with labour. It is only when they are very large, and situated towards the cervix or vaginal canal, that they may become a serious impediment to delivery. Those with short pedicles, and which are designated "polypi," may be projected backwards before the advancing fœtus, and be mistaken for some part of the latter by the unobservant obstetrist.

Sometimes the tumours soften towards the termination of gestation, so that during parturition they may be sufficiently compressed and flattened for the fœtus to pass over them. If they have an elongated pedicle attached to some part which is easily displaced, they may be pushed beyond the vulva by the fœtus, or the pedicle may be ruptured by the latter, and the parturient passage thus left unobstructed.

The recognition of these tumours is not very difficult when they are within reach of the hand. To prevent their being mistaken, during manual exploration, for some part of an ordinary or deformed fœtus, their nature and mode of attachment must be attended to. With this object, the hand should be carefully passed between them and the uterus and vagina in every direction, so as to find their pedicle, and thus be assured that they do not belong to a fœtus.

With regard to the treatment, we must refer to the general indications already given. We may only add that, when the tumours are not very large, it is better not to interfere until Nature has done what it can in overcoming the obstacle; for in these instances, as in so many others, it sometimes effects surprising results. If they are pediculated and can be reached, they may be incised, ligatured, or removed by the écraseur; should the base not be attainable, or very extensive, they may be partially extirpated.

If, after parturition, there appears anything like a serious hæmorrhage due to this extirpation, this may be suppressed by plugging with lint or fine tow, which may be steeped in perchloride of iron.

The following selected observations will illustrate what has been said with regard to these fibrous tumours:

1. The first case on record is that published by Jeanroy (*Recueil de Méd. Vétérinaire*, 1828, p. 639). In this instance the Cow was in parturition, and being unable to calve an empiric had been called in; this man, though the fœtus was in a good position, tore off the head. Jeanroy found the Cow to be suffering from ascites, and on puncturing the abdomen more than two gallons of fluid escaped. On exploring the uterus, he discovered a large polypus occupying the upper part of the organ. With a probe-pointed bistoury he removed a large portion of it by incision, and extirpated the remainder by enucleation. The operation was completely successful, as when the polypus was removed the calf could be easily extracted, and two months afterwards the Cow had completely recovered. The animal subsequently produced three calves.

2. Leaux mentions the case of a Cow, seven months pregnant, which had been exhibiting violent expulsive efforts. On examination the vagina was found to be unobstructed, but the os uteri was so contracted that a finger could not be introduced. Nothing was done. Next day the animal was found lying dead, and behind it was a fœtus in its envelopes, as well as a tumour which had been expelled at the same time. This tumour was of a reddish-brown colour, soft, and weighed about eleven pounds; it appeared to be of a fibrous nature, and was perforated by cavities which contained a serous fluid.

3. Corbet (*Veterinarian*, vol. vii. p. 78) alludes to a Cow—"a large roomy animal"—which had occasionally exhibited symptoms of colic while pregnant, and discharged copiously from the vagina. It had been gored by other cattle, and had also sustained some heavy falls while in calf. Being unable to calve at its full time, Mr. Corbet had to attend; but he could not deliver the calf, though it was small, and was preparing

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to resort to embryotomy when the Cow died. A polypus weighing upwards of *six stones* was found in the uterus. The greater part of the tumour was composed of matter closely resembling coagulated blood, the smaller end which lay towards the bladder being more highly organised and of a bluish colour. The mass was easily torn.

4. Horsburgh (*Ibid.* vol. xiv. p. 604) was sent for to attend a Mare which had been attempting to foal for some time. He found the animal very weak from long-continued straining, and discovered in the vagina a yellow-coloured mass, the size of a man's head. This mass projected considerably beyond the vulva whenever the "pains" returned, and had "been forcibly kept back by a stout fellow every time these labour pains came on." The Mare, having been lying, was got up in order that a better examination might be made, and then a firm hard body was found beyond this substance, and which was surmised to be the head of the foal. A pain coming on, Horsburgh did not hesitate to cautiously make an incision through what he then discovered to be a "substance resembling coagulable lymph." On enlarging the incision, the head of the foal presented itself, covered by the fœtal membranes, and the creature was then extracted alive. Soon the placenta was removed, and then the obstruction was examined. It was found to be firmly adherent to the os uteri, was about two inches in thickness, and when removed weighed nearly eight pounds. At the previous parturition, about twelve months before, it had appeared a little. The Mare quite recovered.

5. Dick (*Ibid.* vol. xix. p. 458) relates the case of a Cow at the full period of pregnancy, and which was straining for many hours without being able to calve; the os had at last to be dilated, when the calf was removed with much difficulty. Uneasiness continued for two days afterwards—indeed the animal was quite ill, and no fæces or urine were passed. A tumour was then observed in the vagina; it was about eight inches in length and the same in circumference, and was loosely attached, its anterior extremity being fixed near the meatus urinarius; it was not covered by the mucous membrane, which was distinctly ruptured at that part of the vagina to which it was attached. No pain was evinced on pressing the tumour, into which the fingers could be easily passed without much bleeding ensuing; it had all the appearance of imperfectly organised lymph, and did not possess the usual characters of a polypus. As no harm seemed likely to arise from its removal, it was excised. Soon after this micturition was easily effected. The Cow was recovering when it was attacked by pleuro-pneumonia, and had to be killed.

6. Lewis (*Ibid.* vol. xxv. p. 184) attended a Cow which had gone a week beyond its time, and could not deliver itself. The os uteri was sufficiently dilated to admit two fingers, but it appeared to be so indurated that further dilatation was deemed impossible, the constriction being so great that it felt as if a ligature had been passed around the cervix. Next day, nevertheless, a calf was with difficulty extracted; and on the animal lying down soon after, the uterus became completely inverted. The broad ligaments were torn, and the organ was so much injured that amputation of it was attempted. The Cow, however, succumbed, and on examination it was discovered that the os uteri was "torn into fragments," and "had a large excrescence in a schirrous state around its neck, which had evidently acted as a strong ligature." The broad ligaments were ruptured as was the uterus itself; likewise the vagina, through inversion, and also the rectum.

7. Howell (*Ibid.* vol. xlii. p. 97) describes a tumour which had formed beneath the mucous membrane of the vagina of a pregnant Cow. The animal was aged, and exhibiting symptoms of parturition for some time without any visible progress being noted, an exploration was made *per vaginam*. This revealed the existence of an immense tumour filling up the vaginal canal and firmly pressing against the cervix uteri. With much difficulty the os was reached, when it was found that although the fœtal presentation was natural, delivery was impossible. The Cow was consequently slaughtered. The tumour, which was ovoid in form, with slightly flattened sides, measured fifteen inches in its long and ten in its short diameter—having a circumference of twenty-five inches at its largest part. Its surface was smooth and unbroken, and covered by the vaginal mucous membrane; while its colour was but little different from that of the adjacent parts. Its attachment, which was just above the os uteri, was broad and thick; in this respect it differed greatly from ordinary vaginal polypi. Its weight was a little under twenty-one pounds. Histologically, its fibres were closely arranged in a network, and their meshes contained exudation corpuscles.

8. Cartwright (*Ibid.* vol. xlv. p. 203) gives an account of a vaginal polypus (lipomatous) in a Cow, and which was removed by means of a copper wire ligature. The tumour, which was pendant from the vagina, was pear-shaped, about nine inches in length and five across its widest part; its surface was uneven. The ligature was

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applied around the pedicle and tightened on the fifth day. Three days afterwards the tumour was excised close to the ligature, and the remaining parts returned. The animal did well. It was not pregnant.

9. A case similar to the foregoing is mentioned by Lemaitre (*Mémoires de la Soc. Vét. du Calvados et de la Manche*, No. iii. p. 109). This was a non-pregnant eighteen months old Mare, which showed febrile symptoms, had frequent attacks of colic, made expulsive efforts, and reddish-coloured matter escaped from the vulva. When the hand was introduced into the uterus, it encountered a fleshy mass fixed by a narrow pedicle to the left side of the organ, in the vicinity of the cornu. The tumour was removed by twisting and pulling it. It weighed about four and a half pounds. The Mare had quite recovered in seven days after the operation.

10. Delhaye (*Annales de Méd. Vétérinaire de Bruxelles*, 1853, p. 549) reports the case of a Cow which was in labour for twelve hours. On a vaginal exploration being made, an unusual-sized polypus was found obstructing the os uteri in which it was fixed. A kind of incision was made, which allowed Delhaye to introduce his hand between the cervix and the substance of the polypus, and then, by a brief manipulation, he was able to isolate the mass from the subjacent tissues and remove it altogether. Ten minutes afterwards parturition was accomplished spontaneously, and the Cow and calf did well.

11. Delwart (*Ibid.* p. 550) describes a polypus growing from the floor of the vagina near the cervix uteri, and which, while the animal was straining in parturition, was pushed beyond the vulva. At first sight it looked like a case of inversion of the vagina; but on exploration its true character was detected. It was easily removed, and normal delivery afterwards took place with ease.

12. Leconte (*Mémoires de la Soc. Centrale de Méd. Vétérinaire*, vol. v. p. 153) observed a heifer, two years old, and advanced in pregnancy, in whose vagina were a number of polypi, some of which were so large that they projected beyond the vulva when the animal was lying. The largest measured from four to five inches in diameter and its pedicle was as thick as a finger. Nothing was done until parturition commenced, when the mass was removed by incision and enucleation.

13. A heifer, about twenty months old was, according to Fabry (*Annales de Méd. Vét. de Bruxelles*, 1860, p. 415), making violent expulsive efforts without any assignable cause. Exploration revealed the presence, on the upper wall of the vagina, of an oblong fluctuating tumour as thick as a man's arm, and which so filled up the passage that the finger could scarcely be introduced beyond the meatus urinarius. No treatment was adopted and the animal was killed for food. On the carcase being dressed, it was observed that this tumour extended to the neck of the uterus, and that it contained a dark-coloured fetid pus, enclosed in a dark-tinted kyst. The walls of the uterus were extraordinarily thickened by a massive exudate—the product of a previous inflammation.

14. Fleury (*Recueil de Méd. Vétérinaire*, 1863, p. 259) has given a very interesting history of a Cow which was in labour for nine hours, and with which, at each pain, there appeared between the labia of the vulva, at the same time as the fore-feet of the fœtus, a voluminous round tumour. In order to make an examination, it was necessary to push the tumour as far forward as the uterus, and then it was ascertained that the head of the fœtus was turned towards its back, the nose being directed to the sublumbar region of the mother. The head was brought down, a cord was passed behind the occiput and the ears, and on this being pulled at the head and neck were put straight. Then the left hand of the operator keeping the tumour in the interior of the uterus, in front of the pelvic inlet, the assistants pulled at the cords, and without much trouble—owing to the large size of the pelvis and smallness of the fœtus—brought away a living and well-formed calf.

Parturition being thus happily accomplished there remained the tumour, which was found to be attached by a short, but very thick pedicle within and almost on the lower border of the os, to the left side. Owing to the mobility of the uterus, the tumour could be withdrawn outside the vulva, and there it was fixed by the hands of two assistants, while Fleury passed a long sacking-needle, furnished with a long and very strong thread, through the middle of its pedicle, and in this way enclosed this portion in a tight double ligature. By two cuts of a bistoury the pedicle was then divided a short distance from the ligatures, and these, with the mucous membrane dragged out by the tumour, being immediately put back in the vagina nothing was seen of the operation save the ends of the thread which were purposely left outside the vulva.

In twelve days after the operation the Cow was discharged as cured.

The tumour was oblong, irregular on the surface, hard and resisting, and divided into two unequal lobes by a deep fissure; it was covered by mucous membrane, though

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this was only loosely adherent to it. In its largest diameter it measured more than ten inches, and it weighed over twelve pounds. It grated when cut into by the bistoury, as if it was an unripe apple, and a yellow serous fluid escaped from its interior, which was hollow near the end opposite the pedicle. Around this cavity the fibrous tissue—soft and rose-coloured—yielded by pressure a greyish opaque fluid which was miscible in water, and was not found in any part of this growth. Seven-tenths of the mass was composed of a dense dull-white fibrous tissue disposed in irregular striæ or in concentric tufts.

Watson (*Veterinarian*, vol. xlv. p. 174) gives the history of a sheep-dog which had been in labour for a day, but could not deliver itself because of what the owner called the "pup-bed" coming out. This had been frequently returned, though it caused the poor animal great pain, which was only relieved when the mass was again extruded. On examination, a tumour as large as a hen's egg was found protruding from the vagina. "At first sight it had every appearance of an everted bladder," but on manipulation it was discovered to be a firm fibrous tumour, with a long pedicle extending into the vagina. A ligature was applied to the neck of the tumour, and this was removed by the scalpel: tincture of opium enemata were administered, and in about an hour three puppies were born. The bitch afterwards did well.

15. To Barbenoire and Arloing (*Journal de Méd. Vétérinaire de Lyon*, 1868, p. 76) we owe our last example of this kind of tumour. A Cow thirteen years old, which had calved in a natural manner fifteen months previously, and was supposed to be again about five months pregnant, was suddenly taken ill. Suspecting abortion, Barbenoire introduced his arm into the uterus, the os of which, strongly contracted, had to be previously incised; there he found an enormous hard tumour, which he vainly endeavoured to extirpate. The animal died next day, after suffering for four days; the cause of death appeared to be due to metrorrhagia. The tumour, on a *post-mortem* examination, was discovered to be entirely confined to the uterus, with the exception of a somewhat voluminous "appendice," which was found to be strangulated at the origin of the left cornu, into which it was prolonged.

Arloing examined this morbid production and described it as follows: An oval, uneven-surfaced tumour, traversed by grooves or fissures, one of which deeper than the others, limits the *appendice* mentioned by Barbenoire as extending into the left horn; and studded by small fibro-vascular prolongations by which, no doubt, it grafted itself on the uterine walls. Its longitudinal diameter measures 35 centimètres (nearly fourteen inches), transversal 20 centimètres (nearly eight inches), and it weighs about 6,610 kilogrammes (about fifteen pounds). The tissue of which it is composed is hard, resisting, and grates under the scalpel: it has a fibrous aspect; its density is pretty much the same throughout; and its colour is in general a dull white or nucrous tint, with here and there light red down to carmine and violet points, according to the degree of vascularisation. This vascularity is very considerable on the surface of the tumour, but diminishes as the centre is approached. Examined microscopically, the neoplasm is found to be formed, throughout the whole of its mass, of fine long parallel fibres, on whose course are seen dark-coloured dilatations corresponding to the nuclei which the caustic soda has rendered visible. These fibres are joined in bundles, which cross each other in various directions. There are found, in addition, cells or fusiform bodies, as well as somewhat irregular globular bodies with dark contours.

From the histological characters, Arloing came to the conclusion that the tumour was a fibroid.

THROMBUS OR HÆMATOMA.

Thrombus or hæmatoma of the vagina or vulva, usually appears most frequently after delivery. Pfirter, however, has recorded the case of a Mare in which a large blood tumour, or hæmatoma, was caused by the rupture of blood-vessels and the escape of blood into the connective tissue around the vagina. It formed a great swelling on the sides of the vagina and vulva, the infiltration of blood extending to the perineum. This tumefaction proved an obstacle to parturition; so that it was necessary to remove it by opening it freely, and taking away the clots of blood which had formed. The hæmorrhage which ensued was checked by the injection of a solution of perchloride of iron.

Saake has observed these blood-kysts most frequently in Swine; death from hæmorrhage has sometimes resulted from their rupture.

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The application of ice or cold water, or perchloride of iron, or even the actual cautery, and plugging the vaginal canal, will generally arrest the bleeding.

SEROUS KYSTS.

Kopp, Hering, Ayrault, Lafosse, Liautard, Müller, and others, have observed serous kysts on the vaginal mucous membrane, and even in the uterus, of the Mare and Cow.

The vaginal kysts are of variable size, but most frequently as large as a pear, which they are generally not unlike in shape. They are attached to the mucous membrane by a very narrow pedicle, and in some instances appear between the labia of the vulva when the animal is reclining, but disappear again into the vagina when the standing posture is assumed; though occasionally they are so large that they cannot return without assistance.

The kyst is smooth and transparent, and contains a clear limpid serosity, in which albuminous flakes are often observed.

Not unfrequently, the glands of Bartholin in the vagina of the Cow are greatly distended with mucus, serum, or even pus, as a result of inflammation.

Such kysts are not likely to retard parturition, and if they should, their treatment is very simple; as a lancet puncture suffices to evacuate the fluid they contain, and the walls readily adhere and cicatrise.

Hering has seen them occupy the vagina and extend into the uterus; and in the latter organ their presence may be more serious than when they are limited to the vagina. We have given an instance of this, furnished by Liautard (*see* p. 167), and which shows that they may prove troublesome obstacles to delivery, as well as dangerous to the animal in whose uterus they may have formed.

When the kyst is attached to the cervix or its neighbourhood, it may pass into the os and obstruct it, and thus prevent the fœtus passing through. When very large it may so closely simulate the "water-bag," as to be mistaken for it—though the mistake need not lead to grave results; indeed, if ruptured the kyst immediately collapses, and can no longer prove a barrier to the expulsion of the fœtus. If the kyst is situated towards the os, and if puncturing it be deemed inadvisable, pushing it beyond the pelvic inlet out of the track of the fœtus will be sufficient to overcome the obstacle.

Vaginal kysts may be mistaken for an everted bladder: a mistake which we are assured is often committed, from the external aspect of the tumour, its oval shape, and its colour. Of course, this mistake would prove most unfortunate, should the treatment we have recommended be adopted; but a careful examination should always he made before any active interference is attempted, and this examination will obviate such an error.

Hernia of the bladder through the ruptured walls of the vagina, may also simulate a vaginal kyst; and if this viscus is punctured in this position, it will lead to the same lamentable results, in all probability, as in inversion.

This accident we will now notice, and point out the signs by which it may be distinguished.

HERNIA OF THE BLADDER INTO THE VAGINA: VAGINAL CYSTOCELE.

Dystokia from the existence of a vaginal cystocele is a somewhat rare accident, and only a few instances are recorded as having been observed in the Mare and Cow during parturition.

Inversion of this viscus may occur in two ways:—1. When empty, it

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may, by a spasmodic contraction of its walls, evert itself—the mucous membrane becoming external and the peritoneal coat internal—and thus turned outside-in, it may pass through the meatus urinarius into the vagina; 2. It may, without being everted, escape into the vagina by an old or recent fissure in the floor of the passage. Most of the cases occur during parturition, and when the animal is straining violently, whereby a portion of the contents of the abdomen and uterus are pressed against the bladder, and may thus produce its inversion. It is not at all improbable that the viscus may, in consequence of the pressure it occasionally receives, be in a spasmodic state, or the cervix may be dilated and relaxed at times (Cartwright).

In the Mare and Cow the urethra is short, straight, and wide; and this no doubt renders the bladder liable to inversion. Zundel states that it may, during parturition, acquire such dimensions from retention of urine that it will entirely fill the vagina, and protrude externally during the expulsive efforts of the animal.

However this may be, it is certain that the cystocele will present a different appearance in the vagina according as its peritoneal or mucous membrane is visible: *i.e.*, everted or non-everted.

In the first case we find a somewhat hard, red tumour with a corrugated surface, and attached to the floor of the vagina by a short narrow pedicle. Examining the lower wall of the vagina attentively, the meatus urinarius cannot be found, but on the soft pulpy surface of the tumour will be observed two small openings—the apertures of the ureters—from which a fluid continually escapes, and which may be recognised by its odour as urine; this fluid may even be thrown out with a certain degree of force during the labour pains. These characters should be sufficient to indicate the nature of the obstacle.

In the second variety, the bladder escapes through a rent in the wall of the vagina, and this rent may only involve the muscular layer—the vaginal mucous membrane remaining intact; or, which is more frequent, the muscular and mucous tissues may be ruptured. In either case there is found in the vagina a round, smooth, and fluctuating tumour, attached to the floor of the canal by a pedicle more or less wide, and beneath which the meatus urinarius can be seen or felt. The most striking pathognomonic feature of this kind of tumour is its rapid growth, in consequence of the accumulation of urine in the interior of the displaced bladder, the fundus of which is towards the vulva and the neck directed forwards—its position being the reverse of normal; the fundus, by pressing on the urethra—which is doubled on itself—prevents the urine from escaping, and we have in this way a rapidly increasing vaginal tumour. In a case recorded by Violet (*Recueil de Méd. Vétérinaire de Lyon*, 1862, p. 371) the tumour had acquired, within eight hours, a diameter of from eight to ten inches. Such a tumour must, therefore, constitute a more or less serious obstacle to parturition.

We have pointed out the necessity for a careful examination of the tumour, in order to avoid making a mistake, as the cystocele resembles other tumours, and especially the kysts we have already described, or even the "water-bag," and an error in diagnosis may lead to grave consequences. Such an error is recorded by Charcot (*Journal Pratique de Méd. Vétérinaire*, 1826, p. 165), who, being called upon to attend a Cow which had been attempting to calve for three days, found on separating the labia of the vulva a whitish, tense, and fluctuating tumour. Thinking that this was only the "water-bag," he punctured it; when the colour and odour of the fluid which escaped quickly undeceived him. When the bladder had collapsed, he then

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recognised the tear in the vagina through which the viscus had passed. The Cow being in a dying condition and the fœtus still alive, Charcot had recourse to the Cæsarean section; the calf was saved, but the mother died.

As the diagnosis of this accident is of so much importance, we will notice the symptoms in greater detail.

Protruding through the opening of the vulva, or immediately within the labia, will be discovered a tumour of a pyriform shape, and varying in size and colour, according to the duration of the accident. Sometimes this tumour will be seen hanging from within the vagina by a kind of peduncle, for at least eight or nine inches, and will contain two or three pints of fluid. At times, the protruded part will be nothing more than a thickening of the bladder, produced by strangulation and inflammation; and it will be changed from its normal colour to that of an inflamed surface, or, if it has been hernied for some time, to a darker hue. Sometimes it will become gangrenous and slough; at other times its surface appears rugged and plicated, and on occasions a large quantity of blood has exuded from its surface. Should there exist any doubts as to the nature of the tumour, the meatus urinarius must be looked for; if that cannot be discovered, then the greatest circumspection should be exercised. The attachment and situation of the protrusion should be noted, and also whether it is continuous with the vagina. The nipple-shaped prominences which mark the openings of the uterus into the bladder should also be looked for, as their presence will at once denote the case as inversion of this viscus, as will the escape of urine from them.

Treatment.

The chief indication in vaginal cystocele is *reduction*, or reposition of the displaced viscus. This, however, is not always, if ever, an easy task. In a case of simple hernia, the bladder is soon distended by the urine, and owing to the increase in size, it cannot be returned by the opening through which it passed when it was empty. Compression of its walls will not suffice in the majority of cases to evacuate its contents, because, as has been shown, the weight of the organ lies upon the doubled urethra. To empty the bladder a catheter must be employed; the shoot of an elder tree deprived of its pith has been successfully used for this purpose on an emergency. Once emptied, according to Saint-Cyr, the bladder easily resumes its normal situation.

Puncture of the organ has been practised when catheterism was not tried; a fine trocar been inserted obliquely into the upper part of the viscus—which was now of course the inferior part—so as to make it pass for a certain distance between the membranes before entering the cavity of the sac, in this way imitating the entrance of the ureters. The operation was completely successful, as the bladder had been little more than half emptied before the hernia was spontaneously reduced.

Cartwright says, with regard to treatment: "Provided we are called to the case at an early period, and before a thickening of the parietes of the bladder and sphincter has taken place, we most probably will succeed. We should, with the left hand, press gently upon the sides, and with the right hand the fundus of the bladder, until we feel it gradually receding from us; after which we may carefully introduce a pessary or catheter, so as fairly to force it into its natural situation. If there should be violent straining at the moment we are employing the taxis, we had better desist for a time until we have abstracted four or five quarts of blood, or give a dose of opium in solution, to allay any irritation or spasm. But if we cannot succeed in this way, I

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think a far more preferable plan will be to get a stick with a round blunt point that will pass through the sphincter, and force it against the base of the protruded fundus. A very excellent instrument would be a female catheter, such as is used for the Cow or Mare, as it would have the necessary curve. In thus trying to re-invert it, we may use considerable force without rupturing it; though, of course, we must be cautious in our pressure."

Should the distended cystocele be immediately in the track of the fœtus, and the expulsion of the latter urgent, if the bladder cannot be returned before birth, it must at least be emptied, to allow the young creature to get through the vagina. As the latter passes over it, the viscus should be protected from injury by the fingers.

We will return to a consideration of this condition when treating of the accidents occurring as a sequel of parturition. In the meantime, we will give one or two illustrative cases to show the importance of exercising care in diagnosing, and skill in treating, this accident.

Youatt (*Cattle*, p. 522) relates that a Cow had been three days in labour, and little advance had been made. It was lying on the right side, exhausted, and at intervals lowing mournfully, and making violent efforts to expel the fœtus. A round, fibrous white tumour presented itself; it was evidently distended with some fluid, fluctuation being detectable on the slightest touch. Not dreaming that it could be anything but the membranous bag that contained the natural uterine fluid, he punctured it, and found that what escaped was urine. It was the bladder which had protruded through a rent in the vagina, adds Youatt, and which he might have recognised by its smaller bulk and firmer texture, and by the ease with which the neck would have been discovered on a slight examination.

Baker (*Transactions of the Veterinary Medical Association*, vol. i. p. 57) records a case of inversion of the bladder in a Mare while in the act of foaling. It was replaced three times within two hours, and there was little difficulty in doing so; probably owing to unusual width of the urethra.

Littler (*Veterinarian*, vol. xxxvi. p. 273) was sent for to see a Mare which was unable to foal. He found the animal being led about in a straw yard, in order to avert or mitigate the violent throes of parturition which had been present for two and a half hours. Protruding from between the labia of the vulva, during each throe, were the Mare's urinary bladder and three fœtal feet. The bladder was completely inverted, and "from its elastic or yielding nature apparently contained gas on its peritoneal surface, distending it to the size of an inflated Sheep's bladder." It was not observed to have been injured either by exposure to the air, or by the repeated and forcible compression to which it had been subjected by the fœtal extremities during the parturient paroxysms. Its mucous membrane was not in the least discoloured, being clean and shining, and without the slightest trace of congestion. The fœtus was lying on its left side, the head and neck thrown back and extending along the floor of the uterus, from the right to the left flank of the Mare. The fore-feet were beyond the vulva, and the right or upper hind-foot was in the vagina. Reposition of the displaced bladder was the first thing attempted, and this was readily effected by equable pressure being exerted by the hand on the surface of the viscus, "when the elastic matter was speedily expelled, and the collapsed body easily passed through its widely dilated neck, which was relaxed to such a degree as to admit of the free introduction of the three middle fingers."

Though so easily returned, however, it was as readily inverted again, every expulsive effort bringing it into the vagina; and the frequent attempts made to prevent its protrusion, by the operator placing his arm firmly on its cervix, while his hand was engaged in rectifying the position of the fœtus, were perfectly ineffectual, and even the application of the hand of a strong assistant over the meatus was equally unavailing. Delivery of the fœtus, which was dead, had therefore to be effected over the cystic hernia; this was accomplished without any visible laceration of the bladder by the violence to which it had been subjected; its mucous membrane, however, was thickened and congested throughout its whole extent, and the effusion of blood on its abraded surface gave it the appearance of a "spherical mass of coagulated arterial blood."

After being washed, it was readily placed in its natural situation by gentle pressure, when its cavity was explored to "correct local deviation." No subsequent displacement occurred. The operation occupied thirty-five minutes. Suitable treatment was

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adopted—chiefly the administration of opiates, clothing the body and limbs, with mashes and infusion of linseed as diet; thick dark bloody urine was passed for some days; there was also much difficulty in moving the limbs. In six days recovery was complete.

This was one of three cases of inversion of the bladder during parturition, which this veterinary surgeon had met with in his practice.

TUMOURS IN THE VICINITY OF THE GENITAL ORGANS.

Tumours in the bladder, when of large size—as polypi, steatomous growths, etc., as well as calcareous concretions, may hinder parturition, or even render it impossible. Even an excessively distended bladder may offer an obstacle to the accomplishment of this act, either in checking the advance of the fœtus, or by sympathetically disturbing the uterine contractions.

The indications here are obvious.

Tumours of various kinds may be developed in the connective tissue of the pelvic organs, and especially between the vagina and rectum, and more or less obstruct labour. Ovarian tumours may also prove troublesome, as may likewise multiple abscesses and kysts in the neighbourhood of the genital passages. In some cases these may be successfully punctured; in others extirpation may be possible; while in others, again, the obstetrist can only choose between embryotomy and the Cæsarean section.

Distention of the rectum from an accumulation of fæces may prove a cause of dystokia—particularly in the Mare; but this should be easily discovered, and readily removed. Tumours in the immediate vicinity of the anus are rarely a cause of difficult parturition.

We have already alluded to melanotic tumours.

2. Rigidity of the Cervix Uteri.

Rigidity or *spasm of the cervix uteri* is a condition not unfrequently met with among animals—most frequently in the Cow, next in the Goat, and less often in the Mare. It appears to be more common with nervous, irritable animals, and especially primiparæ, than others; though it is sometimes noted in emaciated and debilitated animals, and even in those which are old, and which have previously brought forth without any trouble.

Without any modification in the structure of the cervix, but merely by a kind of rigid contraction of its fibres, the os remains closed, and cannot be dilated by the efforts of the parturient animal. The cervix is not soft and elastic, as in the normal condition, but feels prominent and rigid, and shows less sensibility than usual; while the os will not admit a finger, or if it does, it grasps it most powerfully.

The majority of veterinarians admit the existence of spasm of the cervix, while others maintain that rigidity and spasm are synonymous terms, in so far as this condition is concerned. The first are ready to confess, however, that spasm is not always present, because very often the "pains" are feeble and few, and the absence of dilatation appears to be due rather to something abnormal in the contractility of the uterus, as a whole, than of this part in particular; whereas, when there is spasm, it has usually been observed that there are inordinate and disordered contractions of the organ. In short, it has been attempted to prove that in rigidity of the cervix there is a purely passive condition of this part, while in spasm there is an active contraction of the organ. In reality, there is no marked distinction between the two conditions, at least so far as obstetrical practice is concerned; and this form of dystokia, in its more salient features, might be looked upon as merely an

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exaggerated manifestation of that derangement which we have designated tumultuous or irregular parturition, or "false labour" (*metripercinesis*, as distinguished from *metracinesia*, or feebleness of the uterine contractions), in which the contractions are irregular or partial.

We have pointed out that there are two sets of muscles in the uterus—the circular and longitudinal, and that there exists a marked antagonism between the circular fibres of the cervix and fundus of the organ, and the longitudinal fibres. So that if the first are more active than the second, and the latter cannot, as a consequence, overcome the resistance they offer, the os remains closed and labour cannot advance. This is, we think, the true explanation of this condition.

Symptoms.

The symptoms vary somewhat. In one case there is at first nothing unusual to be noted, the pains being manifested with their usual regularity and intensity, and the animal is in noways distressed. The only thing that is likely to awaken suspicion, is the unusual duration of parturition, which may extend over two, three, four, or more days, if assistance be not afforded. As the period is prolonged, the animal may in some instances lose condition, exhibit indications of exhaustion and suffering, and gradually sink; or it may appear ill for some days, then rally and assume its ordinary appearance—constituting a case of "missed birth."*

In other instances, the creature manifests an unusual amount of excitement at first; there is agitation, straining, and symptoms of colicky pains; the abdomen is frequently looked at by the animal, which lies down but soon gets up again; the pulse is full, strong, and frequent; the conjunctivæ are injected; the skin is hot; fæces and urine are passed at frequent intervals; there is thirst and anorexia; and sometimes during the throes the vagina is protruded beyond the vulva, and appears as a large red mass.

A vaginal exploration is necessary, in order to learn the cause of obstruction. This should be carefully and gently made—the latter precaution being most important to observe during the throes. It may be necessary, if the mucous membrane is dry, to inject some emollient fluid into the vagina, or introduce it by a sponge.

When the hand is passed through the vagina, the os will be found more or less contracted, so that scarcely one or two fingers can be introduced into it, owing to the spasmodic resistance it offers, while the cervix preserves its elongated shape.

In the Cow, Saint-Cyr has frequently found the cervix and vagina filled with a tenacious gluey matter, which sticks to the fingers like bird-lime, and which, by glueing together the margin and walls of the os, doubtless increases the resistance the canal offers to dilatation.

If the finger can be introduced into the os, it will be found that there is

* We may here call attention to certain signs presented by Cows, and which have been described by Biot (*Recueil de Méd. Vétérinaire*, September, 1876, p. 1037) as essentially pathognomonic of uterine disturbance in these animals, and for this reason have been specially designated as *uterine*. These signs, upon which he places the greatest diagnostic value, are observed when the sick Cow is approached or touched in any way. The animal then "suddenly elongates the neck, extends the head, yawns, protrudes the tongue, and emits at the same time a kind of dull moan, but which is rather a powerful expiration than a real moan." When these signs are present, Biot asserts that the *corps délit*—the disturbance—is in the uterus, and never elsewhere. Laborious or protracted parturition, mal-positions of the fœtus or monstrous conformation, occlusion or induration of the cervix uteri, hydramnios, torsion of the uterus; and after parturition, inversion of the uterus, retention of the placenta, and vitulary fever with or without paralysis;—all these may give rise to the manifestation of this singular phenomenon, which he has never witnessed in any other affection—not even in chronic diseases of the uterus.

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neither deformity nor morbid induration, and that the constriction is due to the fibres of the cervix alone.

Saint-Cyr points out that, contrary to what we have stated above, the cervix uteri is sometimes completely effaced; the bottom of the vagina being occupied by a kind of smooth-surfaced ball, in the centre of which is a narrow opening, and through which the fœtus can be felt. The convex body is the posterior segment of the uterus which, pressed by the head or some other part of the fœtus, is pushed into the vagina; while the small aperture is the os—partially effaced and undilated. This trace of the os, instead of being in the centre, is at times more or less to one side, and occasionally it can only be found with much difficulty.

Diagnosis.

From the symptoms enumerated, there should not be much doubt or delay in diagnosing this cause of dystokia. As in so many other instances, however, the necessity for a correct diagnosis is imperative, as on its accuracy will depend the success of treatment.

If the exploration has been carefully made, the state of the cervix will at once explain the delay in birth. Perhaps the only other condition of the cervix with which it might be confounded is "induration;" but in spasm this part is hot, tense, and painful, and neither hard, lumpy, nor deformed, as in the latter.

Prognosis.

Simple rigidity or spasm of the cervix uteri, provided there is no alteration in its texture, is not in itself of very much consequence. In many cases Nature overcomes the obstacle, and in the course of twenty-four, forty-eight, or seventy-two hours of more or less severe and exhausting labour, delivery is effected spontaneously, and the animal and its progeny are none the worse after a short time. This delay has been most frequently observed in the Cow and Goat; in the Mare it is rarely so prolonged.

But, as a rule, it is not advisable to allow so much time to elapse after labour has commenced, without, at least, ascertaining the nature of the obstacle which delays birth; as during the longer intervals especially, complications may arise which might lead to serious results. The fœtus may die, or it may assume a wrong position in the uterus, which may afterwards prove troublesome to the obstetrist; the mother may become exhausted and the uterus paralysed, so that the fœtus cannot be expelled when the os is dilated; or, still more serious, the energetic contractions of the uterus may produce rupture of the organ.

So that a prognosis must be based on these considerations; and both the owner of the animal and the veterinarian must bear in mind the fact, that while premature and too active intervention in such a case is to be deprecated, too long delay in affording assistance is to be equally guarded against.

Treatment.

As this condition of the cervix uteri is, at the commencement, of no great importance, and merely retards natural delivery, active interference is forbidden for some time.

When the first signs of parturition do not extend beyond some hours—one or two for the Mare, five or six for the Cow, according to Saint-Cyr; when the obstetrist, by vaginal exploration, has assured himself that the genital organs, as well as the pelvis, are not in any way deformed or altered; that

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the animal is all right otherwise; and that rigidity of the cervix is alone the cause of delay in birth; then he ought to wait, while being prepared at the same time for any emergency. The glutinous matter which has been mentioned as occupying the vagina and os and covering the cervix, should be removed as much and as gently as possible from these parts, so as to permit dilatation to take place when the spasmodic constriction begins to yield.

If, however, labour appears to be unduly prolonged without any progress being made in parturition, and if the "pains" are energetic, while the animal's condition is not so satisfactory, then intervention may be counselled. But this intervention should be of the simplest and mildest character; and in the majority of cases it will be attended with entire success. Injections *per rectum* or *vaginam*, of emollient or oily fluids, to which tincture of opium or extract of belladonna has been added; the ointment or extract of belladonna smeared around the cervix or introduced into the os; blankets or sacks steeped in hot water and applied over the loins of the larger animals, or warm water baths for the smaller ones; and, in certain cases, the administration of draughts containing some soothing medicament—such as chloral, chloroform, or opium;—these are the means to be adopted.

Bleeding has been advocated by some authorities—particularly on the Continent; but we quite agree with Saint-Cyr that, unless something very unusual in the general condition of the animal demands it, the abstraction of blood is of very questionable value.

Opium is of much service, from the influence it possesses in controlling the uterine spasms; it is therefore to be recommended when the "pains" are severe and frequent. It may be given in large doses, both in draught and enema, and frequently.

Chloral hydrate and chloroform, particularly the former, are of great utility, and possess advantages over opium as soothing agents.

For a very long time, belladonna has enjoyed the reputation—and apparently with justice—of being one of the best agents for combating spasm of the cervix uteri, and permitting dilatation of the os. Occasionally its efficacy has been contested, but the great balance of evidence is in its favour, and its employment is almost a matter of course with every veterinary obstetrist. It is generally applied in the form of *extract* around the cervix, about a drachm or so being required for one application—it is rare that a second application is needed. Time should be allowed for its action.

Sometimes it is attempted to dilate the os uteri by manipulation—the fingers and hand being the dilators; but this means should not be adopted until milder measures have failed, and until time and patience have been exhausted over them. The hand and fingers well oiled, or smeared with extract of belladonna, should be introduced in the form of a cone, towards the os; if they cannot be passed into the canal in this shape, then the insertion of one finger may be attempted, followed by a second, and so on until the hand has been pushed through.

Very frequently this cannot be accomplished at the first trial, nor yet at the second; but with patience and judgment it rarely fails, and if conducted with the care and gentleness which all operations of this kind should receive, such manipulation may be attempted without the least danger at intervals of a few hours, until crowned with success. The condition of the os should be ascertained, after a certain period has elapsed since the last attempt, every precaution being adopted to prevent injury; and an entrance to the os ought only to be effected when the resistance has greatly diminished, and can easily be overcome.

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A fairly typical case of this condition, and one which illustrates the evil results of undue haste in attempting to effect delivery, is given by Cartwright (*Veterinarian*, vol. xv. p. 371). A Cow, three years old, when within about two days of calving, was found straining violently, and had protruded a portion of the vagina and rectum. The os uteri was not in the least dilated, but the cervix felt larger and harder than usual, and projected a good deal into the vagina. The head and feet of the calf could be felt by examination *per rectum*, and were not far from their natural position; but when the animal strained, they were forced with such violence against the rectum that it was feared they would penetrate it, and large swellings were formed at the anus and vulva. Blood was abstracted, and opium given in solution. In three hours the symptoms were not so urgent, and more opium was given. During the night an amateur had repeatedly examined the os uteri, had tried to dilate it, pulled out portions of hard lymph therefrom, and got the fore-feet and head of the fœtus into the passage; afterwards, four or five persons had been pulling at the latter with ropes, but could not get it away. Cartwright found the calf properly presented, but counselled abstention for an hour or so, as the os was not sufficiently dilated. Two hours afterwards, it was attempted to extract the calf by three persons pulling at the cords attached to it, while the operator tried to dilate the os. While traction was being made, the cervix protruded about five inches beyond the vulva, and was excessively tight around the calf's head; but from the force of pulling, the "stricture" ruptured to the extent of four or five inches. The calf then immediately came away, and the uterus became inverted. The placentulæ were removed and the organ was returned.

The animal continued to strain for about a week, and nineteen days after delivery a great quantity of putrefying matter was removed from the inner surface of the uterus by manual exploration; in four days after this, the creature being in a helpless state, it was killed.

The uterus was found to be quite contracted, and contained about a pint of matter. There was a distinct cicatrix, about four inches long, over a portion of the cervix and vagina, where probably the laceration had occurred. "Taking the cervix uteri, uterus, and vagina all together, there was little amiss with them, more than after an ordinary case of parturition. The cervix uteri was was a little rigid, but perhaps scarcely more than usual."

Mechanical dilatation of the os by means of the sponge tent has been much, and most successfully, employed in human obstetrics for a long time, and the method has recently been greatly simplified and perfected by Sims and Joulin. Saint-Cyr thinks that it is perfectly applicable to animals, and we are of the same opinion. The tent can perhaps be purchased at any druggists, but if not it is easily made. Joulin makes those he uses in the following manner:—From a somewhat fine and dry sponge of inferior quality, he cuts two long conical pieces, one about three and a quarter inches in length, about an inch wide at the base, and one-third of an inch at the apex; the other five or six inches in length, two and a half inches at the base, and one-third of an inch at the apex. Of course they would require to be larger for animals.

These cones are then prepared for use by wrapping them closely round in twine, the circles of which should be so near each other as not to leave ridges on the sponge. By this pressure the tents become extremely compact, and look like a thick bougie.

When required for use, the twine is removed—this should not be done until the tent has been prepared for at least two or three hours, when it will have acquired sufficient rigidity. A piece of cord should be attached to its base, so as to allow it to be withdrawn when inserted in the os; but before this insertion takes place, the apex must be covered with a little lard, cerate, or extract of belladonna. The sponge is passed into the os as far as possible, either by the fingers or forceps, and until the base of the tent is close to the margin of that opening. The narrow and slightly flexible apex of the tent allows of its passage through the os into the uterine cavity; but in order to

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be successful the operation must be quickly performed. Otherwise, the sponge rapidly absorbs mucus and loses its rigidity.

No plugging or other means are necessary to retain the tent, as the portion which projects into the uterus quickly increases in size from the absorption of moisture; so that, after a few minutes, a certain amount of force is necessary to withdraw it therefrom by means of the cord.

The sponge-tent acts in several ways, and simultaneously: 1. It detaches the membranes, and this is often sufficient to induce labour; 2. It acts as a foreign body in irritating the posterior segment of the uterus, which reacts by contracting; 3. It dilates the inner opening of the os; 4. It also dilates the entire length of the os, by swelling through imbibition of the uterine mucus.

To obviate the risk of softening before it is inserted into the os, Joulin prepares the tent in the following manner. Instead of wrapping it round with twine while it is in a dry state, he saturates the sponge in a solution of gum Arabic, and then having rolled the twine round it, leaves it to dry for some days. After this treatment it preserves a certain degree of suppleness, but may remain for a minute or two in contact with mucus before imbibing it.

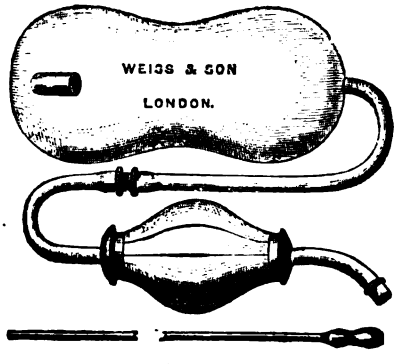

Fig. 77.

BARNES' UTERINE DILATOR.

Barnes' procedure for the dilatation of the os uteri in woman, has also proved of great service in human obstetrics; but to our knowledge it has only once been tried with animals, though there is no reason why it should not be successfully employed, not only in producing abortion in those cases to which we have previously alluded, but also in the morbid condition now under consideration.

This procedure consists in dilating the os by means of fiddle-shaped india-rubber bags, which for women, are of three different sizes; but the very largest of them would probably be required as the smallest size that could advantageously be used for the Cow or Mare.*

The bag, in an empty condition, is introduced into the os by means of a whalebone sound or director, which fits into a small pocket at the side; it is pushed through the canal until the pocket end projects into the uterus; then water is steadily injected into it by means of the tube attached to the

* These bags are made by Weiss & Son, surgical instrument makers, Strand, London. When ordered, the animal for which they are to be used should be mentioned.

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other end. When filled with water the bag remains in the os, in consequence of the middle portion being narrower than the two ends.

This dilator produces the same results as the sponge tent, over which it has some advantages. The only drawback to it is, perhaps, the thickness of its substance; as it cannot be passed into the os unless this is permeable to two or three fingers.

The instance to which we have alluded as that in which this dilating bag has been tried, is recorded by West (*Veterinarian*, 1876, p. 384). On February 9th, 1876, he saw a very valuable Cow, the winner of several first-class prizes, which should have calved in the previous November, but had showed no signs of doing so. It was, in fact, a good example of the condition which we are now treating of, and which has been vulgarly designated a "horned-up" os uteri. The animal was apparently healthy, the pulse and temperature being normal, and there being no offensive discharge from the vagina. An examination *per rectum* revealed the presence of a fœtus in the uterus, while exploration *per vaginam* proved that the os uteri was nearly closed, and that the end of a finger could not be inserted. Belladonna was applied, and the cervix patiently manipulated for a long time, but the constriction could not be dilated to the smallest extent. From the time that elapsed since the period of gestation had expired, this was evidently a case of "missed birth."

It was proposed to incise the cervix, so as to allow the hand to be introduced, but this was objected to by the owner, as it would probably render the Cow useless for breeding purposes. The case was left as hopeless, and as it was decided that the animal should not be killed, it was kept as a "pensioner."

About the end of April it was proposed that Barnes' inflating india-rubber bags, as used for women, should be tried. As might have been foreseen, it was soon discovered that, though suitable for the human female, the bags in ordinary use were neither sufficiently long nor strong enough. Special bags were therefore prepared, and the smallest was introduced into the os by means of the whale-bone director, though with the greatest difficulty. It was then gradually filled with warm water by the india-rubber syringe and tube attached to it. In about ten minutes this bag had sufficiently dilated the os to admit that of the next size, and in rather less than an hour the largest bag was filled, when the passage was so widened that the decomposed fœtus was removed with very little trouble.

The uterus contained a large quantity of horribly fœtid fluid; this was removed, and the cavity thoroughly cleansed and syringed out with a dilute solution of Condy's fluid. The animal quite recovered.

A simpler contrivance than that of Barnes, and which will perhaps be found useful on similar occasions, is that designed by Schnakenburg, and named the "Sphenosiphon." It is merely the bladder of an animal tied to a syringe, and which, when water is injected into it, mechanically dilates the cervix. For veterinary purposes, the bladder might be attached to a piece of india-rubber tubing, which again could be fixed to the nozzle of the syringe. It and Barnes' dilator act in the same manner as the natural "water-bag," formed by the fœtal membranes and liquor amnii.

Another means which might be successfully employed in such cases, as it is simple and without danger, and at the same time effective in producing premature artificial delivery in woman, is the *uterine douche* introduced into obstetrical practice in 1848, by Kiwisch of Dresden. This is generally known as the "ascending uterine douche," and consists of a jet of water at a certain temperature directed against the posterior uterine segment for some minutes, and repeated, if necessary, at intervals of two or three hours. It is often resorted to in woman to favour the dilatation of an *entirely closed* os, and to prepare it for the application of another method, which may be either Barnes' or Schnakenburg's.

Saint-Cyr proposes to adopt this method to animals in the following manner. The apparatus may consist merely of a bucket, or barrel with one end out, such as may be found in almost every stable or cow-shed, and a long

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piece of india-rubber tubing about half-an-inch in diameter, which can be procured easily and cheaply. To one end of this tubing is fitted the pipe of an ordinary syringe—either enema or garden; the other end is immersed in the barrel or pail, which should be filled with tepid water at a temperature of about 40° Cent. (104° Fahr.), and placed sufficiently high to yield a pretty strong jet.

In order to set the water flowing, the tube must be exhausted of air by suction with the mouth, and the end provided with the syringe pipe carried into the vagina and directed towards the cervix uteri. Each douche should continue for about ten or fifteen minutes, or longer; and it may be repeated every two or three hours, or even at short intervals, according to circumstances, until the desired effect has been produced.

Cazeaux speaks highly of this method of dilating the cervix in woman, and for the following reasons:

1. The uterine douche prepares the act of premature birth with the greatest possible gentleness, by means of the softening and the necessary dilatation of the inferior segment of the uterus.

2. By this means all preparatory treatment is needless.

3. This procedure is easily employed, and not at all disagreeable to the woman, as the injection of warm water does not produce any discomfort.

4. It does not require much time.

5. Its action can be graduated at the will of the obstetrist, who may, according to requirements, increase or diminish the duration of the douche and the temperature of the water, as well as vary the parts of the cervix on which he directs it.

6. Finally, it can never occasion lesions of the genital organs, nor yet injure the fœtal membranes or the fœtus.

We deem this uterine douche well worthy of notice, and though there are only, so far as we can ascertain, three cases on record in which it has been tried with animals, yet as these were most successfully treated by it, it may be assumed that it will be found a most valuable means of not only dilating the os uteri, but also of controlling the action or relieving certain morbid conditions of the uterus itself.

Quivogne communicates to Saint-Cyr (*Traité de Obstetrique Vétérinaire*, p. 373) the following three instances of the successful application of the douche.

1. In 1859, a Cow, aged five years, and seven months pregnant, was purchased, and two days afterwards it jumped over the fence of the meadow in which it had been placed. In a few hours it began to exhibit symptoms of colic. A vaginal examination was made, and it was discovered that there was complete occlusion of the os, so that the extremity of the little finger could not be introduced. Quivogne deemed it the best course to wait before interfering.

Some hours having elapsed, however, labour pains became frequent and energetic; though the cervix was in the same state as before. Still later, towards the evening, the condition of the animal was more aggravated, and penetration of the os was altogether impossible. All the measures that might be adopted in such a case were passed in review, but none of them could be decided upon. Here was a cervix anatomically healthy; to resort to incision appeared to be imprudent, and too dangerous an operation. Irrigations with tepid water were then thought of, and it was resolved to try them.

In order to apply them, Quivogne had recourse to a small garden syringe, to which was already attached an india-rubber tube. The irrigations were commenced and continued until the morning, at first under the direction of Quivogne, then by the people belonging to the house. The next morning at six o'clock the patient was lying quietly and was being douched without the slightest manifestation of displeasure. Then an exploration was made, and it was found that the os had sensibly dilated, as the

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whole of the fingers of the hand, gathered together in a cone-like manner, could be inserted, and by a slight pressure the whole hand was passed through. The douches were resumed, but only for a short time, as the "water-bag" was not long in appearing, and very soon after delivery was effected.

2. In 1860, the same veterinarian was called upon during the night to attend upon a Goat, which was showing symptoms of abortion. Vaginal exploration, although difficult, on account of the smallness of the pelvis, nevertheless satisfied him that this was another case of rigidity of the cervix. He at once decided to have recourse to the uterine douches. For lack of better apparatus, he was compelled to use a horse syringe, with which he directed, as well as he could, frequent jets of tepid water on the cervix. Here again, notwithstanding the imperfect apparatus employed, the result was favourable; as delivery was effected without any trouble at one o'clock next morning.

3. In the same year, Quivogne was again requested to see a Goat which was about to abort. The obstacle to the passage of the fœtus was, in this case also, the rigidity of the cervix and occlusion of the os uteri. Having already succeeded twice with the douche, he was determ ned to give it another trial, though in a modified form. He placed a washing-tub on a table, into the plug-hole of which he fitted a sufficiently-long india-rubber tube; having filled this vessel with tepid water, he immediately commenced the vaginal douches, and these were productive of complete success in five hours.

Rougher treatment for the dilatation of the cervix than that which has been described, is sometimes resorted to, either through impatience, ignorance, or in cases which demand prompt action; as the other measures require a certain amount of time, from the slowness of their operation—though perhaps this is rather an advantage than otherwise.

Forcible dilatation of the os uteri has been practised in human obstetrics, and special instruments have been devised with this object. Such dilators have been constructed by Osiander, Busch, Mende, and Krause, but they have not been much used, as milder measures are far more preferable. The same remark is applicable to veterinary obstetrics, in which there is only too often a tendency to imagine that because the patient is an animal, so all the more force and brusqueness should be resorted to.

Forcible dilatation of the cervix, which is not to be recommended, except perhaps in very exceptional instances, has its advocates, and two cases reported by Oschner, a Swiss veterinary surgeon, prove that it may be successful, notwithstanding its disadvantages. In these cases, every other known means had failed; so Oschner procured a pair of large fire tongs used by blacksmiths, and wrapping their jaws round with tow which was smeared with grease, he introduced them, closed, through the os; then an assistant gradually opened the shanks or handles of the tongs, and so produced the desired widening of the passage. The inflammation set up by this manœuvre was dissipated by the employment of soothing remedies, after fifteen days' treatment.

It is obvious that such a mode of dilatation should not be practised, unless there is something most unusual in the case; as it is a most painful operation, and likely to produce contusions and lacerations of the cervix, which may require much time and attention to repair.

Incision of the cervix (*vaginal hysterotomy*) is another operation which can scarcely ever be required for rigidity or spasm of this part, and ought to be reserved for more serious conditions. At any rate, it should not be practised until the other measures we have enumerated have been fairly tried, as it is an operation not without risk of ill consequences.

In some cases, in which the spasmodic action of the uterus is irregular, and leads to occlusion of the os, it might be advisable to resort to anæsthesia, produced by the inhalation of ether or chloroform. Of course the anæsthesia

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should not be pushed to complete insensibility, but be limited to semi-consciousness or "obstetrical anæsthesia." This is more particularly to be recommended for the smaller animals.

In the majority of cases, when the rigidity has been dispelled or the spasm relaxed, birth will take place without further assistance being required; though it may be well that the obstetrist assure himself that the fœtus is in a favourable position for delivery. If there appears to be atony of the uterus or the mother is exhausted, or if the fœtus is dead or in a faulty position, then it will be necessary to afford aid in parturition by adjustment and traction.

In very many instances, it must be remembered, that this rigid condition of the cervix is due to malpresentation or malposition of the fœtus in the uterus; and even when the os has been sufficiently relaxed, the young creature cannot pass through until it has been properly placed, and not unfrequently aided through the genital canal.

3. Induration of the Cervix Uteri.

Induration of the cervix is the term applied to this part when its texture is altered in any way—whether the alteration may be fibrous, sarcomatous, or cancerous—so that its elasticity being destroyed, and its structure inextensible, it offers an obstacle to parturition.

This alteration, or "scirrhus," as it has sometimes been designated, is not at all unfrequent; but it has only been observed, it appears, in the Cow, and would seem to be almost, if not quite, peculiar to that animal.* The reason for this partiality has been variously accounted for, but probably Bouley, in an unpublished note to Saint-Cyr, has afforded the most satisfactory explanation. He remarks that "irritation produces in the bovine species phenomena of *induration* much more durable than in any other species; in proof of this, witness the *plastic* engorgements—so adverse to suppuration, and so slow to disappear—which are caused by a seton introduced beneath the skin of an ox; witness, also, the enormous swellings observed as a consequence of inoculation for pleuro-pneumonia (bovine), and those indurated tumours vulgarly designated *osteo-sarcomatous*, so frequent on the maxilla, and which repeated irritation produced by the prick of a needle are sufficient to produce. This seems to be a general organic fact, of which induration of the cervix uteri is only a particular instance."

This induration must not be confounded with the dense, fibrous, though normal, consistence of the cervix of the Cow's uterus, which, there can be no doubt, has often been mistaken for a diseased condition, and particularly when in a rigid or spasmodic state. The distinction between what we may term the *functional derangement* and the *pathological alteration* of this part, is of great importance from an obstetrical point of view; as the first may be remedied by the mild and innocuous measures enumerated, while the second can only be overcome by a more or less serious surgical operation.

In some cases, perhaps the induration is congenital; but it must be admitted that, as a rule, it is due to the influence of disease or injury—past or

* I can only find one case mentioned as occurring in any other animal, and that happened in a Ewe. It is reported by Shentone (*Veterinarian*, vol. xxix. p. 36), who says that the creature had been in labour since the previous night, but had made no progress, and was very much exhausted. "It was a case of scirrhous os uteri. I told him (the owner) I would divide the stricture as the only means of saving her, but in her case it was almost a 'forlorn hope.' However, I did divide it, cutting in two places, parallel to each other, and with a good deal of difficulty extracted a large lamb that had, from its appearance, been dead for some time." The Ewe recovered.

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present—in the textures. It may, therefore, be expected to be more frequent in old animals, or those which have already been bred from, than in those which are young or are pregnant for the first time, though these do not appear to be exempt.

Rancon assured Rainard that morbid induration of this part was witnessed more frequently in the ancient Briançonnais, where he practised for thirty-six years, than in other regions of France. We are not aware whether the influence of breed or locality has been observed to influence its prevalence in other countries.

Symptoms.

Owing to the situation of the cervix, the nature of the tissues entering into its composition, as well as to the slowness with which the pathological alterations take place, this condition may be in existence for a long time, without any appreciable change being observable in the animal's health. Therefore it is that the Cows which are so affected do not exhibit anything, during the who leperiod of pregnancy, which might lead any one to suspect the existence of uterine disease.

In some cases, however, towards the termination of pregnancy there has been remarked a listlessness or gradually increasing debility, which has been so great at last that the animal assumed the recumbent position, and could not get up without assistance. This general weakness has been mistaken for paraplegia, and has sometimes been supposed to be due to lumbago; but it may have been merely a symptom of generalised cancerous infection, the part itself being the seat of cancer.

But in the great majority of cases, the existence of induration is not suspected until parturition sets in, when the labour pains, which may continue for a long time, attract more than ordinary attention, as birth does not take place. And not unfrequently during the pains, and more especially when the animal is lying, a livid, irregular-shaped, and nodulated kind of tumour appears between the labia of the vulva; this is the undilated cervix uteri.

In other instances, however, nothing is observable externally, and a vaginal exploration is necessary. The cervix is then discovered to be more or less protruded into the vagina, and to form a voluminous, irregular, nodulated tumour which in some cases feels as hard as wood, and in others it has a rugged, soft, and ulcerated surface. Some veterinary obstetrists have described transverse rugæ, composed of a solid, unyielding, fibro-cartilaginous material, in the os.

The os is not always easily found, and it is sometimes so contracted, that one finger cannot be introduced into it; at other times it is not so constricted, and the fœtus may be felt through it. But in every case it is irregular and deformed, deviated from its usual direction, and its walls are greatly thickened, perhaps corrugated. Its degree of hardness and thickness will indicate whether, and to what extent, it can be dilated; and this condition may not only involve the whole of the cervix, but also the walls of the uterus itself, as well as those of the vagina.

When the cervix is ulcerated, the hand will be found covered with blood after the examination.

Diagnosis.

The diagnosis of this condition must be left, to a large extent, to the tactile impressions derived from a vaginal exploration. In some cases an ocular inspection of the cervix may be possible, and the previous history of the case may also be useful in this direction.

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Prognosis.

The influence of the induration on the act of parturition, will depend upon the degree and extent of the alteration. If this is not very serious, and does not implicate the organ very much, and particularly if the induration is localised in some unimportant part, parturition, though protracted, may nevertheless be accomplished without assistance. Often, however, the results are troublesome; one of these being laceration of the cervix, from its unequal dilatation.

Though there is a great difference, pathologically speaking, between the various alterations—for example, between simple fibrous transformation and cancerous degeneration—yet it is admitted that the most benignant alteration is infinitely more serious, from an obstetrical point of view, than simple rigidity of the cervix, either in its immediate or remote results. This Saint-Cyr has proved to be the case in nineteen recorded observations. Of these, seven were more or less unfortunate in their results; in three instances, the mother and fœtus succumbed; in other three, the mother died, but the progeny was saved; and in the seventh, the calf died but the Cow lived. This is a very high rate of mortality, and yet Saint-Cyr is not quite certain that in these nineteen observations there were not some which were rather cases of simple rigidity than induration of the cervix. For as Rainard remarks —and the remark would also apply to the observations recorded in English veterinary literature—it is not always easy, for lack of sufficient details, to discern clearly to which category belongs such or such an observation given by writers under the title of "indurated cervix," "schirrous cervix," "stricture of the os uteri."

In arriving at a prognosis in a case of this description, the immediate results are not alone to be taken into consideration; as pregnancy and the manipulatory operations necessary to effect delivery—which is always tedious and difficult—give to morbid alterations of these parts—even when quite benignant in their nature—an exceptional gravity; so that many animals, even after a comparatively easy delivery, succumb soon afterwards to the diseased condition. The uterus may be ruptured through the efforts at delivery.

Pathological Anatomy.

The lesions found after death are generally alluded to as "fibrous degeneration," "schirrus," or "cancer" of the cervix; and it is usually mentioned that this part was "hard and like cartilage," "creaking under the knife like cutting an unripe apple or a turnip;" or that there was "schirrus" or "cancer," "nodular and hard like cartilage."

Macgillivray states that when the contraction of the os uteri is the result of prior disease, it will generally be found of a hard fibroid nature; while, on the other hand, where the contracted parts are soft and very much thickened, acute disease will commonly be found accompanying the stricture. "In hard stricture, the transverse rugæ or folds appear generally to be transformed into a compact, unyielding fibro-cartilaginous material; in one very serious case I found six of these hardened unyielding transverse rugæ or folds between *the os tincæ* and *os internum*. In soft stricture, without any actual disease being present, the contraction is generally confined to the os and the vaginal portion of the cervix uteri. In cases of complicated stricture, or, in other words, stricture accompanied by some active disease, it will often be found that the stricture is merely the concomitant effect of the disease, and such causative disease will almost invariably prove to be either ulcerative, schirrous, really

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cancerous, or fungous in its nature. . . . Deposits of a fibrinous nature are only too common in patients of rheumatic constitution."

Lecoq, Gellé, Horsburgh, Berger, Bruckmüller and Macgillivray have each recorded autopsies of animals which died from, or were killed because of, this condition. These are all the writers, to my knowledge, who have done so.

1. Called upon to assist a Cow which could not calve, Lecoq (*Journal Pratique de Méd. Vétérinaire*, 1828, p. 88), on introducing his hand into the vagina, found that the neck of the uterus was thickened and hard, and the os quite closed; that a round body of the same density was present at the upper part of the vagina, and was prolonged towards the anus. When he withdrew his hand it was stained with blood. Dilatation of the os being deemed impossible, and the animal being nearly dead, Lecoq had it destroyed; at the autopsy he discovered the following lesions: "The lining membrane of the uterus was of a dark-red colour, which became black towards the cervix; while the os was so contracted that the finger could scarcely be passed into it. The walls of the cervix presented a yellow schirrous engorgement, so hard that it creaked under the scalpel; its thickness varied from one to two inches, and in its centre were several small purulent centres the size of a cherry-stone. A cylindrical body of the same character, about five inches in length, and gradually diminishing in volume, was lodged at the upper part of the vagina."

2. In a Cow which had died about three weeks after parturition, but which, it appears, had been suffering for fifteen months, and had succumbed to the effects of calving, Gellé (*Pathologie Bovine*, vol. iii. p. 618) found the following, among other lesions: "The vagina was in its normal condition, but the neck of the uterus was invaded by an enormous hard, unequal, and lobulated *cancerous* tumour, softened at several points, and from several openings in which escaped a pultaceous, greyish-white cerebriform matter, mixed with blood-streaks, and which blackened the silver probe. A little of this matter flowed into the vagina; but in the cavity of the uterus there was a large quantity, which was also more coloured by the blood that had passed with it through the fistulous openings in the tumour. The large violet and slaty-coloured patches on the lining membrane of the uterus, testify to the chronic character of the inflammation.

3. Horsburgh relates (*Veterinarian*, vol. xiv. p. 605) the case of a Cow in labour, which had been very ill for two days, and which had been attended by an old shepherd. When Horsburgh saw the poor animal it was dying, and the os was completely contracted and undilatable. He attempted to incise the cervix, but this caused so much pain that he desisted, and awaited the death of the animal, in order to perform the Cæsarean section and extract the calf. In a short time the Cow succumbed and the operation was performed, but the fœtus was dead. On examination, the latter was found in a natural position, but the uterus was much inflamed. A stricture of the os, about four inches in length, existed; this was "corrugated longitudinally, and of a cartilaginous hardness—so much so that I could not force a passage with the finger, but found a blunt-pointed stick to answer the purpose. I removed the uterus by dividing the vagina about four inches posterior to the stricture, and, with the hooked bistoury, made an incision longitudinally through one of the sides of the cartilaginous substance. The parts were immediately dilated, until I could with ease introduce my hand. On making the incision on the other side, the corrugations gave way."

4. Macgillivray (*Ibid.*, vol. xlv. p. 718) attended an aged Cow, almost reduced to a skeleton from the effect of rheumatic fever. The animal had not been able to get up for three weeks, and was now in the pangs of impotent labour. "On examination, I found this a case of hard stricture, the worst case I ever met with, there being no less than six transverse hardened bands, each completely encircling the cervix uteri. The os uteri was also firmly rigid. I found it utterly impossible to complete the incisive operation in this case, and only succeeded in cutting through three of the transverse rugæ or hardened bands; and as the Cow was evidently a worthless subject, and there being no doubt that the Calf was alive, I proposed performing the Cæsarean operation, in order to save the life of the latter. The owner at once consented, and appeared highly delighted with the Calf, which was alive and ultimately did well. The Cow was killed immediately after the operation."

Treatment.

The condition of the cervix uteri being ascertained, there should be no delay in resorting to active measures, as it is impossible for delivery to be

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effected, in the great majority of cases, without such interference. Here the necessity for a correct diagnosis is, as we have already insisted, of the greatest moment; for if the obstacle to birth is only rigidity or spasm of the uterus, this can generally be overcome by mild measures and without risk or injury to the animal; whereas, in induration, these measures would be ineffective, and valuable time would be lost in trying them.

Delivery, in induration of the cervix, must be effected by one of two serious operations. This must be either *vaginal-hysterotomy* or *gastro-hysterotomy*. We shall again allude to, and describe these, in speaking of obstetrical operations.

It may only be necessary in this place to say that *vaginal-hysterotomy*—by which is meant incising the cervix, either completely or partially, in one or more places—does not offer any very dangerous consequences when the textures are healthy; though when they are much degenerated, the operation may be followed by troublesome, if not fatal results. Nevertheless, dilating the cervix by incision is rarely so serious for the mother as the Cæsarean section; though the fœtus may incur more risk, as, after the cervix has been relaxed, it is often a tedious and difficult operation to effect delivery, and strong traction may even be necessary. As this measure offers a chance of saving both mother and fœtus, it should, as a rule, be preferred to gastro-hysterotomy; and this preference is still further warranted by the fact that the life of the mother is of more value than that of the fœtus, and if one must be sacrificed, it should be the latter. Should the fœtus happen to be dead, then there is an additional motive in preferring incision of the cervix.

When the os has been considered sufficiently dilated for the introduction of the hand and arm into the uterus, then the fœtus should be placed in position for extraction—the most favourable being, of course, the vertebro-sacral, with the head and fore limbs towards the os. Should it be found impossible to engage these in the passage, then more incisions may be made in the cervix, and this can be done without displacing the fœtus.

It is well to remember that it is very much better to dilate the os by incision than by laceration, through unduly forcing the fœtus into it. At the same time, judicious traction should be made during the maternal efforts.

Aubry, Van Dam, and some others, have witnessed fatal hæmorrhage resulting from the incisions; while metro-peritonitis has also been reported as an equally unfortunate sequel.

But these cases are exceptional. Those veterinary obstetrists in this country and on the Continent, who have had most experience in the operation, are unanimous in asserting that, provided certain precautions are adopted in making the incisions, no such results are likely to follow.

Donnarieix states that, in thirty years, he has performed vaginal hysterotomy in sixteen cases of schirrus, and other kinds of induration of the cervix leading to occlusion of the os uteri, and of these only one died, though the cause of death was not ascertained. Recovery is the rule and death the exception.

Of course recovery must always be doubtful if the disease of the cervix is of a malignant nature, as the operation and the irritation caused by the extraction of the fœtus will, in all probability, hasten its progress.

In some rare instances it may be advisable to have recourse to the Cæsarean section at once. When, for example, labour has been severe and prolonged —when some days have elapsed since parturition commenced, and the veterinary surgeon is not sent for until amateurs have exhausted their efforts and the animal is sinking; or when, from a vaginal exploration, it is ascer-

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tained that uterine or vaginal disease is so extensive and advanced that the mother cannot live much longer, and the fœtus is alive; then this formidable operation should be adopted without delay.

Though very many cases of induration of the cervix, with stenosis of its canal, are recorded in Continental veterinary literature, yet we do not find half-a-dozen instances in English journals.

Of these we select the following:

1. Hall (*Veterinarian*, vol. xxviii. p. 272) attended a Cow which had been in labour for twenty-six hours, and was so much exhausted that the labour pains had almost subsided. The os uteri was found to be impermeable. Stimulants and ecbolics were administered, but they produced no effect on the uterus. It was then "determined to cut through the ligaments or bands which encircle the inner margin of the os uteri, and having done this with great difficulty, it afforded only slight relief; for it was more like cutting bone than elastic tissue. I could even now only get three fingers in; but this giving me more room to work, with a curved knife fitted to my finger I made four incisions—one above, another below, and one at each side. With great caution I had to proceed, for the Cow was now making violent throes; but I had more room, and with the assistance of five men I brought the calf into the world alive." The Cow quite recovered.

2. Macgillivray (*Ibid.*, vol. xlv. p. 717) was called to a seven-year-old Cow which had been trying to calve for twenty-four hours. The fœtal membranes had ruptured, but an amateur who had been interfering could only succeed in passing one finger into the os uteri. The labour pains were tolerably severe, and the entrance to the uterus was found to be quite rigid and closely contracted, admitting only two fingers with great difficulty. The cervix was soft, but within the os were three transverse bands, exceedingly firm and unyielding, and no manipulation could relax them. It was resolved to cut through these apparently cartilaginous rings; but as the cervix could not be brought sufficiently back into the vagina to be seen and manipulated externally, cutting through it was difficult and required extreme care. A partially covered knife was, however, introduced into the os, and two lateral incisions, "up and out," were made through the transverse bands. "The effect was wonderful, the whole parts relaxing almost instantly, and the fore-legs of a fœtus made their way into the vagina; but it required considerable traction to get the head, and subsequently the whole body, away. There were twins present, and both were born alive and did well. Very little assistance was required in bringing the second calf away. There was scarcely any hæmorrhage."

3. The same writer mentions the case of a two-year-old Cow in its first pregnancy. This animal had been unwell for some days; there was anorexia, and occasionally severe labour pains. "The whole uterus and its contents were seemingly at times forced into the pelvic cavity, and at such times the walls of the vagina became everted." On exploration, the cervix was found firmly contracted, the os only admitting a finger. Dilatation by "emollients" and other means having been tried, an interval of twenty-four hours was allowed to elapse before incision was attempted. The operation was performed as in the other instance, and delivery was effected. "In this case, however, the calf was of great size, and it required a tremendous amount of traction to effect a separation between the mother and fœtus. The calf was alive and did well; and the mother, notwithstanding much unavoidable laceration, with good nursing and treatment came all right."

4. Another case alluded to by Macgillivray as one of "soft stricture," was also that of a primiparous two-year-old Cow which had occasionally been seized with labour pains during five days. These were at times so severe as to bring the cervix uteri into view, when "it presented a very inflamed appearance, was extremely ragged in outline, and considerable fungous excrescences had become developed around the margin. . . . The cervix was quite soft, and attended with much inflammatory action and surrounding thickening." Vaginal hysterotomy was performed as in the previous cases, and with much difficulty a living calf was extracted. But the mother was so "frightfully torn," owing to the large size of the fœtus, that it was deemed advisable to have it slaughtered. The owner would not then consent, but after the creature had lingered for ten days, it had to be killed.

5. Migliano (*Il Medico Veterinario*, 1875) is the latest writer who treats of dystokia from induration or stenosis of the cervix uteri. The first case of dystokia recorded by him occurred in a Cow three years old, which had already produced a calf without any difficulty. When seen by Migliano, the animal was in the act of parturition; it was lying on the right side, manifested indications of uneasiness or pain, and a small quan-

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tity of a slightly fetid fluid escaped from the vulva. The proprietor stated that the Cow had eaten a little food, but much less than usual. To inform himself as to the position of the fœtus, Migliano made a vaginal exploration, when he encountered an obstacle that prevented further investigation, in the form of occlusion and rigidity of the cervix uteri. In presence of the collective symptoms in this case, he thought it better to wait.

On the following day, another attempt at exploration proved the existence of the same obstacle, the character of which it was now determined to ascertain. Migliano found it possible to assure himself that it was composed of three dense fibrous rings, each the thickness of the little finger, very slightly elastic, disposed transversely, and so firmly closing the uterine opening as to render every effort to introduce the hand futile.

The diagnosis Migliano arrived at was the existence of new formations of a fibrous nature, arranged in a circular form around the cervix uteri; and he asks if the *quasi* atresia might not by chance be due to a spasmodic contraction or torsion. It did not appear logical to attribute the condition of the uterus to spasm, because of the long duration of parturition without any interval of relaxation in this insurmountable obstacle, which would scarcely allow two fingers at most to be introduced; and torsion could scarcely be admitted, because in that condition the ridges are never transversal, but always spiral or oblique. For these reasons, and seeing that the efforts of the animal could not overcome the obstacle, it was proposed to cut through the fibrous rings by means of a probe-pointed bistoury. But the owner would not consent to this operation, and obtained the opinion of other two veterinary surgeons; these recognised the presence of the impediment, but did not share in the opinion given as to its nature, attributing it to mere hyperæmia, with erethismus of the cervix; they bled the animal thrice at short intervals, and prescribed emollient drinks.

Migliano retired from the case, and he afterwards learned that the owner, alarmed at the illness of his Cow, and not having any one at hand who could promptly relieve it, sought the assistance of a milkman, who, notwithstanding the prostration of the animal because of a second sanguine emission, attempted to operate by force. With the aid of his nails he lacerated the primary obstacles, with his hand destroyed the fibrous rings, and succeeded in producing a tear of some four or five inches in the left side of the cervix, and another of less importance on the right side. The hand could then be introduced into the uterus, and the Cow was delivered of a live calf. An hour afterwards the placenta came away, followed by clots of blood weighing nearly seven pounds, evidently derived from the lacerations.

The dilatation which was thus accomplished irrespective of the rules of surgery, rendered parturition possible; otherwise this could not have taken place.

Some months subsequently, this veterinarian encountered the same anomaly in an equally young Cow, which, the first time also, brought forth a calf without any difficulty. In this instance, the calf had been dead in the uterus for forty days at least, according to the history elicited from the proprietor.

But here the fibrous rings were incised, and by their resistance and inextensibility they bore a great resemblance to those found in the other Cow. The fœtal membranes being ruptured, the fœtus appeared; but it was so distended by gas developed beneath the skin, and in the thorax and abdomen, that long and deep scarifications had to be made in it. When reduced to a smaller volume in this way, it was in a short time, and by means of gentle traction, withdrawn from the uterine cavity without occasioning any great amount of suffering to the Cow, and without producing the slightest hæmorrhage.

It is to be observed that in this case recovery took place in fifteen days, and that, in the preceding instance, it required a month. On the twenty-fifth day the animal was sent to pasture, but could not be sold in perfect health until a month and a-half after the extraction of the fœtus.

The author thinks it well to relate these facts, with a view to demonstrate that, in the bovine species, there sometimes really exists constriction of the os uteri by new formations of fibrous or cicatricial tissue, notwithstanding the opinion of those who pretend that it is only due to a simple spasm, which may be cured by belladonna or the forcible introduction of the hand; and also that probably in the two cases narrated above, the constriction may have been consecutive to the lesions produced in the cervix in the preceding parturition of the animals, which were too young for breeding with safety.

4. Complete Obliteration (Atresia) of the Os Uteri.

Congenital atresia of the os uteri may at once be admitted as an impossibility in obstetrics, as if this canal is *completely* closed impregnation cannot

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take place. But between fecundation and parturition, certain alterations may occur which, by leading to more or less persistent closure of this passage, will prove an obstacle to birth. These alterations may, indeed, exist at the period of fecundation, but then the uterine opening must be only partially closed; and, in fact, at parturition the os may be superficially, and partially, as well as completely occluded. This condition has been observed in the Mare, Cow, and Sheep.

Causes.

This occlusion may be due to agglutination of walls of the os, the formation of fibrinous membranes or bands, the development of cicatricial tissue from wound or injuries sustained in previous pregnancies, etc.

Symptoms.

The symptoms are, of course, the usual external symptoms of retarded parturition. Internally, the hand, on being introduced into the vagina and pushed towards the cervix, comes in contact with a round, smooth, and tense but fluctuating tumour at a variable distance from the vulva, or even between its labia; the fœtus can be felt through this tumour, and this might lead to the supposition that this is the "water-bag." But on passing the hand to the base of the tumour, instead of finding the borders of the os—as we should do if it was the fœtal membranes—there is discovered a circular furrow, one side of which is the extremity of the vagina, and the other is continuous with the tumour—which is the posterior segment of the uterus pushed into the vaginal canal. On the surface of this tumour may be found a small imperforate depression; in other instances there is a kind of prominent ring, like the top of the neck of a bottle, but without an opening; this is the cervix. In other cases no trace of the cervix or os can be distinguished.

Results.

If relief is not afforded, the mother may die from exhaustion or rupture of the uterus; or a rupture may occur through which the fœtus and its membranes will pass, and the mother survive for a longer or shorter period, constituting a case of extra-uterine pregnancy. Or neither of these results may happen, but after a certain time the labour pains and the other indications of parturition subside, the dead fœtus is gradually dessicated as the fluids surrounding it become absorbed, and the animal does not appear at all amiss; its condition being perhaps only accidentally discovered, either when it dies or is killed long afterwards, or when the remains of the fœtus begin to be expelled in a vicarious manner.

Diagnosis.

The diagnosis of this condition must be based on the signs just alluded to. The only other anomaly, perhaps, with which it might be confounded is deviation of the uterus, in which the cervix may be tilted up towards the vertebro-sacral angle, even almost beyond the reach of the hand. The position of the cervix and os tincæ should be the guide in diagnosis.

Treatment.

As in induration of the cervix, so in atresia delivery must be effected by incision, or puncture if the os is found to be obstructed by superficial fibrinous bands or membranes. For the latter object, the extremity of the finger or a metal catheter may suffice, the pressure being gradual and the

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movement semi-rotatory. The bands may, in rare instances, be ruptured by means of the finger-nails or divided by scissors. If, however, the resistance is too great, and the os is closed either through the production of cicatricial tissue or other morbid alteration, then it will be necessary to incise it as for induration, and in the way to be hereafter described.

But if the os is obliterated and the cervix cannot be found, then the portion of the uterus which protrudes into the vagina must be incised, and the fœtus removed by this artificial opening. With this object, Hubert recommends a convex bistoury, the blade of which is covered to within a few lines of its point. The instrument is to be directed to the part where the os is supposed to be; then the coats of the uterus are to be carefully incised to a small extent—layer after layer, until the escape of the liquor amnii announces that the fœtal membranes are opened. The small slit thus made is to be enlarged by a probe-pointed bistoury—the enlargement being either crucial or T-shaped. Then the fœtus is to be extracted.

Hubert has performed this operation once on a Sheep, and a shepherd by his direction also performed it on another Sheep, and in both cases the result was favourable for mother and offspring.

The number of instances of atresia of the os uteri are extremely few, and Saint-Cyr has only been able to mention three. These are as follows:

1. Lecoq (*Mém. de la Société Vétérinaire du Calvados et de la Manche*, Nos. v., vi.), called to attend upon a Cow in parturition, had much difficulty in finding the place where the cervix uteri should be, the os being only a slight depression without any opening. The Cow could not calve, and Lecoq therefore decided to perform gastro-hysterotomy. A living calf was extracted, but it was so weak that it died on the same night, and the Cow also succumbed next day. Unfortunately, an autopsy could not be made.

2. In 1844, Leconte (*Mém. de la Société Centrale de Méd. Vétérinaire*, vol. v.) met with a similar case to the last. The Cow had been in labour for twelve hours, and on exploring the vagina and uterus he felt a kind of "septum" which, examined in every way, only offered a vestige of the os. "On the uterine *wall* of the vagina," he writes, "was a kind of cervix, a sort of ring, hollow in its centre and similar to the mouth of a bottle. The opening did not seem to be more than one-third to three-quarters of an inch in depth, and about an inch in width, the bottom being closed by a solid membrane which resisted every effort to force it. The fœtus could be distinctly felt through the walls of the uterus, but no issue could be found for it except this rudimentary os.

Vaginal hysterotomy was practised, and the fœtus was easily extracted; but it was dead, and the Cow died in an hour and a half after the operation. Nothing is said as to an autopsy having been made.

3. Hubert, a Belgian veterinary surgeon, has published three observations on this condition (*Annales de Méd. Vétérinaire de Bruxelles*, 1856, p. 143). The first refers to a Mare, the other two to Sheep. Doubts are entertained, however, as to the correctness of his diagnosis, and particularly with regard to the Mare, from the fact that this animal gave birth to a living foal, and without operation, after violent and repeated straining.

What is remarked as still more extraordinary, perhaps, is the statement that no unfavourable results followed birth, and that in the succeeding year the Mare brought forth another foal without any assistance.

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CHAPTER IV.

Other Causes of Maternal Dystokia.

THERE are some other causes of Dystokia which, though comparatively rare, yet deserve attention from the Veterinary Obstetrist, and will complete our notice of the maternal obstacles to parturition. These are: (1) *Anomalies of the placenta;* (2) *Morbid adhesion between the fœtus and uterus;* (3) *Stricture of the uterus by external bands;* (4) *Persistent hymen;* (5) *Vaginal and vulvular atresia.*

ANOMALIES OF THE PLACENTA.

We are but little acquainted with the morbid alterations of the fœtal membranes of animals, and of those changes which lead to the more or less permanent adhesion of these to the fœtus and to the uterus. The subject appears to have received very little attention, and the observations are so few that Saint-Cyr makes no mention of these adhesions as a cause of difficult or impossible birth.

It is very probable that animals are less subject to disease of the uterus and the placental membranes than the human species, and this will no doubt account to a certain extent for the absence of notices of such occurrences. Nevertheless, that animals are disposed to metritis, endometritis, and perimetritis, no one can deny; and that we may also have such anomalies as hyperplasia of the chorion, as well as myxomata of that membrane, in addition to new formations of the placenta and placentitis, might be expected. But, as we have observed, there is indeed but little direct evidence to prove that any of these morbid conditions ever exist, though some of them at least may lead to abortion, while others give rise to obstacles which may retard or altogether prevent birth.

Scirrhous Chorion.

According to Cox (*Veterinary Journal*, February, 1877), scirrhous chorion is occasionally met with in animals, and proves an obstacle to parturition.

The membrane is found to be separated from the uterus, and envelops the fœtus, as it were in a leather bag, no part of the creature being distinguishable. This is probably the condition known in woman as *myxoma fibrosum placentæ.*

The labour pains are seldom violent, though the fœtal membranes (water-bag) cannot be expelled into the vagina, even when the os uteri offers no obstacle.

An early examination is necessary, as the fœtus soon perishes. An incision must be made through the chorion, and the fœtus extracted.

MORBID ADHESION BETWEEN THE FŒTUS AND UTERUS.

Adhesion between the uterus and its contents may be due to inflammation of a portion of the mucous membrane, to hyperplasia of the chorion, or to disease of the ovum or placenta, by which the two latter are brought into direct contact with the interior of the organ. Or it may be owing to a deficient quantity of liquor amnii when the fœtus begins to be formed; for if the amnion, in the course of its development, is not separated from the growing fœtus by a sufficient quantity of fluid, connection between them is almost certain to be established either in isolated spots (Simonart's "bands"), or over a wide surface. Adhesion between the amnion, chorion, and lining membrane of the uterus, is then not only possible but probable, and in this

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ay the fœtus is brought into a solid union with the maternal organ. It ill readily be understood that such an occurrence will prove a very serious stacle to birth, and greatly endanger the life of the mother.

Rainard (*Traité Complet de la Parturition*, vol. i. p. 461) furnishes us with o observations, a writer in the *Veterinary Journal* ("Nemo") with another, d Naylor with two. These are the only illustrations I can find in veteri- ry literature.

1. Two pupils of the Lyons Veterinary School—Patusset and Chabral—were, in 40, sent to attend a Cow, between seven and eight years old, which, according to e calculations of its owner, was ten days beyond its ordinary period of gestation. was in fair condition, and up to a recent date had been in apparent good health. At e usual time of parturition, it exhibited a few symptoms of labour; but they dis- peared, though only to manifest themselves in eight days—the evening previous to e arrival of the pupils. For more than twenty-four hours the animal lay on its litter, raining so violently and continuously, that it was then nearly exhausted. There as anorexia, the pulse was small without being quick; and the mammæ, which had eviously been distended with milk, were empty and flaccid.

Palpation in the right flank, as well as an examination *per rectum*, led to the belief at the fœtus was dead. Vaginal exploration proved the cervix to be contracted, but oderately tense; the "water-bag" had not appeared. A stimulating draught was escribed, friction was applied to the skin, and the animal was walked about in der to excite the uterine contractions, which were now weak. In about half-an- ur the contractions were stronger, but birth did not progress.

It was then decided to forcibly dilate the os uteri, and as this dilatation could not e effected by the hand, the cervix was incised in a crucial manner by four cuts. The imal appeared scarcely to feel the incisions. Then one of the pupils introduced s hand to extract the fœtus, and in doing so ruptured the membranes, when a uantity of fœtid liquor amnii escaped. The fœtus was placed in the dorso-lumbar osition, and every means of extraction employed, but without success. The Cow ed.

The autopsy showed that a portion of the placenta had become fibrous and resisting, d adhering firmly to the uterus, near the cervix, had prevented the dilatation of the and the passage of the shoulders of the fœtus.

Rainard remarks that in such a case, serious though it was, there might have been different termination had an experienced Veterinarian attended it; as he would ave recognised the nature of the obstacle by passing his hand around the inner sur- ce of the uterus, and finding the indurated adhering placenta, he would have torn away or incised it, so that delivery would have been easy.

2. Vincent, cited by the same authority (*Op. cit.;* p. 463), was consulted by a col- ague in a similar case of difficult labour occurring in a Mare. The skin covering e first and second phalanges of the right anterior limb had contracted a strong adhe- on with the uterine mucous membrane, not far from the os. The skin of the fœtus as also attached to the membranes, which themselves adhered to the internal surface the uterus. These adhesions offered a formidable obstacle to delivery, which uld only be accomplished after they had been fully recognised; they were destroyed the fingers, without using a cutting instrument.

3. "Nemo" (*Veterinary Journal*, October, 1876) was sent for to attend a valuable ort-horn pedigree Cow, reported unable to calve. Labour had commenced more than ur hours previous to his arrival, and on examination it was found that the fœtus was ead, though the presentation was natural. After futile attempts at extraction, em- yotomy was resorted to; the fore extremities, head, and part of the neck being tached. The traction hooks were then inserted into the integument, close to the ine, and as far back as could be reached on both sides, so that evisceration could be complished. Having obtained the assistance of three men to each hook-cord, an tempt was made to extract the remainder of the fœtus, but it could not be moved. ven lashing the Cow by a rope round its horns to the stall-posts, and using a lever, iled to bring it away.

The case being deemed hopeless, the animal was killed and an autopsy made. ll the organs were healthy, except the uterus and vaginal canal. On opening the erus, surprise was excited in finding the placental membranes firmly attached to e fœtus from the shoulders to the sacrum, and "forming, in addition, a solid mass ith the uterine parietes, thereby suspending the calf." "So close and compact as the union, that a sharp scalpel had to be employed to dissect them from each

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other; thus proving that no traction or other means could have severed them during the life of the Cow. My only wonder was that we did not pull away the uterus from its attachments altogether, in our efforts to extract the fœtus before the animal was killed. The lining membrane of the uterus exhibited depressions like *sulci*, denoting the former site of ulcers: there was also considerable thickening of the floor of the vagina, evidently of some duration."

It was elicited, on inquiry, that the Cow had been put to a Bull suffering from gonorrhœa, and about twelve or fourteen days afterwards a vaginal discharge was perceived, which soon became purulent; the Cow frequently micturated, and occasionally strained and moaned previous to doing so. This condition continued for at least a month. Hence "adhesion of the placental membranes to the embryo and uterus during gestation."

Naylor (*Veterinarian*, vol. xxiii. p. 324), attending a Mare in parturition, found both fore-feet of the fœtus protruding, but no head; the latter was discovered to be lying back towards the side of the foal, though it was immovable. While attempts were being made to adjust the fœtus, the Mare threw itself down, and strained so violently that the fore limbs and shoulders of the foal were expelled; though the amount of traction exercised by two strong men could bring it no farther. More help was obtained, and the foal was advanced a little. "At length a noise, as of something cracking inside the Mare, was heard, and out came the foal with the placenta and the uterus; the latter being attached to the fœtus, around its abdomen and loins. In a short time the bowels followed—having escaped through a lesion in the womb; the poor animal soon sank. On inquiry, I was told that the Mare had received a hurt in the autumn of the preceding year, from the giving way of a bridge when she was upon it. She was got out of the water with difficulty, but did not appear to be much injured." "I have seen a calf adhering in a similar manner, but could not learn anything of the previous history of the Cow."

Rainard does not mention whether the fœtus in Vincent's case was alive; but this could scarcely be possible. Neither does he state whether the Mare lived. He, however, justly remarks that Veterinary Surgeons should be aware of the possibility of such adhesions, either with the placenta or the envelopes, and, through them, with the uterus; and that they are otherwise easier recognised than those external to the uterus.

The hand, introduced into the uterine cavity, is passed over its inner surface, around the fœtus, as it were: and by this means the existence, seat, extent, and resistance of the adhesions will, in the majority of cases, be ascertained. When the adhesions are situated towards the fundus of the organ —its most distant part, and where the hand cannot reach, then there will be difficulty; but this must be overcome by raising the uterus and throwing it backwards, by elevating the front part of the animal's body, and lifting the abdomen by means of a plank, blanket, or sack.

Most frequently the adhesions can be broken up by the fingers; but if they are too strong, then a bistoury or other convenient instrument will have to be employed. Their incision must be carefully made, and the "crutch" or "repeller" (to be hereafter described) will be useful in keeping the fœtus away from the part where the separation is being effected. The cutting should be done gradually and steadily, the point of the instrument being kept at an equal distance between the fœtus and the mucous surface of the uterus.

In alluding to these *internal* adhesions, we may observe that some very rare cases are recorded, in which parturition was opposed by *external* adhesions between the peritoneal covering of the uterus and the sac of a hernia, or neighbouring viscera.

Stricture or Occlusion of the Uterus by External Bands or Membranes.

Several writers have described the presence of bands or membranes exter-

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al to the uterus—either in the peritoneal cavity or vagina—obstructing the assage of the fœtus and rendering birth almost, if not quite, impossible ithout an operation.

Gunther, Gellé, Rainard, Cartwright, Herman, Mignon, Rolland, and olmé have observed this cause of dystokia.

1. Gunther (*Lehrbuch der Practischen Veterinär-Geburtshülfe*) mentions a band about e length and thickness of a finger between the vagina and cervix uteri of a Cow, and hich impeded delivery. It was readily discovered, and after its division birth took ace.

2. Gellé (*Journal Pratique de Méd. Vétérinaire*, p. 72) states that in the early part of arch, 1829, a Cow, in its eighth month of pregnancy, received a blow from the horn another Cow. From that time it was observed to be unwell, being dull and not eding so freely as usual. This condition continued until April 4, when it became orse. Next day it showed symptoms of colic, followed by expulsive efforts as if in bour, and which continued on the 6th and 7th. It was sent to the Toulouse Veteri- ry School on the 11th, and on its arrival it appeared to be weak and lay down. llowed to rest for some time, it was got up for the purpose of making an examina- on. The pulse was "concentrated" and accelerated, and the abdomen somewhat stended. Introducing the hand into the vagina, Gellé found the os uteri contracted, d thinking that the non-dilatation of the os tincæ and the absence of labour pains dicated that parturition was not likely to occur soon, he decided to wait (eight days d already elapsed), though it was noted that the calf was dead. Medical treatment as adopted, but on the 12th the Cow died from exhaustion.

An examination revealed, besides somewhat intense peritonitis, a fœtus in the right orn of the uterus. The body of that organ was engaged in an abnormal opening in e mesentery belonging to the small intestine; the borders of the tear were rounded d thickened, and fibrous in appearance, and the opening itself was five or six inches diameter; it strangulated the body of the uterus about seven or eight inches in ont of the cervix. Behind the strangulation the organ was thickened and swollen; d immediately in front of it, there was a vast ecchymosis. The fœtus had its head rned back on the right side of the neck; the two front limbs being carried forwards d crossing each other. The macerated condition of the fœtus and the facility with hich its hair could be removed from its skin, proved that it had been dead for some ne. The membranes and liquor amnii exhaled a very fœtid odour.

It was the strangulation of the body of the uterus through this rent in the mesen- ry, which rendered birth impossible.

3. Rainard (*Op. cit.* vol. i. p. 456) describes the case of a Cow seven or eight years d, extremely emaciated, and having a hernia in the right flank. Before he saw it, e animal had been for some hours in labour, and the "waters" had escaped after tempts at delivery by a quack. It was lying, and continually straining in the ost violent manner. An examination proved the os to be so contracted that the gers could scarcely be passed into it, and it was necessary to have recourse to in- sion before the hand could be admitted. The fœtus was alive, but evidently very eak; one of the fore limbs presented, the other was bent backwards, and the head as curved downwards in front of the pubis. These parts were put right, the crea- re being in the dorso-lumbar position. Cords were attached to them, and traction ade when the mother strained. But no progress could be made, and at last the Cow itted some plaintive moans, ground its teeth, its breathing became hurried, the dy was covered with a cold perspiration, the eye dull, and the labour pains suddenly asing, the poor beast died in a few seconds.

Examining the body, it was observed that the hernial tumour at the flank, and nstituted by the omentum which adhered at this point, sent off a thick inelastic brous cord, which passed over the upper face of the uterus, compressing that organ, d preventing its dilating.

Rainard also states that he knew of another case of this description, in which a kind cord encircled the uterus; it was thick, very resisting, and formed at the expense the lateral ligaments of the uterus. The calf could not be extracted, and the Cow erished.

4. Cartwright (*Veterinarian*, vol. xxi. p. 494) was called to attend a Cow which was ported unwell. The owner informed him that it should have calved some months efore, and that at that time it showed the usual signs of approaching parturition; hese, however, disappeared, but much offensive matter subsequently continued to scape from the vulva. On "touching" the animal for the calf, an inert tumour could e distinguished, and a rectal exploration could not detect a live calf. Examining the

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Cow *per vaginam*, the hand encountered "a ligamentary band close to the os uter extending from the upper to the lower side of the vagina, of the thickness of a penn cord." "It was quite firm in its texture, and on pulling at it, I drew the vagina bac and the band in sight, so that the bystanders could see it: I divided it." The anim was affected with pleuro-pneumonia, and was killed.

"The uterus was about the size of a peck measure. It contained a quantity reddish-coloured matter, bones, and putrid flesh. The matter lay, in a great measur in the posterior parts of the horns. The posterior parts of the fœtus were complete denuded of flesh, and lay floating in the matter. The ribs were also bare. The co tents of the abdomen and thorax were not converted entirely into matter. The hea and neck were the least denuded of flesh. The fœtus could not have been more tha five or six months old. The back of the neck lay against the os uteri, which was pe fectly sound and contracted. The internal surface of the uterus varied in colour, a in many places it looked as if it had been torn or bruised; but, taking everythi into consideration, it was remarkably healthy, if we estimate the pressure it mu have received, and also its contact with so much purulent matter. The contents we not at all offensive in smell. The vagina was next laid open: it was healthy. T band or ligament spoken of took its rise from folds of apparently glandular structur of the vagina, near to the os uteri, and was inserted into the opposite side of the vagin It was of the thickness of a penny cord, of a fibrous texture, whitish colour, and abo three inches long."

5. The same authority (*Ibid.* vol. xxii. p. 395) met with a similar case in a Ma which had gone its full period of pregnancy. A person who first assisted it found t head and only one fore-leg of the fœtus presenting; the animal was straining violentl and had forced out nearly half a yard of the rectum, which could not be returne The other fore-leg was discovered to be over the neck of the fœtus. By pushing ba the body, this leg was put right, and then a small foal was extracted without dif culty. The prolapsed rectum was now reduced. After this the Mare was very and uneasy, and died in about thirty-six hours. On an autopsy being made, it w observed that the mesentery was torn away from the rectum for at least a yard extent. On laying open the vagina and uterus, a strong band, the thickness of one little finger, and about a foot in length, was found stretching across the former, abo six inches from the os uteri. Cartwright had no doubt that at the time of parturiti the non-presented fore-leg of the foal was retained by this band, and this led to t protracted parturition and rupture of the mesentery.

6. This authority found an analogous cause of dystokia in a Sow which could n bring forth its whole litter. It had delivered itself of several and then stopp though the straining was continuous. One pig was extracted with much difficult but in fragments. The animal was killed, and about five inches from the entrance the vagina there were two distinct passages formed by a strong band or septum, whi was, to all appearance, muscular in structure, though covered with mucous me brane; it was attached to the upper and lower part of the vagina, though inclined little to one side; the attachment was about three inches long, and the vagina w divided into two distinct cavities for about seven inches of its length.

7. The same excellent authority describes another case (*Edinburgh Veterina Review*, vol. ii. p. 285) in which there was a vertical band across the os uteri th prevented birth. This was divided, parturition took place, and the animal did wel

8. Goubaux (*Recueil de Méd. Vétérinaire*, 1873-74, *Archives Vétérinaire*, Novemb 1876, p. 562) has drawn particular attention to the existence of these bands as a cau of dystokia in the domestic animals, but particularly in the Mare and Cow. He fers more especially to the two following instances: Rolland, in 1874, attended Cow, a primipara, in which there was a vertical septum, three centimetres wide the middle, between the vulva and vagina: this prevented birth, and the Cow calv when the band was incised; the specimen is now in the Museum of the Alfort Scho In May, 1867, Colmé was called to assist a three years old Heifer which could n calve; the two fore-limbs of the fœtus only presented. An exploration discovered fibrous band, three centimetres broad, its extremities attached horizontally to ea side of the cervix uteri, the os being perfectly dilated; it divided the latter into t openings, through each of which one of the fœtal limbs had passed. The band w divided, scarcely any hæmorrhage resulted, and birth took place in the ordinary wa and without any troublesome consequences.

Goubaux also gives some interesting details of a *post-mortem* examination of a C which had a similar band immediately behind the cervix, and sums up as follow Some of these bands are situated between the vulva and vagina, and are vertica others are placed at the bottom of the vagina, close to the cervix, and may be ver cal and horizontal; they are very strong and resisting. They may not constitute

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bstacle to copulation, whatever their situation, but they may prove an obstacle to arturition; their division does not occasion hæmorrhage or any serious result, and his operation allows parturition to take place in the usual manner.

It may be that some of these bands are nothing more than the hymen, alluded to elow.

With regard to the treatment of these cases, but little can be said. When he bands are in the vagina, their division is the principal object, after which, no other obstacle is present, delivery can take place. When, however, the terus is constricted by an external abdominal band—though this condition ill be difficult to diagnose—then no course can promise anything like a uccessful result except the Cæsarean section.

Persistent Hymen.

At page 29, we have described a wide duplicature of the lining membrane of the vagina, which covers the meatus urinarius, and which looks ke, while it acts as, a valve (*valvula vaginæ*) to that opening. This membrane, which stretches across the passage and separates the vulvular from the aginal canal, is the analogue of the hymen of woman; and, as in her, it ay persist after the impregnation of primiparæ—having escaped rupture uring coitus—and becoming abnormally rigid, may prove an impediment birth in some instances—though it must be confessed they appear to be xceedingly rare.

This cause of dystokia should be very much less frequently met with in he equine and asinine species than other of the domesticated animals, in onsequence of the size and conformation of the male organ of copulation, om which the membranous vaginal partition can scarcely escape rupture, hen it is present, which is only occasionally.* With the bovine, caprine, ine, and porcine species, however, the case is different; as the penis, from s volume and shape, is far less likely to lacerate the hymen; and it is in e bovine species alone that the persistence of the latter at parturition has en found—at least so far as published observations show; and in all the stances the animals have been young and primiparæ.

It is just possible that in many animals of these species, the hymen may more or less intact until parturition sets in, when the fœtus, in its passage rough the vagina, ruptures and effaces it without much delay resulting, or her cause which might attract attention.

But in others—few though they be—the membrane would appear to offer rather serious amount of resistance to the expulsion of the young creature, d demand the services of the obstetrist.

The cases recorded are exceedingly few, and none are to be found in nglish Veterinary literature.

* The hymen appears to be only exceptionally present in the Mare, though it is an error to ume that it is always absent. Not only is it sometimes to be found, and occasionally of ge size and extraordinary tenacity, but it may even become a source of trouble in unimpregted Mares. Of this we have an example by Mr. Thomson, of Beith (*Veterinarian*, vol. vii., 147). That Veterinarian was called to see a young Mare, said to have inversion of the dder. On his arrival, he saw protruding from the vulva a membranous sac containing about a art of fluid in its cavity. An examination proved the sac to be a simple membrane, exmely vascular and much inflamed. It was easily pushed back into the vaginal cavity, where as found to be attached to the posterior part of the urethra and all around the vaginal al, so that the passage to the os uteri was completely obstructed; the membrane could not pushed so far forward as the cervix. On removing the hand, it again protruded whenever Mare made an effort.

In another instance—a year and a half old Filly—Mr. Thomson observed an intact hymen, there was a small opening in it, immediately behind the urethra.

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1. On March 28, 1863, Mignon (*Recueil de Méd. Vétérinaire*, 1863, p. 767) attended a two and a half years old Cow in an advanced stage of pregnancy, and which exhibited all the signs of approaching delivery, with the exception of the labour pains, which were not yet manifested. They however appeared on April 1st, and continued for about fifteen hours, but without any progress being made towards birth. On the 2nd, Mignon endeavoured, by abdominal taxis, to assure himself if the calf was still alive, but this failing he had recourse to vaginal exploration, when, to his surprise, his fingers met an obstacle almost at the vulvular orifice. He was soon convinced that this obstacle was nothing more than a wide band—a real duplicature of the mucous membrane—placed at the entrance to the vagina, which it incompletely closed as a vertical septum, being attached by its extremities to the walls of the canal. This vaginal band—a veritable hymen—was flattened on both sides, wider at the ends than in the middle, and had curved borders; it measured two and a third inches in length, three quarters of an inch in depth at its extremities, but only about one-third inch at its central portion. The calibre of the vagina was considerably diminished by this band; the canal had two orifices—an inferior and a superior, and nearly of equal dimensions; three fingers could scarcely be passed into either of them.

This obstacle to birth having been recognised, the necessity for removing it by incision was apparent. It was divided in the middle by a bistoury, and the constricted vagina then became widely dilated, when a well-formed living Calf was soon produced.

2. Hermann, a Swiss Veterinary Surgeon (*Journal de Méd. Vétérinaire de Lyon*, 1851, p. 73), met with a similar case in 1849. In a quey, he found a thick resisting membrane in the vagina, which offered an obstacle to parturition, and which partitioned that canal into two portions. When incised, delivery took place.

3. Hamm (*Magazin für Thierheilkunde*, 1842, p. 185) attended a Cow which had gone nine days beyond its time for calving, when it commenced to show symptoms of that act. With the early labour pains, there appeared at the vulva a round tumour as large as a man's head, and which appeared to be covered by the vaginal mucous membrane. On pressure, this tumour fluctuated, and on a careful examination it was perceived that the membrane covering the tumour was the hymen. On incising this, a large quantity of mucus, which had collected between it and the cervix uteri, escaped. The os was contracted at this time, but it soon dilated, and birth occurred without any trouble.

4. Vincenzo-Luatti (*Recueil de Méd. Vétérinaire*, 1859) alludes to a Cow—a primipara, and three years old, which, otherwise in good health, was affected by complete procidence of the vagina. On examining the parts, this Veterinarian found a white ligamentous band, two or two and a half inches wide, and the third of an inch in thickness, very strong, and attached above and below to the walls of the vagina, so as completely to occlude the canal—at least so far as exploration was concerned. Both surfaces were quite free.

Luatti introduced a straight probe-pointed bistoury as high as possible between the band and cervix, and at a single cut divided the former to near its inferior insertion. Then the prolapsed vagina was reduced, a retaining bandage was applied, and the labour pains, which had not yet shown themselves, were waited for. In six or seven days, Luatti was informed that the Cow had calved, and that it and the offspring were well.

Treatment.

The indications for treatment, when the hymen is present and an obstacle to birth, are obvious: divide it at once. This division may be made in the middle of the membrane, and does not demand any particular care or surgical knowledge; though it is well to make a close examination before the incision is made, in order to avoid making a mistake should the membrane appear as a tumour.

Vaginal and Vulvular Constriction or Atresia.

Stenosis and Atresia of the vulva and vagina have not unfrequently been recorded as either delaying, or altogether preventing, parturition in animals according as the obstruction is incomplete or complete.

This condition may exist previous to impregnation, and to such an extent as to offer no obstacle whatever to that act; or it may become developed

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n the interval between impregnation and parturition. Of course, if atresia s complete and of such a character that the spermatic particles cannot pass nto the os uteri, impregnation cannot take place, and the animal remains terile.

The condition may, therefore, be congenital or acquired. Incomplete congenital stenosis of these passages is not at all uncommon in young animals, n which the vulva and vagina are often so constricted and inelastic, that during copulation they are injured, and this injury tends still more to diminish their calibre and dilatability during pregnancy. Congenital stenosis to a very abnormal degree may sometimes exist, however, without any apparent traumatic influence.

A recent case of this description is recorded by Macgillivray (*Veterinary Journal*, December, 1876). Called in to see a two-year-old Heifer which was reported to be suffering from constipation of the bowels, he found the creature very uneasy, straining every few minutes, and voiding small pellets of dung. The urine was natural; abdomen hard and tense; breathing much hurried; pulse 75 beats per minute, and temperature 104°. The straining being a suspicious symptom, inquiry was made as to whether the animal had been put to the bull, but the reply was in the negative. On separating the *labiæ vulvæ*, nothing abnormal could be detected; and it was therefore concluded that obstruction of the bowels was really the cause of illness. Treatment was adopted accordingly. During five days there was no alteration, though the bowels had acted freely; but on the fifth day, on attempting to explore the vaginal passage, it was discovered that the hand, or even a finger, could not be got beyond the vulva. Thinking it might be merely an extra tightness at the *ostum vaginæ*, considerable force was used, but only one finger could be made to penetrate about an inch. No vaginal canal existed, and its walls seemed to have grown firmly together.

The Heifer was now straining so violently, as to leave but little doubt that irritation about the generative organs was the sole cause of the illness. Continuing patiently to exert steady force, two fingers were finally pushed some four or five inches through where the vagina should have been, when there all at once escaped a dark-brown fluid which had a most repulsive odour. This fluid came away in variable quantity every time the creature strained. Next day, after great difficulty and laceration, from vulva to uterus, the os of the latter was reached; the operation was like "forcing one's hand into a piece of raw firm muscular tissue." "The os uteri was fully dilated, and the uterus itself had seemingly been pretty much distended by the imprisoned fluid."

As the case was considered hopeless, and the animal was in good condition, it was killed. An examination of the vagina and uterus could not be made.

Macgillivray was of opinion that this case goes to prove the existence of a menstrual discharge in the brute female, analogous to that in the human female, the symptoms of retention being somewhat similar. "The œstral products—however many times the Heifer had been in 'heat'—had evidently never found exit from the uterus, and the result was the immense collection of a most abominably-smelling sero-sanguineous fluid, which escaped after the forcible opening up of the hitherto imperious vaginal canal."

A very similar case is recorded by West (*Veterinary Journal*, February, 1877), but in this instance the animal recovered.

Acquired Stenosis or Atresia is generally the result of certain diseases or injuries, such as inflammation, suppuration and ulceration, and laceration, often due to difficult parturition. These may lead to hypertrophy and density of the tissues, hard resisting cicatrices, solid adhesions, or partial or complete obliteration.

Malposition of the vulva may also lead to atresia. I witnessed a case of this kind in an Arab Mare of high pedigree in Syria. The vulva was partly below the ischial arch.

In primiparæ, cases of abortion, cases in which birth occurs in a hurried manner, as well as when the water-bag is ruptured too soon, or in those breech presentations in which the hind legs are bent forward and only

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the hocks offer—in all these the narrowness of the vulva and vagina, from lack of preparation, is often an obstacle to parturition, their tissues being "hard."

But with patience and warm emollient injections, as well as careful and gradual manual dilatation, this obstacle may be overcome. When birth is taking place too hurriedly, Rainard recommends closing the animal's nostrils and opening its mouth, pulling out its tongue, and pressing on the loins to prevent its arching the back and straining. It is very rare that the resistance is serious, and in the great majority of cases birth occurs spontaneously, or with trifling assistance.

Some authorities, however, have met with instances in which it was necessary to dilate the vulvular orifice by incision, in order to prevent this part being lacerated, and to spare the animal pain and subsequent deterioration.

When the dystokia is due to disease or a traumatic cause, birth is more difficult; and this difficulty is increased as the pathological alteration is extensive.

1. In the *Zeitschrift für Thierheilkunde und Viehzucht* (Band 7), there is the description of a case in which the wall of the vagina was some inches thick, and the diameter of the canal only one and a half inch. This was the result of disease.

2. Leconte (*Mém. de la Société de Méd. Vétérinaire*, vol. v. p, 185) has furnished us with a very interesting case of this description.

He attended a Mare in parturition, which had previously, and while at pasture, received an injury from the horn of a Cow; this injury was inflicted in the region of the perinæum, and the vulva had been torn as far as the recto-vaginal septum. The cicatrices, still visible, proved that the laceration had been very extensive, and the vulva was so deformed and contracted that the hand could scarcely be passed into it. The vagina, cervix uteri, etc., appeared to be all right.

The Mare was making frequent parturient efforts; the liquor amnii had escaped—it was not known how long before; and the fœtus soon presented itself in a good position at the vulvular orifice, the head resting on the two fore limbs. At this part, however, the fœtus met with serious resistance to its outward progress. Nature might have surmounted this obstacle, perhaps, and birth might consequently have taken place without assistance, but there must have occurred considerable lacerations.

Leconte, therefore, preferred facilitating the exit of the young creature by operating as in vaginal hysterotomy. He made two lateral incisions—one above the other—on each side of the vulva, about an inch and a half apart, and about an inch in length: these incisions allowed sufficient space for birth to take place. Parturition was completed without an accident, and the incisions, treated as simple wounds, cicatrised in a few days.

The treatment of stenosis of the vulva and vagina must be, of course, surgical, and will vary according to the cause producing the constriction. But it will chiefly consist in incisions carried to a depth and extent commensurate with the exigencies of each case, and modified according to the anatomy of the part which forms the seat of stricture. It will be found that lateral incisions are, when they can possibly be practised, preferable to those made either superiorly or inferiorly, as they are less likely to be followed by inconvenient alterations and unfavourable consequences; while, with regard to the vulva, the textures at the sides of that orifice have more vitality, and therefore cicatrise more rapidly, than at the superior commissure.

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BOOK II.

FŒTAL DYSTOKIA.

THOUGH the obstacles to parturition offered by the maternal organs are somewhat considerable in number, yet it is found in practice that those due to the fœtus are far more frequently met with, and are much more numerous; though all of them may not constitute real or serious obstacles, some being easily removed or overcome, when birth takes place without any difficulty.

The obstacles which the fœtus may offer to birth are, for convenience of study, divided into two natural groups, according as they result from some physical condition of the young creature itself, or from the more or less irregular manner in which it is presented at the pelvic inlet. Each of these groups, again, it is heedless to add, embraces a certain number of varieties of obstacles; but though grouped and classified in this way, we must remember that difficult parturition due to the fœtus may not be owing exclusively to any one of these obstacles in every case, but in some instances may result from a combination of two or more of them.

But this combination does not preclude us from studying them separately; indeed, their separate consideration is absolutely necessary, as it is only by analysing them that we can realise their influence in hindering birth, either when alone or combined.

As will be seen from the following synoptic table, these obstacles are very numerous and varied, and require careful consideration from the obstetrist: opening, as they do, a wide field for investigation and reflection, as well as practical deduction.

The two groups referred to consist (1) of the obstacles independent of presentations and positions, and (2) of the malpresentations and positions of the fœtus, and the difficulties resulting from them.

SYNOPTIC TABLE OF FŒTAL DYSTOKIA.

- **Fœtal Dystokia.**
  - **Independent of the Presentations.**
    - *Excess in Volume of the Fœtus.*
    - *Anomalies in, and Diseases of the Fœtal Membranes.*
    - *Abnormal Quantity of Placental Fluid.*
    - *Anomalies in the Umbilical Cord.*
    - *Diseases* ... ...
      - Hydrocephalus.
      - Ascites, Anasarca, and Hydrothorax.
      - Emphysema.
      - Polysarcia.
      - Contractions.
      - Tumours.
    - *Death.*
    - *Monstrosities.*
    - *Multiparity.*
  - **Resulting from the Presentations.**
    - *Anterior* .....
      - Limbs ...
        - Incompletely Extended.
        - Crossed on the Neck.
        - Flexed at the Knees.
        - Completely Retained.
      - Head and neck ...
        - Bent Downwards and Backwards.
        - Bent Laterally.
        - Bent Upwards and Backwards.
      - Hind Quarters ...
        - Forced Abduction of the Limbs.
        - Croup Bent Under the Body.
    - *Posterior* ...
      - Lumbo-pubic and Lumbo-iliac Positions.
      - Limbs ...
        - Flexed at the Hocks.
        - Completely retained.
    - *Transverse* ...
      - Dorso-lumbar.
      - Sterno-abdominal.

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GROUP I.

OBSTACLES INDEPENDENT OF PRESENTATIONS AND POSITIONS.

In this group, the maternal organs of generation and those parts immediately concerned in parturition may be perfectly healthy, and the fœtus itself may be in a favourable position for expulsion; yet birth is either protracted, or rendered impossible without assistance, because of the excessive volume of the fœtus, anomalies in or diseases of its enveloping membranes, an abnormal quantity of placental fluid, anomalies in the umbilical cord, or from disease or malformation of the young creature, or a plurality of fœtuses in animals ordinarily uniparous.

CHAPTER I.

Excess in Volume of the Fœtus.

Excess in volume of the fœtus, due to normal or abnormal development of either the whole or only a part of its body, is far from constituting an unfrequent cause of dystokia in the domesticated animals: rendering spontaneous birth more or less difficult or altogether impossible, notwithstanding the healthy condition of the maternal organs, and the regularity and energy of the uterine contractions.

Causes.

Several causes may be in operation to lead to excessive development of the fœtus—either wholly or partially. Among these we may cite the following as the principal:

Prolonged Gestation.—It has been shown that the fœtus may be retained without injury for several weeks beyond the period usually allotted for its expulsion, and there can be little doubt that during this interval its development is continued. This extra-development being unprovided for in the dimensions of the genital passages of the mother, leads of course to protracted or difficult parturition.

There are instances recorded of the fœtus of the Cow and Mare weighing 117, 165, and 189 pounds. It may, therefore, be readily understood that the greatly exaggerated volume which this weight represents, must meet with much resistance in passing through a canal which, in ordinary circumstances, gives exit to a fœtus weighing from 56 to 80 pounds.

Instances of this exaggerated development, through prolonged retention, are far from uncommon. We will therefore only give one example.

A correspondent in the *Veterinarian* (vol. ix. p. 453) was called to see a Heifer three years old, and which was supposed to be long beyond its time for calving. On examining it, the os uteri was found to be closed, so that the hand could not be introduced into the organ, though the fœtus could be felt. It seemed to be so enormous in size that he had no hope of extracting it. An examination per rectum confirmed the suspicion that the calf was larger than the passage would admit. The animal was killed, and the autopsy verified the opinion as to the impossibility of delivery taking place.

Reduced Number of Fœtuses.—With multiparous animals, when the numbe

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of fœtuses is smaller than usual—as with the Bitch which has only one or two, instead of five or six—the excess of nutriment they receive increases their bulk to an abnormal degree; and as almost every breeder of dogs knows, this often leads to serious results in parturition.

Disproportion in Size Between the Male and Female.—There can be no doubt that a disproportion in size between the male and female, in many instances, exerts a marked influence in this direction. More especially is this the case in *crossing with different breeds*, or in attempting to breed from *too young* females.

Delorme, quoted by Rainard (vol. i. p. 474), says that he has known a certain number of Camargue Ewes die every year through non-delivery, they having been put to Dishley Rams, which were much larger than the native Sheep.

The case of small Bitches crossed by large dogs is familiar to all dog-breeders. There appears, indeed, to be a natural tendency in some small-sized Bitches to seek intercourse with dogs much larger than themselves, and this preference not unfrequently leads to fatal consequences in parturition.

But in many instances dystokia is due to exaggerated development of some particular region of the fœtus, and more especially of the head—a peculiarity derived from crossing, or breeding from a male possessing this character. Indeed, some authorities deny that crossing small female animals with males which are generally larger, is likely to prove a source of difficult parturition, provided there is nothing unusual in the proportion of any region of the latter. It is pointed out that, in the human species, small women are very often married to very large men, and yet their accouchements are more or less easy. It has also been remarked that Melingié, in order to form the breed of Sheep known in France as the *race de la Charmoise*, coupled the small *Berrichonne* Sheep with the great New Kent Rams; and yet in two thousand births only one was difficult.

A German veterinarian surgeon, Nathusius, mentioned by Rueff and Baumeister, asserts that in the cross between the small Merino Sheep with the huge English Rams, he has observed fewer difficult births than in flocks composed solely of Merinos. And Saint-Cyr states that he has often seen little "Bressanne" Mares which were put to big Percheron or Anglo-Norman Stallions, foal without difficulty at the ordinary period. We might also adduce the small female Ass coupled with the Horse-Stallion, and which rarely suffers during birth. Abortion or premature birth may be more frequently the consequence of such "mesalliances."

Though certain facts could be opposed to the above conclusions, yet it must be admitted that the *uniformly* exaggerated development of the fœtus is not a very common cause of dystokia, and is, as a rule, only so when the pelvis of the female is smaller than usual. So that we must look rather to special conformation than exaggerated development. And so far as conformation is concerned, we find that excessive development of the croup, chest, or head have the principal influence.

With regard to the *head*, it is indisputable that of the three regions this most frequently proves an obstacle to parturition. In the Bitch this is more particularly remarked. But it is also noted in other animals.

Price, in his book on Sheep, mentions that a grazier in Appledore employed Leicester Rams for several years, and obtained a breed with very small heads and "kindly disposition;" but he did not approve of them, because they were not sufficiently large, and did not fetch a good price in the market. He

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therefore, in the summer of 1804, hired some large Kentish Rams, in order to give size to his flock. In the following lambing season, he lost twelve Ewes, from the immense size of the lambs' heads, and he was obliged to "draw" (extract artificially) nearly all his Ewe lambs. In 1806, he had the same difficulty, and lost nine Ewes, in a flock of two hundred and fifty, from this cause.

Mr. Cartwright (Whitchurch) casually states that he has frequently known of some bulls "getting calves with very large heads, and causing great difficulty in calving; and the owners, finding what trouble there was at calving-time, and the danger of losing their Cows, have sold them, and obtained others whose breed had not this objection."

Rueff and Baumeister (*Op. cit.* p. 247), in alluding to this subject, remark that in the bovine species it is nearly always the head which forms the chief obstacle to birth; and they refer for proof of this statement to the small native Cows of Wurtemberg, which, when crossed by the Original Simmenthalern Bull, have often difficult labour, as the latter breed has often a large head.

And Schaack writes to Saint-Cyr, stating that for thirty years the Cows in the district of Lyons were all put to a Bull remarkable for its massive framework. The head especially was very developed, and as the animal transmitted this conformation to nearly the whole of its progeny, the size of the head of the fœtus very often rendered parturition difficult.

Breeding from immature undeveloped animals is almost certain to produce laborious births; and the reason for this is not difficult to find: the genital canal, and particularly the pelvis, is not sufficiently developed for the passage of the fœtus. A very striking instance of this, as well as of very remarkable precocity in the bovine species, is given by Mr. Barker (*Veterinary Journal* November, 1876). We will give the case in his own words:

"On the 14th of May, I was requested by the bailiff of Greenshills Farm, to go and assist or deliver a young Cow of a calf, this Cow being the property of J. T. Wharton, Esq.

"On arrival, I found the smallest animal to be a mother that ever I witnessed or heard of. This creature, a black-polled Scot, nine days short of one year old, had made perfect preparation for parturition, and there was one fore-foot of the fœtus projecting about two inches from the vulva.

"On inquiry, the bailiff told me that she had been accidentally 'bulled' when she was ten weeks and five days old, while sucking her mother; the Bull of the same breed going with the herd of Cows, the calves of which were all allowed to suck their mothers so long as they chose.

"The above statement to many may seem incredible, as it did to a neighbouring eye witness, who was asked to give a little assistance in pulling the calf away; for although he saw the calf's foot projecting, he remarked that he could hardly believe his own eyes, and asked me if I did not think that the Bull (the father of the mother) had got two calves at once, one within the other—as the mother was only a calf herself.

"On examining her, I found the other fore-foot and head back in the uterus, and the calf dead. I therefore corded the projecting foot and thrust it back, and, with difficulty, corded the other foot and brought it forward as far as I could; then I returned both feet and corded the lower jaw. After manipulating a short time, I succeeded in getting both fore-legs and head straight, when I met with a great obstacle —viz., the pelvic orifice being by far too small to admit the legs and head together, one leg filling the vaginal canal almost completely. I at once allowed the head and one leg to fall back, and introduced an embryotomy knife, with which I skinned the leg, and divided it from the trunk with the scapula. I then brought the next one and divided it in the same way, except having to leave the scapula, owing to so little room to work in; and the calf having only died about an hour before, the muscles etc., were very strong and difficult to sever without using very great traction. After the above reduction, I again corded the lower jaw, which had slipped, and essayed to bring the head forward; but this I found could only be done as far as the eyebrows

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the entrance into the bony canal of the mother's pelvis refusing admission of the bulky parts of the fœtus's head. But after manipulating the head, and using gentle traction, I succeeded in getting the whole of it into the passage, and ordered the men to pull simultaneously with her throes. The pelvic brim and inferior surface of the vertebræ here again refused egress to the sternum and anterior dorsal vertebræ of the calf; and very strong but steady force was employed to move the fœtus, but this failed. I therefore made an incision through the skin in the calf's throat, and subdermically cut a hand-way into the thoracic cavity, which I emptied of its contents. We then continued traction during her throes, and, as with the head, the most bulky part of the body passed over the brim of the pelvis with a sudden jerk, and entered the vagina.

"It again stuck obstinately at the pelvis, but was overcome by perseverance—the calf and placental membranes coming away *in toto*. It was a well-nourished and full-grown calf; and had not Nature endowed the mother's pelvis with great flexibility and elasticity of its ligaments, nothing short of the Cæsarean operation would have succeeded in delivering it.

"I was not very much surprised at the incident, as last year I delivered some of the same herd in a similar way, and these exactly one year old on the day they calved. I may add that about a teacupful of 'beastings' (*Colostrum*) were in the udder of each Cow when parturition occurred, but no more was secreted in any of these precocious creatures."

Influence of Food.—There is no convincing proof before us that the manner of feeding or kind of food has much influence on pregnant animals, so far as excessive volume of the fœtus, and consequent difficult parturition, is concerned.

Cox (*Veterinary Journal*, vol. i. p. 265) says: "The size of the fœtus depends considerably upon the condition of the parent and the kind of food given to it. Fat animals, and those emaciated from the continuous use of food of a poor nature or insufficient in quantity, bring forth a small fœtus. Where the debility is the result of pregnancy, and food has been given of a nutritious character and in sufficiency during that period, the fœtus will be disproportionately large, the extra nutriment having been diverted to its growth. Green food, or 'depasturing,' causes the fœtus to grow rapidly and attain a great size; but Nature compensates for this by giving with such diet greater relaxation of the tissues of the dam, and an increase of the placental fluids to lubricate and assist at delivery."

Diagnosis.

The diagnosis of excessive volume of the fœtus is difficult, and can only be established, as a rule, at parturition; for we do not possess any certain means of appreciating the dimensions of the fœtus *in utero* before its enveloping membranes have ruptured and the os is dilated. An unusual size of the maternal abdomen towards the termination of pregnancy, is an uncertain and very often deceptive sign.

Nasse, a German Veterinarian, imagined that this excess in development might be ascertained by weighing the animal during gestation. With regard to the Bitch, he thought there was danger when the weight was increased by two-fifths during this period, the normal increase being only one-third. But it is evident that an inordinate increase in weight may be due to other causes than the fœtus or fœtuses—such as an unusual number of these, an excess of amniotic or allantoic fluid, greater obesity of the Bitch, etc. Otherwise, if this test could be applied to the Bitch with practical results, the conclusions derived from it could not be made applicable to the other animals.

The only circumstance which might give rise to suspicion, is the prolongation of gestation beyond its ordinary period; though this suspicion, as we have seen, will not always, nor yet very often, be confirmed.

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It is only, then, at parturition that this obstacle on the part of the fœtus can be ascertained. If at this time, in spite of energetic and sustained uterine contractions, labour is protracted and does not advance, and if on exploration the pelvis and genital organs are found to be well-formed and normal, the os dilated, the fœtus in a favourable position and not malformed, it may be suspected that the obstacle to birth is dependent on the large size of the latter. A closer examination will probably confirm this suspicion.

With the *Bitch*, the principal obstacle, as has been already said, is generally with the head of the puppy, which, when it is large, is lodged at the entrance to the pelvic inlet, where it can be touched *per vaginam*.

The common-bred Bitch, with muzzle more or less elongated, when fecundated by a male of the same size and conformation, and bringing forth from five to eight young, has usually no difficulty in pupping. The tapering or conical form of the muzzle of the puppies, allows it to enter the passage and pass easily through, under the influence of the uterine and abdominal contractions. But when the Bitch is of small size, and has been impregnated by a larger and young vigorous dog, and especially if the muzzle of either or both of the parents is short and the cranium brachycephalic—as in King Charles' spaniels, pugs, and bull-dogs—parturition is oftentimes extremely difficult, as the forehead in these breeds is very large and cylindrical. This difficulty, as has been mentioned, is increased as the number of puppies is small, as then the latter are more developed.

With the *Cow*, the head of the calf may also be the chief impediment, and provided the young creature is otherwise in a favourable position, the muffle may pass through the inlet, but the remainder of the head remains fixed like a wedge in the long and almost undilatable bony canal. The head is often so firmly wedged at this part that it can scarcely, even with much force, be advanced or pushed back, and this "wedging" is always one of the most serious difficulties which the obstetrist has to overcome.

With the *Mare*, the head of the foal is smaller, longer, and more tapering than that of the calf, and meets with much less resistance in passing through the comparatively short and wide canal. But as Saint-Cyr points out, and as we have previously shown, in the equine and bovine species the young creature finds more difficulty when the anterior part of its body—chest and shoulders—begins to enter this part; and from their respective dimensions it is evident that, even under ordinary conditions, the anterior region of the fœtal trunk must submit to a certain degree of diminution in order to pass the pelvic inlet of the mother.

The limits within which this diminution is compatible with physiologic parturition, are not yet perfectly ascertained; though there can be no doubt whatever — for we have facts to prove it—that the development of the young creature may be so exaggerated that sufficient reduction cannot be effected to allow of its being born.

Mignot, of the Agricultural School at Saulsaie, France, furnished Saint-Cyr with the following notes and measurements which he made of a case of protracted parturition due to this cause.

An Ayrshire Cow, aged three years and ten months, 1·30 mètre high, and weighing 460 kilogrammes, had just brought forth its second calf. The previous year it aborted; this time it went its full period. The calf was in a favourable position—anterior vertebro-sacral—it was born alive and well, but birth was laborious because of the excessive size of its chest; so that powerful traction had to be exercised to compl

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delivery. The calf was poor, and weighed immediately after birth 30 kilogrammes. Its dimensions were as follows :—

	Mètres.
Supero-inferior diameter of the head	0·237
Bi-temporal ,,	0·118
Vertebro-sternal ,, of the chest	0·385
Bi-scapulo-humeral diameter ,,	0·197

With the Cow, the maximum pelvimetric elements were :—

		Mètres.
Height	1·030 × 0·182 = Sacro-pubic diameter	0·236
Width of croup	0·456 × 0·428 = Bi-iliac diameter	0·195

These figures clearly show the difficulty to be overcome in parturition in this instance. It will be noticed that the head itself could scarcely pass through the pelvis, because its vertical diameter was about equal to that of the pelvic cavity ; that the thorax had to submit to a considerable reduction, as its vertebro-sternal diameter (0·385 mètres) exceeded by about 15 centimètres the corresponding diameter (0·236) of the pelvis ; while the two transverse diameters were about equal. If the circumference of the thorax be compared with that of the pelvic canal, it will be found that the large circle (the fœtus) had to pass through the small circle (the pelvis). But the result proved that this can be done in these conditions, and without injury to the mother or fœtus ; though, as Saint-Cyr justly says, this, or very near it, must be the extreme limit of possible physiological reduction, and that beyond this limit the life of the fœtus at least must be seriously compromised.

In other instances, and especially with the foal, the passage of the croup presents the greatest obstacle, and the difficulty may even be serious.

Prognosis.

In such cases as those we are now studying, in which birth is delayed through undue development of the fœtus, it generally happens that the membranes have ruptured, and the liquor amnii has escaped, at an early stage ; consequently, the maternal passage is dry and tenacious, and perhaps swollen and irritated ; while the fœtus, no longer protected in its hydrostatic bed, is directly exposed to the uterine contractions, and in proportion as these are energetic, so does it the more rapidly succumb. The mother, in turn, becomes exhausted through unavailing efforts at expulsion, and if judicious assistance is not opportunely rendered, is not long before it also perishes.

It will, therefore, be seen that a prognosis in such cases of dystokia cannot always be of a favourable kind, as very often the death of the fœtus, if not of the mother, has to be taken into consideration. More particularly is this the case with the smaller animals—and especially the Bitch, though, as has been shown, the larger females, if they do not die so frequently, yet are not exempt from danger.

Indications.

The indications for the treatment of these cases are similar to those given for constricted or contracted pelvis : (1) Extraction of the fœtus entire by manipulation ; (2) Removal by embryotomy.

1. *Extraction of the Fœtus entire.*—If the "waters" have escaped for any length of time and the parts are dry and viscid, warm emollient fluids should be injected into the vagina, and if necessary the portions of the fœtus presenting may be lubricated with glycerine, oil, unsalted lard, or any other lubricant. The hand should then adjust the fœtus, if this is requisite, and attempts made to extract it by judicious traction, cords, and other accessory means to be hereafter described, being employed as occasion demands.

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The degree of traction will depend upon the amount of resistance to b overcome; it being carefully borne in mind that a medium degree of forc well directed, is often more effective than severe traction misdirected an inopportune.

For this reason it is that a careful adjustment of the fœtus should be mad before any force is resorted to, the "wedged" portions being "eased" an well smeared. It not unfrequently happens that a very trifling displacemen of the fœtus will allow it to pass gradually through the pelvic canal, and lea to the successful termination of a case which otherwise many would conside impossible to deliver.

2. *Embryotomy.* — When forcible extraction is deemed impossible, o dangerous for the mother, and when the latter has ceased to aid in expellin the fœtus, then the only alternative is embryotomy, which, entailing as i does the destruction of the progeny, yet affords the only chance of savin the parent. The operation will be described hereafter.

Anomalies In, and Disease of, the Fœtal Membranes.

It is very rare indeed, so far as published observations are evidence, tha anomalies in, or disease of, the fœtal membranes prove an obstacle to birth That they may sometimes do so, however, is evident from what we hav previously described. As Franck justly remarks, it is not unlikely that th retention of the fœtal membranes after birth is due, in many cases, to inflam mation of the placenta (placentitis). A not unfrequent condition of th membranes is congestion of, or extravasation into, the placenta, rupture of th capillaries (*capillary apoplexy*), and hæmorrhage between the placenta ma terna and placenta uterina. Partial separation of the two placentæ is als not very uncommon in the Mare; and metrorrhagia may be due, at times, t *placenta prævia*. Such hæmorrhage, when it occurs in the uterus, and th blood mixes with the uterine milk, gives rise to a chocolate-coloured fluid between that organ and the fœtal membranes, and in the asphyxia and intra uterine respiration (pulmonary) of the fœtus, this reddish-coloured fluid i often present in the lungs.

Hartmann describes a case in which the chorion papillæ of an aborted foal were small, pale, hard, and cartilaginous; and Broers (Canstatt's *Jahresbericht*, 1861, p. 53) describes two fœtuses in the uterus of a Cat, and on the inne surface of the membranes of one were numerous vesicular extravasations, while the other could scarcely be recognised. It may be surmised that many abortions or fœtal deaths are due to disease of the placentas.

The fœtal membranes may be too *thick* and resisting, or too *thin* and friable. In the first condition, they resist the labour pains too long, and after the os uteri is completely dilated they may be found intact outside the vulva; the fœtus may even be expelled in them. Such tenacious membrane may, to a certain extent, hinder delivery, though seldom, if ever, produce dangerous consequences, except to the fœtus.

Very thin membranes may, on the contrary, not resist the uterine contrac tions for a sufficient length of time, and therefore rupture before the os is sufficiently dilated. The consequent escape of the "waters" will render labour longer and more difficult. The utero-vaginal canal is dry and retentive, and the contractions of the uterus are weaker and much less effective.

The treatment for both of these conditions has been already indicated.

At page 350 we alluded to *adhesions* between the fœtus, its membranes, and the uterus, as a cause of protracted or impotent labour. We have now to

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refer to adhesion of the membranes to each other, or to the fœtus only, as a cause of difficult labour.

These adhesions are generally of the nature of fibrinous bands passing between the membranes, or from the surface of the young creature's body to the interior of its envelopes, due to the development of some local inflammation. Such cases are certainly rare, but their occurrence must nevertheless be taken into account.

One of the most interesting instances of this occurrence is given by Millot, and quoted by Rainard (*Op. cit.* vol. i. p. 492). The animal, a Cow, was eight years old, and had been in the pangs of labour for eight days. Some months before it had received a kick on the abdomen from a horse, which caused it to show all the symptoms of impending abortion. After eight days suffering, the symptoms subsided and the appetite returned; but emaciation persisted until the period for parturition. When this occurred the animal was quickly exhausted, and Millot found it lying on the left side; the eyes sunken; the visible mucous membranes pale; the pulse frequent, small, and weak; the respiration hurried and plaintive; the *labiæ vulvæ* tumified and the mucous membrane ecchymosed, while a reddish-coloured and fœtid serum escaped from this opening. The fore-feet of the calf presented, and on opening the vulva the head could be perceived.

As every attempt to make the Cow stand on its feet had proved useless, it was decided to remove the fœtus while the mother was in the recumbent position; but the debility was so great that three bottles of hot wine had to be administered before extraction could be attempted. And even then the Cow gave but little assistance, as the pains had nearly subsided. Traction having proved ineffectual to advance the fœtus, the hand was introduced to discover the obstacle which hindered its progress. In passing it over the anterior surface of the head, a kind of flattened cord was felt passing between that part and the membranes. Nothing else being met with, this cord was cut, when the fœtus, which was dead, came away immediately.

An examination of the calf showed that death had not occurred recently, as the hair came off readily, and there was a fœtid odour. The subcutaneous connective tissue of the head was infiltrated with a yellow serosity, which greatly increased its size. On the left frontal region—that to which the cord was attached—there was an indentation extending to below the orbit, and the bone was thickened; while the corresponding part of the brain was diminished in volume, the ventricle being nearly effaced and the cerebral tissue had the colour of yellow wax and the consistence of suet. No alteration was noticed on the other side of the head. There was no doubt as to these lesions having been produced by the kick from the horse a month previously.

The cord attaching the head of the fœtus to its envelopes, showed a peculiarity worthy of attention in an anatomo-pathological point of view. It had the aspect of the skin, and was covered with hair for more than an inch in extent, beyond which it was composed of the normal layers of the envelopes. Where it was inserted into the head, the skin was notably attenuated in a horse-shoe-like form. It seemed probable that a shred of skin had become detached by the injury, and contracted adhesions with the fœtal membranes; in this way constituting the cord covered with hair, which proved so serious an impediment to birth.

Vincent describes a very interesting case, in which the skin covering the joints of the first and second phalanges of the right fore-leg of the fœtus had contracted close and strong adhesions with the envelopes, and these with the uterine mucous membrane—in a somewhat similar manner to that recorded by "Nemo" at page 351. These adhesions opposed a serious obstacle to birth, which could not be accomplished until they were broken up by the fingers.

A curious case is given by Lhomme (*Journal des Vétérinaires du Midi*, 1868, p. 372) which shows, among other things, that adhesion of the membranes to the uterus does not always prove an obstacle to spontaneous delivery.

This Veterinarian was called to attend a pregnant Mare, reported to be suffering

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from colic. The animal was lying extended on the ground, breathing heavily, stru gling, and making expulsive efforts. A portion of the fœtal envelopes was observ to protrude beyond the vulva, which led to the belief that abortion was about to tal place. The colic was allayed by medicines, hygienic measures were recommended, a Lhomme retired, persuaded that the expulsion of the fœtus would soon occur. T days passed, however, and he was again sent for; as although the pains had d appeared and there had been no abortion, yet the membranes still hung from t vulva.

An examination proved that the fœtus was still alive, and that the os uteri w firmly closed on the extruded envelopes, so that a finger could not be introduce There appeared to be a veritable strangulation of the membranes which, having unde gone change, irritated the vagina, and made the Mare restless.

By means of curved scissors, these extruded membranes were removed as close the cervix uteri as possible. The Mare was immediately relieved, as the pawin stamping, and whisking of the tail ceased. No opinion could be given as to the resul the case being so unusual. It was certain that the embryonal sac had, by this oper tion, been opened; but then there was no escape of liquor amnii, owing to the closu of the os on the remaining portion of the envelopes. But the question was whethe the fluids would yet escape, or whether this would be prevented by cicatrisation the membranes on the distal side of the strangulation. It was still three months the time for parturition, and the owner of the Mare was recommended to report whe ever the slightest sign of illness appeared; and if abortion should take place, he w requested to keep the fœtus and membranes for Lhomme's inspection.

The animal continued to enjoy perfect health, however, and at eleven months an twelve days—three months and two days after the operation—it brought forth strong and perfectly-formed mule. The fœtal envelopes were carefully examined, an a cicatrix was discovered which corrugated and united them together; from this par they were in plaits to the extent of several inches, and these plaits were destitute villi. The opening in the membranes through which the fœtus had passed, was betwee two and three inches from the cicatrix.

Adhesions, when they exist and are a cause of dystokia, and when they ca be reached, must be broken up or cut through. In the majority of cases, th fingers will suffice; if not, then a bistoury must be used.

Difficulty in parturition in the Cow is sometimes experienced from th envelopes being torn in several places, and the head or limbs, or both, pass ing through these fissures.

In such cases the entangled parts of the fœtus must be sought for, released and brought into a favourable position by tearing or cutting through th obstacles.

Fromage de Feugré (*Cours Complet*, vol. i. p. 87) reports an observation furnishe by Lacueille. A Heifer was in labour for five hours, and was much exhausted by th manipulations of amateurs. The calf presented the head and one fore-leg. Lacueille instead of acting with precipitation, allowed an interval to occur between each of hi attempts at extraction; but an hour elapsed before he could discover the elbow of th other fore limb, which was entangled in the torn envelopes. Delivery was soon afte effected, and the membranes came away with the calf.

Abnormal Quantity of Placental Fluid.

We have already described the condition known as "hydramnios," and have pointed out that when it exists abortion nearly always takes place When the accumulation of fluid interferes with parturition, labour is slow and delivery difficult, owing to the great distention of the uterus and th pendulous state of the abdomen.

The indications for treatment have been given at p. 175.

An unusually small quantity of the liquor amnii, when it is not due t premature rupture of the envelopes, has not, to my knowledge, been men tioned as a cause of dystokia; though there is no reason why this deficiency

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ıould not lead to protracted labour, if we call to mind what has been said
s to the uses of this fluid.

The indications will be the same as for those cases in which the fluid has
scaped prematurely.

Anomalies in the Umbilical Cord.

Anomalies in the umbilical cord are not a very common cause of dystokia.

The cord may be unusually *short;* but this deficiency does not appear to
perate prejudicially in parturition, as the natural twist in it admits of its
ongation to a certain extent, while during the act of expulsion the walls of
ıe body of the uterus approach the cervix as the fœtus advances into the
agina. Even if the cord happened to be *too short*, it is questionable whether
would constitute a serious obstacle to birth, as it would most probably
ther rupture or the placenta would separate from the uterus.

If by chance the fœtus should not be expelled until it was discovered that
ıe cord was not sufficiently long, this might easily be cut in the vagina, as
r as possible from the fœtus, the ends being compressed by the fingers and
gatured after delivery.

In the domesticated animals the cord is never so long as to occasion what
s been designated in human obstetrics *prolapsus of the cord, i.e.*, its descent
to the os, vagina, or outside the vulva, after rupture of the membranes,
ıd alongside the presenting part of the child : an accident attended sometimes
ith great danger to the latter, from compression of the funis.

The comparatively short cord of the domesticated animals also exempts
ıem to some extent from another frequent cause of difficult labour met with
woman : the *coiling* of the funis around some part or parts of the fœtus.
evertheless, this coiling has been observed in animals—more often with the
are than the Cow. Havon, Delwart, Hurtrel D'Arboval, Rueff, and Sac-
ıers have seen it coiled around the neck, and more especially when the
etus was in a wrong position—bent towards the flanks, near the cord.
aven has found it round the loins; and numerous observers have noted it
ıcircling one or more of the limbs. Daubenton had remarked the fre-
ıency of leg coils in Sheep.

Coiling of the funis around any part of the fœtus is not in itself a common
ıse of dystokia, although it may render delivery protracted and fatiguing.
is more likely to induce asphyxia in the young creature, from the stretching
ıd diminished calibre of the blood-vessels composing it, and consequent
ıeck to the flow of blood.

Rainard is of opinion that the obstacle to parturition from coiling, is less
rious in the Mare and carnivorous animals than other creatures, because of
ıe readiness with which the placenta is detached in them.

The dangers of strangulation are also much less when the fœtus presents
nteriorly; when the presentation is posterior, there is risk of suffocation,
ecause it is difficult to ascertain the situation of the cord in order to divide
; and the uterine contractions, as well as the artificial traction, tend to
ghten the funis around the neck.

In the human species, it has often been remarked that children are some-
mes born with their limbs deficient, and the spontaneous amputation has
een attributed to the constriction produced by this coiling or twisting of the
ıbilical cord around the part, during the development of the fœtus. Vrolig,
illairet, and Goubaux have recorded similar mutilations in animals.

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Indications.

When coiling of the funis is ascertained to be the cause of difficult parturition, the indications are to uncoil it; or if this cannot be effected, then it must be divided either by the fingers, scissors, or a probe-pointed bistoury—hastening delivery as much as possible afterwards.

There is not much to be feared from hæmorrhage after section of the vessels, as they seldom bleed.

CHAPTER II.

Diseases of the Fœtus.

While in the uterus the fœtus may be affected with disease, which, causing its death, will lead to abortion or premature expulsion, or perhaps undue retention. Other abnormal conditions, more or less allied to disease, may give rise to vicious conformation or excess of volume, generally or locally, and thus prove a cause of difficult parturition. These conditions may produce *hydrocephalus, ascites* and *anasarca, emphysema, polysarcia, muscular contractions*, and *tumours* of various kinds.

Hydrocephalus.

As the term implies, "hydrocephalus" signifies dropsy of the brain, the dropsy being constituted by the accumulation of a more or less considerable quantity of fluid in the cranium of the fœtus, leading to a proportionate enlargement of that region.

This diseased condition is not at all uncommon in the bovine and equine species, and some of the specimens of craniums found in museums are wonderfully deformed, through the accumulation of fluid in their interior.

Pathological Anatomy.

This diseased condition is recognised by a more or less exaggerated development or volume of the cranium, the vault of which has been elevated and distended by the fluid collected in the brain ventricles.

In some cases, the distention has been so slight that the frontal bones are not much raised; while in others the collection of serum has been so great that these and other bones of the cranium are displaced, and the forehead, rising almost at right angles to the face, suddenly reaches an extraordinary height, giving the creature a startling appearance. The hydrocephalic tumour varies in figure as well as in volume. It is sometimes quite globular, and protrudes so high and so much over the face as to give the physiognomy a strangely human appearance (Fig. 81); in rare cases it is narrow, but excessively protuberant, involving only a part of the cranium (Fig. 83); at other times it is bilobular, and the divisions may be either alike or unequal in volume. Not unfrequently the diameter of such a tumour in the calf measures more than a foot. The tumour is soft and depressible in parts, hard and resisting in others, owing to the bones of the cranium being altered and separated in places. These bones—and particularly the frontal, temporal and parietal—are, as a rule, considerably deformed and thrown out of their natural direction, and in places so expanded

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and rarefied as to be no thicker than tissue-paper; when the internal distention has been very considerable, their borders do not meet as in their normal condition, but are often widely separated, leaving between them vast fontanellæ occupied only by a thin translucid membrane—the *dura mater*—which is in immediate contact with, and adheres closely to, the skin.

In some instances—especially in the calf—the bones in their upper part

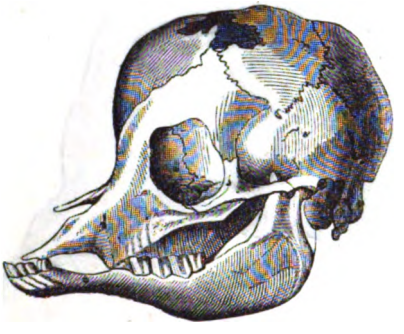

Fig. 78.

SKULL OF A HYDROCEPHALIC CALF: THE CRANIAL BONES ARE PARTIALLY DESTROYED AND DEFECTIVE.

do not join at all, and the roof of the cranium, or, rather, of the cranial tumour, is entirely absent (Fig. 79). In other instances, and particularly in the foal, a kind of bony arch extends from the nasal to the occipital bones, in the direction of the saggital suture, with only here and there, on each side,

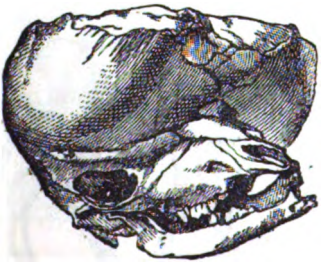

Fig. 79.

SKULL OF A HYDROCEPHALIC CALF: THE ROOF OF THE CRANIUM IS ABSENT.

small osseous patches from the parietal or temporal bones, and adhering to the dura mater.

The tumour is always entirely covered by intact, though sometimes very thin skin, to which the hair is ordinarily attached, and is indeed at times longer than usual, especially at the sides. This often makes the animal appear as if it wore a high fur cap (Fig. 81).

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Owing to the great development of the forehead the upper jaw appears to be shorter than usual; and, indeed, it will be found that it is really so (Fig. 78).

When the cranial cavity is opened, and the dura mater incised, there is

Fig. 80.

SKULL OF A HYDROCEPHALIC FOAL: THE CRANIAL ROOF IS DEFICIENT AT THE SIDES.

found a quantity—varying with the dimensions of the tumour—of limpid, colourless, or slightly yellow or greenish serum.

The quantity of fluid varies considerably, but it is generally from two

Fig. 81.

CALF AFFECTED WITH HYDROCEPHALUS: ITS SKULL IS REPRESENTED IN FIGURE 79.

to four pints in the foal and calf. Rainard estimated the quantity of fluid that had been contained in the skull of the Calf sent to him, at two and a quarter litres—the largest quantity he had met with. Drouard, however, in 1842, published the details of a case of a foal whose cranium held four and a-half litres (about eight imperial pints).

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Figure 80 represents a Foal's skull, now in the museum of the Lyons Veterinary School, and which, from its dimensions, Saint-Cyr calculates to have contained eight litres (about thirteen pints). Kopp not long since exhibited the head of a Foal before the Veterinary Society of Alsace, the diameter of whose dropsical cranium was fourteen inches, and which it was computed would contain about twelve litres of fluid (more than two and a-half gallons). And Quesnel has also shown a skull of about the same dimensions, to the Veterinary Society of Calvados et de la Manche.

Mr. Olver (*Veterinarian*, 1874, p. 481) describes the cranium of a hydrocephalic Foal which measured thirty-six inches in circumference, ten inches from one orbit to the other, and twenty-seven inches from the occipital crest to the nasal bones. At least twelve pints of fluid were contained in the cavity, and the cerebral substance remaining was quite disorganised, the dura-mater being much thickened. The cranial cavity was almost wholly surrounded by bone; the only portion which was solely enclosed by skin was a space about four inches in circumference at the top.

In the Museum of the Munich Veterinary School is a skull, the cranium of which measures nine by eleven inches in diameter.

Professor Lombardini (*Giornale di Veterinaria*, 1873) speaks of the head of a Calf, the cranium of which was more than fourteen inches high; it was eight and a-half inches long, and four and a-half broad. This Calf, with two others, well-formed, was aborted at six months, without any injury to the Cow, which was six years old. There can be no doubt that if the full period of pregnancy had been reached, this Calf would have proved troublesome to extract.

But these latter are quite exceptional instances, and are three or four times larger than those usually met with.

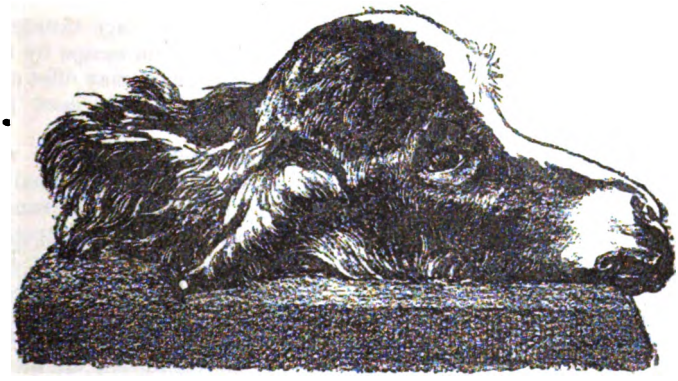

Fig. 82.

' Head of a Foal affected with Hydrocephalus.

This accumulation of fluid takes places in the ventricles of the brain, as has been ascertained from dissection by Rainard, Taiche, Chouard, Axe, and others, who have found the tumour formed externally by the skin, and internally by the membranes of the brain, to which adhered a thin layer of cerebral substance. The spinal cord, plexus choroides, and cerebellum, have been generally observed to be intact, and only the cerebral hemispheres are destroyed more or less completely.

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Though this alteration, or rather destruction, of the brain is of so serious a character, and though it must have begun at an early period of uterine life, yet it does not appear to have much influence on the development of the fœtus, as this is usually found to be full grown, its skin covered with hair and well-formed everywhere except in the head. Exceptional cases occur, however, in which development is arrested; as in some mentioned by Lecoq, of hydrocephalic Calves, in which the limbs were atrophied and the bones of these cartilaginous.

If intra-uterine existence can be maintained by the hydrocephalic fœtus until the period of parturition, it generally perishes during birth or soon after—usually after one or two respirations. In some exceptional cases, however, such creatures have lived to the eighth day after birth, and, as Saint-Cyr remarks, they might survive even longer if the dropsy is not very extensive.

In the most favourable cases, nevertheless, there is little profit to be expected from keeping such animals alive, as they are ordinarily weak and thrive badly; they can rarely stand, and they refuse the teat, being usually in a semi-comatose state; if the tumour chances to be pressed upon, the young creature becomes completely unconscious and lies in convulsions.

Very few cases of recovery, even in the mildest form of the malady, are recorded.

Dystokia.

The obstacle this congenital condition of the fœtus presents during birth, must, of course, depend upon the volume of the cranial tumour. The birth of a hydrocephalic fœtus often takes place spontaneously, though perhaps only after much straining. If the cranium is not very large, and provided the labour pains are sufficiently energetic and the position favourable, the tumour yields, and the head becomes elongated in its passage through the os and the pelvis, or it may rupture internally and the fluid escape by the ears, nostrils, and eyes. When extremely large, the cranium may offer an invincible obstacle to spontaneous delivery, notwithstanding the most powerful labour pains.

And, besides, the mechanism of parturition in such cases varies with the presentation—anterior or posterior. The head of the hydrocephalic fœtus being more or less spherical—instead of conical, as in the normal condition—it results that this part, when the young creature is pressed upon by the uterus, no longer acts as a wedge to gradually dilate the os uteri. The head certainly commences the work of dilatation, but in a very incomplete manner, and when the jaws—particularly the upper one—have cleared the os, further progress is checked by the voluminous forehead. If the hand is introduced into the vagina, the cervix uteri is found to be contracted on the nose or jaws of the fœtus; and the delay in further expulsion depends upon the size of the cranium, the protrusion of the uterus into the pelvic cavity, and the exhaustion of the organ by futile contractions.

In the posterior presentation, birth takes place in the manner already described; the hinder extremities advance through the os, then the body and neck, and birth is apparently taking place satisfactorily until the head reaches this aperture, when further advancement is stopped—the resistance to expulsion being in proportion to the volume of the head.

Not unfrequently, with such a condition of the fœtus we have also a malposition to complicate matters.

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Diagnosis.

In the anterior position, there is not much difficulty in diagnosing the presence of hydrocephalus: as the hand can feel the voluminous spherical cranium beyond the muzzle and eyes, with the ears on each side, and its unequally resisting surface—hard in some parts, soft or fluctuating in others. When, however, there is a malposition of the fœtus, then it is sometimes more difficult to discover the hydrocephalus; and often this cannot be done until the position is remedied. The head should be sought for in every case, and it will be recognised by the mouth, eyes, and ears; after which the size, consistence, and form of the cranium can be estimated by passing the hand over it.

In the posterior presentation, hydrocephalus has been recognised while the fœtus was still in the uterus. The greatly enlarged head may be felt *per*

Fig. 83.

EXTRAORDINARY DEVELOPMENT OF THE CRANIUM OF A HYDROCEPHALIC CALF.*

rectum, or even through the abdominal walls. But, as a rule, it is only at an advanced period of labour, and when the body of the young creature is already beyond the os, and perhaps without the vulva, that a difficulty is discovered and the cause sought for.

In such a case manual exploration is necessary, and this should be effected, if possible, by passing the hand between the fœtus and the wall of the vagina. This is difficult if the body is still in the passage, and it may be requisite to have recourse to traction to withdraw it therefrom. If, however, it is beyond the vulva, then the hand can be easily passed along the neck as far as the head, when the real state of affairs can be discovered.

Indications.

The indications for treatment in cases of dystokia from hydrocephalus alone, without reference to such a complication as malposition of the fœtus, are simple and few.

* For the photograph of Figs. 82, 83, and 99, I am indebted to my friend, Mr. Shipley, M.R.C.V.S., Yarmouth.

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When the hydrocephalus is not considerable, judicious traction will often accomplish delivery; and several cases are on record in which foals and calves whose cranium was of large size and full of fluid, have been delivered by this means, some of them alive, and in the posterior as well as the anterior presentation. In such a case, suppose the fore feet present, these should be secured by cords, the ends of which may be given to an assistant; then the hand should be introduced into the vagina, and if necessary the os should be dilated sufficiently to allow of another cord being fastened on the upper, or, perhaps better, the lower jaw, which is often wider. Traction can then be made during the throes of the mother.

When, however, traction will not effect delivery because of the size of the head, and the mother is becoming exhausted, the cranium must be punctured —an easy operation when the presentation is anterior, but more difficult when it is posterior.

The puncture may be made by means of a bistoury, a scalpel or ordinary knife, or, which is preferable, a somewhat large trocar and canula, curved if possible. The most fluctuating part of the tumour should be penetrated, and the fluid having escaped, the cranial parietes collapse, or give way to pressure; the head is thus greatly reduced in size, and delivery can be completed.

Rainard recommends the puncture to be made on the side of the cranium; and should it be necessary to still further reduce the size of this part by bone-forceps or other means, the side of the cranium will be found most suitable. In the posterior presentation, the back of the head may be punctured, and the weight of the young creature's body, hanging beyond the vulva, will sufficiently steady the head for this purpose; but in the anterior presentation, traction should be made by means of the cords while the cranium is being opened.

Rainard informs us that Conte, being called in to assist a Mare in foaling, found a posterior presentation, and having diagnosed hydrocephalus, he was able by version to convert it into an anterior presentation, when the head was easily punctured.

Embryotomy has been recommended in such cases; but, beyond reducing the size of the head, if that is the only obstacle, there is no necessity for resorting to further breaking up of the body of the fœtus. Indeed, it will be found that, in ordinary cases, patience and judicious manipulation will often enable the obstetrist to dispense with craniotomy. This is well exemplified in the following instance.

Drouard (*Recueil de Méd. Vétérinaire*, 1842, p. 40) was requested to attend a Mare labouring under difficult parturition. The animal was nine or ten years old, in good condition and well-formed, and had produced and reared three or four foals. The presentation was posterior, with the hind legs bent forward under the body. The breech occupied the passage, and could not be moved forward to allow the hand to seize the thighs and so bring up the legs; the labia of the vulva were becoming swollen, and the Mare, being exhausted by fruitless straining, was in a dangerous condition. There appeared to be only two methods of delivering the animal: by practising embryotomy, or forcibly extracting the hind extremities. For this purpose a strong hooked instrument was fixed in the right hip of the fœtus. Six or seven persons pulled energetically at this instrument, while others supported the Mare and prevented her falling. As soon as the skin and muscles began to give way, the femur became disarticulated, and was drawn out. After this it was thought that the other parts of the fœtus might be extracted by ordinary means; but tumefaction of the parts increased so rapidly that the other extremity had to be removed in the same way. A hook was then inserted into each of the acetabular cavities, and the body of the fœtus was easily drawn into the vagina when, the head having arrived at the pelvic inlet, all further progress was stopped. The hand was introduced into the uterine

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cavity, and a monstrous head was recognised; in this considerable fluctuation could be detected, and hydrocephalus was diagnosed.

Drouard was preparing to puncture the head, when the assistants, taking advantage of an effort of the Mare, pulled all together so strongly, that they extracted the trunk and head of the fœtus—a cranium of such monstrous size had scarcely ever been seen before. The fœtus altogether was small and emaciated, but the enormous head was larger on the right side than on the left. On the slightest displacement, the fluctuation of the contained fluid could be both seen and felt.

Macgillivray (*Veterinary Journal*, January, 1877) attended a Cow which had been showing symptoms of calving for some hours, the *waters* having escaped, etc. He found parturition further advanced than was expected, for a pair of feet were protruding from the vulva. Observing that the soles of the two feet were shown uppermost, he concluded that it was a hind-leg presentation, or something worse. It proved to be a hind-quarter presentation, and very slight traction sufficed to bring away the fœtus as far as the fore-quarters, but there it came to a complete standstill. He introduced his arm into the passage, expecting to find a fore-leg turned back; but could discover no such obstacle—his hand slipping quite easily all round the body of the fœtus. He now attached cords to the hind-legs above the fetlocks, and with the assistance of five or six people drew away a living fœtus. The cranium was of an immense size, and precisely similar in shape to Fig. 78.

What rendered the extraction of the fœtus so difficult, and the case so uncommon, interesting, and complicated, was that one of the fore-legs passed right over the top of the enlarged cranium (from occiput to muzzle), and was, in fact, partially imbedded in a groove during its whole course along the abnormally large fœtal cranium. This malpositioned leg must have been there for months, as the bones of the cranium were quite firm and unyielding; and the erratic leg persisted in keeping its *cranial* position even after delivery. This malpostured fœtal monster remained alive for a few minutes only; which the farmer's wife thought a very lucky circumstance, as she was just asking him to *make away with it* when it *went away* of itself!

Every case, however, does not terminate successfully.

Olver (*Veterinarian*, vol. xlvii., p. 481), in a case of difficult parturition in a cart Mare, found, on examination *per vaginam*, the fore limbs of the foal in the passage, with the head turned back out of reach. The presenting limbs being detached from the body of the fœtus, an enormously enlarged head was discovered, the enlargement being surmised to be due to hydrocephalus. Attempts were made to puncture the cranium, but unsuccessfully—though the reason for the failure is not stated; consequently, the Mare was killed. We have given the dimensions of the cranium at p. 373.

Ascites, Anasarca, and Hydrothorax.

"Ascites" (fluid in the abdominal cavity), and "Anasarca" (fluid beneath the skin), either partial or complete, do not appear to be such frequent diseases of the fœtus as hydrocephalus. The cases recorded are comparatively few.

Anasarca has been observed in the foal, calf, and kid, and ascites chiefly in the calf. These pathological conditions have generally been confounded.

With regard to ascites, it appears that in all the recorded observations, the fœtus was in what we have designated the "natural presentation and position;" though twice these were complicated: the head being turned back on the left side in one, and in the other all the limbs presented with the head, the left fore-limb being contracted.

Sometimes the fœtus has ceased to live before the full period of pregnancy has expired, and is expelled from the uterus; at other times it reaches maturity, and living through a few of the early pains, it succumbs before parturition is completed, either from the effects of protracted labour or from the manœuvres adopted to extract it. None appear to have been born alive; nor would they be likely to live if by chance they were extracted before death seized them. In addition to the abdominal cavity, the scrotum is often enormously enlarged through its communication with the latter, of which it is only a kind of diverticulum. Hydrothorax is often combined with ascites.

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With regard to anasarca, Noyes (Rainard, *Op. cit.*, p. 476) has witnessed a number of cases of *general anasarca* in the course of a year, in the neighbourhood of Mirepoix, France. He states that the calves were born at least three weeks before their time, and always dead. The connective tissue of the entire body—from the head to the croup—was infiltrated with serum, the young creatures being double or treble the size of ordinary calves; the head especially was enormously large. During pregnancy the abdomen of the Cows was so developed, that their owners thought they were bearing twin calves.

Quétier has published details of analogous cases of general infiltration, in which the fœtus was at least twice its natural size.

This condition has been witnessed in the fœtus of the Mare by Pauli (Gurlt and Hertwig's *Magazin*, vol. viii.), and by Lehnhardt (*Ibid.*, vol. ix.) and Herran (*Journal de Vét. du Midi*, 1864) in the Goat. The latter authority made an autopsy of a Goat which had died from injuries inflicted on its head, and found in it twin fœtuses, whose body was completely infiltrated.

Cause.

The cause of this dropsical condition is not well ascertained. In some cases it may be due to uterine dropsy of the mother or to constitutional hydræmia; but in other instances it cannot be so, as the mother is in good health, and it would then appear to be owing to derangement of the fœtal circulation, and particularly of the venous system—probably congestion of the umbilical cord. At times, disease of such organs as the kidneys may produce it.

Arloing informed Saint-Cyr (*Op. cit.*, p. 544) that Guilhempey, veterinary surgeon at Cologne (Gers), met with three cases of fœtal ascites which proved a cause of dystokia in the Cow. The fœtus in each case was in the normal position (vertebro-sacral of the anterior presentation); but though the feet were in the vagina, delivery could not be effected, notwithstanding the most skilful and energetic traction. In the first cases, after many difficulties and much examination, it was ascertained that the abdomen of the fœtus was enormously distended; and at the moment the mother strained, or when traction was made, this region seemed to divide into two masses, separated by the spine of the young creature. Recognising it as a case of ascites, the abdomen was punctured by means of a long knife, the blade of which was guarded with tow except at the point; a great quantity of fluid escaped, and the mother then straining violently, delivery was effected. The second case was of a similar character, and in the third case, though puncture diminished the difficulty, yet it did nor permit it to be entirely overcome, as in the others. This was because, in addition to the ascites, there was hypertrophy of the liver and kidneys. One of the latter weighed nearly eighty-two ounces (2,300 grammes), the other about seventy ounces (1,990 grammes); the liver weighed ninety-two ounces. The peritoneum was thickened, and showed traces of chronic inflammation. One of the kidneys sent to Arloing for examination weighed only fifty-six ounces, but a large quantity of blood had escaped from it into the vessel in which it had been carried. It appeared to be five or six times larger than the kidney of a calf ready for the butcher, and its surface still allowed its usual lobulated arrangement to be seen. Its proper capsule, covered by its thickened peritoneal envelope, was easily removed, and beneath it appeared a great number of somewhat translucid greyish points. On section through the middle, the two structures of the kidney were distinguishable, but their tint was pale; everywhere, but more particularly in the cortical substance, were observed the greyish points, the contents of which could be readily removed, leaving a small cavity in their place. After hardening in chromic acid, sections were made, when the greyish points, on being submitted to microscopic examination, appeared to be so many *kysts* filled with the *débris* of epithélium from the uriniferous tubes.

The connective stroma was also hypertrophied, and particularly abundant in the neighbourhood of the papillæ.

This was evidently a case of kystoid degeneration of the kidney, from atresia of the papillæ—a kind of degeneration observed in the human species, and described in Virchow's "Pathology of Tumours."

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Franck remarks (*Handbuch der Thierärztlichen Geburtshülfe*, p. 429), that he fact that sometimes a Cow will for a number of years bring forth these dropsical calves (*Wasserkälber*) in succession, while other Cows in the same hed produce healthy calves, shows that there is probably, in these cases, t least some anomaly in the uterine vessels; the fact, also, that sometimes long with general anasarca and ascites, there are rhachitic alterations of the ones, points to mal-assimilation, or deficient supply of the protein substances and phosphorus salts, the deficiency being presumably due to disease n the part of the mother, or to some anomaly in the composition of the terine milk.

Dystokia.

The amount of difficulty met with during delivery in these cases will epend upon the quantity of fluid effused into the abdominal cavity, chest, r superficial connective tissue.

Sometimes delivery is possible with the aid of traction. But in the great majority of instances, when the head and fore-feet have passed through the s, further progress appears to be impossible. In these cases we have extreme distention, but even in some of them delivery by traction is not hopeless. Cazeaux (*Traite Théoretique et Practique de l'Art des Accouchments*, . 659) says of this condition in the human fœtus: "The abdominal parietes ave been observed to yield in such a way that a large portion of the tumour emained above the inlet, while the trunk gradually descended into the elvis; and when once a part of the abdomen had cleared the passage, the uid escaped into it and towards the point where there was least resistance, he volume of the part still in the pelvis progressively diminishing, and elivery being finally accomplished naturally."

Saint-Cyr is of opinion that it is probable delivery has been effected in a milar manner, in those cases in which the dropsical fœtus of animals has een extracted without operation or mutilation.

Sometimes the walls of the abdomen give way, as in the case recorded by ourjon (Rainard, *Op. cit.*, p. 485). This veterinarian attended a Cow, three ears old, which was in the act of parturition. The fœtus was in the natural osition, and the head and fore limbs were external to the vulva. Strong raction was employed to extract it, during which the abdomen ruptured, and was estimated that more than twenty litres of fluid escaped. The Cow as in great danger for a month afterwards.

Diagnosis.

The nature of the obstacle can only be ascertained by vaginal or uterine xploration, though an examination *per rectum* may assist in leading to a correct diagnosis.

In vaginal exploration the great size of the abdomen in *ascites*, the distention of its parietes, and the fluctuation on pressure, should reveal the state affairs. Not unfrequently, however, the body of the fœtus so completely ocks up the passage that it is impossible to pass the hand, and it may be ecessary to remove the protruding limbs by embryotomy in order to diminish s volume. Hesitation in resorting to this operation is usually unjustifiable, the fœtus is nearly always dead, and if alive it cannot exist after birth.

It has been recommended, in addition, to remove the two first ribs, in der to allow the hand to explore the interior of the fœtus. If the obstacle

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is due to ascites, the convex condition of the diaphragm, and the fluctuation of the fluid on the abdominal side of it, will be remarked.

When the dystokia is owing to *anasarca*, this will be distinguished by the general roundness of the surface of the body, owing to the subcutaneous fluid, which effaces all the prominences, and to the œdematous sensation communicated to the fingers by pressure.

Indications.

When the condition of the fœtus is once ascertained, the principal indication, if delivery by traction cannot be effected, is to diminish its volume, by producing the evacuation of the fluid which distends it, as promptly and effectually as possible.

In *ascites*, puncture of the abdomen through the parietes of that cavity, if they can be reached, or puncturing the diaphragm through the chest, if they cannot, must be practised. In the first, a bistoury or any kind of convenient knife, or a trocar, will suffice; in the second, a long trocar or long-bladed knife, wrapped round with tow to near the point, will answer the same purpose; or if the hand can be introduced into the thorax, the fingers alone will rupture the diaphragm. As the fluid escapes, the abdomen collapses, and delivery is then easy.

When anasarca is present, the fluid must be got rid of by deep incisions through the skin wherever the hand can reach. The mechanical extraction of the fœtus should then be easy. In a case reported by Anacker, however (*Thierarzt*, 1868, p. 85), the fœtus was so large that it had to be removed by gastro-hysterotomy.

1. In 1815, Rouchon communicated the following case to Rainard (*Op. cit.*, p. 484). He was called to see a Cow, ten years old, and which had always until then been in good health, and had calved four times: but the belly had never been so large as during the pregnancy with the calf which it was then attempting to get rid of. It was extremely feeble, and before anything could be done towards assisting it, a stimulant had to be administered. No portion of the fœtus was visible, but on Rouchon introducing his hand into the uterus, he found the fore limbs and the head; the creature was in the dorso-lumbar position, and on the fingers being passed into the mouth, it was discovered that it was dead. The limbs and jaw were corded, and on traction being patiently but forcibly exercised, the head and fore limbs were extracted, though it was imposible to remove more than these. With very great difficulty the hand was again passed into the genital passages, and it was found that the abdomen and scrotum of the fœtus were of an enormous volume. The abdomen was punctured with a bistoury, and Rouchon estimated that from seven to eight litres of a yellow, oily-looking fluid escaped therefrom. The extraction of the calf was immediately effected, and soon after the Cow expelled nearly three-fourths of a bucketful of the same kind of liquid.

2. Courjon, according to the same authority, saw a Cow, three years old, the fœtus of which, in the same position, had the head and fore limbs protruded; in the attempts to extract this fœtus, its abdominal parietes were ruptured, when it was calculated that twenty litres of fluid escaped. Soon after, this veterinarian had to puncture the abdomen of another calf fœtus with a bistoury, then to enlarge the incision with the fingers and hand, in order to permit the escape of the fluid therein, which was supposed to amount to twenty-five litres.) The fœtus had also anasarca of the hind limbs.

Schwarz, according to Franck, describes the case of a calf affected with *hydrops universalis*, which an empiric had been trying for twelve hours to extract, and the four feet of which had been drawn into the vagina. Schwarz incised the kystoid swelling about the neck, after which the calf could be removed.

3. Voigtlander (*Sächs. Jahresbericht*, 1861, p. 67) also mentions a similar case, in which the fore limbs had to be extracted, and the chest and abdomen opened, before birth could be effected. The Cow was saved.

4. Müller (*Oesterr. Vierteljahresschrift*, 1868, p. 36) likewise describes a dropsical calf, the fluid in the kysts being clear and yellow, with whitish flakes; they had the form of echinococcus kysts, and were formed by a thin serous membrane. The lungs were

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ery small, and the chest contained a quantity of water; the heart was large, and he right chambers much widened.

5. Gierer (*Ibid.*, 1871) alludes to an ascitic calf which, when being forcibly extracted, uptured internally, and a stream of fluid gushed from its mouth and nostrils. The ame authority writes of another calf in the same condition, which ten men had ex-racted as far as the withers, but could get it no further. Gierer contrived to make n opening in the abdomen, when a great quantity of fluid escaped, and the young reature was then removed.

6. Dinter (*Sächs. Jahresbericht*, 1867, p. 87) relates a case in which five men had ex-racted the calf as far as the shoulders, when it remained fast. It was punctured by a rocar and canula, and eight to ten quarts of blood-tinted serum escaped. When xamined after it was removed, about half a pailful of fluid was still in the abdomen.

7. Binz (*Geburtshülfe*, etc., p. 241) gives the case of an ascitic calf, the head and ne fore limb of which had passed through the os uteri. The chest and abdomen were pened through the breast, the fluid was evacuated, and delivery effected.

An extremely rare cause of dystokia is due to congenital occlusion of he urachus, which leads to great accumulation of urine in the bladder, and onsequent distention of the abdomen. A very good example is given in the early report of the Veterinary School of Hanover, for 1872.

This condition will be diagnosed in the same way as ascites, and the same ndications for extraction of the fœtus are to be observed.

Emphysema.

Emphysema of the fœtus is sometimes found to be a cause of dystokia. econte mentions that he has met with a case in which a living fœtus was artially emphysematous, the head and neck, as far as the shoulders, being nvolved.

This case is exceptional, however, as this condition is, as a rule, observed nly after the fœtus has perished in the uterus. It sometimes happens that uring parturition the water-bag is ruptured before the young creature has ade sufficient progress, or it may be in a bad position. The uterus then closely ontracts on it, over the whole of its surface, and it soon succumbs. In the ourse of two or three days its tissues have become softened and decomposed; he subcutaneous connective tissue becomes distended with gases, the result of his decomposition, and in a short time the entire carcase of the young reature is inflated. This inflation indirectly distends the uterus, and the etus sometimes increases so immensely in volume as to cause rupture of the alls of that organ.

The hair on the skin of the fœtus is loose and easily removed; the skin often dry, and the fluids small in quantity. Gases are not unfrequently isengaged in the fœtal membranes, and particularly in the amnion. Bossetto *Giornale di Veterinaria Practica*, 1859) mentions a curious case of this escription, in which, after rupturing the membranes of a fœtus that had een dead in the uterus for some time, on withdrawing his hand from the agina there was a rush of carburetted hydrogen; this became ignited by he flame of a candle held some distance from the vulva of the pregnant nimal. The flame, ten to twelve inches long, burned for some time, and he Cow did not appear to suffer.

Indications.

The dryness of the skin and the large volume of the fœtus, as well as the nertia of the uterus, are the obstacles to extraction. Consequently, version nd retropulsion cannot be beneficially resorted to here; but deep incisions ay be practised on the surface of the body of the fœtus as far as the hand

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and knife can reach. The maternal passages, as well as the fœtus, should then be well lubricated with some fatty agent, and if the carcase is in a favourable position traction may be tried—cords and hooks being employed in a manner hereafter to be described. If the position is not favourable, then it must be corrected.

Should mechanical extraction fail, then embryotomy must be practised. After the fœtus has been removed, thorough cleansing of the uterus will be necessary.

Polysarcia.

German authors only, so ar fas I can ascertain, make mention of this condition, in which there are abnormal accumulations of adipose matter in the subcutaneous connective tissue; so that at birth these fat deposits often cause the calf to weigh more than a hundredweight. They are designated in Germany "lard calves" (*Speck-kälber*).

Indications.

The indications for the extraction of these lardaceous calves are, as might be presumed, the same as those for over-developed fœtuses in general.

Contractions.

This designation has been given to the permanent contraction or retraction of certain muscles—and we might add tendons and ligaments—which, in

Fig. 84.

Deformed Head and Neck of a Foal, due to Contraction and Pressure in the Uterus.

becoming hard and rigid, are at the same time reduced in length and thickness, so as to form inextensible cords which deform the part they are attached to, and prevent its assuming its natural positions.

This state of contraction and rigidity only takes place slowly and progressively, and it chiefly, though not exclusively, affects the muscles of the neck and fore limbs, giving these a vicious direction which it is very difficult to change, and which at parturition may become a rather troublesome cause of dystokia.

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The causes of these deviations, which bring about actual alterations in the ructure of the bones and muscles themselves, are very obscure. Bouley is ' opinion that the lesion is solely due to the *passive* influence of a false sition, which the fœtus assumes and maintains for a long time, and to hich the muscles and bones finally accommodate themselves. Rainard ought the cause might be of a mechanical nature, and due to the pressure ercised on the fœtus by the colon—particularly its pelvic portion—when led with hard fæcal matters, the residue of ligneous provender. He also nsidered it possible that it might be of a convulsive kind, owing to disease the nervous centres.

When the neck is affected, it is bent round to the side, the nose being ried in the flank, or even resting on the hind quarters of the fœtus; and rigidly is it curved, that not only does it resist all attempts to straighten it the uterus, but even when extracted and the fœtus is dead, the neck can- t be made to assume a rectilinear direction.

The period of gestation at which this deviation occurs is, of course, diffi- lt to arrive at; but Rainard and Saint-Cyr are of opinion that it takes ace early, as the bones of the head and neck are more or less deformed in me cases, the head being more especially distorted and curved laterally, d moulded, so to speak, to the parts on which it has rested during intra- erine existence.

This distortion appears to be more frequent in monodactyles, the neck of hich is longer than that of ruminants or other domesticated animals; and cording to French writers, it appears to be more common in some localities an others, and to be frequent in certain years—particularly in those scarcity or bad forage. Houssard reported that in Franche-Comté he had en the majority of brood Mares abort near the termination of pregnancy, experience great difficulty in foaling, from this abnormal distortion of the ck. Courjon, another Veterinary Surgeon practising at Meyzieux, Isère, s remarked on the frequency of this accident, under the influence, it was esumed, of the same causes. Schaack informed Saint-Cyr, that in his long perience he had met with several cases of this kind, one of which was in Calf that nevertheless lived, notwithstanding the deformity.

Contraction of the limbs also appears to be more frequent in Foals than alves, and varies in degree: from slight bending at the knees, which gene- lly more or less disappears after birth, and as the animal acquires strength, extreme flexion, so that ligaments must be ruptured, and perhaps bones oken, before the distortion can be corrected. The accident is alluded to Favre (*Le Vétérinaire Campagnard*, p. 290), Gaven (*Journal de Méd. étérinaire*, 1850, p. 201), Lemaire (*Recueil de Méd. Vétérinaire*, 1858, 444), Véret (*Ibid.* 1837, p. 289), and Cartwright.

Véret's case, alluded to by Saint-Cyr, is somewhat remarkable, and deserves notice. n exploring the uterus of a Cow in obstructed parturition, he recognised that the fœtus as alive, and that it was presenting with the head and all the feet together. The t fore leg was very thin and had only one claw: it was bent at three angles at 25° 30°, and it was impossible to straighten it without tearing the skin, as well the exor muscles which, by their retraction, had produced these angles. One of the gles was at the fetlock, the other at the knee, and the third at the elbow. The tus was at the same time affected with ascites. Delivery was very difficult, but it as effected after the two fore limbs had been removed and the abdomen punctured. The fœtus, in addition to the defective conformation of its left fore leg, had a very ort and thick neck, and the xiphoid cartilage was about eight inches long and rved upwards. The calcis of the right hock did not project, and the femur of the me limb was bulging.

Cartwright gives two instances—the only ones in English literature—both of which

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are interesting and instructive. In one case (*Veterinarian*, vol. xx. p. 385), the Calf had been extracted by an empiric, who had ruptured the uterus of the Cow, so that it had to be destroyed. The hind parts of the Calf were much contracted and diminished in size; the anus was impervious. The hind extremities were fractured in extraction, but they must previously have been lying under the belly or against the sides, and the *ligaments of the patellæ* appeared to have become shortened, as "the femur and tibia formed almost a straight line, there not being the least flexure at the stifle joints." "The stifle, hock, fetlock, and pastern joints were so firmly braced together, that they were completely fixed and immovable, and would not bend backwards, sideways, or forwards in the least. On examining these joints, not the slightest union of the cartilages or bones had taken place; only a shortening of the ligaments of the joints generally, not permitting the usual flexture of the parts. From the contraction at the stifle joints, the legs were almost straight, forming only a curve by the metatarsal and pastern bones being drawn a little anteriorly."

The other instance (*Ibid.* vol. xvi., p. 487) was in a Cow six years old, which could not calve. The presentation of the fœtus was posterior, and as the hind legs could not be drawn into their proper position by hand, it was attempted to do this by force with cords. But the limbs proved quite rigid; one limb at last broke off below the hock, then the other, and the fœtus was at length extracted by powerful pulling. It was then noticed that "the stifle joint lay forward, high up against the posterior ribs, and was held firmly there by the great contraction of the skin over the parts." "The extensor muscles underneath were very much shortened. The tibia was also bent unusually backwards, as the os calcis came almost in contact with the hip joint. The muscles here were in the same state of contraction and shortening as those attached to the patella, etc. The part of the limb below the hock was nearly in its natural position, being only a little more flexed upon the tibia than usual. The stifle and hock joints were also firmly held together in their altered position, by the shortening of some and lengthening of other of the ligaments of the joints; and when the muscles were cut through, the joints could not be brought to their natural positions without rupturing some of these ligaments. Both hind legs were in this state." The Cow had to be destroyed next day, as the neck of the uterus was ruptured.

Indications.

The indications for delivery are the same as those which will be given for extraction of the fœtus in malposition of the limbs and head.

Not unfrequently recourse must be had to embryotomy; and the limbs more particularly require attention in this operation, as by dividing the muscles, tendons, or ligaments of those which are contracted, they may be straightened and delivery effected. A careful examination should be made of the presenting limbs in all cases in which they are found to be flexed, in order to discover whether the joints are movable; and great care ought to be exercised in using traction before they are straightened or removed by the knife; as rupture of the uterus, or severe laceration of the other soft parts, may be the result.

Tumours.

Tumours of various kinds, situated either externally or internally, may prove an obstacle to birth; though the cases recorded are very few. Some of the former are kysts which, in some instances, may be looked upon as due to a second undeveloped ovule which has grafted itself on the fœtus. Hygromata are not very uncommon, and some of these are often ruptured during birth.

1. Binz (*Geburtshülfe*, p. 244) describes an immense kyst in the liver, which rendered parturition difficult; and we have already alluded to enormously enlarged kidneys producing ascites.

2. Lüdke mentions an enormous kyst on the neck of a calf, as entirely opposing natural delivery. The kyst was situated in the subcutaneous connective tissue, below the ear on the right side, and measured more than a foot in diameter; it contained thirty-six pounds of fluid, which was yellow-coloured, and in which were some flocculi of lymph. During labour it lay against the fore limbs, which were advanced into the pelvis, and

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t had pushed the head so far back that this could not be found. The nature of the umour having been ascertained, Lüdke punctured it; this rendered delivery possible, nd saved the Cow.

3. Rossignol (*Journal de Méd. Vétérinaire de Lyon*, 1864, p. 400) gives a very in-eresting account of a case of this description. Making an exploration in a case of rotracted labour, he found that the fœtus, which was dead, was in the anterior pre-entation, with the head turned back and out of reach. It was decided to remove it y embryotomy, in order to rescue the Cow, which was greatly exhausted. The fore imbs were removed one after the other, and this allowed a cord with a running noose o be passed round the neck, which was then straightened and the head brought into he vagina, from which the fœtus was extracted by moderate force.

Birth was then supposed to be finished, but to the surprise of Rossignol and his our assistants, who pulled with all their might, the calf could make no further pro-ress. The case was an embarrassing one, and necessitated another examination; his was rendered easier from the fact of the fore limbs having been removed. Pass-ng the hand beneath the thorax of the fœtus, it soon came in contact with a large, olid, round, and smooth tumour, but no trace of ears or jaws could be felt. It seemed to e firmly attached in front of the umbilicus, though it was slightly movable. Deciding hat, whether it was the head of another fœtus or whether it was a tumour, the nion should be broken by the increasing traction, a rope was passed round the hind uarters of the Cow and held by assistants at its head, and the pulling at the fœtus ecommenced. This at last brought away the whole of the body, but the tumour was eft behind in the uterus. All these manipulations did not last longer than half-an-hour.

The fœtus, though large, was remarkably emaciated. Towards the umbilical region here was a place as big as the hand, which was denuded of skin; the latter had een torn off, leaving the tunica abdominalis exposed; this, around the margin of the ound, showed long fibrous shreds. The umbilical cord was somewhat long, but did ot appear to have had any connection with the tumour. Search was about to be nade for the latter, when the Cow lay down; the labour pains again commenced—t first feebly, but gradually increasing—and at length, without any assistance, a arge white tumour was expelled, and soon after the fœtal envelopes.

The tumour was spheroidal in shape, white, hard, and nodulated, and appeared to e composed of fibro-adipose tissue. It was covered by a thin, smooth, but resisting nembrane, beneath which were blood-vessels. On one side was a net-work of veins, nd there were also some fibrous bands indicating where it had been attached to the œtus. It weighed a little over eleven pounds.

The Cow quickly and completely recovered.

4. Pflug (*Zeitschrift für Thiermedicin*, etc., vol. i., p. 367) was called to attend a oat in difficult labour, and on manual exploration discovered that the first fœtus was n a normal position, but that on each side of the head, in the parotideal regions and owards the larynx, were too large swellings (congenital scrofula) which prevented the assage of the young creature. By manipulation, pressure on the tumours—which ere as large as a small fist—first on one side, then on the other, with gentle traction, he kid was released. Two other kids which were in proximity to the first, were also rtificially delivered.

5. Schliepe (Gurlt and Hertwig's *Magazin*, 1863) describes the case of an unborn oal which had, behind the lower jaw, towards the neck, a kind of scrofulous tumour. On examination, this was found to be a distension of the Eustachian pouch, which ontained six Berlin quarts of yellow but somewhat coagulated serum.

Indications.

The indications will depend upon circumstances. In the examples given, he course there followed may be again adopted. Puncturing the tumour if t contains fluid, removing it if it is accessible and solid, and embryotomy if neither of these operations is likely to be successful, are the only measures which can be recommended.

DEATH.

Many practitioners are of opinion that the death of the fœtus renders parturition difficult. In certain circumstances it may do so, but, as a rule, provided it is in a proper position and properly developed, its death has but little influence on this act. We have already alluded to the death of the fœtus at page 235.

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CHAPTER III.

Monstrosities.

The designation "Monster," "Monstrosity," or *Lusus Naturæ* (French, *Monstre, Monstruosité;* German, *Missgeburt;* Italian, *Mostro;* Spanish, *Monstruo*), is generally applied to a creature which exhibits some vice in conformation,—some remarkable anomaly or organic deviation in form or structure, or both, in one or more parts of its body.

Monstrosities have been conveniently divided into two kinds: those which are *anatomically* so, and those which are so by reason of their *vicious conformation.* The first present no modifications externally, and there is no disturbance of function, but merely a change in the number or position of certain organs—a change only discoverable by *post-mortem* examination. The second includes those defects or deformities which more or less seriously impair the value of the young creature, either by destroying the symmetry of its shape, or rendering it more or less useless by the absence or incompleteness of certain organs.

The term "monstrosity," however, is usually reserved for a creature which presents the most serious kind of organic alterations, and which involve one or more organs—external or internal—these being modified in form, structure, and relations. In this class we may have a deficiency in one or more limbs, head, part of the head or trunk, or fusion more or less incomplete of two or more individuals, etc.

It must be admitted, however, that the limits between these groups of anomalies or organic deviations are not well defined, and that they merge into each other imperceptibly; so that it is not always possible to say where the one class ends and the other begins, and we can only fix upon the types of each of these artificial groups.

In ancient times the appearance of monstrosities was ascribed to the influence of enraged gods, and they were regarded with fear or horror; or they were looked upon as prodigies or freaks of Nature, and described as marvels or curiosities.

Indeed, it was not until the end of the eighteenth and commencement of this century that they began to be studied in a scientific spirit, and their anomalies shown to be only simple modifications or irregularities in the development of organs. Haller and Meckel commenced this new era, but it was not until the philosophical study of this subject had been pursued by Etienne and Isidore Geoffroy Saint-Hilaire, that the science of *Teratology* was founded on a true basis. Then it was clearly demonstrated that monstrosities themselves did not escape the general laws of organisation, but own their sway and prove their universality, and that Nature, in its widest divergencies, never ceases to be faithful to the decrees which the Creator imposed upon it at the commencement.

In 1827, E. G. Saint-Hilaire proposed a scientific classification of monstrosities—those beings which had hitherto been looked upon as combinations of different characters or individuals; and on this basis was raised the science of Teratology by his son Isidore. The labours of these men have been largely supplemented by the researches of such authorities as Meckel, Gurlt, Otto, Bischoff, Leyh, Martin-Saint-Ange, Förster, Dareste, Panum, Lombardini, and others. The labours of these investigators are unknown to English veterinary literature—indeed the entire subject is nowhere mentioned;* it

* A monstrosity is generally only alluded to as such, or as a *Lusus Naturæ;* their scientific classification has never been attempted in this country.

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will, therefore, be our duty to notice it somewhat fully, not only from its novelty in this respect, but also from its importance in a physiological and obstetrical point of view.

Classification.

Various classifications of monstrosities have been proposed at different times by investigators, who generally based their classification either on the notions they entertained as to the mode of formation of these creatures, or on some physical peculiarity presented in their organisation. Buffon divided them into three classes—1, monstrosities by excess; 2, monstrosities by defect; 3, monstrosities by irregularity in structure or situation of parts. To these classes Meckel added a fourth, which included the hermaphrodites. Martin-Saint-Ange divided them into—1, monsters by excess, comprising the union of several fœtuses—double monsters, in fact; 2, monsters by excess of growth; 3, monsters by absence of one or more parts; 4, monsters by general defect, as dwarfs: 5, hermaphrodite monsters.

The two classifications which have generally been adopted by continental veterinarians are those of Gurlt and Geoffroy Saint-Hilaire; that of the former—the eminent Berlin veterinary professor—being preferred by the Germans, Italians, Dutch, and Danish, and that of the latter by the French.

Gurlt's classification and nomenclature are good and explicit, and in some respects to be preferred to Saint-Hilaire's; while those of the latter offer advantages which might lead us to give them the preference, apart from the fact that it is they on which the science was based.

Gurlt* separates monstrosities into two classes—*Simple* and *Compound*. The first comprises eight orders, twenty-six genera, and seventy-three species; the second includes six orders, twenty-six genera, and fifty-nine species.

As some veterinarians may prefer Gurlt's classification to that of Saint-Hilaire, and particularly for its practical utility, we give it here.

CLASS I.

SIMPLE MONSTROSITIES.

This class is occupied with a single individual, and refers to an absence of or addition to parts, exaggeration of them, or alteration in their form or position. It comprises 8 ORDERS, 26 GENERA, and 73 SPECIES.

ORDER I.—SIMPLE MONSTROSITIES THROUGH ABSENCE OF PARTS:—

1. AMORPHUS.—Absence of conformation; 1 species: *A. globosus.*

2. ACEPHALUS.—Headless; 2 species: *A. unipes, A. bipes.*

3. PEROCEPHALUS.—Head defective; 7 species: *P. pseudocephalus* (apparently without a head), *P. aprosopus* (head without a face), *P. microcephalus* (small head), *P. agnathus* (head without a jaw). Varieties: *a*, *P. agnathus hypostomus* (mouth a longitudinal fissure beneath the ordinary situation); *b*, *P. agnathus microstomus* (small mouth); *c*, *P. agnathus astomus* (without a mouth), *P. brachyrhynchus* (short face or nose), *P. anomatus* (without eyes), *P. aotus* (without ears).

4. PEROSOMUS.—The whole of the body defective; 4 species: *P. hemicephalicus* (body defective and head absent), *P. horridus* (horrid deformity), *P. clumbis* (loins absent), *P. pseudoscelus* (body defective, with posterior limbs incomplete).

* Pathologische Anatomie, Berlin, 1833. Article: "*Missbildungen*;" also "*Ueber Thierische Missgeburten*," Berlin, 1877.

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5. Perocormus.—Trunk defective; 3 species: *P. oligospondylus* (defective vertebræ), *P. ecaudatus* (without tail), *P. anacdoca* (without external generative organs).

6. Peromelus.—Limbs defective; 6 species: *P. apus* (without limbs), *P. achirus* (without anterior limbs), *P. monochirus* (with only one anterior limb), *P. ascelus* (without posterior limbs), *P. monoscelus* (with only one posterior limb), *P. micromelus* (limbs shortened); with the varieties, *P. micromelus microchirus* (anterior limb short), *P. micromelus microscelus* (posterior limb short).

ORDER II.—Simple Monstrosities through Smallness of Parts:—

7. Nanosomus.—Limbs and trunk small—dwarf; 2 species: *N. pygæmus* (short and low, but without disproportion of parts), *N. caticeps* (cat-faced dwarf).

8. Nanocephalus.—Small head; 3 species: *N. micrommatus* (eyes too small), *N. brachyotus* (ears too short), *N. brachygnotus* (lower jaw too short).

9. Nanocormus.—Short trunk; 2 species: *N. rectus* (vertebral column straight, but very short), *N. curvatus* (vertebral column short, and curved to one side).

10. Nanomelus.—Limbs short; 5 species: *N. brevipes* (all the limbs short), *N. brachychirus* (anterior limbs too short), *N. campylochirus* (anterior limbs short and crooked), *N. chiropterus* (anterior limbs short, with cutaneous folds resembling wings), *N. campyloscelus* (posterior limbs short and crooked).

ORDER III.—Simple Monstrosities through Abnormal Division of the Body:—

11. Schistocephalus.—Division of the head; 5 species: *S. hemicephalus* (cleft in the middle); with the varieties: *a*, *S. hemicephalus partialis*, or *hydrencephalocele* (partial hernia of the brain, with hydrocephalus); *b*, *S. hemicephalus totalis* (absence of all the cranium); *c*, *S. hemicephalus complicatus* (cleft cranium, face defective); *S. bifidus* (face divided), *S. fissipalatinus* or *rictus lupinus* (cleft palate), *S. fissilabrus* or *labium leporinum* (cleft or hare-lip), *S. megolostomus* (wide mouth).

12. Schistocormus.—Divided trunk; 6 species: *S. fissicollis* (neck cleft), *S. fissisternalis* (sternum divided), *S. schistepigastrico-sternalis* (division of the sternum and anterior portion of the abdomen), *S. exomphalus* (divided umbilicus), *S. fissiventralis* (the whole of the abdomen divided), *S. fissispinalis* or *spina bifida* (division of the spinal column).

13. Schistosomus.—Division of the head and trunk; 3 species: *S. reflexus* (division of the body and inversion of the spinal column), *S. contortus* (division of the body and torsion of the vertebral column), *S. microchirus* (division of the body and anterior limbs shortened).

14. Schistomelus.—Cleft limbs; 2 species: *S. fissimanus* (division of the anterior limbs), *S. fissungulus* (division of the phalanges).

ORDER IV.—Simple Monstrosities through Absence of the Natural Division of Parts:—

15. Atretocephalus.—Absence of openings in the head; 1 species: *A. astomus* (mouth absent).

16. Atretocormus.—Absence of the natural apertures in the body; 2 species: *A. aproctus* (anus absent), *A. anurethra* (urethra absent).

17. Aschistodactylus.—Phalanges undivided; 1 species: *A. solidungulus*

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(absence of division of the phalanges and claws in those animals which usually have them divided).

ORDER V.—SIMPLE MONSTROSITIES THROUGH FUSION OR COALITION OF ORGANS: —

18. CYCLOPS OR MONOPHTHALMUS.—One eye in the middle of the face, and a proboscis in addition; 3 species: *C. megalostomus* (large mouth), of which there are two varieties: *a*, *C. megalostomus rhynchænus* (large mouth and proboscis), *b*, *C. megalostomus archynchus* (large mouth, but no proboscis); *C. prostomus* (irregular mouth), in which are two varieties: *a*, *C. prostomus arhynchus* (irregular mouth and no nose); *b*, *C. prostomus rhynchænus* (irregular mouth and nose); *C. astomus* (without mouth), with two varieties: *a*, *C. astomus arhynchus* (mouth and nose absent); *b*, *C. astomus rhynchænus* (proboscis present, but mouth absent).

ORDER VI.—SIMPLE MONSTROSITIES THROUGH ABNORMAL POSITION AND FORM OF PARTS:—

19. CAMPYLORRHINUS.—Curvature of the nose; 1 species: *C. lateralis* (lateral curvature of the nose).

20. CAMYLORRHACHIS.—Curvature of the vertebral column; 2 species: *C. scoliosa* (lateral curvature of the spine), *C. contorta* (torsion of the spine).

ORDER VII.—SIMPLE MONSTROSITIES THROUGH EXCESS IN FORMATION:—

21. MEGALOCEPHALUS.—Head abnormally large; 2 species: *M. hydrencephalus* (with hydrocephalus), *M. polycerus* (head with large horns).

22. DIPHALLUS.—Double penis; 1 species: *D. imperfectus* (double penis, incomplete).

23. MEGALOMELUS.—Limbs with supernumerary parts; 1 species: *M. perissodactylus* (with supernumerary digits).

ORDER VIII.—HERMAPHRODITES:—

24. HERMAPHRODITUS.—Double sex, with predominance of organs belonging to one sex; 2 species: *H. lateralis* (genital organs to one side), in which there are two varieties: *a*, *H. lateralis masculinus* (with predominance of the male organs); *b*, *H. lateralis femininus* (with predominance of the female organs); *H. transversalis* (the external generative organs belonging to one sex, and the internal to the opposite sex), including two varieties: *a*, *H. transversalis masculinus* (external genital organs male, internal female); *b*, *H. transversalis femininus* (external genital organs feminine, internal male—often imperfect).

25. PSEUDO-HERMAPHRODITUS.—False hermaphrodites; 4 species: *P. megalomasthus* (male with large mammæ), *P. microphallus* (penis unusually small), *P. hypospadiatus* (with the urethra divided inferiorly), *P. femininus* (false feminine hermaphrodite).

26. ANDROGYNUS.—Double hermaphrodites, the male and female organs existing in a single individual, one sex being incomplete and the other predominating; 2 species: *A. masculinus* (the external organs are masculine, with a small penis, the internal organs being male and female—though the one set is more complete than the other), *A. femininus* (the external organs are feminine, with abnormally large clitoris, the internal being male and female, with predominance of the one over the other).

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CLASS II.

TREBLE AND DOUBLE MONSTROSITIES.

In these monstrosities there is a union of two or three individuals, neither of which is complete, but which are united at various points: often with a completely-developed body is united a portion of a second individual. It comprises 6 ORDERS, 26 GENERA, and 59 SPECIES.

ORDER I.—TRIGEMINAL MONSTROSITIES, in which are united one or more parts or organs of three individuals:—

1. CEPHALOTRIDYMUS.—Three heads united to a single trunk; 1 species: *C. unicorporeus* (with a single body).

2. CORMOTRIDYMUS.—Posterior part of the trunk triplicate, with more than four limbs; 1 species: *C. tricaudatus* (three croups with three tails, but only one anus and four posterior limbs).

3. MELOTRIDYMUS.—Posterior part of the body double, and more than eight limbs; 1 species: *M. decapus* (ten limbs of unequal length).

4. SOMATOTRIDYMUS.—Triple body; 1 species: *S. sternalis* (three chests united).

ORDER II—MONSTER WITH TWO HEADS—*Cephalodidymi*:—

5. DIPROSOPUS.—Double face; 3 species: *D. sejunctus* (the two faces separate), *D. distans* (the two faces diverging), including three varieties; *a*, *D. distans distomus* (a mouth in each face); *b*, *D. distans monostomus* (a mouth in one face only); *c*, *D. distoma hemicephalicus* (without a cranium); *D. conjunctus* (two faces united) has two varieties: *a*, *D. conjunctus distomus* (double mouths); *b*, *D. conjunctus monostomus* (with one mouth).

6. MONOCRANUS.—Single cranium; 4 species: *M. mesognatus* (the lower jaw included in or united to the other from the commencement of the branches), *M. dignatus* (lower jaw double), *M. heteroprosopus* (diverse faces), *M. bimandibularis* (upper jaw double).

7. HETEROCEPHALUS.—Double heads, one of which is complete, the other very incomplete; 2 species: *H. interpositus* (between the two branches of the lower jaw of the complete head is interposed the lower jaw of the incomplete one), *H. oppositus* (the lower jaw of the complete head is depressed in front, and on its upper surface—anterior extremity—it is united to the corresponding part of the second jaw, with which it forms an acute angle).

ORDER III.—DOUBLE-HEADED MONSTROSITIES, WITH THE TRUNK WHOLLY OR PARTIALLY DOUBLE:—

8. DICEPHALUS.—Two separate heads; 7 species: *D. biatlanticus* (double head and two atlases), *D. subbicollis* (double head with apparently two necks), *D. bicollis* (double head and two necks), with two varieties: *D. bicollis omocephalus* (both heads alike), *D. bicollis heterocephalus* (one head perfect, the other imperfect); *D. subbidorsualis* (double head, with apparently a double back), *D. bidorsualis* (double head with double back), *D. bilumbis* (double head and double loins), *D. bispinalis* (double head and vertebral column) has two varieties: *a*, *D. bispinalis quadrupes* (with four limbs); *b*, *D. bispinalis achirus* (without anterior limbs).

9. DICRANUS.—Double cranium; 1 species: *D. bispinalis* (cranium and vertebral column double).

ORDER IV.—MONSTROSITIES WITH A SINGLE HEAD, BUT THE TRUNK OR LIMBS MORE OR LESS COMPLETELY DOUBLE—*Cormo-melodidymi*:—

10. DIPYGUS.—Double croups; 3 species: *D. bidorsualis* (double croup

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and back), *D. subbidorsualis* (double croup, with half the back doubled), *D. bilumbis* (croup and loins doubled), containing two varieties: *a*, *D. bilumbus teleocephalus* (with head regular); *b*, *D. bilumbis cacocephalus* (with head irregular).

11. HETERODIDYMUS.—Unequally-developed twins, the body of one being large and regularly or irregularly formed, the other being small and slenderly attached to some part of its fellow; 3 species: *H. octipes* (with eight feet), containing two varieties: *a*, *H. octipes emprosthochirophorus* (the anterior limbs of the parasitic twin situated in front); *b*, *H. octipes pleurochirophorus* (the anterior limbs of the parasitic twin situated at the side); *H. tetrasulus* (with four posterior extremities), also containing two varieties: *a*, *H. tetrasulus monopygus* (with one croup); *b*, *H. tetrasulus dipygus* (with a double croup); *H. triscelus* (with three posterior limbs).

ORDER V.—MONSTROSITIES WITH A SINGLE HEAD AND TRUNK, AND MORE THAN FOUR LIMBS—*Melodidymi*:—

12.—OPISTHOMELOPHORUS.—An animal regularly formed, but which bears on its back or croup a supernumerary limb or limbs; 3 species: *O. trichirus* (with an anterior limb on the back), *O. tetrachirus* (with two anterior limbs on the back), *O. tetrascelus* (with two posterior limbs on the croup).

13. EMPROSTHOMELOPHORUS.—With a supernumerary limb or limbs on the neck, thorax, or beneath the pelvis; 5 species: *E. octipes* (with four supernumerary limbs beneath the thorax), *E. trichirus* (with an anterior limb on the thorax), *E. tetrachirus* (with two anterior limbs on the neck), *E. triscelus* (with a posterior limb beneath the pelvis), *E. tetrascelus* (with two posterior limbs beneath the pelvis).

14. PLEUROMELPHORUS.—With a supernumerary limb or limbs situated on the side; 4 species: *P. octipes* (with four limbs on the side), *P. tetrachirus* (with two anterior limbs on the side), *P. trichirus* (with an anterior supernumerary limb), *P. triscelus* (with a posterior supernumerary limb).

ORDER VI.—MONSTROSITIES WITH THE HEAD, TRUNK, AND LIMBS MORE OR LESS COMPLETELY DOUBLE—*Somatodidymi*:—

15. OCTOPUS.—With eight limbs; 4 species: *O. janus* (two faces placed opposite each other, and eight limbs), *O. quadriauritus* (eight limbs and four ears), containing two varieties: *a*, *O. quadriauritus monoprosopus* (with a perfect face); *b*, *O. quadriauritus aprosopus* (face absent); *O. biauritus* (eight limbs and two ears), *O. synapheocephalus* (eight limbs, and the heads joined externally only by the skin).

16. TETRACHIRUS.—With four anterior limbs; 2 species: *T. symphyocephalus* (four anterior limbs, two lateral and two incomplete, on the back, and heads joined), *T. choristocephalus* (four anterior limbs, and heads separate).

17. TETRASCULUS.—With four posterior limbs; 2 species; *T. symphyocephalus* (four posterior limbs, and heads united), *T. bifacialis* (four posterior limbs, and the two faces separate).

18. GASTRODIDYMUS.—Twins united at the abdomen; 3 species: *G. quadrupes* (twins united at the abdomen, and furnished with four limbs), *G. tetrachirus* (with four anterior limbs), *G. octipes* (with eight limbs).

19. GASTRO-THORACODIDYMUS.—Twins united at the thorax and abdomen; 1 species: *G. thoracodidymus octipes* (with eight limbs).

20. EPIGASTRODIDYMUS.—Twins united at the thorax and epigastrium; 1 species: *G. octipes* (with eight limbs).

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21. Thoracodidymus.—Twins united at the thorax; 1 species: *T. octipes* (with eight limbs).

22. Schelodidymus.—Twins united at the posterior extremities; 1 species: *S. heptamelus* (with seven limbs, the posterior pair being united into one, the next pair at the side, and the other four in front).

23. Ischiodidymus.—Twins united at the pelvis; 1 species: *I. examelus* (with six limbs, four anterior and two posterior).

24. Omphalo-Chronodidymus.—Twins united at the umbilicus and the head; 1 species: *O. disomatus* (the bodies separate).

25. Pygodidymus.—Twins united at the croup; 1 species: *P. aversus* (bodies united at the ischii and sometimes at the buttock, and in opposite directions).

26. Cryptodidymus.—Inclusion of one twin within the other; 2 species: *C. abdominalis* (twin included in the abdomen), *C. subcutaneus* (incomplete fœtus included beneath the skin of the complete one).

Such is the classification adopted by Gurlt, and it will be seen that it is very complete, while the nomenclature scarcely leaves anything to be desired. Nevertheless, as Saint-Hilaire's classification and nomenclature are also employed, and are in some respects advantageous to know, we will now allude to them, though not in such detail as we have done those of Gurlt, and following the summary given by Zundel. Saint-Hilaire separates the Monstrosities from the vices of conformation, which he distinguishes as *Hemiteries*, or simple and trifling organic anomalies, and *Heterotaxies*, or mere changes in the situation of organs, and nearly always without alteration in relative position and connections. For the *Hermaphrodisms*—due to the union of the sexes or some of their characters in the same individual—he forms a separate class, which he again divides into two subclasses, according as there is an absence or excess in the number of parts; he distinguishes male hermaphrodism, female hermaphrodism, and neutral hermaphrodism; mixed; complex—masculine or feminine; and bisexual—perfect or imperfect. The Monstrosities—properly so called—exhibiting anomalies which are more or less serious, either because of the injurious influence they exercise on the functions of the individual, or the vicious conformation they give rise to—are divided into two classes: *Simple Monstrosities* and *Composite, Double*, or *Triple Monstrosities*.

The first class comprises three orders: 1. *Autositic Monstrosities* (*αὐτος, self, σῖτος, nourishment*)—whose organs are capable of maintaining them for a variable period after birth. Only one or more regions of the body are involved, the majority being little, if at all, different from the normal standard; the circulatory apparatus is always more or less complete, particularly the heart; the lungs, nearly all the digestive viscera, and at least a portion of the head, are present; and all the anatomical and physiological characters are manifested externally by the general conformation, which, in the greater part of the body, remains symmetrical and almost normal. 2. *Omphalositic Monstrosities* (*ὀμφαλὸς, umbilicus*, and *σῖτος, nourishment*)—those which live imperfectly, being maintained by the nourishment derived from the mother through the umbilical cord, and dying as soon as the cord is ruptured. These *omphalosites* are deficient in a large number of organs, and those which are present are generally very imperfect; externally all the regions appear to be anomalous, and the symmetry is imperfect or even effaced. 3. *Parasitic Monstrosities*—the most imperfect of all, and generally inert, irregular masses, composed of bones, adipose tissue, etc., destitute of umbilical cord,

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nd attached to the generative apparatus of the mother, at whose expense hey maintain an obscure parasitic existence, by means of a vascular pedicle.

The double monstrosities are divided into *autositarian* and *double parasitic.* he first are composed of two individuals more or less intimately united, and omewhat equal in development; this inequality indicating that they both ave been equally nourished, and that their functions have been alike com-lete. The second are composed of two distinct individuals, very unequal n development, the smallest being the most imperfect; testifying that it,

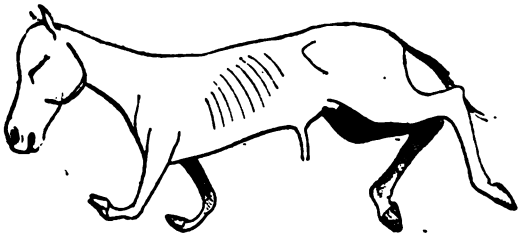

Fig. 85.

Ectromelian MONSTROSITY (SAINT-HILAIRE) : *Nanomelus Campylochirus* (GURLT) ; HORSE.

ke a parasite, has lived at the expense of the other. It would appear at the triple monstrosities have not been met with in sufficiently large umbers to establish a trustworthy classification.

Each of the orders of Saint-Hilaire, like those of Gurlt, contains several milies, subdivided again into genera and species, according to their affinities, d which include all the monstrosities he had met with. With regard to

Fig. 86.

Ectromelian MONSTROSITY (SAINT-HILAIRE) ; *Nanomelus Campylochirus* (GURLT) : GOAT.

ese families, it may be mentioned that among the single autositic mon-osities, there are the *ectromelians* (*ἐκτρόω, to make abort, μέλος, limb*) in which have a more or less complete deficiency in the development of the limbs, her anteriorly or posteriorly, and involving one or more of these (Figs. , 86.)

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The *Symelian Monstrosities* (σὺν, with μίλος, limb) are those which Gurlt includes in his first Class and Order, there being an absence of parts, with fusion of others (Fig. 87).

The *Celosomian Monstrosities* (χήλη *hernia*, σῶμα *body*) more frequent perhaps than any others, are those which Gurlt places in his third Order—Schistocormus, and are chiefly characterised by the absence, more or less complete, of the abdominal parietes, and the abrupt curvature of the spine backwards,

Fig. 87.

Symelian MONSTROSITY (SAINT-HILAIRE); *Perosomus pseudoscelus* (GURLT): PIG.

downwards, or to one side; so that the pelvis and posterior limbs are directed forwards, to one side, or over the back, while the abdominal cavity being open, allows its viscera to float about unprotected. There are many degrees of this deformity. Sometimes the abdominal cavity is open, the thorax being undeformed and closed-in posteriorly by the diaphragm, and the ribs attached to the sternum (*Schistocormus fissiventralis*, Gurlt, Fig. 88). Sometimes the posterior end of the spine is curved forward to the middle of

Fig. 88.

Celosomian MONSTROSITY (SAINT-HILAIRE); *Schistocormus fissiventralis* (GURLT): CALF.

the back (*Schistocormus reflexus*, Gurlt); the ribs follow in the same direction, but instead of bending downwards to enclose the chest, they spring upwards towards the dorsal spines; the sternum is absent or divided throughout its length (*Schistocormus fissisternalis*—Gurlt, Fig. 104), with evisceration of thoracic organs—most frequently the heart (*Ectopia cordis*, Fig. 89); the diaphragm is not present, the chest is as widely open as the abdomen, and the viscera of both cavities are external to the body (*S. Schistepigastrico-sternalis*).

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t other times the spine is twisted, and the body and head divided (*Schistosomus ntortus*); or other deformities of a similar kind, and more or less complex, ay be found. The skin follows the displacement of the various regions—he external surface being generally in contact—while the lining membrane of he chest or abdomen, or both, becomes external; sometimes to such an ex-

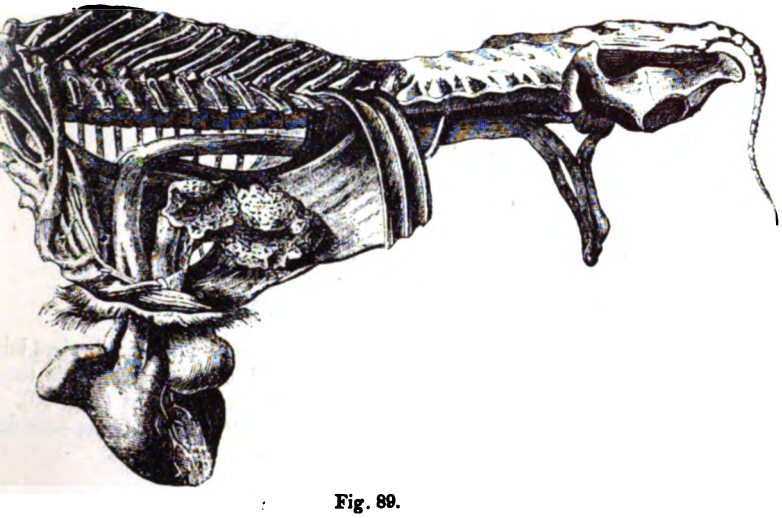

Fig. 89.

Ectopia Cordis: *Schistocormus flexisternalis.*

t is this inversion of the body carried, that it is turned, as it were, outside : the skin forming a kind of internal sac—the hair to the interior—and ntaining the head and limbs of the fœtus. With such a deformity, of rse other serious malformations or displacements co-exist: distorted pelvis,

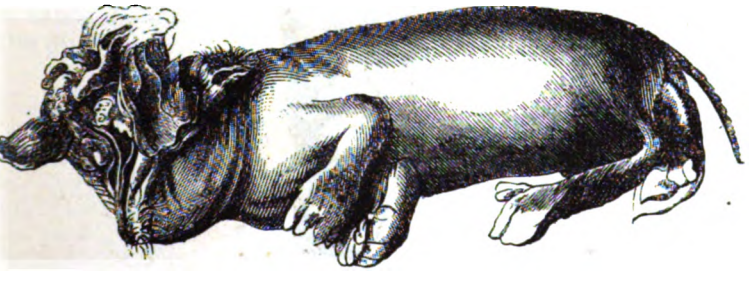

Fig. 90.

Pseudencephalian MONSTROSITY; *Perocephalus pseudocephalus*, GURLT.

ted or undeveloped limbs, atresia of the anus, more or less complete ence of the generative organs, etc.

This kind of monstrosity will have to be specially noticed hereafter, the ntration of the viscera of the fœtus often considerably baffling the obste-t; while the frequent distortion of the spine and limbs renders delivery y difficult.

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The *Exencephalian* monstrosities, belonging to Gurlt's third Order in the first Class, are those which have the brain defective, deformed, and external to the cranial cavity—itself more or less imperfect.

The *Pseudencephalian* monstrosities belong to the third Order of Gurlt's

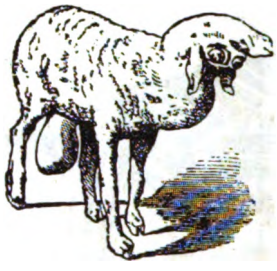

Fig. 91.

CYCLOPEAN MONSTROSITY: RAM.

first Class, the encephalon being absent and replaced by a variable-sized bright red tumour, composed of a multitude of small bloodvessels; this tumour rests on the base of the cranium, the roof of which is absent (Fig. 90).

The *Anencephalian* monstrosities—Gurlt's first Order, first Class—are desti-

Fig. 92.

CYCLOPEAN MONSTROSITY; *Cyclops megalostomus archynchus* (GURLT): ASS.

tute of the encephalon or anything to represent it, and the roof of the cranium is entirely absent.

The *Cyclocephalian* monstrosities (κύκλος circle, κεφάλη head)—Order five, Class first of Gurlt—are characterised by the approximation, or more or less complete fusion of the eyes into one organ, with absence, displacement, or deformity of the nose and mouth; but the ears are usually in their natural position, or perhaps are lower than usual. Not unfrequently the nose is

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sent and the mouth greatly enlarged, while the fusion of the eyes may not e complete (Fig. 91, 92).

Fig. 93.

Acephalian} MONSTROSITY; *A. perosomus hemicephalicus* (GURLT).

The *Acephalian* monstrosities—Gurlt's first Class and first Order—are ore or less destitute of head, and sometimes of neck, thorax and thoracic gans (Fig. 93).

Fig. 94.

Schistocephalus fissilabrus or *labium leporinum* (HARE-LIP).

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The *Anidian*, or *zoomylian* monstrosities, we have already described at page 165; so we need not again refer to them.

The *Schistocephalian* monstrosities (Gurlt) have the head or face cleft: most frequently the face, the division being sometimes limited to the nose and upper lip.

Those monstrosities which are characterised by the abnormal situation and form of different parts—and which are included in Class first, Order six, of Gurlt—are not exceedingly rare, and in some instances are probably due to muscular contraction, or mal-position for some time in the uterus (Fig. 95).

Fig. 95.

Camylorrhacchis contorta.

Saint-Hilaire divides the double monstrosities into two orders: *Autositaric* and *Parasitic;* the former being constituted by individuals more or less intimately united and somewhat equally developed, each concurring to the mutual existence; while the second is made up of those monstrosities which, though united, have one being more or less complete—being reduced in fact to a limb, jaw, or other fragment of a body implanted or subsisting on an individual which is fully developed. These are included in Gurlt's second Class.

In the autositaric order we have the *Eusomphalian* and *Monophalian* monstrosities: these have the common character of two heads and four pairs of limbs; the first have, however, a distinct umbilical cord to each of the united fœtuses; while in the other—the *Monophalian*—there is only a single umbilical cord and umbilicus.

The *Eusomphalian* monstrosity consists, then, of two pretty equally developed fœtuses, each with its own umbilical cord, the two being usually joined together by some soft part at any region of the body; so that they may be separated by a surgical operation without the existence of either being compromised. This is included in the third Order of Gurlt's second Class.

With the *Monomphalian* monstrosity, on the contrary, there being only

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one umbilicus and one cord, the fœtuses are joined at the ventral surface, and

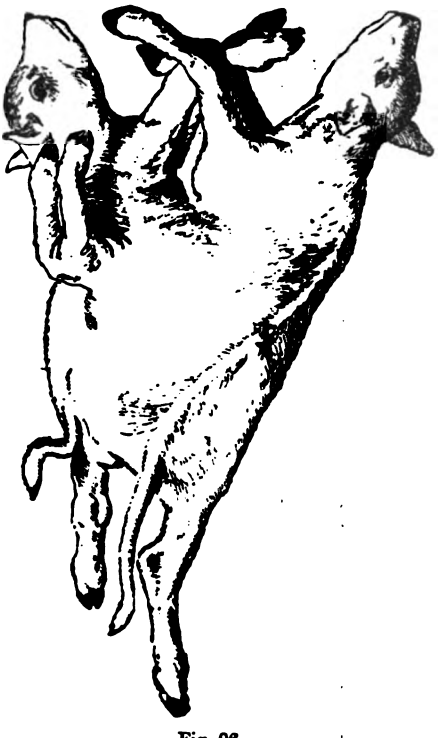

Fig. 96.

MONOMPHALIAN MONSTROSITY: *Cephalo-cormodidymus* (GURLT).

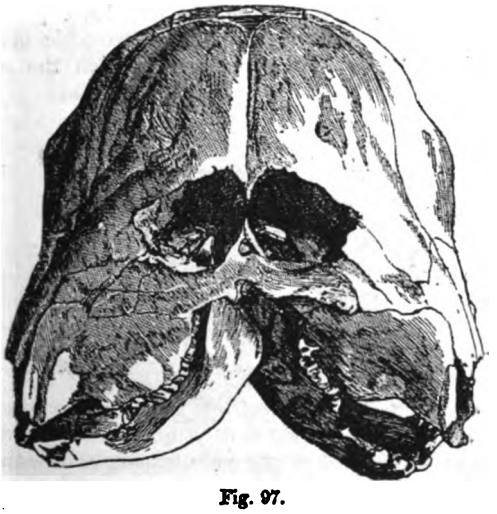

Fig. 97.

SKULL OF SYNCEPHALIAN MONSTROSITY.

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have usually several organs in common—notably the liver, to which the umbilical vein passes (Fig. 96).

The *Syncephalian* monstrosities have two bodies either completely separated, or only divided above the umbilicus, and surmounted by a more or less incomplete double head: the two heads being fused, as it were, into one (*Dicephalus heterocephalus* of Gurlt—Fig. 97).

The *Monocephalian* monstrosities, as the name implies, differ from the last in having only one head but a double body, the separation of the two usually taking place below the umbilicus (Fig. 98).

Fig. 98.

MONOCEPHALIAN MONSTROSITY: *Cormo-Melodidymi* (GURLT).

The *Sysomian* monstrosities (Fig. 99) have two heads on apparently a single body though a closer investigation will prove that the unicity is merely superficial, and that at least some parts are double. Gurlt describes a full-grown Sysomian lamb he examined, and which had, apparently, a single body and only four feet, but two necks, two heads, and two tails, and the skin normally covered with wool. The trunk, though somewhat small, gave no indication of its duplicity. It had, nevertheless, two vertebral columns, the inner ribs attached to each being shortened and fused together, while the external ones were attached in the usual way to the single sternum. The viscera were generally double, though they were confounded at certain points. A single heart sufficed for two pairs of lungs, one pair of which, however, were only rudimentary. The two livers were combined into one, and in some parts the intestines merged into a single tube, again to become double, and finally to terminate in one rectum.

The *Monosomian* monstrosities have, in reality, only a single body, the duplicity generally commencing towards the neck, in the cervical region, not unfrequently at the atlas, and sometimes as far as the facial region (Fig. 100).

Among the double parasitic monstrosities, we may mention Saint-Hilaire's *Heterotypians*, in which the smallest of the

Fig. 99.

SYSOMIAN MONSTROSITY: *Dicephalus bicollis* (GURLT).

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etuses is attached to the anterior part of the body of the other, at or near the mbilicus; the *Heteralians*, in which the parasitic fœtus is very incomplete, nd perhaps reduced to a single region—as a head without a body—attached me distance from the umbilicus; the *Polygnathians*, in which the parasite reduced to the mere fragments of a fœtus—the jaws and some cephalic

Fig. 100.

MONOSOMIAN MONSTROSITY: *Dicephalus bi-atlanticus* (GURLT); CALF.

nains adhering to the jaws of the other fœtus. All these are included Gurlt's classification, which we would advise the veterinary obstetrist, as ule, to employ.

The Polymelian (*μέλος, limb*) monstrosities—Gurlt's *Melodidymi*—com- se those creatures which are so frequently exhibited in public, and in

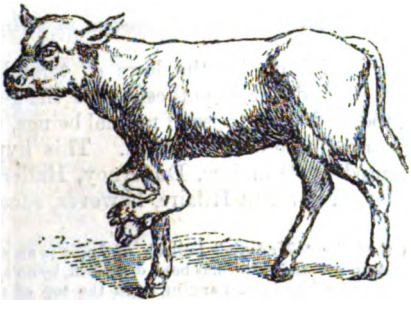

Fig. 101.

POLYMELIAN MONSTROSITY: *Emprosthromelophorus* (GURLT); CALF.

ich there is only a single body and head, but supernumerary limbs. These bs may vary in number, and be attached to various parts of the complete us; there may also be present, in addition to the supernumerary members, unformed kind of tumour resting on the back or shoulders, which in one e has been recognised to be composed of the heart and lungs of a second

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fœtus (Fig. 102). In other instances, the tumour is alone observed, without the additional limbs.*

The *Endocymian* monstrosities are those double fœtuses of which one, or part of one, is included within the other. They are the *Cryptodidymi* of Gurlt's Second Class.

Origin of Monstrosities, and the Laws of Teratology.

The causes which operate in the production of what we have designated "monstrosities," appear to be numerous.

Putting to one side, as unworthy of notice, the superstitious ideas which long prevailed with regard to the formation of these monstrosities—be-

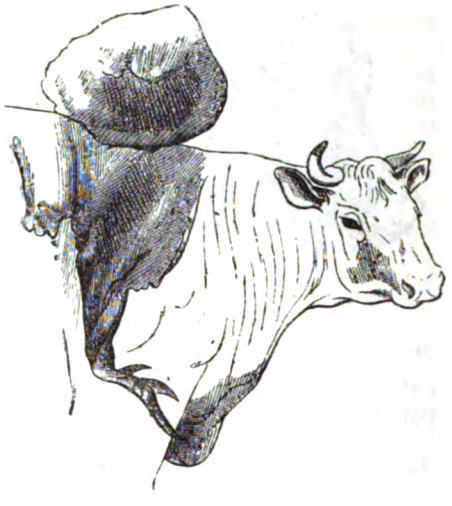

Fig. 102.

DOUBLE PARASITIC MONSTROSITY; *Polymelian notomelus*; COW.

cause they can all be explained by the laws of teratology—we come to the period when Régis started the hypothesis that the germs of these must have been originally produced with those of normal beings, and that they were developed in the ordinary course of generation. This hypothesis, or something like it, was accepted by Winslow, Duvernoy, Haller, and others, up to the time of Meckel. Geoffroy Saint-Hilaire, however, successfully combated

* It is not improbable that the "Nadeah" bullock of India is an animal with a parasitic monstrosity attached to it. A bull of this kind has been described, by an amateur, as having "an excrescence of skin, covered with white hair, hanging from the top of the hump, about seven inches long and of a soft nature, in appearance resembling a child's stocking, dangling from side to side as the animal moved, but in no way unsightly or repulsive to look at."

Such animals are worshipped, and not put to any work; they are usually exhibited covered with a kind of earth-coloured cloth trimmed with cowrie-shells, and the owners derive a livelihood by exhibiting them. The "fakeers" or holy mendicants usually obtain possession of them. These double or polymelian monstrosities receive their sacred designation from the god Mahadeo, who is believed by the Hindoos to have ridden upon a bull called "Nadeah," which was capable of changing its shape, and producing as many legs or horns for offensive or defensive purposes as it might find necessary. Thus it happens that any animal with unnatural or extraordinary marks, is supposed to have some affinity to the great "Nadeah" of Mahadeo, the founder of Hindoo teratology.

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and demonstrated that these anomalies in organization are not primary, t accidental; that embryos which, had they been placed in ordinary cir-mstances, would have been developed in a normal manner, and which had, fact, begun to be so developed, only became anomalous and monstrous be-use their development was disturbed.

Therefore these anomalies did not exist previous to impregnation, but were e result of some perturbation occurring during the development of the em-yos, which were at first perfectly normal.

The opinion which at present prevails with respect to these malformations, to the effect that the embryo or fœtus has been submitted to some kind of eration *in utero*, and that this has been produced during the interval be-een conception and birth. It is a matter of ordinary observation that metimes a fall, blow, sudden fright, or a powerful mental impression will, woman, disturb the ordinary course of pregnancy, and give rise to more less unusual symptoms, and even premature birth of an imperfect fœtus. has been attempted to explain the action of these influences, by supposing at the sudden physical or mental shock produces an abrupt contraction of e vascular system and, co-incidentally, of the uterus; and that the fœtal embranes are thus all at once constricted, and slightly lacerated. Conse-ently, a part of the liquor amnii escapes (as has been frequently observed), d this is succeeded by adhesion of the margin of the laceration in the mem-anes to the corresponding part of the body of the embryo; and thus are med those layers or bands which, whether temporary or permanent, disturb re or less the development of the young creature, either by preventing gans from occupying their natural cavities, hindering the union or fusion of rts, or opposing or delaying the formation of those which should afterwards pear. That this opinion is not improbable may be at once conceded, when remember that during the early stages of development the ovum is little re than a semi-fluid mass, and that its constituent parts are extremely pressionable.

But the formation of monstrosities is more particularly due to what has en designated the *theory of retardation* or *arrested development;* the devia-ns from the normal standard being the effect of disturbance and arrested pply of nutriment during the period of intra-uterine growth. G. Saint-laire has proved experimentally, by means of eggs artificially hatched, that production of monstrosities is due to the interruption or accidental sus-sion of development which had commenced in a regular manner; while ckel has shown the striking analogy there exists between many ano-lies and various transitory conditions of embryonic organization.

t has been well remarked that the majority of the malformations due to ect in the higher animals, represent, in a more or less perfect manner, the mal conformation of the inferior classes. For instance, the imperfection bsence of limbs is the natural condition of fishes and some reptiles; the rt is not present in zoophytes; when it has but one cavity in the higher nmalia, it only resembles the single heart of crustaceæ; and when the icular septum of the heart remains patent, it is like the reptilean heart. this is explained by the fact, that the embryo of the domesticated animals, rriving at its ultimate development, appears to pass through all the degrees rganization which mark the different types in the zoological series. And means of the knowledge we possess of the organization of these types, we sometimes able to say when a particular monstrosity began to deviate from normal condition, the nature of the deviation, and its cause.

n excess of general development is less frequent than the opposite condi

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tion: partial excess of an organ or region is not unfrequent; while excess of parts is far from rare, and may be noted in the vascular system, in internal organs, and externally: more particularly is it remarked in the extremities, when we have in some species "polydactylism," and in others "hyperdactylism." It is often observed that an excess in development in one part coincides with defective development in another, as if the balance in formative organization must be maintained throughout the body.

With regard to *double* monstrosities—the result of two fœtuses being accidentally joined together, and fused, as it were, into each other—G. Saint-Hilaire proposed a special law which he designated the *law of similar union* or of *mutual affinity*. The result of this law is the production of symmetrical development in a double monster in as perfect a manner as in a single and normal individual; the two creatures which, by their union, form either a partial or complete double monstrosity, are always joined by the homologous faces of their bodies—side to side, front to front, or back to back. And not only are they united by their homologous surfaces externally, but internally they are allied by homologous organs: each part or viscus of one corresponding to a similar part or viscus of the other; so that each vessel, nerve, or muscle on the plane of union of one, notwithstanding the apparent complexity, is joined to the corresponding vessel, nerve, or muscle of the other: just as the two moieties of a single and central organ, originally distinct and lateral, become naturally fused together at a certain period, and in obedience to the laws controlling their formation and development. A double monster is, therefore, only a being composed of four more or less complete moieties instead of two, as in the single individual.

With regard to more complex monstrosities, we find that, instead of two moieties, as in the normal condition of an individual, or the four moieties as in the double monstrosity, we may have six, eight, or even more; but yet the law of similar union prevails, and the moieties combine in twos. Therefore it is that a triple monstrosity is only a double monstrosity doubled, and a quadruple one a triple monstrosity doubled also—all the phenomena of the compound monstrosity being accounted for on the same general principle.

The formation of double monstrosities has given rise to some discussion, and at present there are two chief theories which are worthy of notice. According to one of these, there have been originally two ova, which may have been derived from one or from two Graafian vesicles or follicles rupturing at the same, or nearly the same, time, and passing down the oviduct together, towards the cornu, become fused by pressure in their passage. The other theory supposes the existence of only one ovum, by whose division or cleavage the double monstrosity is formed.

The first view is that which has found most favour, though quite recently it has been considered as quite exploded by Dittmer (*Reichert and Du Bois-Reymond's Archiv.*, 1875), who is inclined to adopt the latter theory, and believes that the double monster is only an instance of bilateral symmetry carried too far. According to him, in the primitive germ of the normal embryo a longitudinal groove is formed, which afterwards represents the middle line, the two lateral parts developing symmetrically. But if this groove is too deep at one or both ends, the two halves will there be separated; and the separated extremities have the power of producing the wanting lateral half of each. The separation of the two halves may occur at one extremity or at both, and it may extend to any depth. According to these differences, we should have the various forms of double monster—from such creatures as the Siamese twins to cases of a small supernumerary leg. There

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ay even be a further stage of this process. One of the separated halves may resent a similar exaggeration of bilateral symmetry, if it again separate into wo halves like the original germ.

Thus may be explained monsters with three heads or three tails.

Some objections might be raised to this theory, but this is not the place o enter upon their discussion. We may, however, point out that it will arcely apply to included monstrosities, in which we have one creature, ore or less perfectly developed, contained within another. We can scarcely oubt of the existence of two ova, the included one being the oldest, and at this inclusion has probably been effected at a very early period of germ evelopment.

To return, however, to the long-accepted theory. If we descend from the omplex phenomena of double monsters to single ones, and from these to mple anomalies, we find again that every anomalous union between organs kes place by homologous parts. What have been designated "Symelian" onstrosities are characterised by the fusion of their more or less atrophied bdominal limbs; in the "Cyclocephalian" monsters the eyes are more or less ised into one organ of vision; while with the "Otocephalians" the ears emselves are joined, and often intimately confounded. The union of the idneys, testicles, cerebral hemispheres, and other double organs, is often bserved in creatures otherwise normal in conformation; and all these nomalies occur under the reign of the same law—that of "similar union" -which for organs, as for entire individuals, operates on homologous parts.

With regard to the remote or proximate causes which lead to the produc-on of monstrosities, it is very probable that the most prominent are irregu-rity or inequality in the nutrition of the fœtus, physical injury, undue ressure, alterations in the membranes, or diseased conditions of the young eature. G. Saint-Hilaire and Valentine, by disturbing the development of ne embryo of the fowl during the early stage of incubation of eggs—through naking, jarring, and pressing them, perforating the shell, or covering it with ax—could almost create monstrosities at will. And, as Zundel remarks, n accident during gestation—a blow, a fall, a displacement of the uterus—ill produce the same results in animals. And Lafosse observes that it is erhaps because of the pressure to which the fœtus of ruminants is exposed, wing to the accumulation and fermentation of food in the rumen, that must e attributed the greater frequency of anomalies in the species of this order an in the other domesticated animals. The quantity and quality of the food, nd the work to which the mother is subjected, have an undoubted influence n the nutrition of the embryo.

A circumstance which appears to have some influence in the production of nomalies in animals, is the great disparity in size between the male and male. Lafosse endeavours to prove this by showing that the frequency of rtain vices of conformation—such as hypospadias, umbilical hernia, want f proportion between the jaws, etc.—is most notable in the mule.

We are also convinced that excessive consanguinity (breeding "in and ") likewise leads to the frequent production of monstrosities; we have itnessed some startling instances in the Cow and Pig. Weakness of the rocreative powers may also tend to the development of monsters.

A too small uterus may likewise act mechanically in distorting the fœtus; hile the health or disease of the organ, or of the fœtal membranes, must xert a powerful influence on its development and conformation. It is not nprobable that the Celosomian monstrosity (*Schistosomus reflexus*), observed nly in the bovine species, is due to the form of, or pressure in, the uterus;

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and to the same cause may also be ascribed the greater frequency of double and triple monstrosities in this species than in any other.

The amputation of limbs, or portions of them, may be due to the action of the umbilical cord, which, in the Mare at least, is perhaps sufficiently long for this purpose.

Hereditary influence is here undeniable. In the human species it has often been remarked, and scarcely less frequently in animals. Hornless cattle, double-headed puppies, tail-less cats, and other anomalies, are commonly reproduced. Franck* mentions the case of a Mare which constantly had foals whose lower jaw was so short that they could not suck; consequently they died. Gurlt alludes to a Bitch which brought forth four litters of puppies; the first litter consisted of six, two of which were minus their fore feet and were hare-lipped; there were five in the second litter, four of which were monstrosities; in the third litter there was the same number, and the fifth puppy, which was otherwise normal, had a hump in the middle of its back; four puppies were produced in the fourth litter, three of which were anomalous.

A psychical or mental influence has often been invoked to account for certain monstrosities, and the vulgar opinion since Old Testament times is certainly entirely in favour of its existence; but, on the other hand, it has often been denied. While there can be no doubt that the popular mind has greatly exaggerated this influence, yet it would appear from the interesting observations collected by Tréhonnais, as well as the curious instances recorded by Buhler, Weber, Herbst, Bagge, Rueff, and others—and which we regret we have not space to quote—that it does operate to some extent in animals; fear especially, as has been already said, will re-act on the embryo or fœtus.

Disease of the fœtus itself, or maladies transmitted from the mother, may play an active part in the production of anomalies and monstrosities.

Frequency of Monstrosities.

Monstrosities are far from being rare in the domesticated animals, but they do not occur with the same frequency in all the species. Gurlt† tabulates 740, which shows the proportion furnished by the different animals. This is as follows:—

Ass	3
Mule	3
Goat	24
Mare	56
Cat	71
Bitch	78
Sow	87
Ewe	179
Cow	239

Baumeister and Rueff mention that in the King of Wurtemberg's private stud, of 2340 foals produced, there were only nine monstrosities, or one abnormal to 260 normal foals. In the Hohenheim dairies, among the Cows the monstrosities were only one-half per cent. (1 per 200); swine came next in frequency, then goats and sheep. Among the latter there was only one monster in 768 lambs.

* Handbuch der thierarztlichen Geburtshülfe, p. 434. † Pathol. Anatomie, vol. ii., p. 5.

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Saint-Cyr collected 49 instances (not including hydrocephalic monsters), which were apportioned in the following manner:—

Cow - - - - - - -	27
Sheep and Goat - - - -	13
Sow - - - - - - -	4
Cat - - - - - - -	4
Bitch - - - - - - -	0
Mare - - - - - - -	1

Though monstrosities are not rare in animals, yet all do not give rise to difficult parturition; for in some cases the deformity does not interfere at all with birth; in others in which the deformity is of such a nature as would impede delivery, birth often occurs prematurely when the fœtus or fœtuses are small and soft; while even when fully developed, double and triple monstrosities have been occasionally born without assistance.

Nevertheless, there is ample proof that triple, double, and even single monstrosities, often require to be removed artificially, and may be productive of serious consequences to the mother. These we will now allude to.

Distorted Monstrosities.

The distorted monstrosities which Gurlt has designated *Camylorrhacchis contorta*, and which are characterised by abnormal situation and form of different parts (Fig. 95), may occasionally, from their crooked shape, prove a source of difficulty during birth. The distortion may be due either to muscular contraction in the fœtus, or to extraneous uterine pressure, and if we glance at the figure which illustrates one variety of this malformation at page 398, we will readily perceive that the obstetrist may indeed have a serious task before him if he is required to remove such a mis-shapen fœtus. The remarks we have made with regard to dystokia from muscular contraction, are applicable to this form of monstrosity; and in the majority of instances, it will be found that embryotomy, or even the Cæsarean section, must be resorted to. The following are illustrative cases.

Wilson (*Veterinarian*, vol. xl. p. 770) attended an aged Cow which had been in labour for more than twenty hours. The abdominal viscera of the fœtus were hanging from the Cow's vagina, and as much of the pudendum as could be seen was livid and flaccid. Introducing his arm, he discovered what afterwards proved to be an irregularly-round bony mass, too large apparently for birth. The presenting substance was a portion of a malformed fœtus. Nothing resembling a calf could be discovered, though what seemed to be a kyst was found; this was punctured, but with no evident result. Embryotomy was out of the question, as it was not known how to proceed; so it was decided to draw the mass into the genital passage, in order to extract it. Tracing the connections of the fœtal viscera, what was supposed to be the œsophagus was found in the middle of the hard mass. Four or five inches within this orifice, a strong iron hook, to which a cord was fastened, was inserted.

Smearing the fœtus well with soft soap, and giving the cord to an assistant, with instructions to pull steadily and gently, after some manipulation the mass was carried into the os uteri, and by continuing the efforts delivery was effected. On examination, the bony mass felt within the uterus was found to be composed of all the bones of the trunk, except the cervical vertebræ, "jumbled and thrown together." "Projecting from one side of this were the fore legs, and in the middle of these the head and neck, all fully formed and well haired." The part mistaken for a kyst and punctured, was discovered to be a large piece of perfect skin growing from the bony lump, and falling round the whole mass. The Cow recovered in a short time.

The same writer (*Ibid.* vol. xli. p. 606) attended another aged Cow which had been in labour for a day. Two or three persons had felt for the calf, but could not understand its presentation, which was very peculiar. The head and fore legs were in the

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natural position, but the two hind feet were also in the passage—one resting on the spine and the other against the right shoulder of the calf, each leg with its posterior part superior. Wilson, at first believing two calves to be present, endeavoured to return the hind legs into the uterus, but they were immovable, and the presentation could not be changed. Embryotomy was, therefore, resorted to, and each hind leg was detached at the stifle joint; after which the Cow calved without much difficulty. An examination of the fœtus showed that the position of the hind legs depended upon a twist in the loins. The Cow perfectly recovered.

Cyclopean Monstrosity.

A Cyclopean Monstrosity would not, so far as the visual deformity is concerned, give any trouble to the obstetrist; but in conjunction with this condition we not unfrequently find other anomalies existing, as in the following instance:—

Wilson (*Veterinarian*, vol. xli. p. 607) mentions the case of a Cow which was nearly fifty-five weeks pregnant when parturition commenced. The presentation of the fœtus was natural, but the limbs were excessive in size. Eventration had to be effected before delivery was completed, the calf having been in the genital passage for more than two hours, notwithstanding the efforts of three or four men, who pulled at it from time to time. The calf was not larger than the female calf usually is, but the nasal bones were entirely absent, as well as the nasal openings—the skin in this situation being elongated as a simple but well-haired flap. On the under part of this flap, which was about three inches long, the lower jaw, mouth, and tongue appeared to be properly formed. "The fœtus was a cyclops, as only one eye existed, and this in the centre of the forehead. The eye was very imperfect, and the eyelids were much contracted and ran parallel to the longitudinal suture. The external ears seemed to be perfect in form, but the meatus auditorius was closed in both of them."

This, it will be seen, was a variety of Gurlt's cyclops. Youatt gives a good description of the head of a cyclops foal in the *Veterinarian* (vol. vii. p. 434).

Pseudencephalian Monstrosity.

The head of the fœtus may prove a cause of protracted or difficult parturition, as we have seen when treating of hydrocephalus as a source of dystokia, as well as in other kinds of anomalies, when it is either greatly deformed or double. We are cognisant of only one instance in which a pseudencephalian monstrosity (*Perocephalus pseudocephalus*, Gurlt) gave rise to difficulty in birth.

Maw (*Veterinarian*, vol. xxxiii. p. 450) attended a Cow in calf for the first time, and which had been violently in labour for six hours. A shepherd had been attempting delivery, and found the fore legs of the fœtus presenting, the head being turned back; the latter was adjusted, but yet, notwithstanding considerable force, the calf could not be removed. By skilful manipulation Maw succeeded in extracting it, when it was discovered to have "a protuberance on its head about the size of a child's head, with hair on it, and the tongue protruded from the mouth like a man's hand, with the thumb and fore fingers. On all the four feet were four digits, and the hind quarters and tail were like those of a dog; the legs were about six inches long, and there was no roof to the mouth—this aperture freely opening into the nostrils. The Cow was much exhausted, but ultimately recovered.

Double-headed (Monosomian and Sysomian) Monstrosities.

The occurrence of double-headed monstrosities is more common, perhaps, than any other anomaly; they are observed more particularly in ruminants, though instances are recorded of their appearing in the Pig, and even in the Cat species.

We have collected reports of some three dozen cases, the large majority of which refer to this anomaly in the Calf, and not one to the equine or asinine

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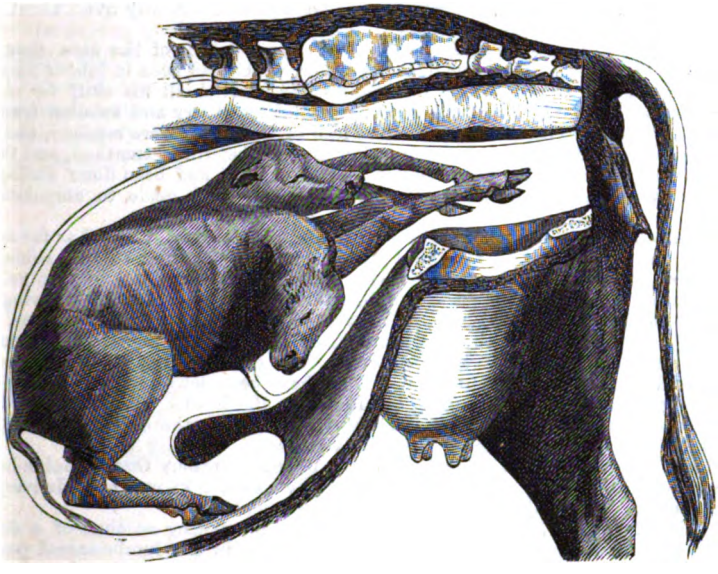
species. Only two of these cases appear in English literature. We have already shown, in the classification of monstrosities, the kind and degree of division there exists between the heads, and we have only now to deal with this anomaly from an obstetrical point of view.

It may be observed that many of these creatures have been born alive, and have continued to live for some time. Canu mentions a double-headed Calf which survived its birth fifty days, and Bert gives a good description of another which he examined when it was fifteen months old; but in the latter instance the anomaly was limited to the lower part of the head, the jaws only giving evidence of duplicity.

The existence of this anomaly renders birth more or less difficult, or even impossible, according to the size of the heads, their point of junction—whether at the face or cranium, or towards the neck, and also according as



"Fig. 103.

SYSOMIAN MONSTROSITY: *Dicephalus bicollis* (GURLT).

the presentation of the fœtus is anterior or posterior. In very many of the cases recorded, the mother died or had to be killed, while in others birth occurred without assistance and with but little difficulty: rather a matter for wonder, considering the width of two fœtal heads joined towards the upper part of the neck. In this respect the Monosomian must prove more troublesome sometimes than the Sysomian monster. In the majority of cases the presentation is anterior.

An examination will reveal the existence of this condition, when the obstetrist will adopt the measures necessary for extraction. In very many of the cases embryotomy will have to be resorted to, or even the Cæsarean section. Decapitation of one or both heads may sometimes suffice. In other cases, judicious manipulation and well-timed traction will effect delivery. When the heads are united at the cranium (as in Figs. 97 and 100), and it is impos-

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sible to decapitate, the obstetrical saw, chisel, or bone forceps may be usefully employed to disunite them at their junction.

With double necks, amputation of one head and neck should be effected as low down as possible.

1. Wilson (*Veterinarian*, vol. xlii., p. 407) describes a Monosomian monster; the heads were of equal size and fully developed. With the exception of the atlas and dentata, the bones were natural in shape. The dentata did not differ much from the normal form; but the ring or body of the atlas was curved from below upwards, at its anterior and middle part, and had attached to the extremity of this curved portion an extra piece, which was carried with a sweep upwards and backwards to join the body of the bone superiorly. This interposed portion of bone contributed, on either side, to the formation of the concavities for the attachment of the two occipital bones. The spinal cord was not bifid, as only a common but enlarged cavity existed in the atlas. The presentation of the fœtus was posterior, and delivery could not be effected until the greater part of the fœtus was removed by dissection.

This was the fourth case of double head this veterinarian had met with in twenty-five years' practice. The first (a calf) was delivered alive, but only lived about half-an-hour; the next two were born dead.

2. Shipley (*Veterinary Journal*, March, 1877) gives details of the case shown in figure 100. The mother was a medium-sized Cow, which had been in labour for about twenty-four hours, during which an empiric had exerted all his skill for several hours to effect delivery. Shipley found the genital canal dry and swollen from the severe treatment. With difficulty the fore legs of the fœtus were reached, and then a malformed or double head. The lower jaw of each head was smashed, and the incisors pulled out or hanging from the gum. This damage had been done during the attempts at extraction; unsuccessful efforts had also been made to amputate the head.

With much trouble and labour, the fore limbs were pushed forward as far as possible into the uterus, and a strong cord passed over the back of the heads behind the ears; then, with the aid of some men who pulled at this cord, and in manipulating the two noses of the fœtus—first to one side, then the other, gradually drawing each forward—the heads were extracted, and cut off at their junction with the atlas. The neck was now pushed back, the fore limbs lifted up, and with a little assistance the body of a well-developed calf was extracted. The creature was alive at an earlier period, and Shipley had no doubt that it could have been delivered more easily than by cording the lower jaws and using a halter over the head. The spinal cord was single; the cerebrum on each side was fairly developed; the cerebellum was only "semi-double;" the two tongues were nearly perfect.

3. Canu (*Mém. de la Soc. du Calvados*, etc., p. 362) mentions that a double-headed calf was found behind a Cow one morning, and it was not known how delivery had been effected. It was alive, and sucked by either mouth.

4. Rainard (*Op. Cit.*, vol i., p. 486) gives a very interesting account of a double-headed kitten, which made a posterior presentation in the lumbo-sacral position. The body having been extracted, the greatest difficulty was experienced in removing the head, which the finger introduced into the uterus discovered to be double. It was finally removed by traction—first on one side of the body, then on the other—the young creature dying during the manipulation.

5. Förster (Franck, *Op. Cit.*, p. 441) delivered a Cow of a double-headed calf, which was affected with prolapsus cerebri; no cutting was required—only manual assistance. The calf lived for about sixty hours; when it sucked by one mouth the milk escaped from the other mouth. The junction of the heads took place at the temporal bones, immediately behind the orbit (Fig. 97). The Cow was a frequent bearer of twins.

Franck gives a number of examples of this form of monstrosity, from German veterinary literature.

Celosomian Monstrosities.

Those creatures which are more or less destitute of abdominal and thoracic parietes, and otherwise deformed in various degrees, would appear to be somewhat frequently met with by the veterinary obstetrist. The above designation for them will be recognised as that bestowed by G. Saint-Hilaire, the name proposed by Gurlt being *Schistosomus reflexus* or *contortus* (Fig. 88).

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They also are found more often in the Cow than in other animals, the Sheep being next in the order of frequency. Of forty-nine monstrosities referred to by Saint-Cyr, twelve belonged to this order, and of these eleven were calves, and only one lamb. Our own figures place the proportion of calves much higher.

Perhaps this relative frequency, as Saint-Cyr remarks, is at least partly due to the fact that the singularity of the malformation is so striking that observers are more ready to publish cases of this kind; while parturition being always more or less laborious, empirics who may chance to be called in cannot understand the anomaly, and the veterinary surgeon has at last to be sent for.

Diagnosis.

The diagnosis of this malformation is not difficult to the practised obstetrist. If the fœtal intestines are apparent at the genital orifice of the mother, their small size indicates at once that they are those of the fœtus, while an exploration of the vagina and uterus will discover the distorted body, with the viscera unprotected and floating freely about. When nothing is visible externally, of course the diagnosis is more difficult; and this difficulty is increased with certain presentations and positions of the fœtus. When, for instance, this is anterior, and the spine is greatly distorted, the hand will first meet the head, and around it all the feet; and it will be in vain for the obstetrist to

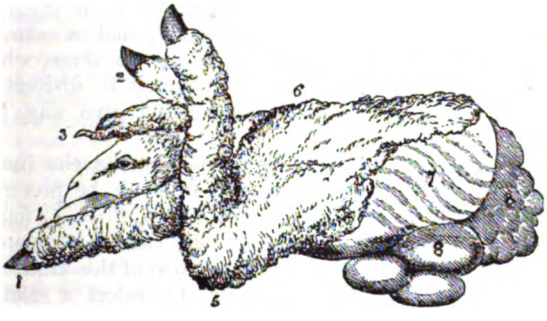

Fig. 104.

CELOSOMIAN MONSTROSITY: LAMB.

1, Hind Foot; 2, Fore Feet; 3, Tail; 4, Tongue; 5, Elbow of Left Fore Limb; 6, Stifle; 7, Ribs everted; 8, Viscera.

attempt to separate these, and to push back the posterior limbs in order to put the fœtus in a good position, as the rigidity of the crooked spine prevents this being accomplished. In other cases the presentation may be abdominal or posterior, and then the hand encounters a confused, soft, floating mass of viscera, the nature of which is not easily ascertained. However, the *feel* of the intestines should lead to a suspicion of the case, while the twisted spine, deformed pelvis, and general distortion, ought to lead to a diagnosis. In some cases the exposed heart can be seized by the hand, and if the fœtus is alive the contractions of this organ will be distinctly perceptible.

Prognosis.

The prognosis in these cases of dystokia will greatly depend upon the distortion and size of the fœtus, as well as upon its position. In thirty-nine

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observations collected by Franck, twenty-eight—or seventy-two per cent.—of these monstrosities were born without injury to the mother, and a number of them without assistance; the remaining eleven Cows had to be slaughtered. In thirty-two instances, twenty-eight—or ninety-three per cent.—of the fœtuses presented by the abdomen; only four cases—thirteen per cent.—presented anteriorly, with the head and all the feet towards the genital canal. The latter were the most serious, as in three of them the Cows died. Of the twenty-eight abdominal or visceral presentations, twenty-three births took place without permanent injury to the mothers, the other five being killed. One was delivered by the Cæsarean section. In some of the cases in which birth occurred without assistance, the young creature was born alive.

Extraction.

As we have seen, the prognosis in the large majority of cases is favourable, and particularly when the presentation is abdominal. Here careful manipulation will effect delivery, and often the only mutilation necessary is the removal of the fœtal viscera. These being got rid of, hand or cord traction made on the most convenient parts, or the insertion of a hook behind the spine into the pelvis, or any other likely and accessible part, with gradual pulling delivery will be effected; if not, the vertebræ should be divided.

But when the head and all the feet present, then the case is much more serious. If the fœtus is only moderately developed, even in this position it has been removed by traction. But in nearly all these cases embryotomy must be adopted. Some practitioners have succeeded in extracting the calf by cording the head and fore limbs, and pulling at these, while the hind limbs were being pushed back into the uterus, and so dislocating the spine and straightening the body. If the spine does not give way, it may be cut or sawn through.

In removing the body of the fœtus by instalments, the limbs are amputated one after the other, according to the rules to be prescribed for this operation; and it may be necessary to excise two, three, or four of the legs, and even the head of the fœtus, before delivery can be completed.

As we have shown, the number of cases recorded of this kind of monstrosity is relatively somewhat large; but we will only select a small number in illustration of the varieties, difficulties, and results met with in practice.

1. Bull (*Veterinarian*, vol. ix., p. 158) mentions a Ewe which had gone its full time, and with difficulty produced a lamb. This creature presented a sudden incurvation about the centre of the spine, with a similar inversion of the ribs; so that the hind legs lay upon the neck and upper part of the shoulders, while the fore legs took a direction upwards, embracing the hind quarters, and forming a kind of collar, by which they and the head were encircled. The head was deeply bent under the breast, and the chest and abdomen were not enclosed; consequently, all the internal organs lay loose or floating in the uterus while the young creature was there (Fig. 104). Every part appeared to have attained its full development.

2. Tennant (*Ibid.* vol. vii., p. 439) describes the case of a Cow which had calved. It had usually produced twins, and it was suspected another remained in the uterus. On introducing the hand, it met with a substance which felt like the liver, and afterwards proved to be so; the parietes of the abdomen were absent, the common integuments were reflected upwards upon the sides, and the whole of the viscera left exposed. The left hind leg was bent first forward and then backward over the ilium towards the tail, somewhat enveloped in the integument of the belly. There was no diaphragm, but the thoracic viscera were entire. After extraction, the hind leg just mentioned was found to resemble the fore leg.

3. Marshall (*Ibid.*, vol. xl., p. 650) attended a small heifer, three and a half years old, which had gone its full period of gestation, and which three shepherds had been attempting to deliver of its calf for twelve hours. Examination *per vaginam* dis-

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covered one fore and two hind-feet, as well as the head, presenting: the latter being inverted, and one knee and hock much distorted; the tail could also be felt. Every attempt to rectify the position or extract the fœtus by pulling failed, and the Cow was destroyed. A superficial examination of the fœtus showed that the whole of the viscera of the abdomen, chest, and pelvis were on the outside of the body, but nearly in their normal position and perfect. The intestines contained meconium; the mammary glands and four teats were on the thighs; the spine was bent backwards about the middle of the dorsal vertebra, with the spinous processes resting on the sacrum; the sternum and abdomen being split upon exposing the viscera. One fore-leg was turned back at the shoulder, resting upon the ribs near where they join the vertebræ, and hooked at the pastern over the spine; the other fore-leg was placed in a contrary direction, the two hind-legs and head accompanying it. These were the parts which presented in the uterus. The fœtus was alive a short time before the Cow was destroyed.

Recourse could not be had to embryotomy: "there was no room to use the knife, as the greatest bulk of the fœtus was at the part to be operated on, and the upper joints of the limbs were immovable."

4. Toll (*Ibid.*, p. 719) alludes to five cases, in two of which the Cows were killed by the owners; in the other three delivery was effected by removing the abdominal and thoracic viscera of the fœtus, dividing the lumbar vertebræ by means of a strong knife, and extracting the hind quarters by a hook and cord. The Cows did well.

5. Gibbs and Helmore (*Ibid.*, vol. xli., p. 517) each met with a case. The former was successful in extracting the monstrosity; but the latter could not deliver, and the Cow had to be killed.

6. Watson (*Ibid.*, vol. xliv., p. 531) attended a Cow in parturition which two men had been trying to deliver for some hours. The animal was standing, and two of the feet of the fœtus were protruding from the vagina. An exploration proved that the calf was malformed, the heart and intestines being exposed, three feet presenting, and a large sac on the cranium. The head and tail were in the genital passage, while the fourth limb—a fore one—was felt doubled up and enclosed in a sort of bag. The cranial sac was punctured; the confined limb released, by incising the bag containing it; then, after attaching cords to two of the legs and trying in vain to bring the fœtus into a favourable position, it was found necessary to amputate two of the extremities *in utero*. This was done by cutting the skin round the pastern, slitting it up to the shoulder in the one case and hip in the other, then skinning and dissecting with the scalpel. These limbs being removed, cords were fastened to the others and to the lower jaw. Considerable traction was then applied, and the remaining portion of the fœtus was extracted.

The Cow made a good recovery. The lower part of the body of the fœtus was open from the neck to the anus, the spine curved backwards in a circle towards the head, so that the lower surface of the vertebræ became uppermost; the limbs and viscera were correspondingly displaced, and the skin had no attachments to the other tissues; there was no pelvic cavity, but simply a broad pubic bone growing out from the vertebræ with which the hind limbs articulated; and the whole vertebral column was completely anchylosed.

7. Rossignol (*Journal de Méd. Vétérinaire de Lyons*, 1866, p. 263) was requested to assist a Cow which was in labour. The owner informed him that, instead of bringing forth a calf, nothing was to be seen but bowels, and Rossignol therefore suspected that a serious injury had been done to the Cow, through rupturing the metro-vaginal parietes. It was not so, however. The Cow was lying on its left side, and made no expulsive efforts; but a large mass, composed of coils of intestine, distended by gas, lay outside the vulva. The colour of these was rather bluish, and from their small diameter it was obvious that they belonged to the fœtus. On passing the hand into the vulva, it readily entered a large cavity, recognised to be a part of the fœtus; the kidneys, liver, and rudiments of the stomach of the young creature could be touched. The abdominal parietes, as well as the skin, were evidently absent. As the tail and the points of the hocks could be made out, it was obvious that the presentation was a posterior one, and that extraction would be easy. Each hind limb was accordingly pushed forward by the cannon bone until the hoofs could be touched; these were then lifted up and brought towards the vulva. This manœuvre was facilitated by the position of the fœtus—which was lumbo-pubic. Delivery was accomplished in less than half an hour. The fœtus was completely destitute of skin from the last three sternal ribs to the pelvis; it adhered to, but did not extend beyond, the loins; it covered the ribs, but not their cartilages; the ribs curved outwards, the sternal ones had no cartilages, and the lungs and heart were visible.

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The Cow lay as if paralysed for eight days, and was able to get up on the fourth day after delivery; the following year it gave birth to a well-formed calf.

8. Daube (*Journal de Vétérinaires du Midi*, 1869, p. 497) visited a Cow which had gone seventeen days beyond its time, and had worked until the previous evening. It was exhibiting symptoms of colic; a vaginal exploration did not discover any fœtal movements. A large quantity of liquor amnii had escaped, and the udder had become suddenly swollen. As the labour pains were only very slight, nothing was attempted until the next day. Early in the morning, however, the owner came to report that the Cow was nearly dead, and though straining violently, there were no signs of the calf. Daube found the Cow lying, and apparently very prostrate; so he immediately proceeded to deliver it. When his hand reached the uterus it met an unformed mass, the position of which he could not ascertain; he felt it in all directions, but there was nothing definite—nothing but convexities. It was impossible to seize a limb: the hand always glided between the different envelopes of the fœtus without meeting anything recognisable. However, in thrusting it into the abdominal cavity the head of the creature was felt, and this led to the suspicion that it was a posterior presentation. Passing the hand over the back a hard convex mass was perceived; this was the vertebral column, on each side of which the ribs were found constantly under the hand. This extreme difficulty in diagnosing the case, or distinguishing the position of the calf and seizing the limbs, caused Daube to believe that his hand was engaged between the inner surface of the uterus and the external surface of the placenta; and as he had been already engaged for two hours in trying to make out the nature of the mass, he came to the conclusion that the fœtus had become twisted on itself and entangled in the placenta. Impressed with this notion, he thought it necessary to tear through what he considered were the fœtal envelopes (the "waters" having escaped since the previous evening), imagining that by this procedure he might be able to distinguish and seize the limbs, as well as the body of the fœtus. This laceration having been effected, the hand was withdrawn, when, to his great astonishment, the intestines of the creature were recognised; soon the liver, spleen, lungs, etc., were successively extracted. But he could not comprehend how he had torn the skin of the creature in order to allow of this escape; however, in the midst of his manipulations he at last discovered the articulation of a limb, and which he took to be that of the stifle. After five hours labour, it was deemed impossible to extract the fœtus entire; so embryotomy was decided upon.

The limb was disarticulated by the bistoury, and found to be as surmised; its extraction, nevertheless, was hindered by the ilium, which was placed in a vertical direction at the pelvic inlet; so he was obliged to amputate it at the stifle. The fœtus was pushed forward, and, attaching a cord to the ilium, this was brought into a horizontal position and extracted. Still the hind limb could not be removed, until by chance the upper extremity of the tibia was secured by a cord, traction was applied, and the leg came away, though destitute of skin, which had become everted from it, and had to be cut through at the foot before the member could be completely detached. It being impossible to find the other limb, a cord was tied to the piece of skin which had just been divided, and a hook having been fixed into the most accessible part of the fœtus, four men and Daube himself pulled at the cords, when the fœtus was finally extracted. At first sight it looked as if the fœtus was still in the placenta, but a little investigation proved it to be otherwise. The ribs appeared, in the first place, to form two wings to the vertebral column; then the skin of the fœtus itself formed a closed sac enveloping it, and which proved so resisting. The limbs were greatly misplaced and distorted. The right fore-leg, for instance, was detached from the scapula and suspended merely to the skin, being apparently destitute of muscle; it bent around behind the head like a collar; the left fore-leg lay along the left jaw in passing above the preceding, when it deviated to the right, curved round the nostrils, and towards the left eye, where it was indented by the other limb, the inferior extremity of which was placed against the right jaw. The left hind limb was directed forwards along the vertebræ; the tail was also reversed and passed forward; while no trace of the anus could be discovered.

The most remarkable feature of the case, in Daube's estimation, was the disposition of the skin, which was inverted—turned outside-in—and formed a closed sac for the calf itself, being perfectly contiguous throughout, the internal part having become external, and the hair everywhere in contact with the young creature's body. The pectoral, abdominal, and pelvic organs must, therefore, have floated in the placental fluid.

9. Bosch (*Münchener Jahresbericht*, 1873-4) describes an instance in which the intestines were enclosed in a skin capsule some distance from their proper situation, the

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abdominal cavity containing a yellowish mass of exudate (*sulzige exsudatmasse*), as did also the fœtal membranes.

10. Anacker (*Der Thierarzt*, 1870, p. 85) alludes to a monstrosity of this kind, the abdomen of which presented; the liver, kidneys, etc., were removed, but the Cow had to be killed.

Franck gives a number of instances similar to the above.

Double and Triple Monstrosities.

We have already alluded to monstrosities which have the head double; we now come to the consideration of those which have the body more or less double, or even triple, and which have been designated by G. Saint-Hilaire as *Eusomphalian*, *Monomphalian*, and *Monocephalian*, according to the degree of separation of the bodies, and whether two are united to a single head—the double-headed creatures being designated *Syncephalian*.

From an obstetrical point of view, there is little need to distinguish between the Eusomphalian and Monomphalian Monstrosities; for, as already explained, they consist of two distinct fœtuses joined together at some part of their body, the character distinguishing them being the presence of a double or single umbilical cord (see Figs. 96, 98, 99, 100).

The occurrence of such monstrosities is generally, though not always, serious, so far as birth is concerned; they are met with in all the domesticated animals, but perhaps most frequently in the bovine and ovine species. Several instances are mentioned in which birth has taken place without difficulty, and the young creatures have lived. Holzner of Erding, quoted by Franck, states that a double lamb, with eight feet, double abdomen, and single breast, neck, and head, was born without assistance. But in other cases, unless relief is afforded, the gravest results are certain to ensue.

Saint-Cyr alludes to three instances in which embryotomy had to be practised, and in two of these the mother succumbed; the third, however—a Mare—recovered.

Diagnosis.

The diagnosis of these monstrosities is often very difficult, as they may be mistaken for ordinary twins. Franck has drawn attention to the circumstance that there is very frequently a difference in the presentation of the merely double-headed fœtus and the double fœtus, particularly the double croup; the first being mostly in the anterior presentation, the latter in the posterior.

In the case of the double fœtus, its presence may be suspected when one cannot be moved without also moving the other; when one is brought into a good position with regard to passing through the pelvic inlet, and it cannot be advanced beyond a certain point, though the passage appears to be sufficiently wide to permit easy delivery, because the other lies across the inlet; when the hand is passed between the two fœtuses and is stopped at the point where the skin is carried between them at their junction; and when they are united by homologous parts, as already explained. With regard to the latter, as Saint-Cyr points out, we may be positive. If, for instance, two fœtuses lie together at the inlet in the same presentation—anterior or posterior—there is nothing to be inferred from this as to their being monstrosities or merely twins, as the presentation may be the same for these latter; but if one is in the anterior, the other in the posterior presentation, then we may be certain that they are *not* united. Heterologous parts do not unite.

The diagnosis in the case of Monocephalian monstrosities is comparatively easy when the head presents. But much care and attention are necessary in

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forming a diagnosis in such cases, and the examination of the bodies should lead, if possible, to an exact notion of their condition.

Extraction.

In some cases, though they are very rare, extraction may be possible by manipulation and judicious traction; but, as a rule, embryotomy, or even the Cæsarean section, has to be practised. If it were possible to separate the two individuals by excising the parts which unite them, then birth would probably be as easy as with twins; but it can rarely be practicable, for the simple reason that the point of union is generally beyond reach: it is too extensive to be cut through, or the junction is of an osseous character. Nevertheless, cases may occur in which the knife and the obstetrical saw or bone forceps may be most effectively employed in accomplishing disunion.

When the monstrosity is in the anterior presentation, should it prove to be double-headed, then it will be found advisable to remove one of the heads as low down the neck as possible; after this is done, removal of two or more of the anterior limbs, by subcutaneous section, will often diminish the diameter of the body to such an extent that traction on the head and remaining skin of the limbs will sometimes effect delivery. If not, then evantration of the thorax and abdomen will be necessary. When the two croups cannot be made to pass through the pelvis together, it will be imperative to divide each across, as far back as possible, extract the anterior halves, push the posterior into the uterus, turn them, and deliver them as in the posterior presentation. Sometimes excision of one or more of the hind limbs, in order to diminish the volume of the double croup, will be necessary before the operation can be completed. With Monocephalic monstrosities, of course the head and neck are not interfered with, only the body and limbs requiring attention.

When the presentation is posterior, the procedure must be carried out in a similar manner; but in all cases the task is a long and fatiguing one, and the tax upon the endurance and sensibilities of the mother is heavy indeed.

The examples of such monstrosities occasioning dystokia are not numerous; in English veterinary literature we can only discover two.

1. Carlisle (*Veterinarian*, vol. xiii., p. 405) was called to assist in delivering a Cow, the peculiar formation and monstrousness of the calf preventing birth. The fœtus was presenting two feet and a tail, but its position could not be made out, three hind legs and two tails being discovered; two of the legs were in the vagina, with one tail; the other leg was articulated with the superior part of the pelvis, and lay over the back. The body seemed to be large, and changing its position or extracting it was deemed impossible. The Cæsarean section was proposed, but the Cow was too weak to undergo such a formidable operation; so embryotomy was decided upon. "I introduced an instrument resembling a short strong bistoury, guarded by my finger and thumb, with its handle resting on the palm of my hand. I commenced my dissection at the rectum, cutting downwards, severing the symphysis pubis, and dilating the opening as much as possible. I succeeded in removing the abdominal viscera, and part of the contents of the thorax. I next crushed in the ribs; by so doing I was able to remove the double pelvis and the hind legs. We now gained a favourable position, and from our conjoint efforts we brought to light one of the most singular formations ever witnessed. The animal had two heads, seven legs, and nine feet; two spines and two tails—one emerging from the termination of each spine; also a double number of ribs. The ribs were given off from the superior and inferior spine, and met at the middle of the sides, forming only one cavity. There was a trachea and œsophagus to each head, and these united near to their termination in the lungs and stomach. The hind leg, which articulated with the superior parts of the ossa innominata, was double from the hock, and at its termination were three distinct feet, perfectly developed. The organs within the thorax and abdomen were single, except that at the termination of the colon the intestine was bifid, forming two rectums,

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which terminated under each tail. When the creature was placed in a standing position, the two fore legs which grew from the inferior spine pointed upwards over the shoulders of the outer fore legs. In all, as I have stated, there were four fore legs, three hind ones, and nine feet. The umbilical cord entered the abdomen on the side, at the union of the ribs." This, it will be perceived, was a *monomphalian* monstrosity —Gurlt's *Cephalo-cormodidymus.*

2. Cartwright (*Ibid.* vol. ix. p. 619) describes a *monocephalous* monstrosity, which was extracted by the manual force of fifteen men and the empiric who superintended them. Four hours were occupied in the extraction. The presentation was anterior, and the calf was born naturally as far as the middle of the body. The uterus of the Cow became prolapsed soon after, and a farrier attempting to return it, injured it so much that the animal had to be killed.

3. Jannée, a Belgian Veterinary Surgeon (*Journal de Méd. Vétérinaire de Lyon*, 1851, p. 311), extracted a double monster from a Mare ; the latter survived.

4. Olivier (*Ibid.* 1847, p. 422) describes the birth of a monocephalous fœtus, which presented posteriorly, back upwards. Two hind feet had passed through the vulva ; these were pulled at, and this, with the efforts of the mother, brought two other hind feet into view. As nothing more could be done by traction, embryotomy was practised.

5. Saint-Cyr (*Op. cit.* p. 432) received the body of a monocephalous lamb which had been taken from a Ewe three years old, and which had, without much difficulty, produced three well-formed lambs, then this monstrosity. The expulsion of the latter was not very troublesome ; the presentation was anterior, position vertebro-sacral. As it was a little slow in being born, slight traction brought it away. It was alive before parturition was completed, but was dead when born.

6. Franck (*Op. cit.* p. 438) alludes to a Cow which had an extremely pendulous abdomen, and could not calve. An examination discovered four hind feet in the genital passage ; so it was surmised that the deep abdomen could not be altogether the cause, and various attempts were made at delivery ; but these only resulted in producing tumefaction of the parturient canal, and a closer examination was consequently rendered impracticable. Franck thought the case was one of twins, and tried to extract one of them by a pair of the presenting feet. But as this was impossible, and every other attempt failed, the Cow was killed, without embryotomy having been resorted to. The monstrosity was monocephalous—eight limbs, double croup, and the body single forwards.

7. Horst (Kahlert's *Geburtshülfe*, p. 186) removed a monomphalian monstrosity from a Cow by embryotomy.

8. Funk (Franck, *Op. cit.* p. 439) attended a Cow in which the four hind feet of the fœtus presented ; it was believed to be a twin birth. After attempting to deliver on this supposition, it appears to have been discovered that the dystokia was due to monstrosity. The Cow was finally killed, and there was found in the uterus a very large fœtus, which had a single head, chest, abdomen, and two fore extremities ; but it had three spines and pelves, and to each a pair of hind limbs—six posterior limbs in all.

9. Adam (*Ibid.* p. 439) describes a double lamb which a sheep brought forth dead. It was eusomphalian.

10. Tetzler (*Ibid.* p. 439) describes a triple monstrosity he removed from a Cow, which recovered from the severe manipulation. The monster was single anteriorly, but it had two well-developed spines, and four hind limbs, a third rudimentary spine, with a pair of undeveloped limbs.

CHAPTER IV.

Dystokia from Multiparity.

At page 147 allusion was made to the relative position of the young in multiple pregnancy, and at page 238 we described the manner in which twin births take place. We need not again refer to these, but we must notice those cases—rare, it is true—in which difficulties are encountered from pathological conditions in twin parturition. As has been shown, in ordinary cases one fœtus occupies the body of the uterus, the other one of the cornua, or both may be in the cornua ; and both may present either anteriorly (Fig. 37),

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posteriorly, or one in the first and the other in the second presentation (Fig. 53). One alone must pass through the genital canal, then the other, as there is not space for both at once; and birth is usually quite as easy as if there was only one fœtus. Indeed, it is sometimes easier, from the fact that parturition either occurs before the full period of gestation has expired, and the progeny are therefore not so largely developed; or, if the usual term has been reached, it nearly always happens that the twins are smaller than in uniparous births. When the most advanced fœtus is expelled, a variable period elapses before the birth of the second takes place. During this interval, the uterus is accommodating itself to its altered conditions, and preparing for the expulsion of the remaining fœtus, while the parent remains restless, pays but little, if any, attention to the young creature already born, and manifests a particular anxiety, which is an almost certain indication that parturition is not completed; when the uterus has got rid of its occupants, the mother then turns its attention to the offspring.

This is the ordinary course of affairs; but it is not always so fortunate. In some instances, after the expulsion of the first fœtus, the uterus is seized with a kind of inertia, and labour may be suspended for hours, even for days, and sometimes more than a week.* During this suspension, the parent at times gives indications of uneasiness by pawing, looking at the sides now and again, straining at intervals perhaps, and not unfrequently exhibiting symptoms of colic, while the milk retains all the characters of colostrum until the other fœtus is born.

Retention of the second fœtus after a certain time is fatal to its existence; even in animals with a multiple placenta—such as the Cow, whose fœtus retains its vitality much longer than that of those whose placenta is single, like the Mare—the retained fœtus has never, according to Saint-Cyr, been known to exist forty-eight hours after the birth of the first.

This suspension of labour in twin birth, and which is not at all unfrequent, is ordinarily due to malposition of the second fœtus; and this cause of dystokia is one which nearly always demands the attention of the veterinary obstetrist.

* This uterine inertia, scarcely noticed by veterinary writers as occurring in multiparous animals, we have often observed. Even while we write these pages a case presents itself. A medium-sized bull-terrier Bitch, belonging to a brother officer, required my assistance last year, through being unable to pup. The animal had been in labour for some time, and the head of a puppy was in the vagina. This was easily removed by an instrument hereafter to be described, as was another which we contrived to seize immediately afterwards. These were all that the uterus contained, and they certainly were not too large for the genital passage; the uterus could not expel them.

About a month ago, this officer, who had in the meantime removed to Portsmouth, wrote to inform me that the Bitch was again pregnant, and owing to my having made him acquainted with its uterine peculiarity, he was anxious to know what he should do when its time was due for pupping. Recommending certain hygienic precautions, I advised that nothing special should be attempted unless birth was delayed, as on the previous occasion; then a dose of tincture of ergot of rye was to be administered, followed by another if necessary. The other day I had a letter stating that on the Thursday night the Bitch had four small pups, but there was no sign of milk. A dose of castor oil was given, as symptoms of constipation were exhibited (due, in all probability, to fœtal retention); the following day the animal was in pain, "and as she was strong and well in herself, I did not like to give the ergot of rye yet. However, on Saturday morning she became very ill, and was scarcely able to stand up, and yet there was no milk. So about ten o'clock, I gave her a drachm of tincture of ergot of rye (our prescription), and about five p.m. she passed a *dead* pup, followed shortly by *five live ones*. She is now (Tuesday) all right, but all the live puppies died, save two."

This case is interesting, as showing the tendency in some animals to uterine inertia; as testifying to the great value of ergot of rye—at least, with the carnivora—its ecbolic action on animals being denied by many veterinarians; as proving that the death of one fœtus *in utero* does not always imperil the existence of the others; and as demonstrating that, contrary to what occurs in the Mare and Cow, fœtuses will exist in the uterus of the Bitch for forty-eight hours after the expulsion of others without succumbing, even when one of their number is dead.

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This malposition of the single fœtus will be noticed presently; we have now to consider difficult birth due to multiparity. Dystokia from this cause always happens when the two fœtuses are about the same distance from the os uteri, and both present together at the pelvic inlet; the uterine contractions carry them simultaneously into the opening, but of course they cannot possibly pass through the canal at the same time; hence the difficulty in birth—a difficulty which varies according to the relative situation of the two fœtuses towards each other.

The fœtuses may be so situated that when the hand is introduced into the vagina or os, it will either encounter the head of one fœtus with the fore limbs of the other; four anterior or posterior limbs; two hind and two fore limbs (Fig. 105); two, four, or six feet; a head and a tail, etc.

The cause of this malposition is in all probability due to the relative

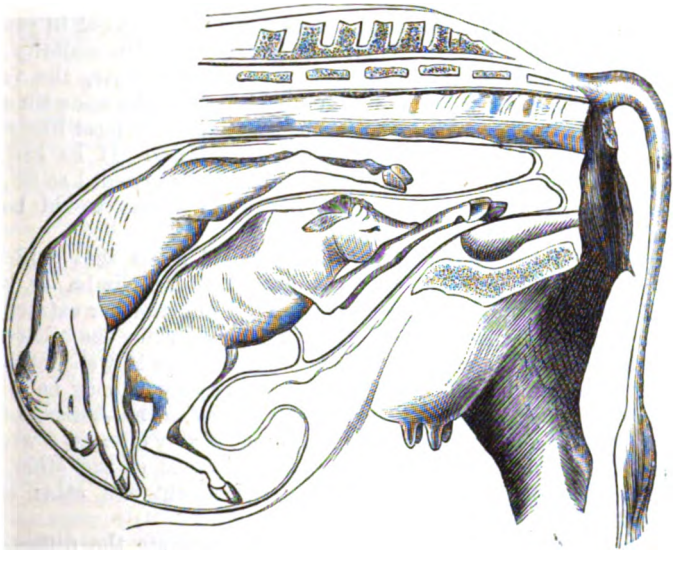

Fig. 105.

TWIN FŒTUSES, IN DIFFERENT PRESENTATIONS, PASSING INTO THE GENITAL CANAL.

smallness of the twins, and the changes which occur in their situation during birth; and it will be apparent that the obstetrist must, in some cases at least, find it difficult to distinguish between such presentations of twins and some of the monstrosities or deformities we have described.

Diagnosis.

In such cases the obstetrist has to ascertain, as Saint-Cyr points out:

1. Whether individual twins are present; 2. To distinguish, among the parts which present, those which belong to each fœtus. This can only be done by a most careful manipulation, and even then at times the obstetrist will find himself embarrassed. For instance, when the fore feet of one fœtus presents along with the head of the other, the operator may be led to believe that there is only one animal to extract; and as the position is seemingly favourable, and the difficulty only due to excessive size of the fœtus, power-

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ful traction is resorted to for its removal. This, however, fails to effect its object; and when another exploration is made, it is discovered that the attempt has so fixed the fœtal parts in the pelvis, that the most energetic and skilful manipulation will scarcely move them in order to alter their position.

In other instances, we find the limbs of the fœtuses so interlocked that they are with the greatest difficulty disengaged.

Extraction.

It is evident that, if delivery is to be effected, one fœtus must be extracted at a time. They must, therefore, be disengaged, and one pushed forward into the uterus, while the other is carried towards the vulva. When the latter has been born, then the second, if in a wrong position, must be adjusted and removed.

This is easily written; those who have had to carry it out in practice are alone competent to say how difficult it is to execute in the majority of cases. It must be remembered that, as in nearly every other case, the veterinary obstetrist is only called in when the fœtuses have been for some time wedged in the pelvic entrance by the uterine contractions, and most likely also by the injudicious manipulations of amateurs or empirics. If he had the advantage of attending the animal before matters had proceeded so far, and the fœtuses were still in the abdomen, then the difficulties would be greatly diminished.

Recognising the presence of twins, he would select that which is in the most favourable position, cord the head and fore limbs, or the hind limbs if they presented, place them in a good direction for extraction, and by the aid of assistants draw it towards the outlet, while the other fœtus is pushed deeper into the uterus. When the first fœtus is well into the passage, and the other behind and clear of it, the operation may be said to be completed. It may be noted however, that owing to the obstacle offered by the first fœtus, the one remaining in the uterus is very often in a wrong position, and the uterus contracting upon it after removal of the other, may fix it in that position, and thus necessitate adjustment and other assistance being rendered.

Perhaps the following examples will better illustrate the difficulties met with, and the mode of overcoming them, than anything more we could add:

1. Cartwright received from Mr. Cox, of Ashbourne, the following description of a case:—The Cow having made no progress in parturition, he examined it, and found the tail and breech of one fœtus and all the feet of the other presented. He corded the hind feet of the latter, and pulled at them, at the same time pushing the head and fore legs back; but from one of the hind legs not properly advancing, he made a further examination, when he discovered, that it had passed between the hind legs of the other calf, constituting what country people term "leg-hanked." The extremity of the hind leg which did not sufficiently advance was then unfastened, and by pulling at the other leg it caused the one still corded to come from between the hind legs of the other calf; after which it was again corded and brought up, and the calf was readily extracted.

2. The same authority (*Veterinarian*, vol. xxi. p. 496) mentions the case of an aged Ewe which was then yeaning. The head of a lamb was seen beyond the vulva, but it could not pass any further. On introducing the fingers into the passage, the head of another lamb was felt within the pelvis. The Ewe being aged and roomy, the hand could be passed into the vagina by the side of the protruded lamb's neck, when the head of the other lamb was encountered, and pushed back into the uterus. Having done this, one of the forelegs was drawn out; this limb and the body were then pulled at, when the lamb was easily extracted, although the other leg lay behind. Only the

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head of the other lamb presented; but one of the forelegs was eventually secured, and this lamb was removed in the same manner as the last. The first lamb was a very large one; the other was smaller. The Ewe and lambs did well.

Cartwright remaks: "It is astonishing how lambs will rally and recover, though apparently almost dead."

3. Laycock (*Veterinarian*, vol. xxx. p. 505) was called to a Heifer in labour, and in which, he was informed, "all four feet of the calf wanted to come together"—no suspicion existing that there was more than *one* calf in the uterus. On examination, it was discovered that twins were present, and that their legs were so entangled with each other, through the attempts of amateurs, that it was almost impossible at first to ascertain in what position either calf presented. Subsequent exploration proved that the parties who had been trying to deliver the Cow had drawn the legs of one calf along with the head of the other, and so far out that neither head nor limbs could be returned into the uterus. Finding that both fœtuses were dead, one of the protruding limbs was amputated, but no further progress could be made in delivery; then the other limb of the same fœtus was excised, and the body could then be removed. The Cow was too much exhausted to undergo manipulation for the extraction of the other fœtus; so stimulants and gruel were administered, and it was left to rally until the next morning. A farrier, however, soon after interfered; he had the animal's hind quarters elevated by means of pulleys, and took away the calf; the Cow quickly perished.

4. Austin (*Ibid.* vol. xxxiv. p. 16) mentions a Cow in New Zealand, which had been in the field a day and night with the head and fore legs, apparently, of a calf protruding from the vagina. The calf was dead. "After making the Cow fast, I found that the head belonged to one calf and the fore legs to another, and it was a work of some little time to put back both the calves, and get them out separately—the fore legs of the first calf and the head of the second being doubled back."

Both calves were dead; the Cow ultimately did well.

5. Canu (*Recueil de Méd. Vétérinaire*, 1837, p. 442) gives the following good case of a fine Cow, five years old:—Being sent for to see this animal, Canu found in the vagina a head and six limbs so interlaced that it was difficult to distinguish the anterior from the posterior. The head was only half through, and the fore limbs of the most favourably situated fœtus were no further advanced than those of the other; the straining of the mother acted on both the fœtuses alike, and as the second one occupied one-third of the pelvic cavity, no progress whatever was made. In order to avoid a mistake, cords of different colours were attached to each fœtus. Attempts were then made to push forward, with the right hand, the fœtus which presented the four limbs, while traction was exercised on the other.

This, however, was unavailing, for when the front part of the first fœtus was pushed the hind quarters presented, and *vice versâ*; so Canu was obliged to introduce both hands into the vagina. The arms being sustained by an assistant, the anterior limbs were seized by one hand, the posterior in the other, and then he pushed with all his strength; while two assistants, pulling at the moment when the Cow made a great effort, advanced the first fœtus, the chest of which caused Canu to withdraw his arms, when the entire fœtus soon came away. With regard to the second fœtus, two cords were fixed on the posterior limbs; the tail was well placed, and the forearms being grasped above the knees, they were pushed into the uterus. The assistants then pulled, the croup passed into the genital passage, and birth was promptly terminated.

6. Liautard (*Journal de Méd. Vétérinaire de Lyon*, 1846, p. 575) states that a Mare belonging to the Military Train had been accidentally impregnated by an Arab horse while in bivouac. Experiencing difficulty in foaling, he was called upon to attend upon this Mare. On his arrival, he found it to be in an anxious state, looking alternately to the right and left side, and attempting to get rid, by rubbing, of a fœtus half extruded from the vulva, but whose posterior extremities evidently prevented further progress; the poor animal endeavoured to seize the foal by its teeth, strained in an irregular manner, and was much agitated; then it gathered itself on its hind quarters, lay down on the litter with a plaintive moan, sprang up again immediately, neighed, and impatiently kicked the ground.

The fœtus was in a good position; its envelopes were ruptured and the "waters" had escaped; the fore limbs rested on the Mare's thighs, while the head, hanging between them, showed some contusions; the foal still lived.

Two men placed at the head of the Mare grasped her securely, and a third held up a fore-foot; while an intelligent assistant, standing beside Liautard, seconded his efforts. The energetic straining of the Mare effectually prevented any retrograde movement of the foal, which was otherwise too far expelled to be pushed forward.

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After a number of fruitless efforts, the open hand, introduced on the left side of the foal, finally reached the os uteri, when it was found that the creature was not malformed, and the hind limbs had a good direction; there was nothing anomalous in the cervix; but a hard movable body, which the hand could scarcely disturb, because of the difficulty of introducing it farther, was engaged in the inlet, into which it entered more deeply as soon as the pressure was removed. From an attentive examination, Liautard acquired the conviction that this body was a second fœtus, which must be moved out of the way if the Mare was to be relieved from the painful state it was in, and delivery effected. With this view, it was pushed into the uterus as far as possible, the arm was quickly drawn from the vagina, and the assistant at that instant pulling the partially extruded foal promptly and energetically, while the Mare made a strong expulsive effort, the half-born creature was extracted.

Soon after, another fœtus—dead, and in its envelopes—was ejected almost without an effort. This one appeared to have died about the fifth month of gestation, and its small size explained how it could partially enter the pelvis, even though the passage was already occupied by the first. With regard to the latter, it died fourteen days after birth, from the effects of an inguinal hernia produced during parturition—doubtless by the compression the abdominal region experienced while passing through the narrowed genital canal.

7. Van Hertsen (*Annales de Méd. Vétérinaire de Bruxelles*, 1864, p. 281) communicates the case of a fine Dutch Cow, for the fourth time pregnant, and in labour for an hour. The two front limbs and the head of a calf appeared at the vulva, and notwithstanding the energetic pulling of six men, by means of cords tied to the limbs and the lower jaw, it was impossible to extract it. Introducing his oiled hand into the vagina, Van Hertsen discovered that the head and two limbs of the fœtus apparent at the vulva were so tightly fixed in that canal, that he could not turn them; indeed, he could scarcely pass two fingers as far as the middle of the passage. It therefore became necessary to push the calf into the uterus, in order to discover the obstacle to birth; but it was impossible to do so—*it was like pushing against a wall.* To make further traction on the head and limbs appeared to be useless; these appeared to belong to a calf of ordinary size, and the obstacle to its expulsion must depend on some other cause. Embryotomy appeared to be indispensable, and was at once resorted to. The lower jaw, already disarticulated, was removed; then, though with much difficulty, the head was excised; but the limbs were not cut off, as it was thought they might prove useful to attach cords to afterwards. It was again attempted to push the body into the uterus; the Cow was lying, and Van Hertsen, lying down also behind it, and placing his feet against a barrel, seized with his right hand the first cervical vertebræ of the fœtus, and in the left hand the two fore limbs, and pushed with all his force. All at once the part held in the right hand went forward into the uterus, but the limbs did not stir. Being then able to introduce his hand easily into the uterine cavity, he ascertained that it contained two calves, placed one above the other. The limbs in the vagina belonged to the lower one, the head of which was bent back beneath the sternum and between the limbs, so that the neck lay against the Cow's pubis. The upper calf lay like one Horse upon another, and it was the head of this one which had passed into the vagina.

It was then easy to extract the calves in succession, only one assistant being necessary. The lower calf was not yet dead, though it died soon after extraction. Eight days subsequent to this operation, the Cow was perfectly well.

GROUP II.

DYSTOKIA FROM MALPRESENTATION OR MALPOSITION OF THE FŒTUS.

Though the impediments to labour in the human female are not unfrequently due to the fœtus being in such a position that it cannot pass through the pelvic canal, yet it is very questionable whether, in animals, this cause of dystokia is not much more common, much more complicated, and very much more difficult to be rectified. In woman the impediment in this case chiefly occurs when the axis of the fœtus does not coincide with that of the uterus—when, for instance, the head or the breech cannot pass through the pelvic

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inlet, and the presentation is more or less oblique or transverse. It is exceedingly rare indeed that the neck or limbs offer an obstacle to birth.

With the calf and foal the case is very different. These creatures have the neck and limbs long and very flexible, and even the body itself is comparatively long and readily curved in any direction. The consequence is that the limbs or neck may be bent under, to one side, or above the trunk; while the latter may be flexed in such a manner as to become quite distorted.

For these reasons, we have a great number of more or less complicated malpresentations and positions, which give rise to varying degrees of dystokia, some of them of a very formidable kind.

It will therefore be readily understood that, even when the axis of the young creature's body coincides with that of the uterus and pelvic canal, and the latter is normal in dimensions, birth may not be possible without assistance; and this establishes a wide difference between the obstetrics of the human, and the equine and bovine species. Added to this, the veterinary surgeon has the difficulties before mentioned to contend with: powerful and often irritable animals; a long genital canal and deep uterus; uterine contractions so energetic that they fatigue and paralyse the hand and arm; the disadvantages of position in the parturient animal; the late period at which professional assistance is sought for; and the damage that may have been inflicted by amateurs and empirics.

Considering the frequency of these causes of dystokia, and their oftentimes serious character, they deserve the most careful study in order that they may be successfully overcome. This study also embraces the measures to be adopted in overcoming them; and as certain of these have to be resorted to in nearly every case of this kind, we will now refer to them. These general measures are based on the indication afforded by the knowledge that, as labour is rendered difficult or impossible from a vicious position of the young creature, so this position must be changed to one more favourable, in order that natural or spontaneous birth may be effected, or artificial extraction rendered possible. This change of position can only be effected, as a rule, by moving the fœtus itself, and so altering its relations to the neighbouring parts of the mother: the movements being designated *mutations* by obstetrists.

The procedure varies with circumstances: sometimes, for instance, the object may be achieved by merely altering the position of the parturient animal; at other times by sustaining its abdomen and manipulating externally; but in the great majority of cases, it is necessary to introduce the hand into the genital canal, and operate directly on the body of the fœtus. The principal of these mutation movements are three in number: *Retropulsion*, *Rotation*, and *Version*.

In order, however, that these movements may be effected, certain conditions are necessary. In the first place, it is absolutely essential that the os uteri be sufficiently dilated, or relaxed and extensible, for the hand to reach the interior of the uterus; next, the body of the fœtus must be movable in the uterus—a circumstance not always noted, as the organ is often closely contracted on its contents, should the liquor amnii have escaped some time, or the fœtus itself may be fixed in the pelvic canal. And, finally, the fœtal envelopes must be ruptured, as it is impossible to manipulate the young creature effectively while it is entirely invested in them.

Before any alteration in the position of the fœtus can be accomplished, these conditions must be assured.

RETROPULSION.—When the fœtus, in a vicious position, has entered the

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pelvic cavity and become fixed there, or even when in the uterus and approaching the inlet, before the position can be corrected it is nearly always necessary to push it forward into the uterus; as there only, from the greater space this organ affords, and the elasticity of its walls, can the impediment be overcome and adjustment effected.

"Retropulsion" is often necessary during protracted labour, even when the fœtus is in a good position, to enable the obstetrist to attach cords to the limbs or some part of the head or body.

This retropulsion is sometimes easy, at other times it is most difficult and laborious, and in certain cases it may even be altogether impossible.

The most favourable attitude for performing this operation, in the larger animals at least, is undoubtedly the standing one; but the body should not be perfectly horizontal, as a great advantage will be derived from raising the hind quarters to a considerable degree, as we thereby throw the uterus and its contents forward, and away from the pelvic inlet. This elevation may be effected by straw or litter placed under the animal's hind feet. In order to obtain this inclination promptly, Schaack recommends that the Cow be made to kneel on its knees; two assistants keeping the fore limbs flexed, while other two maintain the hind quarters in an upright position.

When the animal is recumbent and cannot be induced to rise, there is but little, if anything, to be gained by raising and supporting it by means of slings or other appliances; as the pressure which these produce on the abdomen opposes the manœuvres we have mentioned. Not unfrequently the sight of a strange dog will cause the animal to get up.

When, however, the Mare or Cow is exhausted, and it would be injudicious or impossible to make it stand, then manipulation must be attempted in the recumbent posture. When this is decided upon, in the great majority of cases it will be found that a considerable advantage will be obtained by placing the animal on its back, propping it up in this position with trusses of straw placed on each side, and raising the croup by introducing another truss beneath the hind quarters.

With regard to the smaller animals, such as the Bitch, they can be placed on their back on a table, and an assistant may raise the pelvis as high as may be deemed necessary. Retropulsion of the fœtus may be effected with the hand in the large animals, the operator supporting himself firmly on his legs; the arm must be strong, and very often it has to be engaged in the genital canal as high as the shoulder. It may sometimes happen that both hands have to be employed as repellers, and the body of the operator pushed forward by assistants.

Seeing the difficulties attending this operation, and finding that the hand and arm are not always sufficient, Continental veterinarians have for a long time resorted to a "crutch" or "repeller" (French, *Repoussoir;* German, *Geburtskrücke*) in conjunction with the hand.

This instrument is of iron, and is between two and three feet in length; it has a handle at one end, and a concave transverse piece, like the head of a crutch, at the other. This piece may be either solid or jointed (Figs. 106, 107, 108, 109). Provided the latter is sufficiently strong at the joints, it possesses advantages over the solid instrument: the principal of which is its easier introduction into the vagina and uterus. The crutch end being carefully carried by one hand through the genital canal, towards the fœtus, is applied to the most convenient part of the latter; while the handle is seized in the other hand, and the propulsion may then be effected either by this hand, the breast of the operator, or by an assistant.

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Many authorities speak very highly of this instrument, from the fact that it permits the displacement of the fœtus much further forward than the hand alone can effect, and thus allows a wider space between the pelvic inlet and

Fig. 106.

SOLID REPELLER, WITH A MOVABLE SPIKE.

Fig. 107.

SIMPLE-JOINTED REPELLER.

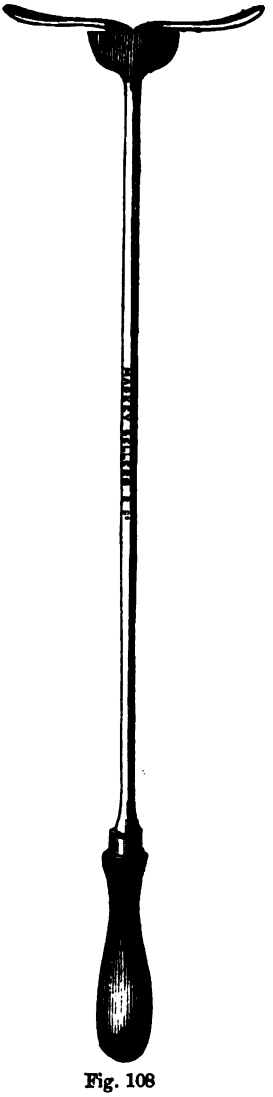

Fig. 108

JOINTED REPELLER: OPEN.

Fig. 109.

JOINTED REPELLER: CLOSED.

the body of the young creature; consequently, adjustment of the latter can be more easily and promptly accomplished.

An assistant can maintain the body of the fœtus some distance from the pelvis by this instrument, while the hand of the operator is making the

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necessary rectifications; the latter is therefore much relieved, and to some extent he is also exempted from the difficulty and fatigue caused by the uterine contractions.

The ordinary repeller has some disadvantages, the greatest of which, perhaps, is its being inapplicable to certain regions of the fœtus which may chance to be in an oblique line to its direction—such as the head, limbs, etc. To remedy this defect, I have added a short, pointed spike, which can be screwed into the middle of the crutch, opposite the handle, when necessary (Fig. 106); and this effectually prevents its slipping; the part in contact with the fœtus, when provided with this tooth or spike, resembles a trident. While the instrument is being employed—all propulsion should only be made during the intervals between the pains—one hand of the operator should guide and maintain it against the fœtus, to prevent injury to the maternal organs.

Some authorities, however, object to the employment of the repeller—or rather assert that they have never required its services. Brunet and Shaack observe that when their own strength is not sufficient, they are aided by an assistant. Brunet has the hand and arm of the latter acting on the fœtus at the same time as his own—both arms being in the genital canal; while Shaack gets his assistant to seize his right arm with one of his hands, resting the other on his left shoulder, and pushing him forward—Schaack's right arm and hand in this way playing the part of the crutch.

In order to propel the head, Binz invented an instrument like a goblet, furnished with a long handle; the hollow portion fitted on the muzzle of the fœtus, and the head could then be pushed forward. Solid rods to be fixed to the limbs of the fœtus, in order to push them out of the way, have been proposed, but their utility is questionable.

It must not be forgotten that, after all, the hand is the safest and most perfect of instruments, and should always be preferred—at least at first—to such appliances as we have described. Saint-Cyr truly remarks that the hand feels the parts on which it is placed; it adapts itself more exactly to the surfaces with which it comes in contact; it perceives the resistance they offer, and warns the operator as to the amount of force necessary to effect a certain object; whereas the presence of a hard and rigid instrument increases the uterine contractions; and however well adapted it may be, it may suddenly glide off rounded and slippery surfaces, and cause serious injury.

Nevertheless, there may be, and often are, occasions when the hand cannot accomplish what is necessary in the way of retropulsion, and it is these in which the repeller may be most useful, and it will be found quite safe when employed by a careful and experienced operator.

We have already remarked that this operation is frequently very difficult and laborious, especially when the animal has been in labour for some time. When the "waters" have escaped, the uterus is closely and spasmodically applied to the body of the fœtus, a portion of which may be so firmly wedged in the pelvis that to move it appears to be a hopeless task; and the genital canal is itself hot and dry. The first indication in such cases is to lubricate this canal, as well as the interior of the uterus, in order to overcome the intimate adhesion between that organ and the fœtus. Mucilaginous or oily fluids may be employed for this purpose, and they should be injected unsparingly into the genital canal, the hind quarters of the animal being at the same time raised as high as possible, in order to facilitate the entrance of the lubricant. After a few injections, the uterus in some cases becomes relaxed, and the fœtus may then be pushed away from the pelvis.

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This spasmodic contraction of the uterus, especially during the labour pains, is a great obstacle to every kind of manipulation in the interior of the organ. In order to diminish the violence of the pains, it is often attempted to attract the animal's attention by pinching its body; pressing on its loins with a stick; putting a twitch on the Mare's nose or ear; partially closing the nostrils to check inspiration; tying a rope tightly round the body; placing a strange dog before it, etc. The inclined position of the body may allay them.

When any or all of these means fail, it may be necessary to give the animal a narcotic in the form of opium or chloral hydrate, either in draught or enema (we prefer the latter), and to continue the emollient injections.

Retropulsion, as we have said, should only be effected in the intervals between the "pains;" though during these the expulsive efforts should be resisted, so that what has been accomplished may not be lost. The propulsion should be done by *jerks*, which are far more effective than a continuous push; they are not productive of any inconvenience.

ROTATION.—"Rotation" of the fœtus consists in turning it more or less round its longitudinal axis, with the view of changing the relation between the presenting parts and the maternal pelvis, or, as Saint-Cyr has it, modifying the *position* without interfering with the *presentation*.

After pushing away the body of the fœtus—but not its limbs, if they are well placed—from the pelvic inlet, the hand and fore-arm are introduced in *supination* and well forward between the body of the young creature and the floor of the uterus; then resting the arm on the pubis, it is employed as a lever in raising and turning the part of the fœtus in hand to the right or left, as may be. If the young creature is alive, this manœuvre is much more easily executed than when it is dead, as it seconds the effort. Boutrolle advises that the abdomen of the mother be raised by means of a girth or folded blanket, while rotation is being effected; and other authorities have recommended the employment of a lever between the fœtus and the uterus to effect this turning. Rainard recommends, when the limbs are in the pelvis, to tie them together, draw them beyond the vulva, put a piece of stick or any other convenient article between them, and to use this as a kind of lever to turn the body of the fœtus round to the necessary extent; or, which is preferable, as in the latter operation the limbs of the young animal may be seriously injured, to give the limbs to an assistant who, acting under instructions from the operator, turns them one over the other in a kind of twisting and swinging manner, in the direction indicated by the operator, whose efforts are in this way greatly assisted.

The operation of rotation is completed when the greatest diameter of the fœtus is coincident with the sacro-pubic diameter of the pelvic inlet—a right or left vertebro-ilial position, for example, being transformed into a vertebro-sacral position.

Saint-Cyr points out that this modification need not always be so complete, and that it frequently suffices to convert a lateral position into an oblique one, by making the dorso-sternal diameter of the fœtus correspond to the oblique diameter of the inlet—measuring this from the supra-cotyloid crest of one side to the sacro-iliac articulation of the other. The same observation is applicable to posterior presentations.

VERSION.—"Version," or "turning," in veterinary obstetrics signifies effecting a *change of presentation*, or, in other words, bringing towards the inlet a part of the fœtus other than that which presented spontaneously, and thus correcting a faulty presentation.

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A longitudinal presentation is that in which spontaneous birth can be alone effected; a transverse presentation renders birth impossible, and these, consequently, give rise to dystokia. Version is therefore indicated in all transverse presentations, no matter what region of the body may first offer at the pelvic inlet; it may even be required in certain forms of anterior or posterior presentation; and in all cases it is necessary to repel the presenting part, so as to bring one or other of the ends of the oval mass formed by the body of the fœtus to the pelvic inlet.

Hence we have two kinds of version: one which has for its object the movement of the head of the fœtus towards the pelvic inlet—*anterior* or *cephalic version;* and the other the posterior part of the body to the same opening—*posterior* or *pelvic version,* corresponding to the *podalic version* in human obstetrics. Each of these versions has its advantages and disadvantages, according to circumstances; though the majority of authorities prefer *pelvic version,* for the simple reason that with this there are only two appendages to care for—the hind limbs, to which it is comparatively easy to give a good direction; while in *cephalic version* there are not only the fore limbs to attend to, but also the head and neck, the unfavourable direction of which may give rise to much trouble in delivery.

Version can only be effected in the uterine cavity, when the uterus is entirely in the abdomen; so if any portion of the fœtus has entered the inlet, retropulsion must be resorted to. Then the operation can be commenced. It is divided by Saint-Cyr into two principal movements: *Repulsion* and *Evolution.*

In these manœuvres, the veterinary obstetrist, as in so many other instances, has not the advantages which the *accoucheur* of woman possesses with regard to manipulation, and especially that which can be practised outside the abdominal walls in conjunction with the version movements in the uterus.

Repulsion.—The hand—usually the right—being introduced into the uterus, reaches the presenting part of the fœtus, and by a succession of forcible pushes, moves it away from the inlet—in fact propels it; though this retropropulsion should not be made directly forward, but *obliquely,* so as to press the region we desire to get rid of upward, downward, or to either side, according to circumstances. In this way, the opposite parts glide over the uterine walls—previously lubricated: they move round towards the hand, and are more easily reached.

Evolution.—When the parts which are sought for reach the hand, they are firmly seized by the operator and drawn towards him. The uterine contractions assist in this operation, the version movement is continued, the fœtus becomes lengthened, as it were, and unfolded, and when its larger diameter is brought into the axis of the pelvis the manœuvre is completed.

Version is not always successful when first attempted; indeed, it has often to be relinquished and again tried, until successful—notwithstanding the fatigue and demands on patience these repeated efforts entail.

Complete version is required in the transverse position of the fœtus, and is generally difficult; it, and indeed all degrees of turning, and all vicious positions of the fœtus, demand that the first thing to be done is to secure the most useful parts which present, as the limbs or head, by cords or other appliances, so as to be able to find and utilise them again if circumstances require that they should be used to assist in delivery. Very frequently traction on one or more of these cords, and the manipulations of a hand in the uterus, will greatly facilitate turning.

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As in so many other obstetrical operations, undue haste and violence are to be guarded against in these mutations, and gentleness, patience, and perseverance observed. We not unfrequently find that, when the presentation is anterior or posterior, and the limbs are in a favourable direction, though the body of the fœtus may be somewhat inclined to the right or left, the uterine contractions are sufficient to effect adjustment, gradual and well-directed traction being alone required from the operator.

Independently of the *general mutations* which have for their object the movement of the whole mass of the fœtus in the uterus, it is sometimes only required to resort to *partial mutations*—as in the adjustment of one or more of the limbs, head, neck, etc., these consisting of *extension*—as when the arm is extended on the shoulder, the fore-arm on the arm, the head on the neck, the latter on the trunk, etc., and *flexion*, in bending the various articulations—as those of the limbs, in order to place them or the body in a better direction; and *rotation*. In all these manœuvres, a rudimentary knowledge of mechanics will be of great advantage, and particularly that pertaining to levers, which is particularly applicable to manipulations of the limbs, that so frequently prove of the greatest service in obstetrical operations.

It only too often happens that the arm of the obstetrist is found to be sadly too short in version and other manœuvres, and these are consequently rendered more difficult of accomplishment. With regard to this it is well to point out, what is not always known, that the obstetrist should always employ the arm corresponding to the side of the fœtus on which the limb, or part sought for, or to be manipulated, is placed. For instance, if the fœtus is in the anterior presentation and vertebro-sacral position, with the head bent round towards the left flank, or the left fore limb (right hind limb in a posterior presentation) doubled under the body, he will use his right arm; but the left will be employed in the opposite conditions. By doing so, the operator gains in length of arm, particularly towards the shoulder, and can consequently reach deeper into the uterus.

Flexion and extension of a limb are often made simultaneously, and it sometimes happens that in extending such a part as the head to straighten it, it effects its own rotation. Extension alone serves to bring the limbs from under the chest or abdomen; flexion is rarely resorted to, and chiefly when it is desired to return an extended limb again into the uterus. In these operations on the limbs, when the weight of the fœtus is an obstacle, the body of the creature is inclined to the side opposite to that of the limb to be manipulated; thus, if the right limb is flexed under the body, and we desire to extend it, the fœtus is inclined from right to left, so that the right side being raised, the limb can be taken from under it. The body is turned in the way we have indicated for *rotation*.

We have casually alluded to the attitude of the larger animals during version, retropulsion, and rotation, and pointed out the advantage to be derived from elevating the hind quarters, either by placing litter under the hind feet, or causing the animal, if a Cow, to kneel on the knees. And we have also remarked that it is not always possible to obtain the desired attitude, but that these manœuvres must sometimes be performed when the animal is recumbent.

It may even happen that it will be advantageous to cause the animal to lie. Leconte strongly recommends placing the animal on its sternum, and flexing the fore and hind limbs under the body; in this attitude the uterine cavity can be more easily explored, and the necessary alterations made in the

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position of the fœtus : the operator lying extended behind the animal. Some obstetrists place the animal on the right or left side, the operator lying on either of his sides, according to the arm he intends to use.

Throwing down an animal for this purpose is always, however, to be avoided if possible ; and if it is already down, it should either be placed on its sternum or compelled to get up. When the uterus is lying very low in the abdomen, should the latter be extremely pendulous, or when the fœtus—as in the Cow—is fixed beneath the brim of the pelvis, it may be found very advantageous to place the parturient creature on its back.

As for the operator, he must conform his attitude to that of his patient. We have already written on this point when treating of parturition, and we have nothing to add. If the animal is standing and the hind quarters are raised, and particularly if the obstetrist is not tall—and more especially if the patient is a Mare, we may follow the plan adopted with much success by Dickens (*Veterinarian*, vol. xxxiv., p. 260). This consists in placing the animal, if the case is likely to be protracted, under an open shed, tying the head to the manger or rack, and supporting the body by two sacks passed under the belly and attached to ropes which pass over a beam above. A partition on the right side, to prevent swerving, is preferred, the assistant being placed on the left side. Immediately behind the animal is put a strong, four-legged wooden cow-crib, which serves many purposes. Firstly, it prevents the Mare backing ; secondly, the operator standing in it is perfectly safe from injury during his manipulations, while it gives him a great advantage in the elevation it affords—especially with tall animals ; thirdly, it forms a convenient stage whereon to place cords, instruments, medicinal agents, etc.

CHAPTER I.

Dystokia Depending on the Anterior Presentation.

We have, at page 222, explained that there are three principal presentations: *anterior*, *posterior*, and *transverse*—the latter being either *dorso-lumbar* or *sterno-abdominal* ; and that in each of these presentations the fœtus might offer in different positions, many of which would be more or less vicious and complicated, whether as regards the whole mass of the body, or only parts thereof—as the limbs, head and neck, etc. We will now consider these false presentations and positions, in the order indicated at page 359, which is that followed by Saint-Cyr : though it differs a little from that adopted by Franck and other Continental veterinary obstetrists.

We may remark that Rainard, looking at the subject from an obstetrical point of view, considered the head and limbs of the fœtus as appendages which, from their wrong direction, may more or less hinder its expulsion. Thus the head, one or both of the fore limbs, or even the posterior limbs in the anterior position, may cause the most varied complications : one or more of which may be found in the same animal, and even complicating each other. Thus, with a vicious position of the head we may have a wrong direction of the fore, and perhaps also of the hind, limbs. But as the double or triple complications are difficult to describe, and as the practical value of the descriptions might consequently suffer, it is deemed the best course to study each complication separately : the complex cases arising from their combination

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being then easily understood, and the indication for overcoming them being also simplified.

These complications are very often found in the Mare and Cow, less frequently in the Sheep and Goat, and rarely in the Bitch, Sow, or Cat. We have no means of arriving at a knowledge of their relative frequency in any species.*

SECTION I.—DYSTOKIA DUE TO THE FORE LIMBS.

In the anterior presentation, and what we have designated the "normal position," the two fore limbs of the fœtus are extended in front towards the pelvic inlet, the head being also extended and resting either upon or between the legs, the distal extremity of which extends beyond its nose—the whole forming a wedge-shaped mass. Consequently, the fore feet should be the first parts to pass through the genital canal; and if only one appears with the head, or if the latter alone offers, then one or both of the anterior limbs are in a wrong direction, and birth may be hindered if they are not adjusted. The directions they may assume are generally four: 1. *They may be incompletely extended in the pelvis;* 2. *They may be crossed over the neck;* 3. *They may be bent at the knees;* 4. *They may be extended completely under the fœtus.* Each of these misdirections may be met with in the four principal positions of the anterior presentation, and, as has been mentioned, one or both limbs may be involved; if the latter, then the direction may be the same or different.

The cause of misdirection of the limbs is not well ascertained. In many cases it may be due to insufficient dilatation of the os uteri, which hinders their advancing with the head: the joints of the limbs readily flexing when the feet come in contact with the cervix, while the uterine contractions propel the more rigid head and neck into the vagina. The misdirection may also primarily occur during intra-uterine existence, and before parturition sets in, and particularly if the fœtus dies before birth, when its position is not the same as at that period. There can be no doubt, however, that the accident generally happens during parturition.

1. Anterior Limbs incompletely Extended in the Pelvis.

As might be inferred, this misdirection of the limbs differs but little from that which they assume in normal parturition, they being only partially retained, and the head more or less in advance of them. It is usually due to the shoulders not being closely applied to the chest of the fœtus, and the elbows, consequently thrown wide apart, coming in contact with the brim of the pelvis, thus proving an obstacle to the progress of the young creature. It

* Zippelius, quoted by Franck, in 112 cases of dystokia, found them to be due to the several causes in the following proportions:

Abortions	31
Occlusion of the os uteri	30
Torsion of the uterus	10
Lateral inclination of the head and neck of the fœtus	16
Lateral inclination of the head and misdirection of the fore limbs	4
Head and neck under the fore limbs	3
Head bent up on the back	2
Torsion of the uterus with posterior presentation	1
Posterior presentation with misdirection of the hind feet	2
Limb over neck	1
Lumbo-pubic position	3
Posterior and transverse presentation	1
Rhachitism affecting the pelvis of Cow and Calf	1
Hydrops amnii	1
Mummification of the fœtus	2

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appears to occur generally in the vertebro-sacral position, and most frequently in the Cow. It may also be owing to the flexion of the fetlocks, when the feet meet with any trifling obstacle.

Indications.

The indication in such a simple case as this is obvious—straighten the fore limbs, and bring them to their proper height in the pelvis. Very often this cannot be done by mere traction, which, in extending the arms of the fœtus, brings the elbows still further away from the body. In such circumstances retropulsion must be resorted to, the body being pushed a little beyond the pelvic inlet; then traction being employed, the limbs are readily extended to their natural position, and delivery may be accomplished with further assistance.

2. Fore Limbs Crossed Over the Neck.

Saint-Cyr asserts that this complication is not very uncommon in the Mare, less frequent in the Cow; and he, with many other veterinary obstetrists, has

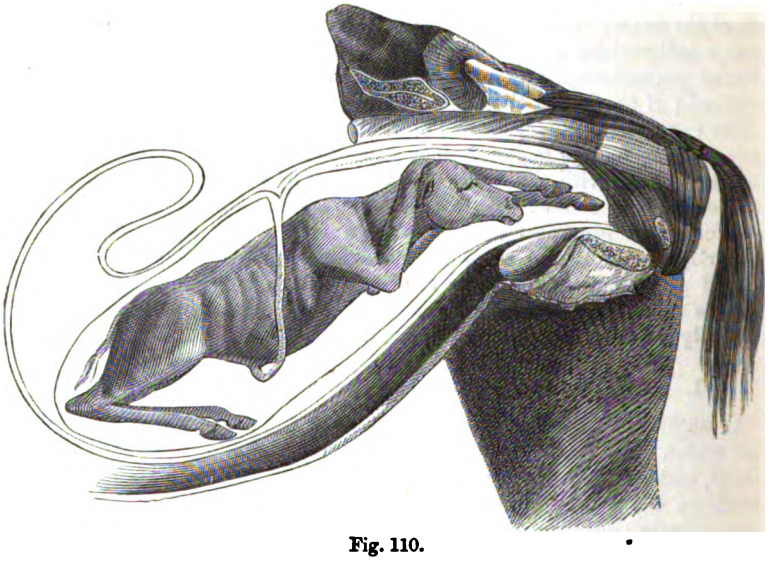

Fig. 110.

Anterior Presentation: Fore Limb Crossed Over the Neck.

witnessed several instances. One or both limbs may be carried over the neck, and the complication is only observed when the fœtus is in the vertebro-sacral position.

It is undoubtedly, in many instances, an obstacle to parturition, as the shoulders are no longer lodged in the hollow space at each side of the neck, but are fixed at the side of the chest, the transverse diameter of which they increase. The obstacle is still greater if one or both of the limbs should chance to cross towards the summit of the head. At all times the complication is more serious if the labour pains are violent and irregular—as they generally are in the Mare when there is any impediment to birth; then there only too frequently results laceration of the roof of the vagina, perforation of the rectum, rupture of the perineum, etc. In the most favourable cases,

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labour is protracted and more severe, and contusions of the genital canal are almost unavoidable. In some cases birth may and does take place without assistance. Rainard alludes to the case of an Ass in which spontaneous delivery occurred, notwithstanding the existence of this complication.

The misdirection is recognised by the limb or limbs appearing to be shorter and higher than usual; if only one limb is displaced, then two limbs will be found on one side of the head, one being much shorter and higher than the other.

Indications.

When only one limb is crossed, reduction is not difficult, and may be effected in the pelvis. The leg is seized a little above the fetlock, raised, drawn to its proper side, and extended in the genital canal. Delivery may then take place without help, or gentle traction on the head and limbs may be necessary.

When both fore-limbs are crossed, and the fœtus is not too far advanced in the pelvis, cords should be fixed to the pasterns, and the trunk pushed into the uterus; assistants then pull moderately at the cords, and in such a manner as to bring each limb to its own side, if the hand of the operator cannot effect this in the uterine cavity. In this way a kind of rotation of the limbs is effected, and they are brought each to its proper side, and a little beneath the head.

When the fœtus is firmly fixed in the pelvis, and retropulsion is impossible, the limbs must be amputated, one after the other. Such an operation must, however, be very exceptionally required in this complication.

3. Fore-limbs Flexed at the Knees.

The fore-limbs flexed at the knees, and fixed under the neck and chest, are a very frequent and often troublesome complication. It is generally found in the Mare and Cow; when it occurs in the Sheep and Goat it is rarely of any importance, as delivery can usually take place without assistance; in the young of Carnivora, the metacarpal bones are too short to offer any obstacle when the knee is flexed.

This misdirection of the fore-limbs may occur in all the positions of the anterior presentation, but chiefly in the vertebro-sacral position—the most frequent. One or both limbs may be flexed, and the complication is not unusually accompanied by a misdirection of the head; hence, there are several varieties of the complication, the most important being those due to the general position of the fœtus. We will follow Saint-Cyr in studying it in three positions—the *vertebro-sacral*, *vertebro-pubic*, and *vertebro-ilial*.

1. Vertebro-Sacral Position of the Fœtus.—If, at the moment when the limbs of the fœtus enter the pelvic inlet, they are not quite extended, and the feet are slightly below the level of the anterior border of the pubis, the uterine contractions push them against that bone, and there they remain; at the same time the head enters the inlet, and as it proceeds the limbs become flexed, the knees are bent and advance with the head, but the metacarpals and phalanges are directed backwards beneath the forearms, and the limbs thus doubled are applied against the neck. We have, therefore, the head, fore-arms, and metacarpals in one mass entering or being propelled into the limited space afforded by the inextensible pelvic circle, and, according to circumstances, the hand of the obstetrist will meet with these parts in varying relative positions, depending on the stage of labour. When parturition has only recently commenced, the head has entered, or is about to enter, the

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inlet, and the limbs placed beneath it are still somewhat free in the uterine cavity, while the fœtus itself is not immovably fixed if the waters have not long escaped. But when labour has been progressing for some time, the head is well advanced in the passage—sometimes as far as the vulva; but far behind it are the limbs imbedded on each side of the neck—the knees towards the head, the feet at the elbows.

With the smaller ruminants, as already remarked, birth may take place spontaneously even now, as they often have more than the one fœtus, and this is comparatively small, with regard to the pelvic diameter; while its bones are elastic and yielding. But with such animals as the Cow and Mare the fœtus is nearly always single and voluminous, and its skeleton is rigid and unaccommodating, and can only undergo a very small reduction in size during its passage through the pelvis.

Therefore it is that, in the larger domesticated animals, such a deviation of

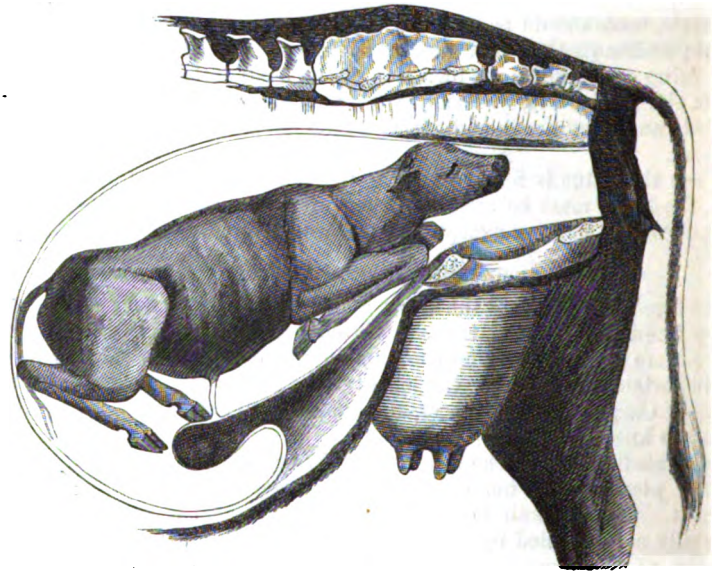

Fig. 111.

ANTERIOR PRESENTATION: FORE-LIMBS BENT AT THE KNEES.

the limbs is always a serious cause of dystokia—not so much, as Saint-Cyr justly observes, from the increased volume that the doubled-up limbs gives to the neck, as because the arms, incompletely extended on the shoulders, retain the latter against the thorax, and prevent their being lodged in the depression at the base of the neck—thus augmenting the vertical and transverse diameter of the chest, while, at the same time, the projecting elbows press against the border of the pelvis.

Indications.

The indications are in this case also obvious: To find the retained limbs, extend the forearm of each on the arm, and to straighten the legs in the pelvic cavity, as they are in normal parturition.

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These indications are not so difficult to carry out when the obstetrist is called in sufficiently early, and the head has made but little advance into the pelvis.

We will suppose both fore legs partially retained in the abdomen, and flexed at the knees. The exploration which has led to this discovery, has perhaps also indicated that one limb is not so much flexed as, or is more accessible than, the other. If this is the left limb, then the left hand and arm must be employed; if it is the right leg, then the right hand and arm will be most convenient; but if both limbs are alike implicated and accessible, then it is immaterial which is first manipulated, so long as the corresponding hand and arm are employed. The same directions are applicable to both, keeping in mind that the right and left hands are opposite. The object is to adjust the direction of the forelimbs, so that delivery can be accomplished. This adjustment is effected in four movements:—1. The hand is passed alongside the neck of the fœtus, the forearm is seized in the middle, the radial border of the hand being upwards, the cubital downwards; then bending the hand, the knee of the fœtus is drawn towards the pelvis, while the elbow is pushed upwards and backwards; 2. The body of the fœtus being thrust

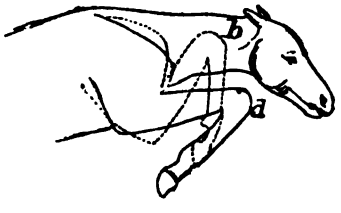

Fig. 112.

ANTERIOR PRESENTATION: EXTENDING THE FORE-LIMB.

away from the pelvis, the metacarpal bone is seized as the forearm was, and moving it in the same manner, the knee is raised as high as, or higher than, the point of the shoulder (Fig. 112, *a* to *b*), and the foot to the level of the maternal pubis; 3. The foot is grasped in the hand, flexed strongly on the fetlock and pastern, and drawn into the genital canal; 4. The limb is then extended towards the pelvic outlet, and if necessary a cord is placed around the pastern, the other limb, if also flexed, being then sought for and treated in a similar manner.

Lecoq, according to Saint-Cyr, has described another method. This consists in passing the arm alongside the head, and, putting the hand in a state of supination, seizing the foot in such a way that the pastern faces the palm and the fetlock the wrist. The operator then pushes the limb away from him, at the same time flexing the fore-arm on the arm as much as possible, until getting the pastern as high as the os, he straightens the leg and brings it towards the pelvic canal. Saint-Cyr has pointed out, however, that this method of straightening the limb *en masse*, and at once, is only possible in quite exceptional cases,—when the fœtus is quite movable, and the extremity of the limb is sufficiently near the pelvis to be easily accessible; and he maintains that the method by progressive extension just described, is that which should be generally adopted. Lecoq's method might be possible with the Cow, but in the Mare it would certainly be most difficult, if not impossible.

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This correction of knee-joint presentation is easy enough when the fœtus has not advanced far into the pelvis; but when it is completely engaged, then the operation is much more difficult. Retropulsion may be necessary, and extension of the limbs is sometimes only possible when the fœtus is clear of the inlet. Thomas (*Journal de Méd. Vétérinaire*, November, 1876), while pointing out that it is possible, and often easy, to extend the limbs in the Cow's pelvis, and that the dimensions of the head of the fœtus allow sufficient space for these manœuvres, insists that the point of traction should be at the lower end of the radius, and not the knee; while Schaack's head-collar should be employed to extract the head at the same time. The cord for the limbs should have a running noose.

After labour has been in progress for some time, the "waters" have long escaped, the head is gradually propelled towards the vulva, the nose may appear between the labia, the uterus, applied closely to the body of the fœtus, contracts powerfully, and futile attempts at retropulsion fatigue the operator. Another procedure must then be adopted. The hand, carrying a pliable cord, must be passed alongside the head as far as one of the bent knees; then the end of the cord is to be passed behind the joint and brought outside the vulva, where it is tied to the other end, the cord forming a loop around the knee. The second knee, if flexed, is to be secured in the same manner, and a cord is also to be fixed on the head; thus there will be three points on which traction can be employed as vigorously as may be necessary. Some practitioners employ blunt hooks instead of cords, but it may be doubted whether they are so useful; hooks are also sometimes resorted to for straightening the limbs by seizing the pasterns, and in some cases they may prove serviceable. The "repeller" or "crutch" may also be most profitably utilised in retropulsion, and in keeping the fœtus forward while the necessary manœuvres are carried out; it should be applied to the head or chest. Harms advises, in the case of one limb bent at the knee, that if this cannot be extended it should be pushed forward under the abdomen by the crutch, which is applied to the humerus, the other limb and the head being corded, and then traction employed. If both limbs are bent and irreducible, this plan might be tried in the Cow, and particularly if the fœtus is not very large.

Should none of these methods succeed, then embryotomy must be adopted, the limbs either being removed at the knee, or the shoulder if possible; though the advantages of this operation are not so great as might be anticipated when the limbs are only removed at the knees, while removal at the shoulder is frequently a most tedious and fatiguing task when it is possible.

2. Vertebro-Pubic Position of the Fœtus.—It is rare that this complication is found in the vertebro-pubic position, and only a few instances are recorded. The fœtus is lying on its back, and the head either presents at the inlet, or is more or less advanced in the pelvis, with the fore-limbs occupying the sacro-lumbar region of the mother, more or less flexed, and often crossed on the sternum.

In this position the fœtus is much less likely to become so firmly wedged in the pelvis as in the one just described, and it is consequently more easily extracted. If, however, the uterine contractions are violent, or care is not observed in attempting delivery, the fore-feet, projecting as they do towards the utero-vaginal parietes and the rectum, may cause grave mischief. Extraction should therefore be set about early, and with every precaution.

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Indications.

Having ascertained the position, it is generally a good plan to empty the rectum before proceeding to extract the fœtus. If the head is in the genital canal, it may be advisable to secure it by a head-collar; then the limbs can be sought for and adjusted, an operation much facilitated by a hand in the rectum. Delivery may now be accomplished by guiding the legs forward into the pelvis—cording them and exercising traction if necessary. It is sometimes very useful, in more difficult cases, to throw the animal on its back. Version is rarely required.

3. Right or Left Vertebro-Ilial Position of the Fœtus.—According to Saint-Cyr, this complication of the limbs in this position appears to be rare. It does not offer anything particular, except that the undermost limb is difficult to reach and adjust by the hand of the operator. It is therefore recommended, after straightening and cording the uppermost limb, to attempt rotation of the fœtus, in order to bring it into a more favourable position—the vertebro-sacral, if possible—before proceeding to the adjustment of the other leg, which is to be effected in the manner already indicated.

4. Fore-limbs Completely Retained.

The complete retention of one or both fore-limbs of the fœtus in the

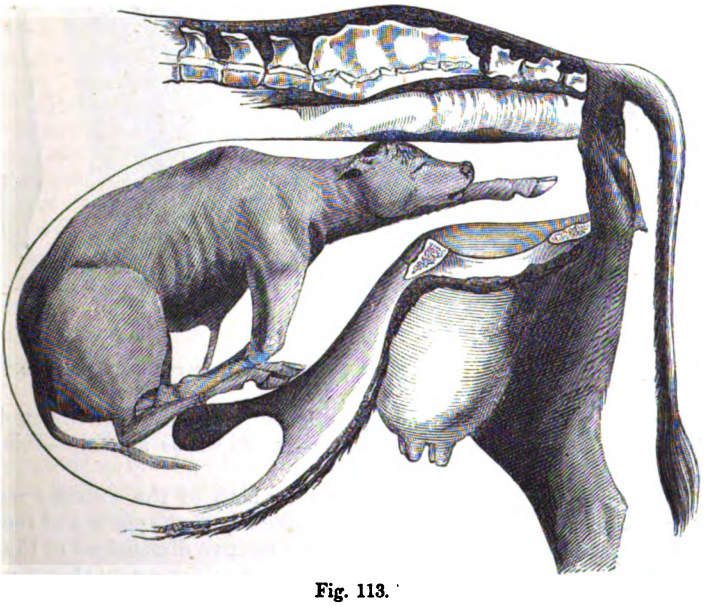

Fig. 113.

Anterior Presentation: One Fore-limb Completely Retained.

uterine cavity is often met with in the domesticated animals, but perhaps more frequently in the Mare than the Cow or other creature. It is always a serious cause of dystokia in the Mare and Cow, and may occur in either of the four anterior positions, though it is usually observed in the vertebro-sacral

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position. It is, no doubt, produced during birth, and in the same manner as knee flexion; its more frequent occurrence with the foal than the calf, is in all probability due to the former having longer limbs than the latter. Under exceptionally favourable circumstances, as Franck remarks, the foal or calf may be born with the fore-limbs under the chest and abdomen, and without injury to the mother or offspring. This is much more likely to occur when the fœtus is small, the maternal pelvis roomy, and only one limb misplaced.

But when the fœtus is large and the pelvis narrow, then birth, especially of the foal, is not possible. Not only this, but unless extraction is soon accomplished the fœtus runs great risk of dying from asphyxia: indeed, the foal is nearly always delivered dead in this complication; so that death of the fœtus may be said to be the rule in shoulder presentations. With the

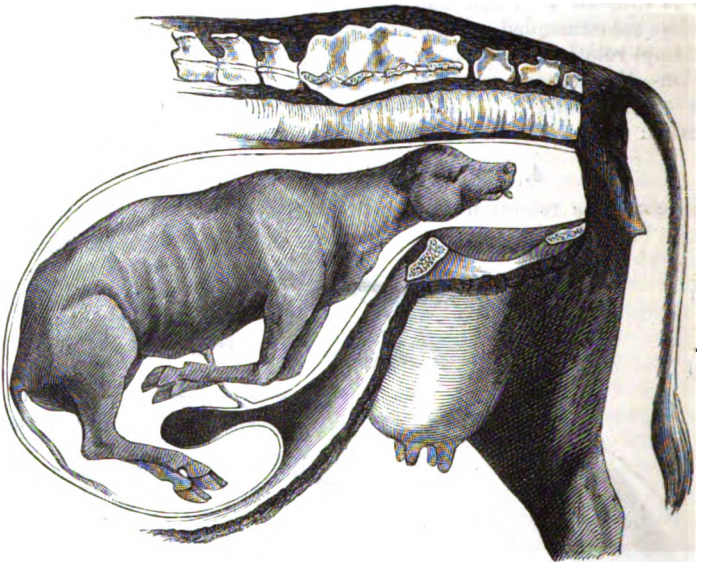

Fig. 114.

ANTERIOR PRESENTATION: BOTH FORE-LIMBS COMPLETELY RETAINED.

smaller ruminants, owing to the formation of the pelvis, birth is not often impeded. With the Sow and Carnivora—multiparous animals—this might be designated a normal presentation.

It will readily be perceived how one or both of the anterior members bent back under the body, will prove an obstacle to the passage of the fœtus, after what has been said with regard to the relative dimensions of the young creature and the pelvis of the mother. The shoulder or shoulders, and the muscles in this region, are the cause of dystokia—more especially the *biceps brachii*, which constitutes a thick and somewhat tendinous elastic mass between the scapula and upper end of the fore-arm. This muscular mass forms a very prominent obstacle on the side of the chest when the limb is thrown back. There is also the large *levator humeri* muscle adding to the increased volume of the thoracic region, as well as the elbow and forearm.

On exploration in this complication, the head is found to be in a good

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direction, the hand encountering it either in the pelvis or towards the inlet, or it may even protrude into the vulva, according to circumstances. The fœtus, if a calf, may be yet alive; if a foal, it is nearly always dead. If only one limb is completely retained, the other will be in a normal position—alongside or under the head (Fig. 113). If both limbs are retained, though the head may appear in the genital canal or at the vulva, yet nothing can be discovered of the legs in the pelvis, they being entirely lodged in the maternal abdomen. At each pain the head of the fœtus is propelled outwards, but as soon as this ceases it recedes again, as if thrown back by a spring.

With small-sized Cows, the hand introduced deeply into the uterus may find the extremity of the fore-limb; but in large Cows, and in the Mare, particularly if the abdomen is pendulous, this is rarely, if ever, the case; indeed, sometimes the limbs can only be reached with the greatest difficulty, though there is generally no trouble in introducing the arm. When the limbs can be felt, they are usually found to be in one of three positions: directed nearly vertically downwards, the forearms resting against the brim of the pubis; lying beneath the abdomen (Fig. 114); or closely applied against the walls of the chest and the flanks. In many of these cases, we have also the head in a vicious position.

In the larger animals, when the two limbs are retained, birth is nearly always impossible; it may certainly be sometimes effected by violent means, but then these are the resort of brute force, and not of humane and intelligent device, and nearly always entail the death of the mother. With the smaller animals, when this complication is a cause of dystokia, delivery can generally be effected by simple measures and *gentle force.*

Indications.

The indications are to reach the limb or limbs with the hand—resorting to retropulsion if necessary—to gradually raise and bring them forward, joint by joint, into the pelvis, and then to extract the fœtus by judicious traction. These indications are not attended with difficulty in those cases in which the head is yet in the abdomen, or only at the pelvic inlet, and are easier carried out in the Cow than the Mare. Then if the *right limb* is sought for, the *left hand* is introduced as far as possible into the uterus, if the *left limb* the *right hand;* it is passed between the organ and the body of the fœtus as far as the shoulder; then the forearm is seized, the thumb being in front and the other fingers behind—the index towards the scapulo-humeral articulation, the little finger directed to the bend of the knee. The forearm is now used as a lever of the first kind, and its upper extremity thrown backward, its lower end forward, so as to move the fœtus more into the uterus, and obtain space to bring the limb towards the pelvis, at the same time carrying the knee upwards in the direction of the inlet. The hand then glides down to the metacarpal bone, which is grasped in the same manner as the radius was—the thumb forwards, other fingers backwards; the knee is pushed away from the inlet; the fetlock, pastern, and foot are then successively raised, strongly flexed in doing this, and then extended when above the rim of the pubis, and brought into the genital canal. If the knee cannot be brought forward or flexed by the hand, the lower end of the forearm should be corded (running noose), or the blunt hook may be used. When the end of the limb is brought into the pelvis it may be corded, and gentle traction exercised by an assistant, while the operator adjusts the leg, more particularly towards the elbow.

Another method is to seize the foot, the pastern being in the palm of the

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hand, and to press on the front of the fetlock, so as to push back this part and extend the joint, at the same time flexing the forearm on the arm. On raising the foot as high as the os uteri, the hand is passed higher up the limb, which is then drawn into the pelvis, and a cord attached. The "crutch" or "repeller" may be most usefully employed in these manœuvres, to keep the fœtus forward in the uterus. When the limbs of the fœtus cannot be reached by the hand, it is advisable to raise the front part of the mother by litter, placing the fore-feet on a box, or even in the manger.

In other cases the fore-limbs can be felt, but cannot be sufficiently seized to manipulate them. The forearm should be corded, and traction employed, while retropulsion is resorted to by the crutch, and also by the hand applied to the shoulder-joint. When the knee is brought up to the inlet, the other part of the operation can be easily executed in the manner already indicated.

One limb being secured in the os, if the second is retained it must be brought into this canal in the same way.

It sometimes happens, however, and especially with the Mare, and with Heifers which have been rudely manipulated before the arrival of the veterinary surgeon, that the fœtus is so engaged in the genital canal, that retropulsion is impossible. In such circumstances some authorities have recommended forced extraction, traction being exerted on the head of the fœtus either by assistants or mechanical means; others have advised decapitation—skinning the head and removing it at the first or second vertebra, taking care that the ends of the bones are covered by the skin of the skull, to prevent laceration; then retropulsion is possible, and extraction may be effected.

With regard to forced extraction, there can be no doubt that if both fore-limbs are retained, it endangers the life of the fœtus, if it is still alive, and also that of the mother; though it may be successfully practised with the Sheep, Goat, and other small animals. When only one limb is retained in the Mare or Cow, forced extraction may, nevertheless, succeed; and Rueff, Harms, Darreau, and other practitioners have proved that it is possible, traction being employed on the head and normally-presented leg. Amputation of the head will not always prove advantageous in retropulsion; indeed, it will often be found that it is a disadvantage.

The most rational and hopeful operation, is detaching the shoulder from the trunk; or the *biceps brachialis* muscle may be cut through by the curved finger-knife (to be hereafter described) in its thickest part at the shoulder-joint, or above the elbow-joint. Then extraction may be again attempted. If the fœtus does not come away, then eventration of the chest and abdomen may be practised. Should delivery be still impossible (which is unlikely), the limb should be detached at the shoulder, and the trunk withdrawn from the uterus, the leg being extracted afterwards.

When one limb protrudes with the head, this may be removed subcutaneously at the shoulder, as it is easier accomplished than amputation of the retained limb.

SECTION II.—DYSTOKIA DUE TO THE HEAD.

Obstacles to parturition from a wrong direction of the head are quite as frequent as, and more serious than, those due to misdirection of the fore-limbs. It is stated that they occur oftener in the Mare than the Cow, but this is questionable; though in the former animal they are more embarrassing, as in consequence of the longer neck of the fœtus the head can

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be carried back much farther—even as far as the flank—while with the calf it seldom goes much beyond the shoulder.* The complication is all the more serious in the Mare from the fact, as has so often been stated, that obstetrical manœuvres in this animal are much more difficult than in the Cow: the straining being far more violent, paralysing arms and hands, while the impatience and restlessness are generally so great, that it is often necessary to throw it down before anything can be done in the way of adjustment.

Misdirection of the head usually takes place immediately preceding or during parturition, under the influence of irregular and energetic uterine contractions before the os is sufficiently dilated; it is supposed sometimes to be due to premature escape of the "waters," to injudicious manipulation of the fore-limbs, maltraction, etc. Some of the cases, however, have doubtless occurred long before the period of parturition, and are of the nature of deformity of the neck or head, or both; we have alluded to them when treating of "Contractions," at page 382.

It will readily be understood why misdirection of the head should prove a serious obstacle to delivery, when we remember the part the nose and cranium play in dilating the os and genital canal, and how largely this voluminous region must add to the bulk of the neck, and render expulsion impossible.

Deviations of the head may be met with in the four principal positions of the anterior presentation; and they may occur alone, or be complicated with misdirection of the fore-limbs. We will not again refer to these latter, as we have been sufficiently explicit with regard to them, but will now study the head in three different deviations from the normal direction, as given by Saint-Cyr. These malpositions are: 1. *Downward deviation*, the nose being towards the chest, and the "poll" or upper ridge of the neck presenting; 2. *Lateral deviation* to the right or left side, the head being carried towards the shoulder or flank of that side, the side of the neck presenting; 3. *Upward deviation*, the head being bent up and backwards in the direction of the withers, or twisted to the right or left side of the chest, with the throat, either straight or twisted, presenting.

Downward Deviation.

This is usually the deviation of the head met with in hydrocephalus, though

* Since allusion was made to dystokia from excess in volume of the head of the fœtus (p. 360), Collin, of Wassy, has published an instructive paper on the subject (*Journal de Méd. Vétérinaire et de Zootechnie*, Nov. 1876, p. 529), which deserves notice here. Observing that in very bony Cows the size of the calf's head is often an obstacle to parturition, especially in primiparæ and in the *Jurassique* breed of cattle, while it is rare in improved breeds, in which the head is small, he describes the nature of the obstacle, and remarks that, if traction is ventured upon to extract the fœtus, it must be very violent, and therefore likely to produce serious, if not irreparable, injury. To avert this, he insists on putting Schaack's head-collar on the fœtus, or a cord placed behind the ears, then each side looped round the lower jaw, to answer the same purpose. The head being thus secured, the protruding limbs are pushed forward into the uterus, after a cord has been fixed to each pastern. If the genital passage is dry, oil is plentifully injected into it. Traction being then exerted on the head, this readily clears the inlet of the maternal pelvis, its dimensions being no longer increased by the addition of the limbs; it is drawn well into the pelvic cavity, and then the fore-limbs are easily brought through the inlet, now only occupied by the neck of the fœtus. The head and feet are afterwards simultaneously drawn towards the vulva, and it is rare, if the traction is judicious, that delivery is not promptly effected.

Through having neglected the precaution of first pushing the fore-limbs into the uterus, Collin, at the commencement of his career, in 1853, lost two Cows. Since that time, in more than two hundred cases, he has been successful in delivering the calf, without resorting to embryotomy. Success is always certain, provided incompetent persons have not previously rendered it impossible. He recommends the same procedure in spasm of the cervix uteri, after reduction of torsion of the uterus, and in fœtal hydrocephalus. In the latter, puncture of the cranium is easier if the fore-limbs have been previously pushed into the uterus.

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it is not very uncommon when the cranium is normal and the fœtus well-formed. The deviation may exist from mere flexion of the head at the atlas —the nose lying immediately in front of the pubic border—to extreme flexion of the whole of the neck, the head being pushed beneath the chest, or even the abdomen. It is only met with in the vertebro-sacral position of the fœtus, and more often perhaps in the Cow than the Mare.

The cause is usually ascribed to premature rupture of the fœtal membranes, and the deviation occurs when the fœtus is entering the pelvis. If the head is not exactly in the axis of the inlet, but inclines a little downwards, and is at the same slightly flexed, the nose comes in contact with the brim of the pubis, and is retained there; while the uterine contractions, pushing on the body, propel the fore-limbs, if they are in a favourable direction, into the genital canal. Thus it will be understood that, if the expulsive efforts continue, the head becomes more and more flexed as the fœtal mass is carried towards the vulva (as is delineated in the shaded and unshaded fœtuses in Fig. 115), until, from vertical and oblique, the face becomes horizontal, and

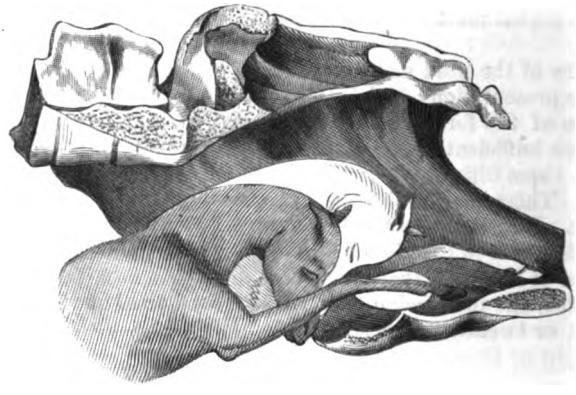

Fig. 115.

ANTERIOR PRESENTATION: DOWNWARD DEVIATION OF THE HEAD.

rests on the floor of the pelvis of the mother, the lower jaw against the throat; the neck becomes proportionately flexed, and as labour goes on the head is retained, as well as the cervical portion of the former; so that when the obstetrist introduces his hand into the genital canal, the feet are found presenting towards the vulva, but far in front of them (or *behind* them, as the explorer stands); this may be designated a *neck* or *poll presentation* (*unshaded* fœtus in Fig. 115).

If, however, the forehead or occipital region comes in contact with the brim of the pubis, the uterine contractions cause it to descend below the level of that bone; while the shoulders and crest of the neck are impelled towards the inlet, and may enter it, according to circumstances. In this case the head lies towards the abdomen of the fœtus, the neck bending downwards, and the mane (if a foal) alone meeting the hand; while the fore-feet may protrude in the vagina, or even beyond the vulva (Fig. 116).

The *diagnosis* of this deviation is not difficult. When the anterior limbs are in a proper direction, the feet and upper part of them are readily found,

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and their inclination should be noted; but in a slight complication the whole of the head cannot be discovered—only the ears, eyes, nape of the neck, and the forelock and mane if a foal. When the deviation is greater or extreme, in the foal only the neck can be felt, and the direction of this is ascertained by noting its anatomical features and their situation. With the calf, which has a shorter neck, it may be possible to reach the head or nose. The upper ridge of the neck is always a safe guide to follow in discovering the direction of the head.

Indications.

There is no difficulty in adjusting the head, if the obstetrist is called in time, and it is movable towards the pelvic inlet, but not engaged in that

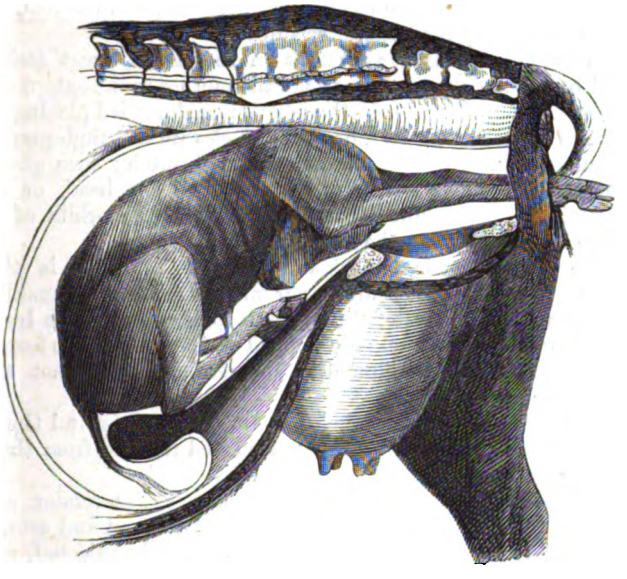

Fig. 116.

ANTERIOR PRESENTATION: EXTREME DOWNWARD DEVIATION OF THE HEAD.

opening. It is merely necessary to glide the hand along the floor of the vagina into the uterus, pass it between the maternal pubis and the forehead of the fœtus, downwards to the nose, which is to be received into the hollowed palm and raised above the pubic brim, by flexing the wrist and drawing it towards the vulva. When the nose is brought into the genital canal, nothing more is to be done than to pull the head into the passage and complete delivery in the usual way. With the calf, whose muffle is wider and cannot be so readily received into the palm of the hand, it is better to introduce the fingers into its mouth, using them like a blunt hook, or to seize the nose by pushing the index finger and thumb into the nostrils, so as to throw the lower part of the head upwards.

When, however, through delay or unskilful attempts at delivery, the nape of the neck is firmly engaged in the inlet, there is no room to adjust the head, the lower part of which is jammed against the maternal pubis below,

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and the vertex against the sacrum above. In such a case delivery has been effected by passing the running noose of a cord round the nose or the upper jaw of the fœtus, and while an assistant pulled at this, the operator, by pressing strongly against the top of the head, made this swing backwards, the nose rising into the passage; birth was then accomplished in a few minutes.

And even with this degree of head deviation, delivery of the foal without adjustment is not impossible; for Lecoq, quoted by Saint-Cyr, gives an instance in which the upper part of the head and poll were so firmly fixed in the pelvis, that it was impossible to push the fœtus into the uterus. This was attempted, however, by squeezing the head closer to the neck, the hand being passed alongside the cheek and the nose gradually raised; at the same moment the Mare strained doubly hard, and gentle traction being applied, the foal was expelled with its head in this position, but without injuring the perineum of the mother. The latter soon recovered, but the foal, as is usual in such cases in the equine species, was dead.

In this degree of deviation, as well as in the others, great assistance will be afforded by raising the hinder parts of the mother to the extent of one, two, or more feet. Lecoq, Rueff, and others have recommended placing the animal on its back. It is perhaps better, however, to elevate the hind-quarters, and to resort to retropulsion either by the hand or the crutch; then after injecting warm water or oleaginous fluids, to either extend the head, or to attempt forced extraction. The blunt hooks fixed firmly in the orbits of the fœtus, will be found most useful in the latter operation.

When the upper part of the neck alone presents, reduction is still possible, provided no great delay has occurred, nor mismanagement by unskilful people allowed. But when the "waters" have been long expelled, the legs pulled at by amateurs, and the uterus closely applied to the body of the fœtus, the case is most difficult; as then manipulation and retropulsion cannot effect much in many instances.

The doubled neck is too voluminous to enter the pelvis, and the longer the pains continue, so the farther is the head pushed forward from the inlet, and therefore away from the reach of the obstetrist.

The contractions of the closely applied uterus also render attempts at delivery almost impossible, by their paralysing the hand and arm.

Large quantities of warm lubricating fluids must be injected, retropulsion attempted by one or two crutches applied to the shoulders of the fœtus—not to the neck; while the hand manipulates, aided, if need be, by the finger-hook (Fig. 120). A blunt hook (Fig. 121) inserted on each side of the lower jaw —when this can be reached, towards the root of the ear, or into the orbits; a cord round the neck—if it can be passed; and other devices may be tried. If they all fail, then the animal should be thrown on its back; indeed, the success which has attended this change of attitude in so many recorded instances, would incline the obstetrist to adopt it without much delay. Very often the altered position of the mother at once disengages the head of the fœtus from its deviation; if this does not happen, then the other means may be tried as in the standing position. Pelvic version may be resorted to in some cases, the anterior presentation being converted into a posterior one.

When reduction cannot be effected, and delivery of the entire fœtus cannot be accomplished, then the obstetrist has no other course left open to him but the adoption of embryotomy. The head may be amputated through the presenting part of the neck, or the fore-limbs removed subcutaneously at the shoulders—the latter is to be preferred in the majority of cases, at least before incision of

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the neck is begun. This gives more room for manipulating the body, and effecting extraction.

In all these amputations and incisions, care must be observed in preventing the maternal organs being injured either by instruments or exposed bones; and when traction on the limbs, or what remains of them, is resorted to, it should be applied to both alike—not to one, as this would be worse than useless.

Lateral Deviation to the Right or Left.

The lateral deviation of the head to the right or left side of the body, whereby the left or right side of the neck presents at the pelvic inlet, is a very serious obstacle to birth, and is only too frequently one of the most difficult to be overcome. It is also one of the most frequent deviations, Saake observing it in 39⅓ per cent. of his cases of dystokia; and it occurs far more often in the Mare than the Cow or other animals. With regard to its origin, as well as to its adjustment, a wide distinction must be drawn between it as it exists in the foal and other young creatures.

The cause of lateral deviation of the head is not well ascertained in all cases. It is not improbable that, in very many instances, it is due to precipitate or tumultuous birth, when the os is either imperfectly or not at all dilated. In such circumstances, the uterine contractions propel the head of the fœtus, otherwise in a good direction, towards the pelvis; but as the os is not open, and as the impelling force continues, the body of the fœtus pushes the nose against either the pelvis or the occluded os; this subsequently yields to one side, and then the deviation becomes increased with every contraction. Premature rupture of the fœtal membranes and escape of the "waters," spasm of the cervix uteri, torsion of the uterus, and other anomalous conditions, may all more or less occasion it. As with the downward deviation, if the nose is not in the axis of the pelvis, or indeed of the os, even though the latter may be partially dilated, misdirection may occur, and all the more rapidly should the fore-limbs chance to pass into the vagina.

The accident appears to be most frequent with primiparæ. In 108 cases of lateral deviation of the head, Saake found 84—or 78 per cent.—in animals pregnant for the first time. The remainder were noted in animals which had previously brought forth, but in which labour was protracted through imperfect or tardy dilatation of the os.

This deviation is more serious when the fœtus is dead than when it is alive; and when the deviation is only slight, the head fitting into the concavity on the side of the neck, birth may even—though indeed rarely—occur without assistance, particularly with the foal, which has a longer and thinner head than the calf. Some authorities have remarked that the deviation is more frequently to the right than the left side, and others the contrary.

In some instances there can scarcely be any doubt that the deviation has taken place some time before gestation is completed, and is the result of a long-continued malposition of the fœtus. In many foals, at birth, the neck cannot be straightened, and the head is distorted from being pressed against the neck or side of the body (Fig. 84), bones, muscles, and ligaments being involved. We have referred to these in describing "Contractions" of the fœtus as a cause of dystokia.

It is not difficult, as a rule, to distinguish the existence of lateral deviation. Usually both fore-feet are in the genital canal, but birth does not progress. But an important fact to remember is that one limb—that belonging to the

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side to which the head is bent—is shorter, or rather less advanced, than the other. The hand, on being passed beyond these towards the inlet, comes in contact with a rounded mass, more or less occupying the whole of it, and rendering access to the uterine cavity difficult. Patient exploration, however, discovers this to be the bent neck; and if it be a calf, owing to the short neck, the head is soon found, and recognised by the ears, eyes, and often the muffle turned towards the shoulder (Fig. 117); with this bovine fœtus, in fact, the greater part of the head in the majority of cases lies against the shoulder.

With the foal, it is only too often otherwise. The much longer neck of this creature, and the more violent uterine contractions of the Mare, generally results in the head being pushed towards the side of the thorax, the abdomen, or even the flank, where it cannot be reached. This difficulty is greatly increased if the abdomen of the mother is very pendulous Occasionally this

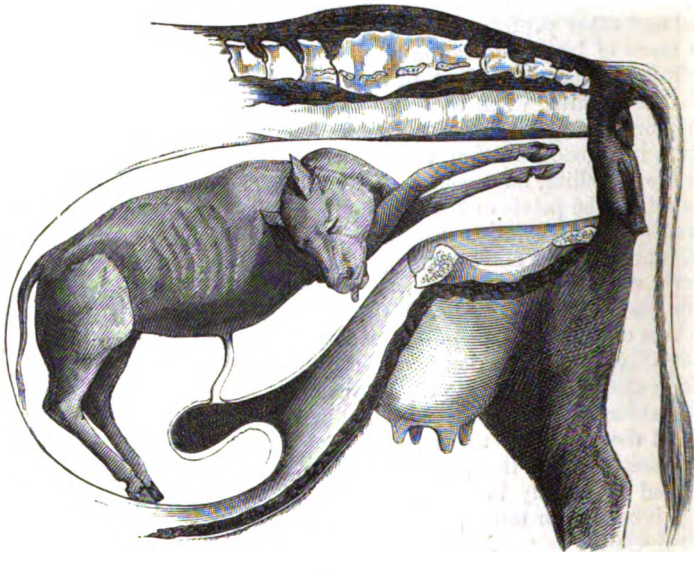

Fig. 117.

ANTERIOR PRESENTATION: LATERAL DEVIATION OF THE HEAD TOWARDS THE SHOULDER.

is also the case with the Cow, though it is rare that in this animal the ears, or even the eyes, cannot be reached by a fairly long arm (Fig. 118). If the animal, be it Mare or Cow, chances to be lying, and the deviation is only to the shoulder, it is most difficult to reach the nose of the fœtus if it is inclined to the side on which the parent lies—*i.e.*, if the Mare is on the left side and the deviation of the foal's head is to the right.

The head may be raised as high as the back, or as low as the under part of the chest or abdomen. The fœtus is usually in the first (or vertebro-sacral) position, though the deviation may also occur in the second (vertebro-pubic) or third (vertebro-ilial) positions; in the latter position the neck may be bent *upwards*, the head towards the maternal sacrum, or *downwards*, the head resting on the floor of the uterus.

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This complication is not only a very frequent, but, as has been said, a very serious one for the obstetrist, and it may be truthfully asserted that birth is not possible without his assistance; indeed, it has been well remarked that "it taxes all his strength, patience, and ingenuity."

With the calf, the neck of which is comparatively short, the head is in most cases no farther back than the shoulder, though it may be as high as the withers or as low as the sternum. It is, therefore, possible to reach it; and though its relatively large size is a great obstacle to reduction, yet in the majority of instances this adjustment can be accomplished, and especially if the young creature is alive, as its spontaneous movements aid the operation; for this and other reasons already alluded to, the calf is more frequently extracted alive than the foal.

As a rule, reduction of the displacement is indispensable in delivery, the

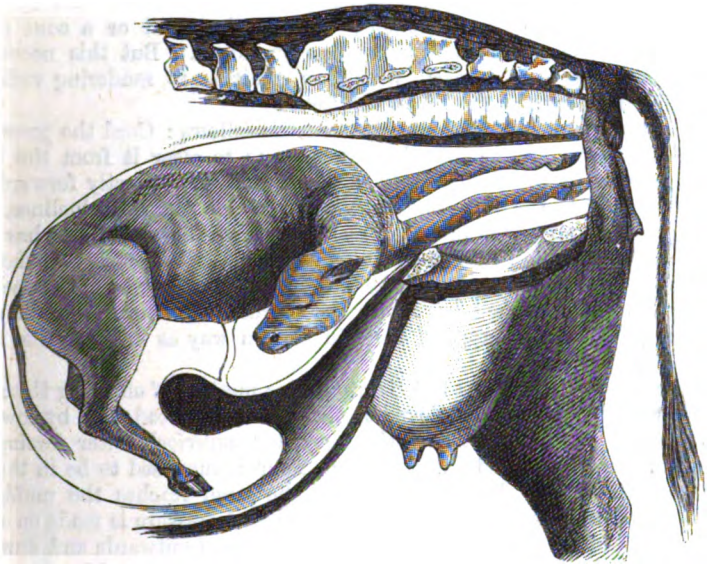

Fig. 118.

ANTERIOR PRESENTATION: LATERAL DEVIATION OF THE HEAD TOWARDS THE ABDOMEN.

head and neck, or shoulder, forming too voluminous a mass to pass through the pelvic canal.

With the foal the head may also not go beyond the region of the shoulder, and the case is then generally not so serious as with the calf, the head being smaller and the displacement more easily reduced. But, as has been pointed out, owing to the long and flexible neck of this creature, the head is most frequently deeper in the uterine cavity: towards the side of the chest, abdomen, flank, or even the croup. Here the hand cannot reach it, and reduction is nearly always impossible; besides, the fœtus succumbs soon after the commencement of the labour-pains: death being due in many, if not in all, cases to premature separation of the maternal and fœtal placentæ. However, owing to the thinner and more flexible neck, and the smaller head, when the latter was lodged in the flank the fœtus has been delivered by

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energetic traction. Mention is made that both in the Mare and Cow delivery has been effected, though the head has been bent back on the neck, side, or flank, without having recourse to embryotomy, and in a great measure by the expulsive efforts of the mother.

Indications.

The principal indication in this deviation is, of course, to get hold of the head, adjust it, bring it into a favourable position in the genital canal, and then terminate delivery. But this indication cannot always be carried out, especially when the head is beyond reach; neither is it always necessary that it should be followed implicitly, so far as the foal is concerned, though in the case of the calf it is an almost absolute requirement. For the latter there are only two courses open—adjustment or embryotomy.

With regard to adjustment, it is generally recommended that the lower part of the head should be secured, either by the hand or a cord passed round the lower jaw, and strong traction employed. But this necessarily produces twisting of the neck, which, in addition to rendering reduction very difficult, endangers the life of the fœtus.

The better plan, therefore, appears to be as follows: Cord the presenting fore-feet; push the fœtus into the uterus, so as to clear it from the inlet; pushing either on the flexed neck or chest, and not directly forward, but rather obliquely to the side opposite that to which the head inclines, so as to bring this round to the inlet. This retropulsion, Mandel asserts, has often alone brought the head into the natural position. If it does not, then the operation must be continued. If the fore-limbs are in the way of the operator, they may also be pushed back into the uterus. The head is then to be sought for, and version applied to it in such a way as to bring its under surface uppermost.

Schaack has communicated to Saint-Cyr his method of effecting this: The extremity of the jaws is employed to straighten the head, not by lowering the chin and drawing it below the neck, but *superiorly*, after forcing the chin and lower jaw up and outwards—the fœtus is supposed to be in the first position. In order to do this, as soon as the hand reaches the muffle the fingers are passed into the submaxillary space, and pressure is made on one of the branches of the lower jaw, so as to *twist the head* outwards and upwards. When this is done, it is an easy matter to put it in a good position by pulling at the nose, as traction then acts exactly in the direction of the atloido-occipital and other joints of the vertebræ; whereas, if practised before this manœuvre, traction tends to twist the neck, and renders reduction much more difficult.

The head being twisted in this way, it has now to be extended and brought into the inlet. To effect this, Bordonnat gives these directions: Place the palm of the hand beneath the chin, seize each side of the lower jaw by the fingers, the thumb being in the mouth behind the incisors. This ensures a solid grip, and the head is brought into a good position by direct traction towards the axis of the pelvis, this traction being applied in jerks rather than continuously. The hand must not relax its hold of the head, when at the inlet, until it has been corded, as it readily slips back again.

If the hand cannot accomplish this, a cord should be placed around the lower jaw, behind the incisor teeth. This, however, is not always easy, as only too frequently the fingers are paralysed by the uterine contractions.

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The *porte-cord* (Figs. 119, 120) may be usefully employed in this direction, and the jaw secured. But sometimes, and generally with the foal (which has no incisor teeth), the cord slips off when traction is applied; it must then be given up, and other means tried. When, however, it does remain attached to the jaw, an assistant judiciously pulling at it will greatly aid the

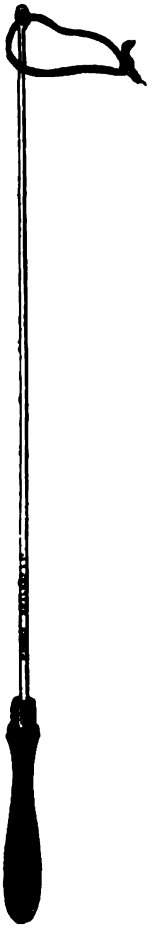

Fig. 119.

STRAIGHT PORTE-CORD.

Fig. 120.

BENT PORTE-CORD.

Fig. 121.

FINGER-CROTCHET.

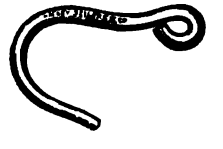

Fig. 122.

SHORT BLUNT CROTCHET.

operator, whose hand is manipulating the accessible parts of the head. In this manipulation, even when the cord will not remain on the neck of the jaw, much benefit will be derived by using the finger-hook (Fig. 121), which can be inserted into the ear, orbit, or angle of the mouth or jaw.

In default of the cord round the jaw, recourse may be had to the short blunt crotchet (Fig. 122)—some obstetrists prefer the long blunt crotchet (Fig. 123)

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—which can be fixed in the angle of the jaw behind the chin, in the cheek, orbit, or ear, or on the under-side of the head—in fact, wherever the operator may deem most effective—the assistant pulling at the cord attached to it, according to the directions of the obstetrist, who guards the hook with his hand, or assists in straightening the head by judicious manœuvres. The ear, or other convenient part, may also be secured by the serrated forceps (Fig. 124), and traction exercised by the cord passing through its eyelets.

In all these attempts it is absolutely necessary that the fœtus be kept as

Fig. 123.

LONG BLUNT CROTCHET.

far as possible from the inlet. It has been recommended in those cases in which the head, lying towards the flank, cannot be reached, that the forepart of the mother be raised; that the abdomen be elevated by a plank, sheet, or sack; that the flank be pressed upon externally by an intelligent assistant; that the animal be placed on its back; that sharp hooks be implanted in the neck, occiput, or other part of the fœtus, etc. Schaack, who has had a large experience in such cases, and appears to have made this subject a special study, points out that all these devices gain the proposed end with difficulty, and have one capital defect—they do not act on the proper part. With regard to traction, he says that it is neither on the ears, occiput, nor even the head, that this should be applied in such cases, but on the point where the neck is

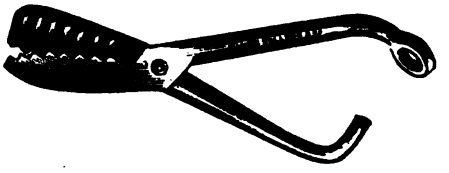

Fig. 124.

NELSON'S SERRATED FORCEPS.

bent. It is necessary, therefore, to introduce the hand into this part, and, by repeated tugs or jerks, to widen the bend; this done to some extent, the hand is moved to another point nearer the head, retropulsion being at the same time practised. By acting in this manner, he assures Saint-Cyr that he has always succeeded in bringing the head sufficiently near to be able to manipulate it.

Delafoy (*Recueil de Méd. Vétérinaire*, 1832, p. 313) many years ago described his method, which consists in carrying a good firm cord, about twelve feet long, and with a knot at the end to hold it by, by the hand into the uterus. The knot, held at the end of the fingers, is passed between the neck and chest of the fœtus; there it is left while the hand seeks for it at the other side of the neck, where it is seized, drawn through, and carried

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without the vulva, the double of the neck being included in it. The hand is again passed into the uterus, and the cord is pushed as near the head as possible; and there it is held, while an assistant twines the two ends until they form one piece closely fixed on the neck—care being taken that the membranes are not entangled in it, or cotyledons, if it is a Cow. The hand is then placed on the point of the sternum or one of the shoulders of the fœtus, and while this is pushed forward into the uterus, the assistant is told to pull steadily. If this movement is well managed, the head of the fœtus is brought sufficiently near the os to be secured and adjusted. Delafoy states that he has practised this procedure a great number of times, and always with success; and others have been equally fortunate. For instance, Lecoq gives the following testimony of his experience to Saint-Cyr: "During my sojourn at Solre-le-Château, I was called one morning to a Cow which had been in labour since the previous evening, and which had passed the night in futile efforts, notwithstanding the more than probable intervention of the owner and his neighbours. I recognised immediately the position of the head, which was turned towards the flank, and so far round that my fingers could not seize the nose with sufficient firmness to bring it into its normal position. I, however, soon succeeded in doing so by a very simple procedure. I passed from above to below, in the concavity formed by the bend of the neck, a cord, the end of which, passed under the neck, was drawn outwards, and, with the other end, placed in the hands of an assistant. A moderate effort by the latter drew the fœtus backwards, and I was then able, with the greatest ease, to straighten the neck by getting hold of the jaw. Birth took place immediately."

Fig. 125.

BINZ'S PORTE-CORD.

One of the long bent porte-cords, such as is represented by Fig. 120, that of Binz (Fig. 125), or those to be hereafter described, might be most usefully employed not only in carrying the cord or sling round the neck, but also in pulling at this part.

In all these manœuvres, should the "waters" have escaped for some time, and the genital canal and uterus be dry and hot, frequent injections of warm water should be applied to them. In certain cases, when the head is adjusted, or even to aid in its adjustment, Nelson's blunt forceps (Fig. 126) will be found of great service in seizing the nasal septum.

With regard to *embryotomy*, though instances are recorded in which *forced extraction* in the Cow has been successful,* yet it should never be resorted to by the humane practitioner (and we earnestly hope veterinary obstetrists are, above all things, humane). The great length and essentially bony structure of the Cow's pelvis, and the large volume and shape of the calf's head, prove such an obstacle to forced extraction in this lateral deviation,

* Franck (*Op. cit.*, p. 373) gives an instance in which two empirics attempted to deliver a Cow that could not calve. They mistook this deviation for a breech presentation, as they could not find the head, and they thought the fore-feet in the vagina were hind ones. They consequently, other means failing, set about extracting the calf *per force*, and eight men pulled at the cords attached to the feet; the young creature was removed, but it was dead. The Cow was unable to get up for eight days, but eventually recovered.

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that, if persisted in, it will not only cause the death of the young creature in all probability, but also that of the mother, unless the fœtus is unusually small and the pelvis of the Cow very wide. In fact, those who have attempted it testify to its barbarity and fatality.

With the Mare, the case is somewhat different. When the head of the foal is deeply buried towards its flank or croup, reduction is most difficult, and requires long and laborious manipulations, which so irritate the organs and exhaust the strength of the mother, that it not unfrequently dies from their effects.

In most cases, too, the obstetrist is called in when the foal is dead, so that there is no necessity for scruples with regard to it. On the other hand, as we have previously said, the long, thin, and flexible neck, and narrow and tapering head, readily allows the latter to become imbedded in the flank, and thus to offer much less resistance than with the calf; while the wider pelvis of the Mare offers further facilities. Numerous instances are given, in which forcible extraction of the foal with the head so deviated, has been attended with complete success—Darreau had eight out of ten cases—and without much suffering on the part of the Mare. Indeed, so successful and

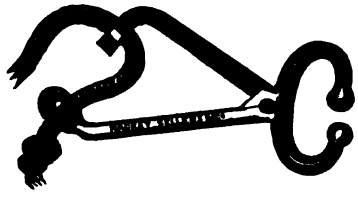

Fig. 126.

NELSON'S BLUNT FORCEPS.

prompt is it, that Donnarieix, who has devoted much attention to this procedure, says it should, as a rule, be adopted in these cases, as it is not possible to restore the head to its normal position; delivery by vigorous traction is, if not easy, at least most frequently followed by success.

Donnarieix operates as follows: The Mare is thrown down near the stable door, the thighs propped against the threshold, and a breeching and sideline, fixed to the wall or held by assistants, may be employed to keep the animal in position. Each fore-limb of the fœtus is corded at the pasterns, the cords being confided to assistants, the number of which will vary according to the amount of resistance—four at least are necessary, and sometimes six or eight. On the word being given, these men pull slowly, steadily and gradually, without jerking, but strongly, and equally on both cords. The foal enters the inlet, but it often happens that, at a given moment, it stops there, owing to the uterus forming a double or ring at this part and opposing progression. Traction must then cease, but the fœtus is to be held firmly in the position to which it has been advanced; the hand is to be introduced between the latter and the uterus—the back of the hand to the fœtus, palm to the mucous membrane—the fold sought for, and dispersed by raising the back of the hand. Then the tractions are to be renewed, and in the course of fifteen, ten, or even fewer minutes, the foal is extracted. It is well to empty the rectum before commencing extraction.

When practised with care and discretion, this forced removal of the foal may

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certainly be commended; but we should prefer, when circumstances will permit, to give a trial to the methods already enumerated; seeing that this procedure is not always successful, and may be followed by untoward consequences. Eberhard, for instance (Gurlt and Hertwig's *Magazin*, 1851, p. 269), gives a case in which forced extraction was attempted in a Mare, and was followed by rupture of the abdominal muscles, through the powerful traction resorted to.

With regard to *embryotomy*, this must be looked upon as preferable to forced extraction—even in the Mare, but particularly in the Cow; nevertheless, it must always be considered as an extreme measure. The operation will be described hereafter, but we may note in this place that the head or the presenting limbs, or even both, may be removed. Decollation is, however, a most difficult business when the head cannot be reached; if it is accessible the operation can scarcely be necessary. The limbs should be removed subcutaneously, the most advanced being first excised, and with the shoulder if possible. Not unfrequently removal of one limb will be sufficient to allow the fœtus to be adjusted—especially in the Mare; or it may permit forced extraction, without adjustment, to be easily accomplished.

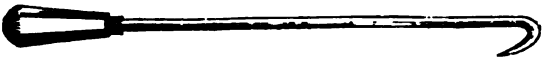

Fig. 127.

Long Sharp Crotchet.

With the calf, both limbs have usually to be removed. In this operation, the long sharp crotchet (Fig. 127) will be of service.

The parturient animal in which this head-deviation of the fœtus occurs, has sometimes a very pendulous abdomen, and manipulation is greatly retarded by this conformation. Placing it on its back will generally give greater facilities for obstetrical operations of this kind.

Lateral deviation of the head is usually encountered when the fœtus is in the first, or vertebro-sacral, position. It may nevertheless be met with, though rarely, in the vertebro-pubic position, or in the right or left vertebro-ilial position, which is still more rare.

These positions, however, do not modify the indications for extraction to any considerable extent, except that in the last, after correcting the deviation of the head, rotation should be practised, and the fœtus placed in the vertebro-sacral position, if possible, before delivery is attempted. When the head is doubled beneath the body of the fœtus in these lateral positions, in order to reach it, it will be found most advantageous to throw the mother down on the side that will ensure the head of the young creature being uppermost. Version may be advisable in some of these positions.

This lateral deviation of the head is liable to be complicated by misdirection of one or both of the fore-limbs, which may be flexed at the knee, entirely retained, or crossed on the sternum. Such a complication of course greatly adds to the gravity of the case, and renders it much more formidable.

Here it will be necessary to adjust the limbs before interfering with the head; though the latter, if it can be reached, and there is any benefit to be

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derived from doing so, should be secured by either a head-collar, or a cord round the neck or jaw. The feet should always be secured by cords, so that if it is requisite to push them into the uterus, they may readily be withdrawn again.

Jones (*Veterinarian*, vol. xxx., p. 20), acting on a suggestion thrown out in the course of a lecture by Professor Varnell, divided the sacro-ischiatic ligament of a Cow whose fœtus was in this position and could not be delivered. The calf was dead, its fore-legs protruding, and the head turned back towards the flank. The ear or orbit could not be reached, but with great difficulty the neck and fore-limbs were corded, and several persons pulled at the cords; however, from "the size and unnatural presentation of the fœtus, coupled with the narrowness of the pelvic outlet," it could not be extracted. A trocar (for lack of a better instrument) was introduced between the ischio-rectal fascia and the sacro-ischiatic ligament to form an opening, into which a probe-pointed bistoury was inserted; with the other hand on the outside, the ligament was quite divided—which was ascertained by feeling the point of the bistoury under the skin. Very little hæmorrhage supervened, and the calf was removed with but little difficulty, from the artificial opening thus made. A diffusible stimulant, followed by a laxative draught, was all the after-treatment adopted. The small orifice "was cicatrised over on or about the third day," and the Cow quickly recovered.

This operation has not, so far as I am aware, been repeated.

With the smaller animals—such as the Sheep and Goat—this deviation must be remedied by forced extraction or the short blunt hook or finger-hook, the fore-limbs of the fœtus being manipulated so as to push away the unencumbered shoulder into the uterus, and bring forward that round which the neck bends. The smallness of the genital passages in these creatures is an obstacle to manipulation, but an intelligent boy with a small hand may be of much service when acting under the direction of the obstetrist.

With the Bitch and Sow these deviations are extremely rare. When they do occur it will be found that forceps will generally effect forced extraction; or a piece of strong catgut or brass or copper wire may be passed round the bend of the neck. Traction on this will either remove the fœtus, or by cutting through the neck permit it to be extracted by the forceps hereafter to be described. Placing the Bitch in a warm bath for a few minutes, and then laying it on the side opposite to that to which the head of the puppy is inclined, will be found advantageous.

Deviation Upward and Backward.

The deviation of the head more or less upward and backward—the inferior borders of the lower jaw being vertical or turned up towards the maternal sacrum—appears to be an extremely rare complication, and is chiefly met with in the Mare, in which it has led to rupture of the uterus and rectum, and delivery by the latter.

The cause is probably the same as in the other deviations of this region.

On exploration, in the vertebro-sacral position, the fore-limbs may be found more or less advanced in the vagina, and beyond them, at the inlet, the hand meets the chest with its sternum, and above it the front part of the neck with the trachea leading upwards to the head, which may be flexed more or less back on the withers or loins (Fig. 128), or inclined to one or other side of the fœtus, the lower jaw always facing the lumbo-sacral region of the mother, or twisted slightly round (Fig. 129).

Indications.

Retropulsion is the first indication, and this alone will often bring the head into its normal position; it should be practised on the sternum. Should the

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head not drop down to the pelvic inlet, then still continuing the retropulsion, the hand may be introduced, the lower jaw seized and brought towards the os, by carrying it downwards and a little to one side if necessary, by a slightly

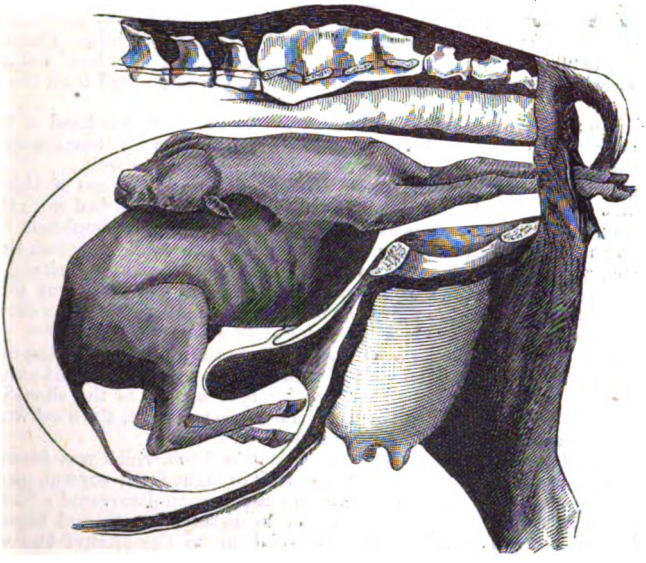

Fig. 128.

ANTERIOR PRESENTATION: DEVIATION OF THE HEAD UPWARDS AND BACKWARDS.

screwing motion. A cord on the lower jaw, or around the head, may be useful if it can be applied. Rueff recommends compression in the rectum,

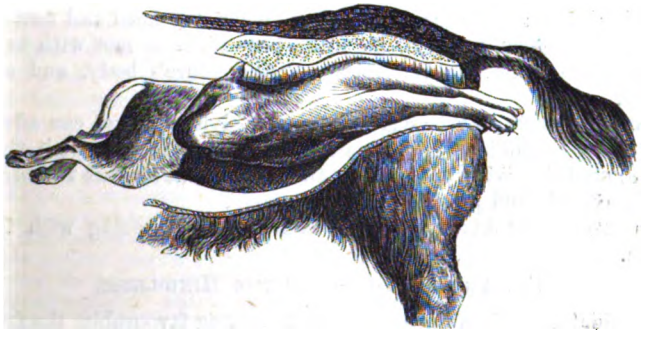

Fig. 129

ANTERIOR PRESENTATION; DEVIATION OF THE HEAD UPWARDS AND LATERALLY.

previously emptied, by the hand of an assistant, while the operator manipulates in the uterus. If the animal is lying, it must be made to stand.

Embryotomy is rarely necessary.

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In the smaller animals—at least in the Bitch—delivery has been effected without reduction of the deviation.

1. Charant (*Recueil de Méd. Vétérinaire*, 1851, p. 895) attended a Mare in labour. With some difficulty he was able to pass his hand into the uterus, and then found that the foal had its head and neck reversed on the back, the throat pressing strongly against the upper part of the maternal pelvis and a little to one side. There was also inversion of the bladder, with hernia of the intestines into it. The head and neck were adjusted with difficulty, and the foal extracted, but the Mare died from the above injuries.

2. Donnarieix describes a case of this deviation in the Cow, the head of the calf—which was dead—being reversed on the back. Much time and patience were required to adjust the misplacement and extract the calf. The Cow did well.

3. Grad (*Briefliche Mittheilung*, Franck, *Op. cit.*, p. 384) met a case of this kind for the first time. It occurred in a Mare; the head and neck of the foal were thrown on the back, and only the sternum presented at the inlet. Three shepherds had been endeavouring to pull away the young creature, which was dead. The fore-limbs were in the vagina, and as it was decided not to exhaust the Mare by adjusting the head and neck, these legs were removed subcutaneously; then the head was sought for. The hand, pushed as far into the uterus as possible, encountered first the cervical vertebræ, then the right ear was at last reached and secured.

It was now discovered that the head lay a little to the right side of the croup, the lower jaw being downwards. The task of reduction was a most difficult one, the arm being too short; but at length the head was brought as low as the shoulder. The neck was not contracted, and a hook being inserted into the orbit, the head was carried into the pelvis, and delivery was then soon completed.

4. Saint-Cyr (*Op. cit.*, p. 472) reports the case of a Bitch which was forwarded to the clinic of the Lyons Veterinary School, having brought forth several puppies the previous evening, and continuing to strain. An exploration discovered a fœtus firmly engaged in the pelvic canal; two limbs could be distinctly felt, and beyond them a rounded surface which was at first supposed to be the croup; the case was therefore suspected to be a breech presentation. The two limbs were seized and drawn outside the vulva, when they were recognised as fore-legs. The head could not be discovered; so traction was continued, though with every precaution, and at last the fœtus was brought away. It was dead, and the head was bent back on the loins, in which it had made a considerable depression (Fig. 129). The Bitch did not suffer much, and soon was quite well.

SECTION III.—DYSTOKIA DUE TO MISDIRECTION OF THE HIND-LIMBS IN THE ANTERIOR PRESENTATION.

Sometimes in the anterior presentation, when the head and fore-limbs are normal and in a good position, an obstacle to birth is met with in a wrong direction of the posterior parts of the young creature's body, and especially the limbs.

The anterior parts may be engaged in the pelvis, and yet can advance no farther, owing to the hind-legs advancing at the same time with them into the canal, or, being widely abducted, the stifles come against the brim of the inlet on each side and prevent further progress.

This cause of dystokia we will now consider, commencing with the latter deviation.

Extreme Abduction of the Hind-limbs.

In this deviation birth appears to be proceeding favourably, the fore-limbs, head, and body being normal and in the natural position, and well through the genital canal—these parts being even more or less outside the vulva, when, just as parturition is supposed to be completed, a check occurs; and the redoubled strainings of the mother, and even powerful traction on the fœtus, are unavailing in bringing it beyond a certain point.

This cause of dystokia appears to be noticed only in the foal, the long limbs of which undoubtedly favour the occurrence of the deviation.

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It may be discovered by passing the hand between the fœtus and the genital passage—between the fore-limbs and underneath the belly of the young creature; when it reaches the pelvic inlet, the thighs of the fœtus are found to be widely separated—the stifles turned outwards, so that the outer aspect of the thighs is nearly horizontal on the floor of the uterus, and these joints are pressing against the ascending branches of the ilium or the anterior margin of the pubis.

Indications.

The indications for extraction are the adjustment of the hind-limbs. This adjustment is all the more difficult as the fœtus is well advanced in the pelvis, and energetic traction has been much employed. Retropulsion must be resorted to, the hind-quarters of the fœtus being pushed as far from the inlet as possible, so that the abducted limbs may be adducted; but retropulsion is not unfrequently very difficult, if not altogether impossible in some cases. Under these circumstances, a slight rotation of the fœtus on its axis, so as to change its relations with the inlet, and allow the stifles to enter the pelvic canal, has been recommended and practised with success.

Heu, quoted by Saint-Cyr, gives the following directions for this manœuvre: A double cord is passed round the loins of the young creature, as near the vulva as possible, the two ends being tied and a stick passed through them. Two turns of the stick being made to tighten the cord firmly round the belly, the front part of the fœtus is lifted to the level of the vulva; then the body, as well as the lever—the stick—is rotated from right to left; after a little manipulation, the resistance is overcome. Heu has by this means been able to extract a living calf.

Should this operation fail, embryotomy is the last resource. This may perhaps be best effected by removing the sternum of the fœtus and the thoracic organs, so that the walls of the chest will readily fall together; the hand and arm can then be passed between the fœtus and the pelvis until the hind-limbs are reached; these are seized by the upper and front part, and adducted one after the other. When this recommendation cannot be carried into practice, the trunk of the fœtus should be divided (*see* "Embryotomy"), the hind-quarters pushed into the uterus, and version effected, when delivery can be accomplished in the posterior presentation. In order to prevent injury to the uterus or genital passages, as much of the skin as possible should be left to cover the divided end of the spine.

This procedure, however, is not always successful. Peuch (Saint-Cyr, *Op. cit.*, p. 475) was called at a very late period to attend a Cow which, during protracted parturition, had been subjected to very severe handling, violent attempts having been made to extract the fœtus; this was consequently so firmly wedged by the haunches and croup in the maternal pelvis, that Peuch could not pass his hand between the young creature and the uterine walls. Finding delivery impossible without embryotomy, he divided the fœtus at the loins and tried to push the posterior part into the uterus, but unsuccessfully. Extraction was impossible, and the Cow was killed by the butcher for food.

Deviation of the Hind-limbs in the Pelvis, the Anterior Part of the Body Presenting.

This malpresentation, known to the German veterinary obstetrists as the "vertical-abdominal" or "dog-sitting position" (*Bauch-Vertikallage, Hunde-Sitzige Lage*), is not at all uncommon, and is one of the most formidable,

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perhaps, which can be encountered. First described by Canu in 1837 (*Recueil de Méd. Vétérinaire*, 1837, p. 444), it has been alluded to by a number of veterinary surgeons, and it has also been mentioned in every work on veterinary obstetrics published on the Continent.

Since that time it has been met with in the Mare, as well as the Cow, and consists essentially in the advance of the hind-limbs of the fœtus in the pelvic canal, at the same time as the anterior part of the body, the position of the young creature being consequently more or less vertical and the body bent at the loins.

As in the preceding deviation, nothing is at first known of the existence of the displacement. Parturition commences and appears to be going on favourably; the fœtus, in the vertebro-sacral position, arrives at the inlet, the head and fore-limbs in advance as in normal birth. Progressive expulsion may continue until the head of the young animal is beyond the inlet, and

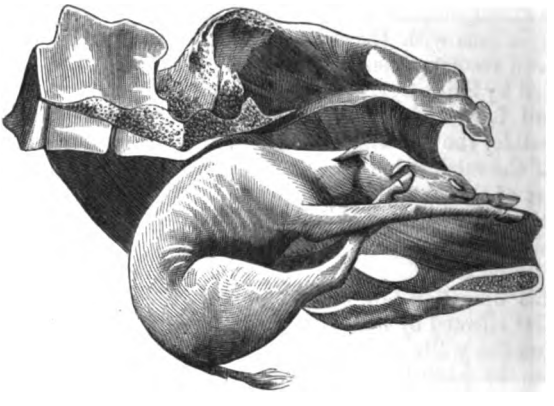

Fig. 130.

DEVIATION OF THE HIND-LIMBS IN THE PELVIS IN THE ANTERIOR PRESENTATION.

as far as, or even external to, the vulva—sometimes the head, fore-limbs, neck, and half of the chest hanging outside the vagina. But further progress is checked, and neither the most energetic straining on the part of the animal, nor the most violent traction by those persons who may be with it, can advance the fœtus beyond this point.

The obstetrist has great difficulty in ascertaining the cause of delay in birth: the difficulty varying, and depending upon the volume of the fœtus, and whether its body more or less completely fills the pelvic canal. The hand can generally only be introduced after much trouble and tact into the passage, and having got to a certain distance it encounters either under the body or head (Fig. 131), to one side of the neck or head, or even projecting upwards above the head (Fig. 130), first one, then a second foot or limb, which are recognised by a careful examination to be those of the hinder part of the body. Sometimes the feet and metatarsal bones have alone entered the pelvis, the other parts of the limbs being in the uterus (Fig. 131); in other cases the hocks may be in the inlet, or even well through the passage—depending upon the size of the fœtus and the capacity of the maternal pelvis; more rarely the stifles have cleared the inlet, and the hind-feet are arrived

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at the vulva. The more advanced the hind-limbs are, so the more is the body of the fœtus bent on itself, and the greater is its resemblance to a dog in a sitting posture. It is needless to state that the fœtus cannot be extracted in this malposition, no matter what amount of force may be exercised; and that violent measures are certain to lead to serious injury to the mother. The greatest care is therefore necessary, in order to ascertain the exact state of affairs; indeed, in all cases of dystokia it cannot be too often impressed on the mind of the young practitioner, that a careful examination is absolutely essential before attempting extraction.

In this particular form of dystokia, the life of the mother may be preserved by timely and rational intervention; while violent and irrational interference, even at the earliest period, will undoubtedly be followed by serious, if not fatal, consequences.

With regard to preserving the fœtus, the prognosis must generally be un-

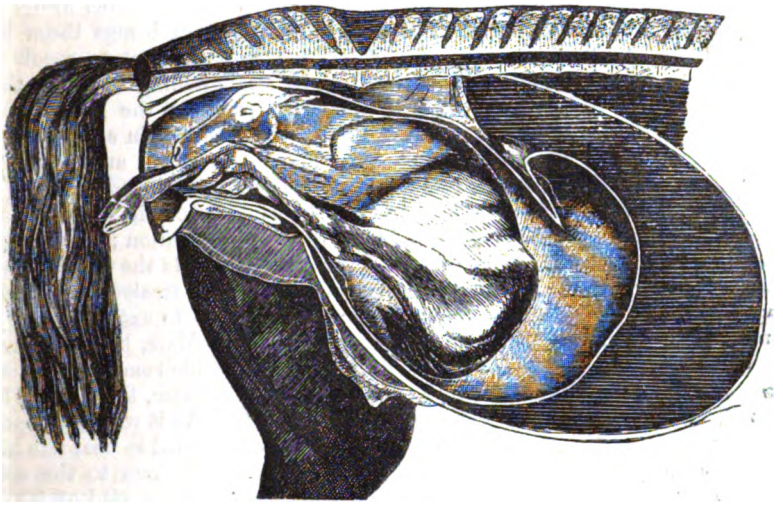

Fig. 131.

HIND-LIMB DEVIATION: ANTERIOR PRESENTATION.

favourable. The foal is, in every case perhaps, certain to perish at an early period; and though the calf is more tenacious of life, and may continue to exist for some time, yet in the majority of cases it succumbs, or it has to be sacrificed to save the mother.

Indications.

In nearly every case the preservation of the mother is the first object to be attained, the life of the fœtus—if it be yet alive when the veterinary surgeon is called in—being quite a secondary consideration; though it must be admitted that if he is present when it is still vigorous and not much engaged in the pelvic cavity, there is no reason why it should not be extracted alive. The indication is, of course, to rectify the deviation of the hind-limbs; and if the fœtus is not too far advanced in the genital canal, this may be accomplished by pushing it, if need be, towards the uterus, and introducing the

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hand between it and the wall of the vagina (often a most difficult matter), to carry the hind-feet back—one after another—into the uterine cavity, either by the hand or the aid of the repeller; then the head and fore-limbs being in a good position, birth can readily be effected. In this manner Carsten Harms has extracted a foal. And when the front part of the fœtus has not advanced into the pelvis, and the deviation has been ascertained in good time, the anterior presentation has sometimes been successfully converted into a posterior one, so that birth could take place.

But such cases are rarely met with in practice; and, as a rule, the veterinary obstetrist finds that parturition has made much progress, the fœtus being fixed in the genital canal and occupying its entire diameter, and its hind-limbs well forward under the body, each labour-pain wedging it more firmly; and the case is perhaps complicated and aggravated by the indiscreet manipulations of amateurs and busybodies. In such circumstances, it is needless attempting to push the fœtus towards the uterus, neither can the hind-limbs be thrust into the uterine cavity; as no sooner are they carried from under the body for ever so short a distance, than a succeeding pain brings them into their former position. Indeed, it is sometimes most difficult to reach the hind-limbs to apply cords to them, and so by straightening to bring them parallel to the body. In a case of this description in the Mare, Obich (*Wochenschrift für Thierheilkunde und Viehzucht*) succeeded in extracting the foal by cording the hind-feet (which were under the body), and pulling at them as well as the head and fore-feet. Donnarieix recommends pulling the posterior limbs forward beneath the body, the contents of the abdomen and chest having been previously removed to facilitate the operation; then cording the hind-pasterns, to draw first one, then the other, towards the vulva. He admits, however, that this is difficult, and one of his cases treated in this way occupied him for four hours; he was even compelled to excise one of the limbs at the hock, before he could straighten it. The Mare, however, lived.

Canu (*Op. cit.*), in 1837, gives another method in which embryotomy may be carried out. The illustrative case was that of a Mare, the foal—which was dead—being born as far as the half of the chest. As it was not possible to push it back, the body of the young creature was divided as near the hind-quarters as possible, by making an incision from the sternum to the spine, behind the last rib on each side; then the abdomen was emptied of its contents, and the spine cut through between the last dorsal and first lumbar vertebra, the amputation being facilitated by an assistant holding the lips of the vulva as far apart as possible. The Mare, which was very exhausted, did not offer much opposition when the croup was pushed into the uterus, and the hind-limbs being corded, version was very easy, and the operation soon finished. The Mare was at work within twenty days afterwards.

Canu's method of extraction has often been practised, both in the Mare and Cow, by subsequent veterinary surgeons; and it has been proved to be both rational and successful—so far as the mother is concerned. In practising it, the following directions have been given by Saint-Cyr, and their observance is important:

1. Find the hind-limbs and secure them by cords around the pasterns; 2. Cord the head and fore-limbs, and pull these out as far as possible beyond the vulva; 3. Remove the abdominal viscera, and divide the spine as near the lumbar region as possible, taking the precaution to leave a good piece of skin attached to the loins, so as to cover the exposed bones and prevent the maternal organs being injured during the subsequent steps in extraction; 4. Obtain a solid bearing on the divided spine, either with the hand or the

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repeller, and push steadily and firmly against it, so as to direct it into the uterus, when the cords on the hind-pasterns being pulled by assistants, guided by the hand of the operator the remains of the fœtus can be removed. This part of the operation is the most difficult and fatiguing for the obstetrist, as well as the most dangerous for the mother, and requires both strength and dexterity to push back the loins and pelvis of the fœtus while advancing the hind-limbs, thighs, and croup towards the outlet; 5. Nothing now has to be done but to exercise moderate traction, and terminate, in the lumbo-pubic position of the posterior presentation, a birth commenced in the vertebro-sacral position of the anterior presentation.

Dietrich recommends eventeration of the fœtus, removal of one of the hind-limbs, and the adjustment of the hinder parts through the abdominal opening; if this cannot be effected, then these parts are to be drawn into the vacant cavity of the abdomen.

When only one hind-leg is in the pelvis, retropulsion of the body may be tried, the fore-legs and head being corded, and the misplaced hind-limb finally extended backwards in the uterus. If this cannot be accomplished, the hind-leg must be drawn forward and amputated at the hock or beyond, and the thigh then carefully pushed towards the uterus.

Removal of the abdominal viscera favours these manœuvres.

1. Cartwright describes the case of a Cow which showed signs of calving, and soon after the fore-feet appeared, and subsequently the head. A variety of assistance had been called in previous to his arrival, but the calf could not be advanced farther than the loins. He found the Cow in a very exhausted state, with one half of the fœtus hanging out. On examination it was discovered that the hind-legs were in the pelvis: "thus preventing us, with all the strength we could muster, drawing the fœtus away; as the hind-parts, together with the metatarsal and tibial bones, were doubled-up, and thus completely blocked the passage. Of course, in trying to pull it away in this position, the femoral bones would be thrown up before the hind-parts could pass." Cords were attached to the hind-legs, the thoracic and abdominal viscera removed, as well as the protruding portion of the body, and the loins were then forced back, while assistants pulled at the hind-legs and extracted the remainder of the body without any further difficulty. The Cow received stimulants, but died in a short time. The uterus was found to be ruptured at the cervix.

2. In the *Edinburgh Veterinary Review*, mention is made of a case in which only one hind-leg in the pelvis proved an insurmountable obstacle to birth. The abdominal organs were removed, the leg in the pelvis drawn forward, and traction at the same time exercised on the head and fore-limbs. The fœtus was in this way removed.

3. Gierer (*Magazin von Gurlt und Hertwig*, 1865, p. 78) describes the case of a Mare, which six men attempted to deliver by dragging at the foal. Gierer found the latter hanging dead from the vagina. Removing the viscera from the chest and abdomen, the hind-feet were reached through the cavity of the body; the abdominal muscles and skin were cut through, but the hind-legs could only then be imperfectly pushed backwards. With the help of five men pulling, however, the foal was extracted. There ensued much swelling of the vulva, but the Mare eventually did well.

4. Marty (*Journal des Vétérinaires du Midi*, vol. xiv., p. 400) attended a case in which the front part of the foal was born, but the hinder extremities were firmly retained, the hind-feet beneath the body. Dividing the trunk, cording the hind-pasterns, and pushing the loins into the uterus while the cords were steadily pulled at, the Mare was delivered and did well some time afterwards.

5. Walther (*Sächsen Jahresbericht*, 1861, p. 123) had a Cow in which all the feet of the calf presented. The fore-limbs were corded, the hind ones secured and drawn towards the vulva. Suddenly the progress of the calf towards the outlet of the pelvis was checked, and on examination it was discovered that one of the hind-feet had passed between the fore ones. This state of affairs changed, however, and the fœtus, in altering its position slightly, had both hind-feet jammed against the pelvis, and the body protruded as far as the shoulder. Embryotomy was decided upon, and the viscera were removed from the fœtus, as well as the front part of the body; the hind-feet were corded, and traction soon removed them and the croup.

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6. In the *Repertorium für Thierheilkunde* (1875, p. 257) is an account of a Mare which had been in labour for eighteen hours. The fœtus was dead; both the fore-feet were in advance and visible, one hind-foot was fixed against the side of the mother's pelvis, while the other pressed against the inlet, the head being turned back to the left side. The fore-feet were corded, the hind ones attempted to be pushed back and the head brought straight; but without success. Version was tried, but failed, and embryotomy had to be adopted. The Mare, however, died in an hour after the operation. The rectal mesentery was discovered to he ruptured, there was blood in the abdominal cavity, and two small lacerations towards the neck of the uterus.

In a second case the head also complicated the deviation; embryotomy was resorted to, and the mother survived.

7. Dus (*Recueil de Méd. Vétérinaire*, 1876, p. 1150) points out that in those cases in which there is deviation of one or both of the hind-feet in the pelvis and the head is turned towards the side, it is better, with the Mare, to attempt extraction by making the presentation a posterior one; for though it may be possible to re-adjust the head and neck of a calf and afterwards extract it, yet with the foal there are great difficulties, and particularly in those cases in which the violent contractions of the uterus are opposed to the introduction of the arm of the operator. He gives two instances, almost identical in their circumstances, in which he was able to deliver foals without very great difficulty, and also indicates how rupture of the uterus from amputated limbs may be prevented. His first case was a six-year-old Mare in labour only three hours. It was lying on its sternum, and making violent expulsive efforts from time to time. Getting it up and securing it, Dus found that the foal was in the anterior presentation, vertebro-sacral position, the fore-limbs well-placed and projecting beyond the vulva as far as the knees; the neck, however, was bent to the left and the head inaccessible to the hand; one of the hind-limbs had cleared the neck of the uterus, but lay alongside the left shoulder, and jammed against the right side of the vagina, the hoof being directed upwards, backwards, and to the right. The uterine contractions were so powerful that the organ was closely moulded on the fœtus, and it was impossible to introduce the arm beyond a certain limit. It was therefore determined not to attempt adjusting the head and neck; though at first it was the intention to extract the foal by vigorous traction on the fore-limbs by a large number of assistants, and to do this the hind-leg in the pelvis must at least have been pushed back. The latter operation, however, could not be accomplished, as the limb was so rigid that, like a spring, it resumed its position as soon almost as it was displaced. It was then deemed advisable to resort to version, and to attempt delivery by the breech. After amputating the fore-legs at the knee, and having pushed them into the uterus,—where they lodged in the right flank, not far from the pelvis, the end of the radius upwards,—they were kept in place by an improvised repeller (a short blunt stable-fork), which pressed strongly against the nearest forearm close to the shoulder, to the right and a little downwards; several men at the same time pulled at the cords fixed on the pastern of the engaged hind-leg. As the traction brought this limb outward, it turned first sideways, the hock to the left, then upwards, as in a normal presentation.

The efforts ceasing, an examination was now made; when it was found that the fore-limbs were still towards the right flank, the stumps directed upwards, though the croup was much nearer the pelvis, so that it was easy now to trace the course of the hind-limb which had been pulled beyond the vulva as far as the hock: this was the right limb; the left could be reached by the hand, and was nearly vertical, semi-flexed, inclined to the right, the foot resting on the belly, towards the mammæ. After several very arduous attempts, it was possible to seize this limb by the hock, and, pushing it forwards and to the left, to pass the hand to the shank; but it was only after most fatiguing efforts that the foot could be reached. This was pulled into the vagina, and a cord being passed round the pastern, the limb was drawn alongside its fellow. The croup now being in the pelvis, nothing more remained to be done but to pull steadily on the two hind-limbs, and birth was very easily effected. No sooner, however, had the foal been extracted than the Mare became dull and indifferent to everything around it; it would neither eat nor drink; the expression was anxious and the flanks greatly agitated. These symptoms indicated an internal injury, and in a few hours the animal succumbed after considerable hæmorrhage from the uterus. There was a rupture of the organ, and Dus shows that this fatal injury was caused by the stump of the fore-limb against which the repeller was pressed, and that it might have been averted had he amputated these limbs nearer the trunk, or if he had torn them off altogether after skinning the fore-arm and dividing the pectoral muscles.

In the following example, he testifies that when the hind-limbs preserve their

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flexibility, it is not necessary to have recourse to this complicated operation to extract the fœtus, without danger to the mother.

He was called to see a Mare which had been for some hours attempting to foal. Three of the foal's feet were visible externally, but no head : two fore-limbs protruded as far as the knees, and the hoof of a hind-foot could be distinguished—the plantar surface being upwards—the other hind-limb was found at the bottom of the vagina. The presentation of the fœtus was anterior, the position vertebro-sacral ; the neck was bent on the body, the head beyond reach. The uterine contractions were extremely energetic. After amputating the fore-limbs at the knees, they were put back into the uterus, where they were kept by Dus's hand ; while two assistants pulled at the most advanced hind-limb by means of cords, and brought it out as far as the hock.

Then the other hind-limb was sought for and found at the inlet ; it was carried into the vagina, then externally by a cord round the pastern, while Dus prevented the fore-limbs from passing through the os. This manœuvre was completely successful in bringing the hind-quarters into the pelvis, the croup upwards. Vigorous and well-directed traction on the two hind-limbs, during the throes of the Mare, resulted in the birth of the foal without any further difficulty. In a few minutes after, the Mare was feeding heartily, and apparently none the worse for the operation.

Dus notes that though labour had only been going on for scarcely three hours in both cases, the foals were dead when he arrived.

8. Sparrow (*Veterinarian*, vol. xvi., p. 130) saw a Mare which had been in labour for some hours, and had been subjected to rude treatment by amateurs. The creature was in great agony, and the genital organs were so much swollen that much difficulty was experienced in making an examination. The labour-pains had ceased ; the fore-legs of the fœtus presented, one of the hind-legs being between them, and this at first led to the supposition that there were twins. The young animal was on its back, and the head could not be reached. It was attempted to force the fore-legs back and draw out the hind one, but this did not succeed. As the Mare was sinking from exhaustion, stimulants were administered, but death soon ensued. On *post-mortem* examination, the head of the fœtus was found lying under and across the withers, and was greatly distorted from pressure.

9. Younghusband (*Ibid.*, vol. xxi., p. 270) attended a Cow in labour, the head and neck of the fœtus protruding to their full extent, and extremely tumified, the creature being dead. Exploration was impossible, so it was decided to perform embryotomy. A circular incision was made round the neck, close behind the ears, and the skin dissected as far back as possible ; then the vertebræ were divided, and the head and neck removed. The loose portion of skin being placed over the divided vertebra, this was pushed into the uterus, and the fore-feet and legs were placed in a proper position. A crotchet being fixed into the upper and back part of the neck, the fore-legs were corded, and the whole confided to an assistant. Owing, however, to the emphysematous condition of the calf, delivery was still impossible. A fore-leg and shoulder were now speedily removed, but yet extraction could not be effected, from the immense size of the thorax and abdomen. The anterior ribs were excised and the contents of these cavities removed ; but as soon as the haunches of the calf reached the inlet, no further progress could be made, notwithstanding the most strenuous efforts. The lumbar-vertebræ were divided, and the adjoining muscles separated, when there was more room for manipulation. The obstacle to extraction was found to be the hind-feet and legs, "which had become impacted forward, and were pressing against the lower parts of the pelvis, in a manner resembling that of a dog sitting upon its haunches." By pushing the parts *in utero* back, the hind-feet were easily got hold of, and thus, as in a breech presentation, with the belly turned upwards, the calf was delivered. The Cow quickly recovered.

CHAPTER II.

Dystokia depending on the Posterior Presentation.

When treating of the mechanism of parturition (p. 227), it was remarked that of the four positions in which we have a breech or posterior presentation, only one is compatible with spontaneous and natural delivery—the *lumbo-*

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sacral; but that this is only possible when the hind-limbs are fully extended backwards, and are the first to enter the genital canal, so as to gradually dilate the channel for the passage of the voluminous and rounded croup. Birth in this position, and without assistance, is more frequent in the bovine than the equine species, and the young creature is nearly always alive. With the Mare, parturition is always longer and more laborious, and the foal quickly perishes after rupture of the membranes. It therefore results, that even when the latter is in the lumbo-sacral position, posterior presentation, and everything is favourable, yet delivery should be hastened if it is desired to preserve the life of the young creature.

The other three posterior positions—lumbo-pubic and right and left lumbo-ilial—are unnatural, and demand the intervention of the obstetrist.

Besides, these positions, as well as the lumbo-sacral, may be complicated

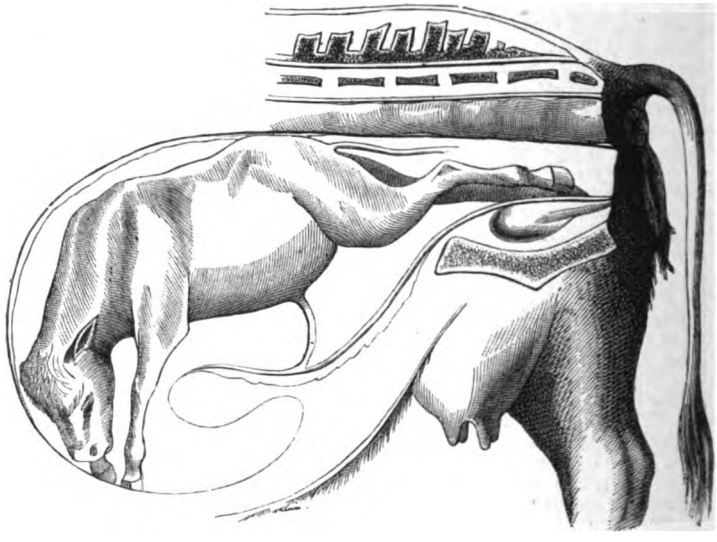

Fig. 132.

LUMBO-SACRAL POSITION.

by a vicious direction of the limbs, which may lead to as great, if less varied difficulties, as those encountered in the anterior presentation.

The varieties of dystokia met with in the posterior presentation depend: 1. On the difficulties depending on the lumbo-pubic and lumbo-ilial positions; 2. Those due to a vicious direction of the hind-limbs; 3. Those arising from the head and fore-legs. Some writers have alluded to dystokia from a wrong direction of the tail; but this must be very rare indeed.

SECTION I.—DYSTOKIA RESULTING FROM THE LUMBO-PUBIC AND LUMBO-ILIAL POSITIONS.

LUMBO-PUBIC POSITION.

In this, the posterior reversed position, the fœtus is lying on its back, its croup and loins corresponding to the floor of the abdomen or the pubis of the mother, with the feet and belly towards the sacrum.

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As a consequence of this reversed position, the hind-limbs, which soonest enter the pelvis, are inclined upwards and backwards into the genital canal, and they are therefore the parts that first meet the hand in exploration. Saint-Cyr points out what might be a cause of error in this exploration, in the following terms: "As the anterior face of the hoof or claws is directed upwards and the plantar surface (sole) downwards, the explorer might be inclined to think that it was an anterior vertebro-sacral presentation; but in pushing the exploration further, and following the cannon bone with the hand, the *hock* is met with—recognisable by its *flatness* on each side, the *point of the hock* downwards, the *bend* being upwards in the same direction as the wall of the hoof; whereas the bend of the knee is in the same direction as the sole of the foot. Beyond the hock the hand also comes in contact with the croup and the tail, lying towards the maternal pubis.

The obstacle to birth lies chiefly in the thighs and buttocks, while the hind-feet project against the mother's sacrum, and, in addition to increasing the resistance, threaten to lacerate the organs interposed between them—the vagina or rectum, or both—and that bony mass. Besides this, the body of the fœtus itself in this position forms a curve exactly the reverse of that of the pelvis; so that it cannot readily accommodate itself to the bony canal through which it should pass. From all these causes this position is not only unfavourable to birth, and must be remedied, but it may also lead to serious accidents.

The position appears to be more frequently met with in the Mare than the Cow, Donnarieix having witnessed it at least a score of times in the first-named animal. This authority, however, is of opinion that it is altogether a secondary position: the fœtus at the commencement being in a normal position (lumbo-sacral), and still alive, is retained at the pelvic inlet by its croup, and soon dies; then obeying the laws of gravity, at a moment when the uterus is relaxed, it turns upside down. And he gives what he considers a proof, in the fact that breeders, in consequence of what he was always telling them,—to the effect that in the posterior presentation the foal does not live for longer than half an hour, were always successful in bringing the young creature forth alive when they at once resorted to traction in such cases: all informing him that the *croup was above and the belly below;* while in all the instances in which he had to interfere, *the belly was uppermost and the back downwards.* In the latter cases Donnarieix never found the foal living.

Saint-Cyr, however, thinks this explanation is not quite satisfactory, that the opinion is too absolute, and that in the Mare, as well as in the Cow, the lumbo-pubic position of the fœtus may very well be *primary.* Donnarieix himself admits as much, from a case recorded by Rochard, in which a living foal was extracted—an extremely rare event in the equine species.

Indications.

The majority of authorities recommend that rotation of the fœtus should be practised in this position, so as to convert it into a *lumbo-ilial* or even a *lumbo-sacral* position; while others, and notably the French veterinary obstetrists, do not think of changing the position, but readily effect delivery when other causes of dystokia do not complicate it—indeed, they look upon these cases as the easiest to remedy, and rarely requiring more than a quarter of an hour.

The most important matter for attention is the direction of the hind-feet during delivery; these should be carefully guided through the genital canal

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until they are external to the vulva, so as to avoid those lacerations and ruptures which are only too readily produced.

In order to accomplish delivery, the pastern of each hind-limb should be corded; then the hand should be glided along the flexor tendons until the point of the hock is reached, this part usually jamming against the brim of the pubis; the hock is now raised, and at the same time the corresponding cord is pulled gently backward and slightly downward, so as to bring the calcis into the vagina; this operation is to be repeated on the other limb, and then both feet are to be directed by the hand through the canal. This being accomplished, the cords should then be pulled upwards, so as to raise the croup and facilitate its entrance into the inlet; after which steady traction, proportioned to the amount of resistance, should be employed during the labour-pains until the young creature is completely extracted.

Naylor (*Veterinarian*, vol. xxxiii., p. 325) attended a Mare which could not foal. He found the young creature lying on its back, with its hind-feet presented at the os uteri, and its croup resting firmly against the maternal pubis. Small strong cords were placed on the pasterns, the feet were brought into the passage, and by assistance and a little manipulation, he succeeded in turning the foal back upwards, when it was soon and easily extracted. No mention is made as to whether it was alive.

Lumbo-ilial Positions.

The lumbo-ilial positions—right and left—have been described at page 225. When simple, the hind-limbs—perfectly extended—first enter the genital canal. Such positions are very rare, and they do not offer anything very noteworthy; they are recognised in the same way as the lumbo-pubic position, and the indications are the same. As a rule, parturition is easier in these positions than in the lumbo-pubic, as only one haunch is jammed against the brim of the pubis: the other, being in contact with the mother's sacrum, can enter the inlet without much difficulty.

Judicious traction on the hind pasterns is all that is needed after the position has been rectified.

SECTION II.—COMPLICATIONS CAUSED BY DEVIATION OF THE HIND-LIMBS.

In the posterior presentation, the deviation of the hind-limbs is, in many instances, a very serious complication. Instead of being extended backwards into the passage, one or both may be bent at the fetlocks or the hocks—the leg against the thigh, these joints presenting; or they may be carried straight forward under the body, the buttocks alone resting against the inlet. So that, instead of a wedge-shaped mass offering its thinnest portion to gradually dilate the genital canal, the fœtus presents a large rounded mass—the croup and thighs—which is not at all adapted for effecting a passage through the limited space. When to this bulk is added the flexed portion of the limbs, it will be seen that this cause of dystokia, generally most formidable in all cases, must be more so with primiparæ, and especially if some time has been allowed to elapse since the commencement of parturition, if the "waters" have escaped, and if amateurs and empirics have been interfering. With regard to this interference, however, it must be admitted that it is less to be dreaded in this presentation than perhaps in any other; incompetent people are, fortunately, at a loss how to act, as there is nothing to lay hold of, and the nature of the malposition or the manner of remedying it is obscure, perhaps unknown to them.

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In the diverse complicated positions of the posterior limbs in this presentation, it may be remarked that they are more frequent and difficult in the Mare than in the Cow—the increased difficulty being doubtless due to the greater length of the limbs in the foal than the calf.

The malposition of the hind-limbs may be of three kinds: 1. Flexed fetlocks, projecting either against the brim of the maternal pelvis, or jammed against some part of the genital canal; 2. Flexed hocks, the doubled limbs engaged more or less deeply in the passage; 3. Hind-limbs completely retained in the uterus, and applied more or less closely against the abdomen of the fœtus, the back part of the thighs and the croup presenting at the inlet.

We have mentioned that one or both limbs may be in a vicious position; even when the two are misdirected they may not be in the same deviation—one leg being perhaps flexed at the hock and the other extended forward towards the chest, one flexed at the fetlock while the other is bent at the hock, etc.

Fetlock Presentation.

This abnormal direction of the hind-limbs is not frequent, and when encountered is not of much importance, so far as obstetrical skill is concerned. The misdirection of the phalanges can be quickly detected by exploration, and corrected as follows:—Extension of the pastern is accomplished by pushing the entire limb forwards into the uterus, and bringing the fetlock towards the vulva by seizing it at that joint—the fingers forwards, and the hollow of the pastern and heels of the hoof in the palm of the hand. By closing the hand and tightening the fingers, the pastern is extended and the foot carried towards the canal. The end of the limb is now corded, and if the other fetlock is in a like condition, it is adjusted in the same manner, and delivery effected.

Hock Presentation.

The mechanism of hock presentations is supposed to be as follows:—The fœtus, in the posterior presentation, and impelled by the uterine contractions towards the cervix, reaches the inlet with the hind-limbs not quite extended, nor the axis of the young creature quite coinciding, perhaps, with that of the passage. Consequently, the legs come in contact with the pelvic brim below by the posterior surface of the shank, while the croup encounters the sacro-vertebral angle above.

The labour-pains continuing, the croup has a tendency to descend, and, with the points of the hocks, to advance through the os: the latter joints become gradually flexed until at last the cannon-bones press against the thighs, and the doubled legs and croup, jammed in the inlet, form far too large a mass to advance further (Fig. 133). Labour is therefore suspended, and the animal becomes exhausted with futile straining.

The increase in volume is well exemplified in the annexed outlines (Fig. 134). In figure A, we observe that the direction of the femur ($a\ b$) is much more oblique than in figure B, which shows the limb extended, and that bone ($a^1\ b^1$) in its usual position. The consequence, in figure A, is apparent in the elevation of the stifle to the middle horizontal line, and the inclusion of the hock and greater portion of the metatarsal bone in the line below, which only touches the stifle ($a^1\ b^1$, figure B).

The mechanism is quite the same in the lumbo-pubic and lumbo-ilial positions, the parts of the pelvic brim against which the croup and limbs impinge being alone different. One limb only may be retained in this malposition,

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as already remarked, the other being extended in a normal manner; but this does not in any way alter the state of affairs—neither with respect to the mechanism, nature of the complication, nor measures to be adopted.

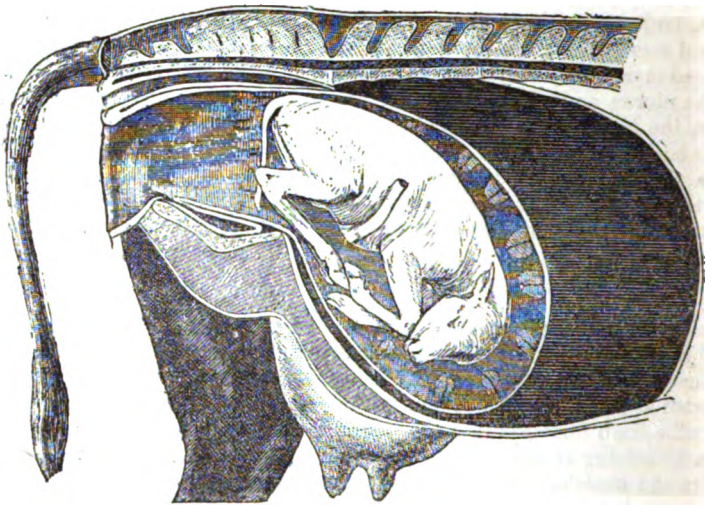

Fig. 133.

HOCK PRESENTATION: CALF.

In hock presentation, the point of the os calcis is always the first part the hand encounters in exploration; but it may be found at various depths. Sometimes the hocks alone are in the canal, the body of the fœtus being still

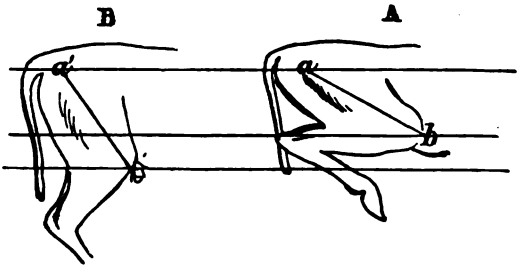

Fig. 134.

DIAGRAMS OF THE HIND-LIMBS IN HOCK PRESENTATION.

in the uterus; while in other cases they and the croup are within the inlet, and are wedged in the passage.

Indications.

The difficulties vary according to circumstances. With the larger animals at their full period of pregnancy, birth cannot take place, as a rule, until the

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deviation has been rectified; and to attempt delivery before this has been done is to expose the Cow or Mare—particularly the latter—to great danger. With the Sheep, Goat, Sow, and Bitch, the fœtus can be, and often is, extracted in this malposition.

The indication is, therefore, with the Mare or Cow, to give the hind-limbs a favourable direction, by extending them in the genital canal; and this is more easily accomplished in the second than the first of these animals, owing to the smaller size of the croup and shorter limbs of the calf. Some authorities are even of opinion that the latter may at times be extracted without the limbs having been adjusted; while others assert positively that delivery may be effected in the Cow by mutation of the fœtus, but that this is impossible with the Mare, unless a particular operation—to be noticed immediately—is adopted. Saint-Cyr, however, has, with more or less trouble, succeeded on four or five occasions, when the foal made a hock presentation, in extending the limbs in the genital canal, and effected delivery without resorting to this operation. He points out, nevertheless, that the foal dies very quickly in this position, while very often the calf is extracted alive, even after long and laborious manipulations. Other writers corroborate Saint-Cyr's opinion with regard to delivery.

The method of adjusting the hind-limbs is as follows:

1. *Push the fœtus as far as possible into the uterus.* This retropulsion can be effected without difficulty—even in the Mare—at the commencement of parturition, when the fœtus has not yet entered the pelvic inlet, or, at most, the points of the hocks are only engaged. But at a later period, when labour is more advanced, and the croup is in the passage and on the vaginal side of the inlet, the difficulty is greatly increased in the Cow, and retropulsion may even be impossible in the Mare. It should always be attempted, however, and in the Cow the attempt will be generally successful.

The hind-quarters must be raised as much as possible, and the hand should be applied against the buttock of the young creature, the thumb on one hip, the fingers on the other, and immediately below the tail. If the repeller is used (and it is very convenient in these cases), it should be placed across the thighs. The retropulsion should be made by steady pushes in the interval between the labour-pains; these pushes should be directed slightly upward, so as to raise the croup. At first the resistance seems to be insurmountable, but gradually the fœtus begins to move forward, and finally is entirely propelled into the uterus, and at a sufficient distance from the pubis to allow the limbs to be extended backwards.

When the animal persists in lying, the hind-quarters may be raised by trusses of straw; and in some cases, especially with the Mare, retropulsion could only be achieved and delivery effected by putting hobbles on the hind-pasterns, and drawing up the hind-quarters by means of the rope attached to them, and which was run over a beam in the ceiling.

Rainard points out that it often happens, during this retropulsion, that the fœtus is pushed into somewhat of a transverse position,—the head and fore-limbs approaching the pelvis, where they may be seized and version effected by moving them round into the anterior presentation, bringing them into the passage, and then completing delivery. This fortunate movement, however, must be extremely rare.

2. When the body of the fœtus has been pushed sufficiently far from the pubis to allow the limbs to be seized, the hand may then *fasten a cord on each pastern* (by means of the porte-cord, if necessary), in order to assist in extending

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the limbs at the proper moment, by a few moderate pulls in the desired direction.

3. *To extend the limbs in the genital canal*, the lower parts must describe the arc of a circle, the hock joint being the centre, the limb below this being the ray; so that the foot, which is at first directed forward, may be brought directly back towards the vulva of the mother. The limb which is most convenient is first extended. Some obstetrists begin by seizing the hock, the fingers in front and below the joint, the palm and thumb on the calcis and shank; the lower part of the limb is then drawn backwards, while the thigh is pushed forward, and by a turn of the wrist the leg is carried through the inlet and straightened. The same procedure is carried out with the other.

Other practitioners endeavour to *flex* the limb as completely as possible, commencing with the tibia and lifting it well up against the femur, then the hock is bent; the limb is now seized at the lower end of the cannon-bone, or even at the fetlock, and is then lifted into the vagina. Schaack's method does not differ much from this. He flexes the leg on the thigh as much as possible, raising the point of the hock as near the buttock as he can; this elevates the foot and brings it nearer. As the labour-pains usually push the fœtus too near the pubis, it must be thrust forward again by acting more particularly on the point of the hock, using it as a kind of propeller. When sufficient space has been gained, the hand descends along the cannon bone and grasps the front of the foot—the thumb and index-finger meeting round the coronet, so that the toe is in the palm of the hand; in this way the pastern and fetlock are forcibly flexed, when, by a vigorous effort—seconded, if need be, by the cord placed round it—the foot is raised above the pelvic brim, brought into the vagina, and the leg extended—an easy operation, generally. With the foal, however, it sometimes happens that, owing to the length of the limbs, the calcis presses against the sacrum of the mother while the foot jams on the pubis. In such cases the pastern-cord is most useful, as the operator may allow the foot to pass from his hand, and press the point of the hock towards the uterus, while an assistant pulls at the cord with such an amount of force, and at such times, as the obstetrist may order. The other limb is to be brought back in the same way.

Cartwright mentions that, in those cases in which the limb cannot be sufficiently extended backwards, the hock should be drawn as far as possible into the passage, and the tendon of the flexor metatarsi divided above its point of bifurcation, in front and at the upper part of the joint; this allows greater mobility. If the fœtus is dead, of course there can be no objection to this section; if alive, it will require consideration.

This is the method to be recommended in every case; and it will very often be attended with success, even in the Mare, when the fœtus is not too firmly fixed in the pelvis, and can be pushed into the uterus. But it frequently happens that retropulsion is not possible, the hind-feet cannot be reached, and delivery cannot be accomplished in the way indicated. We must then adopt other methods applicable to the Mare and Cow.

With the *Mare*, when the fœtus is wedged in the pelvis, so that it cannot be moved forward, it may be presumed that it no longer lives, or that it will perish before delivery is completed. There can be no objection, then, in resorting to embryotomy, so as to relieve the Mare as quickly as possible.

The hind-limbs of the fœtus may be amputated either at the stifle or the hock—some authorities recommend the former, others the latter; while others, again, advise excision at the coxo-femoral articulations. Extraction

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of the fœtus has been effected after amputation in the three regions, but preference is generally given to division at the hock. This is effected by drawing the joint as far into the vagina as possible, either by the hand or a cord passed round the part (Fig. 135); if it can be drawn beyond the vulva, all the better, but this requires much force. The joint is then disarticulated, and the separated portion of the limb withdrawn from the passage. The other leg being served in the same way, delivery can be completed in the ordinary manner—the obstacle being now removed.

"Now and then," as Cartwright remarks, "we are not able to bring the legs straight into the passage, but have to get away the fœtus by means of cords around the hock or hocks, with one or both of the legs doubled forward against the thigh. In these cases it will be advisable to divide the tendons

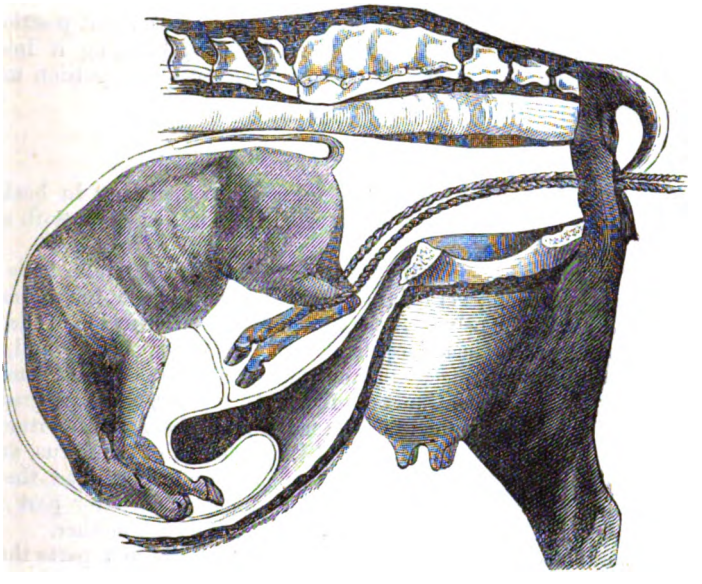

Fig. 135.

HOCK PRESENTATION: HOCK CORDED.

at the back of the legs, just above the point of the os calcis, and also the flexor tendons below the hocks, by which means the flexion at the hock-joints will be more perfect, and the leg and thigh approximate better. After we have done this, we may pull at the cords around the hocks pretty freely; but we must not omit forcing the breech into the abdomen, so as to allow the limbs or the stifles becoming straightened, and prevent the stifles wedging against the anterior part of the pelvis. . . . In some cases, I have known the fœtus to come away in a breech presentation, without the legs being straightened at the stifles; but it is bad practice. In some cases we may remove the leg-bone, by sawing the bone through, close up to the hock, and afterwards passing a cord above the os calcis to pull at, and then pushing the breech forward."

With the *Cow*, the calf is very frequently alive, and an important consideration is how to deliver it in this condition. Should it be impossible to effect

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retropulsion, *forced extraction* in this malposition should be attempted; it has often proved successful, and particularly when only one limb was retained.

To effect forced extraction with one limb alone flexed, the leg extended in the vagina should be corded at the pastern, or above the hock if this can be reached. A cord is then to be passed around the bent hock by means of the porte-cord, and traction exercised during the labour-pains.

When both legs are flexed at the hocks, cords must be passed round each, as in Fig. 135. The necessary force can then be exercised.

Should forced extraction not succeed, the limbs may be amputated at the hocks, as with the Mare.

It is well, in this malposition, when the hind-limbs have been either removed or adjusted, to ascertain the direction of the tail, as it is sometimes thrown back over the croup (as in Fig. 135), and may thus increase the difficulty to be surmounted. It may readily be brought back to its natural position by passing the hand from the root to its extremity, and bringing it into the vagina by withdrawing the arm. In some instances retropulsion may be necessary before the tail can be adjusted.

Thigh and Croup Presentation.

The cause of this malposition is the same as that operating in hock presentation; the deviation is not at all unusual in Mares or Cows with a very pendulous abdomen.

When the thighs and croup alone present at the inlet, the joints of the hind-limbs being partially or only very slightly flexed, it is evident that the voluminous mass cannot pass into the pelvis. Some part of the posterior region of the fœtus —as the hocks—jams against the pelvic border and cannot get beyond, while the points of the buttocks, placed in front of the inlet, are engaged somewhat in the passage. With the continuance of the labour-pains, this part gradually enters the pelvic cavity, while the retained hind-limbs are proportionately forced forward beneath or on each side of the abdomen of the fœtus, until at last they are closely applied to the body, the creature has assumed the position of an animal lying in a natural manner, and the posterior part of the trunk is firmly fixed between the sacrum and pubis of the mother.

The tail and buttocks of the fœtus are, therefore, the first parts that the hand encounters in exploring the genital canal; then the croup and haunches, and below, beneath the pubis, are found the hocks, which may be more or less accessible to manipulation, according to circumstances: though, when the limbs are fully extended under the body, they are beyond reach. Though the croup and haunches may have passed into the pelvic inlet, yet nothing of the fœtus is discernible externally, no matter how long the labour may have been in progress.

In the majority of cases, perhaps, the young creature is in the lumbo-sacral position; while in others it may be in the lumbo-pubic, or right or left lumbo-ilial positions.

Indications.

Authorities are generally unanimous in asserting that this is one of the most difficult malpositions the veterinary obstetrist can encounter. Very frequently the mother perishes without being delivered; and though sometimes a live calf may be extracted, it is rare indeed that a living foal is obtained, and only too often the Mare succumbs after parturition has been accomplished by manual force. The chances of success in saving either mother

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or offspring are diminished in direct proportion to the time labour has been going on, the fœtus advanced in the pelvic cavity, and the maternal genital organs injured or irritated by improper manœuvres. The difficulty is also greatly increased in heifers, or animals whose genital canal is smaller than usual; a large fœtus also makes the malposition more serious.

The rational indication is, of course, to extend the limbs of the fœtus backwards, as in ordinary breech presentation, and to give these and the body a direction in harmony with the axis and dimensions of the pelvic inlet, so that birth may be effected by the combined efforts of the mother and the obstetrist. But this indication is often most difficult to fulfil; though in some instances, and even with the Mare, it is possible when labour is not too advanced, and

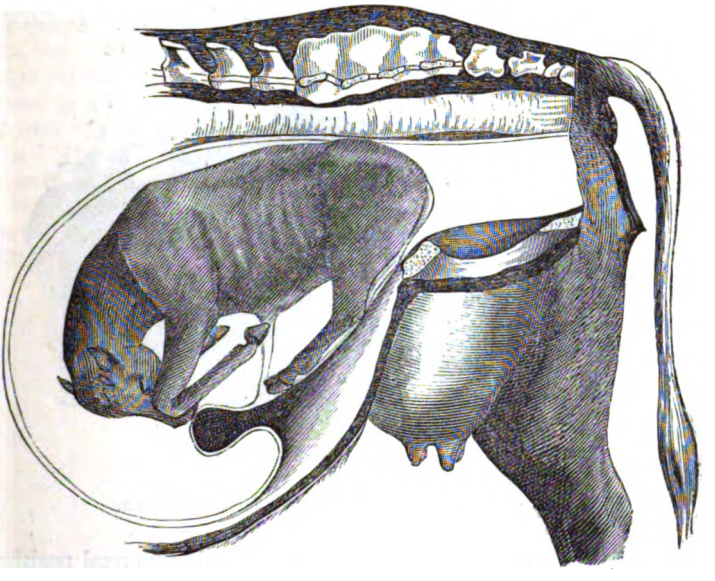

Fig. 136.

THIGH AND CROUP PRESENTATION.

when the fœtus, still in the abdominal cavity, is movable, and can be pushed sufficiently from the inlet to allow the lower part of the limbs to be seized and brought into the vagina.

Pushing the fœtus as far into the abdomen as possible, one of the limbs is seized above the hock, and the thigh and leg flexed as completely as circumstances will permit, by lifting that joint towards the mother's sacrum. Still pushing the fœtus off by means of the repeller, the hand is passed down to the hoof or claws until the toe and front part of these rest in the palm of the hand; by adopting this precaution, danger of injury to the uterus or vagina is averted. Then the foot is brought into the passage by flexing all the joints on each other. Again pushing the fœtus forward, the same manœuvre is repeated with the other limb, if necessary; though forced extraction has sometimes succeeded with only one leg in the passage, that which is retained finding

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space in the abdomen, and even facilitating the passage of the thorax, according to some obstetrists.

This manipulation is rendered more difficult than in hock presentation, from the fact that the hocks in this are deeper in the uterus, and jam against the brim of the pelvis, where they cannot be freed by the hand. The difficulty is surmounted by passing a blunt hook round them, or a cord as in Fig. 135, the two ends of this outside the vulva being twisted and drawn upwards and outwards by an assistant; while the operator, pushing at the croup, throws the body of the fœtus forward, and thus allows the point of the calcis to rise above the pelvic brim, when the leg can be extended backward as in hock presentation.

This method, however, does not succeed in every case; and when the croup is firmly wedged in the pelvic canal and the thighs have cleared the inlet, it is only too often impossible to effect retropulsion. Consequently, there are

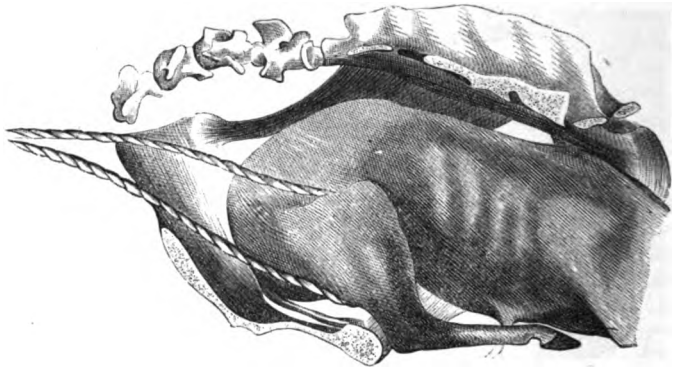

Fig. 137.

THIGH AND CROUP PRESENTATION: THIGH CORDED.

but two courses open: extraction of the fœtus in this abnormal position, or removing it by embryotomy.

Forced extraction of the fœtus, without adjustment, is a very serious, because a very violent, measure, and is frequently fatal to the mother, as well as to the offspring. It should, therefore, not be lightly adopted, and every other measure of a milder kind should be tried if it has any probable chance of success. Throwing the mother on the back or side may effect a change for the better in the position of the fœtus; or if standing or lying, then raising the hind-quarters as high as may be without injury should be tried.

These failing, then Lecoq's method may be resorted to. This consists in passing the hand, furnished with a cord, between the wall of the pelvis and the body of the fœtus as far as the thigh of the latter; the cord is then pushed beneath the thigh as far as possible and left there, while the hand is passed above—between the leg and body, so as to bring the end of the line up around the stifle and back through the vagina. In this way the thigh is encircled by a loop, as in Fig. 137. The other thigh may be secured in the same way by another cord, and this part of the operation will perhaps be much facilitated by using the long bent porte-cord (Fig. 148).

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Saint-Cyr states that one thigh corded may be sufficient; but it is undoubtedly better to cord both, if possible, as traction on the two limbs keeps the body of the fœtus in a straight direction.

The ends of the cords being joined together outside, assistants, under the direction of the operator, pull with the necessary amount of force, while the hand of the operator assists in the vagina, either in guiding the fœtus, seizing on and pulling at any part that may offer, or smoothing down the folds of mucous membrane in the canal which might otherwise increase the obstacles. The fœtus has been extracted alive by this procedure.

Saake's method (*Magazin von Gurlt und Hertwig*, 1869) is somewhat similar, except that there is only one cord, and that encircles the body instead of the thigh. The cord has a ring or noose at the end, and this or the other end is passed between the thighs and brought out at the flank of one side; then the other end is also brought out in front of the other flank. Both ends are carried to the top of the back, the plain end is passed through the ring (Fig. 138) and brought outside the vulva. The body of the fœtus is, it will be observed, enclosed in a loop, the upper part of which—that over the loins—is carried back over the tail to the buttocks, so that the cord now only encircles the flanks. The advantages of this method over the other are chiefly its simplicity, only one cord being required, and the better direction in which traction can be exercised.

In three cases this method was successfully employed by Saake.

There can be no doubt that the fœtus may be removed in this malposition,

Fig. 138.

THIGH AND CROUP PRESENTATION: BODY CORDED.

with both the hind-limbs extended forward under the abdomen. Cartwright says: "I perfectly recollect, in one instance, delivering a Cow of a very large calf with both of its hind-legs under its abdomen, and I never saw a Cow after calving do better." In those instances which are attended by success, it will be found either that the fœtus is small or the pelvis large and well-formed.

Some practitioners resort to the sharp crotchets, fixing them in the muscles of the croup, towards the hip joint; but unless the hook has a bearing on the femur the hold is not very firm. In a case of this kind, Drouard found that the skin and muscles yielded, the femur was disarticulated, and the hind-limb itself entirely torn away from the body. Notwithstanding this diminution in the volume of the fœtus, delivery was still impossible; the other limb was torn away in a similar manner, after which a crotchet was fixed in each cotyloid cavity, and the fœtus was then easily extracted. In addition to the malposition, the young creature was affected with hydro-cephalus.

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The use of sharp crotchets in such cases is always attended with risk; should they slip during traction, or not be carefully implanted in the fœtus, they may do great, if not fatal injury to the mother.

To escape the dangers which accompany the use of the crotchets in this way, another method has been proposed and practised by many veterinary obstetrists. The perineal region of the fœtus is largely incised, and the hand, armed with a crotchet, is passed into the pelvis by this opening, the crotchet being fixed either in front of the symphysis pubis, on one of the branches of the ilium, or, which is perhaps better, in one of the oval foramina. Two crotchets—one for each side—may be used. By this method, a more solid hold is obtained, and greater force can be easily exerted.

Cartwright observes: "In those cases in which we are unable to extract by the breech, through not getting the legs up straight by laying hold of the feet, or when bent at the hocks, we should make pretty free incisions through the skin about the ilio-femoral articulations or rump, and afterwards cut or tear the muscles around these asunder, and then we can secure cords around the iliac processes and coccygeal bones, and hooks against the edge of the obturator foramen, by which means we can remove the pelvic and coccygeal bones; and having done so, we can apply a cord around the head of the thigh-bones and pull them out. We must next make an incision into the abdomen and remove the viscera, as they are sometimes pushed forward, and prevent our removing the other parts of the fœtus. Then we must either pass cords around the skin that surrounds the thigh, or insert hooks into the skin, and draw the remainder of the fœtus out with its hind-legs under its belly, and so complete extraction."

Rueff proposes to detach the coxæ from the sacrum, by operating in the pelvis of the fœtus, and afterwards to extract the hind-limbs thus separated from the trunk. Others recommend symphyseotomy—an operation to be described hereafter.

When the fœtus is in the lumbo-pubic position, the same obstacles are encountered. Very often the hind-limbs are bent at the hocks, and these wedge against the floor of the sacrum. The same order of manœuvres has to be adopted. Retropulsion allows space to flex the upper joints, then extend the limbs. When extraction cannot be accomplished with the animal in a standing attitude, it should be placed on its back. When success does not attend the ordinary manipulations, then the hind-limbs of the fœtus must be disarticulated at the hocks, or higher.

In all manœuvres of this kind, great care must be exercised in preventing injury to the maternal organs by the feet of the young creature, or the jagged ends of bones; and while traction is being employed, the hand of the operator should be busy guiding these parts through the genital passage.

The smaller animals—Bitch, Sow, Ewe—may be delivered by the forceps, small crotchet, or the tube-noose to be hereafter described. The Cæsarean section may also, in extreme cases, be resorted to with the Bitch and Sow.

1. Cartwright (*Lecture on "Veterinary Obstetricy"*) was called to attend a Cow in parturition. It was a breech presentation, but the os uteri was only partially dilated, though by gentle manipulation it became tolerably widened. After much labour one hind-leg was raised, but for a long time the other could not be found. At length it was discovered, and, through great exertion, brought into its proper position and the calf extracted. In the course of the day the Cow died. The difficulty in this case was due to the fact that the main bulk of the fœtus lay in the body of the uterus, while one of the hind-legs lay fully extended in one of the uterine cornua, the opening into which was not far distant from the os, as was demonstrated on opening the Cow. All the time the assistant was striving to force the breech back, to obtain

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space to raise the leg, he was actually obstructing delivery by impacting the limb. Cording the hock, drawing it into the vagina as far as possible, and amputating the leg at that or the hip joint, would have been the proper procedure.

2. The same practitioner (*Veterinarian*, vol. xv., p. 374) was sent for to see a Cow which had been attempting to calve for a whole day. An examination proved it to be a case of posterior presentation, with the hind-legs down towards the udder. A cord was tied round each hock, an assistant pulled gently at the left one, while Cartwright attempted to reach the foot, but could not. The Cow, which had been standing, now lay down on the right side, and the hind-quarters were well raised by means of straw. An assistant pushed back the croup of the calf, while the operator seized the foot; but little advantage could be gained. The Cow being a "roomy" one, the assistant was now directed to firmly and steadily force the point of the hock forwards, while Cartwright pulled at the foot; in this way the latter was got up and brought straight into the passage. This limb being raised, more room was allowed to manipulate and adjust the other leg in the vagina. Both legs were now corded above the fetlock, the vagina was lubricated with oil, and traction begun. The passage was, however, so narrow that the calf could not be advanced; "we then fastened a necking strap from the hames around each leg just above the hock, by means of which it made more room to pull at and was nearer the parts. By severe pulling we got the hind-parts through; but when we arrived at the chest the passage was tighter than ever, and we almost despaired of accomplishing our object." A part of the cart-rope was finally tied round the body of the calf, by which means two men pulled with great effect, and delivery was completed. The Cow received gruel and brandy, and a truss was applied. Perfect recovery ensued.

3. Naylor (*Ibid.* vol. xxxiii., p. 323) examined a Mare in labour, and found the foal lying on its back with its hocks at the os uteri. With difficulty one limb was got forward and the other amputated at the hock-joint. A hook was placed within the pelvis of the foal, and both hind-limbs having been secured, with much exertion rotation was effected, the back of the young creature being upwards. Considerable force had to be employed in extracting the fœtus, during which the perinæum gave way. Though the laceration was sutured and the Mare placed under medical treatment, death occurred in two days.

Dystokia from the Head and Fore-limbs in the Posterior Presentation.

In posterior presentations, difficulties caused by the head or fore-limbs, or perhaps both, have sometimes to be overcome by the obstetrist.

With the fore-legs, the chief obstacle appears to be offered by the elbows. If these limbs are in a state of abduction, and the elbows widely separated from the body, these latter come in contact with the brim of the maternal pelvis, and jam against it: thus offering a formidable resistance to further progress.

The head does not so readily constitute an obstacle to birth, though in the posterior presentation, being the last portion of the fœtus to enter the passage, its widest part may become fixed either in the pelvic inlet, or be retained by the cervix uteri when this has happened to contract earlier than usual. This sometimes occurs with the calf and some of the smaller animals, but more especially puppies. Indeed, it is not very uncommon to witness Bitches with the hind part of the body of a puppy hanging from the vulva, the head being firmly wedged in the passage.

Indications.

This resistance may be overcome in some instances, and especially if the fœtus is dead, by considerable traction. In other cases, however, and more frequently when the fœtus is alive, this traction cannot be practised with impunity, so far as the fœtus, or even the mother, is concerned. Rotation of the fœtus is then to be recommended; and this is not difficult in carrying out, considering that a large portion of the body is already outside the vulva, and can be utilised in effecting the operation. The fore-limbs very often assume a favourable position for extraction during the movement. If rotation is not successful, embryotomy must be resorted to.

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With regard to the head, traction will also remove it from the genital canal: the body of the fœtus being moved alternately from side to side, and up and down, so as to engage the head in the passage by all its diameters.

With small animals, such as the Bitch, an emollient hip bath is very useful; as are also injections of warm water, oil, or glycerine into the vagina.

CHAPTER III.

Dystokia from Transverse Presentations.

The fœtus is said to be in a transverse position, when the hand of the obstetrist, instead of meeting with the anterior or posterior part of the body, comes in contact with the trunk, either by the shoulders, withers, sides, flanks, haunches, loins, back, sternum or belly, or (which is perhaps most frequent) all of the limbs collected together. The fœtus, instead of having its greater axis parallel to the pelvis of the mother, has it transverse, or more or less perpendicular to the antero-posterior diameter of the pelvic canal.

The possibility of the fœtus assuming a transverse position in the uterus has been denied on various occasions by Goubaux, who bases his objections on anatomo-physiological reasoning: contending that the uterus cannot contain the young creature when so placed, if the various dimensions of the latter be compared with those of the gravid organ. In the first place, however, it must be remembered that the uterus is not an unalterably-shaped body with rigid walls, but a membranous sac whose parietes are soft and yielding; and that its form may vary with the displacement of its contents: in a word, that its transverse diameter may be increased at the expense of its length. Besides, the fœtus itself is not a compact unyielding mass, but is so flexible that it may assume the most varied attitudes and shapes.

But the strongest proofs in favour of the possibility of such presentations are furnished by obstetrical experience: the facts published by a host of observers entirely demolishing the antagonistic theoretical notions. It may be noted, however, that though the presentations are justly designated transverse, yet the body of the fœtus is generally a little oblique in one direction or the other.

Though the transverse vertical or horizontal presentations are not altogether rare, yet they are much less common than the longitudinal presentations, and especially the anterior presentation. They do not appear to be primary, and they are more frequent in the Mare than the Cow—perhaps because of the more energetic contractions of the uterus in the former animal not allowing natural adjustment of the fœtus, should the latter not be exactly in a favourable position when labour commences. When the liquor amnii escapes prematurely, the deviation is still more likely to occur, and particularly if the os is not sufficiently dilated. Torsion of the uterus; spasm of the cervix; violent straining and disordered movements of the mother; deviation of some part of the fœtus—especially of the head; hydrocephalus, monosomianism, etc., have all been noted at times as a cause of transverse presentations. Deformed head may also lead to this presentation, especially if it is distorted, as in Fig. 84.

These presentations are essentially dystokial; as it is evident that the fœtus, if of normal size, cannot pass crossways or sideways through the pelvic canal,

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which barely affords space for its passage longitudinally. Birth, therefore, cannot take place without assistance; version must be practised in order to change the presentation, and one or other of the extremities of the oval mass which the body of the fœtus represents must be brought towards the inlet. The malpresentation, through hindering birth greatly, endangers the life of the young creature, and especially if it be a foal.

As mentioned at page 225, the transverse presentations of the body may be limited to two kinds: the *dorso-lumbar*, in which some part of the back presents at the inlet; and the *sterno-abdominal*, in which the lower part of the body (belly) offers. In the latter presentation, the limbs first enter the os and genital canal, and they may be two (a hind and fore), though more frequently three or all of them may be engaged; the head may or may not have passed into the inlet.

Dystokia from the Dorso-lumbar Presentation.

To diagnose this cause of dystokia—or back presentation—is not always easy. Labour has being going on for some time, the "waters" have escaped, and though the straining may be very energetic—even violent—yet nothing is seen of the fœtus. When the hand is introduced into the genital canal, in order to discover the situation of the fœtus and the nature of the obstacle which hinders birth, it encounters at first a more or less rounded surface, which does not offer any special character by which it might be recognised. The hand is then passed deeper into the uterine cavity, and turned in every direction over the body of the fœtus (for such it is), so as to find some parts which may be distinguished, and by which the position of the young creature in the uterus may be learned.

By this methodical exploration, the obstetrist recognises that the body of the fœtus is more or less curved in the back, one of the regions of which presents at the inlet; while the head and limbs, more or less entangled with each other, and more or less accessible to the hand, are directed towards the fundus of the uterus. It now remains to discover the region which first met the hand, and the following memoranda will assist in achieving this point. The *withers* are recognised by the prominences which the spinous processes form at this part; the thin wedge-shaped outline of the part; and the hair of the mane which, in the foal, ends here. The *lumbar* region may be distinguished by the large and almost level surface it offers; the projecting external and internal angles of the coxæ in its vicinity; the hollow of the flank leading to the thigh and stifle. The *dorsal* region, or *back*, is discovered by the arches of the ribs springing from each side, with the intercostal spaces.

Having diagnosed the presentation, the *position* must now be determined, and this is done by ascertaining the direction in which the head lies. With regard to this, we pointed out at page 226 that there were three positions of the fœtus: 1. The *cephalo-ilial positions*, two in number, in one of which the fœtus has the head directed towards the *right flank* of the mother (*right cephalo-ilial position*), and in the other towards the *left flank* (*left cephalo-ilial position*), the head and feet occupying the uterine cornua; while in the *cephalo-sacral position*, the fœtus looks as if seated on the *udder of the mother*, the head being directed forward, the mane towards the sacro-lumbar region of the dam.

It can scarcely be necessary to mention that the exact position of the fœtus should be ascertained before attempts at extraction are ventured upon; as this presentation is, in nearly every case, a very serious one, and only too frequently requires all the skill and judgment of the obstetrist to rectify. The gravity

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of the case will, however, much depend upon the period when the veterinary surgeon is called in, and the condition of the parturient animal. When sufficiently early in his attendance, however, a favourable result may often, if

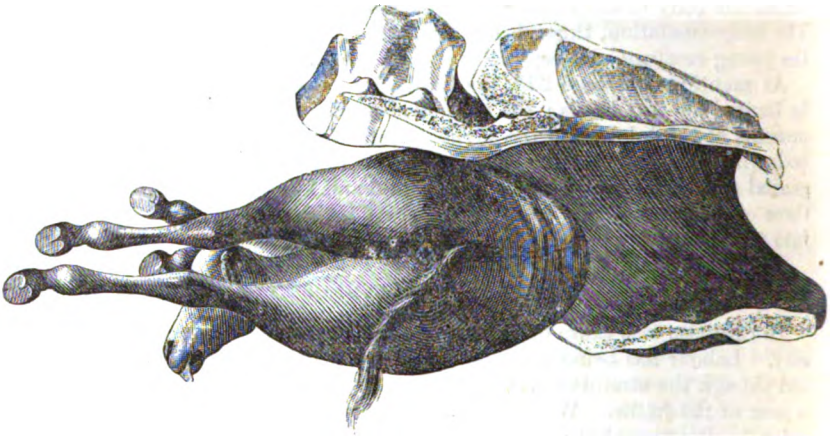

Fig. 139.

TRANSVERSE PRESENTATION: RIGHT CEPHALO-ILIAL POSITION—SIDE VIEW.

not always, be anticipated: the mother may be saved, and frequently the offspring—particularly in the Cow and Goat.

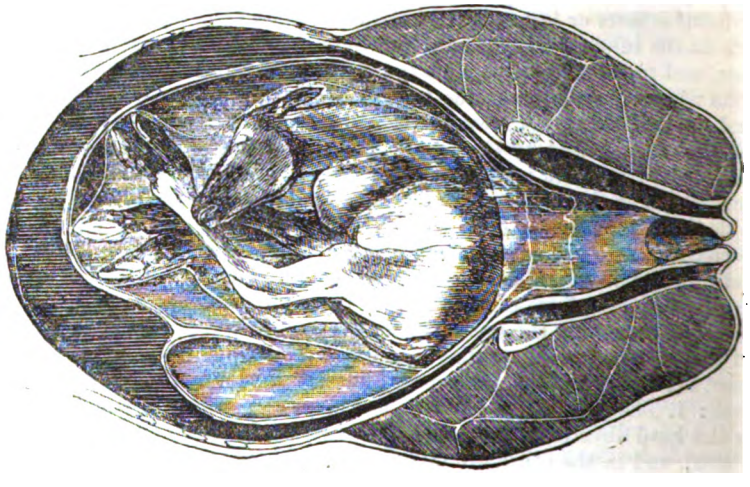

Fig. 140.

TRANSVERSE PRESENTATION: RIGHT CEPHALO-ILIAL POSITION—UPPER VIEW.

This favourable issue is due to the fact, that the presentation does not admit of the fœtus entering the inlet, and it therefore remains in the abdominal cavity, where there is space to manipulate it, and thus remedy the presenta-

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tion. The obstetrist, though he may have to contend with the paralysing and fatiguing uterine contractions, has not to overcome the wedging of the fœtus in the pelvic canal—so common in the defective anterior or posterior presentations.

Indications.

The principal indication in such cases is to convert the dorsal into an anterior or posterior presentation, according to circumstances. Hippocrates has well said, that the fœtus is like a cork which has fallen into a bottle, and which can only be extracted by one end or the other.

Certainly, the presentation offers serious difficulties, from the fact that there is nothing about the fœtus to lay hold of advantageously, or to which cords could be attached. In the majority of instances, a long interval has

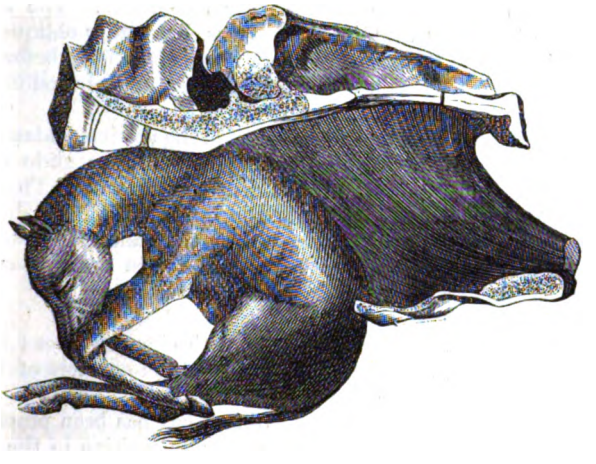

Fig. 141.

TRANSVERSE PRESENTATION: VERTICAL OR CEPHALO-SACRAL POSITION.

elapsed since parturition began; the "waters" have escaped, the genital canal is swollen and congested from the attempts of amateurs at delivery, the interior of the uterus is dry and adhesive, the organ lies as close to the fœtus as a glove does to the hand, and the parent is exhausted with unavailing straining, and perhaps maltreatment; though the most trifling manipulation in the uterus will excite it to the most vigorous contractions.

It is, ordinarily, in these circumstances that the veterinary surgeon is required to save mother and offspring. What, then, is the first, most urgent, and indeed the chief indication? This must be *version*. The presentation *must* be converted into an anterior or posterior one, and this at the expense of much patience, fatigue, and skill. But in what direction is version to be practised? Rainard lays it down, as a rule, that the extremities of the fœtus which are nearest the pelvis are those which should be brought into the inlet; and that if both ends of the fœtus are at about an equal distance from it, the anterior should be chosen, because it is the easiest for delivery. This rule, however, has not been recognised by the majority of the best authorities. On the contrary, experience, as well as theory, has demonstrated that

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in the majority of cases pelvic version is the most advantageous; inasmuch as, when this has been effected, there are only the hind-limbs of the young creature to deal with, whereas in anterior version there is the head in addition to the fore-legs, and this may offer difficulties which have not to be dreaded in the posterior presentation—more especially if there is anything abnormal in the condition of the head. Not unfrequently, and particularly when the fœtus is yet alive and vigorous, a kind of spontaneous evolution is effected in an unexpected direction; for it has been found that, in acting on the croup of the fœtus, this has, by energetic movements of its own, and coincident with sudden contractions of the uterus, described nearly a half-circle; so that instead of the loins being under the hand, the withers and upper part of the neck are encountered, and delivery is readily accomplished.

Before version is attempted, the intra-uterine injection of emollient fluids should be practised; this is most essential if the waters have escaped for some time. Then retropulsion must be had recourse to. The fœtus must not be pushed directly forward into the uterus, but rather obliquely, and in a direction the opposite to that of the part we wish to bring before the inlet. The hand or repeller must be used for this purpose, and as version is difficult, so must the intra-uterine injections be frequent.

The retropulsion and injection, together with the uterine contractions, have the effect, in many cases, of making the body of the fœtus glide around the inner surface of the uterus, until a convenient part presents. Then the limbs and head—if they are required, or only the hind-limbs, if it should be so decided—are brought into the genital canal by the hand or by cords. If the occasion demands it, rotation may be resorted to, in order to convert the vertebro-ilial position into the vertebro-sacral or vertebro-pubic. Delivery is completed by moderate traction.

The manipulations will, of course, vary with circumstances; but it will generally be found that, in all cases, raising the hind-quarters of the mother will render them much easier of accomplishment.

When these manœuvres have failed, embryotomy has been practised. The intestines and other organs can be extracted by an incision in the flank; the vertebræ may be divided at the presenting part, and the entire body cut through at this division; then each half can be extracted in the best and easiest manner possible.

The following are a few illustrative cases of this presentation:

1. Lecoq (*Mém. de la Societé Vétérinaire du Calvados*, No. vi.), in 1824, was summoned to assist a Mare in parturition. The "waters" had escaped three hours previously. On the hand being introduced into the uterus, an undistinguishable mass was encountered. After a long exploration the withers and mane were distinguished, and it was ascertained that the fœtus was almost in a sitting attitude, the head and neck curved upwards and forwards towards the sacro-lumbar region of the mother. A sharp hook was fixed about an inch in depth in the middle portion of the neck, near its upper margin; the handle was given to an assistant, while Lecoq placed his hand, in supination, a little higher than the withers. The fœtus was carried towards the fundus of the uterus by pulling at the hook. Either through this traction, or perhaps owing to the pain caused by the hook, the fœtus made a sudden movement which, seconded by the hand of the operator, produced a somewhat considerable displacement. . . . The crotchet was again fixed towards the neck, but only through the skin. Slight traction was made, while the hand, resting on the upper and anterior part of the shoulder, pushed it sufficiently to allow the top of the head to be reached, then the lower jaw; so that the foal was brought into the vertebro-pubic position, anterior presentation, and delivery was effected.

The foal was born alive—an unusual circumstance in such a protracted labour, and the wounds made by the crotchet had healed in eight days.

2. Saint-Cyr (*Op. cit.*, p. 501) reports that, in 1852, a female Ass, aged six years,

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was brought to the Lyons Veterinary School. It was twelve days over its time of foaling, and eight days before its admission it had shown the first symptoms of parturition, but nothing appeared; the labour-pains had nearly ceased, but every day the creature was becoming more enfeebled. It was in a very unfavourable condition when examined; from the vulva escaped an extremely fœtid brownish fluid. A uterine exploration established the fact that there was a dead and putrefying fœtus; it was lying on the right side, the body very much curved; the limbs were entangled and could be touched towards the left flank; the head was placed on the left side of the chest, where it could also be felt; the back lay in front of the inlet, into which no part of the fœtus was engaged. The uterine contractions were feeble.

The case being diagnosed as a back presentation, right cephalo-ilial position, version was decided upon. Placing the open hand upon the withers, the body of the fœtus was energetically pushed forward, downward, and to the right. After several fruitless efforts, the fœtal mass began to move on the lower surface of the uterus in the direction indicated, and in this way changed the position, as well as the presentation: the croup being brought towards the inlet, while the withers were farther removed from it; the body had begun a rotation movement, for the belly, which had been forward, now looked obliquely upward; while the hind-limbs, which were more accessible to the hand, were near the sacro-vertebral angle. The left hind-pastern was corded and brought into the vagina, then the right, which was situated deeper. The body of the foal was now pushed to the right, while assistants, pulling at the cords as they were ordered, drew it into the axis of the pelvis by drawing a little towards the right. Under the influence of these combined efforts, the limbs were extended in the pelvic canal, the fœtus turned round—the withers advancing towards the fundus of the uterus, the croup entering the inlet; while at the same time the whole body, rotating on its axis, assumed the lumbo-pubic position. The fœtus was, consequently, in this position, posterior presentation; there was nothing to hinder its extraction, and this was accomplished by a few well-managed pulls. The entire operation did not occupy more than a quarter of an hour. Unfortunately, however, the Ass was in a sinking condition when brought to the school; the fœtus and its envelopes were decomposed, and the genital canal was violently inflamed. No wonder, then, that three and a half days after delivery, and notwithstanding the greatest care, the poor creature died from the combined effects of metro-peritonitis and septikæmia.

3. Thierry (*Recueil de Méd. Vétérinaire*, 1874, p. 762) attended a Cow seventeen days beyond its period of calving, and which had been in labour for some time, but nothing had appeared; an empiric had been called in, but he could find nothing save the back. The Cow was lying, back arched, and making violent and almost continuous efforts. On exploration the back of a large-sized fœtus was found; the creature seemed to be lying on the right side, its body greatly curved, the head and fore-legs situated in the right flank, and the tail and hind-legs in the left flank. Pushing the hand deeper, the posterior ribs and left flank of the fœtus were felt; to the right the shoulder could not be reached; but to the left, the left stifle was discovered. The calf had evidently been dead for some days, as the skin came away in shreds, as well as the envelopes.

By the right hand a corded crotchet was fixed in the lower part of the left flank, close to the stifle; by the left hand another very long solid crotchet was fixed in the costal region, as near as possible to the shoulder, and twisted round several times. With the latter an assistant was to push the fœtus forwards, while another assistant pulled towards him with the corded crotchet, with the view of bringing the fœtus into the posterior presentation. At the same time that the assistants executed this task, Thierry pushed his left arm as far as possible towards the left flank of the Cow, and after great exertion got hold of the left hock. Gradually the excessively violent contractions of the uterus enabled him to secure the hind-foot and bring it into the passage, but the right foot could not be touched. A cord was attached to the hind-pastern, and, withdrawing the crotchets, several people pulled at it and brought the limb beyond the vulva; the tail being now seized, powerful traction was combined with the expulsive efforts of the mother.

The right limb, however, was still an obstacle to birth; the attempts at extraction had occupied two hours and a half, and the Cow had stood all the time; now, however, it fell, and the leg of the fœtus secured outside the vulva tore away from the pelvis. A strong cord was passed through the left foramen ovale, and the long solid crotchet was inserted in the loins, towards the thirteenth rib; while another smaller hook was fixed in front of the pubis. By these means an enormous, but well-formed calf, was soon brought away.

With careful subsequent treatment, the Cow quite recovered.

4. Wernert (*Bulletin de la Soc. Centrale de Méd. Vétérinaire*, 1877, p. 74) reports the

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case of a Cow which, during the later period of pregnancy especially, had the belly so large that it was supposed to have twins. The fœtus could be seen moving at the left and right flank, but when the period of gestation had expired an accident caused its death. Parturition commenced, but the efforts were not vigorous; the position of the fœtus could not be ascertained by the farm-people. The Cow lay on its left side, and Wernert, exploring the vagina and uterus, found only the back of the calf; to the right, at the level of the ilium, the tail and buttock were discovered, and to the left, on the same level, the withers and ridge of the neck. Neither feet nor head could be reached, nor yet the elbows or hocks; the umbilical cord was not to be found. Mutation upwards was attempted, with a view to placing the fœtus on its belly; with great difficulty a knee was seized, and this was secured by a cord. Pushing on the spine with the right hand, and pulling at the same time with the left hand on the fixed limb, the operator contrived to effect a slight version, which allowed him to get hold of another foot by the claws. Exhausted by his efforts, Wernert was obliged to desist for half-an-hour. At this period a hind and fore-limb had been brought into the passage; beyond, in front of, and across the pelvis, were a haunch, the back, and the withers. Resuming his efforts, the secured limbs were strongly pulled at, and exploration discovered the other knee and the second hock accessible to the hand; these were flexed and brought into the vagina. In this new position the calf had executed a complete half-turn forward and upward: from the left side, the limbs in front, it was placed on the right side with the limbs behind, the tail being still to the right and withers to the left. At this moment, and for the first time, the head could be felt beneath the belly of the calf, the neck being bent between the limbs and resting on the sternum. The cord was taken off the hind-limb and fixed on the second fore-leg; the hind-limbs were bent, and pushed back as far as possible into the uterus; the neck was straightened, the head properly placed, and the lower jaw corded. Powerful traction then brought away the calf, which was very large and much swollen by infiltration, presenting, as it did, evidences of advanced decomposition. The Cow died the following day; though the cause of death is not mentioned.

Dystokia from the Sterno-abdominal Presentation.

The sterno-abdominal presentation is a rather common one, particularly in the Mare. The fœtus is lying on its side, with the sterno-abdominal region and crossed limbs—either flexed or extended—presenting at the inlet or engaged in the passage, while the dorsal region is towards the fundus of the uterus.

There is no difficulty in discovering this malpresentation, the hand encountering the feet—usually all four—in the uterus, and generally two or more of them in the canal. Nevertheless, as we have two positions in the presentation, it is necessary to distinguish which of them we may have to deal with. The situation of the head, of course, defines the position; so that we may have a *right cephalo-ilial*, in which the fœtus is lying on its left side, the head directed towards the right flank of the mother; and a *left cephalo-ilial*, the reverse of the preceding. In the majority of cases, either the hind or the fore part of the body is nearest the inlet; so that the limbs belonging to one part are more advanced than those of the other. When the head can be felt there is, of course, no difficulty in distinguishing the position, but generally the head is beyond reach.

Then the position must be ascertained by a careful examination of the limbs, before any attempt at mutation is made; and in this we have to distinguish between the fore and the hind-legs, as these alone can inform us as to the situation of the head, this being always of course in the direction of the anterior limbs. In order to be able to do this, retropulsion has often to be employed.

We have mentioned that the limbs are always the first to appear at the inlet in this presentation, and that four, three, or only two may be engaged—the others being flexed and retained beneath the body of the fœtus. When only two limbs are at the inlet, they are necessarily a hind and fore. The head

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may or may not accompany the presenting limbs, or lie so deep in the uterus as to be inaccessible to the hand of the obstetrist.

From this circumstance, there are eight varieties in this presentation, all of which are, nevertheless, fundamentally the same. They are as follows: (1) Hind and fore-limb presenting, with or (2) without the head; (3) Two fore and a hind-limb, with or (4) without the head; (5) A fore and two hind-limbs, with or (6) without the head; (7) All the limbs, with or (8) without the head.

A very careful examination will lead to the discovery of the fore and hind limbs, should the head not be within reach. We have already pointed out how they may be distinguished by the hand. But in this presentation it has

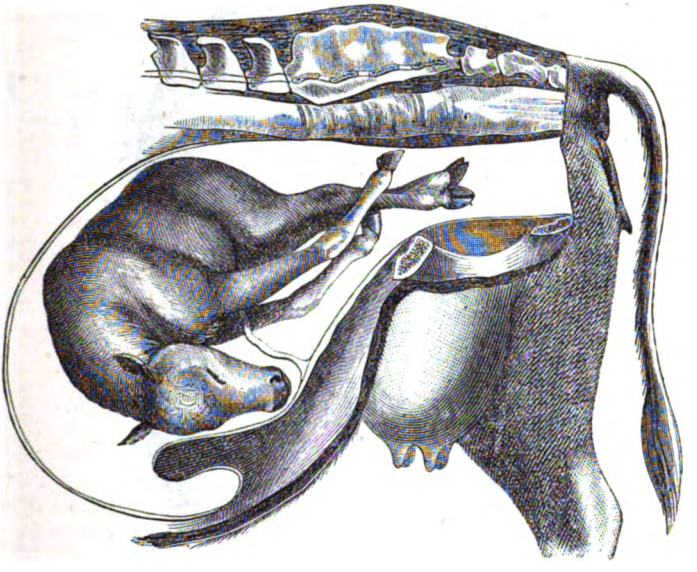

Fig. 142.

STERNO-ABDOMINAL PRESENTATION, HEAD RETAINED: CALF.

to be remembered that, when they are engaged in the genital canal, they cross —the hind crossing the fore-limbs in such a way that the latter are directed towards the hinder part of the body of the fœtus, and the former towards the anterior region. The hind and fore-feet, when engaged, may also be some distance forward, should one end of the body be nearer the inlet than the other.

Indications.

In the opinion of some obstetrists, this is one of the most serious presentations the veterinary surgeon can meet with; while others assert that it is not so formidable. The gravity of the case will depend, as in some of the other presentations, on circumstances, which we need not here again allude to.

When the limbs have been distinguished, it is a good plan to secure them by cords specially marked either by coloured tape or knots, so that the operator may know which are the hind and which the fore-legs.

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As delivery is impossible so long as the young creature remains in this presentation, the first indication is *version*. This should be so effected as to bring the hind-quarters of the fœtus, if possible, towards the inlet—convert the presentation into a posterior one, and the lumbo-sacral or lumbo-pubic position. The reason for preferring this to the anterior presentation, is that we have only two members to deal with; whereas, in the latter, we have three, one of which is the head, and this is only too frequently difficult, if not impossible, to secure.

In order to effect posterior version, the hind-feet are corded; if only one is

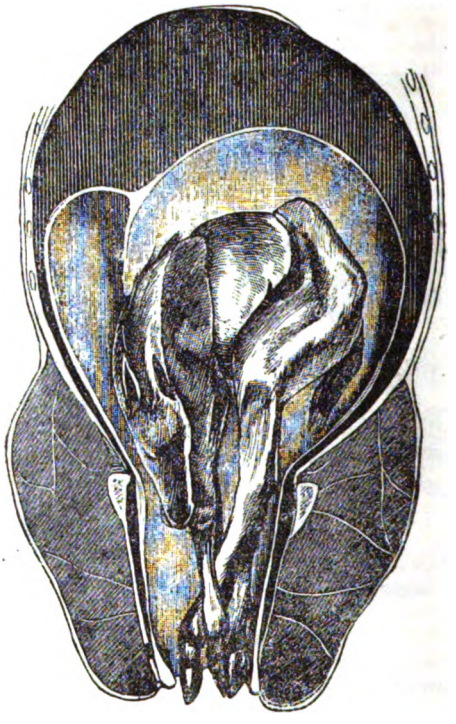

Fig. 143.

STERNO-ABDOMINAL PRESENTATION, HEAD AND FEET ENGAGED: FOAL.

in the passage, the case is then troublesome, but the missing one must be sought for, brought into the vagina in the manner already explained, and secured—the cords being given to assistants. If the head is engaged in the passage, it must be pushed through the inlet, and as far as possible into the uterus. It is recommended by some authorities to push the fore-limbs as well into the abdomen, and in some cases, when the fœtus is small and short-limbed, and the maternal pelvis roomy, this can be done. But, as a rule, it is not advisable to attempt it, for the simple reason that they become jammed either against the sacrum, ilium, or pubis of the mother; and if traction is then resorted to, rupture of the uterus will be the result. But if this

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does not happen, the straining of the mother only too frequently throws the returned limbs again into the passage immediately.

Therefore it is that Donnarieix, after much successful experience of the plan, advises that the fore-limbs be corded, brought one after another as far as possible into the passage by slow and gradual, yet firm pulling, and disarticulated at the elbow-joint.

Fig. 144.

DARREAU'S OLIVE-SHAPED REPELLER.

Darreau, however, either from want of practice in this method, or the difficulty in practising it, only succeeded in amputating the limbs after great trouble; and even then the operation was generally followed by serious, sometimes fatal, accidents. He therefore adopted the following method, which he declares has yielded excellent results. After cording the hind-limbs, an olive-shaped repeller, armed with a noosed cord (Fig. 144), is attached to each of the fore-pasterns, the cord passing through a ring in the handle. This cord is drawn tightly around the pastern, and the free end fastened to the handle of the instrument. By this means each repeller becomes a solid fixture to the fore-limbs, and it is confided to an assistant. The operator then pushes back the fore-limbs as far as possible, while each assistant seconds his efforts with the repellers. When all has been conveniently adjusted, traction is made on the hind-limbs, the repellers still being employed to overcome the resistance of the fœtus, and follow its movements.

These instruments, however, are not always, nor yet often, at hand; and there can be no doubt that retropulsion may be employed by the hand, with care, and often successfully, especially with the calf, whose limbs are comparatively short.

But cases may occur in which *anterior version* may be preferable, and particularly when the head and fore-limbs are most engaged in the pelvic canal; many instances are recorded in which it has been resorted to with perfect success.

Then the hind-limbs must be pushed into the uterus, after being corded; and this retropulsion may be greatly aided by the cords previously fixed on them, as these can be run through the porte-cords, which may then be employed as repellers, as with Darreau's olive-shaped repeller.

In some instances, retropulsion and version are impossible; and should the fœtus be dead, there ought to be no hesitation in resorting to embryotomy. It will generally be found the best plan to remove the fore-limbs subcutaneously, either at the knee or elbow-joints—the lower part of the legs being removed, the remaining portion can be more readily pushed back into the uterus.

1. Gierer (*Oesterr. Vierteljahrschrift*, 1867, p. 84) attended a Mare which could not foal, and it was thought the fœtus was a monstrosity, from all the feet being in the passage. Gierer found the animal lying on the left side, the vulva greatly swollen, and the vaginal mucous membrane dark-coloured. The feet of the fœtus projected about five inches beyond the vulva, and a close inspection of them led to the discovery that the two fore ones were in the upper angle of the vulvular opening, the hind ones on the floor of the vagina; a cross presentation was, therefore, diagnosed, the fore part of the fœtus lying to the left, the hinder parts to the right in the uterus. It was decided to perform version, and convert the presentation into a posterior one; for this purpose it was deemed necessary to excise the fore-limbs at the knee. This was done subcu-

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taneously, from the fetlock to the knee, the skin being preserved to cover the end of the arm-bones. No difficulty was experienced in pushing the remaining portion of the fore-legs into the uterus; but great trouble was experienced with the hind-limbs, as they could not be withdrawn, though traction had been exerted on them by six strong men. The foal was extracted as far as the hocks, and then remained in a lateral position, and it seemed as if the Mare could have been more easily moved by pulling than the young creature; the left side of the croup and tail of the latter was wedged in the pelvic canal. Through energetic and steady pulling, however, the foal was at last extracted. The head was found to be of a concavo-convex shape, as in Fig. 85, and this deformity was evidently the cause of the malposition. The Mare recovered.

2. The same authority (*Ibid.* 1871, p. 130) mentions that he was called to a fine and valuable Mare which had been in labour for ten hours, but no progress had been made in birth. On his arrival he found that the foal was dead; that the four limbs were crossed on each other, and projected beyond the vulva as far as the fetlocks. Gierer decided to push the fore part of the foal into the uterus, and deliver by the posterior presentation. The fore-limbs were skinned as high as the knees and removed at these joints, the skin being here also used to cover the cut surface, so as to prevent injury to the maternal organs. The stumps were with great difficulty thrust forward into the uterus; then the hind-limbs were energetically pulled at, after the tail of the foal had been brought into the passage, and delivery was at length accomplished. During the operation the Mare lay a good deal; it rested for seven days before recovery took place.

3. In the *Compte rendu* of the Brussels Veterinary School for 1872–73 (*Annales de Méd. Vétérinaire de Bruxelles*, 1874, p. 389), Degive describes two cases of this presentation. The first occurred with a heavy draught Mare, eight years old, which had been eighteen hours in labour, and had been roughly handled by incompetent persons. It was brought into the school infirmary, where it appeared somewhat prostrated, but it did not make any expulsive efforts. Two feet of the fœtus were apparent in the vulvular opening. The vulva was swollen, and the vaginal mucous membrane was deeply congested and abraded, an abundant dirty-red fluid escaping from the opening. On exploring the canal the fœtus was found to be dead, its fore-limbs in the passage and their feet beyond the vulva. One of the hind-limbs was directed slightly upward, backward, and to the right, and lay against the side of the maternal pelvis; the other hind-limbs, not so advanced, lay on the left, and the foot was jammed against the brim of the pubis. The base of the neck could be felt, and the head seemed to be curved obliquely forward, upwards, and a little to the left. The case was deemed a serious, if not a hopeless, one, particularly because of the Mare's exhaustion.

Attempts were made to straighten the neck, by first cording the protruded fore-feet, trying to push the hind ones into the uterus, and bringing the head forward: the Mare at one time standing, at another lying with the hind-quarters raised. These attempts were futile, and as it was considered impossible to rectify the direction of the head and neck, it was sought to convert the presentation into a posterior one. This also was a failure, and even the fore-limbs could not be returned into the uterus. Excision of the latter was therefore decided upon, and it was executed by making a circular incision around the fetlock, then a longitudinal incision through the skin from the fetlock to the shoulder on the inside of one limb, outside of the other for convenience; the legs were now torn off, after dividing the pectoral muscles and some of those at the neck and withers. The fœtus was then easily extracted by pulling at the hind-feet. The Mare rapidly sank, however, and died in about an hour afterwards. The uterus was found to be ruptured. The head of the fœtus was distorted laterally, and the neck was also deviated, depressed, and atrophied on the side to which the head was bent: deformities which had evidently occurred some time before birth. The attempts at extraction of the fœtus had occupied three and a half hours, the greater part of the time having been devoted to version attempts, and trying to straighten the neck. Failure was attributed to retraction and loss of elasticity in the uterus, and the fœtus being dead. It is admitted that a different result might have been attained had the fore-limbs been amputated earlier: this operation being always easy, and generally followed by great advantages.

In the second case the presentation was the same, but the Mare was not nearly so exhausted, having been only a few hours in labour; it had also escaped the maltreatment of amateurs. It was soon discovered that the head of the fœtus could not be adjusted, and that version was impossible; ablation of the fore-limbs was therefore resorted to early, and carried out as in the other case. Extraction of the fœtus was soon accomplished, and in five days the Mare was convalescent.

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4. Recordon (*Recueil de Méd. Vétérinaire*, 1877, p. 26) was called to assist a Cow in parturition. Before his arrival it had already given birth to a living and well-formed calf without any difficulty, and in the normal position. The Cow was lying on the left side, making a few expulsive efforts; all the limbs presented, the body of the Calf was horizontal—transversal to the greater axis of the uterus; it lay on the right side, the head turned back in the left flank of the mother, the hind-quarters corresponding to the right flank. The head could be reached with great difficulty, and the belly was the only part that was readily accessible. The calf being dead, embryotomy was had recourse to, as no change could be effected in the position of the fœtus. A bistoury *cachée* in the right hand removed the left shoulder of the calf in about ten minutes, and this reduction in volume allowed the head to be reached and brought towards the inlet, but it could not be brought into it. The abdomen was opened throughout its length, and the asternal ribs cut across; the viscera were then removed, and the great reduction in volume which resulted permitted the head to be seized and carried outside the vulva; slight traction on the head and fore-limbs caused the immediate expulsion of the fœtus; but to the astonishment of the operator and his assistants, a third calf appeared in the natural presentation; this was born in its envelopes, though it was dead. So that of the three calves, two were in the normal presentation, and the other was horizontal and transversal. The Cow did weil, rumination having recommenced next day.

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BOOK III.

OBSTETRIC OPERATIONS.

In the various malpresentations and malpositions, as well as for the other causes of dystokia already enumerated, the indications for adjustment and extraction were alluded to and described at sufficient length, and the means to be adopted for carrying them out were likewise mentioned. It was shown that, in many cases, it is sufficient to correct the abnormal presentation or position, and rectify the deviation of limbs, neck, or head, to effect delivery in the ordinary manner by means of the hand alone. For, as has well been said, the practised hand is the best and most perfect of all instruments, and it can effect in obstetrical operations what no instrument is competent to achieve. Therefore it is that an operator with a long and powerful arm, and a small hand, with strong fingers, possesses many advantages as an obstetrist, and is in a better position to afford relief than one with a short arm and large hand—especially in the correction of those deviations which are so frequent, and oftentimes so baffling.

Extraction by the hand alone may be effected in many cases of difficult parturition, when these rectifications have been made; though even then it is essential that the os uteri be fully dilated, the vagina and vulva dilatable, and sufficiently prepared to allow the young creature to pass through; it is likewise necessary that such a relationship in proportions, between the volume of the fœtus and the capacity of the pelvis, should exist, that extraction can be accomplished without much difficulty. Finally, it is particularly desirable that the uterus retain its contractile power, and that its regular contractions second the efforts of the operator.

In only too many cases of dystokia, however, one or more of these conditions are absent, and the unaided hand—no matter whether it be ever so well endowed and practised—fails to effect delivery: so that, in order to overcome the difficulties, recourse must be had to various surgical instruments and appliances, and there must be practised, either on the mother or fœtus, more or less complicated and serious operations, which demand strength, expertness, and an accurate knowledge of anatomy and physiology, and even of mechanics, in addition to a thorough acquaintance with surgical pathology. Some of the obstetrical operations have already received attention from us; but it is necessary to study them as a whole, in order to master their special features, and particularly the manner in which they are performed; as upon the exactness of our knowledge with regard to them, will generally depend their successful results.

These operations have for their object either to supplement the forces of nature, which are insufficient to secure the birth of the young creature; to diminish the size of the latter when it is either too large, too deformed, or too deviated or distorted, to pass through the maternal passages; to enlarge the latter, or to extract the fœtus by an artificial passage, when these last do not admit of extraction. This leads to a consideration (1) of the *Mechanical means of extraction of the fœtus;* (2) *Embryotomy*, or *extraction by mutilation of the fœtus;* (3) *Vaginal hysterotomy;* (4) *Gastro-hysterotomy* or the *Cæsarean Section;* (5) *Symphysiotomy.* In all these operations the obstetrist requires the aid of assistants, who only too often have to be instructed in the part they are called upon to perform, at the very moment their services are required.

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CHAPTER I.

Mechanical Means for the Extraction of the Fœtus.

MECHANICAL means for the extraction of the fœtus are required when the expulsive efforts of the parent, and perhaps the hands of the obstetrist, are insufficient to produce delivery. These means have for their object the application to the fœtus of extractive force sufficient to overcome the resistance offered by the obstacle to birth; they comprise a number of articles, the chief of which are *cords*, *crotchets* (*hooks*), and *forceps* of various kinds. The uses and advantages of these we will now notice. But before doing this, we must again point out the great advantage, should the "waters" have escaped, and the genital canal and interior of the uterus be dry and tenacious, of moistening these parts well before resorting to the mechanical means. Tepid emollient fluids, such as oil, glycerine and water, bran water, soap and water, or even water alone, should be plentifully introduced, either by a syringe, a simple tun-dish or funnel to which a long piece of india-rubber or leather tubing is attached, or a bladder tied to a tube. A stomach pump, or the common enema syringe, the pipe of which is attached to a piece of tubing, the other end of the latter being tied to the body of the instrument, enables the operator to carry the water, or lubricating fluid, into the uterus and around the body of the fœtus. By raising the hind quarters of the animal sufficiently high, the fluid gravitates to the interior of the cavity. With the Bitch and other small animals, a tepid bath, as well as injections, may be resorted to.

Cords and Bands.

Cords and bands are, of all mechanical means, the most useful in veterinary obstetricy, and are more to the animal obstetrist than the forceps are to the human obstetrist. They have the additional advantage that they are readily procurable everywhere, are cheap, very portable, and can be employed where and when the other means are inapplicable. Owing to their pliability, they can be pulled in any direction desirable, without much danger of injury to the maternal organs. In all cases of difficult parturition, it is an axiom with the experienced veterinary obstetrist that the first thing to be done is to cord the presenting limbs; or if they do not present, to seek for and cord them as soon as possible. When this is done, then they may be returned to the uterus, or put out of the way, as the cords will always bring them to hand again when required. While they are admirably adapted for exercising traction upon, they may also in certain cases be of great utility in changing a malposition of the fœtus, as we have already shown in our illustrative examples, and particularly in Darreau's method of mutation by means of cords applied by the porte-cord to the pasterns (page 487).

They are used with the view of applying traction to the fœtus, and they can be attached to the head, body, limbs, or tail, according to circumstances. The limbs are more particularly the parts upon which they can be most usefully employed, because of the length and solidity of these, the facility with which they can be seized, and the prominences of the joints and hoofs, which prevent the cords from slipping. The head cannot be so advantageously "corded," though it is a most important region of the body to secure in certain cases. The neck can be corded, as can also the loins and croup, as already shown.

The cords vary in thickness and length; they are usually about five or six feet long, though they may be nine or ten feet; and, if spun rope, from

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quarter to half-inch or more thick. At one end is a small loop, or iron ring, by which to form a running noose (Figs. 145, 146, 149). Some practitioners recommend strands of Manilla hemp, and in particular instances, as when a somewhat rigid loop is required, it is very useful to have a long piece of copper wire twined in the cord or hemp. Other obstetrists prefer a leather band.

The Manilla hemp, and web or leather band, are resorted to in order to prevent damage to the fœtus during traction—the cords, from their hardness, thinness, and strands, being liable to cut. But this accident need not be much feared, and the durability, convenience, and other advantages possessed by the cords, are greatly in their favour. They retain their hold better than anything else, and particularly if they have only a simple loop at the end, instead of an iron ring.

Whatever is used for this purpose should be very pliable, and yet sufficiently strong to withstand energetic pulling. A very good cord is that used by Schaack.

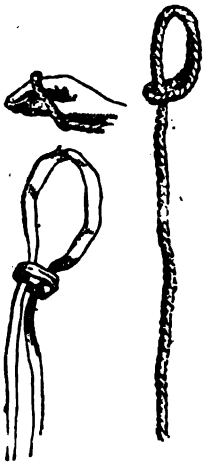

Fig. 145.

TRACTION CORD AND BAND, AND THE MANNER OF APPLYING THEM.

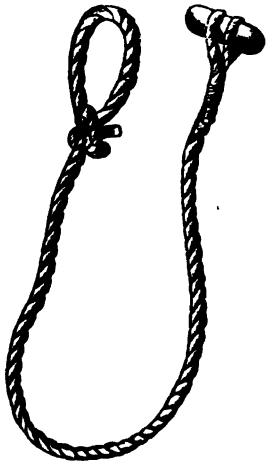

Fig. 146.

SCHAACK'S TRACTION CORD.

This is merely a cord with a running noose at one end, and a small piece of round wood at the other, to give the assistant a better hold, and enable him to use more force (Fig. 146).

When cords are employed on the limbs, they are generally applied to the pasterns, as these parts are most accessible, and afford the most secure hold. They can also be applied above the knees and hocks, when it is necessary to amputate the limbs at these joints. The head may be secured around the lower jaw, though this does not afford a very secure hold. It is better to pass the noose into the mouth and around the top of the head, like a gag-rope.

When the cords are to be applied to the limbs, either of two modes can be resorted to with this object. If the limb is bent, it must be extended and brought opposite the inlet, or into the genital canal, as the case may be. Then Rainard recommends that the fingers be gathered together and

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slightly bent, so as to form a kind of cone, on which the running noose of the cord—sufficiently wide to pass over the foot of the fœtus—is placed, as in fig. 145. The noose is kept in its place on the fingers, in tightening the cord by the free portion which passes along the under side of the hand and arm; unless this precaution is adopted, the noose will be pushed back over the hand when introduced into the vagina, and cannot easily be got forward again. The hand and cord being oiled, are introduced into the passage, and when the foot is reached it is seized in the fingers; these are then suddenly bent, so as to shorten the cone and cause the noose to run on to the pastern by a gentle pull of the cord, which can then be tightened and given to an assistant.

The other method, which is Schaack's, and by some obstetrists considered preferable to that just described, consists in placing the middle of the noose on the dorsal aspect of the ends of the two middle fingers, the finger on each side holding it against these, while the thumb keeps it in the palm of the hand (Fig. 155). The left hand maintains the cord sufficiently tense to assist in keeping the noose on the hand; and if the part of the cord which runs through the loop is placed towards the thumb, the latter can readily increase the size of the noose. The hand is passed into the vagina sideways, the little finger downwards, and when the foot is reached, the thumb and index finger are placed within the noose, which they enlarge in separating from each other, while the remaining fingers, flexing on the hand, are passed around the foot, and cause the noose to glide over the hoof on to the pastern. The fingers now press on the loop, while the other hand, drawing at the cord outside the vulva, tightens the noose around the limb.

When the limb is flexed and cannot be extended, as at the knee or hock, the looped cord may be employed; though a long cord, doubled, will be found to answer very well. This is passed round the flexure, the doubled end pulled to the vulva, and the other end passed through it; this done, the loop may be tightened, passed up to the elbow or stifle, or down to the pastern.

The lower jaw is "corded" in a similar manner; the mouth of the fœtus being opened, the noose is passed around the neck of the jaw, and the knot or loop placed beneath the chin.

As we have already remarked, when treating of certain presentations, in some cases in which the use of cords is urgently indicated, the arm is not sufficiently long to pass them to the region where they may be most effectively employed; while the energetic uterine contractions paralyse the hand, and often prevent it manipulating accessible parts which it is desirable to secure by these means. In these cases, the *porte-cord* is of great service. These porte-cords are of two kinds—*straight* and *curved*.

The *straight* porte-cord is a rod of three-eight inch iron, about three feet in length, a handle at one end, and an eyelet at the other, to receive the cord (figs. 147, 148).

The *curved* porte-cord has the end through which the cord passes more or less bent or curved, and in certain cases it is more useful than the straight one, from which it only differs in this curvature (Figs. 149, 150).

We have already, at page 451, described another form of curved porte-cord introduced by Binz, so large that it can be passed round the doubled neck of the fœtus, while its shortness allows it to be easily manipulated in the uterus. It is from twelve to sixteen inches long, and made of wood or iron; at the bent end is an opening through which the cord passes. The instrument (named a *geburtssonde* by the Germans) is passed to the middle of the cord, and may then be introduced into the uterus, where, from its curva-

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ture and its shortness, it can be pushed behind or between the limbs, in the double of a bent neck, etc. The hand seeks the one half of the cord on the opposite side of the part, and pulls it into the vagina; the instrument is then withdrawn, and the part is ready to be pulled at by the cord left encircling it.

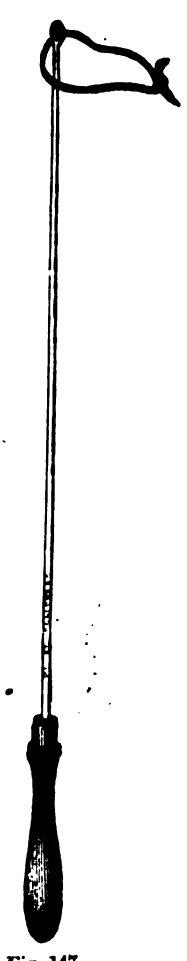

Fig. 147.

CARTWRIGHT'S PORTE-CORD.

Fig. 148.

DARREAU'S PORTE-CORD.

Fig. 149.

GUNTHER'S CURVED PORTE-CORD AND BLUNT CROTCHET, ARMED WITH A CORD AND RING.

Fig. 150.

DARREAU'S CURVED PORTE-CORD.

Tyvaert (*Annales de Med. Vétérinaire*, June, 1876, p. 320) has for a long time made profitable use of a simple porte-cord. This is composed of a somewhat short piece of iron wire, about the thickness of a goose-quill, and bent a little round, the length and curve varying with the part to be secured. One end is turned to form a small ring, while the other is bent to make a

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hook, a little longer than wide. A cord being attached to the ring end, the wire is passed round the part it is sought to seize; the hook end remains free, and afterwards receives the traction cord, serving to form a running noose on the part. This porte-cord is very simple, and may be made on the spot when required; it has proved most useful for securing the neck or hocks.

Gunther (*Handbuch der praktischen Veterinär Geburtshülfe*) has proposed a complicated porte-cord, not unlike a long "ball-gun," and provided at the end with two jaws, which hold the cord, and release it when necessary by means of a spring at the handle.

An ordinary walking-stick may, on an emergency, and by a little ingenuity, be readily made to serve as a useful porte-cord—the bent handle of the stick being utilised as the curve.

The *straight* porte-cord, when required to be used, has the cord passed through the eyelet at the end, the noose remaining beyond the end, and of sufficient size to pass over the foot, or around the neck of the lower jaw, as in figure 144. One hand is introduced into the noose in either of the ways already indicated, while the other hand seizes the handle of the instrument, which is then introduced into the genital canal—the hand with the noose preceding it. When the foot or jaw is reached, the noose is slipped over it, and tightened by pushing on the handle of the porte-cord. Cartwright has employed his straight porte-cord (Fig. 147) to carry the cord over the head of the fœtus and on to the neck.

If the iron of the straight instrument is soft, it may readily be converted into a bent porte-cord (Fig. 149), and in this altered form render good service in the case of flexed limbs or bent neck, and in some malpositions of the posterior presentation. The instrument is introduced in the same manner as the other form, but with only the loop—no noose—at the end of the cord; the curved portion is pushed around the part to be secured, and the hand, leaving it, is passed to the opposite side of the part, where it searches for the loop or ring, which, when found, is drawn into the genital canal. The instrument is then withdrawn, the cord remaining around the part; the free end of the cord is passed through the loop or ring, and being pulled at, the limb, neck, body, or whatever it may be, is secured in the noose so formed, and traction can in this way be directly exerted upon it.

Head-Cord, or Head-Collar.

In addition to the limbs and other parts, we have stated that the traction-cord can often be advantageously applied to the lower jaw. Indeed, in the anterior presentation, even when the fore-limbs are "corded," and the head is in a favourable position, it will generally be found very useful to apply traction to the head in addition, as not unfrequently pulling at the fore-limbs alone only fixes them more firmly in the passage.

We have also mentioned that the interdental space, or "neck" of the lower jaw, is the most convenient for the attachment of the cord; but nevertheless it will be found in practice that this does not afford nearly so firm a hold as the limbs, and that if the noose does not slip off the jaw, which is often the case, should the traction be at all energetic, the bones will probably be smashed, the fœtus, if alive, irreparably damaged, and an important accessory means to extraction lost. Should the head be turned back towards the side, cording the neck does not reduce the deviation, but only allows this to be brought, in a doubled condition, into the genital canal.

It is, therefore, most important that means be at hand to secure the head

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firmly and solidly, either with a view to correct deviation when this part is in malposition, or to exercise traction upon it when it is adjusted, but the fœtus remains immovable by pulling at the fore-limbs.

We have suggested that the noose of the cord, sufficiently widened, instead of being placed on the lower jaw, should be first passed into the mouth of the fœtus, then carried up over the head and behind the ears—the loop of the noose remaining, of course, tightly drawn in the mouth, as this must be the direction from which the traction is exercised; if pulled at from behind the ears, the noose would be drawn off. In placing the noose in this position, the straight porte-cord—and especially Mr. Cartwright's pattern—will be found very useful.

Instead of this simple noose, which can readily be made when needed,

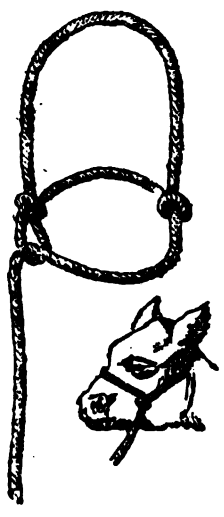

Fig. 151.

BINZ'S SIMPLE HEAD-COLLAR.

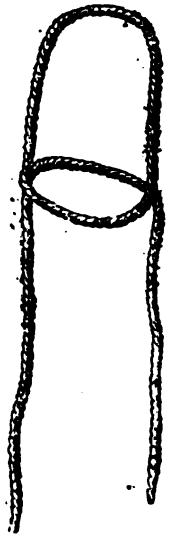

Fig. 152.

RUEFF'S HEAD-COLLAR. No. 1.

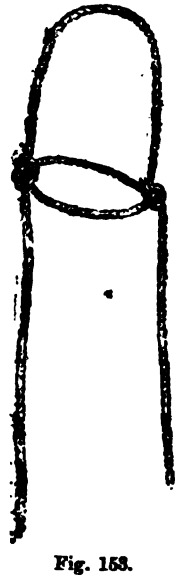

Fig. 153.

RUEFF'S HEAD-COLLAR. No. 2.

various kinds of head-stall have been proposed by veterinary obstetrists from time to time, and some of these possess certain advantages. Günther, many years ago, pointed out the advantages of a head-band like that represented in Fig. 145, the upper part of which was passed behind the ears, while the lower part with the running knot lay between the branches of the lower jaw. Binz soon after proposed a kind of head-collar, or halter, which could be adapted to different-sized heads (Fig. 151); it has a long cord attached, which can be used by assistants to pull at. This halter is held between the thumb and index-finger by its upper part, and passed into the uterus, where it is put over the occiput of the young creature's head, and the sides applied to the cheeks; the lower portion, which was open, is now closed by running the end of the cord through the loop, by which the head is firmly secured, as in the figure (151). Rueff has described two similar halters (Figs. 152, 153) which, having a long cord on each side of the head, must, of course, exercise more direct traction—sometimes an important consideration.

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Binz's halter is made by a cord which has at one end an eyelet or loop, and at a certain distance a loop-knot. When the other end of the cord is passed into the first eyelet, it forms a long semicircle, and when passed through the second, a circle which may be enlarged or decreased at will in pulling at this end. Rueff makes his halter in a similar manner, but instead of having the loop at the very end, it is placed some distance from it; this of course gives a halter with two lead or traction ropes.

Binz has devised a special head-apparatus (Fig. 154), to which he has given the name of "Forceps-band" (*Zangenband*). This is a band of flax, silk, or some other woven material, which is at its widest part about four inches broad, and in length it is about six or seven feet. At one end is a moderately large opening, while the other is divided into two portions to within some distance of the loop; these last pass through a round, movable, cork-shaped piece of wood, metal, or leather. The head of the fœtus is passed between the divided ends of this band, which are then tightened behind the jaw by running the keeper close up to the chin, the undivided portion being brought over the forehead towards the nose. In this way powerful and direct traction can be made on the head, above and below, by means of the upper part with the hole

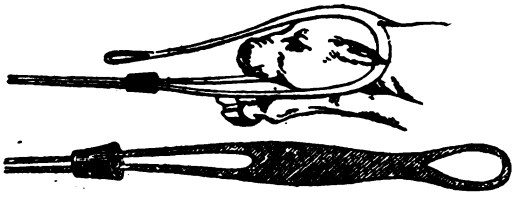

Fig. 154.

BINZ'S FORCEPS-BAND.

at the end, and the two portions beneath. It has been found particularly useful in cases of hydrocephalus.

Schaack, in 1848, introduced another kind of head apparatus, which he designated a "sliding head-stall" (*têtière à coulant*), but which is perhaps better known in France as a "forceps halter" (*licol-forceps*), by reason of its shape and use. It is composed of two doubled cords, one of which (Fig. 155, 1, 1) forms the *head-stall*, while the other (3, 3) makes the nose-band. The two are united by a metallic runner (5), which allows the apparatus to be increased or diminished in size at will. The *runner*, which forms the key of the apparatus, is a piece of brass or pewter a little more than an inch in length, about an inch in breadth, and half an inch in thickness. It is perforated by three holes, two of which are parallel and pass through the wider part of the metal, while the third, placed between them, runs through its narrower surface. The two ends of the head-stall loop go through the parallel holes, the cord composing this being nine or ten feet long and one-third of an inch thick, the loop itself being intended to lie behind the ears of the fœtus. One side of the loop is fixed in the runner, by rings of waxed pack-thread above and below the hole; this waxed thread being also run up on the loop, to give it a certain degree of rigidity. The other half of the cord is freely movable in its hole in the runner, and a knot tied near its end allows it to be distinguished from the fixed half. The *nose-band* (3, 3) is made of two strong but soft strips of leather sewn one within the other,

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and doubled in the middle to constitute a loop eight to ten inches long: the two portions being made into a single cord (4) between three and four feet long, and which passes through the single hole across the runner. The middle part of the nose-loop has a kind of shield or button of thin leather, to prevent the loop slipping through the hole.

This was the apparatus first devised by Schaack, but recently he has somewhat modified and simplified it, by dispensing with the nose-band altogether, as he found that the nose of the fœtus could be better guided and held by the hand. Experience has proved that this simplification allows the halter to be more easily applied.

The manner in which the original halter was employed is described as fol-

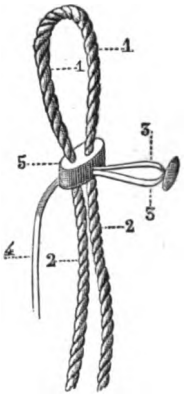

Fig. 155.

SCHAACK'S FORCEPS-HALTER.

1, 1. Head-stall; 2, 2. Two Cords, its continuation; 3, 3. Nose-band; 4. Single Cord forming a continuation of the Loop constituting the Nose-band; 5. Metal Runner, uniting the several parts of the Halter.

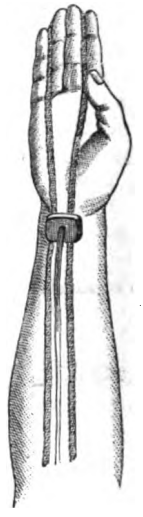

Fig. 156.

MANNER OF PLACING SCHAACK'S HALTER.

lows :—The head of the fœtus being in front of the inlet and readily accessible to the hand, the nose-loop is pulled through the runner until stopped by the leather button; while the head-stall loop is made sufficiently wide. The middle of the latter is placed at the end of the middle-fingers, the movable part of the cord being between the middle and index-finger, the fixed side between the ring and little finger (Fig. 156). The apparatus is at first held by the index and middle-fingers against the other fingers, as well as by the thumb, which keeps both cords in the palm of the hand; and, finally, by the left hand, which, drawing lightly on the three cords, keeps them sufficiently tight. The runner should be at the wrist, the button of the nose-loop towards the hand.

The apparatus being so disposed, the hand is introduced sideways (little finger downwards) into the vagina, until it arrives at the head of the fœtus;

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then the nose of the latter is passed into the head-stall loop, which is pushed forward by one side of the face—say the right—towards the neck and over the ear; the other half being now carried on the opposite side towards the left ear, and then the runner is seized below the jaw. In this way the hand has passed round the length of the head-stall from its fixed to its movable part—the latter readily allowing the loop to enlarge and pass over the salient portions of the head, the loop being nevertheless kept sufficiently tense by the right hand pushing the runner up towards the throat; while the left hand, pulling at the movable cord (recognised by the knot at its end—tightens it as much as may be necessary. The nose-loop is placed by introducing the index-finger of the right hand under the button, and drawing the loop through the runner to a sufficient length, the left hand keeping the other two cords tight; the end of the nose is passed into the loop, which is lifted as high as need be. This done, the right hand is withdrawn from the uterus and vagina, along, while keeping tight, the three

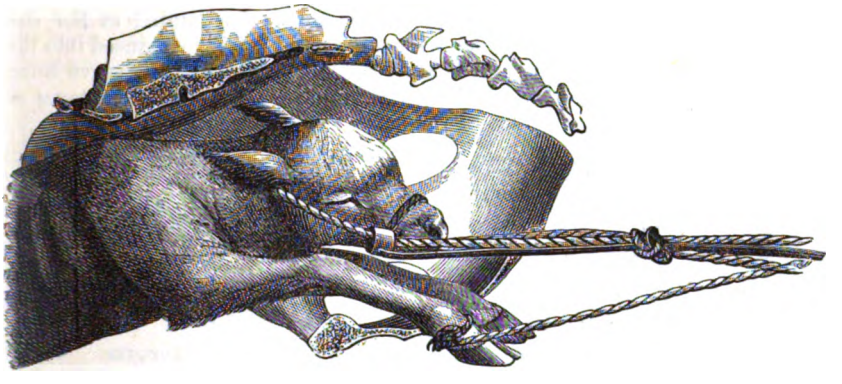

Fig. 157.

SCHAACK'S HALTER PLACED ON A CALF'S HEAD, THE RIGHT FORE-PASTERN BEING ALSO CORDED.

cords. These are tied together in a knot outside the vulva, and the head is thus securely and solidly fixed.

Saint-Cyr and others highly recommend this apparatus of Schaack's, which in its modified form differs but little from that described by Binz some years previously. Saint-Cyr remarks that its extreme simplicity, its trifling cost, the facility with which it can be placed after a little practice, its solidity, which enables it to withstand any amount of traction, and its absolute innocuousness—all combine to render it one of the best and most precious instruments required in veterinary obstetricy. In the first place, when it is properly applied, it cannot slip, and all the amount of force necessary under the circumstance may be employed without fear; next, being formed of small and flexible cords, which are well oiled before use, it cannot injure the maternal organs in any way; thirdly, from the manner in which it acts on the neck, the lower jaw, and the face, and the impossibility of its becoming tighter when once it is fixed, it is absolutely inoffensive, so far as the fœtus is concerned; and, finally, owing to the nose-loop, it always keeps the head in a good direction, prevents it from deviating, and compels it to follow the course

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most favourable for its extraction: in the words of Schaack himself, "Without exaggeration, the forceps of the *accoucheurs* could not answer better for the human fœtus." As an agent of prehension and traction—but particularly the latter, Saint-Cyr asserts that he does not know of anything superior to this apparatus.

Shaack's halter is more especially applicable to the bovine fœtus, the head of which is so much larger and squarer than that of solipeds, and sometimes requires such energetic pulling at to remove from the pelvis.

Crotchets or Hooks.

Obstetrical *crotchets* or *hooks* are iron or steel instruments of variable dimensions, more or less curved at one end—which is blunt, sharp, or pointed; the other end having a ring or eyelet if short, a handle if long. The latter are from thirty to thirty-six inches in length (including the handle), and act directly on the fœtus without any other appliance intervening; while the short hooks have cords attached to them, or they may fit on the finger of the operator by means of a ring. Some sharp crotchets are jointed at the end curve, so as to permit them to be more readily and safely introduced into the genital passage by bringing the sharp point near the stalk, the curve being restored by a spring when the fœtus is reached. But the advantages of

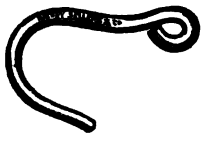

Fig. 158.

SHORT BLUNT CROTCHET.

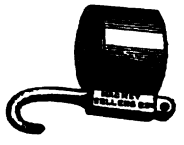

Fig. 159.

BLUNT FINGER CROTCHET.

the jointed hooks are very few, while their strength is impaired and their expense increased. In using the long or short pointed crotchets, risk of injury to the maternal organs may be obviated, if the hand is not found sufficient to guard the instrument during its intromission, by fixing the point in a piece of cork or soft wood, to which a long piece of twine is attached; when the crotchet is required to be implanted in the fœtus, this shield may be removed from the point, and withdrawn from the genital organs by pulling at the end of the twine outside the vulva.

Blunt and sharp crotchets are much employed in veterinary obstetrics, and are very valuable. The blunt crotchets are more particularly resorted to when the fœtus is alive, and it is hoped to extract it before it is dead; they are most serviceable in correcting deviations of the head or limbs, and the long crotchet is especially useful in finding and straightening the latter. The curve should be about four inches wide. The finger crotchet may be usefully employed when the hand is fatigued or paralysed by the uterine contractions. Blunt crotchets of a much smaller size than those required for the larger animals can be most successfully employed in delivering the Sow, Sheep, Goat, Bitch, or Cat.

Gunther's long porte-cord (Fig. 149) can be most effectively used as a blunt crotchet at the same time as a carrier of the cord. A German long blunt crotchet has a concealed sharp blade in the concavity of the curve;

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by means of a spring in the handle, this blade can be projected, and the instrument will then do good work in embryotomy.

With the sharp crotchet, the curve should certainly not be very wide; the smaller it is, the more readily it can be passed into the genital passage, and the less chance of injury is there to the mother or operator; it should not be greater than the hand can cover. At the same time, if the curve is too small, the crotchet does not obtain sufficient hold of the fœtus, is readily torn out, and for this reason may be most dangerous. The point should be so bent as to penetrate readily into the part in which it is determined to fix it, and the angle of the curvature should be such that the more the crotchet is pulled at, the deeper and more firmly the point will enter.

So it is that the point should not be turned round in a semicircular manner, but rather at an acute angle, as in Figs. 164, 165.

There is rather a diversity of opinion with regard to the preference to be accorded to the crotchets; some practitioners preferring the short ones, as they can be readily carried into the uterus guarded by the hand and moved about there, so as to be implanted in the most convenient part of the fœtus; while the cords attached to them allow traction to be made in the most favourable direction. Other obstetrists prefer the long rigid crotchet, which they affirm

Fig. 160.

SHORT SHARP CROTCHET, WITH BROAD OR FLANGED POINT.

Fig. 161.

SHORT SHARP CROTCHET, WITH ROUND POINT.

is more easily placed—one hand guiding the point through the passage, the other hand acting on the handle.

These preferences depend very much upon whether the operator is more practised in the use of one or other of the crotchets, and also, doubtless, upon circumstances peculiar to each case requiring the employment of such instruments. Both long and short crotchets are most useful, and the obstetrist should have several of each, and of various forms and dimensions, so as to be able to select that which is best adapted to meet the requirements of particular cases.

It must be observed also, that many practitioners are not in favour of crotchets, and decry their use. But we are of opinion that there is something unreasonable in this, and the experience of almost every day goes to prove that these instruments afford a simple and ready means of getting hold of the fœtus in regions of its body which the hand cannot possibly reach, or if it could, where it could do very little service either from the shape of the part, its slipperiness, or from the paralysing effect of the uterine contractions on the hand and arm of the operator. They can also be profitably employed in cases in which cords and halters are useless; for not only will they serve in allowing traction to be made on parts which actually present at the inlet, but they can also be utilised in effecting those mutations which are necessary in order to bring particular parts of the young creature in front of the pelvic opening, or through the genital canal, and which the hand could not seize or move.

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It is no doubt true that the sharp or pointed crotchets have certain disadvantages which must not be lost sight of, and which impel us to give the preference to the cords or halter when they can be employed. In the first place, their introduction into the uterus is not such an easy matter as it might appear without trial or consideration; for the contractions of this organ may paralyse the hand which carries the instrument, and causes the latter to escape,

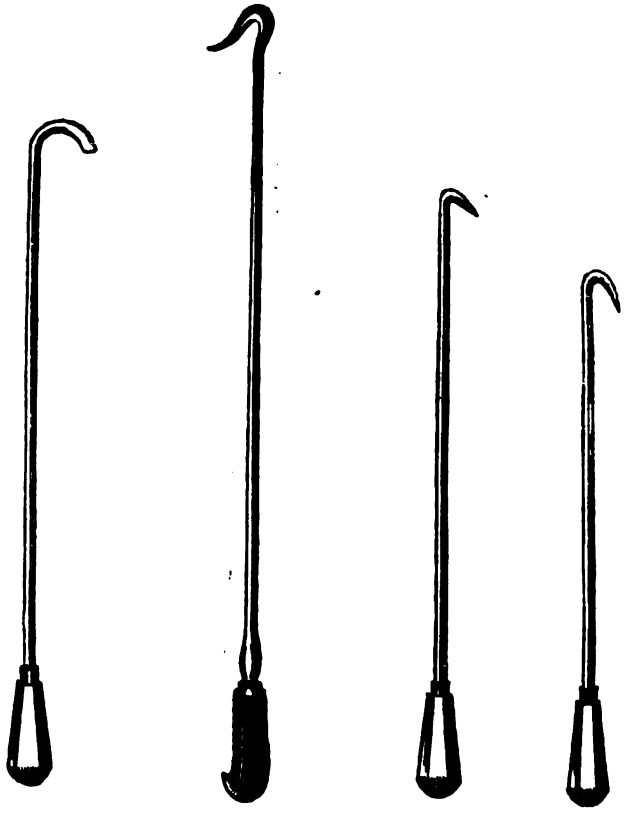

Fig. 162. Long Blunt Crotchet.

Fig. 163. Long Pointed Crotchet.

Fig. 164. Long Pointed Crotchets Dubreau's Pattern.

Fig. 165.

or its point to wound either the mother or the operator. Their employment often produces serious lesions in the body of the fœtus, which are certainly of no importance when this is dead, but may be of much consequence should it be alive. Then, again, the tissues into which they are implanted are not very firm or resisting, so that only a moderate degree of traction can be expected from them, and which is often insufficient to overcome the resistance that prevents the birth of the fœtus. In such a case, if, through forgetfulness or maladroitness, the tissues suddenly give way and the crotchet slips into the maternal organs, serious, if not fatal injuries may be inflicted; or the hand or arm of the operator may be the part torn by it.

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These are undoubtedly disadvantages of a weighty kind; nevertheless, the veterinary obstetrist has always to contend with disadvantages in cases of dystokia, and must overcome them by prudence, patience, and skill. When using the crotchets the same qualities must be brought to bear. His hand must diligently guide them, and note their effects and movements; while, at the same time, he must vigilantly exercise his judgment in directing his assistants as to the amount and direction of the force they are to use, so as to proportion it according to the resistance of the tissues in which the crotchet is fixed, and to desist from traction as soon as there is a likelihood of the instrument breaking away or slipping. With the evidence before us as to the numerous and incontestable advantages offered by these appliances, and the knowledge that their disadvantages can be overcome by intelligent watchfulness, we have every reason to recommend their adoption in those cases which call for their employment.

"In all cases where the head of the fœtus is back," Cartwright writes to us, "I am very partial to using the long sharp-pointed hook in the orbit; even if the head is at the *extreme* distance, with care we can insert it in the orbit and get the head in the passage. Of course, it requires great care in watching that the hook does not break loose and do mischief. I have found that we may pull by the hook in the orbit with great force, without tearing the skin of the calf, provided the latter is not in a decomposed state. From my experience, I can speak highly of the hooks; indeed, you cannot get the head up without them sometimes." And in embryotomy the crotchets may be most usefully resorted to for many purposes.

We will now briefly refer to the parts of the fœtus upon which the crotchets can be most effectively employed, and the manner of employing them.

PARTS INTO WHICH THE CROTCHETS MAY BE IMPLANTED.—The parts into which the crotchets may be implanted are numerous, but those which are selected by the obstetrist will not only depend upon the nature of the malpresentation or malposition, but also upon the simplest indications for the adjustment of these. When the desirable part has been reached, the point of the crotchet is inserted in such a way that the instrument is directed towards the source of traction—the assistant. When blunt crotchets are employed, except in cavities, it will be necessary to make an incision through the skin before they can be inserted. Cartwright states that sometimes the sharp crotchets cannot be used without making these preliminary incisions; but then the instruments must be rather blunt. The best parts for implantation are (1) the *muscular tissues*, (2) the *head*, (3) the *spine*, and (4) the *pelvis*.

1. *The Muscular Tissues.*—These tissues are not advantageous for the employment of the crotchets, for although they are easily inserted, they are as easily torn out. Nevertheless, these instruments, when fixed in certain muscular regions, such as the croup, thighs, loins, and neck—more especially the latter, may render useful service in rectifying deviations, as the skin offers a good amount of resistance. But, from the fragile and yielding nature of the textures, it must be borne in mind that the hand of the obstetrist should never leave the crotchet while traction is made on it, and that its position in them must be most attentively noted, in order to guard against accidents arising from its tearing away.

2. *The Head.*—The head offers many good points for implanting the crotchets—such as the symphysis of the lower jaw, the palate, and the orbit, as well as the ear and angle of the inferior maxilla, on particular occasions.

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It must be observed, however, that all these points are not of equal value. The *maxillary symphysis* is convenient, but not very firm; moderately strong traction will rupture it, and damage may then occur. Still, there are times and occasions when this part may be advantageously seized by the crotchet, which may be inserted in two ways: the point of the instrument may be passed from below the chin into the mouth, or from the cavity of the latter through the mucus membrane beneath the tongue, to below the chin. The first is generally preferable. When traction begins, the operator must be on the look out for tearing away of the two branches of the jaw.

The orbital cavity is the best part of all the head for a solid hold. Some authorities have expressed doubts as to the propriety of fixing a crotchet in the ocular cavity of a living fœtus, from a belief that the eye-ball must be damaged, and Rainard goes so far as to advise that it should only be done when the creature is dead; though he adds that, if there is no other means of remedying a deviation of the head in the living calf, it is well to attempt it, "as it is better to have a living, if blind calf, than a dead one with both its eyes intact."

But it is rare indeed that the eyes are seriously damaged by fixing the crotchet in their socket; and innumerable instances testify that, if the fœtus is alive, the ocular globe is retracted to the bottom of the cavity when the instrument begins to be inserted, and so escapes injury. Schaack, who has freely resorted to this mode of adjusting the head or neck—in the sheep and goat more particularly (the smallness of the pelvis not allowing any other means to be employed)—describes his manner of operating as follows: "The crotchet I use," says he, "is a solid (or long) one; the point is blunt and slightly flattened (Fig. 166). When it is desired to pull at the head of the fœtal goat or lamb, the left hand at first seizes the nose, and the crotchet is fixed in the right orbit; with the right hand the other instrument is passed into the left orbit, the thumb of the left hand keeping the hook in the other orbit by pressing the stalk against the cheek. In this way I can pull with the two hands on both orbits, so as to keep the nose in a good direction." He has never seen the point of the crotchet cause the slightest injury to the globe of the eye, although he has had, in the majority of cases, to pull very hard. The means has answered very well. And Cartwright informs us that "it is astonishing how wounds heal up in the cheek where hooks have been in the orbit. I have had two or three men pulling at the rod (of the crotchet), and the hook did not break out."

Fig. 166. SCHAACK'S CROTCHET.

This immunity from injury, in the case of the living fœtus, does not, however, absolve the operator from exercising all due care in fixing and pulling at the crotchet. The inner aspect of the orbital cavity is the most favourable, and if the fœtus is alive, the blunt instrument must be first tried, the sharp-pointed one being kept in reserve until this has failed, or it may be used at first when the young creature is dead.

The *palatine arch* affords a very solid and useful point of attachment for the crotchet, and many obstetrists have successfully utilised it in extracting the fœtus; some authorities—among them is Schaack—asserting that hooking this part is easier, and the results more certain and direct, than fixing the instrument in the orbit. The stalk of the crotchet is somewhat long; the hook end is passed sideways into the mouth of the fœtus, and over the tongue

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until it gets beyond the palate, when it is turned point upwards, and seizes the base of the vomer. According to Schaack and others, a very strong degree of traction can be made on this part without inconvenience to the young creature. It appears to be an excellent situation to plant the crotchet in the calf—particularly if it is dead, and it is desired to effect extraction as quickly as possible. It may be also employed in the foal, the only risk being more or less disunion of the palate, which may render sucking difficult or imperfect for a short time after birth.

Of course, the head must be in a good position either in the inlet or in the genital canal, before the crotchet can be placed behind the palate. The traction must also be moderate and steady, and the usual precautions observed.

3. *The Spine.*—When embryotomy is practised, or the fœtus is dead, the vertebræ, their transverse processes, or the ribs, afford excellent hold for hooks, though care must be observed in placing them securely, and guarding them when they are being pulled at.

4. *The Pelvis.*—In posterior presentations, when cords cannot be employed to the hind limbs, the loins, or the croup, or when they have not sufficient power, then crotchets must be resorted to; and with this view the fœtal pelvis offers several very advantageous points. After removal of one or both hind-limbs, the *cotyloid cavities*, by their depth and the hardness of their walls, are admirably adapted for receiving the hooks and withstanding energetic pulling. If both limbs are amputated from the hip joints, then a hook may be placed in each cavity; if ablation of only one limb has been effected, then one hook will be most useful.

The *pubic arch* and the *oval foramina* of the pelvis are likewise well suited for crotchet traction in the posterior presentation, when the fœtus is dead. In some cases the sharp-pointed crotchet may be passed directly through the rectum, and pushed forward so as to seize the anterior border of the pubis, the margin of one of the oval foramina, the base of the sacrum, or the shaft of the ilium; care being taken that the point does not pass through the skin. Or the crotchet may be passed from without inwards—the safest method—after the pelvic bones have been denuded as much as possible of their soft tissues. This is, perhaps, the most practicable method, if the hind-limbs have been already removed. But if they have not, then Saint-Cyr recommends that all the soft tissues of the fœtus, from the root of the tail to the ischial arch, should be largely incised, and the hand passed through the incision into the pelvis, which is emptied of its viscera. The crotchet is then pushed into it, and planted either on the brim of the pubis, or in the oval foramen.

It is always safer to pass the hook from without inwards, whenever this is possible, as the point is then in the pelvic cavity of the fœtus.

Forceps.

The introduction of forceps into human obstetricy marked a new era in the *accoucheur's* art, and has been productive of the greatest benefits in difficult cases of parturition in women. But they have not yielded much service to the veterinary obstetrist, except with the smaller animals; notwithstanding that Hurtrel d'Arboval, at the commencement of this century, asserted of the forceps that there are circumstances in which great advantages might be derived from them, that their use is perhaps the best means of completing parturition when it cannot be terminated naturally, etc. Attempts have been

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made at various times to introduce them into general use for the larger domesticated animals, and various models—more or less modifications of the human patterns—have been proposed, but with very little, if any, success.

The forceps used by the *accoucheur* of woman are, as is well known, composed of two branches or blades, which are nearly or quite alike, and form levers of the first order; they are united at the middle by a fixed or sliding joint, and one end—the "bow," or widest part—which is intended to grasp the fœtus, is *fenestrated*, or perforated by a wide opening; at the other end is the handle.

The reason why the forceps has never come into general use in veterinary obstetric operations—except with the smaller animals, as already said—is not so much from a prejudice against novelties and innovations, as because they are really not adapted for this kind of practice, unless in a very modified form, to be presently noticed. Rainard (*op. cit.*, vol. ii. p. 98) remarks: "Medical men will be astonished that I have not mentioned the *forceps*, from which they derive such great advantages. This instrument, which can seize a round head, like that of a child—when each blade fits exactly throughout its whole length—will have much less hold on that of animals, which is elongated, flattened at the sides, and otherwise but little yielding. When the forceps is applied to the foal or calf, it slips and is useless. Otherwise, the readiness with which cords can be attached to the head and limbs, renders these in every way preferable to this instrument. What the forceps cannot do, the cords can; and they have the additional advantage that they scarcely occupy any space in the pelvic canal. The pelvis of our animals is nearly rectilinear; with the cords we pull in a straight line; what more could the forceps do? The entire hand can be introduced freely into the pelvis, and moved about easily. This cannot be done in human accouchements." And Saint Cyr justly asserts that there is no known forceps capable of affording such a solid purchase, and at the same time one so harmless, as a good cord fixed on the pastern, or Schaack's head-stall properly placed on the head.

Though an instrument resembling the human forceps is not at all adapted for extracting the fœtus in such animals as the Mare or Cow; and though in the cords and headstall an excellent substitute is found; yet modified forceps, which might be designated—if not from their shape, at least from their action—*crotchet-forceps*, have been long employed by veterinary obstetrists, and

Fig. 167.

SIMPLE SHORT CROTCHET-FORCEPS.

with much advantage in certain cases. The simplest of these consists merely of two short crotchets, the points opposite each other, and a cord passing through both eyelets (Fig. 167). The hooks can be inserted near, but opposite

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to, each other, on each side of the spine, pelvis, head, flanks, etc., the cord, when tightened, bringing them closer together, and so concentrating the traction. A longer crotchet-forceps, with a wider curve at the points, is not unfrequently used with success in breech presentations with the hind limbs retained; the points are inserted towards each flank, penetrating as far as the shaft of the ilium.

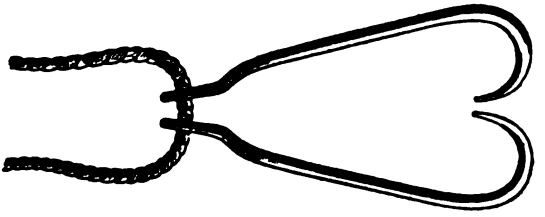

Fig. 168.

LONG SIMPLE CROTCHET-FORCEPS.

Gunther has spoken highly in favour of a long blunt crotchet-forceps to answer the same purpose, but which has what is considered an advantage—a series of notches on each side towards the traction-rope, on which runs a clip that binds them together, and prevents their flying outwards while the assistants are pulling (Fig. 169).

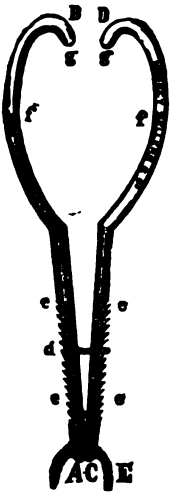

Fig. 169.

GUNTHER'S LONG CROTCHET-FORCEPS.

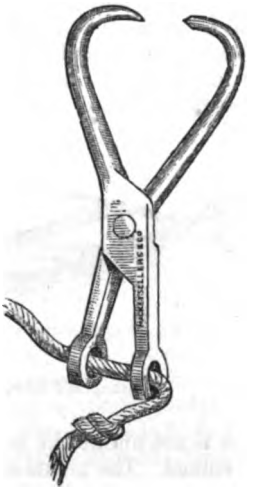

Fig. 170.

JOINTED CROTCHET-FORCEPS.

The two crotchets A B, C D are brought together at A C by the cord C, which passes through their eyelets; *d* is the clip on the ratchet *e e*; *f f*, the curve of the crotchets; and *g g*, their blunt points.

To render their hold more secure, these crotchet-forceps are sometimes

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jointed; and in this form they are preferred by some practitioners. Fig. 170 represents a very useful model, the points being sharp, and one point lying in a slight notch on the opposite one, to render their introduction into the uterus more safe, and also to prevent accidents, should the tissues in which the points are implanted give way. A cord passes through eyelets at the extremities of the blades, as in the other models; but sometimes the eyelets are in opposite directions, and the ends of the branches in which they are pierced are bent towards each other; this variation is supposed to be accompanied by certain advantages, as in Nelson's blunt and serrated forceps (Figs. 171, 172), some of the uses of which have already been noticed.

Some of the models of crotchet-forceps have a spring introduced between

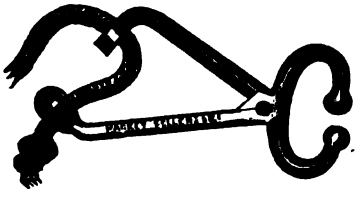

Fig. 171.

NELSON'S BLUNT CROTCHET-FORCEPS.

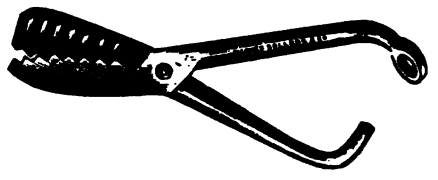

Fig. 172.

NELSON'S SERRATED CROTCHET-FORCEPS.

the branches, and behind the joint, as in Tallich's short instrument (Fig. 173), the jaws of which are bent to one side, and toothed; it is intended to secure a hold of the fœtus, and make traction on parts to which neither cords nor crotchet can be applied: as the skin of the cheek, or the nose or ear, when the head is thrown back towards the flank, in the anterior presentation.

Another instrument of this description has been devised by a Belgian veterinary surgeon, André, which he designated as a *pince-forceps* or *accroche-*

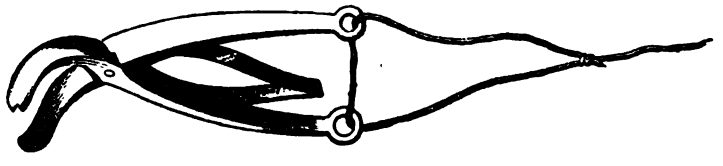

Fig. 173.

TALLICH'S SHORT BENT CROTCHET-FORCEPS.

fœtus. This is not unlike the instrument fixed in the nose of a bull in order to lead the animal. The points of the jaws are bevelled to fit into each other, the bevel being grooved. In one of the jaws is a small hole, into which is fixed a string that passes through the eyelet at the end of the opposite branch, and which is pulled at when it is desired to open the jaws. The two branches behind the joint are very short, and through the eyelet of each passes a strong cord, the two ends of which soon unite into a single piece (Fig. 174). When this is pulled at the jaws close, as in the other jointed examples, and they remain all the more firmly closed as the traction is great. In order to use the instrument, it is passed by the hand into the uterus; the jaws are fixed on the part to be drawn at, by first pulling, outside the vulva,

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at the string which opens them, pushing the points against or over the part, then, when this is between the points, drawing at the single cord which closes them. This is acknowledged to be rather an instrument for holding or fixing a certain region, and not for exercising tractile force upon. André has often applied it successfully to the lower and upper jaw, or the ear, to bring the head into a good position; to the *tendo-Achilles* in order to raise a hind limb, which the hand alone could not do; to the fore-limbs, etc.

With regard to the smaller animals, such as the Bitch, Sow, Sheep, or Goat, in them we may often use the crotchet, the ordinary forceps, or a small-sized model of the human forceps, with advantage. Various patterns are in use, some of them fenestrated, others not; some resemble polypus-forceps, while others again are grooved, serrated, or toothed, at the ends of the blades. An essential which should not be lost sight of in the forceps for such small animals as the Bitch or Cat, is that the blades should be sufficiently long to seize not only the head, but much, if not all of the body of the fœtus. If they are short in the blades, they cannot be made to grasp sufficient of the fœtus to remove it; while the joint being close to the vulva, or even within

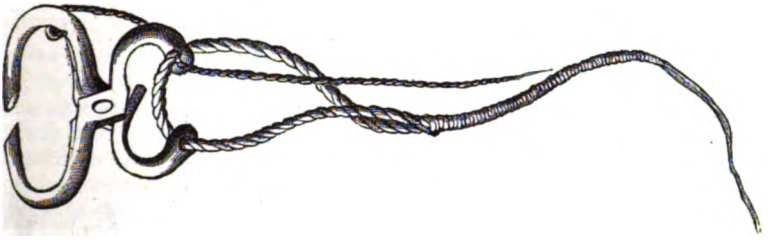

Fig. 174.

ANDRE'S CROTCHET-FORCEPS.

the vagina, is likely to pinch the mucous membrane and cause them other considerable pain.

Hill, of Wolverhampton, who has had extensive experience in this direction, uses a small and slightly modified form of the human forceps for bitches; there is a spring between the branches of the handle (Fig. 175).

Weber has proposed a forceps for these small animals, and it has been preferred by some authorities to the ordinary model. It is a modification of one for a long time employed by Leblanc, which again was fashioned after an instrument designed by Hunter. This is composed of an iron stalk about ten inches in length, with a wooden handle at one end, and two blades or bows at the other. On this stalk glides a long enveloping metal tube, which, near the handle, has a wide ferule or shield, that allows it to be pushed along by the thumb of the hand holding the instrument, and thus to bring the blades together. A nut or female screw, running on a screwed portion of the stalk near the handle, is intended to assist the pressure of the thumb, when this is insufficient (Fig. 176). A finger of the other hand introduced into the vagina, guides the instrument, and allows the part of the fœtus to be seized, to be reached by the operator, either with the view of extracting the young creature or changing its position, according to the indications.

Defays concludes that the forceps employed by veterinary surgeons in the accouchement of the smaller animals should not be merely a reduction in size

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of those employed in human practice, but ought to be something like that of

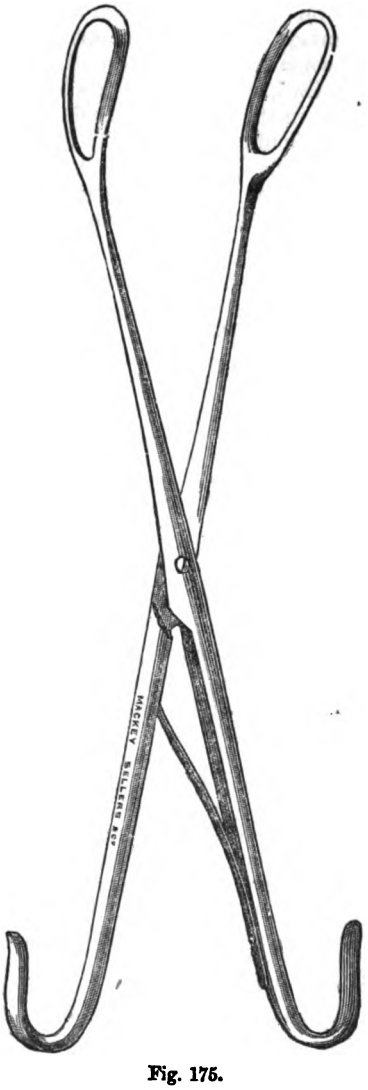

Fig. 175.
BITCH FORCEPS.

Fig. 176.
WEBER'S FORCEPS.

Fig. 177.
DEFAYS' FORCEPS.

Palfin. It is most difficult, he truly says, to apply an instrument in shape

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like that of the accoucheur's ordinary forceps, owing to the neck of the fœtus in carnivora being so thick, and the difference in volume between it and the head far less than in the human fœtus. So that, when the forceps is used, the bow of the blades presses on the neck, slips under the throat, and the head escapes from them. To remedy this imperfection, he has made forceps with the extremity of the blades notched or hollowed out (Fig. 177), while the end of one of the branches has a piece of metal with a slot in it attached by a hinge, and which is intended to hold the blades together when the fœtus is seized.

Though this forceps has sometimes proved of service, yet cases occur in which it is not so useful.

When the Bitch is large, or of moderate size, forceps may be employed with advantage, though they must be of various dimensions. But when the animal is very small, as is usually the case in difficult parturition in this species, the space occupied by the bows of the forceps—if they are ever so thin—so increases the volume of the mass which has to pass through the pelvic canal, that this instrument cannot be used.

As we pointed out when studying the anatomy of this region, the pelvis is cylindrical in carnivora, and if we suppose its diameter to be three inches, and that of the head of the fœtus a trifle less, it will be seen that birth must necessarily be difficult; and this difficulty will be increased if the vagina is narrow and rigid. When the forceps is used, the difficulty is further exaggerated; for when the blades are passed on the head, the fœtus is then augmented in size by a quantity equal to their breadth multiplied by their thickness—the whole constituting a mass greater than the pelvic cavity will permit to pass through it; so that delivery becomes impossible. Forceps, therefore, in small bitches, increases the difficulties of parturition, and these difficulties are all the more embarrassing as the animal is diminutive. Recourse to this instrument is consequently contra-indicated, and if delivery is to be effected, a means must be substituted which presents less inconvenience. As a rule, the loss of one or two puppies is not a matter of much moment, the principal object being to save the mother by bringing the act of parturition to a prompt termination. The *desideratum* is to apply an apparatus which will exert its force behind the head of the fœtus, as if the sum of the expulsive efforts was directed from behind; or as if a new force had been developed in the uterine cavity, which presses directly on the summit of the head.

Fig. 178.
DEFAYS' WIRE-EXTRACTOR WITH THE TORSION RODS.

After much consideration, Defays finally produced an apparatus which fulfils these indications, and, besides its ingenuity, is very simple and easily applied. It consists merely of two rather fine brass, or very pliable iron wires, which can be easily twisted, and are yet strong enough to withstand a moderate amount of strain. The wires should be at least sixteen inches in length, and looped in the middle, so as to be applied to the fœtus in the following manner: The first finger of the left hand being passed into the

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vagina, serves to guide one of the loops towards the summit of and behind the fœtal head; and it then conducts the loop of the other wire beneath the head behind the jaw. This done, the two wires on each side are twisted by a little machine (Fig. 178) composed of a thin iron rod in a handle, the other end of which is thickened and pierced by holes running nearly parallel to the stalk. Into these holes the two wires of one side are passed; the machine on each side is pulled up as close as possible to the head of the fœtus, and then each being turned round three or four times, the neck is enclosed in a kind of noose or collar formed by the two wires (Fig. 179).

The rods are now withdrawn from the latter, and the fœtus can be extracted by exercising traction on the ends of the four wires outside the vulva.

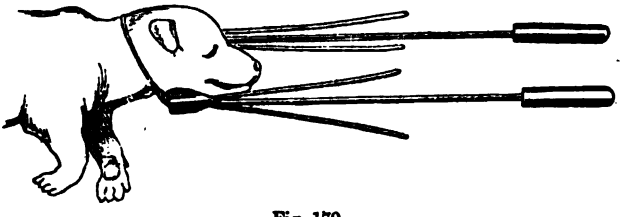

Fig. 179.

DEFAYS' WIRE-EXTRACTOR APPLIED.

By this contrivance, delivery is effected without injury to the Bitch, and, unless it is much decomposed, without separating the head of the fœtus.

We have tried Defays' apparatus, and can speak highly of it; not unfrequently we have succeeded in extracting the puppy alive, and when the use of forceps would have been impossible.

A much simpler, readier, and perhaps more successful apparatus (so far as our experience enables us to speak), is that devised by Breulet, of Marche, Belgium, which meets every requirement in the accouchement of small Bitches, and might be successfully employed with Sows, Ewes, and Goats. This

Fig. 180.

BREULET'S TUBE AND NOOSE.

apparatus is the same in principle as Defay's wire-extractor, but there is only one wire. The principal part of the invention is a noose-tube, consisting of a tubular piece of round wood, from four to six inches long, and half an inch thick. The wire may either be of copper, brass, or iron, about sixteen inches long (we have generally used a piece of catgut, and prefer it); this is doubled, passed through the tube to a certain extent, so as to form a loop or noose at the end (Fig. 180). When it is to be used, the first finger of the left hand carries the loop into the vagina of the Bitch, and slips it behind the occiput of the puppy; then the two ends of the wire are passed through the tube, and this is pushed into the vagina under the chin of the fœtus; the operator now tightens and secures the wire, by giving it a turn round the first finger

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of his right hand, placing his thumb at the end of the tube (Fig. 181). A little traction then extracts the fœtus, and without doing it or the Bitch the least damage. We now employ no other instrument in canine obstetricy, and our success has always been complete, even with the tiniest toy terriers.

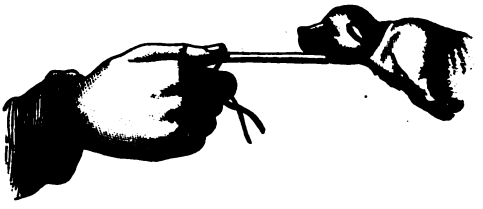

Fig. 181.

BREULET'S NOOSE FIXED ON THE FŒTUS.

When our assistance has been sought for in time, we have generally managed, expeditiously and easily, to extract the puppies alive.

It will be seen that the noose is not unlike the "fillet" used in human obstetrics.

The Employment of Force in Dystokia.

In connection with the foregoing obstetric operations, a rather important question to be considered is the employment of *force* in the artificial extraction of the fœtus. For, as we have seen, more or less energetic traction is very frequently needed to remove the fœtus from its parent, and those who do not understand, or are inexperienced in animal obstetrics, are sometimes astonished, if not horrified, at hearing of the amount of pulling which the fœtus has to undergo, and the parent to sustain, before delivery can be effected in some cases. Yet force is, as a rule, absolutely necessary; and, though some of the various points with regard to it are not yet sufficiently ascertained, and differences of opinion exist with regard to them, yet it is a subject well deserving the attention of the obstetrist, and especially the junior practitioner. Saint-Cyr has, with his usual ability, discussed it carefully; and we will therefore, to a certain extent, follow him in noticing it.

The *direction*, *intensity*, and *nature or means of developing the force to be employed*, have first to be considered, after which it will be desirable to compare *manual* with *mechanical* force, and point out their respective advantages and disadvantages from an obstetrical point of view.

Direction of Traction.

Since the forceps was introduced into human obstetric practice, the direction which the fœtus should be made to follow in the pelvic cavity of woman has been continually discussed, and has been acknowledged to be a very difficult, as well as a very important problem to solve. This difficulty is mainly due to the fact that the pelvic canal in the human female is not uniform in its dimensions, and that the head of the fœtus must pass through it by always offering its greatest diameter to that of the cavity. Consequently, it must execute during its passage a *rotation* movement in one or other direc-

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tion, according to the presentation—a movement necessitated by the different planes of the cavity. In addition, the canal is curvilinear, its axis not being represented by a straight, but by a curved line, whose form and direction are, besides, modified by those deformities of the pelvis which are so frequent and varied in woman, and which constitute one of the principal indications for

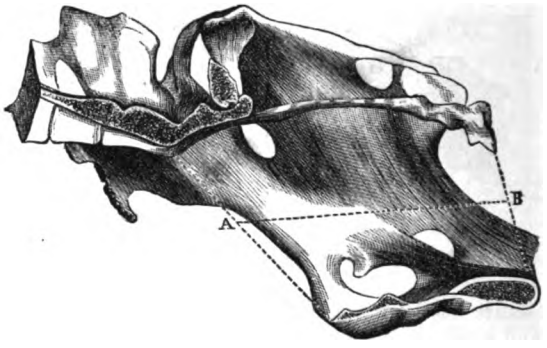

Fig. 182.

DIAGRAM OF THE PELVIC AXIS.

the use of the forceps. Therefore it is, that all the difficulty in the question is to determine, in a rigorous manner, the direction in which to exercise traction with this instrument; though it is generally agreed that it should be made according to the pelvic axis.

With animals, the problem is, of course, much less complicated, as their pelvis is somewhat cylindrical; and its axis—almost rectilinear—can readily be determined by a line passing from the centre of the anterior circumference to the centre of the vulva, or somewhat towards the middle of the line uniting the two superior ischiatic tuberosities. Saint-Cyr justly points out that traction should be made in the direction of this axis (Fig. 182, A B); and that this line of traction, happily for the veterinary obstetrist, and thanks also to the flexibility of the cords which, in his practice, take the place of the forceps, offers no serious difficulty. At page 237, it has been shown that this direction may vary, and may be modified according to the presentation—and more particularly the position—of the fœtus, and also according to the period of labour.

Degree of Traction.

When passing through the pelvic cavity, the fœtus undergoes a certain amount of compression, proportionate to the uterine contractions or the external traction which determines its progression outwards; at the same time, this compression produces a kind of reaction in the body of the fœtus, and gives rise to an eccentric pressure against the walls of the passage, related to that which itself experiences. The question is, therefore, limited to the amount of force necessary to overcome the resistance that prevents the onward progress of the fœtus, without injuring either the latter or the parent. In veterinary obstetrics we have no fixed data to rely upon; but the experiments of Joulin, Delore, and Poullet, alluded to by Saint-Cyr, may afford some idea of the resistance offered by the pelvic girdle to the eccentric pressure. These an-

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thorities found that if a rounded body—a ball for instance, to represent the head of a fœtus—is attempted to be pulled through the pelvis of a woman, it requires a force represented by 375 to 441, and even as much as 635 pounds (estimated by the dynamometer), to produce such serious lesions as fracture in the bones or disunion of the symphyses. But it must not be concluded from this result, that such powerful traction can be practised with impunity in woman. In the first place, the child could not be extracted alive, for its existence appears to be compromised if the degree of traction by the forceps exceeds from 132 to 154 pounds; and in order that the pelvis of woman could resist such pressure, certain conditions are required which we never meet with in ordinary practice: for instance, the pressure should be equally applied to every part of the bony girdle in contact with the head of the fœtus. But this does not take place with the ordinary forceps, which, even in the hands of the most expert accoucheur, not only acts as a traction agent, but at a given moment is unfortunately transformed into a lever of the first or second kind, whose power is incalculable, and which, resting on two opposite points of the pelvic circumference, may burst it, without the dynamometer showing anything more than a relatively feeble degree of traction.

Otherwise, it is not only the bones which have to be considered, but also the soft parts, which, pressed between the fœtal head and the hard pelvic circumference, may be bruised, contused, or lacerated to a variable degree, if the compression exceeds a certain limit. This pressure, however, is always considerable; for, according to Chassagny, when a tractile force of fifty kilogrammes is exercised on the head of a fœtus seized by the ordinary forceps, we may calculate that each square centimetre of surface of the pelvic walls sustains a pressure of 1800 grammes, even in the most favourable conditions; though it may be as much as six kilogrammes or more, according to circumstances.

These observations, though doubtless valuable and significant for the accoucheur of woman, are only very indirectly applicable to veterinary obstetricy. Without taking into account the strength of the pelvic osseous girdle, which is so much greater in the Mare and Cow than in woman, several other circumstances allow us to understand why this bony circle may, in these animals, resist an amount of strain which would appear to be altogether unreasonable, if judged according to the principles which should guide the practice of the human obstetrist. But the veterinarian is in possession of means of traction which give him a great advantage in this respect—an advantage which the accoucheur has not yet been able to avail himself of: we allude to the cords the former so frequently employs as tractión instruments, and which can never be transformed into levers, like the forceps.

In woman, as with animals, the fœtus, in passing through the pelvic cavity, is pressed upon by its walls, and in return it presses upon them, in the manner of a wedge which tends to tear them asunder. But there is a great difference in woman and animals. On the one hand, it is a hard, bony, and little reducible region—the head—which presses against the pelvic walls, to which it transmits, almost undiminished, the pressure itself receives; on the other hand, it is a bony cage—the chest—formed of numerous very movable parts, and which can submit without injury to much distortion, in addition to its being covered by soft and readily compressible tissues: consequently, we can easily comprehend how much in the latter case—that of animals—the eccentric pressure produced by the passage of the fœtus should be attenuated. Besides all this, the head of the infant is spherical, and

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therefore comes in contact with the interior of the mother's pelvis by a circle or narrow zone; the surface of the pelvis in contact with the fœtal head has been estimated at sixty square centimetres, and it is to this limited space that the head transmits the pressure it sustains. Chassagny, from a series of experiments, estimates that, for a traction of sixty kilogrammes—exerted under the most favourable circumstances by his forceps on the head of the human fœtus—each square centimetre of the surface of the pelvis in contact with it should support a pressure of about 500 grammes; in less favourable conditions it may even be much more.

From some measurements made by Saint-Cyr, the pelvis of the Mare and Cow, and which is nearly cylindrical, may be reckoned at 1600 square centimetres (248 inches) of internal surface; and it is on this expanse that is distributed, in a nearly uniform manner, the eccentric pressure which the chest of the fœtus transmits to the walls of the genital canal, to which it is very closely applied during its passage outwards. If, then, it be admitted that the total of this eccentric pressure measures about one-half the tractile force expended on the fœtus, it will be easy to find, by a simple calculation, the pressure on each square inch. Supposing the traction to be equal to 1540 pounds—the estimated strength of seven or eight men pulling with all their force at the cords—the pressure on each square inch would be about 7¾ ounces; or one half that exerted on the same extent of surface with a tractile force of 132 pounds, in woman!

Saint-Cyr does not pretend that these calculations give a rigorously exact measure of what really takes place during parturition; but he believes they may assist, up to a certain point, in explaining certain facts in comparative obstetrics which otherwise would remain obscure: how, for instance, natural birth, which is always so painful in woman, is comparatively painless in the larger animals; and why traction, the very idea of which frightens the accoucheur of woman, is, in the majority of instances, so well sustained by the veterinary surgeon's patients.

It must be confessed, however, that we have as yet no certain data by which we can estimate the exact amount of force necessary, or which may be employed without danger; and on this point the opinions of the best authorities are widely divergent. Some declare for moderate traction—two, three, or four men at the most, pulling simultaneously at the cords with all their force, are, in their opinion, quite sufficient in all cases, if well managed; and they assert that it is rash and dangerous to employ more. Others do not hesitate to have recourse to more energetic traction, and are not afraid of employing the combined strength of six, eight, or ten strong men; being convinced that the parent suffers more from protracted labour than powerful traction: and not unfrequently their success justifies their boldness.

Donnarieix admits that three assistants are usually sufficient with the Cow: one at the head, another at the tail, and the third to aid the operator; while ten are needed for the Mare: one at the head, another holding the rope which confines the limbs of the animal, and prevents its doing damage, a third to hold the tail, a fourth to assist the operator, and the other five or six to pull at the fœtus when necessary. Zundel, however, is of opinion that these numbers are somewhat exaggerated; very often more than three assistants are required for the Cow, and if more than six are needed for the Mare, it is better to have recourse to mechanical means; as too many assistants hamper the operator, and are often in each other's way, while their united strength cannot be usefully applied.

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The assistants should be strong, and have had some experience in handling animals; some of them are to maintain the creature in a favourable position, while the others aid the attempts at extraction, under the orders of the operator. The tractile efforts should be made simultaneously, without jerking, but in a continued and energetic manner, and always in the direction of the axis of the pelvis—in a straight line behind the animal. The direction of the traction may, however, be a little downward in the anterior presentation, lumbo-sacral position, until the withers have passed through the inlet; as by this means the top of the withers is depressed, and this part enters the pelvis before the sternum. The operator stands behind the parent, his hands on the sides of the vulva, which he depresses with the cubital border of one hand, while, with the back of it he separates the lips, and prevents their being abraded by the cords. It is better to engage only one shoulder of the fœtus at a time, if possible; and when the sternum and one shoulder have been carried into the passage, then the other shoulder is brought forward by directing the assistants to pull a trifle towards the opposite side. By acting in this way, with care, and by slow though continued efforts while the parent is straining, delivery will be effected, if this be possible by traction. The operator must not act hurriedly or brusquely, and his hand should carefully attend the advance of the fœtus: facilitating its passage, and aiding the progress of the haunches by passing his open hand between them and the maternal pelvis.

In the posterior presentation, when at least one assistant must be told off to each cord, the traction should be moderate, or even gentle at first, until the operator's hand has adjusted the fœtus as much as possible. In addition, the latter, besides directing his assistants, must frequently himself guide the traction by the disengaged hand, and personally exert himself in the extraction of the young creature: separating the lips of the vulva, and pressing them towards the pelvis when they are pushed outwards by the advancing fœtus; lubricating the latter and the genital canal when necessary, etc.

Means of Developing the Necessary Force.

Hitherto we have only been alluding to the employment of human or manual force in the extraction of the fœtus; and this, of course, is that which is generally resorted to at first. But it is not the only force we may employ, and especially if it is desirable to exercise very powerful traction. It is true that empirics and amateurs have often adopted the barbarous expedient of attaching the cords fixed on the fœtus to a horse or ox, and by making the latter exert its strength, to tear the young creature through the maternal passage. Rainard mentions that in the Camargue, those who have the charge of droves of Mares, not having the services of a veterinary surgeon, yoke another Mare to the cords they fasten on the fœtus, and deliver the parturient animal in this cruel fashion. Being destitute of anatomical knowledge, they act blindly; and not understanding how to adjust a malposition, the foal is nearly always extracted dead, and only too frequently the mother perishes.

With the object of extracting the fœtus by force when manual traction is not sufficient, the *windlass, capstan, wheel, cart, and pulleys,* have frequently been used, and with great benefit. Many veterinarians consider the employment of machines as equally barbarous with the ox or horse traction, but this opinion is scarcely just. They say such machines are blind instruments which cannot be directed at will, and they prefer increasing the number of men indefinitely rather than resort to them.

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But some of the most intelligent and experienced veterinary obstetrists—Lecoq, Gunther, Binz, Leconte, Rainard, Baumeister, Saint-Cyr, Franck, etc.—speak in the highest terms of the utility of these machines; and some of them state that whenever the combined strength of six men is not sufficient to extract the fœtus from the larger animals, they do not hesitate to employ one of these articles. Not only can a greater tractile force be developed by them, but this force may be diminished or increased at will, and as gradually as the circumstances may require. In this direction, though the windlass, capstan, or wheel may be utilised, yet, for convenience in application, portability, and steady graduated traction, nothing can approach the light obstetric pulley, the manner of using which is shown in the annexed drawing (Fig. 183).

When very powerful traction is required, whether manual or machine, there is the risk—particularly if the animal is standing—of dragging it backwards until it falls, or doing it some injury, unless the precaution is adopted

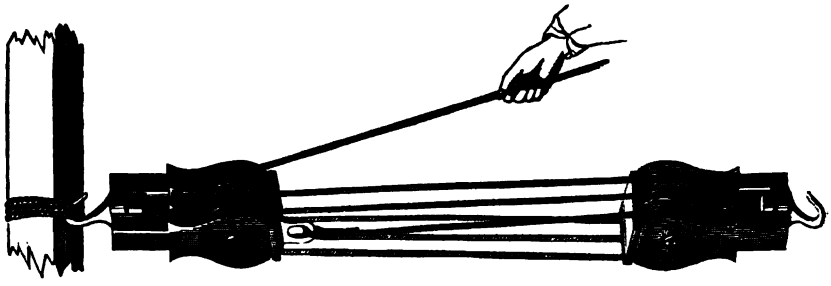

Fig. 183.

Obstetric Pulleys.

of fixing it in some way. It is obvious that there is great danger—indeed cruelty—in attaching it merely by the head or neck, and allowing these to bear all the strain. It is necessary to render the creature immovable, by passing cords, bands, or a sack behind the thighs and above the hocks, bringing the ends towards the animal's shoulders, and maintaining them there either by assistants, or to the manger or any other part sufficiently strong, in the direction of the creature's head. A wooden bar, placed behind the thighs, and secured to the stall-posts, is also serviceable; as is also an ordinary harness breeching, the front parts being secured to rings in the wall or manger. In some cases, vigorous assistants, placing their back against the haunches of the animal, will offer sufficient resistance to its displacement. Many practitioners prefer throwing the animal down, if it is standing, in order to avoid the dangers of being dragged; Schaack even asserts that the body lying on the ground increases the expulsive efforts, and keeps the fœtus in the plane of the pelvis. Donnarieix is not afraid of seeing the animal dragged a little, and recommends that the traction should not cease in consequence. Nevertheless, during the decubitus, the operator is more quickly fatigued, besides being restrained in his movements; the necessary manœuvres are more difficult to perform, and the weight of the fœtus is often an additional obstacle. And even when the creature is lying, if the traction is very strong, it is often necessary to prevent the body being drawn backwards.

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All these inconveniences being recognised by Baron, in 1858 he introduced an obstetrical machine—an apparatus for producing sustained traction (*appareil à traction soutenue*) in the extraction of the fœtus. This apparatus presses against the hind-quarters of the parturient animal, and owing to its construction it can not only develop a very energetic extractive force in the gentlest and most inoffensive way possible, but itself produces the counter-extension in an exactly proportionate degree.

The principal parts of the machine are: a kind of horse-collar (Fig. 184, A) with three stalks (B, C, D) intermediate between this collar and a broad, fixed, female screw (E), which receives a movable screw rod (H) that bears a revolving hook and chain (K) at one end; the other end of the chain has also a hook to which the cord or cords fixed on the fœtus are attached. The collar

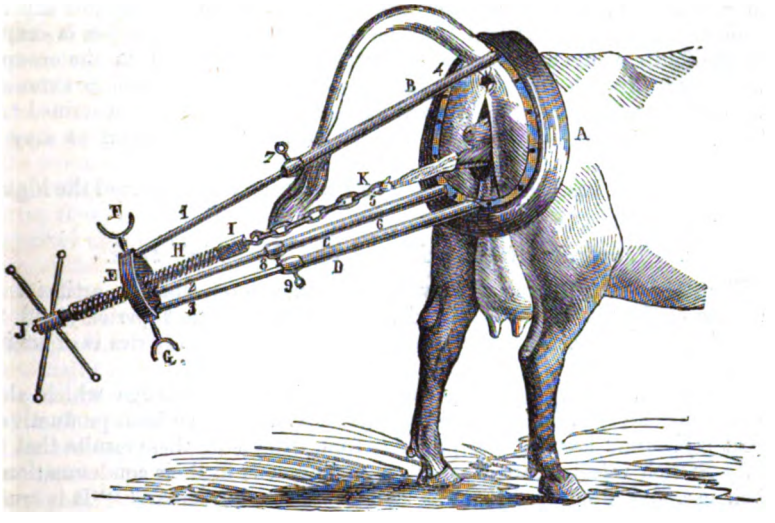

Fig. 184.

BARON'S OBSTETRIC MACHINE.

is made of several pieces of light wood superposed and bound together by an iron band applied to its posterior surface. This band is perforated by three screwed holes placed in a triangular position, and which receive the iron stalks. The anterior face of the collar is so fashioned as to fit closely on the hind parts of the animal, the space for the passage of the fœtus being about twenty inches in diameter. The intermediate stalks (B, C, D) serve to transmit to the collar the pressure exercised by the female screw; they are about forty inches long, and each is composed of two pieces, one of these being hollow (4, 5, 6), the other solid (1, 2, 3): consequently, one fits into the other, and the end opposite the collar enters one of the openings in the flange of the female screw (E); a small thumb-screw (7, 8, 9) secures the two portions of the stalk. The female screw is of iron or copper, the flange being of wood, and its circumference provided with two handles to hold it firmly when the machine is in use. The male screw (H) is of iron, and

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screwed to the right; one extremity articulates with the turning-hook (I); it is screwed in the contrary direction to the principal portion, so as not to become unscrewed during the operation; the other end has a four-branched windlass which can be removed at will.

To use the machine, the animal is made to lie; the cords are attached to the fœtus in the usual manner; the windlass handle is put on its place; the screwed stalk (H) is introduced into the female screw to about as far as J; the collar is applied to the animal's croup, and the three long stalks are fixed —one end in the collar, the other in the flange. An assistant keeps the machine in equilibrium by placing one of his hands on one of the forked handles of the flange, while the other handle rests firmly on the ground. Another assistant, the cords attached to the fœtus being fixed in the hook at the end of the chain (K), slowly turns the windlass in such a direction as will bring the extremity of the stalk (I) towards the flange, while the operator superintends the extraction. It will thus be seen that a strong traction is exerted on the fœtus, while a proportionate pressure is transmitted to the croup of the parent through the three long rods—the machine producing extension and counter-extension at the same time, while it also allows a sustained traction to be obtained—without jerks or checks, and as powerful as may be desired.

This machine has been well tested in France, and has received the highest praise.

Comparison between Manual and Mechanical Force.

The employment of machines which multiply force, for the artificial extraction of the fœtus, can be traced to a somewhat distant period; and the use of the windlass, the wheel, and the cart by rude empirics is of ancient date.

Resorted to by ignorant people destitute of that knowledge which alone can ensure safety and success, these appliances must have been productive of great injury and loss. It was probably from witnessing these results that the early French veterinarians were almost unanimous in their condemnation of their use, and designated them as "cruel" and "murderous." "It is cruel," says Fromage de Feugré, "to tie a cord to a calf, and to pull at it by the windlass or capstan, or by horses attached to it. It is much better, the Cow being tied by its horns, to make men pull at the cord, so that force may be employed with more precaution and management." Hurtrel d'Arboval remarks: "There are people who would go so far as to pull at the cord which is attached to the foal or the calf by the windlass, the capstan, or pulleys; this procedure is not only cruel, but its violence usually kills the fœtus, and often causes lacerations, serious injury, and displacement of the uterus." Other writers have written in equally strong terms against the use of traction machines, and in favour of manual force—which, they argue, is an intelligent force, may be graduated at will, and its direction modified according to circumstances, so as always to act in the most favourable way—*i.e.*, in the axis of the pelvis.

Nevertheless, since 1838, when Lecoq spoke out in favour of mechanical appliances, many of the most experienced practitioners have expressed themselves in their favour. "I propose the pulley," says Lecoq, "because it affords much more gentle and steady traction than that obtained by strength of arm. . . . This opinion is shared by the majority of the veterinary surgeons in our part of the world." "The employment of the *moulinet*," writes

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Darreau in 1852, "gives a more regular and sustained traction than that of assistants, no matter how vigorous and intelligent these may be; in turning it slowly, we obtain a gradual and continuous traction; the shoulders and the body of the fœtus are elongated, the sides are flattened by the pressure, and delivery is effected in the majority of cases without an accident. . . . By this procedure, we succeed in eight cases out of ten." Ayrault writes (*Recueil de Méd. Vétérinaire*, 1857): "I have decided to employ a means which I have often very severely qualified when in the hands of empirics, and which can be only barbarous and brutal by reason of the ignorance of those who apply it: I speak of the windlass, and wheel and axle. . . . It is now amply demonstrated to me that this obstetrical means, so little enticing at first sight, is the first among all the means for producing traction which the veterinary surgeon has at his disposal—provided always that he watches its operation with much attention . . . . so that no part of the fœtus wedges against the sides of the pelvis; for the windlass does not know of any obstacle which it cannot overcome." And Garreau, commenting on Baron's obstetric machine just described, remarks (*Report à la Soc. Centrale de Méd. Vétérinaire*, 1858): "From what has been said, it results from an examination of every part of this apparatus: that the mechanism is simple, and works well and easily; that its power is at least equal to that of the pulleys, windlass, or capstan; that its action is based on mechanical laws; that the traction it produces is so gentle, slow, and regular, that it is without danger for the mother; that its employment altogether leaves behind all the other means used for the production of the necessary counter-extension in fœtal extraction; that the collar transmits, in a regular manner, and to the whole of the inferior and posterior parts of the maternal pelvis, the pressure it receives from the female screw; that this pressure, disseminated over the entire hind-quarters of the female, is proportionally less severe and painful during traction of a given intensity."

Many more references could be given to other very competent authorities in favour of mechanical over manual traction; but we will sum up the evidence by stating that mechanical traction is preferable to that produced by manual power, inasmuch as it is slower, more regular, its action is more sustained, and it is more powerful and efficacious, without imposing increased strain on the parent or fœtus. Manual traction is unsteady and jerking, especially when several men are pulling; all the men do not pull alike or at the same time, therefore even during traction, however steady it may aim to be, the strain varies; men soon become fatigued, whereas the machine can maintain the traction for any length of time without increasing or diminishing it.

One of the objections urged against machine traction, is that its direction cannot be so easily varied upwards, downwards, or to one side or the other, as manual traction. But this is a very trifling objection, and it may be nearly, if not altogether, overcome by making assistants press against the cord or cords, so as to give them the necessary direction.

When powerful traction is required, whether it be manual or mechanical, great attention is necessary in guiding the fœtus through the genital canal, so as to prevent injury to the parent. The traction should cease in the intervals between the labour-pains, and the efforts ought not to be continuous; the animal should be allowed intervals of rest, and time be given for the genital canal to dilate and adapt itself to the passage of the fœtus. Severe and injudicious traction may be productive of the most serious results. Even when the operation is nearly terminated, care will be requisite in order to prevent

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inversion of the uterus. This accident may be obviated by careful manipulation, and abundant injection of emolient fluids.*

CHAPTER II.

Embryotomy.

EMBRYOTOMY, or *embryulcia*, is the name given to every operation which has for its object the reduction in volume of the fœtus at parturition, by mutilating or dividing it; so as to allow it to be extracted by portions, when it cannot be delivered whole. It is a generic term for a number of operations very different in their character, and performed on the fœtus either while it is wholly retained in the uterus, or more or less engaged in the genital passage.

These operations may be practised on various parts of the young creature: head, limbs, or body, and facilitate the removal of one or more parts, so that the remainder can be removed from the uterine cavity. Of course, the life of the fœtus, if it be alive, is sacrificed in every case; and this sacrifice is only made to prevent a greater loss—the death of the parent. But in resorting to embryotomy, the veterinary obstetrist is not hampered by those grave considerations which, in a legal, moral, and religious point of view, have so long embarrassed the action of the accoucheur of woman.

The question with the veterinary surgeon, should the fœtus be living, is as to the respective value of parent and offspring, and which of these should be preserved in the interest of the owner.

In nearly every instance the response is entirely in favour of the parent, this being of most commercial value; and this fact, together with the absence of legal and moral objections, will account for embryotomy being much more frequently practised in veterinary than in human obstetrics. Nevertheless, the destruction of the living fœtus in the case of the domesticated animals should not be lightly entertained; it is the duty of the veterinarian, in the interest of his client, to preserve the life of the young creature, as well as that of the parent, by every means in his power; and it is not until these means have been fairly tried, or are deemed insufficient after due deliberation and without trial, that the necessary mutilation should be undertaken. And it must not be forgotten that embryotomy is not always without danger for the parent; on the contrary, it is nearly always serious, and its consequences have often to be dreaded, while to the operator it is in the great majority of cases a heavy and fatiguing task.

When the fœtus is not dead, then it is only the most urgent necessity that should impel the obstetrist to resort to embryotomy; though when the creature has perished there is no need for hesitation, and the operation may

* While on the subject of mechanical traction in veterinary obstetrics, we may note that two distinguished French accoucheurs—MM. Chassagny and Joulin—have recently introduced an apparatus intended to replace mechanical for manual traction in the human female, both being unanimous with regard to the superiority of the former over the latter. Chassagny gives his reasons for preferring the one to the other (they are the same as those which have been expressed by veterinary obstetrists for many years), in a well-written article in the *Gazette Médicale de Lyon* for 1861; while Joulin, a year afterwards, in his work on midwifery (*Traité complet d'Accouchements*, Paris, 1862), points out in the clearest manner the great advantages of this means of extraction.

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be undertaken at once, if the operator is satisfied that extraction cannot be readily effected otherwise.

We have already indicated the conditions which generally require recourse to embryotomy. These are *deformities of the maternal pelvis*—either congenital or acquired, constitutional or accidental—which prevent extraction of the intact fœtus, this condition being, however, very rare in animals; *hysterocele; disproportion between the size of the fœtus and the genital canal;* certain kinds of *monstrosity;* particular *malpresentations* and *malpositions*, as well as *irreducible distortions* of the fœtus; *death of the fœtus*, when its retention in the uterus has given rise to intense emphysema which hinders delivery; certain *diseases of the fœtus*, as hydrocephalus, ascitis, œdema, etc. Indeed, embryotomy is indicated in every case when parturition cannot be accomplished by the other measures already mentioned, without seriously compromising the life or future usefulness of the parent.

We have stated that division of the fœtus is a heavy and fatiguing task; and we have only now to remark that, however easy it may be to lay down rules and give directions as to how the *manuel* of the operation should be conducted, those only who have had experience in this direction can testify that it is much easier to write and to speak than to act, and that some of the manœuvres so complacently recommended by those who have but little knowledge of the practical part of veterinary obstetrics, cannot be carried out.

The fact is, that embryotomy cannot be restricted to definite rules which shall be applicable to every case; the operation must vary according to circumstances, and these are often of the most diverse kind. In very many instances, before the veterinarian is called in, rude and misguided hands have greatly complicated the case, and caused so much injury and swelling to the maternal organs that the difficulties of the operation are increased manifold.

But, as in everything else, there is a right way and a wrong way of operating—apart from the collateral difficulties of the operation; and though no fixed rules can be laid down for every case which requires embryotomy, yet there are directions, based on the results of practical experience, which afford a general and trustworthy summary of the most important points to be observed—by the young practitioner more particularly. These directions we will now allude to, in treating of the incision, excision, or ablation of those parts of the fœtus which are selected for operation—these being the head, limbs, and body. But we must first notice the instruments in actual use, or which are recommended for performing embryotomy.

Embryotomy Instruments.

The performance of embryotomy necessitates the use of surgical appliances for the division, puncture, or removal of certain parts; and as these operations have to be effected either in the genital canal or in the cavity of the uterus, the manipulation of cutting instruments in such a confined space, under all the disadvantages of distance from the operator, the struggles and paralysing straining of the mother, and the fact that only one hand can be employed, and that without the aid of vision to guide and direct it, renders the operations peculiarly difficult and dangerous. These difficulties and dangers have stimulated the inventive faculties of veterinarians for a long time, in devising instruments by which they might operate quickly and safely, and so obviate fatigue and danger to themselves, and exhaustion and risk to the parturient animal.

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It is needless to remark that many of these instruments have never come into general use, either because they did not fulfil the requirements claimed from them, or because they were too complicated or expensive. Sometimes, also, prejudice rather conflicts with the introduction of any novelty in this direction; while long experience often enables the practitioner to achieve the desired end with instruments which would be useless, if not dangerous, in the hand of a less expert obstetrist.

So it is that, for nearly all the cutting operations, an ordinary pocket-knife or bistoury is sometimes the only instrument employed; the operator being satisfied if the spring is sufficiently strong to prevent the blade shutting up in the handle when it is used in the uterus. Rainard preferred an ordinary knife with a blunt point and a convex cutting edge; others use a bistoury caché. Even small pocket-knives of various sizes are utilised for this purpose, and one of Mr. Cartwright's embryotomy knives is not unlike a gardener's large pruning-knife. In the use and preference for knives, much must depend upon custom and the expertness of the operator.

Nevertheless, convenience, safety, and the absence of long experience, demand that proper instruments be devised for this operation; and this requirement has long been present to the minds of veterinary obstetrists. One of the earliest to introduce a convenient and efficient embryotom was Günther,

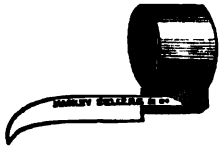

Fig. 185.

STRAIGHT EMBRYOTOM.

Fig. 186.

CURVED EMBRYOTOM.

who, in his work, published in 1830, figures an instrument which is fixed on the finger by a ring; the cutting edge of the blade, about two inches long, being somewhat concave. This embryotom has been slightly modified in various ways by different practitioners—sometimes having two narrow rings, so as to grasp more of the finger; at other times having, in addition, a small button on the back of the blade for the finger to press upon; while the blade itself has been made more curved, straighter, longer, or like the blade of a fleam. This instrument is the prototype of the ring scalpel invented by Dr. Simpson, of St. Andrews, for opening the skull of the human fœtus. Two of these embryotoms which have been used in this country, are shown in the annexed figures (185, 186). An improvement in this instrument is the having a hole at the opposite end of the blade (Fig. 186), through which a piece of cord or tape can be passed and tied round the wrist, to prevent the knife slipping from the finger and falling into the cavity of the uterus. Indeed, this is a wise precaution with all the short instruments introduced into the genital organs, as the contractions of the uterus, struggles of the animal, and the position of the hand, as well as the slipperiness caused by the presence of mucus, etc., only too often render the hold of the instrument very insecure. The middle-finger of the operating hand is passed through the ring and the other fingers enclose the blade, which is in this way safely con-

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veyed to the part of the fœtus which is to be incised. The finger-knife is the most useful instrument in embryotomy.

Günther also at this time introduced another form of embryotom, which has likewise continued in use, and has been more or less altered or improved in shape. This consists of a blade, which can be made to slide out of or into a handle, by the thumb of the hand holding it. It can therefore be introduced into or withdrawn from the genital passage, without risk of injury to the maternal organs. The annexed figure (187) exhibits an improved model of Günther's second embryotom; the original pattern had double cutting edges. We may remark that Zundel and Saint-Cyr give Thibeaudeau the credit of inventing this sliding bistoury; but the instrument is only described by the latter in 1831 (*Rec. de Méd. Vétérinaire*, 1831, p. 152); whereas an exactly similar knife is figured in Günther's work (*Lehrbuch der Practischen Veterinär-Geburtshülfe*), published at Hanover in 1830.

Another kind of embryotom is one not unlike an ordinary large scalpel, along

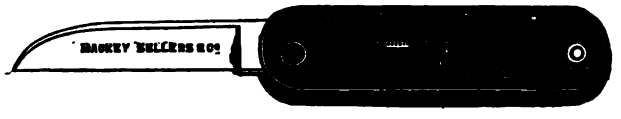

Fig. 187.

GUNTHER'S EMBRYOTOM: IMPROVED PATTERN.

one side of which glides a blade-guard, which can also be moved backwards or forwards by the thumb of the hand that holds it. This is a very convenient knife (Fig. 188).

Embryotoms have also been proposed by Brogniez, Hubert, Contamin, Obermayer, and others, but they all are more or less imitations of the foregoing models.

Günther figures an embryotom fixed on a handle, and which may be of any convenient length—about thirty inches is recommended (Fig. 189); the blade is semicircular, the concave border and point being very sharp. This instru-

Fig. 188.

COLIN'S SCALPEL EMBRYOTOM.

ment is extolled for its usefulness in cutting through the muscles subcutaneously, and especially in separating the limbs from the trunk. The same authority gives the figure of a "Scheerenmesser," or "secator," as it has been termed. This is an instrument about thirty-six inches in length, composed of two branches, held together by two short sheaths, through which the one glides on the other. Each of the branches has a blade placed at a right angle to the stalk; these blades are opposite each other, the opposing edges being sharp, and they are brought in contact by a rachet arrangement and screw moved by a handle at the other extremity. This instrument is very powerful, and can divide bones as well as soft tissues.

Subcutaneous embryotomy is at times very necessary, but after the skin

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has been incised great difficulty is often experienced in separating it from the textures beneath, by tearing through the connective tissue. This is found to be the case more particularly in amputating the shoulder, when the fingers become fatigued in trying to pass them beneath the skin. To facilitate this part of the operation, different-shaped spatulas have been devised, which do the work of the fingers in liberating the skin from the parts it covers. One

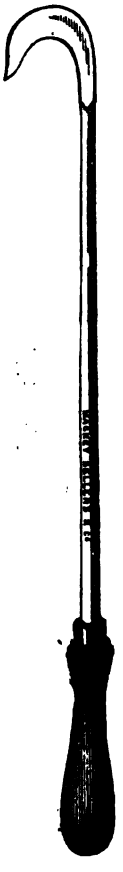

Fig. 189.

GUNTHER'S LONG-HANDLED EMBRYOTOM.

Fig. 190.

CARTWRIGHT'S SUBCUTANEOUS SPATULA.

Fig. 191.

CARSTEN HARM'S SPATULA.

of these spatulas has been used by Cartwright; it is merely a thin but rigid blade of iron, about seven inches long and one or one and a quarter inch wide, the edges being smooth and rounded, and one end fixed in a wooden handle (Fig. 190).

Carsten Harms employs a double spatula about three feet in length; the blade at each end is about an inch wide and two inches long, the intermediate portion being simply a round rod about half-inch thick; one end is a

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little bent to one side (Fig. 191). This instrument can be used with both hands, and is more firmly held than a one-handed spatula.

Ungefrohrn proposes another, but somewhat differently-shaped, spatula. This measures about twenty-five inches, the stalk being about three-eighths of

Fig. 192.
UNGEFROHRN'S SPATULA.

Fig. 193.
CARTWRIGHT'S BONE-CHISEL.

Fig. 194.
CARTWRIGHT'S BONE-SAW.

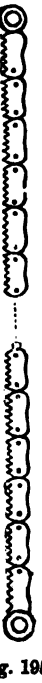

Fig. 195.
SWEDISH CHAIN-SAW.

an inch thick, and the blade two inches long and somewhat crescent-shaped; the convex border is most useful in raising the skin, particularly in parts where the connective tissue is close and resisting. The blade must be pretty strong and slightly convex on one side, concave on the other. The other end has a wide eyelet as a handle.

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The section of bones, though not often necessary, is nevertheless sometimes required to be made, and it is found to be no easy matter—with the larger bones especially. For this purpose chisels, saws, and forceps have been proposed and employed. Cartwright has a model of an instrument for slitting up the skin of a limb, which may, on occasions, be made useful as a bone-chisel. Including the handle, it is about thirty-two inches in length; the chisel portion is a little more than two inches long, and one or one and a half inch broad; only the middle portion at the end is sharp, the two corners, which project a little, being blunt and rounded, as are also the sides (Fig. 193).

Margraff's "Stemmeisen," or chisel, is not unlike a joiner's chisel in shape; the instrument itself is seven or eight inches long, and at its cutting edge (end), which is very sharp, it is an inch to inch-and-quarter broad. The sides are well rounded, and the instrument gradually tapers as it reaches the handle, into which it is fixed. This handle is a round piece of hard wood about three feet long and about two inches in diameter, with a ferule at the end into which the chisel is fixed, as in the ordinary carpenter's chisel. The cutting end of the instrument is carried by the right or left hand to the part of the fœtus to be incised, while the handle is held by the other hand. The two hands can in this way be employed: that in the uterus guiding the movements of the chisel, while that holding the handle applies the necessary force. This simple instrument has been found most serviceable in dividing the vertebræ when the body of the fœtus had to be bisected, dividing the head or, in double-headed monstrosities, the two heads; as well as slitting up the skin. It has been well suggested that if the cutting edge was made slightly concave the chisel would be more useful.

For the same purpose a saw has been proposed. Such an article has been successfully employed when the occasion demanded it. Cartwright's saw is shown in the annexed figure (194). The stalk (of iron) is sixteen inches in length, the saw four inches long, and the handle six inches. The saw-blade should be of the same thickness throughout, the end and back being well-rounded and smooth.

Sjöstedt (*Handbok i Förlossnings Konsten för och uppfödare af Husdjur*) draws attention to the value of the ordinary surgical chain-saw, which a veterinary surgeon at Strömsholm had successfully employed. That which was recommended is about a foot in length, and an inch wide. Each end has a ring to which a cord is attached, and to the cord may be fixed a short, transverse wooden handle. The chain-saw has the advantage of being perfectly flexible, and can therefore be passed around bones, joints, etc., and the necessary movements performed in cutting through these—by pulling alternately at each cord—without endangering the organs of the mother. One hand of the operator must, of necessity, guide the saw and ascertain its progress.*

Bone-forceps might be used advantageously, but we are not aware that they have been employed in veterinary obstetrica. They should be made with the jaws bent, so that the cutting edge would be concave, and they could be made sufficiently strong in jaws and handles to cut through the largest bones. A screw at the end of the handles would bring these together with sufficient force to divide the strongest pieces of bone.

In the foregoing we have only alluded to the instruments which are generally approved of; many more might have been described, but no par-

* All the obstetrical instruments to which reference has been made in this work, are supplied by Mackey, Sellers & Co., Bouverie Street, Fleet Street, London.

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ticular advantage could have been derived by doing so. A multitude of instruments can only be embarrassing to the veterinary obstetrist. Besides, it must be confessed that too little attention has been devoted to the perfecting of those already in use, or to devising others more simple and efficient to supplant them. There is here a wide field still open for those who desire to cultivate a most important department of veterinary surgery.

Instruments necessary for particular operations will be referred to as these are described.

Preliminary Arrangements for Embryotomy.

There is not much to arrange before commencing embryotomy. The operator is supposed to have made an exploration of the genital passage, and to have ascertained the state of affairs; he may even have attempted everything possible in the way of extraction, and failed. Being satisfied that nothing remains to be done to preserve the life of the parent, save removing the fœtus piecemeal, he has to decide, from the nature of the case, how this is to be effected. The necessary instruments he may have with him, or they may be devised on the spot; if the case is more difficult than usual, they may have to be sent for. But, as a rule, the operator must utilise to the best of his ability whatever is to hand; as he usually finds his patient greatly exhausted, either from protracted labour or the mischievous meddling of untutored hands.

The animal must be detached from the manger or rack, and kept, if possible, in a standing attitude: this position being the one best suited for such an operation, or it may be tied by the head to a stake, by a rather long head-rope. A rope, or, better still, a rug or blanket, should be passed round the hind-quarters, a little above the hocks, the ends being held by assistants standing towards the shoulders of the animal. This precaution is required to steady the creature, to keep it in a standing position, and to assist it in resisting the traction generally employed in removing the fœtus. It may be necessary, if the animal is much exhausted or suffering much pain, to administer a stimulant, meal or flour gruel, or an anodyne draught.

Cephalotomy.

Every operation which has for its object the diminution in size of the head, or rather cranium, when this part offers an obstacle to the passage of the fœtus, is designated by this name. Hydrocephalus is the condition which most frequently calls for the operation in the larger animals; though certain malformations and monstrosities, and even an exaggerated volume of the head of the fœtus in the Bitch or Cat, may also require it.

Cephalotomy comprises several distinct operations, which may be performed independently or simultaneously. These are *simple puncture, incision,* or *crushing* of the cranial parietes.

Puncture of the Cranium.

In order to allow the escape of fluid from the cranium, as in hydrocephalus, and thus permit the birth of the fœtus, a simple puncture is often all that is necessary. The fluid having escaped, the thin fragile bones of the cranium readily collapse from the pressure they undergo in the pelvic cavity; so that the head and body can be removed by traction.

Supposing the presentation to be anterior, it is first necessary to fix the head, unless it is firmly wedged in the passage; this fixation may be effected by using a head-stall, Schaack's head-stall forceps, or even a cord on the lower

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jaw: exercising sufficient traction on the cord to prevent the head from slipping from under the hand of the obstetrist during the operation.

The head may be punctured by a scalpel, straight bistoury, finger-knife, or even the finger in certain cases. If a long-bladed instrument is used, there is sometimes a good deal of risk, so far as the maternal organs are concerned; and it is advisable to wrap twine, tow, or tape, around a good portion of the blade towards the handle.

The best instrument, if it is at hand, is a long, medium-sized trocar and cannula, the end of the latter fitting closely on the stalk of the trocar, which should be very sharp. It is introduced safely into the genital canal by drawing the point sufficiently far back into the cannula as to be entirely concealed. This end is then seized between the fingers and thumb in such a way that the index-finger extends a little beyond the extremity of the cannula; the other three fingers holding it in the palm of the hand, while the right hand sustains and guides the instrument. Should the trocar not fit the cannula tightly, the play between the two renders their introduction somewhat difficult, and the point may glide through and wound the operator. The trocar may, in such a case, be pushed quite through the cannula, and the point fixed in a cork which can readily be knocked off by one of the fingers when the instrument has reached the head of the fœtus. Having arrived at this part, the proper spot for puncture is selected, and then the instrument is applied to it—perpendicular to its surface if possible, to prevent slipping. The trocar is made to penetrate slowly by a slight rotatory motion from side to side, and when all resistance ceases the cranium is perforated. This perforation should not be made at the sutures, if they can be avoided, as they overlap and close the opening. The cannula is now held firmly in its place by the left hand, the trocar is withdrawn by the right, and the fluid escapes. The instrument should be sufficiently long for the end to be near, or even outside, the vulva, when the point is on the cranium of the fœtus.

There is no difficulty in performing this operation when the head presents first, even though it should not have entered the inlet, so long as it is easily accessible to the hand. With the posterior presentation, however, the operation is troublesome; as owing to the body of the fœtus occupying the passage, it is extremely difficult to pass the hand armed with the trocar so far as the head. Nevertheless, it may be accomplished in many cases by patience and tact. There is no reason why the trocar and cannula should not be passed through the mouth of the fœtus in some cases, and made to penetrate the cranium at the base of the skull, when the frontal region cannot be attained. If the head cannot be reached in this presentation, then exsection of the body of the young creature must be practised, and the parts removed until the head can be manipulated.

Craniotomy.

Craniotomy, or *incision* of the cranium, is resorted to when puncture has not sufficiently reduced the size of the head. It is an operation of great antiquity in human obstetrics, and various instruments have been introduced to facilitate its performance; but very few of them have been utilised in veterinary obstetrics, and indeed for the larger domesticated animals they are of no use. A simple straight or curved bistoury, Günther's sliding embryotom (Fig. 187), finger-scalpel (Figs. 185, 186), the long-handled embryotom (Fig. 189), scalpel embryotom (Fig. 188), bone-chisel (Fig. 193), or saw (Fig. 194), may one or all be employed, according to circumstances. It cannot be denied, however, that the operation is very difficult to execute, and

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not without serious danger for the parent. Even in woman, with all those advantages and appliances of which the veterinary obstetrist cannot avail himself, craniotomy is always a formidable undertaking. The *cephalotribe* and *cranioclast*, so useful in human obstetricy, cannot be employed with our animals, it would appear; but there is no reason why modifications of these instruments might not be devised to answer the same end.

Hurtrel d'Arboval recommends that craniotomy be performed with a convex probe-pointed bistoury (sharp on the convex border), the middle of the cranium being incised; then the fingers compress the bones, and so effect delivery.

Rainard advises two incisions on each side of the head, in the parietal region. Günther mentions that if, after puncture, the operator cannot crush the bones of the cranium with the hand, they should be cut by his secator, and removed piecemeal. Carsten Harms states that when the head is an obstacle, it should always be crushed, if possible, the bones being broken beneath the skin. Sometimes it is sufficient to remove the lower jaw; and in order to effect this, the jaw is first fixed by a cord, the skin is then cut through on each side—from the commissure of the mouth to the temporo-maxillary articulation, the masseter muscles and the ligaments being divided; a transverse section of the skin is now made between the two joints, the finger separating it, and two or three assistants pulling at the cord, the jaw is removed. If it is the transverse diameter of the head which forms the obstacle, the division must be longitudinal, and great service may be derived from the use of the bone-chisel—either Cartwright's or Margraff's pattern. As much of the skin should be left as possible, in order to cover the jagged ends of the bones.

With the smaller animals, puncture and craniotomy are not at all difficult operations, the bones being fragile and easily perforated or crushed.

Decapitation.

Decapitation, an operation which consists in separating the head completely from the body, so as to allow these parts to be removed one after the other, is not very often required; and fortunately so, as it is not without great danger to the parent. More frequently the head is partially removed, the fore-limbs amputated, or evisceration of the chest or abdomen, or both, practised, rather than resort to decapitation.

Nevertheless, it is indicated when a double-headed monstrosity—monosomian or sysomian—is presented, and in certain irreducible malpositions of the head or limbs—especially in heifers, when the head of the calf is in the genital canal, and can neither be advanced nor pushed into the uterus.

The operation is more or less difficult, according to the situation of the head: if entirely in the uterus or fixed in the passage, or if it is or can be brought near or beyond the vulva. In the latter instance, it is easily accomplished; although, except in the case of double monstrosities, it is rarely very useful, as when the head is in this situation it is not an obstacle to birth, and its removal deprives the operator of a most powerful means of exercising traction on the parts which are firmly retained in the maternal organs. When wedged in the canal, however, the head may prove a troublesome obstacle to the performance of those manœuvres necessary for the reduction of other parts; as it may not be possible either to advance or repel it, nor yet to pass the hand between it and the pelvic walls to search for a deviated limb, for example, or to bring this limb into a proper position.

The passage must, therefore, be freed from the obstacle, and this can be accomplished in various ways, the most common of which is as follows: The

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fore-limbs, if present, are corded and pushed as far towards the uterus as possible; then the head is secured by cording the lower jaw, a pointed hook fixed in each orbit, or a head-collar over the head if it can be placed. Four or five assistants now pull at the head by these appliances, so as to bring it as near the vulva as circumstances will permit; while another assistant keeps the labia apart, in order to expose as much of the head as he can, and prevent injury to the organs of the parent. The operator, with a convenient knife (the curved finger-scalpel is very useful), incises the skin around the neck—first one side, then the other—close to the occiput, passes his fingers between it and the muscles beneath, and pushes it well back on the neck—the assistants pulling at the head at the same time, facilitate this separation. A few cuts now divide the soft tissues down to the vertebræ, and nothing, more remains to be done than to produce disarticulation by vigorous traction, and a twisting movement of the head at the same time; the ligaments gradually yield and tear, the head extends and at last comes away, and the body of the fœtus recedes more or less suddenly into the abdominal cavity. If the limbs have been previously secured, they are brought into the passage by the cords attached to them; or if they are not so accessible, they must be sought for in the way already indicated, and delivery completed: care being taken to cover the exposed bones of the neck by the surplus skin, while the fœtus is being brought through the passage.

Another method is to make an incision through the skin across the forehead, in front of the ears, and to separate it by means of the fingers or spatula as far as the occipital articulation. The knife divides this joint, as well as the soft tissues around it, and particularly the ligaments; traction will bring away the head. The upper part of the neck is covered by the loose skin—which may be fixed there by ligature—and directed into the middle of the passage. Crotchets should now be placed on the bodies of the vertebræ, or even on the ribs if they can be reached; as the limbs do not offer sufficient resistance if they alone are pulled at, neither do they bring the body fairly into the passage. Traction should be made on the sternum, not the withers, as the latter ought first to enter the inlet.

A third method consists in removing the lower jaw, and excising the head from below. Or this excision may be practised from the mouth, the chisel being used to divide the vertebræ, after the cheeks, masseter muscles, and soft tissues behind the lower jaw have been cut through.

Decapitation, under the most favourable circumstances, is often a long and fatiguing operation, as the greatest care has to be observed in order to avoid injuring the parent. But this fatigue and anxiety are vastly increased, when the head is deeply buried in the passage or the uterus. Then, as Saint-Cyr truthfully says, the hand, moist with the fluids of the genital organs, embarrassed by shreds of the fœtal envelopes, hampered by the presence of the limbs, compressed and paralysed by the uterine contractions—the hand can then scarcely hold and guide the cutting instrument, or distinguish what belongs to the fœtus and what to the mother, and has no longer any strength to divide the tissues, which are all the more difficult to cut by reason of their softness and flaccidity. It will readily be understood how such an operation must be difficult for the operator and dangerous for the mother. It would almost be deemed impossible, if veterinarians had not attempted it and succeeded; though the majority of them have said but little as to their mode of procedure.

It is always preferable, if possible, to remove one of the fore-limbs, as this is easier, quicker, and less dangerous.

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But decapitation must sometimes be performed, and then the above instructions will be found useful.

In the case of double-headed monstrosities, the saw and bone-chisel, or a pair of strong bone-forceps, will be valuable. When the head of the fœtus is retained in the uterus, and bent back towards the shoulder or flank, then it may be decided to amputate the head should it and the neck be distorted. Disarticulation may be commenced at the most convenient part of the convexity made by the bend of the neck, cutting through the soft tissues down to the vertebræ on that side, then on the other; then sawing or chiselling through the bones, and afterwards using the crotchets carefully.

Amputation of the Limbs.

When the limbs are so deviated that they cannot be straightened, or when by their presence in the genital passage they prevent the necessary manœuvres for the adjustment of other parts of the fœtus, then it may be necessary to amputate or disarticulate one or more of the extremities. Some of the indications for the operation have been referred to on various occasions: they include all those fœtal monstrosities which have supernumerary limbs that require removal before delivery can be effected; those cases in which the fœtus is exaggerated in volume, either normally, or through having become emphysematous after death *in utero;* those complicated malpresentations, such as the abdominal, hock, thigh, etc., and certain deviations of the head and neck in the anterior presentation. Saint-Cyr points out that, in the latter, it is well to hesitate before deciding to remove the limbs; for if it is true that their ablation allows more space for manœuvres, and more facility for adjusting the head, it is not less true that, should these manœuvres fail, by the loss of the limbs we are deprived of a powerful means of traction when we are compelled, as a *dernière ressource,* to adopt forced extraction. Besides, it must not be forgotten that embryotomy is itself an extreme measure, to which we should only have recourse when every other fails or seems to be really hopeless.

One or both of the fore or hind-limbs may be required to be amputated, according to circumstances. In the earlier days of veterinary science, the obstetrist was content to pull at the limb of the fœtus which he wished to remove, either by mechanical or manual power, until it was torn off by brute-force. Fromage de Feugré mentions that Texier had in this manner torn away the limbs of many foals which he could not extract—the separation of the limb always taking place between the chest and scapula, by rupture of the muscles uniting these two parts; and he asserts that by this procedure he was able to save many Mares—though he says nothing as to the suffering of these before the limbs could be torn from the body.

Subsequently, it was discovered that the skin offered most resistance to this kind of avulsion—the muscles and ligaments being much more easily torn. Then the knife was employed to incise the skin, and thus get rid of the chief difficulty. On the Continent, in amputating a fore-limb, for instance, the skin and muscles were divided as near the shoulder as possible, and the bones, united by their ligaments and covered by the skin, separated by traction. Skellet, in his crude and imperfect work (*A Practical Treatise on the Parturition of the Cow*), published in 1807, writes: "Take a sharp knife, and cut from the point of each shoulder of the calf to the muscular or thick part of the fore-leg; then cut round it, so as to enable the operator to skin the upper part of the shoulder. A knife is then to be conveyed between the shoulder and brisket, so as to cut

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the muscles which unite them. When so done, the leg and shoulder may be easily pulled off from its body. The other fore-leg, etc., is to be taken off in the same way." But the subcutaneous method of excision was greatly facilitated by the directions published in Günther's work in 1830, and also by the publication of the procedure of Huvellier in the same year (*Recueil de Méd. Vétérinaire*, 1830, p. 449); while the parent was protected from some of the dangers and pain which attended the old plan. Since the introduction of this method, it has been adopted by every obstetrist of note, who has either kept to the original *manuel operatoire*, or modified it to suit his own fancy or convenience.

Amputation of the Fore-Limbs.

In order to amputate a fore-limb, it must be more or less advanced in the vagina, or even beyond the vulva. So that, if it is still in the uterus, it must first be removed therefrom and brought into the canal. If both limbs are to be removed, they must be secured by cords around the pastern in the ordinary manner, the cord of the one which is to be first excised being pulled at by two, three, or four assistants, so as to draw it as near, or as much beyond, the vulva as possible. Another assistant then keeps the lips of the vulva wide apart, in order to allow the operator more room. The latter makes a circular incision above the fetlock—or, better still, the knee, taking care not to go deeper than the skin. From this incision, gliding his hand into the vagina, along the limb, he gradually makes a longitudinal one, extending higher up as the leg becomes elongated by the traction.

Some practitioners make this incision on the inner aspect of the limb, others on the outer side. On the latter there is perhaps less danger of wounding the maternal organs, and it may be more convenient for the operator. But this is a matter of minor importance; it is more necessary to be careful in incising the skin over the articulations, so as not to divide the ligaments of these, as this might lead to the limb being torn away at the wrong place; no such precaution is necessary with the muscles.

This longitudinal incision having being made, the skin is separated from the structures beneath, either by means of the fingers or spatula: pushing it up towards the shoulder as it is detached, until at length, as the leg becomes stretched, the incision and the detached skin are as high as the shoulder. The dissection being then deemed sufficient, and the limb being only retained by the muscles which attach it to the thorax, the operator, either by his hand or the crutch, makes pressure on the fœtus, while the assistants are ordered to pull energetically at the cord on the pastern, and in a kind of jerking manner. Soon slight cracking sounds are heard, the muscles are rupturing and giving way, and in a very short time the entire limb—scapula and all—is removed.

The removal of one limb usually leaves a considerable space in the genital canal, and this allows delivery to be completed. Sometimes, however, and particularly when the head is deviated towards the flank, it is necessary to remove the other limb; and this, when effected, permits the head to be sought for and rectified, version accomplished, etc., according to the requirements of the case.

Some practitioners operate in a somewhat different manner to the foregoing. Lecoq, for instance, commences his incision at the upper part of the shoulder, brings it down over the head of the humerus, on the side of the forearm, and as far as the middle of the cannon, where he makes his circular incision; the skin is separated from this part upwards. In some cases this procedure may

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be preferable to the other, and it certainly is less dangerous for the parent; but it may sometimes happen that the shoulder cannot be reached.

Günther pushed back the fœtus as far as possible by means of the crutch, then with the finger-scalpel divided the skin before and behind the scapula, then across—below and above; cutting through the pectoral muscles, and then extracting the limb. Cartwright operates in a similar manner to Lecoq. He first has a leg drawn out, and divides the skin as far as possible; or he introduces his hand, containing a knife, as high as he can on the side of the scapula, and makes an incision thence down the whole length of the limb to the pastern bones; the skin is separated by the fingers or spatula as far as possible from the entire leg, and the transverse pectoral muscles cut through. The limb is then disjointed, either at the pastern or fetlock; the foot being left attached to the skin, as it is afterwards found to be useful in the extraction of the body. Cords are fastened around the limb above the fetlock-joint and knee, and the Cow being firmly tied by the head, the necessary force is applied, and the whole limb drawn away. He writes, "I have known, in some of these cases, the limbs to separate at the shoulder joints, and yet the fœtus has been extracted—both from the Mare and Cow—with the shoulders attached, the points of the latter having, fortunately, not caught the edge of the pelvis. The great danger in these cases is, that the shoulder joints may catch against the pelvis and thus prevent extraction."

Meyer recommends that the circular incision on the cannon be not made until the skin is detached above, as this facilitates avulsion.

It is well to divide as many of the muscles uniting the limb to the chest as possible, and also to apply counter-extension by means of the arm or crutch placed against the chest or opposite shoulder of the fœtus; this also spares the mother much of the pain and exhaustion attending extraction.

Amputation of the entire fore-limb, including the scapula, is a very useful operation in the most serious cases of dystokia; but there sometimes occur instances in which the whole leg need not be excised—as when the legs are an obstacle rather from their length than their volume. This happens, as has been described, in the abdominal presentation of the fœtus, when the limbs so often render version difficult—all of them being perhaps in the genital canal, from which they cannot be advanced or pushed back. In these circumstances, disarticulation of the limbs at the knee or elbow joints is often practised—the latter being generally preferred; though it must be remembered that excision at this part can be but of limited value, and, in fact, is only useful in the presentation just alluded to, because it does not give so much room as removal of the scapula and humerus.

In the abdominal presentation with four legs in the vagina, Donnarieix lays down the following procedure: Three pieces of supple twine are got ready, as well as a strong cord. With the twine the pasterns of three of the limbs are firmly bound, while the cord is fixed on the limb which is to be detached, and confided to five assistants, who pull at the cord while the other limbs are pushed towards the uterus. The knee, then the forearm appear, and the lips of the vulva being kept widely separated, the operator makes a circular incision through the skin at this part; traction is again applied, the muscles tear, and gradually the joint is reached. The tendons and ligaments are cut, and the leg being twisted as it is pulled at, another cut of the knife finally removes it.

With the Sheep or Goat, amputation of the fore-limbs of the fœtus is very rarely indeed required, though, if necessary, it can be effected. The same remark applies to the Bitch and Cat.

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Amputation of the Hind-Limbs.

When the fœtus makes a posterior presentation, with the hind-limbs flexed at the hocks, and so firmly wedged in the canal that they cannot be extended backwards, nor yet sufficiently bent to permit delivery—which is far from being rare in the Mare—these joints are disarticulated.

This is accomplished by passing a running noose round each leg, above the hock, and tying it firmly there. Powerful traction being made on one of the cords by four or five assistants, will bring the point of one of the hocks to the vulva, the lips of which are separated, while the operator divides the gastrocnemii tendons and the lateral ligaments of the joint, so as to produce complete disarticulation. The tibia is then pushed into the vagina, the other limb is amputated in the same way, and birth is accomplished by pulling at both cords, which remain attached to the lower end of the leg-bone.

When the limbs are completely retained in the uterus in this presentation, the procedure recommended at pages 476 and 505 must be adopted. We may remark that Carsten Harms recommends symphysiotomy to be practised on the fœtus, when the buttocks present at the inlet—the symphysis pubis being cut through. By this means, the two borders of the symphysis can be made to overlap, and the transverse diameter of the pelvis thereby diminished. The finger-scalpel and spatula are the instruments he prefers. The saw might be advantageously used.

In certain kinds of monstrosity in which the posterior parts of the fœtus are double, or when the hind-limbs are in the vagina, and in consequence of the narrowness of the maternal pelvis, or width of the croup or haunches of the young creature, birth cannot take place, then amputation of the legs at the trunk may be necessary. Such an operation can be rarely required, however. It is performed in a similar manner to that for removal of the fore-limbs—subcutaneously. A cord is fastened to each pastern, and, one after another, the limbs are drawn towards the vulva; a circular incision is made through the skin above the hock; then a longitudinal incision is carried as high as possible on the thigh, and the skin separated in the ordinary way by means of the spatula—always ascending towards the croup; the gluteal and other muscles attaching the thigh to the pelvis are cut across, and the limb is at last torn away by strong and sustained traction.

Amputation of the hind-limb is a much more onerous and fatiguing operation than the removal of the fore-extremity. The skin adheres very closely to the subjacent textures, and more labour is needed to separate it; the muscles attaching the limb to the trunk are more numerous and powerful, and when they are cut through there remains the resistance of the pubio- and coxo-femoral ligaments (in the foal—the pubio-femoral ligament is not present in the calf). Harms estimates that if three assistants can pull away a fore-limb, four men will not in every instance remove a hind one. However, the difficulties are not always insuperable, and many cases are on record in which the operation has been successfully performed.

After avulsion of the limbs, crotchets should be fixed in the cotyloid cavities or oval foramina, and delivery completed according to the directions already laid down.

Division or Detruncation of the Fœtus.

When one half of the body of the fœtus has more or less passed through the pelvic canal, and the other half is retained, so that it is impossible to extract or return it, it is recommended to cut the trunk in two—*division* or *detruncation*. We have shown that this retention may be due to malposition

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or malpresentation, excessive development of or deformity in the hind-quarters of the fœtus, as well as ascites, anasarca, or emphysema (*physometra*).

If the hind-parts are retained, and the head and fore-limbs are not much beyond the vulva—if so far—cords should be placed on each pastern, and a head-stall on the head, and slow, gradual, but strong traction exerted on them, so as to expose as much of the body of the young creature as possible. This done, the operator, with a sharp bistoury, incises the body in a circular manner as close to the vulva as is convenient (the labia being kept well out of the way by an assistant)—the incision commencing below, which allows the elongation of the vertebral stalk; then the skin and muscles on the sides are divided. When the vertebræ are reached, the bistoury is passed between them, and as close to the loins as possible; slight pulling and twisting will then complete the bisection.

It is a good plan to incise the skin at some distance in front of the place where it is intended to divide the spine, and to separate and push it back over the portion of trunk in the genital canal. When the division of the body is effected, this superfluous skin is pulled forward over the mutilated remaining part of the trunk and sewn together, so as to enclose the latter completely, and prevent injury to the parent during the subsequent manœuvres.

Should the hind-limbs be doubled under the croup in the passage, or should they still be in the uterus, they ought to be sought for and corded at the pasterns, the cords being given to assistants. Then vigorous pressure is applied to the divided end of the spine in the remaining part of the trunk, while the assistants pull until version is effected; extraction is afterwards easy. In some cases it is not necessary, nor is it always possible, to secure the hind-limbs before the trunk is pushed into the uterus, version taking place merely by the retropulsion; and sometimes, when one limb has been found, there is much difficulty in discovering the other. In such a case, and when version cannot be effected, Rainard recommends that the limb which has been secured be drawn towards the vulva, and disarticulated; this will enable the operator to find the other leg.

The fœtus, when wholly retained in the uterus, has been divided, according to the reports of several veterinarians, successfully; but they have not, it would appear, furnished us with any details as to the procedure they adopted. In particular circumstances it might certainly be accomplished, but we scarcely see the necessity for it.

Evisceration.

When it is desired to reduce the volume of the thorax or abdomen, or both, the organs they contain are removed.

This procedure is generally adopted when, after removal of one or more of the limbs, the body of the fœtus still remains fixed in the genital canal; by it we obtain a considerable diminution in the dimensions of these regions, and perhaps next to the removal of the limbs it is the most useful operation in embryotomy, and is to be highly recommended.

As we have said, evisceration of either of the cavities may be practised, according to circumstances. We shall, therefore, describe the mode of reducing the volume of both—thorax and abdomen.

Thoracic Evisceration.

The chest is emptied of its contents first, when the anterior part of the fœtus is in the passage. The head and limbs should be corded—if one of the

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latter is removed all the better; if not, the cords should be pulled well upwards, in order to make more room. Should the head be an obstacle to the performance of the operation, it may be amputated; but if it is back in the uterus, then it may be left there. A strong scalpel with a long handle, the finger-scalpel, or either of the two embryotoms shown in Figs. 187, 188, is the best instrument. It is passed carefully into the vagina until the hand reaches the breast of the fœtus, when the blade is thrust deeply into the chest, between the two front ribs, and as close to the spine as possible, cutting down towards the sternum.

The knife is now dispensed with, and the hand being re-introduced, the fingers are pushed into the fœtal chest and the two first ribs removed, thereby allowing sufficient room for the whole hand to enter the cavity. The lungs and heart are torn away from beneath the spine, and, with the thymus gland, removed from the uterus. The chest collapses a good deal, but if the fœtus cannot yet be extracted, the hand may be pushed through the diaphragm, and the contents of the abdomen carried away through the chest.

Some operators, instead of opening the thorax in front, incise from two to five of the ribs close to the sternum, and pass the hand into the chest by the aperture so made. Others divide the ribs on both sides, and remove the sternum as well as the viscera. It will often be found that the contents of the chest and abdomen can be removed without cutting the ribs.

Abdominal Evisceration.

Evisceration of the abdomen may be effected, as just stated, through the thorax, by tearing away the diaphragm.

But in the posterior or abdominal presentations, and indeed in any presentation or position in which this region is accessible to the hand, eventration can be performed. Nevertheless, it is not always easy; on the contrary, it is sometimes most difficult and dangerous.

Either of the embryotoms used for evisceration of the chest may be employed for the abdomen.

The edge of the instrument is applied to the wall of the cavity, which is incised by drawing the hand towards the operator. Then the whole of the viscera are torn away, and, if need be, that of the chest also, through the diaphragm.

This terminates what we have to state with regard to embryotomy; and it will be remarked that nearly all the operations connected with it require much time, are fatiguing for the operator, and only too often very exhausting and serious for the parent. During the operations, the latter should receive the greatest consideration; from time to time, an interval ought to be allowed for it to rest or to rally from the exhaustion which is always evident to the attentive obstetrist. It may even be necessary to give it a stimulant in the form of brandy, beer, etc., or nourishing drinks—warm or tepid if convenient.

The greatest care should be observed in preventing injury to the maternal organs from the cutting instruments employed, or from the ends of divided bones.

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CHAPTER III.

Vaginal Hysterotomy.

At page 341 we alluded to induration of the cervix uteri as a cause of dystokia, and described more or less fully the indications for overcoming the obstacle; we also alluded to the manner in which these indications should be carried out. As we are now treating of obstetric operations for the extraction of the fœtus, it is necessary that we describe more fully the operation and its consequences, as these are of much importance.

Vaginal hysterotomy consists in incising the indurated and inextensible neck of the uterus, in such a manner, and to such an extent, that it will allow the fœtus to pass through its canal.

For this purpose, the only instrument necessary is a strong probe-pointed bistoury, a bistoury caché, or one of the finger-scalpels or other embryotoms. When the straining of the animal has propelled the cervix uteri towards the vulva, with partial prolapsus of the vagina, the operation is simple, as the eye can then aid the hand. All that has to be done is to glide the instrument into the os, and make the necessary number of incisions through the tissues composing the cervix: the situation and depth of the incisions depending upon the extent of the induration and the atresia.

In other cases there is no prolapsus of the vagina, which is quite soft and elastic. Then the left hand may be passed into it, and the index-finger being introduced into the os, draws the cervix towards the vulva; the labia of the latter are separated by an assistant, and the operator passes the blade of the instrument—guiding it by the index-finger of the other hand—into the os, where he gradually and steadily incises the tissues.

When, however, the walls of the vagina are involved in the induration, this retraction of the cervix cannot be effected, and the part must be operated upon in its ordinary situation: the knife being carried carefully into the vagina, passed to the necessary depth in the os, and the incision made. Perhaps the bistoury caché is the best instrument for such cases.

It is rare indeed that one incision is sufficient; generally from two to four are required, and it is better to have a larger number than make them too deep: they certainly must not pass through the entire thickness of the cervix.

The situation of the incisions is a matter of some moment. The lower portion of the cervix should be avoided, in consequence of its proximity to the floor of the vagina, which is in immediate contact with the bladder and urethra; should these be wounded, the results might be serious, if not fatal; and if the peritoneum is cut or torn during the passage of the fœtus, fluids and discharges will escape into the abdominal cavity, and give rise to peritonitis. There is less danger in incising the upper part of the cervix, as the rectum is not so near; nevertheless, in induration there may be adhesions between them, and an accident is therefore possible—though it must be rare.

So that, if only two incisions are required, it is advisable to make one on each side of the cervix; and if four are necessary, to have them at each corner.

Horsburgh (*Veterinarian*, vol. xviii., p. 215) recommends, if the atresia is complete, to pass the finger or a blunt instrument into the os, then introduce a stout, sharp-pointed, curved bistoury about four inches long—dividing the

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stricture laterally by two incisions—always drawing the bistoury towards the operator; after which he is to introduce both hands, with the palms towards each other, and press them apart. "He will find the part immediately dilate to the proper size, and labour may go on naturally; or he may then proceed to extract the calf if labour has been protracted."

The object in making the incisions only to a comparatively slight depth, and not through the entire thickness of the os, is to prevent extensive lacerations of the organ during the passage of the fœtus. It will generally be found that these partial incisions will, with a little patience, admit the hand; this being passed into the uterus, seizes the presenting part of the young creature, places it in a favourable position if necessary, and then begins to draw it gently into the os.

Sometimes with primiparæ in good health and strong, delivery is afterwards effected spontaneously, and this is the most favourable result; but in the majority of cases labour has been going on for a long time—perhaps two days or more, the parent is exhausted, and the uterine contractions are either suspended, or so feeble as to preclude all hope of their expelling the fœtus. The head and fore-feet must then be corded, and delivery accomplished in the ordinary way.

It is well to remember, however, that the traction resorted to must be judiciously employed. It should be moderate, gradual, and sustained, in order to allow the tissues of the cervix time to accommodate themselves to the eccentric pressure imposed on them by the advancing fœtus. To act otherwise, is to incur the grave risk of lacerating the uterus beyond the possibility of repair, and is quite as reprehensible as making deep incisions.

With regard to the consequences of vaginal hysterotomy, it must be admitted that it is not without danger, and that death not unfrequently results. We have no reliable statistics to guide us in estimating the amount of success or non-success following its performance, as not all—or perhaps not many—of the cases are published. Saint-Cyr has collected thirty-four cases—all those published in France and Belgium since the commencement of the century, and an analysis of these gives the following results:

Mother and progeny saved in - - - - -	14	instances.
Mother saved—fate of the progeny not mentioned—in -	9	„
Mother alone saved in - - - - - -	5	„
Progeny saved, mother died, in - - - - -	6	„
Mother succumbed—fate of progeny not mentioned—in	5	„
Mother and progeny perished in - - - - -	1	„

So that of 40 Cows operated upon, 28 survived, and 12—or 30 per cent.—succumbed; while, with regard to the progeny, 14 calves were delivered alive and continued to live, and 6 were dead; nothing is said as to the other 14.

In other words, of 80 lives more or less compromised, 18 at least—or 22½ per cent.—were not saved by the operation.

And Saint-Cyr is inclined to think that if all the successful cases have been published, there is reason to believe that all the unsuccessful ones have not; and he is apparently confirmed in this view by Bugniet (*Recueil de Méd. Vétérinaire*, 1873), who writes: "Distinguished veterinarians have published very interesting observations on this important question in obstetrics; but I am bound to say that these experienced practitioners have been more for-

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tunate than myself, for I have had nothing but misfortune, and in the interest of science I do not hesitate to say so." Bugniet, after describing three cases in which he operated, and in which death of the mother followed, as evidence that his procedure was not at fault, remarks: "Nevertheless, I acted with extreme prudence; when the incisions were made, I proceeded to complete delivery with great care and deliberation. Incision, dilatation, birth, removal of the placenta—all conducted with knowledge and circumspection; and yet this did not prevent a fatal issue." But in opposition to this experience, we have that of other practitioners who have had a fair—indeed, a large—share of success. Donnarieix, for instance (*Ibid.*, 1874, p. 511), commenting on Bugniet's report, blames the latter for adopting *expectant* instead of *active* treatment, and asserts that he has taken the exception for the rule. From his own experience, extending over thirty years, during which he had performed vaginal hysterotomy in sixty cases with only one death (the cause of which was not apparent), he concludes (1) that incision of the cervix uteri is generally curable, and (2) that palliative measures are more injurious than beneficial, when their uselessness is demonstrated.

Many instances of successful treatment by incision might be given, in addition to those already enumerated, but a few will suffice.

1. Of several cases given by Donnarieix (*Op. cit.*, 1874, pp. 512, 514) we will select two. In one case, atresia was so complete that the index-finger could not be introduced into the os, and it was impossible to discover if there was a calf. The vagina was prolapsed beyond the vulva, and formed a tumour as large as a man's head. After evacuating the bladder by replacing the vagina, hysterotomy was practised, and the fore-limbs of the fœtus were seized and brought through the os, but the head was deviated; so it was necessary to cord the feet, return them to the uterus, and adjust the head. The operation lasted for *six hours*, but the calf was extracted alive. In about half-an-hour, inversion of the uterus took place, with the membranes adherent. The latter were detached, reposition of the uterus was effected, and the organ retained by Renault's bandage—all in a few minutes. The Cow did not die, but lived, and subsequently produced more calves.

The second case was one of occlusion of the os uteri. Vaginal hysterotomy occupied about ten minutes; a bull-calf was born alive, and the Cow did not appear to suffer. The animal, of the Charolaise breed, was of great value, and was subsequently sold for a thousand francs; after producing several calves without any difficulty, it was again sold, when aged twelve years, for six hundred francs.

2. Binz (*Zeitschrift für Wissenschaftliche Thierheilkunde*, 1846, p. 365) describes the case of a Cow which for three years was unprolific; but during œstrum, at the end of this period, the os was artificially dilated by the finger half-an-hour before the animal was put to the Bull. Impregnation resulted, but at the termination of pregnancy delivery could not take place. Binz, on exploration, found the cervix in a cartilaginous condition, and the os completely and firmly occluded. With difficulty one of the fingers was passed half through the canal. The labour-pains were so extremely powerful, that it seemed as if the fœtus would be expelled through the walls of the uterus or the rectum before the os would dilate. An incision in the cervix was then made by means of a probe-pointed bistoury, from the os, and upwards. The labour-pains continuing strong, the "water-bag" soon appeared; but the os did not dilate sufficiently to allow it or the fœtus to enter; a second incision—also upwards—was therefore made in the cartilaginous cervix, which permitted the "water-bag" to pass through. This was opened, and it was found that the calf presented in the proper position in front of the opening. The incisions gradually widened, and in a few minutes a fine Cow-calf, weighing forty *pfund*, was born; in half-an-hour afterwards the fœtal membranes came away. Three or four times a day lukewarm water, with a decoction of chamomile flowers and tincture of myrrh, was injected; the animal ate and drank well, and soon quite recovered; it yielded a good quantity of milk, and in a year afterwards was sold to the butcher in fine condition.

3. The same excellent authority (*Ibid.*, p. 368) performed the operation on a Cow, the cervix of whose uterus was so indurated that it was impossible to bring the calf through it. Birth then took place without assistance, and no ill consequences resulted. When œstrum again occurred, the worst fears of the owner were realised, in that the

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Cow, when put to the Bull, was not impregnated. Binz was consulted, and on examination he found that, at the part where the incisions had been made during the last calving, a hard cicatrix as thick as the finger had developed, but that the other parts of the cervix were sufficiently dilatable to allow him to introduce the finger into the os. The latter being rendered permeable in this way, the Cow was once more put to the Bull, conceived, and at the termination of gestation, with very little help, brought forth a fine calf.

4. Pflug (*Wochenschrift für Thierheilkunde und Viehzucht*, 1863) was called upon to assist a heifer in calving. The labour-pains were strong, and the vagina, together with the cervix—behind which were the head and feet of the calf—protruded beyond the vulva. The calf was alive. Reposition of the vagina was effected, the upper part of the cervix was incised in one place, and the young creature extracted. The hæmorrhage was not serious. The afterbirth was removed piecemeal, and in a few days the Cow regained its appetite. Suddenly it became unwell, and on examination it was found that the upper margin of the cervix was greatly swollen; in a short time an abscess formed, pus was discharged, and the heifer soon recovered permanently.

5. Foglar (*Oesterreichische Vierteljahresschrift für Wissenschaftliche Veterinärkunde*, 1876, p. 30), in referring to this "Scheidengebärmutterschnitt," as the Germans designate the operation, makes some interesting observations. In the course of five years' practice he had performed vaginal hysterotomy on six occasions—partly on primiparæ, partly on pluriparæ. The incisions in the cervix were made, in two of the cases, in the outer margin of the dense cartilaginous ring, so as to allow the inner ring to be incised.* In the other four cases, the occlusion of the os was so complete that, at most, only the tip of the little finger could be introduced. A passage to the interior of the uterus had to be gradually cut by means of the knife. The operation took from one and a quarter to one and a half hour, during which the animals were kept standing: two or three men were placed at the head and tail, and the left hind-leg was secured. The animals remained perfectly quiet. Foglar used the probe-pointed or button bistoury for the operation, the blade being covered for one-half its length by a bandage. The instrument is carried in the hand, so that the forefinger covers the back of the blade, while the remaining four fingers firmly grasp the handle. The hand—well oiled—is passed into the vagina, and after the external ring of the cervix has been incised—right and left—to the depth of one third to half an inch, towards the top, attempts are made, by careful manipulation, to further dilate the passage. This procedure has, as a rule, been attended with success. The *inner* ring is reached, after this manipulation has been continued for some time; and this is dilated, partly by incision, and partly by pressure or distension—though care is taken to avoid contact with the incisions already made. This happened, however, in his first case, in which the textures between the rings had to be divided. Sometimes the knife is dispensed with in the course of the operation, and the hand alone is made to trace the channel, which has often a devious course. During the "pains" the knife is very liable to slip from the hand and injure the uterus—thereby causing unnecessary hæmorrhage. In four cases, in which, after the widening of the incisions, birth took place in a normal manner, the result was most satisfactory; the animals operated upon recovered completely, and after only a brief indisposition. Two afterwards became pregnant, and calved without any difficulty.

In the other two cases the results were not so favourable: the calves being too large to pass through the vagina, and the Cæsarean section was objected to by the owners, and was certainly not deemed very likely to be attended with success by Foglar.

After parturition, the fœtal membranes were either removed artificially, or left to nature; and in no instance were any ill consequences noted. In the first case the "afterbirth" came away on the ninth day; and in all the cases the subsequent treatment chiefly consisted, for the first two or three days, of cold applications to the loins, cold water pessaries in the vagina, gruel and Glauber's salts, with, in particular instances, injection of cold water into the genital canal.

6. Macgillivray (*Veterinary Journal*, 1877, p. 149), referring to the instances alluded to at p. 344, adds: "In the first case the subject was a seven-year-old Cow, on which I operated by incision (making two side cuts up and down), and extracted two living calves. Both calves and the Cow did well. Having made a speedy, good, and perfect recovery, the said Cow was in due course again served with the Bull, and the following season produced (without any uncommon disturbance) a living calf! Thus

* Foglar, following the example of human anatomists, recognises in the canal of the cervix as *os uteri externum* and *internum* or "rings" (*ringen*).

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showing that incision of indurated cervix uteri is no bar to future productiveness of a perfectly normal character."

There is no doubt that, in the majority of instances, and in the hands of careful obstetrists, vaginal hysterotomy will be successful, and will prove a useful operation.

As a rule, after the operation, and for a period of eight or ten days, there is a muco-purulent discharge from the vulva; but the Cow eats, ruminates, gives the usual quantity of milk, and does not appear to be any more inconvenienced than after normal parturition.

The unfavourable results, however, must not be overlooked. Serious injury to the neighbouring organs by the knife, or by the extension of the laceration, is within the range of possibility. When the cervix is completely divided, either by incision, or by subsequent laceration during the passage of the fœtus, we may have intense peritonitis arising from escape of the liquor amnii or other fluids into the abdomen, and speedy death. Or excessive hæmorrhage may lead to serious consequences.

In every case, of course there must be more or less bleeding from the incisions; but, as a rule, this is of no importance, and it ceases after a time. In less frequent cases, however, it persists, and either brings on great debility, or, if excessive, will lead to a rapidly fatal termination. This result is most to be apprehended when the cervix is greatly degenerated, and its tissue extremely vascular—as in carcinoma and sarcoma. It may also occur from rupture of blood-vessels, in laceration of the cervix or body of the uterus, during the passage of the calf through the incised os.

When serious hæmorrhage occurs, cloths or sponges steeped in cold water, astringent lotions, and styptics—as the perchloride of iron—should be applied as close to the part as possible; while cold water irrigation should be maintained on the loins.

Another result is metritis, or metro-vaginitis, which is rapidly fatal, and in which we find the usual local lesions on making an autopsy. Septikæmia is also to be apprehended; and to prevent it, it is well to remove every source of putridity, or anything likely to become putrid, and to use plentifully a weak solution of carbolic acid (1 to 100) or the permanganate of potass in the interior of the uterus, and particularly about the incisions in the cervix—even for some days after the operation.

CHAPTER IV.

Gastro-Hysterotomy, or the Cæsarean Section.

Gastro-hysterotomy, the *Cæsarean Section*, or *abdominal hysterotomy*, is an operation which has for its object the removal of the fœtus or fœtuses from the uterus of the parent, when they cannot be delivered *per vias naturales*, by making an opening in that organ through the abdominal walls, and thereby extracting them.

This is a formidable and a serious operation, whether it is practised on the human female or on animals. In the obstetricy of woman, it has been resorted to from a very early period; the Greeks knew it as ὑστεροτομοτοκιη or ἐμβριοελκη, though it is supposed that they only performed it after the

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mother was dead, and to save the child. Persons thus born were sacred to Apollo, and Æsculapius was designated the son of that god, because it was believed he had been delivered by gastro-hysterotomy. Some strange notion appears to have been attached to this method of delivery; as among these old-world people, the person who had been born by means of the operation was esteemed remarkable and fortunate. Hence Claudius Cæsar, Scipio Africanus, Cæso Fabius, Julius Cæsar, and other more or less illustrious personages of old Rome, received the surname of "Cæsones" from being extracted by abdominal incision from their mother's womb: "Quia cæso matris utero in lucem prodiscunt." At a later period these persons were designated "Cæsares,"—a noble title; though, as has been demonstrated, it is a mistake to assert that it owes its origin to Julius Cæsar—this being merely his patronym.

Since these early times, abdominal hysterotomy has been often practised on woman; but when it was first attempted on animals we cannot yet be quite certain. Haller was led to believe that the Greek veterinarians—Apsyrtus and Hierocles—knew and performed the operation on the domesticated animals; but this has been shown to be a mistake. Until we arrive at the time of Bourgelat—the illustrious founder of veterinary schools—in the latter half of the last century, we appear to have no evidence that such an operation was ever proposed for animals. And even Bourgelat only suggests it in cases in which the dam is attacked by a dangerous disease when the period of gestation has nearly or quite expired, and its life may be beneficially sacrificed n favour of its progeny, which is to be quickly removed from the uterus. (*Traité de la Conformation Exterieure du Cheval*, 1768). In 1781, Brugnone (*Trattato della Razzi di Cavalli*, p. 406) intimates that this operation may be performed on Mares and other animals which could not bring forth; but, like Bourgelat, he does not state whether he ever practised it.

It was not apparently until 1813, that Morange, and in 1816 Gohier (*Mém. sur la Chirurgie et la Méd. Vétérinaire*, vol. ii. p. 40), attempted it on the living animal, though unsuccessfully. Morange operated on a Cow, and it was to all appearance in a fair way to recovery, when it succumbed to an attack of indigestion caused by improper feeding. About the same period, Rohlwes (*Das Ganze der Thierheilkunde*, 1822, p. 143) operated on a Mare.

Since that time gastro-hysterotomy has been practised comparatively often, both in this country and on the Continent; and there can scarcely be a doubt that it was mainly indebted to its general introduction, as an obstetric operation, to the fact that the abdomen of animals could be opened with impunity in such operations as ovariotomy (spaying) in swine and other creatures; as well as from the experience that, in abdominal hernia in the pregnant animal, the fœtus had been often extracted in this way, and the mother did not succumb.

Gastro-hysterotomy has been practised both on the large and small domesticated animals, but perhaps with most success on the latter. In 48 cases of this operation, Franck finds that 25—or 52 per cent.—had a fatal termination. Saint-Cyr, from a smaller number, makes the mortality 71 per cent. Franck can only note three instances in the Mare, and they were all fatal, though the foals were saved. For the Cow he has 17 instances; 6 of these recovered (one of them, however, was Morange's, which died from overfeeding fifteen days after the operation, and another was Sacchero's, which was sent to the butcher in six days). This gives 35 per cent. saved, and 65 per cent. lost. In three Sheep there were no recoveries, and in two Goats, only one. With the Pig the operation appears to have been wonderfully successful. In 8 instances all recovered: a result Franck is inclined to attri-

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bute to the different arrangement—or rather attachment—of the placenta, which renders this animal less liable to septic infection through injury to the uterus. With the Bitch, the mortality is about the same as in the bovine species; in 15 cases, 6—40 per cent.—lived. Franck thinks this per centage might be much increased if the operation was performed on the right side, and antiseptic treatment adopted, or, if necessary, even extirpation of the uterus; as putrid infection readily occurs in the Dog.

With regard to saving the young, the operation is not very favourable. In nearly all the instances in which the parent recovered, the progeny has been dead, or died; and in only 4 of Franck's list of cases were the parents, and one or more of the young creatures, preserved alive. Three of these cases were Bitches, and the other was a Sow.

With the Cow, the Calf is often saved, while the parent dies. Of 7 instances, the calves were extracted alive in 6.

With the Mare, the operation must be resorted to early in order to save the foal, as, for the reasons already given, it perishes quickly.

It is only on a knowledge of the length of time the fœtus may live during parturition, or after the death of the parent, that the operation can be undertaken with any prospect of success—so far as obtaining it alive is concerned; and this is an important consideration with regard to the bovine species. Kehrers, in his observations on the Bitch, found that three minutes after death the fœtus began to show symptoms of asphyxia, and in thirty-six minutes it was dead. In pregnant Cows and Sheep which were slaughtered, the fœtus moved about in a very lively manner for eight to ten minutes, but death ensued soon after.

Sauer observed an unusual instance of fœtal vitality in a Bitch which could not be delivered, and was poisoned by cyanide of potassium. Eight minutes after death the fœtuses were observed to move in the abdomen, and this and the uterus being opened, they were extracted alive.

After fifteen minutes, Franck has found in slaughtered Sheep that the fœtus was usually asphyxiated; and he concludes that during the first eight minutes after the death of the parent, the fœtus can be extracted alive (if alive before the parent died); even towards fifteen minutes there is a chance of preserving it, but by that time it is usually dead. When extracted late, and in the first stage of asphyxia, though it may rally for a short time, yet it usually succumbs to inflammation of the lungs—through the amniotic fluid having penetrated into the air-passages during the convulsive gasps the young creature makes.

There can be no doubt that much of the great mortality which follows the operation, is due to the circumstances amid which it is undertaken. It is, as a rule, never resorted to until every other means to deliver the animal has failed, and the creature, worn out by suffering, is already almost dead. In addition to this, the fœtus itself—subjected to long-continued and severe manipulation—is either dying or dead; indeed, it may have perished days before, and, becoming putrid, has already infected the parent.

Death is usually due, when not immediate, to putrid infection—to peritonitis or metro-peritonitis. This is more particularly the case with the Bitch, in which, when the operation is performed early, and the young are extracted alive, recovery generally takes place; though Franck remarks, that wherever the green colouring matter of the placenta imparts a similar tint to the textures it comes in contact with, very often septic inflammation begins there. The same authority points out that there is no great reason otherwise why death should be a frequent result of the operation, when we consider the hun-

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dreds of similar operations performed in the study of embryology, by Bischoff and others, on Bitches, Guinea-pigs, and Rabbits, the majority of which did not have a fatal termination. He also alludes to the success of Nature's Cæsarean section, when we have mummification and maceration of the fœtus, consequent on occlusion of the os uteri, and the remains of the creature find their way out by another channel without much disturbance to the mother.

The most dangerous cases for operation are those in which the fœtus is dead, and more or less decomposed.

Indications.

The operation should only be resorted to in those cases in which delivery by the natural passages—the fœtus being alive—is altogether impossible, or so difficult and dangerous that the mother incurs nearly as much risk as from gastro-hysterotomy itself, while the young creature must be sacrificed; or when the owner prefers having the latter alive, instead of incurring the risk of losing both—the progeny being the most valuable. The operation is therefore likely to be demanded in those deformities of the pelvis produced by fractures, exostoses, etc., which considerably diminish its canal, intra-pelvic tumours, hernia of the uterus, extra-uterine fœtation, certain cases of uterine torsion irreducible by the methods we have described. Atresia of the os should be more advantageously overcome by vaginal hysterotomy, unless the owner is desirous of saving the fœtus and sacrificing the mother.

The operation is also indicated when an animal, near the termination of pregnancy, is so seriously ill or injured that it cannot live until birth takes place. It may then be most judicious, if the progeny is valuable, to kill the parent and extract the fœtus at once. If the parent has just died, or is dying, the operation may also be practised.

In considering the adoption of the Cæsarean section, the species of animal will, of course, weigh a good deal. Those which can be utilised as food, there need be no hesitation in operating upon, and sacrificing immediately afterwards; the value of the carcase and the living calf or lamb, diminishing very considerably the loss which would otherwise be sustained. With the Mare, as we have said, the foal may be very much more valuable than the parent.

With the Bitch and Sow, there is much more prospect of a favourable result of the operation; and, as difficult parturition in them is often so serious, it is advisable to operate in good time. Indeed, in all cases when the operation is once decided upon, no time should be lost in practising it, if we desire to preserve the progeny, and give the parent a chance.

We have seen that the foal soon perishes when it cannot be born, and though the fœtus of other animals retains its vitality longer, yet there is also a limit here. Besides, it must be remembered that the strength of the parent is an important factor in the case, and the longer the delay, so the less chance is there of a successful result.

It is, therefore, most important that the obstetrist loses no time in making his diagnosis, and coming to a conclusion as to the course he must pursue. Embryotomy will, of course, present itself to his mind before gastro-hysterotomy, which is, after all, only to be an ultimate means of saving either mother or progeny, or both, in very exceptional cases. It need scarcely be pointed out that in irreducible uterine hernia, there need be no delay in deciding, and that this condition gives good hope of success—especially in the smaller animals.

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Operation.

Looking at the Cæsarean Section from a purely surgical point of view, there can be no doubt that, so far as the larger domesticated animals are concerned, it is one of the longest, most fatiguing, and most difficult, in veterinary surgery.

There is also the great extent of the wound, as well as the opening of the peritoneum, hæmorrhage, and escape of blood or liquor amnii into the peritoneal cavity, to be considered. Besides, the animal is, as a rule, in a state of extreme prostration, and the results of mischievous interference may be already apparent before the operation is commenced, or even before the veterinary surgeon is called in.

The after treatment of the mother, too, often requires much attention, and is expensive; and recovery requires a considerable period, as convalescence is only too often protracted.

What, however, makes the operation so formidable, if the mother is to be saved, is the quadrupedal position of animals; for, after section of the abdominal parietes, the mass of intestines presses heavily on the part which has to be incised; so that it needs much careful management and supervision to effect cicatrisation, and to procure such a solid adhesion of the margins of the wound that hernia may not result.

If the mother is alive, the operation is a painful one, and one of long duration in some cases, and the pain inflicted causes the animal to struggle; this inconveniences the operator more or less, and—not to speak of the humane feelings which should ever be predominant on such occasions—induces him to avail himself of the advantages of anæsthesia, if they can be obtained. Perhaps no agent is so useful in this respect as the hydrate of chloral, though chloroform or æther may be administered in the usual way—by inhalation—and produce their effect. The objection to the two latter substances, however, is very great, so far as cattle are concerned; as they taint the flesh, should it be necessary to kill the animals, and utilise their flesh as food; whereas the chloral hydrate has not this objectionable action. The latter is perhaps best administered in enema; for horses and cattle, the dose may be from fourteen to twenty-two drams; about two or three drams for dogs (depending on the size), and three to six drams for pigs. It is best given in mucilage or bland syrup of any kind. In a quarter of an hour or so the animal is in a state of narcosis, and the operation may be commenced. Unfortunately, the drug only too frequently causes the death of the fœtus—a matter of some importance when this is of more value than the parent; but not to be considered when the life of the latter is to be preserved.

When the parent is doomed to be killed—as in the case of a worthless Mare, or one suffering from an incurable disease or accident; and the young animal is to be rescued, the best course to follow is to pierce the medulla oblongata, and operate at once, as Vollmar has done with success. By this means insensibility has been produced, and the young creature extracted alive. Günther recommends dividing the posterior aorta after removal of the fœtus, as it is close to hand in the abdominal cavity, and death quickly ensues.

For the operation but few instruments are needed. They consist chiefly of a scalpel, probe-pointed bistoury, scissors, forceps, muscle-hooks, and some common suture needles, pins, and sutures—silk or catgut. For the larger animals a strong suture needle, suture wire, and waxed carbolised thread or twine, teased oakum, tow, small pieces of wood or whalebone for the su-

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tures, and large pieces of linen are required in addition, as well as a body-bandage made by folding a linen or cotton sheet. If the parent is not to be preserved, or is already dead or dying, of course no such preparations need be made; as a scalpel and probe-pointed bistoury, or even an ordinary pocket-knife, on an emergency, and used with care, will suffice.

The operation might, and should if possible, be performed under the carbolic-acid spray; with the smaller animals at least, this antiseptic treatment can be adopted.

The incision in the abdomen may be made in either of two regions—at the *linea alba*, or the *right flank*. If it is desired to preserve the parent, the flank operation is certainly to be preferred, with the larger animals and the Sow, as no sutures can resist the weight of the intestines when the incision is at the inferior part of the abdomen. Even with the Bitch the flank operation should be adopted for the same reason, and also because wounding the mammæ is avoided—an important consideration in more respects than one. It is true that Bourgelat, describing how gastro-hysterotomy ought to be performed in the Mare in order to obtain the living fœtus, says that the animal should be carefully thrown, placed on its back, and there secured. "Then a *crucial* incision is to be made at the middle of the lower part of the abdomen, and it should be about a foot-and-a-half in length—terminating at the pubis. If the large intestine, forced outwards by the struggles of the animal, appears, it should be carried to one side, when the uterus will soon be seen; then an opening, corresponding to the other, must be made with the greatest circumspection, so as not to wound the foal; the membranes are to be opened, the 'waters' they contain escape, and the young creature is to be immediately removed. The success of the enterprise depends upon the attention paid in order to prevent the death of the Mare; the more time lost, so the more is the fœtus weakened; the less time is there to spare if the Mare is dead, for then it is certain that the foal will not live longer than a few moments." The umbilical cord was to be ligatured at four or five inches from the body of the foal; "after which it is only a question of providing means for rearing the young animal, until it can attend to itself."

But Rainard points out that nothing is said as to closing and bandaging the incision, or the after-treatment of the Mare—thus indicating that preserving the foal only was in view.

With the Mare or Cow, the operation is sometimes attempted in the standing attitude; but it is obvious that there must be great inconvenience and danger in this. It is much better, therefore, to place the Mare, Cow, Sheep, or Goat, on the left side—right side uppermost; either side suffices for the Bitch or Sow.

If the animal is narcotised and insensible, then it is not necessary to secure the limbs; but if it is only partially, or not at all unconscious, then means of contention must be adopted, for the safety of the animal as well as the operator. The right hind leg should be firmly fixed backwards, so as fully to expose the region to be operated upon; the other three limbs are secured together in the ordinary manner. A small animal can be held by one or two assistants.

The incision, as has been said, is made in the right flank, rather below and in front of the anterior spinous process of the ilium, so as to avoid wounding the circumflex artery—an accident which might embarrass the operator; if this or any other artery is wounded, it must be tied immediately. If there is no great hurry, and the hair is long, this had better be clipped off. The incision should pass downwards and forwards, in the direction of the fibres

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of the small oblique muscle of the abdomen (no muscle should be cut across); it should extend through the skin to the muscles, and even if it passes into these, there is no danger to be apprehended.

The length of the wound will, of course, depend upon the size of the animal: for the Mare or Cow, it may be from twelve to fourteen inches. The layers of muscles are to be gently cut through until the peritoneum is reached, and into it a small opening is to be made, but in doing this the greatest care is to be exercised, so as not to wound the viscera. The two first fingers of the left hand are passed through this opening, the back of the hand downwards; the blade of the probe-pointed bistoury is placed between these fingers, and carried along—cutting through the peritoneum and muscles until the opening is of the same length as that in the skin. An intelligent assistant should be at hand to prevent the escape of the intestines through this large aperture.

The arm of the operator is now pushed into the abdominal cavity in search of the uterus, which, when found, is brought opposite the incision, should it not be there at first. Two assistants compress the sides of the wound, so as to maintain them closely against the uterus; this, the operator cuts through slowly, layer after layer, using all diligence so as to escape wounding the fœtal membranes.

Two fingers are insinuated between the walls of the organ and these membranes, and the bistoury is again employed to dilate the opening, as in the peritoneal incision, so as to give it nearly the same direction and extent of that in the abdominal wall. Should the membranes be still intact, they are to be torn, and the "waters" allowed to flow—but only *outside* the abdomen, if possible. The operator now, plunging his arm at once into the cavity of the uterus, seizes the first parts of the fœtus that come to hand—fore-legs, head, or hind-quarters, if possible—and removes it quickly; the umbilical cord is torn or tied, and the young creature given to those who will dry and rub it, wrap it in a warm blanket, and otherwise attend to it.

The obstetrist immediately, if the parent is to be preserved, removes the fœtal membranes—an easy task comparatively in the Mare, much more tedious and difficult in the Cow, as all the adhering cotyledons must be separated one by one. Then, by means of a sponge, all the fluid remaining in the organ is to be cleared out, as well as any that may have escaped into the abdomen. It might be well to damp the interior of the uterus with a very weak solution of carbolic acid. This accomplished, the great wound is to be closed.

Nothing is done to the uterus, as a rule; the organ soon diminishes very considerably in volume, and it would appear that the wound in it is not long in cicatrising. The borders of the wound in the abdomen, however, must be speedily and solidly united. The best means of union is undoubtedly the quilled suture, which is to be applied according to the ordinary rules of surgery; care must be taken to make the sutures enter at a good distance from the border of the wound, and to include the muscles as well as the skin. If the cord fixing the outstretched hind limb is slackened a little, it will facilitate closing the wound. A small corner should be left open at the lower end of the wound, to allow the products of inflammation and suppuration to escape. External to the wound, either a layer of fine tow or lint, slightly carbolised, or oakum, may be placed. Over this, long narrow strips of canvas covered with melted glue, may be fixed, to support the sutures and retain the dressing; then on these another thin layer of carbolised tow or oakum, and lastly, the wide body-bandage around the abdomen and loins of

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the creature. Though it is somewhat difficult to apply, yet it is essential that this bandage or compress be put on before the animal is allowed to rise. Afterwards, the bandage may be adjusted and tightened if necessary.

When the incision is made at the *linea alba* the procedure is somewhat similar; but, as we do not recommend it for the reasons above stated, we need not allude to it further.

The after-treatment of the wound is that followed for all such serious traumatisms. Cold water, or ice, or very dilute carbolic acid, may be applied to the wound, if necessary; but very often this requires only ordinary surgical management. *The patient must not be allowed to lie down until the wound is united.*

The diet should be light and sloppy for a short time, unless the animal is very feeble, when nourishing food must be given.

With the smaller animals the treatment will be the same. For enlarging the abdominal and peritoneal incisions, small sharp scissors will be found very useful and safe, the blade with the blunt point being introduced.

The bad results to be apprehended from the operation are septic metritis, or peritonitis, or both; abscess at the seat of the incision, or adhesion of the abdominal organs to this part.

As the subject is particularly interesting and important, we shall endeavour to give the first complete list of cases of gastro-hysterotomy which has yet been published.

1. Youatt (*Cattle*, 1834) states that he had twice attempted the operation, but in neither instance did he save either the Cow or Calf.

2. Berry (*Veterinarian*, vol. xii. p. 709) records a case of extra-uterine fœtation, in which the operation was performed by a medical man, but the Heifer died.

3. Ellis (*Ibid. loc. cit.*): Operation on a Sow which could not farrow because of the immense size of the fœtuses, which were in a state of decomposition. The operation had been delayed too long, however, and the animal died. Ellis mentions that he had twice successfully performed the Cæsarean Section on the Bitch.

4, 5. Carlisle (*Ibid.*, vol. xiii. p. 121) operated on a Sow (flank) which had been in labour for six days, and had gone ten days beyond the ordinary period of pregnancy. The fœtuses, seven in number, were dead, but the Sow recovered. He states that, sixteen years previously (he writes in 1839), a farrier residing near Carlisle had performed the operation on a Mare, and with success. "The poor animal was sadly mutilated."

6, 7, 8, 9, 10, 11, 12, 13, 14. Hayes, in 1824 (*Ibid. loc. cit.*, p. 267), had a kind of experimental operation upon a Bitch, removing six puppies alive, but one died on the following day. The remainder, with the Bitch, did well.

In 1825, he tried to remove a Calf by embryotomy (head very large, and deviated towards the flank), but could not succeed; gastro-hysterotomy was resorted to, and the Cow was doing well until the twelfth day, when it suddenly died. The diaphragm was found to be ruptured and gangrenous.

A third case occurred in a very old Cow, that had exceeded the usual period of gestation about seventeen days. The fœtus could not be extracted by embryotomy; the pelvis being too small. After the Cæsarean section, no untoward symptoms appeared, and the animal was quite recovered in nine weeks.

The same practitioner states: "Since that time I have operated successfully on two Cows and one Sow. Three other Cows on which I operated died, in three, six, and eight days afterwards; two of these were affected with severe peritonitis.

15. Carlisle (*Ibid. loc. cit.*, p. 407) performed the flank operation for torsion of the uterus. The Cow died from strangulation of the intestines.

16. Bowles (*Proc. of the Veterinary Medical Association*, 1839—40) describes a case in which the parent was killed, and the fœtus extracted by the Cæsarean Section.

17. Younghusband (*Ibid.*) records the case of a Cow which had been in labour for some time, and the os uteri of which was completely occluded. The animal was extremely exhausted, and the fœtus seemed to be dead. As the case appeared to be a hopeless one, it was resolved to spare the Cow further pain by killing it. This was done by blowing into the jugular vein, and at the moment the animal expired, the fœtus was seen to move strongly. The abdomen was at once opened by a long knife,

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the uterus incised, and a living Calf extracted. This being well attended to, in two days it was able to drink milk without assistance, and was afterwards reared successfully.

18. Morgan (*Veterinarian*, vol. xxix., p. 698) attended a Sow which could not farrow all her pigs—only two having been born. One was extracted *per vaginam* by the crotchet, but as the animal was sinking, it was decided to resort to gastro-hysterotomy. The operation was performed in the right flank; only one fœtus remained, and this was taken away. The Sow recovered in a short time. The incision in the uterus was sutured. When the animal was fatted and killed, two months afterwards, it was found that adhesion had taken place between the organ and contiguous intestine, and that an abscess had formed, from which a sinus could be traced into the intestinal canal. The right ovary was destroyed.

19. Brooks and Whitworth (*Ibid.*, vol. xxxix., p. 33) relate the history of a Bitch, which, while pregnant, had its pelvis injured by being run over by a carriage. When parturition had been going on fruitlessly for some time, an examination was made, and it was discovered that, owing to the fracture of the pelvis, just above the symphysis pubis, the dimensions of the canal were greatly reduced and altered in form, so that the finger could scarcely be passed. Chloroform was administered, the hair removed from the skin in the right iliac region, where the incision was made. Two puppies were removed, the wound in the uterus closed by silver wire suture. In three weeks the Bitch was well. The puppies, put to another bitch, also lived.

20. Sacchero (*Giornale di Méd. Veterinaria*, 1858) alludes to the case of a four-years old Cow, which had been in labour for three days, and every attempt to remove the Calf, *per vaginam*, had failed. The os uteri could not be dilated. So it was proposed to extract the fœtus by the Cæsarean section. The animal was cast and properly secured; an incision was made in the *left* flank, when all the intestines suddenly rushed from the wound; these were received on a sheet, which was kept moist with tepid water.

The uterus was then exposed, cut into, and a dead Calf pulled out by the tail. The operation occupied less than twenty minutes. The parts were well cleansed by an affusion of warm water, intestines returned, incisions closed by the twisted suture, and covered with fine tow steeped in warm wine. A net was fixed round the body to support the sutures. After the operation was completed, the Cow got up and fed. The case terminated favourably, and the animal was subsequently fattened for the butcher.

21. Braga (*Archivio di Medic. Veterinaria*, June, 1876) was called in haste to attend a Cow—a Primipara—which had been some time in labour, the "water bag" having ruptured, and the fore-limbs of the fœtus were presenting; but nothing more was advanced. Braga found the animal in tolerably satisfactory condition, but the vulva was twice its normal size, and was partly emphysematous. The mucous membrane of the vaginal vestibulum was of a deep red colour, with small black points, showing advancing gangrene. The fore-limbs protruded from the opening, and in such a manner that their posterior surface was superior. An exploration of the vagina discoverd the mucous membrane of this part, as well as of the cervix uteri, to be greatly swollen and extremely hot; while it was also ascertained that the fœtus was in the dorsal position —the sternum towards the maternal sacrum, and the withers on the symphysis pubis, with the head and neck deviated towards the back. Every attempt to adjust the position, or effect delivery, failed—notwithstanding the use of the cords, crotchets, amputation of the head, etc.

Although it was now late, gastro-hysterotomy was proposed to the owner, and the operation was allowed. The Cow was laid on its right side, and the incision was made at the *linea alba*. When the uterus was opened, the back of the fœtus was encountered, and not being able to remove it in this position, nor yet change it, without greatly enlarging the uterine wound, the hind-limbs were disarticulated at the stifle, and the remains of the creature were at last extracted. The incision in the uterus was not closed, but left to itself; while that in the abdominal parietes was united by twisted suture; a wide bandage was applied round the body. A stimulant infusion was administered to the Cow, and aromatic injections thrown into the vagina. The fever ran high, though there was not much prostration; but towards the evening the proprietor became alarmed, and fearing to lose the value of the animal, he sent for the butcher and had it killed for food.

22. Gohier (*Mémoires de Gohier*, vol. ii. p. 40) mentions the case of a Ewe which had been in labour for about twelve hours. The fore-feet of the lamb protruded three inches beyond the vulva, and the head was bent back towards the withers. The fœtus was placed in a favourable position, but the most energetic traction only suc-

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ceeded in tearing away the fore-limbs. The Cæsarean section was then decided upon, and an incision, about five inches in length, was made below the right flank; the intestines were lifted out, and the uterus exposed and cut into. The fœtus was now extracted, and afterwards the placenta. The intestines were replaced; the abdominal wound closed by quilled suture; a compress applied around the body, and several glasses of decoction of gentian administered to the Sheep. Death occurred next day, and it was then discovered that the ilium was the seat of an old fracture which had become united, and in doing so had produced an oblique deformity of the pelvis. The head of the lamb had been arrested and bent back against the callus, opposite the cotyloid cavity.

23. Morange (D'Arboval. *Dictionn. de Méd. Chirurg. etc., Vétérinaire*) furnishes the case of a Cow which had gone beyond the ordinary period of gestation by thirty-seven days. The cervix uteri was altered in texture, and the os undilatable. The Calf was dead, and consequently gastro-hysterotomy was decided upon. When the abdominal walls were cut into, an enormous quantity of reddish serum flowed therefrom. The fœtus was removed, as well as the placenta, and the wounds united by suture. After the next day the appetite had returned; but in fifteen days the owner, thinking the animal was suffering from hunger, inconsiderately gave it a large quantity of lucerne, and the Cow soon died from indigestion.

24. Charlot (*Journal Prat. de Méd. Vétérinaire*, 1826, p. 165) mentions a Cow which was extremely weak from having been in the pangs of impotent labour for three days. There was a vaginal tumour, apparently fibrous, which had been mistaken for the "water bag," and punctured; this was the inverted bladder! The neck of the uterus was indurated.

The animal being now considered lost, the Cæsarean section was practised in the hope of saving the Calf. The operation was successful; a living Calf, which was afterwards reared, being removed from the uterus. The Cow died.

25. Chretien (*Ibid. loc. cit.*, p. 221) describes a similar case; the Cow having been in labour for three days, the cervix uteri indurated, and the genital organs greatly inflamed. The Cow being deemed lost, it was determined to save the calf by the Cæsarean section. The right flank was opened about two inches in front of the anterior spinous process of the ilium, the Cow being in a standing attitude; the incision was about seven inches in length. The uterus presented at the wound, and was incised in turn; the fœtus was removed alive, and then the membranes. A portion of intestine escaped from the wound; this was returned, and the uterine wound closed by continuous or pointed suture; the blood which had escaped into the abdomen was carefully removed, and a double suture united at first the muscles, then the skin. The Cow died eight hours after the operation; the calf appears to have lived.

26. The same author (*Ibid.*) alludes to another Cow which was in labour for six hours. Some time previously it had been treated for a fracture of the ilium, which united; but the animal remained lame, and the callus filled one-third of the pelvic cavity. The two fore-limbs of the fœtus were outside the vulva; the head was retained and thrown over the back. It was brought into a favourable position, and energetic traction applied, but the obstruction could not be overcome. The Cæsarean section was deemed indispensable, and was practised as in the previous case, except that a small opening was left at the lower part of the wound for the escape of discharges. The Cow recovered, but no mention is made as to whether the calf survived.

27. This authority (*Ibid.*) gives another instance of a Cow which had gone twenty-seven days beyond its time for calving, and had been in labour for twenty-four hours. The fœtus was a Celosomian monstrosity, which could not be extracted *per vias naturales;* so in order to save time, and fatigue to mother and operator, gastro-hysterotomy was performed, and practised the same as above. The extraction of the monstrosity was difficult, and it had to be divided—the anterior half being first removed, then the posterior. The Cow was killed next day, as fears were entertained for the result of the operation.

28. Pradal (*Recueil de Méd. Vétérinaire*, 1833, p. 195) attended a Cow which had been making fruitless efforts to calve for forty-eight hours. When the animal was lying, on separating the labia of the vulva the posterior segment of the uterus could be seen well advanced in the vagina; but when it stood the tumour receded into the abdomen.

The cervix uteri was swollen, indurated, and almost cartilaginous in consistence; dilatation of the os was considered impossible. The fœtus was alive and strong as its movements showed. The Cæsarean section was adopted; the right flank, then the

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uterus, was largely opened; the fœtus was quickly removed; and the Cow immediately killed by the butcher. The Calf was reared by another Cow.*

29. Lecoq (*Mém. de la Soc. Vét. du Calvados*, etc., No. vi.) refers to a Cow which had been straining fruitlessly for twenty-four hours, and was weak and exhausted, though the pains still continued. The os uteri was occluded. Without giving any reason for the preference, Lecoq decided on the Cæsarean section rather than vaginal hysterotomy. An incision was made in the middle of the right flank, downwards and backwards, for about seven inches; then the uterus was opened. The fœtal membranes were so thick and resisting that it was necessary to divide them with the knife; the fœtus was then easily extracted, though it was difficult to remove the placenta afterwards. The abdominal wound was closed by suture.

Notwithstanding every attention, the calf, which was weak and ill when extracted, died on the same evening; while the Cow succumbed next day—twenty-four hours after the operation.

30, 31, 32, 33. Rainard (*Op. cit.* vol. ii., p. 103) states that he had performed the operation four times—on the Sheep, Goat, and Bitch, and he was never successful in saving either the parent or progeny; though he admits that the animals operated upon were always in a desperate condition—the long-continued efforts to remove the fœtus by the genital passages having exhausted them.

34. Garreau (*Rec. de Méd. Vétérinaire*, 1854, p. 513) mentions the case of a Cow pregnant with its fourth calf, and which had gone fifteen days beyond its time; though at the ordinary period it had exhibited signs of parturition, which disappeared only to re-appear at the end of the fifteen days.

The uterus was deviated (*see* p. 281), and there was induration of the cervix. Garreau saw no other means of relieving the animal than by resorting to gastro-hysterotomy; though he did not venture to operate. The animal was not interfered with until three months afterwards, when being in the same condition, Garreau was requested to perform the operation. This he did somewhat after the procedure already indicated; the fœtus was extracted, and the abdominal wound closed by quilled suture. Kept on very low diet, and receiving tonics for some days, the Cow completely recovered; eight months afterwards it was sold, because it did not exhibit any inclination for the Bull.

35. Macorps (*Annales de Méd. Vétérinaire de Bruxelles*, 1862, p. 137) had under treatment a Bitch which had in the right flank, towards the last mamma, a tumour the size of a fist, and which had appeared six weeks previously in a very gradual manner. It was neither hot nor painful to the touch or on pressure.

As it was supposed to be a mammary neoplasy, its excision was attempted. A large incision was made in the skin, and there immediately appeared a white saccular body which was at once recognised as a *uterine hernia*. Instead of returning it to the abdomen, as this appeared to be both difficult and dangerous, it was decided to extract the entire uterine cornu as far as the cervix uteri, apply a ligature round it there, and thus extirpate the organ. This was done; a few sutures firmly united the skin incision; the animal was kept quiet, the diet attended to, a few enemas administered, and in eighteen days after the operation, the Bitch—of a sporting breed—was out in the field with its master.

36. Thierry (*Bulletin de la Soc. Cent. Vétérinaire*, 1873) gives an interesting case of a Cow, three years old, which suffered at an interval of three days, from a double luxation of the coxo-femoral articulations from some unknown cause. A rectal and vaginal exploration led to the discovery of a slight deformity of the pelvis, and Thierry satisfied himself that it was a case of *osteomalacia*—a diagnosis which subsequent events confirmed. In fact, in a few days afterwards another exploration found a fracture of the pelvis, which appeared to have occurred spontaneously. Finally, symptoms of parturition showed themselves, but birth could not take place; the fracture had so narrowed the pelvic canal that it was barely possible to introduce the hand. After several ineffectual attempts, the idea of extracting the fœtus by the natural passage was given up, and the Cæsarean section practised. A fine calf, which lived, was the result; the Cow was immediately killed, and at the autopsy the fractures and luxations diagnosed during life were found.

37. Saint-Cyr (*Op. cit.*, p. 579) gave his attention to a Bitch which had been in labour since the previous evening. It had given birth to a puppy twelve hours before, but no more could be expelled. When Saint-Cyr first saw the Bitch, the labour-pains had ceased; by vaginal exploration he could scarcely touch the foot of the most advanced puppy—which was not in the pelvis—with his finger; while the volume of the

* This would have been an excellent case for vaginal hysterotomy, and offered a good prospect of success. The Cow might even have recovered from the effects of the operation practised on it.

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abdomen led him to believe that there were more than one in the uterus. The general condition of the animal was good; so it was decided to try the Cæsarean section, incising the right flank, where the fœtuses were most readily felt by abdominal exploration. Three fœtuses were removed from the right cornu by a single incision; two of these were dead, but one was still alive. The operation being completed, the cornu was returned to the abdomen, but not sutured; and the abdominal incision closed by interrupted suture, a bandage being placed round the body.

After the operation the Bitch was very weak; it died in eighteen hours. The autopsy showed a moderate degree of metro-peritonitis.

38. Ory, in a communication to Saint-Cyr (*Op. cit.*, p. 577) states that he was called to attend a Cow, which, for seven or eight days, had been making impotent efforts to calve. On his arrival he found it extended on the litter, and quite unable to get up. For eight days it had been suffering from complete paraplegia. The "waters" had only escaped about two hours previously, and the uterine contractions were feeble; the Cow was fat, but nearly dead. Vaginal exploration discoved the fœtus to be alive, in the anterior position, head on the withers, and the fore-limbs completely retained and deviated backwards. Attempts were made to rectify this malposition, and the two limbs were brought into the pelvis; but the Cow was evidently sinking and death imminent. Ory endeavoured to get the head rectified, but quickly saw that delay would only entail the sacrifice of the calf as well as the loss of the Cow. The latter was killed by the butcher; then at once, by a single cut of the bistoury, he made a large opening in the abdomen, and by another incision threw open the uterus, from which the calf was taken. The latter was well-shaped and alive, and being reared, became an excellent Cow, which Ory had under observation for eleven years.

39. In 1870, the same veterinarian (Saint-Cyr, *Op. cit.*, p. 578) had to attend an aged Mare in labour. The animal was pregnant with its eleventh foal; it had been straining so violently for some hours previously, that the rectum had become everted. This eversion having been reduced, Ory practised the "touch," and found the cervix uteri so contracted that he could scarcely introduce one finger.

After long-continued efforts, he contrived to introduce three fingers, but it was impossible to effect more. The cervix was excised, but a new difficulty then presented itself: the fœtus filled the uterus so exactly, that the hand could not be passed between it and the fœtus. However, it was ascertained that all the feet of the latter presented, and that the young creature was doubled on itself; it did not exhibit any sign of being alive. Ory then came at once to the conclusion that delivery by the genital canal was impossible; though, for conscience sake, he did all he could during two hours until, exhausted, he was compelled to cease. The Mare being very old and of little value, he determined to have it destroyed; but before doing so he resolved to save the foal—if it still lived—by resorting to the Cæsarean section for its extraction. The operation was easily performed, and in the same manner as in the previous case. But the foal was dead. Its head was *on* the left shoulder, the croup *on* the head,—the creature being thus gathered in a threefold mass, not unlike a ball, to which the uterus was closely applied. All the feet were directed towards the os.

The Mare was killed as soon as the operation was concluded, and its uterus showed a somewhat remarkable disposition. The body of the organ alone had been developed during gestation, and it had a globular or spherical shape, not unlike that of a woman. The cornua were very slightly developed, and formed, near the anterior part of the organ, two nearly equal appendages about three inches long.

40. Rohlwes (Dieterich, *Geburtshülfe*, p. 125), in 1822, refers to the case of a Mare which could not foal. He had the animal placed on its back, the fore-feet fastened to as many posts, and opened the abdomen at the *linea alba*. The foal was alive, and was extracted; it was reared by another Mare, its mother having died, and was afterwards a stud stallion. This is the earliest recorded case of gastro-hysterotomy we can find any notice of.

41. Lehnert (*Sächs. Jahresbericht*, 1873, p. 85) performed the Cæsarean section on a Cow which was dying from a lung disease, and extracted *three* living calves.

42. Feser (*Thierärztliche Mittheilungen der Münchener Schule*, Part iii., p. 296) operated on a Bitch which could not pup, making the opening in the left flank, against which the uterus lay; three puppies were extracted—one from each horn and one from towards the os uteri, the latter being dead, and from a deviation of its head it constituted the obstacle to birth. The heads of the other two puppies were likewise deviated. The uterus and Fallopian tubes—everything behind the cervix uteri—were extirpated by the ecraseur. The uterine and ovarian artery were ligatured. The incisions were closed by suture, and ice applied to the left side of the abdomen. The animal lost about three ounces of blood. An hour after the operation it had a shivering fit, but this soon passed off; though it recurred three times a day for some time. In

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sixteen days the wound had healed and the Bitch was quite recovered. The puppies were reared artificially.

43. The same veterinarian (*Ibid.*, p. 297) performed the *Sectio Cæsarean* on another Bitch two years old. The animal had been in labour for two days, and was extremely weak; no puppies had been born. The section was made on the left side, and four dead puppies extracted. The uterus and ovaries were extirpated by the ecraseur, and the arteries ligatured. Frequent rigors appeared after the operation. In twenty-four hours death ensued, the fatal termination being apparently due to septikæmia.

44. Feser (*Ibid.*, p. 298) relates another instance in which he performed the operation, extracting four living puppies—two from each cornu; the incision was made in the left flank. The uterus and ovaries were also excised in this case, the animal losing about five ounces of blood. Extreme prostration ensued after the wounds were closed, but this was combated by stimulants, and sprinkling sweet spirits of nitre over the body. The appetite was good, and with the exception of traumatic fever, no unfavourable symptoms supervened. In eight days the Bitch had recovered; two of the puppies were reared artificially.

45. Adam (*Briefliche Mittheilung*) performed the operation on a Bitch, under chloroform, making the section at the *linea alba*, behind the umbilicus, and dividing the tissues with the scalpel, the peritoneum with scissors; the cornua were opened by incision. After removal of the fœtuses, the wound in the abdominal muscles was united by suture, then that in the skin. During the first day the animal was very depressed and feverish, but on the third day it was able to move about. The puppies, which were very large, were reared by hand. Eight months afterwards the Bitch again became pregnant, and, not being able to bring forth, died—no assistance having been rendered on this occasion, apparently.

46. Scœrensen (*Tidskrift för Veterinar.* 1868) gives the case of a Sow, the vagina of which was so swollen that it could not farrow after one fœtus had been expelled. Scœrensen operated as for ovariotomy; first removing the bristles from the left flank where the incision was made. A fœtus was extracted from the left cornu, and through the same opening another was obtained. The hæmorrhage was unimportant.

The ovaries were extirpated, and the uterus wound being left untouched, that in the abdominal wall was sutured.

The Sow was fattened and soon after killed. The right cornu was found to be normal; the left contained about a pint of pus at the part where the incision had been made.

47. Jensen (*Ibid.*, 1869) relates an instance in which a Sow could not farrow; the left cornu of the uterus had been previously removed. He incised the right flank, opened the right cornu, and extracted five fœtuses—three of which were alive, and lived. The fœtal membranes were entirely removed, and the wound closed by interrupted suture. The Sow recovered and became very fat. When killed there was a litre and a half of pus in the uterus.

48. This authority (*Ibid.*, 1873) had occasion to resort to the operation again in 1873. The subject was a Sow—pregnant for the first time—which had already brought forth three dead fœtuses. Next day the abdomen was greatly distended, and fluid was discharged from the opening. In the left cornu was found only one very large fœtus, and in removing it, the friable texture of this part was torn. The abdominal wound was closed by suture after the extraction. The Sow recovered and was fattened. When killed, a well-marked cicatrix was observed in the left cornu with some tubercles (*Tuberkel*) around its margin; the cornu was somewhat contracted at this part—elsewhere it was normal.

49. Adam, sen. (*Mündliche Mittheilung*) relates that a worthless Mare became accidentally impregnated, and at the end of pregnancy could not foal, owing to a contracted pelvis. The case being hopeless, the Mare was killed, the abdomen and uterus immediately opened, and a living foal extracted; this was kept alive for eight days.

50. Adam, junr., was called to attend a pregnant Mare which could not expel the foal. Attempts were made at extraction, but all failed. The animal was killed by a blow on the head, and the abdomen and uterus being opened, and the membranes incised towards the head of the foal, the latter was extracted. The entire operation did not occupy more than ten minutes. The foal lived for eight days.

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CHAPTER V.

Symphysiotomy.

SYMPHYSIOTOMY, as the name implies, consists in dividing the ischio-pubic symphysis throughout; so that, by allowing the bones to separate somewhat in the pubic region, the pelvic cavity may be enlarged, and the passage of the fœtus through it rendered possible. But even in woman, with every advantage and appliance, and after a most serious mutilation, the separation procured between the bones is infinitesimal, and therefore can have but little influence on the progress of the fœtus. And when we remember that in woman the mortality is more than 32 per cent., while among those which survive many are permanently disabled, and those which recover often require months before convalescence is established, it will be understood that the operation can never, with our present knowledge, be reckoned among those which the veterinary obstetrist must practise. It may be sufficient to notice the fact that, in animals, the symphysis pubis, as a rule, soon becomes ossified. The operation does not appear to have been resorted to in veterinary obstetricy, and it would require a bold operator to attempt it.

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BOOK IV.

ACCIDENTS INCIDENTAL TO PARTURITION.

THE *accidents* incidental to the act of parturition are rather diverse, and not unfrequently complicate those difficulties already alluded to as hindering natural birth. These accidents may occur either during parturition, immediately after delivery, or within a few days subsequent to that event.

In addition to the accidents, there are *diseases* which appear during the puerperal period; though the distinction between them and the former is not always easy to establish.

Some of the complications just alluded to may succeed a perfectly normal delivery, or an accidental abortion, as well as a difficult birth.

The accidents consecutive to or accompanying parturition, may be enumerated as follows: (1) *Retention of the fœtal envelopes in the uterus* and the *consequences;* (2) *Post-partum hæmorrhage from the genital organs;* (3) *Displacement or hernia of one or more of the internal genital organs through the vulva;* (4) *Traumatic lesions of the genital or neighbouring organs.*

Some of these accidents are either very serious in themselves or in their consequences, and require the greatest skill to remedy; or they are comparatively trifling, and easily repaired.

CHAPTER I.

Retention of the Fœtal Envelopes.

THE retention of the fœtal envelopes, placenta, "secundines," or "after-birth" beyond a certain time after the expulsion of the fœtus from the uterus, must be looked upon as an accidental or pathological condition which requires attention. We have already shown that the placenta is usually shed or expelled soon after the young creature is born, and particularly with such animals as the Mare, Sow, and Bitch, the placenta of which is diffused or zonular; indeed, with multiparous animals—as the two latter—the placenta of each fœtus is extruded soon after its birth, by the succeeding fœtus; so that, if retention occurs at all, it is only the last, or the two last placentæ which remain in the cornua of the uterus.

With ruminant animals, however, retention is far from rare; though even in them there is a difference in this respect, according to species—this accident being much more frequent in the Cow than in the Sheep or Goat. This frequency in ruminant animals is doubtless due to the peculiar conformation of their placentæ—the cotyledonal arrangement being evidently opposed to ready segregation.

But if the Cow is the animal of all others in which this accident occurs, it is also the one which appears to be the least inconvenienced by it; for, as Saint-Cyr correctly observes, it is not uncommon to see Cows which four, six, eight, and even ten or twelve days after parturition, have not got rid of

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the placenta, and yet are lively, the appetite is unimpaired, and they continue to ruminate and give milk as if there was nothing amiss.

Symptoms and Terminations.

The symptoms are generally so marked that the obstetrist readily discovers the state of affairs. Nearly always there is a more or less considerable mass of the fœtal envelopes—sometimes only the umbilical cord—hanging from the vulvar orifice, the labia of which are often swollen and injected. Occasionally the mass is so large as to reach below the hocks, with little bags of liquor amnii at the lower end; it has, if recently expelled, a fresh tint, not unlike that of the intestines; but if exposed for some time, and especially in summer, it is greyish-coloured, somewhat adhesive, and generally soiled by fæces or litter.

In other cases nothing is noticeable, except when the animal is lying on its abdomen; then the pressure on the uterus pushes the cervix into the vagina, and if any portion of the membranes is through the os, of course it is visible. And in others, again, nothing whatever is to be seen whether the creature is lying or standing, the whole mass being retained in the uterus. After the third day of delivery, the os is usually closed; and unless a portion of the membranes chanced to be in the vagina before this period, the entire placenta is imprisoned in the uterus, and a manual exploration will not always discover it. Sometimes only a fragment of the membranes is so retained.

We have mentioned that, in many cases, the animal does not evince any uneasiness at first; sometimes, when the portion of placenta hanging outside the vulva is large and heavy, when the creature is standing the meatus urinarius is pressed upon, and micturition is rendered difficult. There may also be symptoms of abdominal uneasiness—whisking the tail, stamping with the feet, and making efforts as if to defecate or micturate, with slight and brief uterine contractions, which may eventually lead to the expulsion of the placenta.

It often happens that when the os is not completely closed, owing to a portion of the membranes lying in it, spontaneous expulsion takes place, after a variable period.

Deneubourg, a Belgian veterinary surgeon, asserts that it occurs at fixed intervals, which are almost regular "tertiary periods;" that is, if expulsion does not ensue in the first twenty-four hours, it should take place on the third day; and if not then, it will be either on the sixth, ninth, twelfth, fifteenth, or other tertiary interval—but most frequently on the ninth day. How far this assertion may be correct, experience can alone decide; what is more to the point, however, is the fact that, when once this spontaneous expulsion has been effected, there is little to be apprehended.

It is not so when retention is accompanied by decomposition of the membranes. This occurs when the air has access to them; and all the more rapidly does putrefaction progress as the temperature is high, and they are impregnated with discharges.

The odour is most repulsive, and a sanious brown-tinted discharge, composed of *débris* of the membranes, and secretions from the irritated mucous lining of the genital canal, flow from the vulva—soiling it, the tail, thighs, and hocks, and often excoriating them; this discharge is most abundant when the animal extends itself to micturate, and it is then horribly fetid. The hand, on being passed into the vagina, is covered with the fluid, and it may encounter shreds of the placenta.

In such cases, the health of the animal often suffers: there is dulness,

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prostration, diminution in the secretion of milk, decreased appetite, respiration perhaps quickened, temperature increased, and other indications of illness.

The complications from placental retention are somewhat numerous. Contact with the decomposing membranes may so irritate the interior of the uterus as to occasion metritis, or even metro-peritonitis—a diseased condition which is always serious, and often fatal. There is also risk of septikæmia; and even under the most favourable circumstances there sometimes remains a local irritation—a chronic vaginitis or metritis which leads to leucorrhœa.

Some authorities have observed trismus, tetanus, metastatic arthritis, and chest affections, as *sequelæ* of placental retention.

There is no danger when the retention has only lasted for two or three days, and particularly if a large portion of the membranes protrudes beyond the vulva, and they have a fresh tint. Attention is necessary, however, when the placenta begins to putrefy, and a fetid discharge commences from the vulva; though even so late as fifteen days after parturition the membranes may be expelled spontaneously, without any injury occurring to the animal from the prolonged retention. The case is serious, however, when the animal begins to show symptoms of general illness, and particularly if no portion of the placenta can be seen, or the os be occluded. Plastic adhesion of the placenta to the uterus is also a grave complication, though happily rare.

In these instances, the animal gradually becomes listless, weak, and emaciated, loses its appetite, and ceases to yield milk, until at length it falls into a state of marasmus, and perishes from septikæmia. Or in more rapid cases, with these general symptoms we have the lining membrane of the vagina of a deep-red colour and intensely hot, a fetid sanguineo-purulent discharge from the vulva; tremblings over the whole body; hurried respiration, intense fever, and all the other signs of metritis.

Though retention is not, in the majority of cases in the Cow, a very serious affair, yet it should be attended to even in this animal. With other creatures it is much more to be dreaded, as they incur greater risks by prolonged retention.

Saint-Cyr mentions the case of a fine Mare which died in less than eight days from metritis, due to the fœtal membranes being retained; though the cause was not ascertained in time.

Causes.

Retention, it appears, occurs most frequently in cases of abortion, or when birth occurs some days before the proper time. It has also been remarked that a Cow which has retained its placenta unusually long after the birth of its first calf, will do so at every succeeding birth. A protracted and laborious birth is also said by some authorities to favour retention, while other obstetrists declare that the converse is true. The accident is stated to be more frequent with old Cows, and especially when these are employed in draught—as in France and other countries. Abnormal adhesion between the maternal and fœtal placentæ, of course, would be a sure cause of prolonged retention, and we have given instances of such adhesion; indeed, every obstetrist knows that at times there is much difficulty in disuniting the cotyledons in the uterus.

When the cervix uteri contracts rapidly after delivery, and the os is consequently firmly closed, the placenta, though non-adherent, will be retained.

Rueff mentions that the accident is especially frequent in certain years, when the herbage and forage is not good, and particularly when the latter

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is mouldy; it has long been known that these conditions favour abortion. He also alludes to a popular belief in Germany, which attributes this *Zurückbleiben der Nachegeburt*, to allowing the calf to take the teat before the placenta has been expelled; the irritation of the udder so produced re-acts sympathetically on the uterus, which contracts at the cervix, and so retains the membranes.

According to Baumeister, milking too soon, or giving cold water to drink, is supposed to act in the same way.

Numerous other causes have been mentioned as influencing this retention; but we need not notice them, as there is really no proof that they do operate in this way. The accident occurs under all systems of management, and all kinds of conditions; it is, therefore, probable that several causes may produce it, and that some of these are still obscure.

Treatment.

The treatment of placental retention appears always to have been a subject on which diverse views and opinions have been held: many obstetrists maintaining that—with the Cow more particularly—this retention is never dangerous in itself, and that unless there arise complications, the removal of the fœtal membranes should in every case be left to the efforts of nature; while there are others who assert that there is great risk in this retention, and that when it has exceeded two or three days after the birth of the fœtus, there is need for active intervention. The experience of the majority of obstetrists will negative both of these opinions; for it is a matter of almost daily observation, that in many instances the placenta remains without inconvenience in the uterus for several days—six or eight—before it is spontaneously expelled; while in other cases retention for the same period is marked by more or less serious symptoms. This difference undoubtedly depends upon circumstances, the precise nature of which we cannot always fully ascertain or comprehend. Nor can we venture to lay down positive rules as to when it is time to interfere, or when abstention will be the prudent course:—this can only be learned by individual experience and the tact of the practitioner.

It may be remarked, however, that when parturition has been normal, when the Cow does not appear to suffer pain or inconvenience, when the "straining" is unfrequent and slight, the appetite good and lactation established, and particularly when, during a low or moderate temperature, a portion of the membranes protrude beyond the vulva; then there is no great reason for interference until a week or even more has elapsed.

But if, on the contrary, the external temperature is high, the labour has been difficult, the genital organs irritated or abraded, and if fever, restlessness, and suffering are noted, with strong and frequent straining, and especially if there are foul-smelling discharges from the vagina, then intervention is called for, no matter whether the time which has elapsed since parturition is long or short.

When the envelopes form a somewhat large mass hanging from the vulva, it may be anticipated that early and spontaneous removal will take place; though it sometimes happens, as we have pointed out, that the weight of the pendulous portion causes inconvenience in micturition; while it fatigues and pains the animal by dragging on the uterus, and inducing expulsive but futile efforts. Schaack has shown that in nearly all these cases it will be found that a loop of the membranes has become twisted around the pedicle of some large uterine cotyledon; and as this is the obstacle to separation, it is necessary to release the loop as soon as possible, in order to prevent accidents.

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It has also been remarked that, even when birth has been easy and favourable, primiparæ are often irritable and impatient, and the presence of the secundines in the vagina and vulva exaggerate the restless, and occasion frequent and energetic uterine contractions. In such cases it will generally be found judicious to remove the membranes as soon as possible—on the same day, or the day succeeding delivery, if necessary.

If, after the birth of the fœtus, nothing is seen at the vulva except a thin cord, formed solely by the umbilical vessels, we may be almost certain that there is a strong adhesion between the maternal and fœtal placentæ, and that the separation of the latter will be protracted—in all likelihood require to be removed artificially. But even in such a case there is no occasion for immediate interference; on the contrary, it is more judicious to wait, and allow time for the placentæ to soften and the adhesions between them to diminish: though the opportunity for complete detachment must not be overlooked.

When nothing whatever is discernible externally, there is reason to surmise that the placenta is completely retained. But even in this case there is no need to resort at once to removal of the membranes; though it may be necessary, in order to prevent imprisonment for some time, through the closure of the os uteri upon them, to introduce the hand into the uterus, and if they are already partially detached, to extract them. If they remain firmly adherent, however, it is better to gather as much as can be seized into a single mass, carry it through the os into the vagina, and tying it there by a long piece of cord, to leave the latter hanging without the vulva. In this manner the os is prevented from closing, while the cord will assist in effecting artificial removal at a later period, should such be demanded.

Certain medicaments, more or less of the nature of emmenagogues—such as rue, savin, laurel, stramonium, carbonate of potass, etc.—have been for a long time credited with the power of hastening the expulsion of the membranes; and their administration has been recommended before resorting to manual force for the removal of the placenta. Some of the recipes for these potions are very antiquated, and others are quite modern, and lauded by the highest authorities.

Zundel, for instance, extols laurel berries, and gives the following recipe:

Laurel berries	120	grammes.
Aniseed	60	„
Bicarbonate of soda	120	„

These are infused in 4 litres of water, and given in two doses. It may be repeated the following day; but, as a rule, the membranes are expelled within twenty four hours after the last dose has been given. Zundel asserts that this infusion has rendered excellent service, succeeding in sixty per cent. of his cases of retention. Hering and Stockfleth also speak highly in its favour, and assert that it is always successful, provided there is no mechanical obstacle to the expulsion. Baumeister and Rueff recommend carbonate of potass in the dose of 45 grammes daily, at three times, and in an infusion of chamomile or savin. Hummer prescribes 90 gramme doses for three consecutive days, and Hertwig, Lund, and others also prescribe it with the same object. Hering gives the following formula:

Carbonate of potass	15	grammes.
Savin leaves	30	„

These are infused in 500 grammes of water, filtered, and administered tepid. The dose to be repeated every six hours.

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Garreau praises Caramija's uterine tincture, which he states always succeeds in producing expulsion of the membranes, even when they have been retained for two months after parturition.

The formula for this tincture is given by Tabourin as follows:

Powdered savin		250 grammes.
Treacle		190 „
Powdered cumin		125 „
Essence of rue	aa	80 „
„ „ savin		
Alcohol		2 kilogrammes.

Garreau prescribes this tincture in doses of 100 grammes, given in 2 litres of savin infusion.

Cruzel likewise has his favourite potion, composed of 30 to 40 grammes of green rue, or 10 grammes of ergot of rye and 20 grammes of powdered savin, made into a decoction in a litre and a half of water. Delwart, Rainard, and Schrader recommend ergot of rye, and Ungefrohrn stramonium seeds (30 grammes in two litres of water), which he believes to be specific in their action; he advises that linseed decoction be given in the intervals, as it acts as a diuretic, and Rychner asserts that this simple medication is particularly useful when the fœtal membranes are so decomposed that they cannot be removed by the hand.

The subcutaneous injection of ergotine or ergot of rye has also been advised. Extract of ergot of rye, one to three grammes, dissolved in glycerine and spirits of wine (fifteen grammes of each), has been used for injection.

Though medication has been so highly vaunted by some authorities, yet some others have not much faith in it. Deneubourg thinks its chief advantage is in making the owner of the animal exercise patience, until spontaneous expulsion is effected; the least active measures being the best. Other obstetrists entertain the same opinion of these emmenagogues.

For a very long time, an empirical mode of removing the placenta when a part of it protruded beyond the vulva, was to exercise slight and continuous traction on it by attaching a weight to the pendulous portion: in France the farmers attach a "sabot" filled with gravel. Favre of Geneva, who notices this rude method, admits that a weight not exceeding two pounds may be suspended from the membranes, which are collected into a mass and tied with a piece of hemp. This method is, however, objectionable from several points of view.

Manual traction is often employed when a portion of the membranes is visible. This is seized either by the hands, or by means of a towel, or wisp of hay or straw, and gently pulled at—particularly when the animal strains—twisting it at the same time, until the whole mass is removed from the uterine cavity.

This traction is not likely to be productive of much injury to the Mare, Sow, or Bitch, as the adhesion of the placenta is not great, and is usually limited to a few points; it is, therefore, as a rule, generally and quickly successful in these animals.

With the Cow, however, it is not so, owing to the numerous, and often strong attachments of the placentæ, and the fragile texture of the membranes, which are easily torn if too much force is employed; if they do not give way, and the traction is immoderate, then there is risk of irritating the uterus, tearing away the cotyledons, or producing partial or complete inversion of

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the cornua, or even of the entire uterus. Should the membranes alone give way, this may lead to greater difficulty in removing what is left of them in the uterus.

For these reasons, some practitioners discountenance this mode of abstracting the placenta; but there can be no doubt that if the traction is moderate and judicious, the membranes not very adherent to the interior of the uterus, and a good part of them beyond the os, the operation is quite justifiable, and will be successful. When, however, the resistance is marked, or the membranes begin to tear, it is better to desist.

Deneubourg recommends the following method, as better than employing the hands: The protruding umbilical cord is seized between two pieces of wood, the length and size of an ordinary walking-stick, and rolled round them until they are close to the vulva; there, by a slight and gentle circular movement, the portion engaged in the vagina produces a kind of titillation which induces the animal to stretch as in micturition—an act it nearly always accomplishes—and during this period the membranes are rolled round the pieces of wood as they are detached, which usually occurs in about six days, when the whole is removed. When any resistance is experienced, and anything is found to tear or rend, it is evident that adherences still exist, and the rolling must cease; but then, by a kind of jerking movement from side to side, there are communicated to the uterus, by means of the adherent membranes, a series of shakes more or less energetic, according to the state of the organ. Deneubourg says that there need be no hesitation in employing a certain amount of force in practising these movements: "We may act strongly, but gently." Great success is said to have attended this method.

But, after all, it is doubtful whether the more scientific and surgical, and old plan—that of direct extraction by enucleation of the cotyledons—is not preferable. This method consists in passing the hand into the uterus, and detaching, or enucleating the cotyledons, one by one, so as to destroy the adhesions between the maternal organ and the fœtal envelopes, and extract the latter.

When this extraction should take place will depend upon circumstances. It will generally be found that it will not be successful before the third day, as the cotyledons are too closely and firmly united to allow their disunion without injurious force, which may bring about inversion of the uterus, or laceration of the maternal cotyledons, and consequent hæmorrhage. About the third day is generally a favourable period, as the os is still sufficiently relaxed to pass the hand through it into the uterus, while disintegration between the fœtal and maternal placentæ has advanced sufficiently to permit the hand to complete the disunion without need for violence. It sometimes happens, however, that extraction can be effected so late as the fifth or eighth day after delivery; but then the membranes are extremely friable, and will scarcely withstand any degree of traction. Besides, the operator himself incurs great risk of infection, either local or general, from the absorption of the putrid matters in the uterus by the skin of the hand and arm, which have been engaged in that cavity.

An assistant holds the tail of the animal to one side, and the hand and arm, being well oiled, are passed into the vagina; if a portion of the membranes is in this canal, then the operation is not so difficult, as the os will probably be more or less relaxed, and this portion lying towards the palm of the hand—the back of which is upwards—serves as a guide; while the left hand pulls at it gently, as occasion requires. When, however, nothing of the envelopes is to be found outside the os, and that opening is firmly closed

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—as happens four or six days after birth—then it may be very difficult to reach the interior of the uterus. One finger must be at first introduced, then two, and three, and so on, until the hand, in the form of a cone, and by a semi-rotatory motion, can be passed through. This operation is often long, troublesome, and fatiguing, and requires to be carefully managed, so as not to bruise, irritate, or wound the organ.

When the hand reaches the interior of the uterus, it is pressed forward between the mucous membrane of the latter and the chorion—the palm towards the latter—separating them as it advances until it meets with the cotyledons. Some of these—the maternal—may be detached from the membranes, while others are still imbedded in them, as it were, through their fœtal cotyledons. These last have to be enucleated; and to effect this, the cotyledon is gently pressed at its base between the thumb and index finger, and, if necessary, the fingers are moved over each other as if removing a button from its button-hole. Other practitioners make pressure on the summit of the cotyledon by the three first fingers, and thus destroy the adhesion. In this manner the hand passes from one cotyledon to another, effecting disunion as rapidly, yet carefully, as possible. At times a cotyledon will be met with which adheres so very firmly that it cannot be detached in the way just mentioned. Then the nail of the thumb or other finger must be gently insinuated at the border, so as to gradually raise it, and pass the finger over its entire surface.

The tediousness of the operation will be inferred, when it is known that the number of adherent cotyledons may sometimes amount to more than a hundred; and the fatigue is often so great that the right and left hand have to be employed alternately—a circumstance which has advantages otherwise.

When a certain number of cotyledons are detached, the portion of envelopes so released is carried into the vagina, and beyond the vulva, where the other hand, or an assistant, seizes it, and pulls gently on it. As the bulk of this increases by the detachment of more cotyledons, the pulling must cease, and the mass will require to be supported so as to prevent tearing of the membranes, or painful dragging on the fundus of the uterus.

As the hand reaches the cornua, the cotyledons increase, and it becomes difficult to reach them—particularly the cornu in which the hind-limbs of the calf were lodged—because of the insufficient length of the arm. Moderate traction, however, on the part just detached will bring the others nearer, and facilitate the task; but the traction must be judiciously managed, else tearing of the membranes, the adherent cotyledons, invagination of the cornu, or even inversion of the uterus, may result. So likely is this accident to happen, that some practitioners, instead of pulling at the membrane in this way in order to disunite the most distant cotyledons, are content to await their natural separation, merely tying near the vulva the portion of the membranes separated, and cutting away the parts beyond—the separation generally occurring in from two to five days. To facilitate the traction, Gunther recommends that the abdomen of the animal should be well raised by a piece of wood placed under it, and held by assistants.

It has sometimes been found, as already mentioned, that the greater part of the membranes has been expelled, when all at once expulsion has ceased, notwithstanding the volume and weight of the pendulous mass, which caused so much disturbance to the animal that it has refused to eat, persisted in lying, and when compelled to get up, has kept stamping its hind feet until it could lie down again. On introducing the hand into the uterus, it has been discovered that this unusual interruption to the expulsion has been occasioned by one or two large maternal cotyledons becoming entangled in the

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loop of a duplicature of the membranes. Sometimes the drag on these cotyledons has been so great, that they have been brought as far as, or even beyond, the os.

Relief has been given by cutting the membranes off by scissors, close to the vulva, and then releasing the cotyledons.

When extraction of the membranes has been properly conducted, there is no hæmorrhage; if bleeding ensues, then one or more of the maternal cotyledons have been injured, or perhaps torn off altogether—an accident not without danger sometimes, and all the more serious if a number of the cotyledons is involved. This injury may lead, in addition to hæmorrhage, to uterine irritation, metritis, or uterine phlebitis.

Still, such an untoward accident is not always the result of injury to the cotyledons, as instances are recorded in which great numbers, or even the whole of the maternal placentæ, have been torn away by ignorant empirics, and yet the animals have survived—we have shown at the commencement of this work that fecundation and gestation may even take place after ablation of the cotyledons. Nevertheless, these cases must be looked upon as entirely exceptional, and must not be relied upon as evidence that these bodies can be injured with impunity.

In order to be assured that the whole of the fœtal envelopes has been removed from the uterus, it is well to make an examination of them. Knowing their conformation and extent, there should be no difficulty in ascertaining whether they are all present.

After the removal of the membranes, there always remains in the uterus a quantity of thick, grumous, diversely-coloured fluid, more or less unpleasant smelling, which is derived from the fœtal fluids, the blood which has escaped from the umbilical cord, and the partly-decomposed envelopes. As the retention of this fluid is likely to do harm, particularly if there is any wound or abrasion of the mucous membrane, as much as possible of it should be removed by the half-closed hand. It is often advisable to wash out the interior of the organ with tepid water, and to inject a weak solution of carbolic acid, chloral, or permanganate of potass.

When extraction of the envelopes has been effected in good time, and with the necessary precautions, the Cow bears the operation very well, and does not appear to be much inconvenienced, while but little after-treatment is needed. Gentle walking, if the weather is fine, in order to calm its restlessness and to allay the straining, if it is still present; keeping in a well-lighted and properly ventilated stable; a blanket over the body if the temperature is low; a few enemas, if constipation threatens; and a light laxative diet, with bran, oatmeal, or linseed gruel, are usually all that are necessary.

When the envelopes have putrefied in the uterus, through delay in removing them, and an abundant and fetid discharge flows from the vulva, while the animal itself is unwell and feverish, then the case is serious, and requires instant and close attention. The uterus must be cleared, without delay, from its putrescent contents, and in order to accomplish this, the hand must be passed into the organ, and everything removed which it can possibly seize. Before doing so, however, the hand and arm should be well and frequently smeared with carbolised lard, butter, or oil, to prevent septic infection; if there are wounds or abrasions upon them, the greatest care should be taken in this respect—indeed, it is questionable whether they should be introduced at all if the skin is not intact.

When everything has been taken away which the hand can remove, then the interior of the organ should be thoroughly cleansed by the continuous

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injection of tepid water from a large syringe and tube, until the fluid comes away perfectly clean.

Very weak solutions of the before-mentioned antiputrescents should also be injected, but they need not be allowed to remain. Should the discharge continue, this treatment may be repeated daily until it ceases; and tonics, stimulants, and antiputrescents (as the sulphite of soda) administered internally. Good food and cleanliness are also essentials in treatment.

The hands and arms of the operator should be thoroughly washed as soon as possible after the uterus has been emptied; for this purpose nothing is better than carbolised soap. On the slightest sensation of uneasiness in the arm, advice should be taken with regard to it, as an attack of *Ecthyma parturitionis* is often a serious affair, and has necessitated the amputation of fingers, and even the greater portion of the arm.

It must be remembered that cleansing and detergent injections are absolutely required when the mucous membrane of the vagina or uterus is inflamed, abraded, or wounded, and has been in contact with putrid membranes or fluids. More particularly are they necessary in placental retention in the Mare —an animal peculiarly liable to septic infection. Indeed, so much is this the case, that it may be laid down as a rule that manual extraction of the membranes is always indicated in the Mare, when they are not expelled immediately after birth. The injection of warm water will materially facilitate the operation.

With the Mare, however, retention of the placenta does not invariably lead to serious results, as several cases are on record in which it has continued for two days, and even longer. Binz mentions an instance in which the membranes were not thrown off until the ninth day, owing to adhesion of the uterus to a hernial sac.

CHAPTER II.

Post Partum Hæmorrhage.

HÆMORRHAGE from the uterus, or "flooding," after abortion, or the birth of the fœtus at the ordinary term—an accident so frequent and alarming in woman—would appear to be far from common in the domesticated animals. This difference between the female of the human species and that of animals, is evidently due to the dissimilarity in organisation of the uterine mucous membrane in them, particularly at the insertions of the placenta fœtalis; as well as to the absence of those immense vascular lacunæ which exist in the uterus of woman, the walls of which are so thin and fragile as to be easily torn when the placenta is detached, and which renders insufficient contraction of the uterus after delivery such a grave matter. Another reason for the unfrequency of metrorrhagia in the veterinary obstetrist's patients, is the great rarity of *placenta prævia* in them,* and which is a somewhat common cause of hæmorrhage either during or after delivery in woman.

* Franck (*Handbuch de Thierärztlichen Geburtshülfle*, and *Zeitschrift für Thiermedicin*) has clearly demonstrated the occurrence of placenta prævia in animals. Grey (*Veterinaria* s, vol. xxvi. p. 12) gives two instances of what he believed to be this condition. A farmer, in

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Nevertheless, whether owing to some anatomical or pathological peculiarity, to atony of the uterine walls, rupture of vessels during removal of the fœtal placenta, or even during its spontaneous expulsion, almost every practitioner of any experience has met with cases of metrorrhagia of a more or less alarming character. So serious, indeed, is this hæmorrhage, that the mortality has been estimated as high as 73 per cent. of the cases reported.

We have already, at page 185, alluded to metrorrhagia occurring during pregnancy. In what Cox has designated "pre-placental presentation" (*Veterinary Journal*, March, 1877, p. 178), we may have hæmorrhage ensuing. According to this authority, such presentations are rare, and if they occur at the termination of gestation, may be looked upon as unfavourable; though they are most frequent in cases of abortion, and are then seldom followed by serious results. Metrorrhagia ensues when the usual period of parturition has been exceeded, and the "water-bag" has been presented and ruptured, the entire placenta fœtalis coming away before the fœtus itself. "In some cases, a considerable portion of the membranes envelop the fore-parts of the fœtus, and occasionally to such an extent as to retard delivery; this may be shredded off and removed without risk, but it will be found that the posterior part remains attached. The fatality attendant upon these cases is owing to neglect of examination and proper aid, and this negligence is owing to the absence of 'pains.' After the removal of the fœtus, it is found that hæmorrhage has taken place from the open vessels, and the quantity indicates that it commenced immediately after the separation of the placenta. I have seen these cases only in cattle."

In certain instances, there can be no doubt that, as in woman, insufficient contraction of the uterus is a cause of *post partum* hæmorrhage; and, according to Schroeder, this atony of the organ is especially observed after a rapid emptying of its cavity, whether artificially or naturally produced, also after a previous and very considerable distention. It therefore occurs after very rapid deliveries, too early turning, and extraction, in hydramnios, and twins. The hæmorrhage is sometimes also due to general debility, and too feeble development of the uterine muscles (either congenital or depending upon previous very difficult labours). Partial adhesions of the placenta to the uterine wall, which, however, are rarely caused by real connective-tissue bands, may also give rise to profuse hæmorrhage; because the separated places in the vicinity of the adhesions can only imperfectly contract.

Symptoms.

The symptoms of *post partum* hæmorrhage are not well marked, unless the bleeding is visible, though they are those of profuse hæmorrhage in general. There is the quick, weak, running down pulse, which becomes imperceptible as death approaches, and the throbbing, irregular contractions of the heart; the decoloration of the mucous membranes, rapidly increasing prostration of the animal, with the unsteady staggering gait on movement, and the difficulty

passing through a field in which Cows were grazing, came upon a newly-expelled placenta, and knowing that one of the animals was in calf, and near parturition, he returned to his farm, and gave directions that the calf should be looked for, as he could not find it in the pastures. Nothing of it could be discovered, however, and the Cow was therefore driven home. While being milked, however, it began to show uneasiness, and to evince evident signs of approaching labour. Grey was sent for, and he states: "On examining my patient, I found a dead fœtus with all four legs presenting, which was with the greatest difficulty extracted." The Cow lived. In the second instance, he was called to attend a Cow which had expelled the fœtal membranes, and exhibited great uneasiness. "In this case, on making an exploration, I again found the fœtus presenting in a false position; but, after a little manual dexterity, I was enabled to remove a dead calf of unusually large size." The Cow survived.

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of maintaining the standing position towards the end; the haggard *facies;* with chilliness of the surface, cold clammy perspiration breaking out over the body; and, finally, the recumbent position, convulsions, and death.

Sometimes there are indications of abdominal pain—indicated by pawing and looking anxiously at the flanks; but these indications are only likely to be present when the hæmorrhage is due to traumatic influences. When the hæmorrhage *per vulvam* is discernible, then, of course, there can be no difficulty in diagnosing the accident; but when it is entirely internal, the manifestation of the symptoms above indicated should give rise at once to a suspicion of the state of affairs, and lead to a manual exploration of the uterus.

Treatment.

The essential indication in the treatment, is to suppress the hæmorrhage as speedily as possible; the next, to sustain the vital powers of the animal.

If the fœtal membranes have not been expelled, they must be removed without delay—yet as gently as may be; as, until this removal is effected, the uterus will perhaps not contract. The contraction of the organ is very important, and when the membranes are present, it often happens that the manipulation required to remove them, brings about this result. If the membranes are not present, then the hand and arm must be pushed into the uterus, and gently moved about, in order to excite contraction, if the organ is flaccid and uncontracted.

At the same time, the interior of the organ should be freed from the blood and clots it may contain; cold water douches ought to be applied to the loins and vulva, as well as injections of the same. If deemed necessary, a towel, or sheet, steeped in cold water, or a large sponge impregnated with vinegar-and-water, perchloride of iron, or any other styptic, may be passed into the vagina, or even into the uterine cavity.

Should the hæmorrhage persist, revulsives in the form of mustard cataplasms, or stimulating liniments, may be applied to distant parts of the body, as the chest, neck, or limbs. Internally, tannic acid, salts of lead and morphia, perchloride of iron, tincture of ergot of rye, or any other agent likely to act as a hæmostatic, may be administered.

1. In 1822, Gellé (*Pathologie Bovine*, vol. iii., p. 539) was called upon to attend a Cow which was losing much blood from the vulva. The animal had calved two days before, and on the previous day, as the secundines had not come away, the owner had attempted to remove them himself. In doing so, however, owing to ignorance, he had taken away not only the membranes, but also a good number of maternal cotyledons, and so caused the hæmorrhage. When Gellé saw the animal, a long stream of blood, as thick as a straw, flowed from the vulva; the pulse was full and strong; the creature very restless. Four kilogrammes of blood were abstracted (!), and the injection of cold water into the vagina ordered. Soon after, the uterus was explored, and about one third of the membranes—which had been left by the owner—were removed, as well as some clots. The treatment was continued until the next day, when the animal was well.

2, 3. Schaack reports (*Journal de Méd. Vét. de Lyon*, 1851) that on two occasions, in pulling at the membranes in order to remove them, he has torn away large cotyledons. "This accident has been followed by hæmorrhage and muscular tremblings; then ensued suffering, fever, tumefaction around the vulvar opening, and in eight or ten days death occurred." This unfortunate result happened during summer, and death was probably due to septic metritis rather than to the hæmorrhage—though the latter may have been indirectly the cause of the metritis.

4. Saint-Cyr (*Op. cit.*, p. 600) observed a case of uterine hæmorrhage under the following circumstances. A fine Mare, three years old and a primipara, gave birth to a foal after much difficulty, and inversion of the uterus soon followed. When Saint-

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Cyr arrived, the organ was entirely expelled, and hung as low as the hocks, forming a tumour much larger than an ordinary bucket. The Mare was straining incessantly. Despairing of effecting reposition of the organ in the condition in which it then was, a number of somewhat deep scarifications were made in the tumified and reddened mucous membrane, by means of a lancet; and as soon as the blood began to flow in abundance the tumour diminished in volume, until at length it was so much smaller that reduction was attempted—it being anticipated that the hæmorrhage would cease when this was achieved. But though reposition of the uterus was ultimately accomplished, the blood still continued to flow, and soon its interior was so distended as to induce new expulsive efforts, which terminated in the uterus being again inverted. It was in vain that attempts to check the bleeding were made by abundant affusions of acidulated cold water; the animal became weak, staggered about, fell, and died without the hæmorrhage being checked in the slightest degree.

The whole of the performance did not occupy more than half an hour. This occurred at the commencement of Saint-Cyr's professional career, and it taught him a lesson as to the danger of scarifications—in the Mare at least—in inversion of the uterus.

5. Peuch (Saint-Cyr, *Op. cit.*, p. 600) was sent for at mid-day in haste, to see a Mare which could not foal. The animal was found standing, the head drooping, eyes half-closed, and exhibiting great prostration; it was much emaciated. The owner said that from time to time it strained, but nothing appeared; the "waters" had escaped in the morning. Exploration found the hind limbs engaged in the vagina; they were secured, and by traction a foal was readily extracted, but it was dead. No sooner was delivery effected, however, than the Mare sank on the ground, and at the same time there appeared at the vulva an enormous mass, which in a second or two descended to the hocks: in a few seconds complete inversion of the uterus had taken place, and from the mucous membrane, which was now external, an abundance of blood oozed and streamed—bright-red, like arterial blood. In presence of such a formidable hæmorrhage, there was not a moment to lose. The owner, who was the only assistant present, was requested to get the Mare up, and this was happily accomplished without very much difficulty, when Peuch seized the uterus with both hands, and in a few minutes the organ was reduced. As soon as this was effected the bleeding ceased. To prevent a relapse, Peuch kept his arm in the uterus for about a quarter of an hour, when it was cautiously withdrawn and no more blood flowed. A good bed of litter—higher behind than before—was then prepared, and on this the Mare was led and its head secured to the rack, to prevent lying down. It was watched for several hours, during which it received some gruel. On the next day, an injection of dilate perchloride of iron was administered, and afterwards injections of decoction of willow bark. The following day nothing amiss was observed, and some months later the Mare was sold.

6. Vernant (*Rec. de Méd. Vét.*, 1872, p. 523), in 1867, was called to attend a Mare which had foaled during the night, and had lost an enormous quantity of blood *per vulvam*. The owner had removed the placenta, by pulling at the portion hanging out of the vulva, and the bleeding immediately ensued. Though no time was lost in attending the Mare, the distance being very short, when Vernant arrived the animal was dead.

7. Vernant (*Ibid.*) relates an exactly similar case which occurred in his practice in 1872, and which was also due to removing the placenta artificially from a Mare after a normal delivery.

8. Anderson (*Veterinarian*, 1844, p. 357) attended a Mare which, while in foal, had fallen into a saw-pit, and this accident brought on labour; inversion of the uterus immediately followed the expulsion of the fœtus, and the animal died from hæmorrhage.

9. Mayer (*Ibid.*, vol. xvi., p. 45) gives an instance—almost exceptional, we believe—of bleeding from the funis umbilicalis after calving. The subject was a valuable young Cow, "of full plethoric habit," which had been rather uneasy during parturition. "The consequence was, that after the fœtus was expelled there were two or three quarts of blood poured out from the cord; but, as sometimes happens, the parties did not take the proper alarm, until the blood kept issuing from time to time in such quantities as to endanger the animal's life; they then sought for assistance, but before it could be rendered, the animal was dead."

10. Mayhew (*Ibid.*, vol. xxi., p. 559) had under treatment a small terrier Bitch, which had been for some hours in labour. Two dead puppies and a living one were extracted. The animal was greatly exhausted, and while a stimulant was being administered, a stream of bright arterial blood was observed flowing from the vagina. "The hæmorrhage gradually increased, and the Bitch, raising itself, began to show symptoms of delirium. The case looked desperate, and, concluding that the bleeding was proceeding from the uterus, which, in consequence of the enfeebled condition of

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the animal, had not power to contract, I resolved to resort to the injection of cold water. Half an ounce of the tincture of galls was mixed with a quart of water; but not more than the third of a pint was injected, before a sharp but low cry informed me that the agent had done its work. No more was injected; but the hæmorrhage ceased, and the Bitch seemed refreshed." It recovered.

11. Cox (*Ibid.*, vol. xxvii., p. 16) reports the case of a Cow which, showing symptoms of calving the previous day, the owner examined it and found the calf in a wrong position, but with the help of a neighbour contrived to accomplish delivery. From that time the Cow became unwell, refusing all food, etc. Cox found the pulse quick and weak; the mucous membranes blanched; breathing quick and laborious; constipation; limbs cold and nose dry. Suspecting rupture of the uterus, he introduced his arm, and although very little blood had been discharged, the case was discovered to be one of "flooding," the uterus being full of coagulated blood; the Cow was evidently sinking. A sponge, impregnated with acetic acid and tincture of opium mixed, was passed into the uterus; stimulants were administered, with plenty of gruel; and cold water was constantly applied to the loins, vulva, etc. The animal recovered. There was no straining until the arm was passed into the uterus, and in all probability this stimulus to contraction was the principal factor in suppressing the hæmorrhage.

12. Sarginson (*Ibid.* vol. xxx., p. 329) alludes to a Cow which was brutally maltreated by an empiric, who forcibly dilated the os uteri, and tore away a calf, which soon after died. Profuse hæmorrhage commenced immediately, "the blood fairly spouting out." The placenta had been extracted along with the calf. The os uteri and vagina were lacerated to some extent; the Cow was sinking from loss of blood. Cold water was continually applied to the loins for many hours, and dilute sulphuric acid given internally. This checked the hæmorrhage, and stimulants and tonics, with good food, being allowed, the animal in seven days was convalescent.

13, 14. King (*Ibid.*, vol. xlii., p. 157) gives a description of two cases of *post partum* uterine hæmorrhage in the Cow, in which he succeeded in suppressing the bleeding by slowly injecting cold water into the uterus. By furnishing himself with two bladders, and holding each in succession—when filled with water—in contact with the large end of the pipe of an ordinary clyster syringe, and pressing the bladder with the other hand, he was enabled to introduce the fluid very gradually and with little force. Three gallons were thus injected. The animals were freely supplied with stimulants at intervals.

15. Cox (*Veterinary Journal*, March, 1877) delivered a Cow of its calf without difficulty; the placenta followed, and everything appeared to be well until soon after, when it was reported that the animal was "parting with great quantities of blood. This proved to be the case; it was discharged in volume equal to an ordinary pump spout. It was an urgent case. I soaked four or five double towels and a sheet in cold water, and passed them through the vagina into the uterus, and then blocked that passage up in a similar manner. From fifty to sixty cans of cold water were thrown on her, and a double cloth over her loins was kept constantly wet. Acetate of lead and opium were administered internally, with alternate doses of laxative medicine. On the third day the cloths were eased by twisting them, and on the fourth day they were expelled. The animal recovered, and was in usual milk in ten or twelve days."

16. The same veterinary surgeon (*Ibid.*) was sent for in great haste to see a Mare which had foaled, and was reported to be losing great quantities of blood. When he arrived, he found the animal so exhausted that it was staggering about. "In several places where she had stood for a short time, were clots of blood the size of a man's head, besides much fluid blood that had been evacuated, and had sunk into the ground. I douched her with a great volume of cold water, and adopted the treatment before mentioned. I did not introduce cloths into the vagina. The Mare recovered."

CHAPTER III.

Inversion of the Uterus.

INVERSION, *procidence, prolapse of the uterus*, or *vagino-uteral inversion*, signifies a kind of hernia of the organ, consisting in its partial or complete turning inside out: the inverted fundus escaping through the os uteri (*partial inver-*

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sion), vagina, and vulva, and perhaps descending as low as the hocks (*complete inversion*), where it forms a more or less voluminous tumour.

When the inversion is very partial, nothing whatever is seen externally, and an exploration alone reveals the existence of the accident; if more developed, the uterus appears as a round tumour between the labia of the vulva when the animal is lying, and especially if the floor is sloping backwards, which causes the gastro-intestinal mass to press upon the organ. Sometimes the procidence is so very slight that there is merely a bulging inwards at the fundus of the uterus, or in one of the cornua.

In complete inversion, we not unfrequently have prolapsus of a portion of the vagina; and it is recognised as appearing in two forms or degrees, according as there is inversion of the body of the uterus, or inversion of the cornua as well; sometimes it is only one cornu, which is then deviated to the right or left of the vertical direction of the body of the organ, according as it is one or other of these parts. If both cornua are completely inverted, they terminate inferiorly in the form of a cone; but if they are only incompletely so, then they remain cylindrical at their lower end, and at the centre of the cylinder is a depression or cæcal cavity.

Inversion of the uterus is, of course, only possible when the os uteri is dilated; consequently, it occurs either immediately before or after birth.

Again, inversion is *simple* or *complicated*. It is *simple* when the viscus is intact, uninjured, and not accompanied by the extrusion or displacement of any other organ. When it is wounded or torn, or when there is accompanying hernia or protrusion of other viscera, then it is *complicated*.

As we have said, ruminants are most liable to this accident: the Cow coming first, then the Sheep and Goat; the Mare is less frequently affected, and the Sow and Bitch perhaps not so often as the Mare. Inversion of the uterus has been observed in the Cat and Rabbit.

With the Bitch and Sow, incomplete inversion of the uterus is far from uncommon, as is also simple inversion of the vagina, for which it might be mistaken. In uniparous animals, the whole of the organ is usually inverted; while in multiparous creatures, generally little more than the portion which contained the fœtuses is involved.

The accident has been observed in animals kept in houses and stables, as well as in those roaming about at liberty; and it has been known from time immemorial. The Roman veterinarian, Vegetius, alludes to it, and recommends the employment of an inflated pig's bladder as a very good pessary.

Symptoms.

The symptoms of uterine inversion vary with its extent. With uniparous animals, inversion always commences at the fundus of the organ, most frequently towards the largest cornu where the greater part of the fœtus was lodged. Under the influence of an irregular, and kind of spasmodic, contraction, this part is drawn, or pushed inwards, just as the foot of a stocking is inverted; and this action continuing, the fundus or cornu is more or less rapidly carried towards the os, through which it passes into the vagina (*incomplete inversion*), dragging after it the body of the organ, which also becomes inverted as it proceeds.

It is rare indeed that inversion does not go beyond this; for the considerable alteration in position and relations which has already taken place, gives rise to sensations of discomfort and pain, and these re-act on the nervous system, and induce contraction of the uterine and abdominal muscles. Powerful and hurried expulsive efforts ensue, and soon the organ

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is pushed beyond the vulva, where its own weight carries it downwards, and renders the prolapsus *complete*—the lining or mucous membrane having become external.

When inversion is complete, the uterus has the form of an enormous pear or calabash-shaped tumour, hanging between the posterior limbs: the wider and rounded portion being inferior, and sometimes extending as low as the hocks, the narrow extremity or pedicle being at the vulva, in the interior of which, and between the labia and the tumour, is a more or less deep and circular *cul-de-sac*, according as the prolapsus has involved a certain extent of the vagina.

That the surface of the tumour is composed of the uterine mucous membrane, is easily apparent from its softness and colour—which is sometimes a bright red, at other times somewhat violet or brown, according as it is much injected with venous blood, or irritated by the external air, or the litter, fæces, etc., with which it may have come in contact, and which may be adhering to it. With the Mare and Sow, we can recognise the uterine placental villi, and the innumerable depressions for the reception of those of the fœtal placenta; in the Cow, Sheep, and Goat, we have the deep-red isolated fungiform eminences or cotyledons, and in the Bitch and Cat, the wide dark-brown zone. Sometimes we notice with the Cow,—more rarely with the Mare,—portions of chorion still attached to the placental surface of the uterus; and nearly always are seen excoriations, more or less extensive ecchymoses, and even gangrenous patches, on the membrane—indications of the injury the organ has sustained, either during or after parturition. This mucous surface is not so sensitive as might be imagined; it is more or less hot, and bleeds at the slightest touch, though the hæmorrhage may not be profuse; at one side or the other may be noticed a kind of depression —the opening to the cornu which is not yet inverted.

The longer the period which has elapsed since inversion occurred, so the larger is the tumour. This increase is due to the violent expulsive efforts of the animal, as well as to the increase in weight of the organ in consequence of the congestion and infiltration which has taken place in its textures: constricted—even strangulated—at its upper part, the circulation is maintained with great difficulty, and the capillaries become gorged with blood. The walls of the organ lose their elasticity, become thickened and dense, and darker tinted, until, from its increased volume and altered aspect, it can scarcely be recognised; while its reposition is rendered extremely difficult, if not impossible.

In consequence of the excessive hyperæmia, ulceration and gangrene usually supervene; these are serious lesions, and may induce a fatal termination.

Such a grave accident as this, in which we have such extensive displacement, with severe straining at the suspensory ligaments of the uterus, and sometimes their rupture; the irritation and perhaps abrasions or wounds of the mucous membrane; the tension on the vagina, and the compression of various parts or organs—all this might be expected to produce general disturbance. And this is the case. From the very commencement, and even before anything is apparent at the vulva, the animal is uneasy and anxious-looking; it paws with the fore, or stamps with the hind-feet; switches the tail as if driving off insects; lies down and gets up frequently, finding no ease in either attitude; and strains more or less energetically at closer or wider intervals, thus adding to the extruded mass. Not unfrequently the Mare kicks at the prolapsed uterus, or endeavours to attack it with its teeth.

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At first there is no perceptible fever, and the animal, in the intervals of straining, attentive to what is going on around it, is solicitous about its progeny, and may even eat. This state is not of long duration, however; for soon after inversion is complete, indications of fever manifest themselves: quickened pulse and respiration, elevated temperature, and an expression of anxiety and pain. The straining is more frequent and energetic, and soon exhausts the animal; and the prostration, together with the great weight of the pendant uterus, compels it to assume and maintain the recumbent posture, in spite of attempts to make it get up. The organ assumes a gangrenous or intensely inflamed appearance, and the animal soon succumbs, either from the nervous prostration resulting from its sufferings, or from the condition of the uterus.

In woman, sudden inversion of the uterus always leads immediately, according to Schroeder, to great general disturbance—the heart's action is deranged, and syncope, convulsions, vomiting, etc., may sometimes be caused by the sudden change in the position of the uterus. More frequently those symptoms depend upon acute cerebral anæmia, to which the sudden emptying of the uterus of its contents already predisposes, but which must be still greater when not only the contents of the uterus, but the whole organ itself, passes out of the abdominal cavity. The blood then rushes into the vessels of this cavity, which are suddenly under a greatly diminished pressure, and the cerebral anæmia that ensues is due to the scanty supply which the upper half of the trunk now receives.

A similar condition is sometimes—though rarely—observed in animals, and particularly in the Mare. A good instance is that furnished by Peuch at page 569 (case 5).

Complications.

One of the ordinary complications of this accident, is the adherence of the fœtal placenta to the uterine surface; though this is much more frequent with animals which have a multiple placenta—Cow, Sheep, and Goat—than with the Mare, Ass, Sow, Carnivorous animals, or the Rabbit.

The inversion of the uterus—when complete—also brings about displacement of the vagina, as Hurtrel d'Arboval has remarked; the deeper portion of this part is found folded on the neighbouring surface of the cervix; the bladder and inferior wall of the rectum are drawn into the middle of the pelvic canal, and occupy the place the uterus has quitted; the *meatus urinarius* is doubled on itself, and so compressed that no urine can flow through it; while the ureters continuing to carry that fluid to the bladder, this reservoir soon becomes filled and greatly distended, without relief being possible. Hence results another source of suffering, and another cause of exhausting efforts which are added to those occasioned by the prolapsed uterus. In certain cases there may also exist prolapsus of the rectum, and displacement, or even inversion, of the bladder.

The uterus may also be wounded or torn, either from bad management during parturition, or from injudicious attempts at reposition; or the injury may be due to rats, cats, dogs, or pigs gnawing at the bleeding mass; sometimes it is the creature itself, or a neighbouring animal which inflicts the damage.

The contact of the air, and particularly of foreign bodies, induces inflammation, which frequently runs on gangrene, and this to dissolution. Gangrene is readily induced in the Sheep. Sometimes perforation of the vagina or uterus, arising at times from sloughing of a gangrenous patch, has caused fatal peritonitis; at other times pelvic abscesses have formed.

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After reduction has been effected, metritis and metro-peritonitis may appear; this is not at all unlikely in the Mare. Lafosse mentions paraplegia also as a complication; this may be a consequence of gangrene and septic infection.

An exceptional complication is hernia of the intestines, through a rupture in the uterus. It may be noted that in prolapsus uteri in the Mare, it has happened that the colon has followed the fundus of the organ, and become invaginated in the inverted sac. Funk also mentions the case of a Bitch in which one of the cornua became inverted, and prevented the expulsion of the remaining fœtuses from the other cornu; thus necessitating the performance of the Cæsarean section.

Ayrault has, on three occasions, encountered an unusual complication after reduction of the prolapsed organ, in the form of severe lameness, with knuckling over of the two hind-fetlock joints, but without any articular swelling. This complication disappeared as the animals recovered from inversion.

Prognosis.

There can scarcely be any doubt that, if no assistance is rendered to an animal suffering from prolapsus uteri, death must ensue, and more or less speedily; as gangrene is inevitable, while spontaneous reduction is impossible.

In some instances death occurs in less than twenty-four hours, but most frequently the aninal may live from three to five days—very rarely longer. Sabini (*Journal des Vétér. du Midi*, 1869, p. 175), an Italian veterinarian, cites a case in which treatment was not adopted until the seventh day; but this is an altogether exceptional instance.

Inversion of the uterus is generally fatal when owners of animals have neglected to procure assistance until too late, or who employ ignorant people to attempt reduction. If attended to sufficiently early by those who are competent, the number of recoveries is considerable, and, as Saint-Cyr truly observes, perhaps in no other pathological condition is the utility and power of art, when invoked at the proper time, better demonstrated.

The prognosis is not equally favourable, however, in all the domesticated animals; and between the Mare and Cow, for instance, the difference is considerable.

With regard to the latter animal, Deneubourg, who has often had to treat this accident, has never lost one of his patients. In one hundred cases, Donnarieix has only had three deaths. Moens, in twenty-seven cases, has not had a fatal termination. Guillaume, cited by Gellé, lost three cases out of forty-two; Loyer of Nemours, nine out of twenty-seven; and Mazure, Holland, one in four.

With regard to the Mare, Donnarieix had eight cases, and all perished; Cruzel had three, and they also succumbed; Schaack only saved one of two.

In 249 cases of prolapsus uteri in the Cow, collected by Saint-Cyr, there were 30 deaths—or a mortality of 12 per cent. For the Mare he only found 19 cases, and of these 14 were fatal—a mortality of 74 per cent.

A number of authorities quoted by Zundel give the per centage of recoveries in the Cow as 97, and in the Mare as 50.

It would, therefore, appear, and it is no doubt true, that this accident is much more fatal in the Mare than the Cow.

Inversion in the Sow is nearly always fatal, unless amputation of the uterus is resorted to; but this animal and the Bitch will live, in very rare cases, for two, three, or four days with the uterus prolapsed.

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It has often been stated that inversion of the uterus leads to infecundity; but though it may do so in some instances, yet it cannot be accepted as a rule. Numerous cases are on record, and particularly for the Cow and Bitch, in which fecundation has taken place after this accident.

Though inversion is likely to recur after another pregnancy, or even during a succeeding gestation, yet even in this case it is not invariably so; though to avert it care may be necessary.

Causes.

Inversion of the uterus is generally consecutive to parturition, and is most frequent in the Cow, whose uterine ligaments are so extensive and extensible. It usually occurs within two or three days after parturition, rarely later.

With multiparous animals, in which each uterine cornu forms a kind of independent uterus, it can be understood that one of these may alone be inverted, the fœtus contained in the other cornu being retained there for some time—though not without danger to its existence should this period be much prolonged.

With uniparous animals, however, this cannot take place, it appears; as the uterus cannot become inverted without the fœtus being expelled. Nevertheless, Aubry (*Recueil de Méd. Vétérinaire*, 1859, p. 731) has published a very curious observation, in which it is mentioned that a Cow, affected with prolapse of the vagina during pregnancy, had complete inversion of the left cornu at the end of that period; but the calf, which was lodged in the right cornu, and which was alive and well developed, was retained there for two entire days. It was then necessary to interfere and effect delivery, which was followed by total inversion of the organ. This incident, which appears to be unique, does not, however, prevent us from accepting the rule as general, that inversion of the uterus is absolutely incompatible with the prolongation of gestation.

In order that this inversion can take place, it is essential that the os uteri is more or less dilated; consequently, the accident is only observed in breeding animals, and either during or soon after parturition or abortion.

In order that it can occur, a certain degree of relaxation of the sub-lumbar uterine ligaments must be present; there must also be some cause of irritation in operation after the expulsion of the fœtus, sufficient to excite the contraction of the muscles of the uterus and lead to inversion—though it is often difficult to ascertain what this cause may be.

In very many instances gestation has gone on to its full term, the animal is strong and healthy, birth natural and easy, and there is nothing to indicate the advent of such an accident—when, suddenly, after a few expulsive efforts, the uterus is ejected in an inverted state.

It has been attempted to explain the occurrence of the accident in such cases, by alluding to the lymphatic temperament of the animals, and their consequent laxity of tissue; and it is often the case that Cows which are "soft," and kept on food that is better suited for the production of milk than flesh, are the most frequent subjects of inversion: this sometimes occurring after each birth, and though parturition was perfectly normal.

Inversion or retropulsion of the vagina during pregnancy, has also been accused as the cause of inversion of the uterus; and it may be so in some instances, but it certainly is not so in all. Indeed, excellent authorities maintain that there is no proof that this accident is more frequent in animals suffering from inversion of the vagina than those which are not. And it must

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be remembered, as already stated, that the os must be more or less dilated and dilatable for inversion of the uterus to occur—a condition which does not always, nor yet frequently, co-exist with vaginal inversion. The latter, indeed, is far from rare in non-pregnant animals, and in those which have never been pregnant; and it is not at all uncommon in those which are advanced in pregnancy, and yet do not suffer afterwards from this uterine displacement.

Difficult and laborious parturition, when much manipulation and energetic traction on the fœtus have been employed, has likewise been acknowledged as a cause of uterine inversion; and it is certain that the efforts to remove a fœtus which—whether from malposition, deviation of parts, excess of volume, etc.—cannot be expelled in a natural manner, are somewhat frequently followed by this accident. But on the other hand, how often do we find that the most vigorous—even painful and violent—traction, and long and complicated manœuvres—are not succeeded by inversion; while, on the contrary, the easiest and most rapid birth sometimes is.

The retention of the fœtal placenta beyond the ordinary period, must also be taken into account as one of the exciting causes; as it then acts as a foreign body, irritates the interior of the uterus, and so by a reflex action induces contraction of its muscular layer—this giving rise to invagination of the extremity of one of the cornua, which is supposed to be the commencement of inversion.

It is also extremely probable that injudicious traction on the fœtal membranes may, for mechanical and physiological reasons, bring about this result in a flaccid and dilated uterus, when the cervix is also relaxed. More especially is this likely to happen if the placenta is adherent towards the fundus of the organ, or in one of the cornua.

Much mystery appears to have attached to this inversion of the uterus, and though various causes have been assigned as operating in its production, yet as these were not present in every case, it has been admitted that a particular predisposition must have existed.

We are much inclined to believe that several causes may be invoked to account for the accident. A flaccid, non-contracted uterus after birth, with a weak cervix and dilated os, and relaxed broad ligaments, we would certainly look upon as a predisposing condition; and this is most likely to be present in lymphatic animals, or those suffering from atony, brought about by debility through disease, or bad or insufficient food, exposure to weather, etc. When this condition is present, it is easy to understand why inversion may occur from abdominal pressure at the cornua or fundus of the organ, or external mechanical force; and we can also comprehend why an antiperistaltic movement of one of the cornua, or a portion of it—just as happens in intussusception of the intestines—may take place sometimes, and lead to this condition immediately after birth, and before the cervix has had time to contract. Any trifling irritation may lead to this wrong movement, and once commenced it is far more likely to continue than to cease—as in the case of the intestines, when one portion becomes invaginated within another.

We believe this will be found to be the correct opinion.

Treatment.

Whatever may be the cause of inversion of the uterus, the obstetrist must lose no time in remedying the accident; as when interference is not prompt, a fatal termination, or, at the very least, most serious consequences rapidly ensue.

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In treating the inversion, several important indications are to be observed, but they may be classed as: (1) the *immediate* or *preliminary measures* which the local symptoms demand, (2) the *reduction* or *reposition of the uterus*, (3) the *retention of the organ*, (4) the *after treatment;* or should reposition be impossible or contra-indicated, then recourse must be had to (5) *excision* or *amputation of the uterus.*

Preliminary Measures.

The preliminary measures consist in combating the local and general symptoms.

The animal is sometimes standing, sometimes lying down. If the latter, it must be got up by some means or other; as the standing attitude is by far the best for reducing the inversion, there being more space in the abdomen when its walls are not compressed by the ground, and the obstetrist can operate more easily and quickly, while the downward inclination of the lower surface of the pelvis and abdomen is favourable for reduction and retention. If the animal is not very feverish, but only debilitated, and there is otherwise no great urgency in the case, a strong diffusible stimulant may be administered, with the view to enabling it to get up. It may also be induced to rise by bringing a dog before it; or it may be aided by a sack or sheet passed under its chest.

If it cannot be made to get up, or is unable to stand when raised, then of course reposition must be effected while it is lying—fatiguing, and often troublesome, as the operation then is. This fatigue and difficulty may be somewhat diminished in raising the hind-quarters of the animal as much as possible, by means of bundles of straw placed under them,—all the litter being removed from beneath the abdomen, so as to relieve the viscera it contains from pressure as much as possible. Cosse, Tyvaert, Haubner, Andersen, and others advise placing the animal on its back, with the croup so raised; while Viborg, Fässler, Bettinger, Obermayer, Hering, Merkt, Adam, and several other obstetrists, recommend raising or suspending the animal by the hind-limbs, over a beam—a procedure which, they assert, is most advantageous when reposition is possible or advisable. But, as has just been said, the recumbent position, with the larger animals, is always to be avoided when possible, and every means should be tried to get them to stand. With the smaller animals—as the Sheep, Goat, Sow, Bitch, or Cat—it is convenient to place them on a bench or table, and lying either on the side or back, with the hind-quarters well raised.

If the accident is recent—an hour or two, or even a little longer—the uterus may be returned at once; but should a longer interval have elapsed, it is well to ascertain the condition of the rectum and bladder, and to empty them if necessary; though it must be confessed that it is often a most difficult task to accomplish evacuation of the bladder. It may be done, however, by causing assistants to raise the uterus, and to seek for the meatus urinarius on its lower surface, near the vulva, introducing one or two fingers into that canal, or a catheter through it into the bladder.

Should the fœtal membranes still be adherent to the uterine surface—wholly or partially—then they must be carefully removed without injuring the cotyledons, enucleation being effected in the manner already described. If properly performed, this removal should not cause any hæmorrhage; and if any pulpy gangrenous cotyledons are found, it is better to remove them at once with scissors than leave them to be eliminated in the ordinary way; though if they show any vitality at all they need not be interfered with.

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Torn or gangrenous portions of mucous membrane are also to be excised in the same manner.

This done, the uterus should be cleansed from matters adhering to its surface—such as litter, mud, dirt, filth or blood; and this may be effected by means of a fine soft sponge or cloth, the fluid employed being either cold or tepid water, milk and water, some astringent or soothing lotion, if there is much tumefaction or irritation, or a stimulating fluid—as the dilute tincture of opium—if the organ is much bruised and congested. Some practitioners immerse the entire uterus in a bucket containing either of these fluids; and some particularly prefer cold water, allowing the organ to remain in it for as long as five or ten minutes. By this means it is freed from extraneous matters and cleansed; while the congestion is allayed and the mass considerably reduced in size.* Meyer, Pfirter, and others state that this immersion in cold water has an astonishing effect, and greatly facilitates reposition. Schnee even recommends the application of ice, which, he asserts, not only diminishes the volume of the protruded organ, but allays its irritability and contractions. When attempting to reduce the cornu or uterus, he holds a piece of ice in the hand he applies to the part.

If from long inversion and consequent congestion, infiltration, or inflammation, the volume of the uterus is so increased that it appears impossible to return it, scarifications may be made on its surface; these often lead to a notable decrease in its size, and reduction may then be effected. If it is determined to scarify the organ, the greatest circumspection should be observed in making the incisions; they must be quite superficial, and only a few at a time. Should the hæmorrhage prove excessive—which it sometimes does, when the scarifications are deep and numerous—then styptics must be applied.

If the uterus is torn, it may be necessary to close the wound by the continuous suture—but this must not be drawn too tight; mere apposition of the edges being all that is necessary. If the wound is not extensive, it need not be closed; indeed, there are many cases on record in which wounds of the uterus have not been sutured—the organ having been merely returned to the abdominal cavity, and yet recovery has taken place.

If hernia of the intestine or any other viscus is present, then, of course, this must be reduced before the uterus.

Reduction or Reposition.

When inversion of the uterus is incomplete—a very rare occurrence—and the organ has not passed beyond the vagina, reduction is comparatively easy. It is sufficient, with the larger animals, to introduce the closed fist into the vagina, and to push the uterus as far into the abdomen as may be deemed necessary. When the animal strains, the operator must not push, but maintaining what he has accomplished as well as he can, recommence as soon as the expulsive effort has ceased. Whether inversion is complete or incomplete, and if the animal is standing or lying, it is always well to have the hind-parts higher than the fore.

When it is complete, then four assistants are necessary. One of these

* A little care on the part of owners of animals, would often prove of great advantage in averting serious consequences in such an accident as inversion of the uterus, before the arrival of the veterinary surgeon. This care should be mainly directed to keeping the animal in a standing attitude; and preventing the uterus from being soiled, bruised or torn, as well as swollen. The organ may readily and easily be preserved from injury by receiving it on a sheet or large cloth, or, better still, a basket or tray, and holding it well raised until professional assistance arrives.

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stands at the animal's head, and holds it firmly—if a Cow he may seize it by a horn with one hand and nasal septum by the other; if it is a Mare, a twitch on the nose or ear may be required, and it may even be necessary to have a side-line on one of the hind-limbs. Another assistant holds the tail over the croup with one hand, and with the other he presses or pinches the loins in order to diminish the straining; while a man stands at each side of the croup to aid in raising and returning the uterus. It is well to attract the animal's attention as much as possible, as it then offers less opposition to the manipulations, and does not strain so violently. Pinching the nose and loins will be found very effective in this respect, and if a Cow, a dog may be introduced in front of it. Should the animal be much exhausted or unsteady, two additional assistants may be required to stand at each side.

The uterus must be placed on a cloth or sheet in two or three folds and well moistened, the ends being held by the two assistants at the croup, so that the organ may be lifted as high as the vulva. By doing so, there is neither traction nor compression on the mass, and as the circulation in it is thereby much facilitated, the tumefaction subsides to a corresponding degree. It also allows the operator more freedom, as he could not sustain the weight of the prolapsed organ—sometimes as much as 100 to 140 pounds—and at the same time attempt its reposition.

Indeed, some practitioners recommend that the two corners of each end of the cloth on which the uterus is placed, should be tied round the neck of the assistants, so that their hands may also be free to aid the operator in his manœuvres: though this device must, one would imagine, have more disadvantages than conveniences.

When the animal strains very severely and almost continuously—as sometimes happens during reposition—it is useful to constrain the chest as much as possible by a girth, so as to prevent its expansion. It may even be necessary to give a strong anodyne draught of chloral or opium.

For effecting reposition, three methods are recommended, and these we will now notice: merely observing that whichever may be adopted, the operator always stands directly behind the animal, with the inverted organ immediately before him.

First Method.—If the inverted tumour formed by the uterus, external to the vulva, is not very voluminous, and if by the application of cold water to it —should it be tumefied—it is reduced in size, then reposition may be effected by pressure on the fundus of the organ. This pressure is to be made by the closed fist against the central part of the tumour; and in some instances, if it is well directed, and the inversion not serious, the organ may be returned to the pelvic cavity by one push, while another will carry it into the abdomen.

Rainard and other practitioners approve of this method, and describe it somewhat in detail. The operator is to seek for the largest cornu—that which contained the fœtus—seize it by the fundus, and reduce this by pushing it inwards, as we would the finger of a glove which has been turned outside in: continuing the reduction by successive portions until the pedicle of the tumour is reached, when more serious resistance is encountered from the os uteri. This being overcome, the body of the uterus is next replaced, either by the fist pressing against the widest part, or by using a pessary. The pressure is to be directed straight forward, through the vulva and pelvic canal, upwards and inwards.

Great care is necessary in exerting the pressure, which should not be applied while the animal is straining. During expulsive efforts, the operator must be content to wait, merely keeping the parts where he has carried them,

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until the straining has ceased. The pressure must be steady and well-directed, so as not to bruise or lacerate the uterus. When a portion is got within the vulva, it is held there by one hand, while the other manipulates the next part to be returned. Reduction must be effected progressively, so that the organ may be completely replaced; if it is not, then re-inversion is certain to occur.

Some practitioners employ the pad or cup-shaped pessary, to aid them in this operation; the round end is applied to the fundus of the uterus, and the pressure is made at the other end of the instrument by the chest or abdomen of the operator, whose hands are thus at liberty to direct the viscus into the vulva and vagina.

Second Method.—If the uterine tumour is voluminous, and hangs—a heavy mass—as low as the hocks, then the first method is dangerous, if not impracticable, and must not be attempted. The best method now undoubtedly is to return, first, *the parts of the organ nearest the vulva*, and not act directly on the fundus of the uterus until the greater portion has been replaced in the pelvis.

In order to accomplish this, the assistants on each side of the croup raise the uterus in the manner already described, so as to bring it near the vulva, and opposite the axis of the pelvis. Then the operator gently presses with open hands on each side on the parts close to the vulvar opening, in order to force them gradually into it. By acting in this way with care and patience, and preventing, as well as he can, the expulsion of those portions he has already reduced, the tumour by degrees becomes diminished, and may even be entirely returned. But it is not necessary to continue the method after two-thirds or three-fourths of the total mass has been conveyed into the pelvic cavity; for it is then more expeditious, and quite as safe, to apply the closed fist to the extremity of the tumour, and push it directly into the vagina and abdomen. In some instances it will be found that, towards the termination of reduction, the organ itself returns to its normal position, and often quite suddenly, as if it had been thrown back by a spring.

Sometimes a combination of the first and second methods is most useful: an assistant pressing on the extremity of the tumour, while the operator manipulates near the vulva.

Third Method.—This method was first brought to notice by Coculet (*Journal des Vet. du Midi*, 1862), who, finding the previous methods long and laborious, set himself the task of improving it.

This he has succeeded in doing by an ingenious procedure, which is described as follows. A dry and clean piece of linen, about a yard in length, and twenty-eight to thirty inches wide, is passed beneath the inverted uterus, and close up to the vulva; its lower border is then lifted over the organ, one of the ends folded over it, and then the other end over this, so as to envelop the entire uterus—the four corners of the wrapper being uppermost. Tepid water is now kept incessantly applied to this cloth, which is gradually tightened every minute, by placing the open hand beneath the mass, and with the other hand pulling at the upper end of the wrapper.

This equable, gentle, and sustained pressure over the entire organ, soon (fifteen to twenty minutes) brings about a marked diminution in its size, and renders its reduction easier.

The method has been most successfully employed on several occasions; though some practitioners prefer immersing the protruded uterus in cold water at once, as being a quicker plan for reducing it, while also effecting the necessary cleansing process.

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Certainly cold water might frequently be substituted for tepid, and compression might commence at the lower extremity of the organ, particularly if the bandage is elastic, on the Esmarch principle; this would greatly expedite the operation, and would prevent injury to the uterus.

Jensen (Hering's *Repertorium*, 1874, p. 183) describes a similar method to that of Coculet.

When the uterus has been returned to the abdominal cavity, the operator has then to ascertain if it is properly disposed. It sometimes happens that the extremity of one or other of the cornua remains invaginated in itself to a certain extent, and thus renders reduction incomplete; this will undoubtedly induce renewed straining, and in all probability bring about re-inversion. It is, therefore, essential that the hand of the operator should carefully examine every part of the interior of the uterus and the genital canal, and particularly around the cervix.

This is more especially necessary when, after reposition has been effected, straining continues—a sure indication that the parts are not in their normal position. The hand must then be again introduced, and if any abnormal folds of the mucous membrane—any commencing invagination—is encountered, this must be gently smoothed down, or adjusted, and replaced—not forgetting, should the cornua be involved, the very dissimilar disposition of these in the Mare and Cow.

When reposition has been finally accomplished, the straining ceases, and the animal soon appears to be quite easy: that is, if reduction is made early—on the same day, for instance—and provided there is no injury to the organ. It is generally advisable to keep the hand in the uterus for a short time until the latter begins to contract freely; if this is not done, the flaccid organ may again become inverted.

With the smaller animals, reposition is rendered difficult, because of the small pelvis not admitting the hand; and with some, and particularly the Sow, reduction of the prolapsed cornu or cornua is often a serious matter. The cornua must be reduced in the manner already indicated, the finger, or even a tallow candle, being employed to replace them, then the body of the organ should follow; a small pessary with a handle, or retroverter, may be used to complete the operation. Frick, a Swiss veterinarian (*Schweizer Archiv.* vol. xii. p. 249) has adopted a plan which has succeeded in his hands, and also with other obstetrists who have tried it. The inverted organ being reduced, the animal is raised by the hind limbs, and a quantity of mucilaginous fluid is injected into the vagina and uterus, until they are filled. This fluid acts in a mechanical manner, forcing the uterus to distend and assume its ordinary form.

In some cases, when reduction is attempted, the animal continues to strain so violently that it is almost impossible to operate, notwithstanding the adoption of the measures already recommended.

In these cases *bleeding* has been advised and practised, but not always with success; if the animal is not strong, it may do positive harm. Opium is not always a soothing remedy for ruminants, and if given in narcotic doses may lead to mischief. Ether has been employed to produce incomplete anæsthesia in the Mare, so as to diminish the expulsive efforts, and with success. Andelfinger, Rueff, and Baumeister, as well as Saint-Cyr, recommend this partial anæsthesia.

Van Dommelen, a Dutch veterinary surgeon, gives the preference to a very strong dose of alcohol, so as to produce semi-narcosis. He has employed it

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in a great number of instances of inversion of the uterus in which there was violent straining, and has never observed any accident.

Chloral hydrate, either in draught or enema, should be found an excellent agent in such cases, as well as the subcutaneous injection of acetate of morphia. The injection of dilute tincture of opium into the uterus may also be found beneficial.

It must not be forgotten that a tight surcingle round the chest or abdomen, or both, and raising of the hind parts of the animal as high as possible, will greatly assist in diminishing the straining.

Contention or Retention of the Uterus.

Reduction of the inverted uterus having been accomplished, and everything done to remove the slightest traces of invagination, the animal—unless serious injury has been inflicted on the organ—immediately begins to look easier and happier, and the inexperienced would suppose that there was no further occasion for interference. The experienced obstetrist, however, is well aware that certain precautions must be adopted against a possible recurrence of the accident. True, this recurrence is to a certain extent provided for by raising the croup of the animal as high as may be convenient, either by means of litter or boards, and keeping the forehand low. But this is not always a preventive, and veterinary obstetrists have therefore devised other means for retaining the uterus in its place until all risk of another inversion has passed away. These devices consist of *pessaries*, *sutures*, and *bandages*.

Pessaries.—These are instruments of various forms, which are introduced into the genital organs, and kept there for a certain time, in order to prevent displacement of the uterus after its reduction. There are several described and used by veterinary obstetrists.

The *pad pessary* (Fig. 196) is a round piece of wood, from twenty to twenty-five inches in length, with a hole at one end, through which passes a loop of

Fig. 196.

PAD PESSARY.

strong cord six to eight inches long; and at the other end a round pad, three or four inches in diameter, composed of tow or rags, covered by a piece of soft cloth, and firmly tied to the stalk by a piece of twine fixed in a small circular groove therein.

In using this pessary, the pad is steeped in oil or melted lard; it is then carefully introduced into the vagina, and placed against the cervix uteri, and cords from each side of the loop at the other end, attached to a surcingle round the chest, keep it firmly in its place. The pad portion of the pessary may be of wood, though the elastic material is to be preferred. A transverse piece of wood, with an eyelet at each end, and made to move up and down the handle by means of a screw, is sometimes substituted for the loop of cord.

This pessary may be most usefully employed as a repositor, in effecting reduction of the inverted uterus.

The *ring pessary* (Fig. 197) is equally simple, and is preferred by some

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practitioners to the pad one. It is composed of a wooden, or better, an iron ring, about two-and-a-half inches in diameter, pierced by an elongated or mortised hole at opposite sides, and of a strong wooden stem about twenty inches long, cleft in two as far as the middle, where it is tied by a piece of twine or wire. The ends of the two branches (A A) are firmly tennoned in the mortises of the ring; and the other end of the stalk (B) is flat, and passes

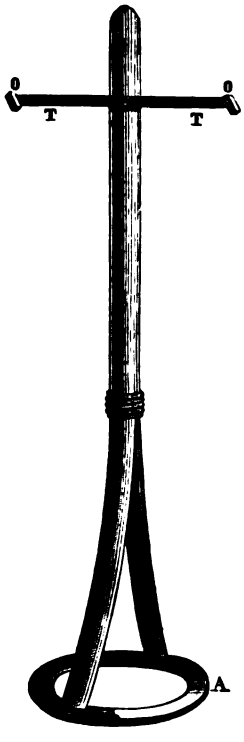

Fig. 197.

RING PESSARY.

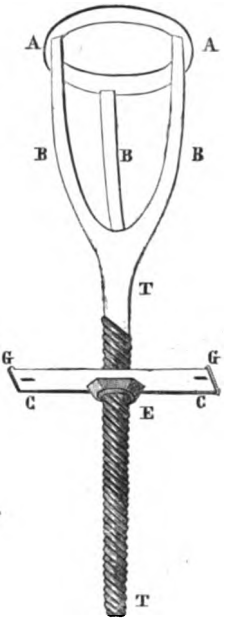

Fig. 198.

CUP-AND-BALL PESSARY.

through the central opening of a transverse piece (T T), which is about eight inches long, and has at each end an aperture (O O), in which are fastened the cords or straps destined to fix the apparatus.

When required for use, the ring is wrapped in a narrow piece of fine linen, which is rolled round it in a uniform manner, so that it may not irritate the neck of the uterus, with which it has to come in contact. This part is well oiled, and being passed through the vagina, is so placed against the uterus that the cervix will be in the middle of the ring, which should make pressure on the *cul de sac* of the vagina. It is secured by means of cords or straps at the end of the transverse portion, in a similar manner to the other pessary.

The *Cup-and-ball pessary* (Fig. 198), invented, or first described by Chabert, is not at all unlike the last. It is composed of a round iron or steel ring (A A), about the same in diameter as the other; from this springs three

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stalks (B B B) which unite about six or seven inches from the ring into a single stalk (T T), which is screwed from a little beyond this union to the end. On this screwed portion moves a transverse piece (C C), by its middle opening, or female screw (E); this piece has openings (G G) at its extremities, which receive straps or cords.

To use it, the ring and the three branches are dipped in melted wax, then cooled, and again and again dipped and cooled, until the instrument has acquired a sufficient volume, and the middle of the ring is reduced to about one and a half inch. This prevents its injuring the genital organs, when it is applied exactly in the same manner as the preceding pessary—the cervix uteri being in the centre of the ring.

A *rondelle pessary* has been devised by Leblanc, and Rainard has invented a pessary (similar to Fig. 197) for small animals.

A *bottle pessary* has frequently done good service, when nothing more suitable has been at hand. An ordinary glass bottle, with a deep concave and smooth bottom, has a long piece of wood fixed in the neck, and can thus be made to act like the other pessaries; though its weight is objectionable, and there is also the danger of its breaking.

A very ancient pessary—employed even by the Greeks of an early period—and one which has been most usefully resorted to by Tolney, Laubender, Willburg, and others, is the *bladder of the pig* or *ox*. When required for use, the bladder is steeped in warm water, then a long wooden tube, or a piece of india-rubber tubing, is fastened to the neck of it; the bladder is introduced into the uterus and inflated, the tube being then closed.

Rainard recommends that it be only placed in the vagina; but the majority of obstetrists prefer it in the uterus. It has been allowed to remain there as long as ten and fourteen days.

For valuable animals, it has been suggested that Gariel's air pessary might be employed. This acts on the same principle as the bladder; in fact, it is an india-rubber bladder, which is inflated by means of a long tube with a stop-cock. This tube may be in connection with another bag and stop-cock, the former being already filled with air, which can be transferred to the other bag when it is placed in the vagina or uterus.

The smaller animals rarely require pessaries of this description; though there is no reason why, if necessary, modifications of the three first, and on a proportionately small scale, might not be employed. The ring might be made of india-rubber, or cork. For the Bitch, more particularly, the *cuvette pessary*, however, has been recommended and used. This is an imitation of that employed for woman, and is merely an oval, circular, or oblong piece, made of gum, india-rubber, gutta-percha, or ivory, one to two inches in diameter, and having a hole in the middle. When required to be introduced, this pessary is well oiled; the narrow end is passed edgeways into the vulva, and the piece is pushed in beyond the bulb of the vagina. Then, by means of the index finger, it is placed vertically: the hole in the middle allowing the finger to fix it in the centre of the vulva, its two ends being retained by the branches of the ilium, or at least in front of the ischium and the bulb.

A spring, or elastic pessary, such as is now frequently employed for woman, and which can be more easily introduced into the vagina, might be useful with the smaller domesticated animals.

Salt, of Birmingham, has introduced into human gynæcology a new flexible annular pessary, which might be advantageously employed by the veterinarian for the smaller animals. It consists of a watch-spring coiled spirally, with the extremities left free, and encased in caoutchouc; it collapses for

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introduction, and when *in situ*, it expands to the circular form, or such other shape as may best accommodate its contact with surrounding parts.

The value of pessaries in inversion of the uterus in animals has been a good deal discussed. We are not aware that they have been much, if at all, employed in this country; and in Germany they do not appear to have obtained much favour; while in France, though they have often been resorted to, yet their use has been only limited, as their practical utility has been questioned by many excellent obstetrists.

It has been pointed out that if they can be supported without inconvenience by some phlegmatic unimpressionable animals, more frequently they irritate the organs in the pelvis, cause straining and uneasiness, and produce those relapses which their application was intended to prevent. Therefore it is that, nowadays, they are not made available to anything like the extent of a few years ago.

Saint-Cyr admits that if, in some exceptional case, it is necessary to employ a pessary, the *pig's bladder* deserves the preference for the larger animals. It is found nearly everywhere, requires no other preparation than merely softening its texture by pouring some tepid water into it, whilst its outer surface is well oiled. It is easily placed where desired, even in the uterus; its soft, flexible walls cannot bruise or excoriate; and, by inflation, it can be distended to the size necessary for each particular case.

Sutures.—The suture is generally preferred to the pessary, as being simpler, more easily applied, and having fewer inconveniences than the latter. Being inserted outside the genital organs, they do not irritate those which are most concerned in inversion, neither do they provoke expulsive efforts on the part of the animal.

The sutures may be of hemp or silk, or metal; and they may be passed directly through the lips of the vulva, or include the skin towards the point of the hip, on each side. The first may be named the *labial suture*, the second, the *hip suture*.

The *labial suture* may be "interrupted," or "quilled," and is made according to the principles of surgery. A saddler's large needle, or a sacking-needle with a handle at one end and an eye near the point, is the most useful. Through the eye is passed a piece of whipcord, two or three strands of well-waxed thread, or a piece of cotton or silk tape, or moderately thick carbolised catgut. The needle is passed through one lip of the vulva—say the right—from the outside, and near the *upper* commissure; it is then passed through the left lip, from within to without, towards the inferior commissure.

The needle is then cut from the suture, sufficient of the latter being left for both ends to tie in the middle of the vulva. A second suture is then placed in the contrary direction—upper part of left to lower part of right lip—so that the two sutures cross each other obliquely, in an X fashion. The ends are now tied towards the centre of the vagina; and, if thought necessary, a third suture, directly transverse, may be placed between these.

It is more convenient and painless to pass the needle first through the tissues, then the suture through the eye of the needle, withdrawing the latter, which carries the suture with it.

This *labial* suture is painful, as it is placed in textures already swollen and sore, and it does not always retain a sufficiently solid hold to prevent the uterus tearing it out when the straining is very severe and violent. The *hip suture* has therefore often been resorted to in these cases, and with advantage. The needle—either the above, or a small seton needle—is passed through a fold

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of skin lifted up at the point of the hip or ischium, on a level with the upper commissure of the vulva, and carried across to the other hip. The next suture is a trifle lower, and the others below this: there being, in all, about four to six sutures, the ends of each being tied in the middle, or fastened to bits of round wood at each side. In this way, the vulva lies behind a number of strong cords—their strength and durability being in proportion to the width of skin they are made to enclose. The sutures may be drawn more or less tightly, and they may either be transversely parallel, or cross each other obliquely.

When the animal is not pregnant, the vulva is not nearly on a level with the ischial tuberosities. After parturition, however, the vulva is swollen and prominent, and stands beyond these parts. It will therefore press against the hip sutures, and may even become excoriated or cut by them; so that, to avoid injury, and diffuse the pressure, it is well to place a thick pledget of tow, or other soft material, on each side of the vulva, on which the sutures may chiefly rest.

Though good service has been obtained from these sutures, in a number of instances, yet many practitioners prefer the *metallic* suture. This may be of lead, or iron wire softened. The needle is like that used for the other sutures; a pair of wire-pliers is necessary, and two sizes of wire are recommended. The thickest size is cut into pieces of a convenient length, and an eyelet

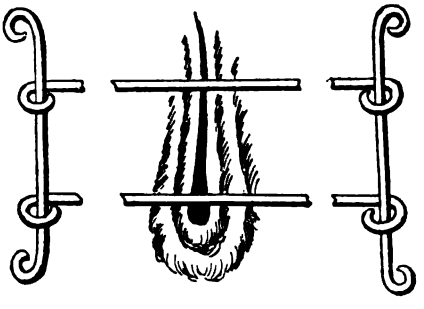

Fig. 199.

ZUNDEL'S LABIAL SUTURES.

turned at one end, while the other is made into a hook. The left lip of the vulva is seized by the left hand, and the needle pushed through it from the outside, a little obliquely upwards, so as to bring it out above the superior commissure; the wire is passed into the eye at the point, and the needle being smartly withdrawn, the wire is pulled through. The needle is introduced into the right lip in the same manner, but downwards, and the wire pulled through it. The hooked end is now passed into the one with the eyelet, drawn sufficiently through, cut off, and the end bent also into an eyelet, the suture constituting an ellipse at this part, which is opposite the vulvar opening. Beneath this suture, one or two more are placed, and all are joined together by the thinner wire, which, doubled, is longer than the space occupied by the sutures; each piece is passed into each eyelet of the upper suture, and firmly crossed and twisted as far as the two points of the suture; the same is done with the second and the third suture—the whole being joined into a solid piece, which, according to report, does not interfere with the physiological functions of the animal.

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The same objection applies to wire sutures through the vulva, as to vegetable sutures; and there can be no doubt that they are less painful and more effective when passed through the skin at the point of the hip. Two wires across are generally sufficient; the ends are bent round by pliers after they are inserted, and through these eyelets on each side a vertical wire is passed (Fig. 199). This keeps the horizontal wires together, and in place.

Other metallic sutures, in the form of pins, screwed at one end to fix into plates after being passed through the labia of the vulva, and other contrivances of this description, have been described; but in principle they are all the same, and there is no manifest advantage in their employment.

In fact, it may be said of all the labial or other sutures, that they in no respect prevent the inversion of the organ internally, but merely prevent its escaping beyond the vulva; and, as their integrity depends not only upon the material of which they are composed, but also upon the integrity, or

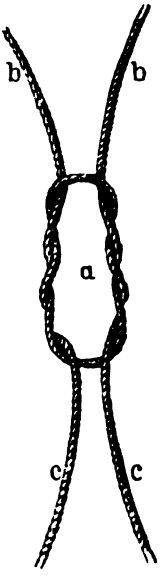

Fig. 200.
THE LOOP OF DELWART'S TRUSS.

power of resistance of the textures through which they pass, it often happens that they either give way themselves, or they "tear out" prematurely, leaving oftentimes troublesome wounds or cicatrices.

It must not be forgotten, too, that even under the most favourable circumstances, these sutures, both during their insertion and their maintenance, are a source of uneasiness and pain to the animal.

Bandages, or *Trusses*.—To dispense with the inconveniences of the pessary and suture, the *bandage* or *truss* has been proposed, and extensively employed; and we must confess that, in the great majority of cases of uterine inversion, it should be adopted in preference to the other methods of retention.

The truss or bandage may be composed of cords, surcingles, leather, canvas, etc., which are so arranged and disposed as to make pressure upon the sides of the vulva, and, by keeping it closed, prevent the extrusion of the uterus, without interfering with defecation or micturition.

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There are several kinds of truss in use, and these vary somewhat in their details, though in principle they are the same. Some of them are fixed around the shoulders and neck, others round the chest only, and others again round both regions—most frequently to a collar, or surcingle. We will allude to those which are recognised as most useful.

Two of the most useful and readily-made trusses are composed of light rope or thick cord—something like a clothes-line. One of these is termed "Delwart's Truss," and is formed by cords united by a loop in their middle, in such a manner that an oval space (*a*, Fig. 200) sufficient to admit the vulva, and compress it laterally, is formed—the inferior commissure being left free, to allow the escape of urine, and uterine discharges, should there be any. The two portions of one of the cords (*b b*, Fig. 200) passing over the back,

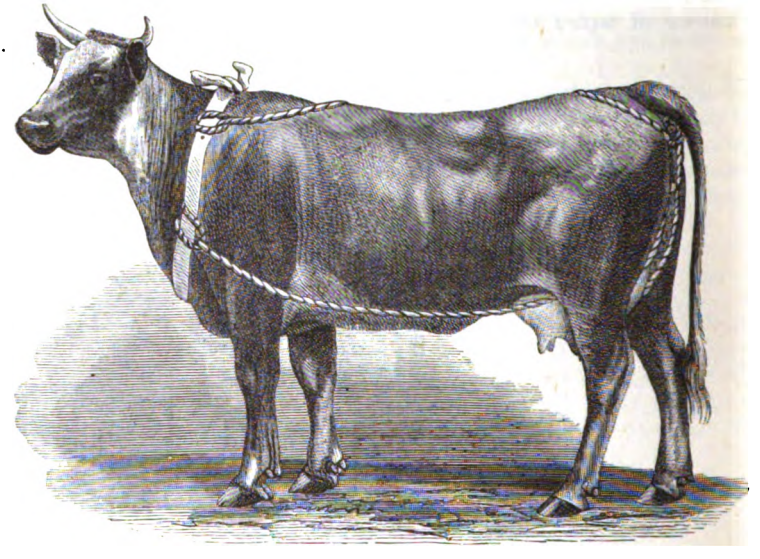

Fig. 201.

DELWART'S TRUSS APPLIED.

are secured to a collar or band round the neck or chest; while those of the other cord (*c c*) pass between the thighs, and are tied to the lower part of the collar or surcingle, in the manner depicted in Fig. 201. The loop may be wrapped in tow or cloth, to prevent chafing to the parts under the tail.

Another rope truss, described by Renault in the *Maison Rustique du XIX Siècle* (vol. ii. p. 286), is perhaps more simple, and yet quite as, if not more, effective as the preceding. This is composed of a leather strap which buckles round the neck, and a rope from twenty-four to thirty feet long, and the thickness of the little finger, or a trifle less, according to the size of the animal. The neck-strap is not indispensable, though it is useful in giving more firmness to the truss; it may be replaced by a thicker rope, or in the case of the Mare, by an ordinary draught collar.

In order to apply the bandage, the neck-strap or collar is first to be put on; the cord is then to be doubled in equal parts, and put across the back, behind the withers, so that each portion may fall behind the shoulders, to be

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passed under the chest. In front of the chest, the two portions are crossed, the left passing to the right, and the right to the left. Each side is carried through the collar, and back, over the front of the shoulder, at the top of which both are tied in a simple knot, so as to be easily untied when required. At ten or twelve inches from this, a firmer knot is tied, then several others beyond it towards the loins—according to the length of the animal—and at nearly equal distances, as far as the root of the tail, where a simple knot is tied. The branches of the cord then separate on each side of the vulva, and

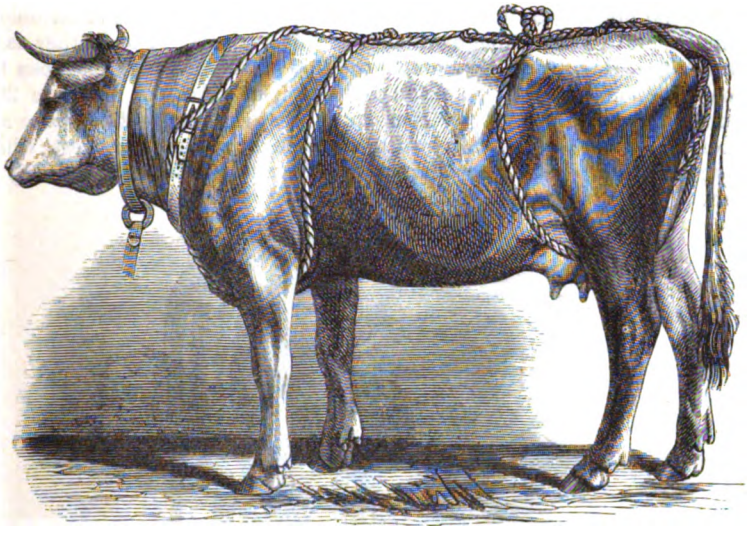

Fig. 202.

RENAULT'S TRUSS.

unite again by a simple knot below the inferior commissure; again separating, each cord is carried between the hind legs, brought up by the flank towards the loins on each side, and tied over the back to one of the loops there, as shown in figure 202. This truss can be made as easy or tight as may be necessary, and its simplicity is its great recommendation.

Horsburgh (*Veterinarian*, vol. xiv. p. 490) describes a similar truss, which he applied to a Mare that had inverted the uterus three days after foaling. Giving the animal some extract of hyoscymus and gum opii, dissolved in a pint of warm water, to allay the straining, as soon as this dose began to operate he reduced the organ. This was done by securing the animal, sponging over the uterus with a little vinegar and water, and "taking hold of a clean towel in the left hand, doubled, and the corners of the towel falling back on the arm—made bare for the purpose. I then applied the doubled fist to the fundus of the uterus, with the assistance of the right hand in bearing it up by a moderate degree of force, and returned it to its place, slowly withdrawing the hand, and leaving the towel for a few minutes. I next proceeded to remove the towel, by introducing the hand, greased for the purpose, into the vagina, taking it by the corners, turning it several times round, and at the same time bringing it out slowly. After which, I introduced the arm to the full length, in order to ascertain whether it was in its proper position, using a little force on the further end, in order to stretch it. I then withdrew the arm, and proceeded to apply the necessary bandages. First, a strong girth, or surcingle was buckled tightly round the abdomen, to prevent the muscles acting with such force as again to expel the uterus. This is

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essentially necessary. I then took a small rope, or narrow web (the one used on this occasion was a cavesson for breaking horses in the *mènage*), forming an eye (loop) in the middle, to be passed over the neck, as if for casting. I then passed the ends between the fore-legs and along the belly—one on each side of the udder, up between the hind-legs—tying a single knot exactly at the inferior part of the vulva. Another was placed superior to the anus, carrying the ends up on each side the tail, fixing them securely and tightly to the loop round the neck, and on each side of the withers." This truss was a perfect success, and could be dispensed with in three days. Horsburgh condemns sutures passed through the labia pudendi.

A very efficient and suitable truss is that made of a piece of stout leather, with a round opening in it above, corresponding to the anus, and an oblong opening beneath this, through which the vulva passes. The leather is so shaped as to embrace and lie close to the root of the tail and between the buttocks, extending for some distance below the vulva, as in figure 203. It is maintained in position by four strong leather straps—two above and two below—which pass on each side to a surcingle around the chest, which may again be attached to a collar or breast-strap, should the straining be violent.

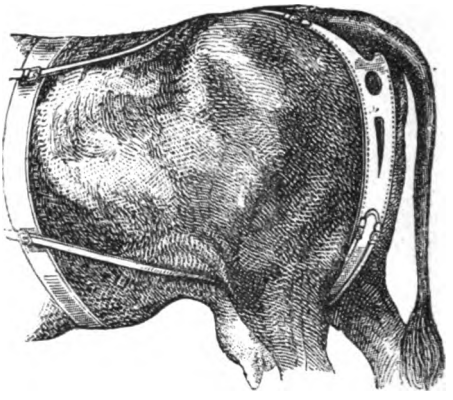

Fig. 203.

LEATHER TRUSS.

Another kind of truss is formed by an ordinary crupper attached to a surcingle, and, if need be, this to a breast-strap or collar. From the part of the crupper under the tail proceeds two, three, or four narrow leather straps, which passing over the vulva, are attached to the loop of a doubled rope in the perinæum, each portion of the rope being passed between the hind-legs and tied to the lower part of the surcingle. Or a cord may be attached to the crupper at each side of the vulva, and carried forward between the hind-legs and underneath the belly in the same manner, two or three transverse narrow straps passing between the two, immediately over the vulvar opening.

When there is much swelling, a soft cloth doubled several times, or a sponge steeped in cold water, may be placed over the vulva beneath the straps, though in such a way as not to interfere with micturition or defecation.

Various other trusses for the Mare or Cow have been proposed by veterinary obstetrists, but in principle they are all the same. We need only notice one of these, which has been proposed by Lund, a

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Danish veterinary surgeon, and which has been greatly lauded by Dieterichs and others for its cheapness, simplicity, and efficiency. The chief part of it is a narrow piece of iron, nine millimetres thick (about one third to three eighths of an inch), welded at its extremities, and turned into a triangular shape that enables it to include the vulva, while the loops at its three corners allow it to receive cords (fig. 204). The base of the triangle, which fits under the tail, is about two to two and a half inches wide, and the sides from five to seven inches long. The loopholes at the angles may be replaced by small hooks to receive the cords.

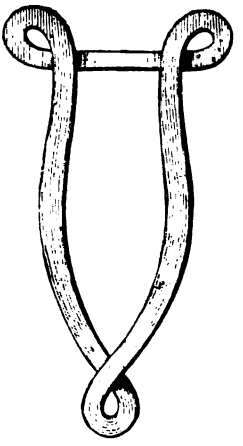

Fig. 204.
LUND'S TRUSS IRON.

This metal plate, which may be of round iron, and convex on one side, concave on the other, fits over the vulva and the base to the tail, the apex being below the lower commissure, while the convex side is towards the animal. Cords pass through the loops or around the hooks, one above, another below—as in figure 205—and are fastened to a surcingle or collar, or both, like the preceding trusses. Any blacksmith can make the plate in a few minutes; and from what has been said in praise of this cheap and simple method of retaining the uterus, there can be no doubt that it will be found most useful.

All these trusses are intended for the larger animals, and cannot well be applied to the smaller creatures, with the exception perhaps of Lund's plate, which, much diminished in size and made of a piece of strong iron wire, might be serviceable for the Ewe, Sow, Goat, or large Bitch. For these smaller animals Rainard recommends a triangular bandage, made by folding a piece of strong cloth in a triangular manner. The base of this triangle lies over the loins, is carried down by the flanks to beneath the abdomen, where the corners are tied together; while the point of the triangle is passed over the croup and vulva—a hole being made for the tail to pass through, and another for the anus, brought between the hind-legs, and either by means of tapes attached to it, or if sufficiently long, by splitting up the end to a short distance so as to make two strips of it, and fastening the piece to the ends already tied beneath the belly.

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It must be acknowledged that these trusses, no matter how skilfully they may be contrived or however well they may be adjusted, will not hinder vaginal inversion of the uterus; all they can do is to prevent the organ from being suddenly protruded beyond the vulva again, and so exposed to the air and the irritating effects of extraneous matters before it could be returned once more. This alone, however, is an important object achieved, and is a great step towards permanent retention. Besides, by maintaining the labia of the vulva in close apposition, the truss, if well applied, prevents the admission of air into the genital canal; and thus does away with one source of irritation. And as the apparatus does not cause any pain or inconvenience to the animal, it is for these reasons to be preferred to any other means for maintaining the reposition of the uterus.

With regard to the best kind of bandage, this is of secondary importance to its proper application. Simplicity and efficiency are the *desiderata*, and

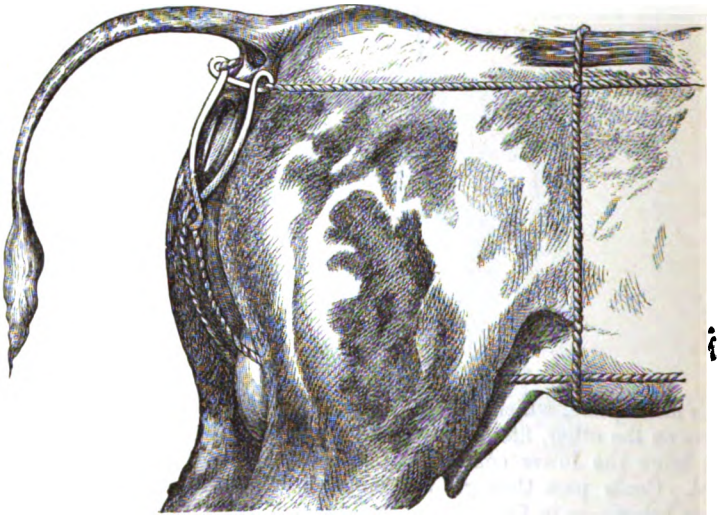

Fig. 205.
LUND'S TRUSS APPLIED.

these will be found, we believe, in the trusses we have described, and particularly in those of Renault and Lund.

If reposition of the uterus is properly effected, and the truss well applied, there is but little reason to apprehend a recurrence of the accident.

After Treatment.

When the uterus has been returned to its natural situation, an antiseptic injection or "swabbing" of the interior accomplished if deemed necessary, and precautions against a recurrence of the inversion adopted, little more remains to be done except to observe some simple directions, which are to be followed out for a few days after reposition.

If the weather is favourable, and little or no fever present, Saint-Cyr recommends that the animal—covered with a rug—should be walked about for a few minutes; as this takes away its attention from the accident, regu-

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lates the general circulation, and allays the expulsive efforts. If, however, there is fever, with the pulse quick, full, and hard, and the animal is strong, he advises the abstraction of blood.

In any case, the animal should stand with the hind parts well raised, and it ought not to be allowed to lie down for a day or so.

Great attention should be paid to the diet, particularly in ruminants, from the tendency to tympanitis and constipation. Indeed, tympanitis may be sometimes considered a cause of inversion in the Cow and Ewe; and the rumen is at times so distended with gases, and accordingly proves such an obstacle to reduction, that it has to be punctured in the usual way before reposition can be effected. For the same reason, this inflation of the digestive organs has to be guarded against in the after treatment. For the first day only oatmeal gruel, with barley-water—both tepid—should be allowed in small but frequent quantities. Subsequently for some days, easily-digested sloppy food may be given, and if the appetite is fickle it should be tempted by choice portions of diet; though the quantity must not be large at any time until all danger is past.

Should there be a tendency to constipation, soap-and-water enemas may be administered.

Micturition is rarely deranged; but if no urine is passed within twenty-four hours after reposition, an examination should be made, and the bladder emptied in the usual manner. The different disposition of the urethral valve in the Mare and Cow will, of course, be borne in mind in passing the catheter.

Nearly always these simple measures suffice to restore the animal to its usual condition in three or four days, in uncomplicated cases. In exceptional cases, however, we may have metritis or metroperitonitis, or leucorrhœa follow the accident. The animal may go off its milk and fall into low condition, without exhibiting any acute symptoms; or indications of puerperal fever may supervene. Sometimes the animal remains sterile for a variable period. With the Ewe, chronic inversion of the uterus often leads to loss of the wool.

In complicated cases we may have wounds, lacerations, rupture of the uterus, cornua, or vagina, lesions of neighbouring organs or textures, etc.; these we will refer to hereafter.

A curious complication of uterine inversion has been mentioned by Ayrault (*Recueil de Med. Vétérinaire*, 1857, p. 723), who has witnessed it in three cases. This consisted in great lameness in the limbs, without swelling of the joints, but with marked knuckling over in the hind-pasterns. This complication disappeared spontaneously as the patients recovered from the other effects of the inversion.

Amputation of the Uterus—Metrotomy.

Though it should be recognised as a rule, that, provided there is no serious complication and the obstetrist is called in good time, with patience and skill reposition of the inverted uterus is possible, yet cases will occur in which the operator is baffled in his attempts at reduction, or when, at the first glance or after an examination, he has to recognise this as impossible or useless. "Since I have been in practice," says Schaack, "I have been often called upon to remedy this kind of displacement, and from what I have seen I am led to believe that the impossibility of reduction is not so much due to the difficulties in the cases themselves, as to the hurtful manœuvres which have been performed. Nevertheless, it must be acknowledged that the develop-

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ment of the hernia and the rigidity of the tissues are sometimes so great that it requires a certain amount of confidence in one's self neither to be disconcerted nor afraid. . . . To be successful it is necessary to insist—to insist in spite of everything—on applying one's self to seize each alternative point of relaxation; to engage, bit by bit, the displaced organ in the vulva, in commencing with that which is nearest this opening, then successively all the remainder."

This advice is judicious and sound; but, as we have said, in certain cases the extruded organ is so injured, either by the unskilful attempts of ignorant men to return it, or from other causes, that it would be certain death to the animal to replace it in the abdomen. We refer now to extensive lacerations and bruises, or when the organ has become softened and gangrenous. Lacerations and ruptures are always more serious, it must be remembered, in the lower than the upper wall of the uterus.

In other cases, when reduction has not been complete, and one horn remains more or less invaginated, or the body of the organ is not well adjusted, inversion will again and again occur in spite of all attempts at retention; and this only too frequently leads to such grave injury, that there is no hope of the organ regaining its normal condition, even should reposition be at last successful. Indeed, its walls are so softened and friable that they cannot withstand the least pressure, but tear whenever an attempt is made to carry the uterus into the vulva.

With certain animals, too—as Swine—reposition is extremely difficult, particularly when one or both cornua are inverted; as the smallness of the organ, as well as of the pelvis, is a great obstacle to manipulation.

In such exceptional circumstances complete extirpation of the uterus (*Metrotomy*) has been recommended and practised.

It is now many years since the operation was introduced into veterinary surgery, as Binz states that it was performed by Jenne, a German veterinarian in Forchheim, so long ago as 1802.

Though the operation is apparently a most formidable and painful one, and only to be ventured upon as a last resource, yet, on the whole, it is tolerably successful. Of twenty-five cases collected by Saint-Cyr, no fewer than nineteen recovered from the operation. Franck refers to thirty cases, eighteen of which recovered, and four (two Cows and two Goats) were killed, though not, it would appear, on account of the operation. Of these thirty cases only one was a Mare; 17 were Cows; 3 Goats; 4 Sows; 1 Ewe; 2 Bitches; and 2 Cats. He remarks that of the unfortunate cases, there were probably some which died from other causes than the amputation; while some evidently perished from septic infection. We know that recoveries have taken place after the Cæsarean section and excision of the uterus in the same animal, at the same time.

The operation might be more successful did it not happen that it is late before it is resorted to, and very often the animal is already greatly exhausted.

It is curious to note that it has been recorded by several observers, that some Cows which recovered have shown signs of œstrum—doubtless because the ovaries were left intact; while other Cows have yielded milk after the operation. Lecoq informed Saint-Cyr that he knew of a Cow from which the uterus had been removed, and which gave an abundance of milk for two years afterwards.

Operation.—Various modes of operating have been practised and recommended. With the larger animals, the hind-limbs should be secured—

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especially with the Mare—or the animals may be thrown down, or fixed in a travis if there is one convenient.

Chloroform, chloral, or morphia may be administered to the animals about to be operated upon. It is also a good plan to tie the uterus up in a large cloth, so that it may be easier moved about by the operator or his assistants, and render the operation cleaner and less repulsive-looking.

The oldest, and perhaps most popular, method is the *ligature in mass.* A piece of strong whipcord, well waxed and made into a running loop, is passed over the tumour as near to the vulva as possible, but without including the meatus urinarius. When evenly placed around the pedicle, it is then gradually, but firmly, tightened by pulling at each end so as completely to intercept the circulation in the mass. This done, the cord is tied in a knot.

Though this method has been much employed, and with a fair amount of success, yet it has been condemned by some good authorities, on the plea that it is dangerous to tie such a voluminous mass; as all the parts cannot be sufficiently and equally compressed to become mortified at the same time. Those parts which have not been firmly bound still retain a certain amount of circulation, become inflamed, and occasion violent pain.

Rainard therefore recommends the *double ligature.* A long sacking or saddlers' large needle, is armed with a somewhat long double piece of whipcord. This is passed through the middle of the pedicle of the tumour, from below to above, and the needle cut away from the cord. The pedicle is thus perforated by two pieces of cord; one of these is very firmly tied round the right half of the pedicle, the other round the left, so as to include the whole in two separate ligatures.

Claverie (*Journal des Vét. du Midi*, 1860, p. 535) reports a serious hæmorrhage by this double ligature, after removal of the uterus, which necessitated the application of a ligature in mass above the others, as well as the application of the actual cautery to the cut surface. It is possible that the needle wounded some large vessel, which, of course, would not be included in either of the ligatures.

The uterus of the Cow has been successfully deprived of its circulation by means of *clams* about an inch thick and ten inches long.

They were applied close to the vulva, and the two ends fastened together by twine.

Saint-Cyr alludes to a successful case of amputation of the uterus in a woman, by means of *caustic clams*, or rather a clamp; the operator being M. Valette of Lyons; and he believes that the same procedure might be advantageously adopted by veterinary surgeons. He recommends the long curved clams used for hernia, and suggests that the groove be filled either with chloride of zinc, or with tallow powdered over with corrosive sublimate.

By whatever procedure the pedicle of the tumour is rigidly compressed, the uterus has afterwards to be excised. Some veterinarians are of opinion that it is better to wait until it is completely mortified, or even until it sloughs away spontaneously; and they allege, in justification of this opinion, the danger of hæmorrhage when dealing with such a large and vascular organ as the uterus is at parturition. Others, dreading the dangers resulting from the retention of such an enormous mass suspended behind the animal, counsel its immediate amputation. The incessant traction it exercises on the vagina, the obnoxious odour it gives off, the contact with the absorbing surface of the septic products resulting from its mortification, expose the

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animal, they declare, to serious accidents, which can only be averted by at once cutting away the uterus.

We quite agree with these authorities, and with Saint-Cyr, that these dangers are most serious; and as the risk of hæmorrhage may be obviated by sufficiently constricting the base or pedicle of the mass, it is certainly most advisable to amputate it at once, and at a short distance—from an inch to three inches—behind the constriction.

Trasbot (*Bulletin de la Soc. Centrale de Méd. Vétérinaire*, 1870) brings under notice the use of the *écraseur* in amputating the uterus. The case to which he refers was not successful; but it is probable that this result was due to the imperfect or improper manner in which the instrument was used.

With the *écraseur*, the tissues should be slowly and gently cut through. The entire pedicle may be included, or the chain may be passed through the middle of it by means of a needle, like the double ligature.

The *elastic ligature* (Dittel's) has been suggested as worth a trial, and if properly applied we think the result might be favourable. This consists in applying a long piece of india-rubber tubing around the pedicle, and tying it firmly there. The tissues are cut through by the continuous pressure, which causes obliteration of the vessels and cessation of nutrition.

It has also been suggested that Esmarch's method of amputation by *elastic compression* of the part to be excised, might be most successfully employed in ablation of the uterus in animals. Considering the volume of the uterine tumour and its great vascularity, there must be an immense advantage in sending back into the circulation of the animal the larger part, or even the whole, of the blood contained in the organ, before separating this from the body, and in addition performing a bloodless operation. Coculet's method of reducing the volume of the inverted uterus by compression, has been already alluded to, and is the same in principle. Esmarch's method essentially consists in winding around the part to be amputated—commencing at the distal extremity—an elastic band, so as to press the blood from this part into the body; and above the band to tie firmly a piece of india-rubber tubing, so as to prevent a reflux of blood by the arteries. The elastic band is now removed and the part—pale and bloodless—is excised.

When the uterus has been cut away, the portion of vagina or carvix remaining should be returned as far as possible into the genital canal, and if there is any hæmorrhage, injections of cold water will probably check it. Cicatrisation generally occurs within fourteen days. If ablation of the uterus is not effected immediately after constriction of the pedicle, but is allowed to take place spontaneously, mortification and sloughing are completed in from six to ten days.

In some cases, the animal does not appear to be much disturbed after the operation, in others it is very uneasy. Ledru describes an instance (*Rec. de Méd. Vétérinaire*, 1866, p. 115) in which the Cow operated upon was for an hour as if mad. It lay down, got up, rolled about, kicked and stamped, and climbed into the manger. Its eyes appeared to be starting from their orbits; it flexed its hind limbs like a horse attacked with paraplegia, and it was impossible to get near it. These symptoms appear to have been caused by the intense pain; though they gradually subsided and the animal ultimately recovered.

In many instances no unusual symptoms have been observed, and the mother has anxiously occupied itself with its progeny. This has been noticed with the Sow.

After the operation the cows appear to have fatted well; and when killed,

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in those which were examined large masses of fat have been found in the place of the uterus, and filling the pelvis.

It may be remarked that in one case recorded—in the Cow—a portion of intestine had become prolapsed with the uterus, the interior of the sack of which it occupied; another similar occurrence was noticed in a Bitch. Franck insists on this complication being always looked for in the Mare, and he recommends that this animal be always either narcotised by morphia or chloroform, so as to get rid of the violent straining to which it yields itself.

An exploratory incision may then be made in the body of the uterus, and if any intestine is found in its interior, this must be returned to the abdomen before amputation is ventured upon.

From among the many recorded cases, we select the following as examples:

1. Barker in 1841 (*Veterinarian*, vol. xiv. p. 444), gives one of the earliest instances of this operation in England. The patient was a Sow, which, after producing nine young ones, had the uterus inverted. No attempt was made to replace it, and a ligature being tied tightly round its pedicle, the organ was cut away, leaving a small portion of it protruding. No hæmorrhage followed. It soon after took some gruel and then ordinary food, suckled its young, and was recovering rapidly when it was attacked by aphthous fever. It ultimately did well, and became very fat.

2. Gregory (*Ibid.*, vol. xvii. p. 422) amputated the uterus of a Sow, the organ being so torn after complete inversion, and the animal being so prostrate, that no other course was open. A ligature was applied to the "uterine vessels," and the uterus excised. An opiate dose was administered, and laxative medicine, and recovery soon took place.

3. Gardner (*Ibid.*, p. 485) amputated the inverted uterus of a Ewe, as the organ was always extruded when returned. "I commenced as high as I could, tying the uterine arteries as I came to them, and stitched the cut edges together in order to prevent an effusion of the intestines. No more care was taken with her than usual, and in ten days' time she was caught for me to look at her, when I found that adhesion had taken place, and she was as well as ever."

4. This veterinarian (*loc. cit.*) had to operate in the same manner on a Cow, whose inverted uterus had been injured by rough handling, and the labia of the vulva torn by sutures. The animal recovered and fattened well.

5. Cleveland (*Ibid.*, vol. xx. p. 378) attended a Sow which had farrowed four days previously. The entire uterus was inverted and the mucous membrane lacerated. "A ligature was applied as far forward within the vagina as convenient, including the ovaries; and then, with a sharp knife, the whole of the protruded uterus was removed. The animal sickened for a few days; then her appetite returned." Recovery was complete.

6. Dickens (*Ibid.*, xxviii. p. 130) records the case of a fine Sow which brought forth a litter of twelve, and inversion of the uterus soon ensued. The organ had been twice returned, and the labia sutured, but without avail, and it was rapidly becoming gangrenous. Two strong ligatures were placed round the cervix uteri, and then the organ was excised. The creature was kept warm and carefully nursed. It soon partook of some milk and peas, and the mammary secretion gradually returned, so that the young family were all suckled. Afterwards the Sow arrived at great "bacon weight."

7. Leech (*Ibid.*, vol. xxxix. p. 790) attended a pointer Bitch which had pupped several days previously, and the uterus had become inverted. It had been returned several times before he was called in, and the organ was so swollen that he could not replace it. "Upon careful examination, and after passing the catheter, I found that the bladder was included in the mass; therefore I made an incision in the body of the uterus, and found that therein was also a knuckle of intestine as well as the bladder. I returned the bladder and intestine into the cavity of the abdomen, and raised the hind parts of the Bitch, so as to keep them there whilst the operation was performed. This was done in the following manner: A needle armed with a strong ligature was passed through the neck of the uterus, behind the meatus urinarius, including one-fourth of its substance, which being tightly tied, the needle was again passed through another fourth and tied in the same manner; then again through another fourth in the same way, leaving one-fourth up to this time free. The whole of the neck of the uterus was then included in one strong ligature, *which closed the aperture into the*

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abdomen." The parts behind the ligatures were then removed by the scalpel, and the remainder returned into the vagina. The hæmorrhage was very trifling; the parts were sponged with cold water; a dose of opium was administered, and a good dry bed allowed. Next morning more opium was given, and the animal partook freely of bread and milk. No untoward symptoms intervened, and in about a fortnight the Bitch had quite recovered. This case demonstrates the necessity for a careful examination of the tumour before excision is ventured upon, as the inverted uterus contained both bladder and intestine, and if these had been included death was certain in a brief period.

8. Brown (*Ibid.*, vol. xl. p. 845) partially amputated the uterus of a setter Bitch. The organ had a tumour upon it, and a ligature was passed round it near this tumour, and the latter, with the distal portion of the uterus, cut away. There was considerable hæmorrhage, and the uterus was returned with some difficulty. The ligature came away on the third day, and recovery was rapid. Before the operation the Bitch was in a very sorry condition; after recovery there was a wonderful improvement. The case was complicated by a fracture of the ilium.

9. Barnes (*Ibid.*, vol. xliv. p. 656) amputated the uterus of a Ewe which had lambed, and the inversion had occurred four hours before his arrival. The organ was so much torn and swollen, that it was impossible to effect its return. A ligature was firmly tied round the cervix, and the mass removed by a sharp bistoury, the arteries being ligatured as a further precaution against hæmorrhage; the vulva was likewise sutured, to prevent a protrusion of the remaining parts. When the operation was finished the Ewe was in a sinking condition; but stimulants were given, and, with attention, in a week it was convalescent.

10. Olver (*Ibid.*, vol. xlv. p. 98) removed the uterus of a Bitch by a ligature placed close to the vulva, and excising the body of the organ by the knife. There was little bleeding, and the remaining portion of the organ was returned. A stimulant was given, and good food, and recovery was rapid.

11. Broad (*Ibid.*, xlviii. p. 175) removed the inverted uterus of a Bitch by means of clams and the hot iron. "Bitches appear to suffer very little from the operation. . . In all cases where it is possible to use the clams and hot iron I do so, as I find that ligatures cause the animals much suffering; besides which, there is a greater danger of blood-poisoning from absorption of the morbid products during the sloughing process. In all cases of cauterizing it is better to use the iron at a black heat.

12. Goffi (*Il Medico Veterinario*, 1876) had to attend a Cow—primipara—for inversion of the uterus. The organ had been greatly contused and lacerated through the attempts of the owner and his friends to return it, and reposition was hopeless. After assuring himself that the extruded sac did not contain any viscera, he tied a strong ligature round it, near the vulva, then amputated it about two inches beyond the ligature. There was a slight hæmorrhage, and when this was subdued the remaining portion was put back into the pelvis. Soon after, the Cow was very restless, and strained severely. It was bled and sedatives were given. On the fourth day there was acute traumatic fever, and inappetence; small doses of carbolic acid were administered, and improvement took place; but on the eighth day superficial œdema manifested itself. This was combated by oil of turpentine *intus* and *extra*. Gradually recovery took place, and about the thirteenth day there was so little amiss that the Cow was turned out to pasture. It never went off its milk, though the calf died on the fourth day.

13. Lorretta (*Ibid.*, 1876) returned the inverted uterus of a Cow, and everything appeared to be well until the fourth day, when the accident again occurred. During the owner's journey to request the attendance of Lorretta, a large Saint Bernard dog in the cow-shed devoured a large portion of the protruded uterus. On the arrival of the owner and veterinary surgeon, the Cow was lying on the floor inundated with blood, and apparently about to die. A knuckle of intestine protruded through a rent in the uterus. Nothing could be done but to amputate the organ. This was ligatured close to the vulva—after the intestine had been returned—by a well waxed and soaped cord, which was passed round it several times, being tied each time. Then by means of a convex bistoury, he cut through the mass about two inches below the ligature, applied an astringent lotion to the ligatured end, and replaced it in the pelvic cavity. From the fourth day the Cow appeared to be quite well, seeking food and ruminating, and on the twelfth day it was cured.

14. Ledru (*Recueil de Méd. Vétérinaire*, 1866, p. 115) returned the inverted uterus of a Cow, and applied a truss. The owner removed the latter too soon, and inversion again occurred; but this time reposition was impossible. Amputation being decided upon, a whipcord ligature was applied round the pedicle of the tumour, about two and a half inches from the vulva; there was some hæmorrhage when the uterus was cut

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away four or five minutes afterwards. For an hour the Cow was very uneasy, but next morning it was tranquil, and in a few days gave its usual quantity of milk and quite recovered.

15. Claverie (*Journal des Vét. du Midi*, 1860, p. 535) reduced the inverted uterus of a three-year-old Cow with great difficulty, and attempted to retain it by sutures in the vulva and a truss. All appeared to be going on favourably until the fourth day, when the organ was again prolapsed, tearing away the sutures and the truss. Excision of the uterus was considered the only means of saving the animal, and this was performed by double ligature—the needle being passed through the middle of the pedicle; the body of the organ being amputated, the remainder was returned to the vagina. Much bleeding ensued, and the part had to be withdrawn, another circular ligature applied, and the hot iron used to close the bleeding vessels. Cooling lotions and charcoal were afterwards employed; for ten days the animal was dull, and the secretion of milk and appetite were diminished; soon after this, however, it improved rapidly and completely recovered.

16. Turquet (*Recueil de Méd. Vétérinaire*, 1868, p. 20) relates a case of inversion in which, from the great infiltration and gangrenous condition of the uterus, reduction was impracticable; so it was decided to amputate. The operation was performed by passing a cord about two yards in length, and with a piece of wood at each end, around the uterus about two inches from the vulva—the Cow being held by two strong men; while other two assistants pulled at the ends of the cord, so as to tighten it gradually around the tumour. Turquet kept his finger on the knot, so as to judge of the amount of constriction, and finding after a minute or two that it was sufficient to stop the circulation, the cord was firmly tied.

There was scarcely any bleeding when the uterus was removed about two inches from the ligature, and the latter disappeared within the vagina. The animal was extremely uneasy, threw itself down, groaned and bellowed, and otherwise exhibited indications of pain for about ten minutes. Next morning it was ruminating; the ligature came away in due course, the Cow suckled its calf and gave the usual quantity of milk, and in five months afterwards was fatted.

17. Schüller (*Œsterreich. Vierteljahress. für Wissenschaftliche Veterinärkunde*, 1858, p. 17) appears to be one of the few veterinarians who has attempted amputation of the uterus in the Mare. He was called to attend a seven-year-old Mare, which eight days previously had given birth to a dead foal, and soon after suddenly inverted the uterus. For eight days (!) was the swollen, gangrenous organ protruded, and when he saw it, the mucous membrane was greatly infiltrated and sodden, and covered by a yellowish exudation. The animal stood with its hind-legs wide apart, and looked dull and heavy; the pulse was 65 per minute, the respirations 25 to 30. It still fed, except during the paroxysms of straining. No attempt was of course made to replace the uterus, and with the owner's consent amputation was resolved on. A twitch was placed on the Mare's nose, and a man placed at the head, while two others stood on each side to keep the animal steady and to assist in the operation when necessary. The upper part of the uterus, near to the vagina, was then freed from the discharge and exudation by means of the finger and tepid water, and the mucous membrane exposed. A strong, well-waxed ligature was tied round the pedicle, about two inches from the vulva, and the uterus excised by a sharp bistoury about half an inch from this part. The hæmorrhage was unimportant, and the remains of the uterus disappeared in the vagina. A few sutures were passed through the vulva, and a pledget of tow put over it and retained by a bandage. Internal treatment was also resorted to. Next day the pulse was 73, and the respirations increased; micturition and defecation were normal. The vulva was greatly swollen, injected and hot. The straining was feeble, and only occurred at long intervals. On the succeeding two days the Mare was livelier, the appetite was better, and the straining had almost disappeared. The vulvar sutures had given way, and the bandage was removed. A small quantity of unhealthy, dirty-brown coloured fluid escaped from the vulva. This was corrected by injections, and in three days the discharge was healthy. In fourteen days after the operation the Mare was discharged cured.

18. Moens (*Annales de Méd. Vétérinaire de Bruxelles*, 1866, p. 591) was less fortunate with a Mare, six years old, which had the uterus inverted and hanging as low as its hocks. The organ had a large rent in it, and a jet of arterial blood flowed in such quantity that it was evident death must soon take place from hæmorrhage. A ligature was therefore at once applied around the cervix, and with the aid of several persons ablation was effected. The Mare died two days afterwards.

19. The same authority (*Ibid.*) practised the operation on a Cow soon after this unfortunate case, and with the greatest success. In all, he had operated on eighteen Cows, without a fatal case; and he is of opinion that total ablation of the uterus in

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this animal is incontestably more benignant than reposition. He remarks on the ease with which it can be executed, and that it requires no special dexterity: all that is needed is a strong ligature applied as close as possible to the vulva, and firmly tied round the part; the organ being cut off about two fingers' breadth from the ligature. A little straining often occurs afterwards, but rarely anything more serious.

20. De Ceuster (*Ibid.*, p. 588), in attempting to reduce the inverted uterus of a Cow, ruptured the organ almost unconsciously—its texture was so soft and friable. Amputation was decided upon. The opening was enlarged to discover if the sac contained intestines. A strong suture (*forte suture*) was placed at the base of the organ, close to the vulva, and in half-an-hour, when the uterus had become cold, it was amputated about two inches from the vulva, and the ligatured end returned. The following day there were a few expulsive efforts, and for twelve days a foul-smelling fluid was discharged from the vulva. Tar-water was injected. The animal fed well immediately after the operation, and gave an abundance of milk.

De Ceuster is of opinion that the obstetrist should not hesitate in resorting to amputation of the inverted uterus when he cannot return it, or when it is so damaged that, if returned, the animal's life may be endangered.

Van-Hacken (*Ibid.*, 1863, p. 259), Sulmon, and De Meester (*Ibid.*, 1877, p. 158) record successful cases of ablation of the uterus in the Cow.

CHAPTER IV.

Inversion of the Vagina—Inversio Vaginæ.

Inversion, procidence, prolapsus, or *fall of the vagina,* is a hernia of this part through the vulvar opening, analogous to that of the uterus, and with which it may be complicated when inversion of the latter is extreme; though in this case it does not add to the symptomatology or gravity of the accident.

The accident may occur in other than pregnant or parturient animals, though rarely; it may also take place during gestation, particularly towards the termination of that condition, when the gravid uterus pushes it outwards. Most frequently, however, it is witnessed after parturition, and particularly when delivery has been difficult and protracted, and especially when force has been necessary to extract the fœtus, and the expulsive efforts were severe.

It often occurs when the "waters" have escaped for some time, and the young creature, lodged in the genital canal, is extracted without the precaution of lubrication. Its progress through the dry, tenacious passage causes the mucous membrane of the vagina to gather in ridges and folds; the connective tissue beneath is torn, and this leads to inversion, which may occur immediately, along with the exit of the fœtus, or when the animal afterwards strains—sometimes so long as four, six, or eight days subsequent to parturition.

Fatigue, such as that induced by travelling, or severe exertion, immediately or soon after calving, or keeping the animal in a stall, the floor of which slopes too much backwards, are also likely to produce the accident. It may also take place after abortion, and retention of the placenta.

When inversion of the vagina occurs without that of the uterus, the latter is propelled backwards by the contractions of the abdominal muscles, pushing before it the walls of that canal until it has extruded them beyond the vulva, and itself occupies the cavity of the pelvis. During this extrusion, the connective tissue which attaches the vaginal mucous membrane to the pelvis is more or less lacerated; and it is this laceration which, as Saint-Cyr justly remarks, constitutes the serious character of the accident, and differentiates it from simple prolapse due to relaxation of the connective tissue, which is of no great moment, but which may precede it. The latter condition is

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not very rare towards the end of pregnancy, and under certain circumstances it may lead to complete inversion. Rainard mentions having seen a Goat which had inversion of the vagina fifteen days before parturition, and to such an extent that the mouth and nostrils of the fœtus protruded through the half-open os uteri, so that it could breathe and lick the hand.

But, as has been said, inversion of the vagina occurs far more frequently after abortion and parturition, though not so often as inversion of the uterus.

Symptoms.

Of course, the chief symptom of this accident is the presence of a tumour between the labia of the vulva, and which may hang for some distance below that opening. In this respect it resembles inversion of the uterus, though the difference is otherwise very marked. In the majority of cases the tumour is most voluminous when the animal is lying, and can then be best examined. It is circular in form, varies in size from that of an apple to a large melon, and is not unlike a thick sausage; the surface is *smooth*, more or less of a deep red colour streaked with darker patches, and covered by a thick white mucus, or a fibrinous exudate; in other cases it is inflamed, excoriated by the tail or litter, and covered with foreign matters. *There are no traces of cotyledons or placental follicles.* On the under surface of the tumour is observed a longitudinal depression, or furrow, which leads to the urethra. At its end is a round opening, into which the finger can be passed as far as the os uteri, which will be found either completely closed or partially open. At the vulva the tumour is narrow, and exhibits longitudinal folds or ridges, due to the constriction caused by the vulva. Passing the finger between the tumour and the vulva, there is found a depression, or *cul-de-sac*, formed by its direct continuity with the vulvar mucous membrane. In certain cases, the cervix uteri can be seen in the middle of the tumour. Not unfrequently the tumour is not visible when the animal is standing; though it may show itself when it lies down, micturates, defecates, or strains. When, however, the inversion has occurred to a considerable extent, or the case is chronic, the tumour often remains external to the vulva.

There is generally more or less difficulty in micturating, arising from the pressure on the urethra; and instances are recorded in which extreme distention of the bladder, from retention of urine, had occasioned serious symptoms, and led to paralysis, and even rupture, of that viscus. There may also be more or less straining—indeed, this symptom is nearly always present; febrile symptoms may likewise be noted in some cases.

When the mucous membrane has been long exposed to the air, it becomes thickened and indurated, from the constant irritation giving rise to effusion and exudation; it assumes a greyish tint, and is covered with a coriaceous epithelium, which gives it a leathery appearance.

The local symptoms which we have indicated should sufficiently distinguish between this accident and the presence of tumours in the genital canal. In the Bitch, inversion of the vagina has been sometimes mistaken for a condylomatous tumour; and cases are recorded in which tumours of this kind, protruding beyond the vulva, through insufficient examination have been mistaken for inversion. Inversion of the bladder has also been confounded with that of the vagina. The pyriform kysts which sometimes form in that canal, and contain a clear citron-coloured fluid, have likewise been sometimes confounded with inversion of the vagina.

To avoid errors which might have a serious tendency, a careful examina-

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tion must be made, and nothing should be attempted in the way of operation until the state of affairs is exactly determined.

Prognosis.

Inversion of the vagina is not nearly so serious an accident as inversion of the uterus; and Cows, Mares, and Bitches may often suffer from this condition for months without showing much apparent inconvenience. This is the kind of inversion that is liable to recur; reposition may be readily effected, but no sooner is it accomplished than inversion again takes place through the animal straining.

In other instances, however, the accident is much more serious. The mucous membrane of the vagina, exposed to contact with the urine, fæces, and litter, in addition to friction from the tail and other objects, as well as the attacks of flies, etc., becomes irritated, excoriated, abraded, and indurated, while it is greatly thickened from exudation; a more or less fœtid muco-purulent secretion covers its surface; cicatrisation of the torn sub-mucous connective tissue ensues; new adhesions are formed which fix the part in its abnormal situation, and offer what is sometimes an insurmountable obstacle, if not to reduction, at least to retention, after that has been effected. If assistance is not afforded, the animal gradually loses condition and becomes emaciated; hectic fever sets in, and it falls into a state of marasmus. At other times the extruded part becomes acutely inflamed, intense fever supervenes, and the creature succumbs to the effects of vaginitis—either simple or complicated with metritis—and almost as rapidly as from inversion of the uterus.

Treatment.

The more speedily treatment is resorted to after inversion has occurred, the more easily is reduction effected and likely to prove permanent, while the risks from injury are greatly diminished.

The treatment is somewhat similar to that recommended for inversion of the uterus, the preliminary steps being the same in both accidents, and reduction accomplished according to the same rules. The part of the vaginal membrane nearest the vulva is to be carefully and gradually returned should the tumour be large; if comparatively small, then it may be reduced *en masse*, by applying the closed fist to the centre of the most dependent part, and pushing it into the canal. When reduction has been effected, it is particularly necessary to observe that every part has assumed its normal shape and position; as it often happens that the mucous membrane, particularly towards the bottom of the canal, forms a thick fold, which must be effaced if it is desired to obviate renewed straining and a recurrence of the inversion. All the folds and inequalities from one end of the canal to the other, as far as the cervix, should be smoothed carefully down by the hand or a soft damp cloth. If, after reduction, the straining continues, it may be inferred that the mucous membrane is irritated by the existence of wrinkles or folds on its surface. The hand must then be introduced again into the vagina, and the ridges effaced either by passing the hand over them so as to carry the membrane onwards, or by gentle pressure entirely obliterating them.

If the membrane is irritable and inflamed, astringents—such as acetate of lead, and anodynes—such as opium, may be applied to it; and as a matter of precaution, a truss may be used for a few hours.

When the fœtal membranes are still in the uterus, some obstetrists recommend that they should be removed before reduction of the inversion is

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attempted; but others—and among them Saint-Cyr—are of opinion that reduction should be accomplished first, and removal of the membranes afterwards, unless the latter are so lightly attached that they can be pulled away without introducing the hand into the uterus. In any case the membranes must be removed, as their presence is certain to cause expulsive efforts which will inevitably lead to protrusion of the vagina again.

For the retention of the reduced organ, sutures are often passed through the labia of the vulva, and Harms and Schleg (*Magazin von Gurlt und Hertwig*, 1869, p. 13) have rings (*ringelns*) with this object. Schleg's ring is a thin flat band of steel, pointed at one end, and with a round hole and slot a little above the point; at the other end is a kind of button raised on the surface. The point is passed through the labia, and the band bent round so as to meet and button at the ends. This ring has been worn, according to Schleg, from a few days to more than five months. But in general, it will be preferable to employ a truss for the retention of the vagina, if the accident is recent.

When the submucous connective tissue of the vagina has been much lacerated, and abnormal adhesions have taken place, then a recurrence of the inversion is to be apprehended. This recurrence is, of course, most likely to take place in chronic inversion, and all the skill and patience of the veterinary surgeon will be required in dealing with such a case. At times the accident has proved so troublesome, and retention has so baffled every attempt after reduction was effected, that amputation of the protruded portion has been practised, and with success.

Rainard appears to have been the first to venture on this bold measure, and he practised the operation several times on Bitches. He ligatured the entire inverted mass close to the vulva, in one case: but as this gave rise to intense fever, and, when cured, the animal suffered from incontinence of urine, he adopted another procedure. Instead of including the whole of the tumour in one ligature, he divided the pedicle into three portions, which he tied separately, so that each ligature only enclosed one-third of the mass. After tightening the ligatures, the Bitch was allowed to run at large, the only attention it received being the injection of emollient fluids into the vagina, and a smaller allowance of food. The pain was much less in intensity and duration than in the first case, and the tumour came away in five or six days, when recovery took place. Rainard, however, advises immediate excision of the portion of the mass beyond the ligatures, when these have been drawn tight.

Daprey operated on a two-year-old filly in a somewhat different manner. Inversion of the vagina had been present for fifteen days, and the tumour was as large as a man's head; it was cold, of a dark-brown colour, and the animal was greatly agitated and feverish. As gangrene was apprehended, it was decided to remove the whole mass. This was done by practising a kind of saddler's stitch around it, by means of two needles armed with a waxed thread; and when sewn round, the two ends of the ligature were drawn so tight as to raise the enclosed sides of the tumour into plaits like the mouth of a tied sack; they were then firmly joined. The Filly was kept standing with the hinder part of the body raised, and the tumour was dressed with chlorinated water and vinegar. Between the seventh and eighth days the mass came away; the discharge diminished in quantity and fœtidness, and on the tenth day the animal was nearly well.

Saint-Cyr mentions that Bernard operated upon a female Ass, which had the vagina inverted for more than a month, and every means of retention

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had failed. Amputation was practised, by a circular incision around the base of the tumour. At the first cut of the bistoury, it was observed that the mucous membrane was very much thickened, and easily detached from the other parts; so that, instead of making a total amputation, it was considered better to make it only partial, by dissecting away all that tissue to the extent of four to five inches. This was done, and the hæmorrhage was inconsiderable; but it persisted so long afterwards that the animal was seized with symptoms of syncope. However, these symptoms passed away, and the creature began to eat. A rope truss was applied, and for eight days there was a discharge of pus. At the end of that time, when the truss was removed, recovery was found to be complete. On exploring the vagina some time afterwards, a thick but dilatable ring, about the middle of the vagina, was found, through which first one finger, then two and three, could be passed. Beyond this ring the canal was normal in width.

There can be no doubt, then, that the inverted vagina may be amputated without much risk, when reduction is impossible or incomplete; but whether an animal which has undergone this operation can be utilised for breeding purposes afterwards, we have no evidence to prove. It is possible that the cicatricial tissue uniting the wound, may be sufficiently yielding to allow of gradual dilatation by manual or mechanical means, and thus not offer much impediment to impregnation or parturition.

CHAPTER V.

Inversion of the Bladder—Prolapsus Vesicæ.

At page 328, we have alluded to inversion of the bladder as occurring before parturition, and described the symptoms and treatment of this accident. The remarks we there made are applicable to the accident when it follows delivery. It is of somewhat rare occurrence, and is perhaps more frequently met with in the Mare than the Cow.

We have particularly insisted upon the necessity for a careful examination of these vulvar tumours before adopting any surgical measures; and this precaution is above all things necessary in this accident, as an incision in this viscus is certain to lead to a fatal termination: of this we have given an illustration in page 331.

Reduction must be attempted according to the directions given at page 330, and care must be taken not to lacerate the organ, as this also will prove fatal. Elmue (Canstatt's *Jahresbericht*, 1859) relates an occurrence of this description.

In desperate cases, when reduction cannot be effected, or when the organ is so much injured that reposition is almost certain to be followed by death, amputation may be ventured upon with some prospect of success.

With regard to the operation, Cartwright remarks: "It is to be observed that the ureters enter the substance of the neck of the bladder obliquely towards its sides, but their orifices are to be seen when the bladder is inverted, and the Cow or Mare is standing up, at the upper surface of the viscus, about half an inch apart. To detect them, we must draw the bladder sufficiently down, so that we may be able to inspect the parts. Where they enter, the inner membrane (now the ureter) will have a soft and jelly-

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like protuberant appearance, in the middle of which will be detected two very small openings of a nipple-like shape. To be certain that we have hit upon them, we may introduce a probe, and pass it down towards the suspended fundus. Having discovered the orifice of the ureters, and passed a ligature around the neck of the bladder below them, we have nothing more to do than occasionally tighten it, so as to effect complete strangulation and sloughing of the body of the bladder; though, as soon as we find it dead, we may, to save time, cut it away with a scalpel. We should also, after having applied the ligature, puncture the distended fundus; since its great weight may cause a dragging and inflammation about its cervix, or may force the ligature over the mouth of the ureters, which would occasion the death of the animal. After the separation has taken place, the remaining portion will contract within the vagina, and the cavity will be closed by the vulva. The urine will generally ever after run down the thighs, excoriating them; though in other cases the fluid will accumulate within the vulva, and be from time to time ejected in large quantities."

When excision is not resorted to, spontaneous amputation may take place.

When the inversion or prolapsus is complicated by rupture of the floor of the vagina, then the accident is of the most serious character, though not invariably fatal in its results.

1. Riviere (*Journal de Méd. Vétérinaire de Lyon*, 1867, p. 236) reports the case of a Cow which had a laborious delivery, in consequence of lateral deviation of the head of the fœtus, and manual aid was necessary. The fœtus was very large, and soon after it was extracted the envelopes came away; but in about a quarter of an hour very violent straining ensued, and almost immediately a quantity of reddish fluid flowed from the vulva, followed by a tumour as large as a child's head. A careful inspection proved this tumour to be formed by the fundus of the bladder, and a manual exploration discovered, on the floor of the vagina, a long slit through which the organ had passed. When this laceration took place, was not known; but the owner of the Cow had attempted to deliver it the previous evening, and had, as he thought, pierced the "water bag." The bladder was full of urine, so it could not be returned, nor yet could it be emptied by pressure on its surface.

The contents were removed by a hastily-devised catheter, made of a piece of elder-tree deprived of its pith. When the urine was abstracted, reduction was easy, and the Cow recovered in less than twenty days.

2. Canu (*Mém. de la Société Vétérinaire du Calvados*, 1835) was requested to see a Mare that, half an hour previously, had given birth to a foal without any difficulty. He found the animal lying on its left side, straining violently, covered with perspiration, and a membranous-looking substance hanging from the vulva, which led to the suspicion that inversion of the uterus or vagina had taken place. The owner said that he had been for a long time attempting to return this membrane, but had failed. Canu carefully examined it, but was unable to satisfy himself as to what it really was. He therefore caused the Mare to rise, which was done with difficulty, owing to weakness. The creature made repeated efforts to void its urine, from time to time ejecting it to a considerable distance. Canu did not even suspect inversion of the bladder, as he had never seen or read of such an accident. The tumour was red, thickened, and bloody, and an examination by means of a candle proved the vagina to be all right. Following the floor of that canal, however, the *meatus urinarius* could not be found, and the tumour commenced where that conduit should be; at the same time the Mare violently expelled some urine, and it was now surmised that it was really the bladder that was depending from the vulva. A close scrutiny led to the discovery that the organ was torn at the fundus, through the owner's efforts to replace it; he had used all his force, and the Mare at the same time struggled violently. After considerable deliberation, nothing was done, except abstracting a quantity of blood and reducing the diet. At the end of three days, the mammary secretion proving troublesome, the foal was restored to the Mare. The bladder was then swollen and black, and the thighs were excoriated from the constant flowing of urine. On the fourth day, in consultation with another veterinary surgeon, it was decided to pass a ligature around the organ, behind the orifice of the ureters. This was done, and the owner was entrusted with the task of tightening the ligature every

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day. Next day the Mare showed symptoms of colic, and it was found that the ligature had slipped upwards for more than an inch, and closed the ureters—thus causing uneasiness from retention of urine in these ducts. The bladder being pyriform—the pedicle next the vulva—it was difficult to keep the ligature in its place. This was ultimately accomplished, however, by passing two small pieces of wood through the tumour behind the ligature, and attaching the latter to them. Every day the constriction was increased until the whole mass—weighing nearly six pounds, and very fœtid—was held only by a narrow band; this was divided without any hæmorrhage. The remaining portion was immediately retracted as far as the *meatus urinarius*, when the lips of the vulva closed, leaving nothing to be seen. The urine, however, continually flowing through the ureters, accumulated in the vulva, whence it was frequently ejected, and running down the thighs excoriated them still more.

Canu then determined to have a little projecting spout of tin made, with brass wires to attach it to the vulva. This was fitted below the inferior commissure of that opening, the wires serving to fasten it to a crupper worn by the animal; the hair of the tail was tied up so that it might not disarrange the apparatus. By this means the urine was thrown beyond the hocks, and a few emollient lotions healed the excoriations. The Mare was put to work six weeks after the accident, and in three months it was sold at a fair.

3. Lecoq (*Ibid.*, 1837, p. 252) mentions that a draught Mare, after difficult parturition, and expulsion of the fœtal membranes, without the slightest warning protruded a round dull-coloured body as large as a fist, from the vulva. Next morning this had a fleshy appearance, was pyriform in shape, as large as a three-pint bottle, and eight or nine inches in length. It was soft, and only some small transverse rugæ were apparent on its surface. On the hand being introduced into the vagina, it was evident that this body was continuous with it; and on separating the labia of the vulva, on the upper surface of the part, at a short distance from each other were two nipple-shaped bodies, the size of a pea, from the centre of which, at every effort made by the Mare, a faintly-tinged fluid was projected. It was therefore evident that the tumour was the inverted bladder. Reposition could not be effected, owing to the struggles of the Mare, the constriction and engorgement of the sphincter, and the thickening of the parietes of the bladder; so to save the animal, amputation was resolved upon. "Having prepared a strong waxed thread, many times doubled, and to the extremities of which we had attached two small pieces of wood to facilitate tightening the ligature, we passed it round the body of the bladder, an inch and a half below the orifices of the ureters, and drew the knot as tightly as possible. In exploring the bladder, we perceived that it contained some fluid, and on cutting into its fundus about a pint of light-red odourless liquid—the product of the exhalation from the utero-vesical portion of the peritoneum—escaped."

The Mare's health appeared to be scarcely affected by the operation. Three days afterwards the efforts to micturate were less violent; the bladder below the ligature was flaccid, livid, and like macerated flesh; the parts above, and in immediate proximity to the ligature, were red and inflamed. Every time the animal strained, a jet of urine escaped from the ureters, and in the intervals between these efforts it ran continually from the vulva, though without causing any apparent inconvenience. A new ligature, tightly drawn, was placed above the other, at which the parts were becoming gangrenous. Six days subsequently, the tumour was excised an inch below the ligature, and the remaining part was well washed with camphorated spirit of wine. Suppuration speedily set in, and in another fifteen days the part had healed. The Mare was put to work in a month, and did well; inside the thighs was slightly excoriated for some months afterwards, and the salts of the urine had become deposited on the hair and skin. The urine trickled down these parts almost continuously.

Nine months after the operation, the condition of the Mare was as follows: "The thighs are a little excoriated, the vulva somewhat swollen, the urine runs only at intervals, but oftener than in a healthy state, and in a small quantity at a time. The Mare assumes the natural attitude in order to micturate, and discharges about half a pint of urine at each attempt. The hair below the vulva is thin and easily removed, on account of the flow of urine over the part."

4. Devaux (*Ibid.*, p. 219) relates the case of a Mare which had eversion of the bladder fifteen days after abortion. When he attempted to examine it, the animal struggled violently and threw itself down, and there ensued a violent distention and bruising of the tumour; so that in the course of a few minutes five or six pints of blood escaped from it. Washing with pure vinegar checked the hæmorrhage. The Mare being raised and tranquillised, reduction was effected by causing the mass to be supported by an assistant, and gently pressing on its sides with the fingers and

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hand; it returned readily, and the hand was kept pressing on it for nearly half an hour. The animal was tied up during four days, and completely recovered.

5. Baudson (*Annales de Méd. Vétérinaire de Bruxelles*, 1877, p. 153) refers to the case of a three-year-old Mare, which had inversion of the bladder for six weeks. Reposition had been effected by an empiric, but inversion recurred almost immediately. The tumour presented the characteristic appearances, though it was greatly inflamed, owing to the rough manipulation to which it had been subjected, as well as the exposure. The animal was in much pain and strained violently. Reduction being deemed impossible, an iron clam was fixed behind the ureters, and gradually tightened until the eighteenth day, when the fundus and body of the organ came away. The remainder was spontaneously retracted, and the Mare went to work.

6. Decleene (*Ibid.*, 1876, p. 147) furnishes an interesting case of *retroversion* or *retroflexion* of the bladder against the floor of the vagina, which was inverted by the displaced organ. The amateurs who had tried to relieve the animal—a Cow which had just calved—thought the mass was the thickened fœtal envelopes of a second fœtus; commencement of inversion of the uterus; inversion of the bladder; or hernia of the intestine. The animal was lying when Decleene examined it, and it was breathing quickly, as well as making violent expulsive efforts; during which a round tumour, the size of a man's head, appeared at the vulva, and diminished in size when the straining ceased. The temperature of the tumour was low; it was rather hard, and almost stony in consistence during straining; when there was not straining, fluctuation could be detected. The surface was smooth and regular, except at its posterior part, where were some abrasions, due to the owner's attempts to tear through it, from an idea that it was the "water bag" of a second fœtus. A vaginal exploration proved that the upper and lateral surfaces of the tumour were directly continuous with the vaginal mucous membrane; and that the os uteri was partially dilated, but normal. Internally the hand could not advance far into the vagina, as at the *meatus urinarius* the mucous membrane was reflected on itself at a very acute angle. In order to pass the finger into the meatus it had to be bent, and even then it could only be advanced a short distance, in consequence of the inflexion of the neck of the bladder.

Moderate pressure for more than five minutes was unavailing in replacing the organ, in consequence of the continuous straining of the Cow. The animal was incited to get up, and at the moment when its hind quarters were raised, the knees being bent, the pressure forward and a little upward caused the bladder to suddenly resume its normal position and relations. The animal quickly recovered.

7. Neale (*Veterinarian*, vol. xi. p. 410) states that a Sow had inversion of the bladder after bringing forth a litter of ten pigs. A butcher thought it was the uterus, and returning it into the vagina, put stitches through the lips of the vulva to retain it. It again protruded, however, and nothing more was done to it. It sloughed away, and the Sow did not suffer much; indeed, in six months after the accident, it was killed for bacon. The bladder was found to have completely disappeared, and the ureters passed directly from the kidneys to a mass about the size of a lemon, lying in the vulva—the remains of the organ.

8. Leech (*Ibid.*, vol. xx. p. 425) attended an aged Cart Mare which had foaled a few days previously, and was suffering from inversion of the bladder. On the supposition that it was the uterus which protruded, the owner had tried to return it, and had passed sutures through the labia of the vulva. On these being removed, it was ascertained that the bladder, which filled the vagina, was extensively and severely inflamed; urine was ejected at intervals from the ureters. Attempts at reduction were made, but without success. The organ was then ligatured behind the ureters, and the ligature tightened every day. The animal received general depletive treatment. On the sixth day the tumour was removed by the knife; it weighed seven pounds. The Mare died three days subsequently, from inflammation of the vagina, neck of the bladder, and the ureters. Leech was of opinion that the inflammation was chiefly due to the weight of the mass after the ligature was applied, and he recommends immediate amputation.

9. Tailby (*Ibid.*, vol. xliii. p. 33) attended a six-year-old Mare which had foaled three days previously, and soon after was observed to have a large mass protruding from the vulva. The animal was in great pain, pulse and respiration much increased, tremors in the hind quarters, great difficulty in moving from side to side, and occasionally lying down and getting up again. The protruded viscus, supposed to be the uterus, was evidently the bladder: urine trickling from the orifice of the ureters, and the hand could be readily passed into the vagina. The organ appeared to be in a gangrenous condition. Reduction was attempted without casting the animal, but it strained so violently that it had to be thrown down. The fundus and as much

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of the body as could be grasped, were seized, and gentle pressure was steadily applied with three fingers upon the entrance to the urethra; during a struggle made by the animal, a large portion of the mass receded, and the hand of an assistant completed the reduction. The uterus, vagina, and bladder were then injected with solution of carbolic acid (1 to 60). Anodynes and stimulants were subsequently administered, and the Mare recovered.

10. Robinson (*Ibid.*, p. 781) relates a case of inversion of the bladder in a Mare, a sequel of parturition. It was attended with so much general prostration, as well as congestion of the bladder, that he thought it inadvisable to attempt reduction. The urine conveyed by the ureters filled the vagina, and was frequently ejected. The Mare was ultimately able to partially retract the organ within the vagina!

CHAPTER VI.

Traumatic Lesions of the Genital and Neighbouring Organs.

Either during or after parturition, the genital and neighbouring organs are exposed to injuries of a more or less serious character, according to their situation and extent. These we will now consider in the following order: 1. *Laceration and rupture of the uterus;* 2. *Laceration and rupture of the vagina;* 3. *Thrombus of the vulva and vagina;* 4. *Relaxation of the pelvic symphyses;* 5. *Rupture of the bladder;* 6. *Rupture of the intestines;* 7. *Rupture of the diaphragm;* 8. *Rupture of the abdominal muscles;* 9. *Rupture of the sacro-sciatic ligament.*

Section 1.—Laceration and Rupture of the Uterus.

Laceration and rupture of the soft parturient passages are very far from being unusual during parturition in the domestic animals, and particularly in the Mare and Cow; and of these the uterus and vagina are most frequently involved.

Solutions of continuity of the uterus are often met with by the veterinary obstetrist, and they are either *incomplete*—when the organ is only partially torn or lacerated, or *complete*—when they penetrate through the entire thickness of the uterine wall, and perforate into the abdominal cavity. These solutions may occur either during pregnancy, during parturition, or at a variable period after the fœtus has been removed from the uterus—when it is generally a complication of inversion of this organ. *Ante-partum* rupture has been already fully alluded to at page 180, and we have now to study its occurrence during and after birth.

Rupture during Birth.—Rupture of the uterus may occur spontaneously in a complete or incomplete form during parturition; and though the accident is perhaps not so frequent in animals as in woman, yet there are many cases on record in which it has undoubtedly occurred in them, and it has been affirmed by highly competent authorities that it has been observed in Cows which had not received any assistance during parturition.

It can easily be understood why, if there is any material obstacle to the passage of the fœtus—such as induration or torsion of the cervix, or a malposition or deformity of the young creature—the violent contractions of the powerful muscular layer of the organ should overcome the resistance of some portion of its own fibres, and thus lead to a more or less extensive solution of continuity, which may involve the other tunics and produce complete perforation. Non-penetrating, or incomplete lacerations, in the majority of instances occur towards the cervix, and are usually longitudinal. Complete rupture may take place at any part of the organ.

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This accident is more likely to occur spontaneously when there chances to be an alteration in the texture, wholly or partially, of the uterus wall; though this predisposing cause does not appear to be so often present in animals as in the human female, in which sudden perforating ruptures never take place when the uterine tissue is healthy. Nevertheless, there can be no reason to doubt that in animals alterations in the tissue of this organ may and do occur; and, as in woman, this may asume the form of anomalous development; interruption of the normal tissue by interstitial fibroids or cicatrices; separation of the muscular fibres by submucous fibroids, or by projecting thin parts of the fœtus; inflammatory softening of some portions of the parenchyma during pregnancy; or thinning of the wall at some part by pressure. This pressure may arise from contact with the brim of the pelvis, or exostoses in or upon the bony canal.

The exciting cause, however, proceeds from considerable impediments to the progress of labour, and the accident is due to the energetic contractions of the uterine walls and abdominal muscles, as well as to the pressure, direct or indirect, of the diaphragm through the fully dilated chest cavity.

In such cases the rent may be so great, that the fœtus passes entirely through it into the abdominal cavity, enveloped or not in its membranes; or only a portion of it has escaped through the tear, and it may be extracted therefrom with more or less difficulty *per vias naturales*, and in some recorded cases birth has taken place by the natural efforts, the existence of rupture only becoming evident when the uterus was accidentally extruded after birth.

More frequently, however, the accident arises from artificial mechanical causes, brought into operation in the course of manœuvres for effecting the extraction of the fœtus. The various instruments employed may either tear or incise the uterus; or the organ may be lacerated during traction on the fœtus when the "waters" have escaped, and its walls closely envelop the young creature; or during retropulsion or version. The tenuity of the uterine parietes at this period, renders such an accident as laceration one of easy occurrence; and, however large the tear may be during life, after death it usually appears much smaller, because of the contraction of the muscular tissue.

In all these cases, when the organ remains *in situ*, the *diagnosis* is difficult, and generally it is only on *post-mortem* examination that the lesion is discovered. Nevertheless, certain clinical symptoms are often observed during life, which, if they were constant, might lead to a suspicion of the existence of rupture. Thus, the expulsive efforts are very energetic and regular up to a certain period, when all at once they cease; the animal begins to manifest symptoms of abdominal pain—lying down and getting up, stamping and pawing, looking towards its flanks, moving about uneasily, moaning, bellowing, neighing, or even screaming, when the rupture occurs.

Non-penetrating lacerations do not, as a rule, give rise to very marked symptoms immediately; though subsequently they may produce metritis or metro-peritonitis, or induce septic infection. Their presence is not easily diagnosed during life.

In some few instances, the existence of complete rupture has been ascertained by manual exploration of the uterus; in others it has been discovered *de visu* in inversion of the organ. The pulse soon becomes feeble if there is much hæmorrhage, and exhaustion quickly supervenes. If death does not occur promptly, acute fever ensues, and symptoms of peritonitis or septic infection.

The complications attending this accident are always serious, and render

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the prognosis unfavourable in nearly every case. When, however, the lacetation occurs at the upper part or sides of the uterus, the accident is not so grave as when the floor of the organ is involved; if the os remains closed, so as to prevent the admission of air, the circumstance is still more favourable, though this can rarely indeed be the case.

The chief *complications* are *hæmorrhage, hernia of the intestines*, and *peritonitis.*

Death from direct *hæmorrhage* is less frequent than might be anticipated, knowing the great vascularity of the uterus at parturition. This unfrequency is explained by the fact, that bleeding from such a laceration is less profuse than from an incised wound of the same dimensions. Nearly always, too, the fœtus is partially or entirely expelled from the uterus into the abdominal cavity, or is born immediately after the accident, and the organ then may firmly contract.

Nevertheless, in some instances, the hæmorrhage is so great that a fatal termination soon takes place, with all the symptoms already described at page 567.

Hernia of the intestines occurs when the rent is somewhat large, and the uterus, flaccid and uncontracted, allows these viscera to enter its cavity—they being propelled therein by the action of the abdominal muscles. In some instances the intestinal mass received into the uterus has been so large that they have passed through the vagina and vulva, reached the ground, and the animal has trodden upon them—thus hastening death; while in others, the hernia has been reduced and the creature survived.

Peritonitis may be primary or secondary. When *primary*, it is due to the escape of blood, the fœtal fluids or envelopes, or the fœtus itself. When *secondary*, or *consecutive*, it may result either from the extension of the inflammation to the peritoneum, or the discharge of the lochia, pus, etc., from the interior of the organ.

The escape of fluids from the uterus is, of course, more likely to take place when the rupture is inferior than when lateral or superior. Death is nearly always the result of peritonitis or metro-peritonitis.

Treatment.

The treatment of rupture of the uterus during parturition is generally very unsatisfactory. Very little can be done to check the hæmorrhage, if it is great, and consecutive peritonitis is always a most serious complication.

If the fœtus remains within the peritoneal sac, a favourable termination can scarcely be hoped for; though in some rare instances, if air does not obtain access to the cavity of the uterus or abdomen, it is possible that it may terminate in all the various ways of extra-uterine pregnancy. If the fœtus is extracted, the rent may heal up; though this is very unlikely if the edges are much contused, and the animal will, in all probability, perish from consecutive purulent peritonitis.

If the fœtus is still wholly or partially in the uterus, it and its envelopes must be extracted without delay, and as gently as possible; as hæmorrhage will probably only cease with the contraction of the organ. If the uterus does not contract, but remains flaccid after removal of the placenta, then it may be stimulated to do so by introducing the hand into the interior for some time, after removing the coagula. If this fails, and the rupture is not in the floor of the uterus, small pieces of ice, cold water, or astringents may be introduced, and ergot of rye administered; a jet of cold water should be allowed to play upon the loins, wherever the rupture may be. If there is hernia of

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the intestines, these, of course, must be promptly returned into the abdominal cavity, before anything is done to the uterus.

Some authorities advise that the uterus should be gently inverted and brought outside the vulva, in order that the rent may be closed by suture, and then return it. But this course is not to be recommended, as it is very dangerous, and the wound will unite without sutures if the organ contracts and no complications follow.

The cavity of the uterus should be swabbed with a weak solution of carbolic acid (1 to 100, up to 250); and to prevent septic infection by admission of air, a pledget of carbolised lint or tow should be placed in the os or vagina, and changed now and again.

Straining must be subdued by doses of opium or chloral, or the subcutaneous injection of morphia; and the diet must be carefully attended to. If there is constipation, mild laxatives and enemas may be administered. Consecutive fever and peritonitis must be treated by cold, and large doses of anodynes—such as opium, as well as counter-irritants. Metritis must be treated in the same manner, by the gentle injection of cold water; or the introduction of small pieces of ice into the genital canal will be beneficial. Should symptoms of septic infection appear, stimulants, with small doses of carbolic acid and sulphite of soda, must be given.

When the fœtus has passed through the rent into the abdominal cavity, delivery *per vias naturales* is then impossible, and the Cæsarean section must be resorted to; unless it be decided to allow the animal to take its chance, and get rid of the fœtus as in extra-uterine fœtation, should it survive the accident.

Rupture of the Uterus after Parturition.

Rupture of the uterus after parturition generally complicates inversion of the organ, and is due to mechanical injury either on the part of amateurs, or even of the veterinary surgeon, when endeavouring to replace it; sometimes it is produced by the animal itself, or by other animals when the prolapsed organ gets in their way. In some instances it has been caused by the jagged bones of the fœtus in embryotomy, and in others by pessaries introduced into the genital canal to retain the inverted organ.

In such instances the diagnosis is easy; for if the uterus is still inverted the rent is visible, and its dimensions, situation, and gravity can be taken into account.

It is somewhat remarkable that laceration or rupture of the extruded organ is much less serious than the same amount of injury to the uterus *in situ*, and it would appear that in inversion there is the greatest tolerance of the most serious lesions. Why this should be has not been explained; but the fact is nevertheless patent, that in very many instances, when reposition of the uterus has been effected, the rupture has readily cicatrised, and union has been so complete and substantial, that the animals have afterwards been successfully bred from.

Some authorities have closed the rent by suture; but very many have not, and the termination has been as favourable in the one series of cases as the other. Unless the rupture is in the lower wall of the uterus, sutures are at least superfluous.

Beyond the measures for reduction of the inversion, and the necessary antiseptic after-treatment, little more has to be observed. When the rupture is serious in inversion, and grave results are to be apprehended should the

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uterus be returned, then it may be advisable to amputate the organ. This may be accomplished in the manner already indicated.

We shall notice a few of the recorded cases of rupture of the uterus.

1. Louis (*Recueil de Méd. Vétérinaire*, 1861) attended a Mare—a primipara—which had aborted, and soon afterwards the uterus was inverted, with the placenta adhering to it; the organ was ruptured in the two-thirds of its antero-posterior diameter, *i.e.* laterally. It was the left side—probably the left cornu. The Mare was straining violently. The inverted portion was replaced, a cord truss was applied, and the animal had recovered in twenty days.

2. Darquié (Gellé, *Pathologie Bovine*, vol. iii.) was called in to reduce the inverted uterus of a four-year-old Cow, three days after parturition. Reduction was accomplished, and a truss applied. The straining continued, however, and on the fourth day after reduction, one of the strands of the truss having been torn, inversion again occurred. On the arrival of Darquié, the uterus was found to be enormously swollen, and the mucous membrane hanging about it in shreds. He went for assistance, but forgot to close the door of the shed, and during his absence two large dogs had got in, and commenced devouring the organ. When he returned half an hour afterwards, the Cow was lying and covered with blood, and the uterus was destroyed nearly as high as the vulva. Fearing the results of the hæmorrhage, Darquié was about to ligature *en masse* what remained of the uterus, when the animal suddenly jumped up, and all that was left disappeared in the pelvis. Nothing was done except to prescribe some acidulated injections into the vagina, low diet, and a few hygienic measures; in about fifteen days the Cow appeared to be quite well.

3. Eleout (*Rec. de Méd. Vétérinaire*, 1841) had to treat a Cow which produced a dead calf, and soon after showed complete inversion of the uterus. The latter was of a deep red colour, and soiled. Reposition was attempted. "I commenced with the left cornu, which I readily returned, holding it by its base, and pushing it with my left hand until it disappeared. I proceeded in the same manner with the right cornu, which was likewise replaced. There was only a small portion that was not returned, when the Cow backed upon me with such force that the termination of the right cornu was ruptured, and my hand and arm penetrated into the abdomen. The uterus, finding nothing to resist it, was again expelled. My first thought was to unite the edges of the wound by suture; but seeing that the animal was greatly debilitated, that the mucous membrane of the uterus had been too long exposed to irritating contact with the air, that by this proceeding I would protract the operation, and that in similar cases others had obtained a radical cure by excising a portion of the organ, I set about a second reduction of the uterus, which was returned into the abdominal cavity without difficulty." A pessary was introduced into the vagina, and the hind-quarters of the Cow elevated; emollient injections were employed, and stimulating draughts administered. On the following day there was much fever and general disturbance. Blood was abstracted, febrifuge medicines given, and a poultice applied to the loins. On the fourth day the pessary was withdrawn, and a sanious fetid fluid escaped from the vulva. Vaginal injections were frequently resorted to. In twelve days the Cow was turned out to graze, evidently recovered.

4. François (*Annales de Méd. Vétérinaire de Bruxelles*, 1877, p. 157) describes a case of inversion of the uterus in a Cow, which was complicated by a rupture in the wall of the organ, about eight inches in length. This rent was closed by suture, the uterus was returned, and retained by a truss. The case did well.

5. Obich (*Wochenschrift für Thierheilkunde und Viehzucht*, 1869, p. 349) describes the case of a Cow which, suffering from torsion of the uterus, had, during detorsion, a rent made in the upper wall of the organ; this rent was so large that the outspread hand could be passed through it into the abdominal cavity. The animal was very ill for eight days, but it gradually recovered without any treatment.

6. Adam (*Ibid*, 1870, p. 411) mentions that a four-year-old Cow had a calf, and appeared to be quite well until ten days afterwards, when hæmorrhage from the vulva was observed; and on the following day there was loss of appetite, high fever, and greatly accelerated pulse and respiration, and the animal showed such serious symptoms that it was killed. On examination the uterus was found to be tolerably healthy, but in the right cornu, which had contained the calf, was found a quantity of partially coagulated blood, while the mucous and muscular coats were lacerated to the extent of nearly two inches—the laceration commencing at the base of a cotyledon. In the pericardial sac was some dark-red fluid, and the right endocardium was marked by large ecchymoses; while the fourth compartment of the stomach, as well as the small intestine, had their mucous membrane tumified and very red, and that of the

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gall-bladder was ecchymosed. All this pointed to a sudden attack of septikæmia, resulting from the laceration.

7. Copeman (*Veterinary Record and Transactions*, vol. v. p. 154) relates a case of rupture of the uterus in a Cow, occurring after protracted labour. The rent was nearly eight inches long, and about a foot from the os; the small intestines passed through it into the uterus. These were replaced, and Copeman held the edges of the laceration together for a quarter of an hour. No other treatment was adopted, and the animal recovered.

8. Higginson (*Veterinarian*, vol. xiii. p. 395) was summoned to attend a Cow which had calved five hours previously. He found complete inversion of the uterus and the fundus of the organ so lacerated as to allow a large portion of the small intestine to pass through. This rupture was probably produced by an amateur who had tried to reduce the inversion, but failed. The intestine was first returned, and then the uterus, a truss being applied. Stimulants, opiates, and febrifuge medicines were administered, and in nine days the Cow was convalescent. This Veterinarian does not approve of sutures in the uterus.

9. At page 336 we have given an instance in which a rent in the uterus and vagina was discovered to have cicatrised perfectly.

10. Cartwright (*Veterinarian*, vol. xv. p. 429) relates the case of a Cow from which a calf had been forcibly extracted by an amateur on the previous day. On examination, the uterus was found to be ruptured, and as the animal was evidently sinking it was killed. At the neck of the uterus was a rent sufficiently large to admit a man's head. The rectum was also torn.

11. The same authority (*Ibid.*) states that he was called to a Cow, from which the head, fore-limbs, and body of a calf had been removed. It was intended to extract the hind extremities by the application of greater force, but on the amateur introducing his arm they could not be found. Cartwright soon discovered that the uterus was ruptured to a very great extent, and through the opening the limbs had receded. The Cow lived for several hours after the accident, without evincing any pain or debility, and was ultimately destroyed.

12. This authority (*Ibid.*, vol. xviii.) gives an account of a Cow which was most cruelly dealt with by amateurs, while trying to deliver it of a calf in malposition. The extraction occupied two or three hours, during which time it was observed that the animal breathed quicker than usual, and groaned very much; it also strained violently, though this ceased immediately before delivery. It soon began to "breathe short, threw the head about, moaned, and was restless." Death took place in about twenty-four hours. The uterus was observed to be ruptured on its lower surface, to the extent of eighteen inches in a straight line from the cervix towards the fundus. The abdomen contained about two gallons of bloody serum, and the peritoneum was inflamed.

13. Cartwright (*Ibid.*) gives another fatal case of rupture of the uterus, due to attempts to extract a calf in a false presentation. The Cow died. The peritoneum was inflamed, about two quarts of coagulated blood was contained in the uterus, and the floor of the latter, towards the fundus, was lacerated and ruptured in two places. One rupture was towards the posterior part of the fundus, extending in a circular manner nearly around it. The organ had contracted very much.

14. Younghusband (*Ibid.*, vol. xxvi. p. 382) was sent for in haste to see a Cow which, three days previously, had calved, and was apparently quite well until that morning, when inversion of the uterus was discovered. He found the placental membranes adherent to the surface of the organ, which was greatly soiled. The hind-quarters were well elevated, the placenta detached, and the uterus cleansed by weak spirit and water; on proceeding to return it, a large rent was found through which the hand could be passed, and which was supposed to have been caused by the next Cow having trodden upon the extruded mass. Reposition was attempted. "Judging I had got all the part into a right position, I made an attempt to withdraw my arm; but in doing this the Cow immediately began to strain with such violence that it was with the greatest difficulty I could retain the part. But by a fortunate slip, her anterior parts were brought so near the ground that I now easily accomplished that which for a length of time I had found the greatest difficulty in attempting to do—getting the part into a right position, retaining it there, and withdrawing my arm without difficulty." The usual measures were adopted to prevent a recurrence of the inversion, an anodyne was given, and recovery soon ensued. The Cow had two calves afterwards.

15. The same veterinary surgeon (*Ibid.*) refers to the case of a Cow which calved without difficulty, and soon after had inversion of the uterus, the placenta remaining adherent. The owner took precautions against injury to the organ, and hurriedly

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sent for Younghusband, who on arrival detached the placenta, and readily replaced the uterus. Immediately, however, a portion of the small intestine appeared through the vulva, and a rent was soon discovered towards the fundus of the organ. The intestine was returned without much difficulty, and contraction of the uterus was brought about by applying tincture of opium and camphor. No truss was employed, and the Cow recovered.

SECTION II.—LACERATION AND RUPTURE OF THE VAGINA.

Lacerations and rupture of the vagina are not at all unfrequent in the larger domesticated animals, and they are generally as serious as those of the uterus. These accidents may occur during copulation, as well as in parturition; but they are more common in the latter. Trifling laceration of the vagina and vulva is often observed in primiparæ, or those animals in which the soft parturient passages are narrow or rigid.

The injury may be either *spontaneous* or *accidental*. The accidental injuries are those produced artificially during assisted labour, and are due either to the instruments employed—hooks, forceps, knives, etc.; the hand or the nails of the fingers of the obstetrist—the sharp exposed bones of the fœtus when embryotomy has been practised, or from some salient part of the young creature during the uterine contractions. In the latter case, the feet generally cause the laceration or rupture. Deformity of the pelvis, or roughened nodules of bone in the vicinity of the genital canal, may also lead to serious lesions of the vagina.

When the lesion occurs in what we may call a "spontaneous manner," it happens either that the vagina is lacerated along with the uterus, during natural labour and from continuity of texture, or when the os is amply dilated, but the vagina is overstretched by the fœtus.

In some instances such an accident as rupture of the vagina may be *secondary:* as when the textures which form its walls are much bruised and contused during the passage of the fœtus. Then gangrene may supervene, and the mortified tissue be thrown off in a gradual manner, until complete perforation has taken place.

The lesions arising from these different causes are extremely varied—from removal of the epithelium or simple abrasion, to laceration of the mucous membrane, or even thorough perforation of the vagina; and they may be situated either towards the vulva or cervix uteri, on the sides, floor, or roof of the canal; while they may only concern the vagina, or involve, at the same time, the neighbouring organs and textures. Consequently, the gravity, as well as the symptoms of such lesions, vary considerably, according to their simplicity or complexity. Nevertheless, as we shall have to note hereafter, a very trifling abrasion may bring about very serious consequences; while an apparently formidable injury may be followed by no unfavourable indications.

With regard to rupture of the vagina, and particularly with that which may be designated "spontaneous," it may be remarked that when the lesion occurs towards the cervix uteri, it is nearly always transversal, and, as has been before noted, the vagina may be completely separated from the uterus. In other instances, the form and direction of the rupture will differ considerably. Longitudinal rents often extend into the cervix uteri and body of the uterus.

Of all the domesticated animals, the Mare appears to suffer most frequently from lesions of the vagina produced during parturition. The reasons for this liability we have already alluded to, and they may be chiefly referred to

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the length of the limbs of the fœtus, and the energetic and rapid contractions of the uterus; as well as the greater susceptibility of this animal to morbid influences—such as septikæmia. Nevertheless, in all animals these injuries are notoriously serious, and if the laceration occurs when the tissues of this part are bruised, chafed, and irritated by manipulations during a laborious delivery, they are all the more grave. Rainard justly remarks that Bitches and Cats in which such a condition of the tissues exist, all succumb if there is the most trifling rupture of the vagina, even if there is no hernia.

If the laceration is extensive towards the bottom of the vagina, the abdominal cavity will be opened, and the fœtus, if it has not been expelled, may have partly passed through the rupture; and in consequence of the walls of the passage being much less contractile than those of the uterus, the accidental opening is more pervious in the former than the latter, and thus all the more readily allows the intestines or bladder to pass through.

Laceration or rupture of the vagina is more easily diagnosed than when this accident occurs in the uterus, as the vagina is much more accessible to the eye and hand; though in some cases it is difficult to arrive at an exact knowledge of the situation or extent of the injury.

With regard to *prognosis*, this will much depend upon circumstances, and the complications met with. Sometimes a mere abrasion of the mucous membrane, which produces a raw surface, or a laceration extending to the submucous connective tissue, may lead to *septic infection*. This is particularly to be apprehended should the fœtus or membranes have undergone decomposition, or any putrid matter—as the lochia—allowed to remain in the genital canal, especially during hot weather. Wounds or lacerations on the floor of the vagina are generally more serious than those on the roof or sides, for the reasons mentioned with regard to rupture of the uterus. And even wounds or rupture of the sides or roof of the vagina are much more serious than the incisions made through its walls in ovariotomy, owing to the presence, during parturition and the puerperal state, of fluids which may quickly become, or are already, putrescent.

Hæmorrhage is generally not so much to be dreaded as in lacerations of the uterus; though occasionally it may be so serious as to endanger the life of the animal.

Hernia of the intestine occurs when perforation of the vaginal wall, near the cervix, is complete, and the peritoneal cavity is opened. This is a serious complication, as is also *hernia of the bladder*, which may happen when the rent is adjacent to that viscus; though in the case alluded to by Rivière (page 605) it was deemed a fortunate circumstance that cystocele was present, as the bladder effectually closed the rupture in the vagina, and thus prevented the escape of the lochial and other fluids into the abdominal cavity.

Peritonitis and *pelvic cellulitis* are also very serious complications succeeding laceration, and are a consequence either of the extension of vaginal inflammation to the neighbouring tissues, or the escape of septic matters or inflammatory products into the pelvic connective tissue or the peritoneal cavity.

So that if extensive laceration of the vagina does not produce rapid death, there are other grave dangers to be apprehended from either present or subsequent complications. The inflammation of the vagina and submucous tissues, with suppuration and partial gangrene, may lead to the formation of fistulæ, or even of wide-spread destruction of the soft parts in the pelvic cavity, which sooner or later induce a fatal termination. Should this not occur, and some of the neighbouring organs have been injured at the same time as the vagina, then we may have such important damage as to

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render the animal nearly valueless. We will refer to some of these injuries presently.

The *symptoms* of injury to the vagina and neighbouring organs will, of course, vary with their nature and extent.

Much constitutional disturbance is generally only manifested when the lesions are serious, or when septic infection has taken place. Small rents may not give rise to any perceptible derangement, except, perhaps, a little fever and tumefaction; but if they extend deeply into the connective tissue, then acute fever, infiltration, and other grave symptoms may supervene.

With regard to *treatment*. This also must depend upon circumstances.

When rupture of the vagina is recognised during parturition, delivery should be effected as speedily as possible, and with every care, in order to prevent the laceration extending and the fœtus passing into it. If, unfortunately, some part of the latter has lodged in the rent, it must be removed therefrom with the utmost precaution, so as not to injure other viscera. The fœtal membranes should also be extracted as soon as possible. If there is hæmorrhage from the vagina, this may be suppressed by ice or injections of cold water if the rent is superior or lateral; if it is inferior, then a sponge or a cloth soaked in cold water should be placed in the canal. Should there be hernia of the bladder or intestines, these must be replaced at once.

In all cases of wounds, abrasions, or rupture of the vagina, every precaution should be observed with a view to the prevention of septic infection. With this object the greatest cleanliness must be observed, all decomposing matters, or matters likely to decompose, should, if possible, be scrupulously removed, and injections or "swabbings" with weak solutions of carbolic acid or other disinfectants, practised. If there is much danger of hæmorrhage, a suitable tampon of lint or fine tow, saturated in these fluids, may be allowed to remain in the vagina for some time.

1. Petzold (*Sächsen Jahresbericht*, 1865, p. 73) relates that a Cow was delivered of its calf by manual force, though without much difficulty; nevertheless, there ensued much swelling of the vulva, which extended to the right hock. On a close inspection being made, there was found on the right side of the vagina, about four inches from the vulva, a rent nearly three inches in length; while the whole of the vagina itself was swollen, hard, and of a bluish-red hue. Fæces and urine were voided with difficulty; the animal was feverish, had lost its appetite, the respiration was hurried, etc. Injections of tepid aromatic infusions, with acetate of lead, were resorted to. From the third day all the more serious symptoms disappeared, and on the tenth day the wound had healed.

2. Field (*Veterinarian*, vol. xxxi. p. 1.) communicates the case of a young Mare which, being expected soon to foal, was put into one of the bays of a barn with that view: at the same time another Mare, due to foal two months later, was put into the opposite bay. Both were fenced off from contact with each other, and the breadth of the floor intervened. The Mares were visited by the carter at night, and there was nothing to attract his particular attention. When he looked in upon them early next morning, he found the Mare which had been expected to foal was dead, and that the other had aborted. The first had evidently been dead some hours, and on a closer inspection, its bowels were observed to be lying about its feet, bruised and lacerated, but there was no foal. An autopsy was made, and the fœtus, full-grown, was found with its head bent on the chest and the fore-legs under the body. In the violent efforts made by the Mare to expel the foal, the intestines had been forced through a wide rupture between the vagina and rectum. The other Mare had aborted through fear or sympathy, or both.

3. Shipley (*Ibid.*, vol. xxx. p. 383) attended a Mare which required assistance in parturition. The animal was lying down and getting up frequently, straining, etc. A very small portion of the fœtal membrane was hanging from the vagina, the calibre of which was contracted, and the general appearance of the parts was not that of the

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parturient period. The *liquor amnii* had escaped. The foal was large and alive; the fore-limbs were in the vagina, but the head was bent round to the right side. Attempts were made to adjust the latter, during which the hand came in contact with something, the character of which could not be detected from its being covered with the membranes. The Mare was very much exhausted, and threw itself down violently once or twice. Traction by means of cords was exercised on the fœtus, during which the Mare suddenly fell on the left side and violently strained, forcing from the vagina what appeared to be a portion of the single colon, covered by part of the chorion. The case being deemed hopeless for the Mare, even if the fœtus was removed by embryotomy, it was shot, and a longitudinal incision being at once made along the *linea alba*, the uterus was exposed, opened anteriorly, and a fine healthy filly extracted. The young creature lived and did well. The wall of the uterus was found to be ruptured to the left of the upper part, and anterior to the os; the rent was about five inches in length, and somewhat oblique, a considerable portion of the single colon and rectum protruding through it. The meso-colon and meso-rectum were also ruptured to the extent of six inches.

4. Meyrick (*Ibid.*, p. 503) alludes to a Mare he was called upon to attend which could not foal. The labour-pains had only commenced two or three hours previously, but there was no appearance of the foal. On introducing the hand into the uterus, the fœtus was found to be so placed that there was no difficulty in adjusting it. While, however, attempts were being made to bring one of the fore-feet through the os, the Mare strained very violently. "This led to an immediate protrusion of a portion of the vagina in the form of a large bladder, close to my shoulder. Immediately afterwards the vagina burst, and a quantity of the intestines gushed out through the rent, the Mare falling down at the same instant. The mucous membranes of the mouth and nose became blanched almost immediately, and the pulse so tremulous and weak as scarcely to be felt." In about fifteen minutes death took place; and on opening the abdomen a large quantity of blood was found in it, and which had escaped from a rupture, two or three inches in length, in one of the common iliac veins. Much blood had also poured from the rent in the vagina. The foal was dead.

5. Galtier (*Recueil de Méd. Vétérinaire*, 1875, p. 47) was summoned in the afternoon to aid a Mare which had been attempting to foal since the morning. It had lain on its side, making violent expulsive efforts, and Galtier was only sent for when it was noticed that the intestines were protruding from the vulva; on his arrival the Mare was dead. The small intestine and floating colon, pushed through a rent in the vagina, were fully exposed externally, but not torn, and notwithstanding their expulsion, the abdomen was still considerably distended. As soon as the abdominal walls were incised, a large quantity of uncoagulated blood escaped from the cavity—the result of hæmorrhage from the ruptured vagina. The fœtus was in the anterior presentation, vertebro-sacral position, the lower part of the head pressed against the brim of the pubis and slightly inclined to the right, although the Mare died when lying on the left side. The uterus and its contents occupied the right flank, and the small intestine and floating colon, more free than the large intestine, pushed by the other portions of the intestinal mass by the efforts of the mother, had passed through a rent on the left side of the vagina, close to the cervix uteri which remained intact. The rent was irregular, and sufficiently large to admit the fist; it extended lengthways, and its borders were ragged, ecchymosed, red, and thickened, with considerable extravasation of blood in the connective tissue. The stomach and large intestine contained a great quantity of alimentary matters, and Galtier is inclined to attribute the rupture to this condition, together with the faulty position of the foal and the recumbent attitude of the Mare. He points out that a trifling amount of manual skill in raising the head of the fœtus would probably have prevented the accident; that the full condition and exaggerated volume of the first portions of the digestive tube may have contributed to bring about the misdirection of the fœtus; that when parturition is near, animals should not receive food in too great bulk; that assistance should be sought for immediately the discovery is made that birth is delayed; and that when the life of the mother is compromised, the Cæsarean section should be practised without delay, in order to preserve the offspring.

Complications of Ruptured Vagina.

We have mentioned some serious complications of ruptured vagina, in which adjacent organs and tissues were involved. These are chiefly the rectum, bladder, and the perinæum, one or more of which may be perforated and torn, along with the vagina. These ruptures vary in extent and gravity,

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and while some of them are necessarily fatal, others are not so; though they may lead to serious deformity and inconvenience, such as accompany chronic fistulæ in important regions. We will follow the example of Saint-Cyr, and consider them under the head of *recto-vaginal fistula, rupture of the perinæum*, and *vesico-vaginal fistula.*

Recto-Vaginal Fistula.—Injuries to the rectum are generally produced through the wall of the vagina, during the passage of the fœtus. When the salient parts of the latter, and more especially the feet, are misdirected and pressed up towards the sacrum of the mother, and if the rectum chances to be distended with fæces, not only will the vagina, but this viscus also may be perforated, and some portion of the fœtus will soon appear at the anus. If this accident is discovered in time, it may be possible to push back the parts thus misdirected into their natural outlet, and complete delivery by the vagina; but, notwithstanding this happy termination, the communication between the vagina and rectum very often remains permanent, and we have a recto-vaginal fistula.

The treatment of these cases is not always satisfactory, so far as a perfect cure is concerned. Sutures have sometimes been employed to close the wound in the rectum, when it was sufficiently accessible. But this surgical operation can rarely be resorted to, and all that can be done is to keep the lacerated parts clean, by frequent injections *per vaginam* and *rectum*, prevent constipation, and treat the injury on ordinary principles—not forgetting the free employment of antiseptics.

If sutures are employed to close the fistula, they may be supported by a pessary or tampon placed in the vagina, beneath the fistula.

When the limbs, or other parts of the fœtus, protrude through the anus, it is nearly always advisable to amputate them, in order to effect the replacement of the remainder more easily in the vagina, and with less risk of further injury to the parent. Once in the genital canal, then the fœtus can be extracted in the ordinary manner. Opiates should be largely administered.

1. Cruzel (*Journal de Méd. Vétérinaire*, 1832, p. 153) had his attention directed to a Cow, which, after aborting, had a fistulous opening between the vagina and rectum, through which a portion of the fæces escaped. These caused a great and constant irritation in the vagina. The animal was in a state of marasmus, and was therefore killed.

2. Favre (*Le Vétérinaire Campagnard*, p. 300) was shown a Mare, which the groom found with some pellets of fæces in the vulva. Removing these, others followed. There was no external lesion apparent, but, on examination, Favre discovered in the floor of the rectum, about five fingers' breadth from the anus, a longitudinal fissure from five to six inches in length, the borders of which were cicatrised, and came together when the rectum was empty. The roof of the vagina was fissured in the same direction, and the corresponding borders of the two fissures were adherent; so that a free and direct communication existed between the rectum and vagina. The cause of the fistula was not known, and no treatment was adopted.

3. Mongau (*Annales de Méd. Vétérinaire*, 1856, p. 406) was called to assist a Mare in labour, and found the fœtus in a wrong position. The head, neck, and a fore-limb of the young creature had passed through the wall of the vagina into the rectum, while the other fore-limb protruded from the vulva. The parts in the rectum were pushed back through the rent, and the fœtus was placed in its normal position, and extracted. In a short time the Mare was sufficiently well to be sold. Mongau adds that this was not the first time he had to treat such a case, and he remarks that when the parent lives, the tear in the rectum does not entirely close—there always remains an opening by which fæcal matters pass into the vagina.

4. Dupont (*Recueil de Méd. Vétérinaire*, 1858, p. 105) was consulted about a Mare which the stud-groom at the stallion-station of Bordeaux declined to put again to the horse; as, at each attempt the latter had the penis covered with fæces when it was withdrawn from the vagina. Externally, there was nothing wrong noticed with the

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Mare; but, on the hand being introduced into the vagina, there was found in the roof of that canal an opening into which the fingers could be easily passed. At that moment the animal passed fæces, and, on the hand being withdrawn, it was soiled by excrementitious matters. The fistula was in the middle part of the canal, and was between two and three inches in length. When the rectum was empty, its borders were in apposition; these were thick and irregular, from the presence of large, soft granulations, which bled readily. Dupont did not see the animal again after this examination.

5. Griois (*Ibid.*, 1859, p. 411) relates that a farmer, in the vicinity of Amiens, was aroused during the night, owing to one of his Mares which was in labour. The foal was apparent, and he set himself to pull it away. The task was a long and difficult one; but, aided by two neighbours, it was at length accomplished—the fœtus being extracted, and the envelopes soon followed. It was not until late next day that it was discovered that the foal had been removed *per rectum*. Griois being then called in, made the following observations: The anus, from which the *débris* of the fœtal envelopes still hung, was much lacerated in every direction, but especially at its lower part; it was also considerably swollen. The vulva, on the contrary, did not offer anything unusual—not even the slightest infiltration. The hand, on being introduced into the rectum, perceived at about six inches from the anus, a rupture, eight inches long at least, with ragged margins, and corresponding to a similar rent in the uterus (vagina?). Through the openings the hand could not only be passed into one or other of the canals, but also into the abdominal cavity, *where the fæces which had escaped from the rectum could be already felt*. The fissure in the rectum was sutured, and appropriate treatment adopted. In eleven days the wound in the intestine was cicatrised, and some months afterwards, the animal was sold for a good sum.

6. Lecouturier (*Annales de Méd. Vét. de Bruxelles*, 1867, p. 268), was called upon to examine a Mare, which, two months after parturition, exhibited unsteady gait, rigidity of the loins, difficulty in rising, and pain in defecation, discovered, on rectal exploration, a tumour on the anterior part of the left side of the pelvis. An examination *per vaginam* led also to the discovery of a solution of continuity of the vaginal wall, at a point corresponding to the tumour. From the bottom of this wound was removed the remains of a fibrinous clot, the whole of which could not be brought away, even after the opening was enlarged. It was then found that the recto-vaginal septum was perforated. Green food was prescribed, as well as emollient enemas, and slightly stimulant injections into the vagina. In six weeks the fistula was cicatrised.

7. André (*Ibid.*, 1864, p. 175) reports that a Mare, four years old, strained very much during parturition when, all at once, the fore-limbs of the foal appeared—one by the vulva, the other by the anus. The owner, who was with the Mare, at once endeavoured to push back the two limbs, and bring that which had entered the rectum into the vagina; having accomplished this, birth soon took place. André prescribed a soft diet, and the application of lard three times a day to the vagina. Cicatrisation, without fistula, was complete by the seventeenth day.

8. Ory (Saint-Cyr, *Op. cit.*, p. 662) had to give his attention to a Mare, five years old, which had foaled on the previous evening. For three weeks previously the animal had exhibited, from time to time, and chiefly during the night, symptoms of colic, which gradually became more marked and frequent, until on the day of foaling it had seven attacks. On the evening of that day appeared the expulsive efforts, and soon the anus began to dilate in an extraordinary manner, until the two fore-limbs of the fœtus appeared at the opening, and then the head showed itself. At last, under the influence of a violent effort, the anus, which seemed to have attained its extreme limit of dilatation, tore, and gave exit to a well-formed and lively foal.

When Ory arrived, the poor Mare was in a state of great prostration. The *sphincter ani* was lacerated to the extent of four inches; the rupture extending obliquely downwards and outwards, and from right to left, passing through the skin, and exposing a portion of the left semimembranosus muscle, though the perinæum was uninjured. On introducing the hand into the vagina, it was noted that this and the rectum formed together one vast cavity, containing a certain quantity of well-moulded fæcal pellets. The anus, which had been so violently dilated, remained wide and flaccid. Ory did not attempt to repair these enormous lacerations, but limited his treatment to removing, three times a day, and by hand, the fæcal pellets which fell into the vagina; to cleansing the cavity as thoroughly as possible, and to injecting a mixture of oil, carbolic acid, and an infusion of elder-flowers; while the external wound was dressed with a decoction of oak bark, to which acetate of lead was added. This treatment was continued for fifteen days, and in about three weeks the external laceration was almost cicatrised; the animal's health was good; but the vagina and rectum remained as a single cavity, and forming a kind of cloaca, where the fæces accumulated.

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The owner stated that, since the accident, the Mare could only be worked at a slow pace on the farm. As soon as it began to trot, a noise was heard, due to the air rushing out and in to the fistula. Then the animal became tympanitic, and evinced symptoms of colic. Then, also, the urine and fæces were sometimes ejected simultaneously from the anus, which was always dilated; but these passed by their natural channel when the Mare was at rest.

9. Schrader (*Magazin für die Gesammte Thierheilkunde*, 1837, p. 261) was requested to examine a six-year-old Mare, which had been purchased a few days previously. When the animal micturated, fæcal pellets came away at the same time. A rectal exploration, as far as the arm could be inserted, did not discover anything amiss, until, on withdrawing it with the fingers downwards, an opening was encountered, which led in an oblique direction from the rectum to the upper part of the vagina. A finger could be easily passed from the vagina into the rectum. The opening was about an inch in diameter, but it could be readily dilated; its borders were even and smooth, and the animal did not evince any pain when they were touched. The Mare had produced one foal. The fæces were tolerably well retained in the rectum, but flatus always passed through the vagina.

10. Hawthorn (*Veterinarian*, vol. vii. p. 28) was sent for to see a Mare which was reported to have the foal "coming the wrong way." Hawthorn was struck with the singularity of the case. "The foal was protruded as far as the middle of the chest, and the fore-legs were almost a yard asunder—one hanging down towards the thighs, and the other standing up above the tail. The body of the foal was lying on its off-side: of course it was dead. The left leg had, in the act of foaling, been forced through the rectum, and then through the anus." The Mare was cold and feeble; the pulse was scarcely perceptible, and the animal appeared to be sinking rapidly. It was decided to extract the fœtus by embryotomy. "The nearest place which was suitable for the operation, was a barn a quarter of a mile distant, to which she was immediately walked; and as I followed her, and witnessed her staggering gait, I felt as if she was going to execution. She was thrown, and pulleyed up to a joist. The near leg of the foal was dissected off at the knee, and, by the right hand, forced back into the vagina, where it was received by my left hand, and drawn a little forward. As the only obstacle to the foaling was now removed, the remaining part of the operation was soon accomplished, and the Mare got on her legs. The wound through the rectum was terrific, as I had easily passed my arm through it. She was then walked home, and seemed much better." The animal was dieted on wet bran and clover for a week. The rectum was emptied manually two or three times a day, and the vagina washed out. "The fæces which escaped through the wound into the vagina were not wholly expelled; it was therefore necessary to cleanse the vaginal passage. The wound in the rectum healed very rapidly, and the Mare never exhibited any unfavourable symptoms after the extraction of the foal." The animal, soon after, was put to work, as if nothing had happened.

11. Morgan (*Ibid.*, vol. xxviii. p. 397) was hastily sent for to see a Mare which was foaling, but the foal was "coming the wrong way." When he arrived he found the animal lying down, groaning, and straining violently, and the head, neck, and one fore-leg of the foal through the rectum, and the other fore-leg through the vulva. The Mare was induced to get up, hobbles were applied, and then the parts of the fœtus protruding beyond the anus were excised as close as possible. The *sphincter ani* was dilated, the parts in the rectum pushed through the rent in that viscus into the vagina, and with a little assistance the remains of the foal were extracted by the vulva. The Mare received opiate and laxative draughts, and soft diet. "Without entering into further details, the animal was under my care for about a fortnight, when she was sold to a builder for £18, and is at present working in a brick-cart, perfectly well."

12. Hudson (*Ibid.*, vol. xlv. p. 409), called to attend a case of difficult parturition in a five-year-old Mare, with the first foal, found, on arrival, that the persons in attendance had delivered the animal, and that during labour the head and neck of the foal had protruded from the anus of the mother nearly as low as the hocks of the latter. When first observed, one foot of the foal was protruding from the vagina, "with the other foot pointing upwards towards the spine, and after pulling it downwards into position, the next pain sent the head into the place which the foot had previously occupied, and a second pain forced the head through the passage and out at the anus." The foal was alive, but to effect delivery the head was cut off, which allowed the neck to be pushed back into the vagina, and delivery to be accomplished. "The Mare looked anxious and unsettled. Her head was held high, and she was paddling with the hind-legs, and whisking the tail occasionally. The pulse and respiration were both somewhat quickened. On an examination being made *per*

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vaginam, I was enabled to pass my hand through a large rent, and to touch the fore-finger of the other hand, which I had passed into the rectum." An anodyne and aperient bolus was administered, the animal ordered to be kept quiet, the parts to be fomented and dressed with lard, and the fæces to be removed if they accumulated. Next day the rectum was emptied, and an enema of warm water administered. The injured parts were dressed with tincture of myrrh, and the mucous membrane lubricated with lard. The appetite remained good. Next day there were indications of congestion of the fore-feet, for which treatment was prescribed, and the rectum was emptied and cleansed as before. Two days afterwards a small quantity of fæces had passed into the vagina, and the following day there was much discharge, and a piece of dead tissue hanging out of the vulva. Thirteen days after the accident, some fæcal pellets still dropped into the vagina, and this appeared to be the only inconvenience. "The rent in the rectum has contracted considerably, and seems to be partly arched over by a portion of the lining membrane projecting from the antero-inferior part of the laceration. Posteriorly, the edge of the lesion feels now only just within the anus, but there is not the slightest indication of union by healing." Soon afterwards the Mare went to regular work.

Rupture of the Perinæum.

Laceration of the vagina is not at all unfrequently complicated with more or less extensive rupture of the perinæum, and occasionally we may meet with rupture of the vagina, rectum and perinæum in the same animal. Sometimes it is only the *fourchette* and superior commissure of the vulva which are involved; in others the entire extent of the perinæum is lacerated, and the lesion only ends at the anal sphincter; while in others, again, the sphincter and part of the rectum are included.

If, in malpositions of the fœtus, assistance is not timely afforded—and particularly in the Mare—so as to correct the deviation, the young creature is pushed outwards by the violent uterine contractions, and if it enters the rectum the anus is dilated; while, if the expulsive efforts are continued, the sphincter and all the tissues between it and the vulva are greatly stretched and strained until they tear. Then the fœtus is finally expelled—sometimes dead, at other times alive—and there remain the most startling and immense lacerations which convert the rectum and vagina into one vast opening, into whose cavity, as Saint-Cyr observes, the termination of the digestive and genito-urinary organs open in common.

These ruptures, immediately after birth, appear two or three times larger than they are some days afterwards, when the distended textures have contracted somewhat; the borders of the laceration are sometimes even, in other cases uneven, ragged, and shreddy.

The consequences are variable, according to the extent of the injury. Moderate laceration does not usually prove very prejudicial; but if severe, serious inflammation of the perinæum, extending sometimes to neighbouring tissues and organs, sets in. If the tear involves the anus and its sphincter, there will be involuntary escape of fæcal matters and flatus; and in the most formidable cases—those in which the vagina and rectum form one wide gaping cavity—the mucous membrane is irritated by the free admission of air and excreta, inflammation and suppuration ensue, fistulæ are formed, and the poor animal only too often presents a painful and repulsive spectacle.

In other instances, partial recovery takes place, and the animals do not appear to be much affected or inconvenienced. They maintain good health, rear their progeny, if it chances to be born alive, and may even bring forth young again, though the laceration has not cicatrised.

The treatment will vary, according to circumstances. If there is much

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hæmorrhage, styptics must be employed; if the bleeding is slight, cold may check it; but if severe, perchloride of iron must be used.

The lacerated margins, if much torn, must be freed from shreds, which are likely to lose, or have already lost, their vitality. They must then be brought together by sutures—either of metal, or carbolised silk or catgut. Cold water dressings may then be applied; or styptic colloid, collodion, or carbolised glycerine may be employed. The parts must be kept as clean as possible, and the animal not disturbed or allowed to lie down until union has been effected. With this object a narrow stall is to be preferred. The sutured septum should be supported from the vagina, by a tampon placed therein. This will tend to prevent the pressure of fæces tearing away the sutures in the floor of the rectum, and this result will also be greatly obviated by administering enemas frequently, and covering the mucous membrane with lard. Sloppy food should be given as diet. Fever and other unfavourable complications must be treated according to their indications. Opiates will prove of great service; and if there is much local disturbance or straining, suppositories of opium are to be recommended.

There are not, so far as I can ascertain, any instances of this accident recorded in English veterinary literature. We shall therefore give a few derived from foreign sources.

1. Cruzel (*Journal de Méd. Vétérinaire*, 1832) mentions that a Mare, ten months pregnant, aborted a living Mule, one of whose limbs, during parturition, had passed through the rectum. A veterinary surgeon attempted to extract it, but not succeeding owing to the obstacle this limb presented, he prolonged the rupture to the anus. The Mare died next day.

2. The same authority saw a she-Ass which had the posterior third of the rectum ruptured, as well as the anus. It was not much inconvenienced.

3. Dupont (*Recueil de Méd. Vétérinaire*, 1858) relates that an empiric being called upon to deliver a Mare in parturition, seeing the feet of the foal protruding from the anus, knew nothing better than to pull at them, and thus extract the young creature through the rectum. Four days afterwards Dupont was sent for, and he found that defecation had not taken place for three days; there was considerable tumefaction in the ano-vulvar region: from the anus to the vulva all the textures were torn and bleeding, and the external borders of the rupture overlapped each other in large swollen masses; the inferior parts of the vulva were covered by the continual escape of the vagino-intestinal excretions. The injury exhaled a very fetid odour. The rectum and vagina were emptied of the fæcal pellets which encumbered the vast cloaca, and then the injury was seen to its full extent. From the cervix uteri to the roof of the intestine, the vagina and rectum formed one vast cavity. The *plica palmata* of the cervix were visible as thick dark-coloured ridges, between which excrementitial *débris* was incrusted. Superiorly, the rectum appeared gaping, and aspiring the air like the piston of a steam engine. The line representing the recto-vaginal septum divided the cavity, in the form of a small red and irregular ring. The mucous membrane was ecchymosed and very congested; the cervix was seriously inflamed. For fifteen days nothing was done but merely keeping the parts clean. At this time the inflammation in the borders of the external wound had disappeared, and repair was going on along the perineal rupture; internally, the mucous membrane had nearly assumed its normal appearance, and scarcely anything remained of the vagino-rectal diaphragm; there was no suppuration or ulceration. Dupont then decided to resort to autoplasty to repair the serious damage, and fixed on the Indian method. "I slowly introduced my left hand into the vagina, and extended the canal by pressing strongly on its sides. The right hand, armed with long fine scissors, pared to the blood the edges of what remained of the septum. Then with a needle armed with a waxed thread, I commenced to bring these edges together by suture, the sutures being eight in number . . . I then passed to the perineal laceration. With the scissors, I destroyed all the granulations as low as the skin. I then applied sutures, securing each by a distinct knot. . . covering the whole externally with a thick layer of collodion."

Every care was taken to ensure success, and for eight days everything appeared to be going on favourably; but on the ninth day it was observed that some of the recto-vaginal sutures had given way, and that the wound had not united; and in two days

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afterwards all the sutures had sloughed through, without the least union having been effected. Nothing discouraged by this failure, Dupont again resorted to sutures, and when the edges were once more brought into apposition by them, with a curved bistoury he cut through the vaginal mucous membrane parallel to the sutures, but at a few lines from the roof, in order to diminish the tension. For fifteen days all went on satisfactorily, and success appeared to be certain, when the same result ensued. Dupont then gave up the case, and the Mare, which had been in excellent health during the seventh month's trial, was sent to work.

4. André (*Annales de Méd. Vétérinaire de Bruxelles*, 1864) was summoned to aid in the delivery of a Mare, ten years old, whose foal was being expelled through the anus. When he arrived it had been delivered, and did not appear indisposed; the foal was well and lively. The birth, which was spontaneous, appeared to have been very rapid; for the servant, as soon as he saw the feet of the foal appear at the anus, ran for his master, and when he returned the foal was born. On examining the Mare, André found a complete rupture of the perinæum, and, consequently, a total absence of any septum between the anus and vulva—the rectum and vagina being merely one large opening. It was also observed that this lesion involved the contiguous walls of these parts to some extent; and on separating the labia of the vulva the cervix uteri could be seen. The fæces were passed by the vulva.

No attempt at repair was made, and treatment was merely directed towards subduing inflammation. A month afterwards the wounds were cicatrised, but not united. The general health was good, but defecation took place by the vulva more frequently than usual, and involuntarily.

5. Jouet (*Rec. de Méd. Vétérinaire*, 1873, p. 56) gives the detailed history of a Mare belonging to Prince Ney of Moscow, and with which, during parturition, the foal could not pass through the vagina, in consequence of the narrowness of that canal; it therefore passed into the rectum, and was born through the anus. About eighteen months after this accident, the rupture, which established a communication between the rectum and vagina, was ten inches in length, and formed an infundibulum in which the fæces accumulated before being expelled by the vulva. The anus appeared to be inert, and did not act. The clitoris was hypertrophied. Notwithstanding this infirmity, the Mare lived for many years, and neither suffered in health or vigour. It was even fecundated without accident, and brought forth a foal with ease. When put to the stallion a second time, however, it received serious injury, lost condition, fell into a state of marasmus, and died.

6. Saint-Cyr (*Op. Cit.*, p. 665) states that the internal clinic of the Lyons Veterinary School received a Mare, five years old, and a primipara, which had brought forth its foal *per anum*, under the following circumstances. Six days previously it exhibited the first signs of parturition. Soon the two fore-feet of the fœtus appeared at the vulva, and quickly after the nose appeared, but at the anus. While the proprietor was in search of a veterinary surgeon, the foal was born without any assistance. It soon died, and when the surgeon came he saw an immense rupture in the Mare, comprising the perinæum and the whole of the recto-vaginal septum. Otherwise the Mare did not appear to be much disturbed, but ate and drank heartily. The veterinary surgeon declared that he could do nothing for the animal; consequently it was sent to the Veterinary School. When it reached there, nothing particular was observed except a slight swelling of the left hind-leg, which caused marked lameness. On raising the tail there was immediately observed a considerable tumefaction of the vulva and anus, then a complete rupture of the perinæum—an irregular laceration rather to the right side, and which made the anus and vulva one long slit. When the great cavity was freed from the mass of fæces it contained, the half-open os uteri could be seen at the far end, while above were the remains of the recto-vaginal septum. The latter was destroyed throughout its entire length, so that the rectum and vagina communicated freely with each other for at least five inches, and their union formed a vast cloaca, in which the fæces gradually collected. The borders of the rupture had commenced to granulate. On the floor of the vagina, not far from the bulb, there were two other wounds of some length, which involved the mucous membrane throughout its thickness—one to the right, the other to the left—from which escaped a quantity of pus.

Rather for the instruction of the pupils than in the hope of effecting a cure, the autoplastic procedure adopted by Dupont was resorted to. The remains of the recto-vaginal septum were made raw, and united by the interrupted suture: six sutures being made without much difficulty; so that, when the operation was completed, the margins of the rupture were in exact apposition and the septum re-established. This was the most difficult part of the operation, as the perineal sutures were easily placed. The rectal and vaginal cavities were thus once again separated, as in the normal con-

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dition. During the day of the operation, the animal appeared to suffer and was restless; it was unable to defecate spontaneously, and the rectum had to be emptied several times, during which manœuvre the sutures were interfered with, the tissues strained, and next morning it was discovered that several of the stitches had given way; so that the edges were not exactly in contact, excrement had passed between them, and it was necessary to again attempt the task of restoration. This, however, was not ventured upon, and nothing was done but to keep the parts clean. Cicatrisation occurred without any noteworthy circumstance except the formation of an intermuscular abscess, which developed towards the middle of the right thigh, discharged a large quantity of pus, and healed slowly. In a month the animal had recovered, so far as general health was concerned, but the infirmity still existed, and rendered the creature almost valueless.

Vesico-Vaginal Fistulæ.

When the floor of the vagina is ruptured, it may happen that the neck or walls of the bladder are involved in the lesion, just as that viscus may, as we have seen, become prolapsed or hernied through the vaginal rent. When rupture of the bladder occurs in this manner, the case is indeed serious. The urine is no longer confined to its receptacle, but escapes through the laceration and becomes infiltrated in the pelvic connective tissue. Hence arises most serious complications: pelvic cellulitis and *urinæ-abscess*, which rapidly lead to a fatal termination. In less formidable cases, the urine may escape by the vagina, but involuntarily; so that the incontinence of urine not only proves a troublesome infirmity, but the constant passage of this fluid over the membrane lining the vagina gives rise to intense inflammation of the canal, and leads to the formation of a vesico-vaginal fistula. This fistula may also be produced by usure or bruising. When the fœtus is very large it occasions over-stretching of the vagina, and if it remains for any length of time in the passage, this distention weakens the vitality of the soft tissues; so that the compression to which they are submitted between the fœtus and the floor of the pelvis will produce mortification, which may extend to the neck of the bladder. The resulting sloughing, should the animal survive, will establish a direct communication between the vagina and bladder.

An animal may live with a fistula of this description, provided urine-abscess, uræmia, or other serious complications do not result.

The *symptoms* need not be specified. The chief is incontinence of urine. When this fluid is observed to be constantly dribbling from the vulva after parturition, the existence of the accident may be suspected, and an examination *per vaginam* will confirm the suspicion.

Treatment must be mainly palliative.

Dupont (*Rec. de Méd. Vétérinaire*, 1858, p. 1057) examined a fine, well-bred, four-year-old Cow, which was in good condition. The animal emitted a very penetrating acid odour, which extended to some distance around it. The tail was entirely denuded of hair; a vast ulcer occupied all the posterior regions, from the inferior commissure of the vulva down to the claws of the hind feet. After washing the parts well with chlorinated water, the hand was passed into the vagina, and a large wound was discovered in the middle of the lower and posterior part of that canal, but it was partly concealed by large, ragged, and irregular vegetations. Pus, thick and plastic secretions, and a thin layer of salts, gave to the touch the sensation of a calcareous powder occupying the bottom of the wound, which was bathed by a permanent "sweating" of urine. When this part of the vagina had been well cleansed, it was observed that there was a considerable loss of substance, and that about three inches of the ischial symphysis was denuded. The irregular borders of what remained of the vagina, stood nearly an inch above the bony surface; great movable, and spongy granulations partly covered the symphysis, and appeared to be the seat of an abundant suppuration. Beyond this the retracted bladder could be felt. The vaginal

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mucous membrane was of a bright-red colour, and the whole of its inferior surface was ulcerated. The place where the hind-feet of the animal had stood during the few minutes' exploration was saturated with urine.

No information as to the date or origin of the lesion could be procured.

SECTION III.—THROMBUS OF THE VAGINA AND VULVA.

Thrombus or *hæmatoma* of the vagina and vulva is sometimes observed after parturition, and is due to an infiltration of blood into the connective tissue of these parts, from the almost inevitable injury they sustain during laborious parturition.

In such cases, when the fœtus is very large, or in a wrong position, considerable manipulation and traction are often necessary to adjust and remove it; and this leads to bruising of the soft parts against the pelvis, and laceration and rupture of the bloodvessels and connective tissue. The bloodvessels are larger, and probably more numerous, during pregnancy than at other times; consequently, there results extravasation of blood, and considerable tumefaction of the genital canal, particularly in the vagina and vulva. Sometimes this tumefaction appears during parturition, when it may form an obstacle to birth.

The mucous membrane is raised into irregular masses, perceptible to the eye, and still more marked to the touch. The membrane itself has a blue, violet, or black tint; the labia of the vulva are considerably swollen, and the engorgement may extend to the thighs and croup.

If there is not much extravasation, the effused blood may be absorbed in a few days; but if the thrombus is extensive, the blood becomes decomposed, gives rise to inflammation, may run on to gangrene, and septic infection may consequently ensue.

As to treatment, scarifications are above all things to be recommended.

Samson, who has had much experience of such cases, says that the labia of the vulva should be well separated, and a bistoury plunged into the right and left walls of the vagina, as if to open an abscess, and the incision should be large, in proportion to the quantity and situation of the clots; pressure must then be made, so as to remove the latter.

The operation appears to be quite innocuous; though a case is recorded by Cartwright (*Veterinarian*, vol. xix. p. 386) in which a great stream of blood issued from one of the punctures, in consequence of a large vein being wounded.

When all the extravasated blood has been removed from beneath the mucous membrane or skin, cold water injections and sponging, and weak solutions of carbolic acid, permanganate of potash, or other detersive and disinfecting fluids, should be resorted to. The same treatment is to be adopted when suppuration has set in, only more attention must be paid to the disinfective treatment.

SECTION IV.—RELAXATION OF THE PELVIC SYMPHYSES.

This accident, which is far from common in woman, is still more rare in animals; and there appears to be only one case recorded—that by Gilis.

Gilis (*Journal des Vétérinaires du Midi*, 1858) alludes to the case of a Cow, eight years of age, which, nineteen days beyond its time for calving, commenced to strain very much. All at once it ceased, bellowed, flexed its fore-limbs, lay down, and began to strain again. In a short time it brought forth a calf in a natural manner. From this time it lay almost constantly, and could only rise with great difficulty. Then it could scarcely move, and its hind-quarters swayed from side to side: the

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ilium of either side rising or falling, as the corresponding limb sustained weight or was raised from the ground. The hand passed into the rectum, found the *sacro-iliac* articulation painful on pressure. There was no abnormal sensibility in the ischio-pubic symphysis; but when the animal walked, the index-finger placed on one pubic bone and the medius on the other, felt an alternate movement of these bones, in harmony with that of each ilium. The sacro-pubic diameter of the pelvis appeared to be diminished, while the bi-iliac was slightly increased. The internal angle of the iliums forming the summit of the croup, projected more than four inches above the spines of the sacrum, which appeared to be as much buried between these angles.

From these symptoms, Gilis diagnosed a partial disjunction between the pubic and sacro-iliac bones. Deeming the case incurable, he recommended that the animal should be fattened and killed. Some months after the examination, it was in the same condition. The accident was attributed at first to pregnancy, then to the exertion the Cow made in draught until parturition, and finally to the act of parturition itself.

SECTION V.—RUPTURE OF THE BLADDER.

Rupture of the bladder alone, during parturition, would appear to be an unusual accident, from the almost total absence of mention of its occurrence. That it may happen, however, is beyond dispute, and the cause of it is obvious. In the Mare the act of parturition is hurried and energetic, and if it occurs while the bladder is distended with urine, the pressure of the fœtus during expulsion may rupture this viscus, and particularly if the rectum above is also full of fæces, the fœtus large, and perhaps in a wrong position.

The extravasated urine gives rise to peritonitis, and the animal will present the symptoms of that most painful inflammation. Death is inevitable.

1. Furnivall (*Veterinarian*, vol. xxxiii. p. 377) was hurriedly called to attend a six-year-old cart Mare, which had brought forth in previous years two foals, and had then foaled fourteen days before its anticipated time. Early in the morning the waggoner entered the stable where the Mare stood along with five other horses, and found the animal with a foal hanging from it, the hips being fast in the vagina. He removed the Mare at once to an empty stable, and went to inform the owner. During his absence, according to the statement of a boy who remained, it heaved violently and ejected the foal, which alighting on its head, dislocated the second and third cervical vertebræ, and did not move afterwards. The Mare then commenced throwing itself about and breathing quickly, striking at the abdomen with the hind-limbs, and, when up, reeling like an intoxicated animal. It appeared to be in the most terrible agony, and in a short time fell down as if shot, and died. This occurred before the arrival of Furnivall, who made an examination of the body. Every organ was found to be perfectly healthy both in the thorax and abdomen, with the exception of the bladder, which was ruptured to the extent of three inches, and the urine it contained had necessarily escaped into the peritoneal sac.

2. Overed (*Ibid.*, vol. xxxvii. p. 505) communicates a case of peculiar interest, in which a Mare, twelve years old, had given birth to a living foal about four weeks previous to his advice being sought. Assistance had been rendered by some farm-labourers, after which the Mare was observed to micturate more frequently and in smaller quantities, the effort being accompanied with pain. Put to the stallion nine days after parturition, the symptoms became more aggravated, the desire to micturate being almost continuous; but nothing in the way of advice was sought for until a later period, when being put into a pasture, the animal suddenly ceased feeding, trembled violently, lay down, rolled several times, got up, and after much straining voided only a few drops of urine, great pain being evinced, and the body was covered with perspiration. Fæces were freely passed. Great prostration was manifested next day; there was straining at intervals, the anus and vulva were intensely swollen, the latter being much inflamed. The bladder was discovered to be quite empty and firmly contracted within the pelvis, and the finger passed into the urethra caused a spasmodic ejection of only a few drops of urine. The Mare died during the evening of the examination. On opening the abdomen a large quantity of fluid—from ten to twelve gallons—escaped; this proved to be urine, with possibly a small quantity of

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serum, as the peritoneum exhibited slight traces of inflammation. The omentum was very dark in colour, and covered with a thin sabulous deposit, some of which was also found adhering to the cæcum, colon, and bladder. The latter was inflamed, unusually thin at the fundus, in the centre of which was a rupture through which a finger could be passed in the contracted state of the organ—the rent would be much larger when the viscus was distended. The injury was supposed to have been inflicted during parturition, when probably the bladder was injured at the fundus, and this led to sloughing at the part where the rupture occurred.

SECTION VI.—RUPTURE OF THE INTESTINES.

There are some instances recorded in which rupture of the intestines has occurred during parturition, without the uterus or other organs being involved. The accident may have been due to over-repletion of the stomach and intestines with ingesta, and the energetic action of the abdominal muscles during the labour pains; or from the animal throwing itself down violently, under the same circumstances.

Schaack mentions a case in which rupture was due to a loop of intestine being compressed between the fœtus and the brim of the pelvis, when the former was passing through the genital canal.

Such an accident is beyond remedy.

SECTION VII.—RUPTURE OF THE DIAPHRAGM.

Rupture of the diaphragm is a rare occurrence during parturition, and I can only find three cases recorded. They were probably due to the same causes as those which produce rupture of the intestines. Death resulted.

1. Molin (*Recueil de Méd. Vétérinaire*, 1837) was consulted concerning an old Mare which was in foal, but nothing was known as to when fecundation had taken place. The extraordinary size of the abdomen and the movements of the fœtus, left no doubt as to pregnancy, and as the period for birth had been exceeded, there were suspicions that it was a case of extra-uterine pregnancy. However, a few days subsequently labour pains set in, and after the animal had been very uneasy for some time they ceased. Two days afterwards, the Mare was again uneasy from time to time, and refused all food. These attacks once more subsided, but in four days a message was sent that the animal was voiding its bowels through the vagina. When Molin arrived, the Mare was dead, and a great part of its intestines were spread over the litter. An examination was made, when the uterus was found to be of an enormous size, the body and cornua forming one vast sac; it had entered the thorax through an enormous rupture in the diaphragm. "This probably had been produced by the violent straining, and was the immediate cause of death." There was a rent in the vagina near the symphysis pubis. The cervix uteri was extremely dense, and the walls of the vagina were also rigid. The os had not dilated. The fœtus weighed 140 pounds.

2. Hayes (*Veterinarian*, vol. xiii. p. 268) performed the Cæsarean section on a Cow, and for twelve days it appeared to be going on favourably, when it died in a few hours. A rupture of the diaphragm at its central part, extending for three inches, and with much inflammation around it, was found. The wound in the abdomen and uterus was healthy, but the vagina was very dark-coloured and jelly-like. Death in this instance may have been due to septikæmia; though Hayes was of opinion that it was owing to the rupture in the diaphragm

SECTION VIII.—RUPTURE OF THE ABDOMINAL MUSCLES.

We have at page 272, when treating of "Hernia of the Uterus" during pregnancy, explained under what conditions, and the manner in which, rupture of the abdominal muscles occurs. The accident can scarcely be designated as one consecutive to parturition; but its treatment may nevertheless engage the attention of the veterinary surgeon, after the uterus has been emptied of its contents. In the same section allusion has been made to the appropriate measures.

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SECTION IX.—RUPTURE OF THE SACRO-SCIATIC LIGAMENT.

We can only find one case of this accident on record; so that it must be extremely rare. It is given by Naylor (*Veterinarian*, vol. xxxiii. p. 321), and the subject was a three-year-old cart Mare, which had a mal-presentation. The animal was down, and the fore-feet of the fœtus protruded beyond the vulva, but the head was not visible, it being bent back to the side of the chest; the young creature was dead. Embryotomy was resorted to, and one limb was about to be removed, when the uterus suddenly contracted with great violence, and half expelled the foal; traction then removed it. "All attempts to get the filly up were ineffectual, and an examination showed that a rupture of the sacro-sciatic ligament on the right side, with other lesions, had taken place." Stimulants and laxatives were administered, and a mustard plaster applied to the loins. "In two days she was on her legs, and tottering about the yard. Suffice it to say that she ultimately recovered, and though for two years the off-quarter was less in size than the other, she ultimately got quite well, and had two or three foals."

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BOOK V.

PATHOLOGY OF PARTURITION.

UNDER the head of Pathology of Parturition, we intend to include those diseases which accompany or follow this act, and are more or less related to it. Some of these maladies are of great pathological interest and practical importance, and deserve the closest study. The parturient or, if we might use the term, puerperal period, is a very remarkable and critical one in the life of the female animal, and it becomes all the more so as the creature is submitted to the influences of domestication, and is rendered more and more artificial by skilful management and breeding.

During pregnancy, a large amount of nutritive material has been abstracted from the parent to nourish and develop the fœtus, and when birth takes place this is retained until the lacteal secretion has been fully established. Consequent upon this reflux, there is established a kind of plethora, which, together with the nervous excitement and succeeding prostration induced by the straining and pain of labour, renders the animal more susceptible to the influence of morbific causes of various kinds. Hence we have maladies which are peculiar to the parturient state, or if common at other times, are at least much aggravated when they appear at this period. Though the parturient diseases of animals are not so numerous as those of the human female, yet they are neither unimportant nor few; and it is possible that, with the advance of veterinary science, their number will be increased—so far as exact definition and differentiation are concerned.

In this respect, the prominent part infection by septic material plays in the development of parturient diseases is to be remarked. It is but recently that this agency has been recognised as one well worthy of consideration in veterinary pathology; and the closer its effects are studied, so the more inclined are we to attribute diseases—and particularly those of the parturient state—to one common source, septic infection.

Of course, there are other maladies or disturbances, chiefly of a local character, the etiology of which cannot at present be traced to septosis, and which merit notice in this part of our work.

The diseases which we have to consider are: 1. *Vaginitis;* 2. *Leucorrhœa;* 3. *Metritis, Metro-peritonitis,* and *Parturient Fever;* 4. *Parturient Apoplexy;* 5. *Post-partum Paraplegia;* 6. *Parturient Eclampsia;* 7. *Epilepsia Uterina* or *Mania Puerperalis;* 8. *Parturient Laminitis;* 9. *Mammitis;* 10. *Agalactia;* 11. *Injuries to the Teats.*

CHAPTER I.

Vaginitis.

INFLAMMATION of the vagina does not often exist independently, but is generally an accompaniment of inflammation of the uterus, or "Metritis," which, being the more serious evil, masks this malady. Nevertheless, vaginitis may occur independently of metritis, and is then generally due to protracted and laborious delivery, which necessitates manipulatory efforts, the use of instruments, etc., the passage of a very voluminous fœtus, the

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pressure of a pessary, or any other cause which may lead to irritation, bruising, or wounding of the mucous membrane. In very exceptional instances, the inflammation may be indirectly due to the action of cold on the skin, or, as Saint-Cyr observes, the ingestion of very cold water—though this is more likely to induce metritis or metro-vaginitis.

The inflammation may lead to, or be complicated with, ulceration, gangrene, or mortification to a greater or less extent.

The labia of the vulva and the lining membrane are more or less swollen, the latter being of a deep or bright red, brown or livid hue; there may be also patches of congestion and ecchymoses, with wounds or abrasions, and in rare cases we may find phlyctænæ on the surface of the membrane. The temperature of the canal is also greatly increased, while its walls are dry and often adhesive. Micturition is generally painful and difficult, constipation is often present, and there is sometimes much itching in the region of the vulva, which is indicated by the continued attempts the animal makes to rub the part. If the inflammation is severe and extensive, fever will be manifested.

When the inflammation has existed for one or two days, the mucus secreted by the membrane is greatly increased in quantity; it is at first a serous limpid fluid, sometimes streaked with blood; then it gradually becomes thicker and sero- or muco-purulent, soiling the tail and the thighs and hocks, and sometimes becoming so acrid as to cause removal of the hair and excoriation of the skin.

Simple vaginitis, of itself, is not a serious affection, and the inflammation often subsides spontaneously in the course of a few days, or rapidly yields to treatment. In some instances, however, it assumes a troublesome, if not a grave character. When gangrene ensues we may have infective inflammation in the surrounding parts, and large portions of the membrane, or even the skin of the labia, may slough, while the discharge is sanious and fœtid. Baumeister describes a diphtheritic form of vaginitis which he observed in a Cow that had calved a few days before, and which died on the third day. At the autopsy, the vagina, as well as the uterus, was found full of pseudo-membranous productions. Another cow which stood beside this one, and which had calved four weeks earlier, contracted the disease a few days after the Cow that died, and also perished—leading to the supposition that this form of vaginitis is contagious.

The *treatment* of simple vaginitis does not merit much consideration. Cleanliness, attention to diet, and injections of cold or tepid water, or mild astringents, into the vagina, generally succeed in subduing the inflammation. When, however, there is any tendency to acute inflammation and gangrene, or there exists ulceration, sloughing, or even abrasions, disinfecting treatment is advisable—a solution of carbolic acid (2 to 10 per cent.), permanganate of potass, or chlorinated or tar water, being perhaps the best local applications. General constitutional treatment may also be necessary, and especially if the fever runs high, and there are indications of septic infection.

CHAPTER II.

Leucorrhœa

When inflammation of the vagina, and perhaps also of the lining membrane of the uterus, becomes chronic, the more acute symptoms disappear; but the

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vaginal discharge continues, and may even increase in quantity. Usually the fluid is of a white, glutinous, and odourless character; or it may be purulent, muco-purulent, or even chocolate-coloured and sour-smelling, or sanious at times. The secretion is mainly composed of mucus. Histologically, we find mucus corpuscles, an abundance of epithelial cells, probably some pus corpuscles, and at times micrococci and infusoria, particularly the *Trichomonas vaginalis*, which is also found in healthy mucus from the vagina. Sometimes the secretion is only manifest in an intermittent manner —as when the animal is lying down or in movement, or during micturition. It is more frequently observed in the Cow—particularly if lymphatic—than the Mare, and especially if there is bad hygiene; it is somewhat rare in the smaller animals. The appetite is in many cases unimpaired, and the creature does not appear to be inconvenienced in any way; in other instances, with the increase in the discharge and the duration of the disease, there is loss of condition and appetite, the yield of milk is less, and it may be viscid; signs of œstrum are more frequently present, but fecundation does not take place so readily as in health, if the os and uterus are affected; if it does occur, the chances are that the full period of pregnancy will not be reached.

When the discharge comes chiefly from the cervix uteri, it is more transparent and watery-looking than when derived from the vagina or interior of the uterus, and the os is usually more or less dilated when these parts are involved, while the uterus itself is not so firmly contracted as when in a sound condition.

The mucous membrane of the genital canal is pale, relaxed, and insensible; in other cases it may be roughened by granulations; and sometimes it is tumefied and red. Vaginal catarrh in the Bitch is often associated with, or dependent on, the presence of papillomata or epithelomata.

In rare instances the tissues lining the canal become indurated and lardaceous, and its calibre diminished. Lafosse has even observed adhesions between the sides of the vagina in an old Mare.

With regard to *treatment*, if the disease is not of very long duration, it may yield to cleanliness and astringent injections—such as solutions of sulphate of zinc, alum, permanganate of potass, tannic acid, etc. When it has been in existence for a long time, however (it may continue for months and even years), it is generally very obstinate, chiefly from the relaxed condition of the membrane. The uterus or vagina, or both if affected, should be thoroughly washed out twice or thrice daily with warm water, which should be injected until it flows out quite clear. A solution of carbolic acid in warm water should then be injected. A solution of the sulphate of iron has likewise been successfully employed. Nitrate of silver has also been efficaciously employed in solution (1 to 10); as has tannic acid (1 to 70).

Tonics should also be freely administered.

If the discharge continues after two or three weeks' treatment, it may be found useful to apply a blister to the loins, croup, or thighs.

CHAPTER III.

Metritis, Metro-Peritonitis, and Parturient Fever.

INFLAMMATION of the uterus (*Metritis*) may be limited to one or more of the internal layers of the organ (*Endo-metritis*), or it may extend to its outer

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covering—the peritoneum (*Metro-peritonitis*), and produce certain symptoms; while the introduction of septic matters into the blood, which is very often a result of this inflammation, will give rise to symptoms of septikæmia. The latter complication, from the febrile indications which accompany it, is appropriately distinguished by the name of "Parturient Fever"—a designation applied wrongly to another and very different malady of the parturient period—*Parturient apoplexy* or *Eclampsia*—and which we will study hereafter.

It is true that we may have metritis and metro-peritonitis without septikæmia—at least to any very marked degree; but the symptoms of fever which accompany the former are generally more or less apparent, and it is often difficult to discover when septic infection has taken place—the high temperature and greatly accelerated circulation being the first notable symptoms observed, and these often appear at an early stage of metritis. And we may have septic infection without metritis, when putrid matter obtains admission to the circulating fluids through a lesion in the uterus or vagina.

Inflammation of the uterus and *Septikæmia puerperalis*, occur in all the domesticated animals. The latter would appear to be very frequent in the Bitch; but the Mare, Cow, Sheep, Goat, and Sow are liable to septic infection, either as a result of metritis, or the introduction of putrefying matter into the blood through an abrasion or wound.

The inflammation, as well as the infection, varies in intensity from acute, sub-acute, to chronic.

Symptoms.

Inflammation of the uterus and parturient septikæmia may ensue very soon after birth—rarely before the second day with the Cow, and seldom beyond the eighth day. With the Mare and Bitch, according to Franck, the development of these conditions may be more retarded. Immediately after parturition the animal may appear to have quite recovered from the effects of that act, yields milk, takes care of its progeny, and there is nothing to indicate the existence of disturbance. The temperature in the rectum is normal, except in those cases—far from rare—in which birth has been difficult and the genital canal has been roughly treated and injured; then the rectal temperature may be higher. The increase of temperature is the first indication of disease, and within twenty-four hours the rise may be as much as two degrees. At the commencement of this rise, there are well-marked rigors; the animal becomes dull and loses its appetite; if a Cow, rumination ceases; there is horripilation, and the pulse, small and hard, may increase in the Mare and Cow to 100 per minute; the secretion of milk gradually decreases, and soon ceases altogether, while the udder diminishes in size and is flaccid; the respiration is hurried and shallow; the mouth hot and pasty, and the visible mucous membranes injected; while the horns and ears are very warm.

The animal grinds its teeth, and betrays the existence of colicky pains by lying down and getting up, stamping, striking at the belly, and turning the head towards the flanks, whisking the tail, and making more or less energetic expulsive efforts. Signs of pain or lameness in the hind-limbs become apparent. When the uterus is more inflamed, the animal does not lie down, because of the increase of pain produced by pressure on the abdomen. The smaller animals, however, maintain the recumbent position.

A very marked symptom is the tumefaction of the vulva—the labia of which are separated—and the discharge therefrom of a fluid, at first serous, and either transparent or having a yellow, chocolate, or reddish tinge; then

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it becomes gradually thicker and more abundant, and becomes modified according to the termination of the disease. Manual exploration of the vagina discovers it to be very hot and sensitive, particularly towards the cervix uteri; and when its lining membrane is exposed, it is observed to be swollen and reddened, and sometimes there are found diphtheritic ulcers and croupous deposits on the inflamed surface. In some cases, when the uterus is very much swollen, and particularly in lean, flat-sided animals, the inflamed organ can be felt on the right side, and pressure on the abdomen often, but not invariably, causes pain. Rectal exploration generally discovers the uterus larger than natural, and more or less distended by gas.

Defæcation is painful, and the fæces are hard.

The Mare attacked by metritis or metro-peritonitis, generally maintains the standing posture, with the back arched and rigid, and marked indisposition to move: only lying down on the approach of death, or towards convalescence; whereas the Cow persists in lying, and this has been supposed to be due to paralysis of the hind-quarters, but it is more probably owing to debility or prostration induced by the pain.

In ruminants there is generally distention of the rumen with gas; there are also acid eructations, and even regurgitations. When the temperature rises very high—and it may reach 42° Cent.—death is certain.

When metro-peritonitis is present, there always occurs—and sometimes very rapidly—an effusion of serum into the abdominal cavity. When this is in large quantity, the abdomen becomes enlarged and rounded, as if the animal had been feeding freely. There is then dulness on percussion in the lower region of the abdomen, contrasting markedly with the tympanitic resonance of the upper regions; while sudden pressure by means of the open hand on one part while the other hand is placed at another point, will cause a perceptible movement of the fluid.

Terminations.

The course of metritis, metro-peritonitis, and parturient septikæmia, is generally very rapid, and may not occupy more than a few days—usually three or four, rarely five or six days. In some cases a chronic form may be met with—and particularly in simple metritis, due to retention of the fœtal membranes, and sometimes to abortion. But these exceptions are few, and the disease or diseases just named may be designated as serious, when we learn that death carries off more than one-half of the number of animals attacked.

Though so serious, however, in those animals which are about to recover convalescence ensues very rapidly, especially with the Cow. As Saint-Cyr observes, a few hours often suffice to bring about such a change for the better, that one could scarcely believe it unless they saw it, and it might excite a doubt as to whether metritis had really been present. In the evening the animal is left in an almost hopeless condition, and next morning one is astonished to find it up, the eye limpid, the physiognomy bright and cheerful, and caresses bestowed on the offspring which, previously, was unheeded or repelled. The animal is certainly not cured, but it is out of danger, and with a few days' care it may be on the way to convalescence. The decrease in rectal temperature is always a favourable sign.

But, as has been said, death is the most frequent termination; and this may occur in two, four, or six days from the commencement of the malady—rarely a little later. Then all the symptoms become aggravated. The tumefaction of the genital organs increases, and extends to the mammæ and hind-limbs; the vulva is covered with ecchymosed patches and becomes cold; the

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vaginal discharge is ichorous and brown in colour, and emits a most fetid odour; the temperature suddenly falls; the surface of the body is covered by a cold glutinous perspiration—especially in the Mare—and the animal expires either in a state of profound coma, or in convulsions.

In such cases death may be due to the violence of the inflammation and its extension to the peritoneum, gangrene of the uterus, or to septic infection by absorption of the putrid matters in the uterus, and general poisoning therefrom.

Franck mentions that in three instances the disease manifested itself on the day after easy parturition, and it had become so severe that, on the second day, it was necessary to slaughter the animals. On the inner surface of the vulvar labia—which was of a dark-red hue—were one to three parturient ulcers, and in a few hours there had occurred an enormous tumefaction of the labia, which extended to the pelvic connective tissue and as low as the hocks, while the dependent parts of the body were also involved. Deep scarifications—which caused no pain—were useless, and were not followed by bleeding. On examination of the bodies after death, thrombi were discovered in the uterine and ovarian veins. In these cases the infection seemed to have been derived from an adjoining Cow, which retained the placenta.

Meyer refers to a case of this kind, in which death ensued during the evening of the day on which the disease manifested itself. He found a large blood-clot in the uterus, and ecchymoses on the intestines.

More frequently than rapid recovery, the malady passes into a chronic state. Then the more acute symptoms gradually diminish, the appetite returns, and the animal does not exhibit much suffering. But convalescence is not established—the mammæ remain flaccid, and the secretion of milk is either very scanty or altogether suppressed; the swelling disappears from the vulva, but the discharge therefrom persists or is increased in quantity. This discharge is either of a white glairy character—leucorrhœa; greyish and grumous, resembling clotted milk; or red, brown, or sanguinolent. It is always more or less odorous, and sometimes extremely fetid; more particularly is this the case when, as often happens with the Cow, the discharge is mixed with or derived from the retention in the uterus of the fœtal envelopes, or even the fœtus itself. In some instances, the croupous exudates which have been formed on the mucous membrane become broken up, and are cast off with the discharges. Franck states that, in one case, a large croupous or false membrane, which had covered the greater part of the interior of the uterus, was shed in this way.

In other instances the cervix uteri contracts, though the mucous membrane is still inflamed; consequently, the muco-purulent secretions are retained for some time, and the discharge from the vulva ceases. But when the organ becomes distended, it contracts, or it is pressed upon when the animal lies down, or during micturition or defæcation; then the os is forced partially open, and the accumulated fluid escapes in great abundance. Saint-Cyr mentions that Gohier, Chouard, and other veterinary writers, give instances of this singular form of chronic metritis; they have seen Mares which every forty days, every month, or at shorter intervals, expelled fourteen, sixteen, and even as much as twenty pints of pus, after exhibiting symptoms of colic, followed by more or less marked expulsive efforts.

In the chronic form of metritis, the animal does not appear to suffer at the commencement, but it soon loses condition; the appetite is irregular, and the skin unhealthy-looking and clings to the bones; the secretion of milk decreases, and finally disappears; and though debility is present, œstrum may occur far more frequently than in health, yet fecundation is not possi-

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ble. Marasmus sets in, with febrile attacks at intervals—pyæmic fever; and though recovery is still probable, by skilful treatment and long-continued nursing, yet death is only too often the sequel.

Even when recovery appears to be progressing favourably, relapses may occur, sometimes through the breaking up and diffusion of venous thrombi, which give rise to a pyæmic process, as in the case recorded by Contamine. On the morning after an easy parturition, the after-birth having also been expelled, the Cow began to tremble very much; the udder was small and flaccid, the back arched, the appetite was lost; there was anxiety, with colicky pains, constipation, and pressure in the right flank caused pain; the labia of the vulva were apart, swollen, and of a dark-red colour. In three days the animal was much better; but after three weeks there was a relapse. Petechiæ formed on the conjunctivæ, the hind-limbs became swollen, and bleeding ensued from the skin and nostrils, and there was cough. The Cow finally recovered.

Occasionally during the sub-acute or chronic stages of metritis, metastatic formations occur in the lungs, liver, joints, and other parts; not unfrequently there are caseous or pseudo-tuberculous deposits in the uterus, which may attain such a thickness in its walls as to simulate pregnancy.

Pathological Anatomy.

In those cases in which death has taken place and an examination of the body been made, the local and essential lesions are found in the genital organs and peritoneum, and when puerperal septikæmia has been present, there are observed indications of general infection of the body. Decomposition sets in early, the tissues are dark-green and fœtid, and meteorism is largely developed.

In simple endo-metritis we will not, of course, find such marked and general lesions, nor will the peritoneum be involved. In the more acute cases, and particularly those in which there has been septic infection, puerperal ulcers of a dirty greenish hue are generally met with in the vagina, often in the vicinity of the meatus urinarius and about the labia of the vulva. The mucous membrane is of a dull dark-red hue, and swollen in patches by diphtheritic infiltration, or covered in parts by croupous exudates. The bladder may also be implicated, though not to such a serious extent, and especially if the catheter has been employed. In the cavity of the uterus is constantly found a quantity of chocolate-coloured or greyish fluid, composed of effused blood, remains of fœtal envelopes, the secretions of the mucous membranes—all in a more or less advanced state of decomposition, and emitting the most repulsive odour. This fluid contains quantities of epithelial and round cells, fat globules, and decomposition bacteria. The quantity of fluid varies considerably, according to circumstances—amounting sometimes to many gallons.

The uterus itself is never contracted as in the normal condition, and it is often two or three times larger than it ought to be.

The walls of the organ are thickened, friable, softened, intensely red, and infiltrated with sanguinolent serosity, inflammatory products, and pus globules. The mucous membrane is thickened, of a dirty-brown or dark-green tint, livid, softened, ecchymosed in places, and covered here and there with diphtheritic or fibrinous exudates and blood-clots, the latter being chiefly found—in the Cow—at the base of the cotyledons, which are, with the exudates and clots, in process of putrefaction, and are grey, pulpy, and almost detached. Sometimes portions of decomposed fœtal membranes yet remain

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attached to the cotyledons; and there are here and there gangrenous eschars, in the form of green or greyish spongy masses of a diphtheritic nature, and which are in process of softening and dissolution. In all these alterations—which are usually very notable in the cornu that contained the fœtus—we have the characteristic features of *Endometritis septica*.

It is seldom indeed, that the puerperal or septic inflammation is limited to the mucous membrane. Nearly always it extends to the submucous connective tissue (*Metritis phlegmonosa*) which is infiltrated with an œdematous transudation; or it becomes the seat of acute inflammatory œdema, in which the tissue swells, becomes tumid, and its interstices filled with fluid, small cells, and a gelatinous, semi-solid material. The muscular tissue is swollen and softened, and a dark fluid flows from it.

The sub-peritoneal connective tissue of the uterus may suffer in a like manner, and undergo necrotic softening and putrefaction; while the serous membrane itself becomes inflamed (*Metro-peritonitis*).

When this takes place, the abdominal cavity contains a quantity of reddish, turbid, sanious serosity, in which are flakes of lymph. The lining membrane of this cavity, and especially that covering the uterus, is highly inflamed, and its surface is covered with pseudo-membranous layers of fibrin; while adhesion may have taken place between the different organs it covers. In some cases the inflammation of the peritoneum is not so diffuse, and is more or less limited to the uterus and organs immediately adjacent.

In other cases, again, the phlegmonous inflammation extends to the pelvic connective tissue (*Parametritis*), and we have diffuse acute œdema, infiltration with pus, or even abscesses.

Indeed, in the uterine connective tissue we may have, in different parts, active cell-proliferation and abscesses, and if the animal chances to live beyond a certain period, these terminate in caseous inspissation, or even perforation into the abdominal cavity.

A very important pathological lesion, and one which is not unfrequently noted in parametritis, is thrombosis of the veins and lymphatics. Thrombosis of the uterine veins has been observed in animals: solid, white or yellowish thrombi adhering to the internal surface of the vessels, and extending towards the larger venous trunks—even as far as the posterior vena cava. Sometimes the breaking-up of these thrombi causes relapse, and embolic pyæmia of the lungs or neighbouring organs. When septic infection does not occur, bruising of the soft parts during difficult parturition may give rise to thrombosis of the veins, with secondary pyæmia. This may explain the occurrence of abscesses appearing at the joints, and inflammation of the feet supervening on parturition. Thrombosis of the lymphatics has rarely been observed in animals; it is noticed within the inflamed spot. "The coagulated lymph either uniformly fills the vessel, or gives the appearance of a string of beads. Sometimes, also, single larger dilatations of lymphatic vessels are seen. The thrombosis may be due to the direct influence of the infecting matter, but more frequently it is caused by the inflammation of the connective tissue around the vessel. The products also of the inflammation of this tissue have a tendency to coagulate, and the contents of the vessels participate in the process." Sometimes the lymphatics are filled with pus (*Purulent lymphangitis*), and the neighbouring glands are swollen and softened. This thrombosis of the lymphatics has been considered a favourable circumstance, since the occluded vessels are prevented from conveying the infecting materials: the inflammatory process being at least delayed at the nearest group of lymphatic glands. The lymphangitis is therefore con-

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sidered an accidental change, which usually remains limited to the diseased part, and may disappear; and it has been remarked that it rarely extends further towards the thoracic duct, unless there are other very considerable changes.

Sometimes the thrombi in the vessels in the uterus soften; so that, in cutting into the walls of the organ, these appear like small abscesses, varying in size from a pea to that of a nut. They can only be distinguished from abscesses by their smooth walls, since the afferent and efferent vessels cannot always be found.

In intense parametritis, with extensive infiltration of the subserous connective tissue, we may have other organs involved, and especially those which are directly connected by means of this tissue—such as the ovaries. The peritonitis may extend through the diaphragm to the pleuræ, or the inflammation in both membranes may be due to ichorrhæmia.

In those cases in which thrombi in the bloodvessels have become detached and broken-up, the masses may be carried in the circulation, and then give rise to embolism and hæmorrhagic infarcts, or to metastatic abscesses, in such parenchymatous organs as the lungs, liver, spleen, kidneys, etc.

In the most rapidly fatal cases, in which death is due to septic parametritis, there is no time for fibrinous exudation, and we have appearances not unlike those observed in splenic fever. The blood is dark-coloured and non-coagulable, ecchymoses are found in various organs and tissues, and there is a marked tendency to rapid putrefaction. The elementary structures of organs show the commencement of an acute inflammatory process—the fine granular infiltration or "cloudy swelling," fatty degeneration, or even disintegration of cells.

We have already stated that there is nothing specific in parturient fever, and so far as its pathological anatomy is concerned, the same alterations are observed in non-parturient subjects. Parturition only predisposes the animal to its occurrence, from the fact that there are wounds and bruises inflicted on the soft tissues of the genital canal; that there is present a quantity of matters—fluid and solid—either decomposed or decomposing; and that the bloodvessels and lymphatics of the uterus at this time are in a favourable condition for the reception and action of this septic material. In animals which have succumbed after the operation of ovariotomy, similar pathological alterations are found.

With regard to chronic metritis, various changes have been observed. In some cases the uterus has contained a considerable quantity of fetid pus, or muco-purulent matter of a white or grey hue; while the mucous membrane has been grey or dark-coloured, thickened, and softened, and the cotyledons infiltrated, softened, or even indurated; the vaginal mucous membrane is also infiltrated and indurated in some cases.

1. Robinson (Saint-Cyr. *Op. cit.* p. 686) reports the case of a Cow which brought forth a calf, naturally and without assistance, three weeks after purchase, and the fœtal envelopes were expelled in the ordinary way at the usual time. The calf was strong and lively, but the Cow did not completely recover from the effects of parturition, but remained unwell, lost its appetite and condition, and soon discharged from the vulva—which remained swollen—a white fluid that, at a later period, was streaked with blood. When Robinson saw it, the animal was in the last stage of emaciation; the pulse was small and 72 beats per minute, the surface of the body was colder than in health, and there was little appetite, though thirst was insatiable. By the vulva a purulo-sanguinolent fluid escaped, and though the urine was ordinarily transparent, yet sometimes its mingling with this discharge rendered it turbid. Chronic metritis was diagnosed, and, in consequence of the condition of the animal, slaughter was re-

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commended. This advice was not adopted, however, and the Cow died in a week afterwards.

At the autopsy the whole mucous surface of the uterus was found ulcerated, and the walls of the organ considerably thickened, as were also those of the bladder and ureters—the latter particularly. The kidneys were enormous in size—nearly four times larger than in health; in them were several abscesses, containing thick yellow pus mixed with a little blood.

It is possible that, as Saint-Cyr thinks, there had been uterine phlebitis, and some fragments of the thrombus becoming detached from the inflamed veins and carried by the blood, had, by a reflux movement, reached the divisions of the renal veins. There they would give rise to capillary obstruction, infarct, inflammation, and all those accidents which accompany embolism. In this way the inflammation and abscesses in the kidney would be produced.

2. Gray (*Veterinary Journal*, June, 1877) describes the case of a Cow two years old, which, some time after being put to the bull, strained at times and ejected small quantities of blood. In two months the animal was observed to be in œstrum, and was again sent to the bull. The symptoms became greatly aggravated; there was a continuous discharge from the vulva of a chocolate-coloured fluid, which had somewhat the consistency of cream, and the animal strained frequently. Loss of condition ensued. On examination the pulse was found to be more than 80 beats per minute, external temperature normal, conjunctivæ pale, and general expression excited and anxious. The blood-discharges increased in quantity and frequency, and in another month the anæmia and debility were so great that the Cow could not stand; death took place soon after. All the organs, with the exception of the uterus, were found healthy. This contained about two quarts of a sero-sanguineous fluid, and externally the organ presented the appearance and volume natural to the third month of gestation, and as if the fœtus had been in the left cornu. The os uteri was dilated, and protruding from it was an elongated piece of blood-clot about an inch in diameter; this was merely a portion of a very large clot, weighing more than twelve pounds, and lying in the cavity of the organ. This mass of clot was in many places firmly adherent to the mucous membrane; at other points it was breaking up. It was surmised that abortion had occurred, and that this led to ulcerative endometritis and hæmorrhage.

Causes.

The *predisposing* cause of metritis, metro-peritonitis, and parturient fever, is the parturient or puerperal state. It is true that septic infection, with its train of symptoms, may occur at other periods and from various causes; but metritis and its complications are, as a rule, it may be said, observed only after abortion or parturition.

The *occasional* causes of metritis, and therefore of metro-peritonitis and fever, are injuries to the genital canal or interior of the uterus, during or after birth. The manipulations necessary for the artificial removal of the fœtus or its envelopes, and by which the mucous membrane is abraded or wounded, are a frequent cause; inversion of the organ, and especially when it has been exposed for some time to the air and the action of irritating substances, or bruised or lacerated in returning it, is another cause. Retention of the fœtus or fœtal envelopes has also been given as a cause of metritis.

But other cases have been noted in which birth was easy and natural, and at the usual time; and yet towards the second, fourth, or sixth day after parturition, the animal began to lose its appetite, the vulva became swollen, fever set in, and all the symptoms of metro-peritonitis became rapidly developed. In these cases, the occurrence of disease has been attributed to some imprudence in management, which brings about derangement in the functions of the skin or digestive organs—as exposing the animal to wet and cold out of doors or draughts of cold air in stables, or giving it cold water to drink or unsuitable food.

Sometimes the disease occurs among such a large number of animals almost simultaneously, that it has been looked upon as epizoötic, and due to a miasma. More particularly has this been the case with parturient fever, but

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which must now be considered as due solely to the absorption of septic matter, *i.e.*, decomposing organic material.

The production of parturient fever in animals, as in the human female, requires two conditions: 1, a fresh wound by which the septic poison can enter. The wound need not be large, but it appears to be almost essential that it is recent; for suppurating or granulating sores do not absorb, so long as the infecting agent does not destroy the suppurating or granulating surface. If the mucous membrane is intact and protected by its epithelium, absorption is also prevented; 2, an active septic substance, either produced in the animal which is to be the subject of parturient fever—auto-infection, or introduced from without—external infection.

Birth rarely takes place in animals without more or less laceration or abrasion of the cervix uteri, vagina, or labia of the vulva; and those injuries which are on the floor of the genital canal are more likely to be followed by septic fever than those which are on the sides or roof, simply because they are brought more directly in contact with the decomposing material. Infection less frequently takes place from the interior of the uterus under normal conditions, as injury is much less likely to occur there from the passage of the fœtus. Exceptionally, it may take place in the uterus through the cotyledons, when some of these are torn during the separation of the fœtal membranes.

As has been already mentioned, the parturient period is eminently favourable for the absorption of septic matters; as the mucous membrane of the genital canal is exceptionally vascular, and the bloodvessels and lymphatics are greatly developed.

Auto-infection occurs generally when there is a fresh wound, and when the fœtus is dead, and, still retained in the uterus, has become decomposed through the access of air; or from retention and putrefaction of the envelopes. The ichorous putrefaction of wounds, or new growths in the uterus or vagina, may also lead to septic infection.

Franck gives the following illustrations, which could be easily and largely supplemented:

1. The fœtus of a heifer was dead in the uterus, and much distended with gas. Embryotomy had to be resorted to, in order to extract it; and this was accomplished, apparently, without causing any noticeable injury to the vagina. On the third day septikæmia became manifest, and the animal had to be killed.

2. A Cow gave birth to a calf in a normal manner; but the hoof of the young creature, on its passage through the vagina, made a small wound. Twenty-four hours afterwards a second calf, in a state of putrefaction, was removed by manual force, but without injuring the Cow. In two days the latter was attacked with puerperal fever, and was killed.

3. Mombrini removed a dead calf from the uterus by embryotomy. Septic inflammation of the uterus and peritoneum set in, and the Cow died on the seventh day.

4. It is well known that Bitches which retain the fœtus in the genital canal for any length of time (eighteen hours or thereabouts), frequently perish from *Septikæmia puerperalis*. This appears to be due to the fact that the puppy so retained quickly dies: owing to the shortness of the umbilical cord, the early separation of the placenta, and birth taking place in the amnion. The young creature also speedily putrefies, and the large raw surface formed by the maternal placenta is a ready inlet for the direct introduction of the septic material into the blood. Speedy death of the Bitch is the consequence.

Embryotomy, when the fœtus is decomposing, is a dangerous operation, if a wound chances to be inflicted during its performance. It is the same with the removal of the fœtal envelopes.

A Cow retained the fœtal envelopes for five days after parturition, when they were

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removed. The operator had evidently wounded a cotyledon or the uterine mucous membrane in doing so, as his hand was stained with blood. In three days the animal was affected with parturient fever and died. No injury to the uterus could be detected on *post-mortem* examination.

With the Mare, removal of the fœtal membranes does not appear to be dangerous. Retention of these is not usually followed by infection; for it is not until the second or third day after parturition that their decomposition usually commences; so that if small injuries have been produced during birth, it is most likely that they will be suppurating or granulating by that time, and thus be proof against the passage of putrid matter. If, however, a fresh wound is made, or the granulations are injured by mechanical means, then removal of the putrid envelopes is full of risk. Foelen mentions that a Cow had a wound on the vulva, and this was infected by putrid membranes; on the fourth day after, the animal died with all the symptoms of parturient septikæmia.

External infection does not appear to be so frequent as auto-infection among animals. It takes place when septic materials are brought to the recent wounds or lacerations of the genital organs by any means—as directly by the hand, instruments, sponges, straw, etc., or indirectly by means of the atmosphere, when the septic materials are suspended therein—the so-called miasmatic infection. There is a close relationship between abortion and parturient fever—a Cow suffering from the latter being undoubtedly dangerous in a stable or pasture where there are a number of pregnant cattle; while a case of abortion or placental retention occurring in a stable, might be considered nearly as serious among parturient Cows.

A retained and decomposed placenta is undoubtedly a fertile source of parturient fever. Franck refers to three instances, in which the Cows calved in a normal manner and the fœtal membranes came away in four hours after; but a trifling wound existed in the mucous membrane of the labia, at the commencement of the vagina. In two or three days afterwards these animals showed very acute symptoms of parturient fever. They stood near another Cow whose uterus contained a decomposing placenta. The emanations from the vulva or discharges of this animal had, there can scarcely be a doubt, infected the three; or the soiled straw may have been the means of conveying the septic matter to the vulvar wounds; the tail of the Cow may even have been an active agent in throwing the vaginal discharges about, as it is generally much soiled by them.

External infection may also be conveyed by means of cords, crotchets, and other obstetrical appliances, if they are soiled with septic matters: which they may be if previously used in the removal of a decomposing fœtus; and the operator himself may be the means of infecting. An instance of this kind is related where, in Switzerland, during 1861-63, in a large cowshed containing about 200 head of cattle, suddenly a number died of parturient fever, though they had no difficulty in calving. For a long time afterwards no other births took place, so no more accidents of this kind were observed; but it was strongly suspected that the herdsman who attended the first sick animal, cleaned it, etc., in helping the others during parturition, had conveyed the infection to them. And it is quite possible that many serious and wide-spread outbreaks of parturient fever in cattle, are due to an obstetrist who has been engaged in removing a dead fœtus or a retained placenta. The same cause may be in operation among Ewes during the lambing season, when, as is well known, parturition occurs in the flocks within a limited period, and under circumstances favourable to the spread of infection; and

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not unfrequently large numbers of Ewes perish from parturient septikæmia ("heaving pains").

We have mentioned that exposure to cold is supposed to be one of the causes of parturient fever. Franck, however, is of opinion that real parturient fever cannot be so produced.

With regard to the nature of the infective material, there is yet much to be learned. The active agent has been surmised to be the *Microsporon septicum*, which has some analogy to the *Leptothrix buccalis*. In the putrid matters and fluids from the uterus, bacteria are always found. But whether these organisms are really concerned in the genesis of septikæmia is still doubtful. Some authorities are inclined to believe that there is a chemical body—septin or sepsin—in such infective fluids, which possesses great putrefactive powers; so that a very small quantity introduced into the blood may produce the most serious results. In favour of the latter view, it is to be noted that very often after rapid death from parturient fever, no bacteria or other similar bodies can be found in the blood.

Another hypothesis is that these organisms are only the originators or bearers of the infective material.

In the puerperal fever of woman, it is recognised that the infecting matter may be derived from a great variety of sources. It is formed wherever organic compounds decompose; therefore it is derived from dead bodies, from suppurating wounds, disintegrating neoplasms, and especially from the secretions of diseased—and sometimes also of healthy—women. So it is that puerperal fever is looked upon as nothing more than poisoning with septic matter from the genital organs.

The experiments of Weber, Billroth, and others, have demonstrated that septic matter has pyrogenetic and phlogogeneous properties, being capable of producing fever and local inflammation.

The theory therefore is, that in cases of acute septikæmia such a quantity of septic matter has been absorbed, that the blood has received phlogogeneous properties, and that it is able to produce inflammatory changes wherever it goes. Such a general inflammation of the whole organism, and especially of those organs whose undisturbed function is necessary for the maintenance of existence, must be capable of destroying life before marked pathological alterations have been developed in individual organs. Accordingly, in such cases functional disturbance of the organs are alone observed during life, and after death only the commencement of parenchymatous inflammation of those organs—the "cloudy swelling" of the cell.

In other cases the infection of the blood is not so intense; fever is the only symptom of general disturbance; the functions of the organs important to the maintenance of life are not so disturbed that death must inevitably follow. If infective matter has only once been absorbed into the blood, the disturbances caused by it soon pass off, as shown in numerous experiments on animals; the poison is rendered innocuous within the organism, or eliminated from it. Such is the case when putrid matter has been once injected into the blood.

By infection from a wound, the absorbed matter has still another effect. Locally, it sets up around the wound an inflammation progressive in character—the acute inflammatory œdema—with a tendency to extend along the connective tissue. In this inflamed spot, again, materials are produced by the disintegration of tissues, equally possessed of pyrogenetic and phlogogeneous properties. Continually small quantities of these materials are absorbed into the blood, and thus the fever is sustained. At the same

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time the blood, now possessed of phlogogeneous properties—though in a slight degree—may also cause inflammation in other organs predisposed thereto, either from their anatomical condition, or from the idiosyncrasy of the patient. Such organs are chiefly the large abdominal glands and the serous membranes, also the striped muscles and the connective tissue. Whilst the process described as consisting of a uniformly acute degeneration of all the organs has been called "septikæmia," that just mentioned, where the process is more chronic and limited to individual organs, has been designated "ichorrhæmia." A specific difference between the two does not exist—it is only one of degree; for where septikæmia has not quite an acute course it ceases to be a pure intoxication with the original infecting agent; but the infection of the blood is now aided by the absorption of the products of the local inflammation—which products, however, are not specifically different from the original agent.

On the whole, septikæmia may be considered the acute, icorrhæmia the chronic, or rather sub-acute, septic infection. The whole organism may also be affected from the local disease by the occurrence of thrombus in a vein; but this, properly speaking, is not peculiar to septic infection (Schroeder).

General infection, then, in the majority of cases, is due to the presence of parturient sores or ulcers in the vulva, vagina, or uterus, and this infection is manifested externally by the high temperature and other serious symptoms. In other cases, when only a small quantity of septic matter has been absorbed, the symptoms have more of a local character; they are less severe, and though the fever may be of a continuous character, yet it is not so acute, and indications of peritonitis are generally absent. Indeed, we may have simple metritis without much constitutional disturbance.

Prognosis.

The prognosis of parturient fever must be, in the majority of cases, unfavourable, as the veterinary surgeon is only too frequently not called in until too late. When infection is but slight, or when the local inflammation is not very severe, then careful treatment may restore the patient to health. It must not be forgotten, however, that what appears at first a mild form of metritis, may become a very grave attack of ichorræmia, or even septikæmia.

Prophylaxis.

From what we have said with regard to the causes of parturient fever and metro-peritonitis, it will be seen that in obstetrical operations great care should be exercised, so as to avoid wounding the genital canal, and especially the interior of the uterus, the vagina, or the vulva. Should injury be unfortunately inflicted, cleanliness, and careful dressing with some such disinfectant as carbolic acid, should be enforced. This is especially necessary when extraction of a dead fœtus or retained placenta takes place.

No person who has been handling a creature suffering from parturient fever, or any decomposing animal matters, should be allowed to assist animals in parturition; and the same rule should be observed with regard to instruments and other obstetrical means, unless these have been thoroughly cleansed and disinfected.

If a case of parturient fever should occur where there are other pregnant animals, or animals which have quite recently brought forth, these should be immediately removed. An animal which retains a decomposing fœtus or fœtal membranes, is also dangerous among these. The same remark applies to animals—such as Ewes and Cows—at pasture. The soiled ground should

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be most carefully disinfected with lime, and pregnant or parturient animals should be kept away from it.

Treatment.

Metritis, metro-peritonitis, and parturient fever being grave disorders, and rapid in their progress, demand prompt, rational, and energetic treatment. The first thing to be attended to is the condition of the uterus, and the removal of any infective matters it or the vagina may contain; as well as the disinfection of any wounds or abrasions in these parts.

The genital canal should be thoroughly cleansed by injections of warm water, and the wounds dressed with carbolic acid and olive oil (1 to 10), applied by means of a brush or feather; or salicylic acid 1 part, spirits of wine 20 parts, warm water 24 parts.

After the interior of the uterus has been cleansed by injections of warm water, an injection of carbolic acid solution (1 to 20–50) should be made every day, and the wounds, if accessible, must be dressed at the same time.

Permanganate of potash (1 to 50 of water) may be employed to inject into the genital canal, when the disease is less acute.

With regard to constitutional treatment, this must be directed towards neutralising the effects of the septic matter by the exhibition of antiseptic remedies, and reducing the high temperature; as a long continuation of this leads to rapid consumption of the tissues, and is fraught with danger to the system.

There is no specific remedy with which to neutralise the action of the septic matters in the blood and tissues. The sulphites of soda and potash have been recommended, as well as sulphurous acid. These appear to have acted favourably in some cases. Carbonate of soda and permanganate of potash have also been well spoken of, as well as large doses of quinine. Carbolic and salicylic acids are now most in repute, and are given in small but frequent doses.

If there is a tendency to constipation, a purgative may be administered; indeed, unless special circumstances forbid it, a purgative may prove most serviceable in assisting in the removal of the septic matter through the intestinal canal. Dogs which have been poisoned by this matter, often recover after profuse and fœtid diarrhœa; and a purgative generally reduces the temperature.

In acute cases, in order to obtain the more prompt action of antiseptics, it has been proposed to introduce them directly into the circulation by intravenous injection. Solutions of carbolic acid and iodine have been employed successfully; and in woman a desperate case has recovered after the intravenous injection of liquor ammoniæ (1 to 3).

As a last resource, and to substitute healthy for poisoned blood, transfusion has been also practised in woman, and with good results. The experiment is worth trying in the parturient fever of animals.

With regard to the diminution of temperature, quinine has been highly lauded. Bleeding is certainly not to be recommended. If the temperature continuously remains very high, then the application of cold water to the surface of the body is indicated. The cold water may be applied to the larger animals by means of cold wet sheets wrapped round the body, and kept cold for an hour or two at a time by pouring on water, at intervals, by means of a small vessel. Smaller animals may be put in a gradually-cooled bath.

The skin must be well dried after the application of the cold water, and

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with the larger animals a dry blanket should be thrown over the body. The stable must be kept scrupulously clean and well ventilated.

Tonics and good food must be allowed when recovery is taking place, and the *sequelæ* of the disease treated according to their indications.

Peritonitis may be combated by the exhibition of large and frequent doses of calomel. Van den Eide and Clement were successful in treating serious cases of metro-peritonitis, by administering calomel, and applying mercurial ointment to the abdomen.

When the pain is very severe, mustard may be applied to the surface of the abdomen, and, in the case of small animals, linseed-meal poultices on which laudanum has been sprinkled; while subcutaneous injections of morphia may be freely resorted to. When great exhaustion or collapse is present, large and frequent draughts, containing diffusible stimulants, must be administered, with nutritious gruel. To the smaller animals milk or beef-tea may be given.

In the chronic form of metritis, the same treatment may be adopted, so far as the genital canal is concerned; and if there is vaginal discharge, the treatment recommended for leucorrhœa will be suitable. If the uterus is not contracted, this may be promoted by the exhibition of preparations of ergot of rye.

In handling animals suffering from parturient fever, or in examining the carcases of those which have died, the veterinary surgeon should be on his guard against inoculation. More particularly is this necessary when exploring the genital canal of the living animal, or removing a putrescent fœtus or fœtal envelopes. The arm and hand should then be well smeared with oil or lard, and thoroughly cleaned with carbolic acid soap when the operation is completed.

CHAPTER IV.

Parturient Apoplexy—Parturient Collapse.

Few diseases affecting animals have received a greater amount of attention, or given rise to more widely divergent opinions as to their nature, than the malady to which, chiefly for convenience, we have given the designation of parturient apoplexy or parturient collapse. Veterinary literature, since the commencement of the century, teems with descriptions and discussions relative to the disease, and the most eminent veterinary pathologists still appear to be far from unanimous as to its nature. The great number of names given to it—some of which either indicate the opinions prevalent with regard to its pathology or causes, or point to prominent symptoms—are evidence of the uncertainty which has prevailed, and now prevails, with regard to it. For instance it has been designated *puerperal fever*, *nervous* or *paralytic form of puerperal fever*, *milk-fever*, *puerperal apoplexy*, *paraplegia*, *puerperal collapse*, *vitulary fever*, *vitulary apoplexy*, *vitulary paralysis*, *processus puerperal*, *puerperal typhus*, *calf fever*, *dropping after calving*, *eclampsia puerperalis*, etc.

The ordinary French name is "Vitulary Fever" (that given to it by Saint-Cyr and other veterinary authorities in France), while in Germany it is commonly known as "Calving Fever" (Franck and others). In England it

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is usually designated "Parturient Apoplexy," "Puerperal Fever," "Milk Fever," etc.

The malady appears to have been known from an early period, but the first exact description of the symptoms we can find is that given by Skellet (*Practical Treatise on the Parturition of the Cow*, London, 1807), who names it "Milk Fever, or Dropping after Calving;" in the following year it is alluded to by Jörg (*Anleitung zu einer rationellen Geburtshülfe*, etc., *für Thierärzte*), who evidently knew Skellett's work, as the latter's plates are copied. Some years after this period the disease began to attract much attention, as with the improvement in the breeding of Cattle, it gradually became more prevalent; until now, the literature of the subject is very extensive.

Without entering at this moment into a discussion as to the nature of the disease, it may be sufficient to say that it is a very serious and acute affection, peculiar to Cows in the parturient state—and especially to those of the improved Milch breeds, in which it is frequent; that its invasion is sudden and its course rapid; and that it is characterised by loss of consciousness and paralysis, seldom by convulsions. It is extremely fatal, death ensuing in a very short time; or if recovery takes place, this is sometimes nearly as rapid as the attack was sudden. It has been confounded with parturient fever, or considered to be only a nervous or paralytic form of that malady; while Franck, who appears to have studied it very carefully, is of opinion that it is identical with the eclampsia of the human female, and considers that "parturient eclampsia" (*Eklampsie in Folge der Geburt*) is the best designation for it. He asserts that to look upon it as a "fever" is a mistake, as a high temperature—the sure sign of such a condition—is not present; while to name it "calving-fever" is not quite exact, as it has been known to affect oxen and other domesticated animals—though seldom.

We shall, however, revert to this question presently.

Symptoms.

The disease sets in suddenly after calving, and without any premonitory symptoms. It may attack the Cow so early as twelve or twenty hours after parturition, but it is most frequent on the second or third day, and generally follows a rapid and an easy birth. It has, though very rarely, manifested itself before parturition, and also during that act. It is seldom that it appears after the third day; though Harms says it may occur so late as the tenth day; Hess records an instance on the fourteenth day, and a case has been witnessed in the fourth week; while Gierer states that he saw a Cow which offered all the symptoms of the disease seven weeks after calving.

In some instances, before the symptoms commence, the lacteal secretion is either diminished or suspended. Generally, however, the first indications are the Cow hanging back in the stall, or the head drooping; there is uneasiness, whisking of the tail, striking at the belly with the hind feet; the appetite is suddenly lost and rumination ceases; the fæces are hurriedly expelled, and the animal becomes indifferent to its calf. There is often a shivering fit, but this is not followed by an increase of temperature. In a few cases, congestion of the brain appears to be present at the commencement; as the Cow presses its head to the wall or leans against the stall-post, it bellows, looks stupid, its mouth is hot, the eyes are reddened, and the eyelids wink, and it half unconsciously treads with the hind feet. The respiration becomes hurried and plaintive, though the pulse may be normal;

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and if the animal is conscious, its physiognomy expresses anxiety and suffering. Unsteadiness and staggering are manifested; the animal can no longer stand, and it either lays itself down, or falls on the floor of the stall. Then it may remain tranquil, merely moaning or bellowing, or striking with its feet at the belly as if affected with colic, and making convulsive movements. Congestion of the brain may be more or less marked; the ears and horns may be warmer than natural, and in addition to the redness of the eyes, tears may flow down the cheeks.

All these changes may become developed in a very few hours; so that an animal which was left in apparent good health only a short time before, is found lying, cannot get up, and is in a soporific condition. This is the stage of the malady at which the veterinary surgeon is usually sent for.

Then he finds it lying tranquilly on its side, fully extended; or, which is far more frequent, resting on the sternum, and the head turned round towards the shoulder or flank (fig. 206). This position of the head is supposed to be due to contraction or tonic spasm of the cervical muscles of one side of the neck. It is sometimes observed at the commencement of the attack, even while the animal is standing. The neck is so rigidly bent that force cannot extend it, and the temperature is distinctly increased on the concave side—that on which the muscles are contracted.

Fig. 206.

PUERPERAL APOPLEXY: COW.

From time to time it may attempt to rise, but it cannot, as a rule, do so; the knees may be flexed, but the hind parts of the body seem to be nailed to the ground. If assistance is afforded, it cannot avail itself of it; or if it chances to be raised, it falls again as soon as let alone. It appears to be insensible to blows or pain of any kind; and if the head is lifted and let go, it drops an inert mass, or is again pressed round against the shoulder. The teeth are ground at intervals, and the stupor or coma becomes more marked. The animal pays no heed to surrounding objects; the eyes are half-closed, and they either move convulsively in their orbits, or are dull and lustreless; the hair is erect and dry, and flies settle on the surface of the body.

The pulse does not vary much in the earlier stage; it may number fifty, sixty, or seventy beats per minute, or it may be fewer than in health, but it is very full and soft. When coma is well advanced, however, and paralysis appears to be complete, it becomes small and quick.

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The respirations may be increased to eighty or ninety per minute, and this occurs more particularly when there is pneumonia, due to the passage of foreign matter into the bronchia—an accident which is frequently noted in this disease. When the coma and paralysis are very marked, the respirations are often slow and deep, sighing or stertorous, at other times calm and regular. We may have all these variations in the same animal—the hurried, stertorous breathing succeeding the quiet and deep respirations in a very abrupt manner. As the pulse increases in frequency the breathing sometimes becomes slower.

The temperature of the body is not increased, as a rule; on the contrary, it is very often below the normal standard—Harms and Adams have found it as low as 35° Cent. (95° Fahr.). The extremities are generally icy cold, and the surface heat of the trunk is irregularly distributed. Sometimes, during the first stage, the temperature is for a very brief period slightly elevated.

The mucous membrane of the mouth is pale, and saliva accumulates about or flows continually from it (hence the disease is sometimes designated *Abtröpfeln aus dem Maule* by the Germans). Food and water are refused, and indeed at an early period there appears to be paralysis of the deglutition organs, and if care is not taken the solids or fluids attempted to be administered may find their way into the air-passages, and if they do not quickly produce asphyxia, they will probably give rise to pneumonia. The functions of the rumen and digestive system are more or less suspended, and the peristaltic movement of the intestines decreased. Hence we have tympany, eructations, and constipation. The eructations may carry fluid and food from the rumen into the pharynx, and even into the nostrils, and these may pass from thence into the trachea. So that we may have pneumonia from this cause alone, and without attempts having been made to administer food or medicine. Constipation is also a marked feature of this paralysed condition.

Micturition is also, as a rule, suspended from the commencement. Consequently, urine accumulates in the bladder and fæces in the rectum.

The secretion of milk may be diminished or suspended, and sometimes very suddenly, even before the voluntary muscles are paralysed; in other instances it may be uninterrupted.

When the animal is about to recover, these symptoms may persist for some hours, or even for two, three, or four days. Then it appears to rouse up suddenly from the stupor into which it was plunged; the tongue is moved about; the head is raised; attempts are made to get up; it elevates the fore-part of the body, and after some struggles finally gets on its hind-legs and stands. The first favourable indications are elevation of the temperature, and resumption of the intestinal peristalsis. The latter is assured when the rectum is found to be filled with fæces, after it has been emptied.

The animal's physiognomy changes, and becomes natural—though it may still look half-stupefied; it drinks and seeks food, and is not long in commencing to ruminate; its calf is caressed; urine and fæces are passed; and recovery sets in so promptly, and goes on so quickly, that in many cases it is scarcely possible to believe that the animal which, twenty-four hours previously appeared to be dying, is now not only recovering, but completely recovered.

When death is about to take place, the more serious symptoms are better marked. The *collapsus*—the coma—becomes more and more complete. The nose rests on the ground as if the animal could no longer support the head,

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and at times sways from side to side. The decubitus, instead of being sternal, becomes lateral, and the body is stretched out at full length on its side. The eye is glassy, and there is no movement of the eyelids when the cornea is touched; the body and mouth are colder; the tympanitis increases; the pulse becomes small, irregular, and intermittent, and very quick, until at last it is imperceptible; the breathing is puffing, slower, and more stertorous, and the animal dies without a struggle, or in the midst of slight convulsions.

In some cases there are epileptiform convulsions, or there may be symptoms of delirium: the animal throws its head about violently from side to side, or bends it rigidly backwards, struggles, bellows, groans, extends the limbs convulsively as if undergoing an electric shock, and appears to be unconscious; the breathing is deep and spasmodic, and apoplexy—parturient apoplexy—seems to be the cause of death.

Duration, Terminations, and Complications.

The duration of the disease is very brief. There are instances on record in which it has been less than twenty-four hours; but two or three days is the ordinary term; it has rarely extended to five or six days.

If there are no complications, the terminations are death or recovery. The chief complications are broncho-pneumonia, milk-metastasis, amaurosis, and temporary or permanent paralysis.

Pneumonia is due to the passage of foreign matters—either food or medicine—into the air-passages during the period when the animal cannot swallow, or when it is comatose, and meteorismus, with eructations, are present. This is often a cause of death when the Cow has recovered from the parturient malady. Indeed, the animal may perish from suffocation alone when the quantity of matter that passes through the larynx is considerable. And not unfrequently, when the creature has lingered for a few days, and is then killed, the existence of pneumonia from this cause will be discovered on making an examination of the body. Adam (*Wochenschrift für Thierheilkunde*, 1870–71) believes that ten per cent. of the Cows which recover from parturient collapse eventually die of pneumonia, due to extraneous matters introduced during the paralysed condition of the pharynx.

Sometimes the animal appears to be almost recovered from the attack of parturient apoplexy, when symptoms of lung congestion or inflammation are suddenly developed, and death soon occurs.

Another complication of parturient apoplexy, is the so-called *milk-metastasis* which does not appear to have been noted in this country, but which is alluded to by Bentele, Born, and Franck in Germany, and Allemani in Italy. Occasionally there is observed, after an attack of the disease, a white, milky-looking emulsion, similar to chyle, expelled as urine, or as a discharge from the nostrils; and at one time it was imagined that this was the milk which, instead of being got rid of by the mammæ, was absorbed or retained in the blood, acted upon the nervous centres, and was then expelled in this vicarious manner.

Though no analyses appear to have been made of this fluid, Franck is of opinion that the fluid is only the normal secretions mixed with lymph. The milk-metastasis theory is untenable, as it is quite opposed to what we know of the lacteal secretion, especially during this disease.

1. Bentele (*Wochenschrift für Thierheilkunde*, 1857, p. 145) states that a Cow attacked by calving-fever, lay for sixty hours in a state of lethargy. The urine, which

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was passed six hours afterwards, was milk (?) with clots—as if boiled—in it. The animal recovered from the attack, but some weeks later had to be killed in consequence of diseased lungs—probably pneumonia from foreign matters.

2. Born (Anacker's *Thierarzt*, 1871, p. 279) relates a case, in which milk flowed from the nostrils of a Cow that was affected with calving-fever.

3. Allemani (*Il Medico Veterinaria*, 1870, p. 289) tells us of a Cow-proprietor, who believed one of his Cows passed milk instead of urine. The supposed milk—which was of a yellowish-white colour—contained epithelium from the bladder, a large quantity of epithelium from the kidney, lymph-corpuscles, and albumen. After some days this condition disappeared. The fluid did not coagulate spontaneously.

With regard to *paralysis*, this is not evident until the animal recovers consciousness, and begins to look bright and anxious for food, when it is found that it cannot be made to rise. The paralysis may be limited to one limb, to the two hind-limbs (*paraplegia*), or to one side of the body (*hemiplegia*). Saake says he has sometimes seen instances in which the fore-limbs were paralysed, while the posterior ones could be moved freely.

Amaurosis is readily discovered, from the animal being blind. It is generally persistent. Breulet, Gabler, Dommelen and Festal have recorded instances.

Prognosis.

The prognosis of parturient apoplexy is generally difficult, if not unfavourable; as a fatal termination occurs in a large proportion of cases. Of 721 cases treated by various methods, Franck states that 294 either died or were slaughtered—40·8 per cent. Of course, no definite conclusion can be drawn from these figures; as it is possible that some, if not many, of the cases may have been parturient fever, while of those killed probably a few recoveries might have been noted. Saint-Cyr, in 466 cases, gives 45 per cent. deaths; while Stockfleth gives 50 per cent.

Often cases which appear very trifling at first, have a rapidly fatal termination; while others which commenced with alarming symptoms, quickly recover. Therefore it is, that perhaps in no disease with which we are acquainted is a reliable prognosis more difficult to be arrived at, not only in the earlier stages, but during the whole of its course. "There is no absolute *criterium*," says Lanzillotti, "by which we can positively say whether we can cure the case, or whether death will ensue; and it often happens that the result contradicts the prognosis." And Allemani states that he has seen cases which looked so favourable, as to lead him to believe they would recover, suddenly become aggravated without any apparent cause, and succumb; while others which exhibited the gravest symptoms in all their intensity, and gave no hope of recovery, have been restored to health.

This is probably the experience of every one who has had to contend with the disease; it is in consequence of this uncertainty, and the fatality attending the malady, that the butcher is so frequently called in, and the animal is killed and its flesh sold as food. As to the propriety of utilising the flesh in this manner, there have been different opinions; but provided the animal has not been drugged to any considerable extent before death, and it is killed early, we cannot see any objection to its flesh being consumed. We have no evidence whatever that there is any deleterious agent developed during the malady. With regard to using the flesh of animals which have been affected with *parturient fever*—a disease with which parturient apoplexy is so often, and has been for so long, confounded—that is quite another matter, as in this we have a blood poison,—sepsin.

Though the prognosis is generally so uncertain, yet there are certain mani-

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festations which may assist us, at any rate to some extent, in forming an opinion as to the probability of recovery or death. Thus, the earlier the attack occurs after parturition, the more serious the case may be considered; while the longer its invasion takes place after that act, so is it less likely to be fatal. When it appears within twenty-four hours after calving, then it nearly always terminates in death. It is the same when the attack is very sudden and powerful; when there is marked coma, rapid and general loss of heat, great distension of the rumen (which may speedily cause asphyxia), violent convulsions, deep mucous *râles* in the trachea and bronchi, lustreless eyes, insensible to light or touch; paralysis of the digestive organs—indicated by meteorismus, torpidity of the bowels, so that the rectum remains empty when it has been evacuated; as well as paralysis of the pharynx and œsophagus—shown by inability to swallow; suspended lacteal secretion, relaxed sphincters, puffing breathing by the mouth and pendulous lower jaw, and total suppression of milk.

The favourable indications are a maintenance of the normal temperature in body and limbs, or the slightest elevation when this is low; natural tint of the mucous membranes, expulsion of the urine either spontaneously or when the finger is introduced into the urethra; and, according to Schaack, "a mode of respiration in which the animal retains its breath for an instant, then allows the air to escape by a long and slightly plaintive expiration.

It is likewise a very favourable sign when the fæces are passed. A return to consciousness is also, of course, a happy omen, and particularly if the animal attempts to rise, desires food or drink, and the lacteal secretion begins to re-appear.

In some cases, however, there appears to be slight recovery, and fatal relapse takes place. The pulse will also aid in forming an opinion as to the probable termination of the malady.

The longer the disease continues, so the more hope there is of recovery; though there is all the more danger of pneumonia from extraneous matters in the bronchia, if the coma or paralysis of the muscles of deglutition lasts for some days. Weigand says that when an animal continues lying for six to eight days, unless it can eat and drink, it should be killed.

Causes.

The unanimous opinion with regard to this disease is that it is peculiar to the parturient condition, and that it has a close relation to the state of the Cow previous to parturition—to a more or less marked *race* or *individual* predisposition. So far as breed is concerned, it is a fact that the Cows most liable to be attacked are those in which the secretion of milk is abundant—"deep milkers"—and which are in a more or less plethoric condition. With the perfecting of Cows for the production of milk, this disease has become vastly more prevalent. Numerous observers testify to this fact. "Since in Algau," writes Bentele, "the Cow has been so largely utilised for the production of cheese—converted into a milk machine, in fact—the previously unknown calving-fever has appeared."

So it is, that in countries or districts where bovines are reared more for their flesh than their milk, parturient apoplexy is not a very common malady, and the losses from it are comparatively small. It is, therefore, a disease almost peculiar to the best breeds of milch Cows.

With regard to *individual predisposition*, there can be no doubt that even in these breeds there are animals which suffer from parturient apoplexy more

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than others; and instances are reported of Cows being attacked after several consecutive births.

Plethora, there can be no doubt, exercises a great influence in the production of the disease. Thus it is chiefly among the well-fed Cows, particularly those kept for milk, in the vicinity of large towns, and which seldom or ever leave their stable, and are abundantly nourished immediately before calving, that parturient apoplexy prevails most seriously and extensively. It is true that it may attack Milch Cows in moderate, or even in comparatively poor condition; but then it will be found that their hygienic management is at fault. For instance, as Saint-Cyr observes, they are Cows which, having been scantily fed during a long winter, are abundantly supplied with food in the spring; or they are Cows which, purchased in low condition, receive a large supply of food from their new owner. Köhne (Gurlt and Hertwig's *Magazin*, 1855) states that he had occasion to observe eighty cases of this disease at Kemper (Rhenish Prussia), and that the majority were Cows which, bought lean in Holland some time before parturition, had passed without any gradual transition from the Dutch pastures to the stables of the Rhenish feeders, where they received a large amount of food. Kniebusch (*Ibid.*) and others have made similar observations. It has also been remarked that a uniform, and even abundant diet, is less dangerous than an abrupt change from scarcity to generous allowance.

Permanent confinement to the stable also acts in a similar manner to abundant and stimulating food, by inducing plethora and laxity of fibre. Thus it is, that while the disease is prevalent in the cowsheds of towns, or in those from which the cattle are seldom driven out to graze or for exercise, it is almost, if not quite, unknown in hilly pastures.

Age, or rather the *development of lactation*, has also a powerful influence. When the secretory power has reached a certain point, the Cow appears to become much more predisposed to an attack. Thus it is asserted that parturient apoplexy has never been observed in a primipara, and very rarely indeed before the third calf, when the lactiferous system has almost attained its maximum development in the more precocious breeds. In twenty-nine cases reported by Haycock (*Veterinarian*, 1851), 3 occurred after the third calf, 5 after the fourth, 16 after the fifth, 2 after the sixth, 3 after the eighth. After the third calf, or even previous to its birth, dairy-keepers are averse to purchasing the better-bred Milch Cows.

Temperature is supposed to influence the production of the disease, and especially exposure to cold. The suppression of the cutaneous functions, and the determination of the blood from the surface of the body to the internal organs, must favour congestion of these organs. Therefore it is that currents of cold air, lying on cold ground, and cold fluids ingested immediately after parturition, have been looked upon as powerful occasional causes. Sanson thinks that the sudden expulsion of the blood so abundantly contained in the uterine mucous membrane and cotyledons—and which should be only slowly diffused—forces that fluid into the neighbouring vessels, and surcharges them beyond measure; while Ayrault is of opinion that the cold air, entering the uterine cavity by its partially dilated os, drives the blood from the mucous membrane into the other viscera, suddenly checks the lochial secretion, and thus gives rise to the disease. This lochial secretion plays an important part in the genesis of the malady, acccording to several authorities.

Other writers suppose that the disease is more common during warm than cold seasons. In fact, it prevails in the most diverse temperatures, and it is

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as serious in cold as in warm weather. Sometimes the number of cases is very great, without any reference to heat or cold; then almost suddenly they subside, and no more outbreaks occur for some time. This has led to the supposition, again, that it depends for its development on a peculiar condition or epizoötic constitution of the atmosphere, but in what this consists no one has attempted to explain. Köhne says: "It is certain that when one of these periods of vitulary fever prevails, a change of atmosphere has occurred or is about to take place, though the converse is not true—for when an atmospheric change takes place we cannot predict an invasion of this fever. But if it happens that several cases of the malady follow each other immediately during a certain atmospheric constitution, we may assuredly predict a change in the weather. This change most frequently consists in a transition from settled to rainy weather, bringing about a diminution in the barometric pressure."

Some veterinarians have ascribed the disease mainly to infection—assimilating the puerperal fever of woman to the parturient *processus* in the Cow, but of this there is little evidence indeed; while others, as already mentioned, imagine that it is merely a nervous form of parturient fever, and due to blood-poisoning.

Günther, very many years ago, and a few others more recently, fancied it was produced by a moral influence, and that this was the removal of the Calf soon after birth, which distressed the Cow. But it was forgotten that the malady sometimes occurs when the Calf is with the Cow, and sucking; and that other creatures in which the moral faculties are more highly developed, and which exhibit great anxiety and distress on being deprived of their progeny, yet do not suffer from parturient apoplexy. Besides, the latter is no more prevalent in those countries or districts where the calves are taken away from the Cows at an early period, than where they are allowed to remain with them.

Others also have attributed the occurrence of the disorder to mental excitement during the act of parturition; but surely this excitement must be greater with the first calf or with the second—when the disease seldom or never appears—than with the third, fourth, or fifth calf, when it is so frequent. Not only this, but it is a notorious fact that parturient apoplexy, in almost every case, follows an easy and rapid expulsion of the fœtus without assistance, and ejection of the fœtal membranes at the ordinary time. Indeed, parturition is generally wonderfully easy and the opposite of abnormal. So much is this the case, that Köhne boldly asserts that a difficult or protracted delivery is never followed by this disease; and another authority (Banderschieren) is no less positive in declaring that if a Cow has a difficult calving, or if the placenta is retained, there is little reason to apprehend an attack of the disease.

The more rapidly the uterus contracts and resumes its normal size, so the more danger there is of parturient apoplexy; while the longer it remains relaxed or the membranes are retained in it, so the chances are diminished. In the examination of the bodies of Cows which have perished, the uterus is generally found very firmly contracted. Before the expulsion of the fœtal membranes, the disease is exceptionally rare. In a very few cases, the attack has commenced during parturition, and in still fewer before birth, and then when the lacteal secretion had not appeared.

Constipation and gastric repletion have been held by one or two writers to be causes, and others attribute it to over-feeding immediately before parturition.

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These are the chief causes which have been given as operating in the production of this grave affection; and it will be seen that they are sufficiently numerous and diversified to prove that the nature of the disease is obscure—so far at least as its etiology is concerned. We shall only, therefore, recapitulate what we have said with regard to the salient points of this question, by stating that parturient apoplexy, as a rule, attacks Cows within one to five days after parturition, and especially when that act has been easy, prompt, and natural; and that the animals which are affected are those of the higher breeds, good milkers, in a state of plethora, and pluriparæ. This brings us to a consideration of the *pathological anatomy* and *nature* of the malady.

Pathological Anatomy.

Notwithstanding the numerous, characteristic, and striking symptoms which mark this disease, the *post-mortem* appearances, no matter whether the animal has been killed or allowed to die, are for the most part of a negative character. In the majority of the descriptions there is much confusion, the lesions of parturient fever being mistaken for those of parturient apoplexy, and *vice versâ*, just as the two diseases are confounded with each other. In this malady the generative organs are usually little changed; the uterus may be congested—which it always is immediately after parturition, or it may even be paler than usual; it is generally firmly contracted.

The digestive organs are also usually normal, or their bloodvessels are much distended—perhaps due to paralysis of the vaso-motor system of nerves. The rumen is distended with gas in many cases, and the third compartment of the stomach often filled with hard dry food between its leaves, while the intestines contain somewhat hardened fæces. The gall-bladder is sometimes much distended. The lungs are normal, perhaps slightly emphysematous; at other times congested, or in different stages of pneumonia if foreign matters have obtained access to the air-passages. The examination of the brain has not yielded very satisfactory or constant results. Some authorities have not discovered any pathological lesions worthy of note, either in the brain, spinal cord, or their envelopes; while others have found well-marked and important lesions. These varied from venous congestion to œdema, anæmia, and exudation. Bragard, cited by Rainard and Saint-Cyr, constantly found injection of the brain and its meninges. Saake and Festal have also witnessed congestion of the vessels of the encephalon, sub-arachnoideal effusion, extravasation, and blood-clots on the surface of the cerebrum and cerebellum. Lecouturier has seen serous effusion in the lateral ventricles—traces of spinal meningitis; while Binz has observed a sanguineous extravasation and gelatinous matter at the origin of the sympathetic nerve, and Fabry blood-clots at the base of the brain, with serum in the cavity of the arachnoid.

In one instance Schaack met with a clot, three-fourths of a line in thickness, covering the left side of the medulla oblongata, and serous effusion into the lateral ventricles; and in another instance an inflammatory exudate on the right side of the cerebellum. Harms has found, in many cases, air in the cerebral bloodvessels; and Noquet and others have reported alterations in the spinal cord, which was reddened, congested, more rarely covered with exudate—chiefly in its lumbar portion, and sometimes the sciatic plexus of nerves has been affected.

Abadie (*Recueil de Méd. Vétérinaire*, 1873, p. 953) made a careful examination of a Cow which was attacked twenty-four hours after an easy delivery, and died in eighteen hours. The rumen was filled with dry food; the second compartment of

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the stomach was normal, but the third was distended with hard cakes; the fourth was normal. The mucous membrane was leaden-coloured, and in the pylorus and cæcum he found a large patch of ecchymosis. In the uterus the cotyledons were shrivelled, whitish, and the lining membrane pale. The organ itself was well contracted, and there was no trace of after-birth or lochia; it was more dry than moist, and the cervix was covered by a small quantity of mucus. The colour of the uterus contrasted strongly with that of the vagina, the posterior part of which was congested, and towards the vulva was a wide patch of ecchymosis. The upper surface of the lining membrane was dry. In the udder was plenty of milk of good quality. The kidneys and bladder were normal; the latter was filled with reddish urine. The blood in the vessels was dark-coloured and inclined to coagulate. There were a few ecchymosed spots on the surface of the heart, which was otherwise healthy. The lungs were normal, though full of dark blood, and emphysematous at the left anterior border; the bronchial mucous membrane was of a livid-red hue, and without mucus; out of the trachea, as well as from the nostrils, flowed a quantity of fluid mixed with food. When the head was cut off no fluid escaped. The dura mater of the brain was normal; no fluid in the sub-arachnoideal space, but the arachnoideal membrane and pia mater appeared somewhat infiltrated and opaque. The brain-substance had a natural hue without blood-points (*puncta vasculosa*) on section. There was no trace of fluid in the ventricles. The other organs were healthy.

Nature.

With regard to the nature or efficient cause of the disease, there has been, and is even now, much divergence of opinion, as already stated. With some authorities it is a fever—a nervous or paralytic form of parturient fever, closely allied to the puerperal fever of woman, and due to a blood-poisoning: the two forms only differing in degree. But we have shown that there is no fever; that the temperature is rarely above, but is generally below, the normal standard; and that sometimes the animal recovers—all the symptoms disappear in a remarkably brief space of time, and leave not the slightest trace of either fever or inflammation. This theory is opposed to the most careful and exact observations, and is evidently based upon erroneous notions, or through mistaking metritis or metro-peritonitis, with its septic fever, for this disease.

With other writers the disease is considered to be a grave form of gastric fever—this opinion being based on the circumstance that there is constipation, and impaction of the digestive organs with hard dry food. But impaction does not produce the symptoms of parturient apoplexy, neither does it cause death in such a brief period. Again, it is supposed that mephitic gases, generated in the digestive apparatus, enter the blood, alter it, and so produce disturbance and stupefaction in all the organs. But no proof of the existence of such a gas is given us.

The increase in the proportion of white corpuscles in the blood towards the end of pregnancy and after parturition, has led some writers to imagine that the disease might be a kind of leucocythæmia. But it is evident that this cannot be so.

Again, the disease has been considered as in its essence a cerebral or spinal congestion, encephalitis, myelitis, a meningo-cephalitis, or a cerebral or medullary apoplexy, according to the nature or the seat of the lesions found after death. But some of these opinions are opposed by the fact, that many of the lesions on which they are based are not found in all cases of death, and that recovery is often quite rapid. With regard to cerebral congestion and apoplexy we shall have to refer hereafter.

Many high authorities—such as Köhne, Carsten-Harms, Wannovius, Fusch, Röll, Baumeister-Rueff, Barlow, and others—have maintained that the disease is primarily a derangement or paralysis of the ganglionic nervous

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system, which affects, or is extended to, the spinal cord and brain during the course of the disease. The following explanation is offered in support of this opinion. A too easy birth throws out of play a certain amount of the nervous force destined to the accomplishment of this act. Hence, there is a disproportion between the polar tension of the force conveyed by these nerves and the muscular irritability, and consequently an obstacle to the conductibility of the nerves charged with the distribution of this superfluous portion of the nerve force. Barlow thought that this disturbance in the function of the sympathetic nerves produces arrest of secretion and general congestion, especially of the brain and spinal cord. Contamine is more or less a partisan of this theory, as he explains the origin of the disease by stating that a reserve of nervous influence which is not expended in the animals that calve easily, by a reflex movement acts at first upon the spinal cord, and afterwards on the brain.

Another theory—that of Lafosse—is that the malady is due to the circumstance that the milky fluid secreted by the cotyledons, and absorbed by the chorial villi for the nutrition of the fœtus, being no longer separated from the blood after parturition, remains in the circulation and accumulates there until the mammary glands eliminate it. When these glands act promptly, the febrile movement is imperceptible or almost nil; but if they are slow in secreting, then arises a more or less intense morbid disturbance, due more especially to the presence in the blood of a product foreign to its normal composition. Without commenting at any length on this theory, it may be sufficient to mention that in some cases of parturient apoplexy, the function of the mammary glands is not suspended.

Others—among them Deneubourg—trace the commencement of the disease to milk fever, the intensity of which, originated by a rapid and easy delivery, is in proportion to the development and secretory power of the mammæ. The resulting disturbance is spread over the entire economy, and favoured by the repletion of the stomach and the pre-existing plethora —suddenly increased by the mass of blood which goes to the uterus during pregnancy—as well as by the state of the nervous system in general which the pains of labour have induced, excites grave disturbance in the important functions of digestion, circulation and innervation. Hence arise disorders, as much more sudden and serious as the repletion of the stomach and the plethora are great, the blood is rich and plastic, and the irritability of the nervous system—especially the ganglionic—is excited. Consequently, we have a general functional disturbance resulting from the "congesting" action of all the cerebro-spinal and trisphlanchnic or ganglionic nervous systems.

For Sanson, the *collapsus* of parturition is the consequence of a sudden disturbance in the physiological condition of the uterus after parturition, consisting in the sudden removal of blood which congested the organ at that time; as during gestation a large portion of the blood is diverted towards the pelvic region, where the uterus is lodged. After parturition the mucous membrane and cotyledons of the organ have lost their function, and the enormous quantity of blood they contained is suddenly thrown into the circulation, surcharges the neighbouring vessels beyond measure, and produces collapse. In proof of this, at the autopsies he made, Sanson affirms that the mucous membrane and cotyledons were always found bloodless, and of a pale-yellow colour.

Werner is of opinion that the vascular system is involved,—as manifested by the diminution in temperature and the lacteal secretion—as well

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as the nervous system—shown by the general depression and loss of sensibility, inactivity of the spinal cord in the dorsal region, difficulty in digestion, quickened heart's action, and slowing of the respiration; and the causes he believes to be a bad regime, and pressure of the fœtus on the stomach and intestines, diaphragm, vena cava, and posterior aorta. A too rapid evacuation of the contents of the uterus brings about a fall of the abdominal viscera, dilatation of the posterior aorta, and slackening of the circulation.

This theory of Wermer's is somewhat analogous to that of Franck, who compares the disease to the parturient eclampsia of woman, and has done more to elucidate its pathology by calling to his aid modern physiological teaching, than any previous investigator.

The great importance of the subject from a pathological and therapeutical, no less than from an economical, point of view, induces us to notice his statements at greater length than we have done those of other veterinary writers, as we think they go far to furnish an explanation of the phenomena of this disease.

Franck (*Wochenschrift für Thierheilkunde*, 1876, Nos. 21, 22) says that nearly all the theories set up have this in common, that their correctness or incorrectness has never been supported by experiments. If we consider the conditions which are present at parturition, as well as the symptoms of the disease, we are led to attribute the origin of the latter to an *acute anæmia* ("Blutarmuth"—poverty of blood), and consequent sudden loss of brain power. With respect to this the following questions have to be answered:

1. Do the same symptoms appear in sudden brain anæmia as occur in calf-fever ("Kalbefiebers," the popular name for the malady in Germany)?
2. Has brain anæmia any relation to calf-fever?
3. If so, what occasions this brain anæmia?

Now as regards the first question, it is an indisputable fact that the functions of the brain are in a great measure dependent on the state of the circulation. A large array of physiological facts tend to show that reduced flow of blood in this organ, and consequent diminished oxidation of the brain ganglia, lead to lethargy, lessened reflex action, loss of volition, and complete unconsciousness. Snakes, which seldom feed, but which on these occasions consume an enormous quantity of food, are known to be in this comatose state after one of their heavy meals; they either move about sluggishly or not at all, are quite stupid, make no attempt to flee from danger, and can be then easily destroyed. This is due to a peculiar distribution of the blood. A large proportion of this fluid must necessarily be diverted to the stomach, in order to convert the enormous quantity of food into chyle; consequently, the stomach has much more blood during the process of digestion than when this is not going on. The stomach having absorbed the blood, it follows that the brain and muscular system must suffer from a deprivation of it. Now there is a general physiological law to the effect, that organs cannot perform their functions without a sufficient supply of the vital fluid; and as the cerebrum is the seat of volition and of consciousness, these two functions are diminished in activity by sudden loss of blood, and if the deprivation is very considerable, the brain entirely ceases to act.

Remove the cerebrum from an animal (such as a pigeon), and the same symptoms appear; the animal is no longer conscious of what is going on; it can no longer assert its will or control its movements; it lies as if in a dream, but otherwise its health is unimpaired. It is different, however, if the whole of the brain loses much blood; then certain functional disturbances

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of the organ are manifest, which often terminate in total unconsciousness. In narcosis the brain is poor in blood and pale; the action of cold on it produces contraction of the bloodvessels and anæmia, resulting in lethargy and, finally, unconsciousness.

Even during sleep there is less blood in the brain than when awake. The fontanella of children collapse somewhat during sleep, and the upper surface of the brain itself becomes pale, as has been shown to be the case in animals by Durham. Strike a dog a severe blow on the muzzle, and it will at once become insensible, and perhaps quickly die. This is owing to the blow having affected the inhibitory filaments (in the track of the fifth cerebral nerve are a number of these filaments, which excite the contraction of the vessels), and caused them to bring about complete contraction of the small cerebral arteries, so that the brain becomes suddenly deprived of arterial blood; hence unconsciousness and death. There is also the instructive experiment of Goltz, by which, when the heart's movements are made to stop at the diastole, the bloodvessels dilate, especially those of the portal system, and there is brain anæmia.

All this tends to show that the same symptoms are common to anæmia of the brain and calf-fever. No doubt coma can result from deficient oxidation of the ganglion-cells of the cerebrum, from exclusion of air; or blending of matter or carbonic acid therein, which prevent the blood from passing into the tissues, will readily induce coma. Another symptom must be referred to—paralysis. This symptom manifests itself in two ways—in single muscles or in groups of muscles. In the first, the nerve connected with the muscle, or its centrum in the brain or spinal cord, ceases to act. This is the commonest form of paralysis, and may be due to apoplexy. In the second case, the paralysis may arise from functional inactivity of the volitional centre, located in the cerebrum. The animal, as a rule, makes no attempt to move, or cannot take the initiative in movement; and we might be inclined to designate it as "paralysis of the will." Some of the symptoms of paralysis which appear at the commencement of calf-fever, may certainly be traced to the latter form. Saake seems to be quite convinced of this, for he says that the paralysis is owing to a disinclination to move the hinder parts.

In the second place, it is particularly interesting to note the frequent occurrence of epileptic attacks and spasms. The latter can be produced by sudden anæmia of the brain. The various centres in the medulla oblongata can, according to Landois, be irritated by anæmia; and sudden and acute anæmia of the medulla oblongata is most likely to occur in the fourth ventricle, above and behind the pons where the "spasm-centre" (*Krampfezentrum*) is situated. From this may arise convulsions which are very similar to, if not identical with, epilepsy. Epilepsy can, however, in many instances be traced to anæmia of the brain and medulla oblongata, induced by reflex action of the vaso-motor centres, or direct influence of the inhibitory nerves. We may easily be convinced of this by watching an animal which is being bled to death after being stunned. When nearly all the blood has escaped, and reflex action through the cornea can no longer take place, insensibility and acute convulsions (Opisthotonos) then set in—the latter bearing the closest resemblance to those of epilepsy and calf-fever, and are assignable to the same cause.

The comatose symptoms occur chiefly in distinct anæmia of the brain surface and cerebral ganglia, and when the medulla oblongata is involved convulsions prevail. It does not seem out of place to direct attention to the

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Rosenberg-Traube theory as to the eclampsia of woman, which applies equally to that of Cows. This theory can be summed up in the following sentences: 1. The origin of the symptoms of eclampsia lies in the altered conditions of the brain circulation, and not in a uræmic blood-poisoning, as Frerichs, Listzmann, Braun, and others have maintained; 2. This altered circulation in the brain is brought about by increased aortic pressure, and perhaps also by direct reflex brain-stimulus. Owing to the sudden and violent contractions of the uterus, blood must be poured into the aorta, and the consequence will be hyperæmia, and afterwards œdema and anæmia, of the brain; 3. The brain œdema and the anæmia resulting therefrom, are materially affected by the aqueousness of the blood after parturition. This hydræmia is undoubtedly increased during the last period of pregnancy, by the appearance of albumen in the urine.

This theory is all the more valuable, as its correctness has been experimentally demonstrated on living animals. Bidder and Munk have made experiments with regard to eclampsia in animals. They first injected tepid water into the carotids; and as soon as the pressure of the water reached seven times that of the blood, coma and convulsions immediately set in. The dilution of the blood does not altogether account for the convulsions. Strong and momentary pressure had no effect; but when the pressure was applied continuously, coma, spasms, or at least unconsciousness, resulted! Bidder came to the conclusion that increased blood-pressure alone would not produce eclampsia; and that this fluid must be much more impoverished, and the pressure more durable, to induce this condition. Although it cannot be denied that the injection of warm water causes certain changes in the blood and unknown disturbances in the brain, and although we can arrive at no definite conclusion as to the extent of blood-pressure in the vessels of the brain, these experiments are of the utmost importance.

The question now is whether, in calf-fever, changes in the brain occur, such as are portrayed in the Rosenberg-Traube theory? This question must be answered in the affirmative. Nearly all those who have had opportunities of dissecting cows which died of calf-fever, mention that, according to the stage in which death occurred, hyperæmia of the brain, brain œdema, and exudation in the cranial cavity. As soon, however, as it reaches the degree of brain œdema, anæmia sets in. It may as well be casually remarked, that animals may suffer from arterial anæmia—and this is most likely to induce eclampsia—simultaneously with venous hyperæmia of the brain.

The question may be asked, How is it that such a brain anæmia ensues after calving, and what makes it so prevalent among cattle? As a matter of fact, there are a host of conditions during, and particularly after, calving which are most favourable to an attack of eclampsia, from the Traube-Rosenberg point of view. It is also a fact that calf-fever sets in, almost without any exception, during or after parturition, and simultaneously with the involution period of the uterus. In many cases, the commencement of the malady corresponds with the "after-pains." Furthermore, the malady in question principally attacks Cows which are in good milk, and, as a rule, those which are best fed; and these attacks generally follow easy parturitions. Consequent on the uterus contraction and diminution, a great portion of the circulation is diverted from it. The blood is poured into the larger trunks and into the aorta. The quicker and more continuous the uterus contractions, the more considerable is this flow of blood. Attention may casually be directed to the fact, that the after-pains are much more severe and continuous after a speedy parturition, than after a tardy one. The blood forced

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back generally finds its normal outlet by the udder and skin; and by watching every normal parturition, one can observe the acute swelling of the udder, which swelling varies in proportion to the number and violence of the pains. By this outflow into the udder and skin, and by which a collateral fluxion is established, the accumulation of blood already alluded to, which would be followed by aortic pressure,* is got rid of without detriment to the animal. In cases, however, where this stoppage is sudden and violent—as happens after a chill to the surface of the body—the aortic pressure must undoubtedly be considerably increased.

One consequence of the increased pressure—always easily observable after a little time, as will be shown presently—must, among others, be congestion of the brain. But the soft brain-tissue can only offer a slight opposition to the distention of the vessels; consequently, sudden effusion and, as a result, brain œdema, ensues. This brain œdema, on its part, causes contraction of the vessels and, in this way, arterial anæmia. The whole process, which can be followed step by step, is greatly aided by (*a*) the heart's hyperplasia, (*b*) the increased flow of blood, and (*c*) the hydræmia which exists in pregnant animals. After parturition, the heart does not at once resume its normal size; it remains for some time in a hypertrophied state. In fact, it seems as if the heart, in good milking Cows, follows the same law as increased circulation in the swollen udder, and is much more enlarged than is the case with inferior milking animals. The result of increased power of the heart is increased action. The blood, which has been largely increased in a pregnant animal, does not at once return to its normal quantity after parturition, but materially aids in producing congestion.

The remarkable fact always, however, holds true, that animals which are in good condition without being fattened up, and those in which the circulation is healthy, are particularly susceptible to calf-fever. An animal which has calved, is like one into whose circulation a certain quantity of blood has been transfused. This superabundance of blood does not quickly disappear from the body; it takes, so to say, the place of a new organ. In animals which have just brought forth, the milk secretion expends this blood. Hydræmia is common to them all. Doubtless, the dilution of blood in pregnant animals is, as a rule, over-estimated. There are, however, many cases of albuminous urine among Cows for some weeks before parturition. Hydræmia is the natural result of this condition of the urine, if it be of long standing. The watery condition of the blood tends materially to brain œdema, if, indeed, this be not really the actual consequence of such a condition. Particular inquiries furnish statistical information as to the number of cases of calf-fever accompanied or unaccompanied by albuminous urine.

It is necessary, however, to append a consideration of a teleological character. The act of parturition is naturally accompanied by great irritability of the sensory nerves, and with much pain; whilst all other operations in animals, which have as their object the preservation of the creature or species—such as appeasing hunger, slaking thirst, etc.—are unaccompanied by pain. There must be some particular reason for this. We know that the vaso-motor centre, and more especially the vaso-motor nerves, together with the distension of the vessels, are greatly influenced by the sensory nerves, because of a reflex mechanism which exists between them; as we know to be the case,

* It must be remembered that blood stasis and undue distention of vessels, is not always due to blood-pressure. Altered innervation of the walls of the vessels themselves can bring this about.

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on a larger scale, between the sensory and motor nerves. As a rule, irritation of the sensory nerves is followed, first by contraction, then by great dilatation of the vessels, which may even lead to extravasation in some cases. The tendency to inflammation and its results must also not be lost sight of. It might be imagined that the pains at birth would have the effect of expanding the vessels, to admit of the flow of blood driven out of the gravid uterus.

It has been remarked by nearly every authority, that calf-fever ensues after quick and easy parturition, when but little assistance has been required. In such cases there can be but little pain, and therefore one would expect little, if any, distension of the vessels. But it is just in these cases of easy parturition that a particularly severe aortic distension arises; as at times the uterus contracting too quickly, causes a mass of blood to be suddenly propelled into this vessel. At other times, the whole vascular system is unprepared for the mass of blood forced into it; consequently, the aortic pressure reaches its highest degree. The question now presents itself: Are there, then, anatomical indications to show clearly why the disease in question should be so prevalent among cattle, whilst with the other domestic animals it occurs but seldom, or not at all? Such indications exist, as a matter of course. The process of conveying blood to the brain of cattle—particularly to that of ruminants—is a peculiar one. The Cow has no single large vessel—no *carotis interna*—to convey blood to the brain, as is the case with the Mare, but a number of small vessels which penetrate to the cranial cavity. These vessels, however, do not spread over the surface of the brain, as in the Mare; they form a sort of network—the *rete mirabile*—from both sides of which a branch develops itself, and which forms the proper brain arteries. The following seems to be the result of the peculiar distribution of the vessels:

1. The circulation of arterial blood to the brain is very uniform; 2. Irregular pressure in the aortic system cannot easily, and then only slowly, be transmitted to the arteries of the brain. Now, however, Bidder's experiments have shown that sudden increase of blood-pressure does not produce any comatose symptoms, but that these always set in if the increased pressure is of any duration. Under these circumstances, brain œdema is much more likely to set in than if the blood pressure were to disappear quickly.

The anatomical arrangement of the *rete mirabile* is such that it chiefly supplies the cerebrum. This should tend to explain why, in eclampsia of the Cow, the comatose symptoms are so common that convulsions seem exceptional. It is an interesting fact that, in Swine, this fever is often observable in those in which the *rete mirabile* is greatly developed. Not long ago, Walley (*Veterinarian*, 1874) asserted that this so-called calf-fever was dependent on this peculiar distribution of the vessels.

Practically, as yet no illness has been observed, such as attacks the Cow and Mare, where the flow of blood to the brain is direct, and conveyed through large vessels. As in the latter, the flow of blood to and from the brain is rapid, a check in the circulation sufficient to cause brain œdema and anæmia is with difficulty effected. In the Mare, increased aortic pressure can very quickly be transmitted to the brain, and can also readily lead to apoplexy. It is worthy of notice that the first stage of parturient fever—viz., the stage marked by congestion of the brain—is observed in the Mare. It soon terminates in death, as is also sometimes the case with the Cow, as a result of apoplexy. Such cases, though not sufficiently substantiated by the results of autopsies, have been described by

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Gerrard (*Veterinarian*, 1874). The Mares in question died during parturition, or soon after.

The second stage, however—which in the Cow is marked by anæmia of the brain and comatose symptoms arising therefrom, as also by convulsions, and which has all the characteristic features of parturient fever—has hitherto not been observed in the Mare. We must now ask the question whether anæmia of the brain can arise in any other manner? Must congestion and effusion always be the forerunners of anæmia? There is no doubt that anæmia of the brain can occur in quite a different manner; but the question is whether, in the case of calf-fever, it shows itself in any other way than that already described? The portal circulatory system, which is governed by the splanchnic nerve—the largest and most important vaso-motor nerve in the body—is a most powerful one. Under certain conditions, this portal system can receive the whole mass of blood in the body; the animal can, to use the expression of a celebrated physiologist, "bleed to death in its own portal vessels."

If the portal vein of a dog is tied, all the symptoms of anæmia set in, and result in death; as the intestines, and more especially the spleen, are distended with blood. The animal dies from want of blood, yet without losing a single drop of blood from its vessels.

Similar symptoms were the result of Goltz's experiments and nicotine poisoning. The latter poison has the effect of paralysing the circulatory nervous centre, and this is followed by a general dilatation of the vessels. In many diseases—among others, in rabies—there are somewhat similar symptoms.* It is also known that after rapid escape of the stomach gas in tympanitis, the evacuation of large abscesses in hydrops, etc, sudden collapse follows from brain anæmia. In these cases the blood flows quickly to the stomach and its organs, and the brain becomes emptied. A similar rush of blood into the portal vein can also be brought about in a reflex manner—viz., through stimulation of the sensory nerves. Stoppage of the heart by reflex vagus stimulation or reflex splanchnic paralysis (consequent paralysis of the portal system), can thus be brought on. Quite recently Fischer (Volkmann's *Sammlung Klinischer Vorträge*, No. 10) has attributed the occurrence of "shock" in man to the reflex paralysis of the nerves of the vessels. The conditions and arguments hold good for those of calf-fever in the Cow.

Werner, in particular (*Wochenschrift für Thierheilkunde*, 1868, p. 363, etc.), decidedly inclines to this idea. He draws attention to the fact, that in calf-fever there is always hyperæmia (?) of the intestines. This primary hyperæmia directly causes brain anæmia. Calf-fever might, therefore, be looked upon as "parturient shock." We will not attempt to deny that such cases occur, but they do not as a rule; added to which, it is probable that this abundance of blood in the intestines in calf-fever is looked upon as symptomatic of paralysis, which first originates from brain anæmia, resulting from lessened stimulation of the vaso-motor centre. This last theory does not in any way account for the congestion of the brain. Besides, if one admits this theory, one must expect to see calf-fever set in as soon as the act of parturition is over—*i.e.*, as soon as the uterus is empty, which is very seldom the case. As a rule, calf-fever sets in simultaneously with the after-birth period (inclusive of the period of after-pains), fifteen hours after delivery, but generally within the first twenty-four hours.

* In rabies in the Horse, this appearance is often present in the highest degree. There is extreme distension of the portal system, with marked anæmia of the brain.

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Now, if it is admitted that calf-fever does not in most cases, according to this theory, account for the direct brain anæmia, it often really occurs in some diseases which are very similar to this one. Thus Gierer remarked, after feeding with leaves of the red beet, plethora of the intestines and anæmia of the brain similar to that in calf-fever. Lies saw anæmia of the brain and epileptic fits in a Mare after a dose of aloes, etc. Some of the symptoms of rabies, especially towards the end of the disease, are to be traced to anæmia of the brain, and have a great similarity to calf-fever. Likewise the kind of aberration which is often noticeable in cattle; here also there is anæmia of the brain.

Saake gives a good instance of primary brain shock, which must come under the head of calf-fever. A portion of the lower jaw of a Cow was broken off by a blow, and the animal developed symptoms of illness which, after Saake's assurance, any one would have taken for calf-fever, had he not known the origin of it. These symptoms are in this case clearly attributable to anæmia of the brain, arising from powerful stimulation of the inhibitory fibres. The same happened in the case of a Dog which received a heavy blow on the nose.

Anæmia of the brain can, therefore, arise in the following ways, exclusive of excessive hæmorrhage:

1st. Through excessive stimulation of the inhibitory fibres, caused by painful injuries to the head.

2nd. By reflex paralysis of the vessels.

3rd. Through congestion of the brain in brain œdema. The latter is clearly that in operation in calf-fever.

Numberless are the hypotheses, as we have already said, as to the origin of calf-fever. The most far-fetched is that which attributes it to paralysis of the sympathetic nervous system. None of the symptoms of the malady favour this belief. The nerve of the intestines is a vessel-nerve, and, indeed, the largest vessel-nerve in the body. Were this to be paralysed, the vessels of the intestines would be paralysed also, which would clearly appear on dissection.

In opposition to this, there is no doubt that in the course of the disease there is paralysis of the vagus. The quickened pulse, the laboured breathing, especially towards the end; the paralysis of the pharynx, the suspended peristalsis—all point to this with certainty.

Harms, in his earlier days, was of opinion that the disease in question arose from introduction of air into the veins. This is, however, most improbable; as if air be admitted into the veins, the symptoms are quite different from those of calf-fever. Added to which, it is incomprehensible how, in normal parturition, air can get into the veins, as there is no wounding of the uterus. Others believe that the malady comes from infection. Results of dissection disprove this. Confounding calf-fever with *febris puerperalis*, which designates quite a different malady in mankind, has misled many people. Calf-fever in cattle is an *eclampsia puerperalis*. It has already been noticed that the malady can arise from other causes; and really it has been observed in oxen, non-parturient cows, etc. Those, therefore, who have been accustomed to name the disease "calf-fever," are compelled to speak of a malady bearing a resemblance to calf-fever. By the term *febris puerperalis* one designates *septic metro-peritonitis* and its results.

Preventive Treatment.

When we see the great and speedy fatality of parturient collapse, and when

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we know that the subjects of it are hearty-feeding, high-milking Cows in a more or less advanced state of plethora, we have every reason to lay great stress on *preventive treatment*, and to combat the predisposition to the malady by a strict attention to hygiene, particularly during the last months of pregnancy and immediately after parturition. The diet should be soft and easily digested, so as to avert constipation; and if the animal is plethoric, the allowance ought to be moderate. When it is possible to allow exercise for some time before parturition, this should not be withheld. Nothing is so likely to prevent an attack of the disease, than keeping the Cow in as natural and free a condition as possible. Exposure to cold and currents of air, and everything likely to diminish the functions of the skin, should likewise be avoided.

More special precautions have been recommended by various authorities, founded generally on the opinions they may have entertained as to the pathology of the disease; but the utility of these prophylactic measures has been more or less disputed. Bleeding during the month before parturition has been highly lauded, but there is every reason to believe that it is more injurious than useful. Others recommend the administration of nux vomica, tartar emetic, nitrate of potass, sulphate of soda or magnesia, and laxatives of various kinds —all of which may prove more or less useful; while others, again, speak favourably of milking the Cow by hand a few days before calving, and thrice instead of twice a day for a short time after that event, if the Calf is removed or cannot abstract sufficient milk. This they insist upon doing if the udder is largely developed or distended.

As there may be danger if the newly-calved Cow is allowed to drink much cold water, this should either be very sparingly given, or, better still, warm gruel, in small but frequent quantities, may be substituted.

Curative Treatment.

The different methods of treatment enumerated for the cure of this disease are completely bewildering, and they are so diametrically opposed to each other—from the obscurity which prevails as to the nature of the malady, we suppose—that we can scarcely be astonished to find that they are all more or less unsuccessful, and that the majority of the most observant practitioners are inclined to believe that recovery has followed most frequently when, without adopting violent measures, the attendant has waited for the curative effects of nature—usually decided about the second or third day: only attempting to combat certain morbid conditions which might aggravate the case.

Nevertheless, it is evident that some mode of treatment must be resorted to, and that this should be based on the indications furnished by the symptoms during the course of the malady, or upon what we know of its pathology. We shall glance at some of the means which may be employed in the curative treatment of the disease.

Previous to doing so, however, we must draw attention to the *position* of the affected animal, and we cannot do this in better terms than those of Williams (*Principles and Practice of Veterinary Medicine*, p. 418): "If the Cow is already down when first seen by the practitioner, his first care must be to see that she is made to lie as near the natural position—on the sternum —as possible; and this he will do by having her packed up at the side by bundles of straw, or, what is better, sacks filled with straw, firmly wedged under the quarter and shoulder, the head at the same time being properly propped by the same means, and care being taken at all times that the Cow

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is prevented from injuring her head by striking it against hard bodies." We may add that some practitioners are particularly careful to have the head well raised above the other parts of the body, especially when the animal is comatose; and this is sometimes effected by means of a halter on the head, or a rope round the base of the horns, the other end being passed over a beam in the stable. This elevation of the head prevents increased congestion of the brain, and facilitates the return of blood from that organ.

It is often beneficial to alter the position at intervals—every two or three hours; and Williams recommends that the mammary gland be also "stripped and hand-rubbed."

The *abstraction of blood* has found much favour with many authorities. Williams says: "In the earlier stages, whether the animal is standing or lying prostrate and in a state of coma, if the pulse be not excessively weak and the heart's action almost fluttering, recourse must be had to venesection. Slow and deep breathing, with a tendency to stertor, add greatly to the necessity for immediate bleeding. The beneficial action of the withdrawal of blood is shown by the pulse becoming fuller, stronger, and better in tone. The opening into the jugular is to be a large one, in order that the blood may flow freely to relieve the congestion—to check, if possible, a further extravasation of blood or effusion of serum, and to divert its active flow into the head; but it must not be carried out so as to debilitate the heart's action. When the pulse becomes fuller and stronger, the bleeding is to be stopped; from three to five quarts will generally be sufficient."

Theoretically, venesection is to be commended. If we accept Franck's opinion that the disease is analogous to or identical with the eclampsia of woman, and if the Traube-Rosenberg theory be correct, then a sudden depletion of the vascular system, by which the pressure is diminished, must stop the attack. It is known from experience, says Schroeder, that after venesection the quantity of the blood soon becomes the same, through the serum taken from all the tissues, whilst the quality is greatly deteriorated by the abstraction of blood. A short time after venesection, we shall expect to find the former blood-pressure in the arterial system, but the blood far more watery than previously. From this theoretical consideration, it follows that abstraction of blood, if the above-mentioned conditions really cause convulsions, must be attended by an immediate favourable result, and under certain circumstances the whole disease may surely be cut short by it. But if all other conditions remain the same, the blood-pressure will, after some time, again reach its previous height; the quality of the blood has, in the meantime, been greatly deteriorated, and consequently the danger of the disease will be increased.

Williams adds: "The bleeding is for the purpose of removing pressure from the brain, and although the pulse may indicate stimulants rather than depletion, it will be found that as the blood flows the tone of the pulse will improve; for the weakness of the pulsation, the want of impulse, and debility of the heart's action, are results of brain-pressure. If, however, the surface of the body be cold, if the animal be tympanitic, the heart's action fluttering, and the pulse almost undetectable, bleeding is calculated to do more harm than good, as the heart's action would now be further impaired, and the amount of arterial blood sent to the brain diminished. For it must be remembered that the cerebral congestion is now less due to an over-abundant supply of arterial blood than to pressure upon it by venous or capillary engorgement; that, in fact, the brain—engorged as it may appear—is in an

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anæmic condition in regard to its arterial supply; and when this is the case, paralysis of the heart is to be prevented, if possible, by the use of stimulants."

A principal indication in the treatment of the disease, viewing it in the light we have done, is to *favour the cutaneous circulation and stimulate the skin* by every means in our power, and thus relieve those organs in which the blood-pressure is too considerable. With this object in view, the skin is to be well rubbed with straw wisps, and then warmly clothed. Or the course of the spine and for some distance on each side, may afterwards be stimulated with strong ammonia liniment. Some authorities recommend the application of a mixture of croton oil with oil of turpentine; others employ a thick layer of mustard, after the skin has been well cleansed with warm water and the hair removed; others resort to sacks steeped in boiling water applied to the spine—sometimes after deep scarifications have been made.

In addition to the applications of turpentine or mustard to the spine, they are often made to the limbs.

In some cases, a hot iron—the laundress's flat iron—has been applied to the back in an "ironing" fashion, and at a somewhat high temperature, a piece of flannel being interposed between it and the skin. The action of the skin can be greatly augmented by covering the body with a wet sheet, and above this a thick woollen one, surrounding the animal with plenty of litter.

Cold water or ice may be applied to the head; but this application requires care, as the resulting coryza and other complications may prove very serious, should the animal recover from the collapse.

With regard to the *tympanitis* which is so often present as a consequence of the torpidity in the digestive organs, this should be combated in the ordinary way, by the administration of stimulants. These are most effective and rapid in their action when given in the fluid form, if the animal can swallow. If it cannot, then they may be administered by means of the stomach-pump or probang, or even in bolus. Williams recommends giving carbonate of ammonia in bolus; the hand being well oiled, is to be pushed as far as possible into the pharynx, when the dose "will slowly gravitate into the rumen." Should the medicine not act promptly, or should the tympanitis be so great that suffocation is to be apprehended, then the rumen ought to be punctured without delay. This may be effected by the ordinary trocar and cannula, the latter being allowed to remain in the rumen for some time. It may be closed by a cork, which is to be withdrawn when the gas accumulates. If care is exercised, fluid medicaments may be introduced into the stomach through the cannula.

Even when the tympanitis is not extreme, but the animal is comatose and there is gastric regurgitation, it will be advisable to puncture the rumen; as by this means the entrance of food into the trachea may be prevented, by allowing the gases to escape through the cannula, instead of by the œsophagus.

Enemas are as essential as counter-irritation. The rectum should first be emptied manually, and then either enemas of warm water, or those of a stimulant or laxative nature, administered. By the rectum enemas of linseed oil, common salt, sulphate of soda or magnesia, aloes, tobacco, oil of turpentine, camphor, etc., have been administered. The rectum forms a safe and convenient channel for the introduction of medicines, and especially those intended to act upon the torpid digestive organs, when the animal can no longer swallow. Powdered camphor in small quantities has even been introduced into the rectum to stimulate the intestines, when drugs exhibited by the mouth have failed to effect this.

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Enemas may be given as frequently as necessary without danger to the animal, and with ease: advantages not available with the mouth administration.

The *urine* should be frequently removed from the bladder, either by pressure on the viscus through the rectum, the introduction of the catheter or nozzle of the ordinary injection syringe into the urethra, or even by passing the finger into that canal.

The *milk* should be often removed, and the udder completely emptied. Even when there is no milk, the teats should be well and repeatedly stripped.

Purgatives are in nearly every case necessary, and they should be active, and given in larger doses, than in ordinary circumstances, constipation being a constant and serious symptom; while action of the bowels may be considered a most favourable sign. The most common are sulphate of magnesia or soda, aloes, chloride of sodium, cream of tartar, linseed oil, castor oil, tartar emetic, ipecacuanha, croton oil, etc.

In the great majority of instances these agents are not given alone, but are associated with other substances.

A very favourite compound in Germany is that mentioned by Köhne, the composition of which is as follows:

Nux vomica - - - -	8½	drams.
Tartar emetic - - - -	2	ounces.
Sulphate of soda - - -	18	„
Common salt - - - -	4½	„

These are boiled together for about a quarter of an hour in four pints of water, and one-fourth given every hour or every two hours.

Harms places great confidence in tartar emetic. He gives 8½ drams in about two pints of water, in four hours three drams in a pint of water, and in five hours two drams. In one serious case he gave as much as two ounces in fourteen hours. In thirty-seven cases of the disease, only two died.

When it is desired to increase the activity of any of the ordinary purgatives, croton oil is generally added in the proportion of six to twelve—or even forty—drops, or oil of turpentine one or two ounces.

Some practitioners extol nux vomica in tolerably large doses, to aid in rousing the action of the intestines.

Stimulants are often administered, and in conjunction with bleeding they may prove of the greatest service at the commencement of the attack, or they may be associated with the purgatives. If given alone, they should be exhibited in small doses and very often.

Other medicaments have been employed—as aconite, bryonia, camphor, phosphorus, datura, quinine, gentian, digitalis, etc.—with varying success.

When recovery commences, small doses of stimulants may be beneficial if there is much debility, and the animal can swallow readily. But in the administration of fluids when the animal is comatose, or deglutition is impeded, the greatest care is necessary to prevent their entering the trachea—an accident which might prove fatal. To test whether the animal can swallow, a little cold water may be poured into the mouth from a bottle. If swallowing is difficult, then the only safe mode of administration is by the stomach-pump or probang, or directly into the rumen by the trocar and cannula. Large quantities of fluids are objectionable, and the amount in any single dose should not exceed a pint.

It must also be remembered, that if it is probable that the animal will not recover, but will be killed and its flesh consumed as food, drugs of a poisonous kind, or likely to flavour the meat, should not be given. Many cases are

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recorded in which people have been poisoned, through eating of the flesh of Cows which had received large quantities of poisonous medicines before being killed by the butcher.

Electricity has been employed with success, both in the comatose stage and when paralysis has remained after the attack. Neumann and Holden relate instances of recovery. The Leyden jar, or, better, the induction coil, may be employed.

To sum up, the treatment of parturient collapse consists chiefly in relieving the congestion of the brain (at the commencement), restoring the functions of and stimulating the skin, promoting the action of the intestines, and removing the milk or stimulating the function of the mammary gland.

All violent and heroic treatment should be avoided, as well as large doses of medicine.

Consecutive congestion or inflammation of the lungs must be treated according to circumstances; and paralysis will be best combated by stimulation to the loins, and the subcutaneous injection of strychnia, with diuretics and purgatives.

Easily digested food in small quantities should alone be allowed immediately after recovery, and the animal must not be given any indigestible food, nor be permitted to eat hay or litter.

It is judicious not to breed from a Cow which has suffered from parturient collapse, unless every precaution is taken towards the next calving period.

CHAPTER V.

Post-Partum Paralysis.

In treating of the diseases peculiar to pregnancy, we alluded to paraplegia (p. 176) as one of these. Paralysis of the hind-quarters is more frequent previous to birth than after that event, and is generally observed in the Cow. After birth, paralysis is comparatively rare, and may affect nearly the whole of the body, or both or only one of the hind-limbs. The Cow is also the animal which oftenest exhibits *post-partum* paralysis. The affection may be due to parturient apoplexy or collapse—as already noticed; it may also be a result of metritis; or it may follow difficult parturition, and especially after the birth of a large calf, or if the latter has been in a wrong position. Franck has often witnessed its occurrence after delivery, when the uterus has been half-twisted. Williams gives an instance in which paralysis appeared to be due to mental disturbance!

Symptoms.

The symptoms are similar to those of *ante-partum* paralysis.

The animal continues to lie, and one or both hind-limbs may be moved in a convulsive irregular manner, or they are completely incapable of movement. In the majority of cases, however, the animal is able to turn itself over at intervals from side to side—particularly during the night. Sometimes only one leg is paralysed. Apparent paralysis is at times observed in Cows, which persist in lying after parturition, and though they can move their limbs readily, yet they will not attempt to get up; their appetite is

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unimpaired, they exhibit no symptoms of disease, but yield plenty of milk, and the excretions are normal.

This condition may continue for weeks or months, and often animals have to be killed in consequence of it.

Nature.

Little is known as to the nature of this affection. Harms and others thought it was due to injury inflicted on the sacral and other nerves during difficult parturition. The sciatic nerves are particularly liable to injury. *Post-mortem* examination, however, has only furnished negative evidence of this. Franck thinks that injury to the cervix uteri may give rise to reflex paralysis; this has been witnessed in a Bitch; and reflex paralysis of the legs has been seen in woman, and ascribed to uterine injury or derangement—when this was repaired the paralysis disappeared. It is not at all improbable that the same causes will produce the same effects in animals.

We can easily understand how paralysis is induced in parturient apoplexy. Williams states that it is due to inflammation and red softening of the spinal cord in the lumbar region.

Treatment.

When paralysis is actually present, the animal must be kept clean and healthy. Blisters, or even the actual cautery, should be applied to the loins, and the subcutaneous injection of strychnia resorted to. The condition of the bowels and bladder must be attended to; the former being regulated by feeding, and if necessary by laxatives, the latter by diuretics. Electricity may be useful in some cases, and particularly when only one limb is involved.

In all cases, the state of the uterus should be ascertained, and if it is unsatisfactory, then remedial measures should be adopted with regard to it.

When the animal cannot turn itself, this must be done by its attendants; and if it is a valuable one, and the paralysis is likely to continue for some time, slinging for a short period every day may be tried. With Cows, however, unless there are special reasons to the contrary, and if they are in good condition, it is often advisable to have them killed for food.

1. Williams (*Op. cit.*, p. 414) mentions that a she-Goat had its kids taken away when they were four weeks old, and in an hour afterwards it was completely paralysed, moaning piteously, and evidently in great distress. It remained in this condition for several days—lying extended on its side and quite conscious, but powerless. It then gradually sank and died.

2. "Veterinarius" (*Veterinarian*, vol. xii. p. 288) gives a case of parturient paralysis in a Mare, succeeding abortion. There were at first evident symptoms of metritis. It ultimately recovered.

3. Toll (*Ibid.*, vol. xxxvii. p. 824) relates a case of parturient apoplexy from which the Cow recovered in three days, but could not rise until ten days afterwards, when it was discovered that one of the hind-limbs was paralysed. The leg was drawn along, the foot being turned back. In a month extensive ulceration had occurred at the fetlock and hock, and there was a large abscess in the gluteal region. The Cow was eventually killed.

4. The same writer gives a similar instance, in which paralysis of a hind-limb followed parturient apoplexy. It recovered sufficiently well to walk about at pasture, and yielded a liberal quantity of milk.

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CHAPTER VI.

Parturient Eclampsia.

We have seen that Franck has compared the malady we have designated "parturient apoplexy" or "collapse," with the disease known in woman as "eclampsia," and has endeavoured to establish their identity. To a certain extent we admit that he has been successful, but we are far from convinced that the eclampsia of woman and the malady of the Cow are identical; though we do not dispute that the same or similar causes may be in operation in the production of both. In the first place, the eclampsia of woman is essentially epileptic or convulsive, the convulsions being of a tonic and clonic nature; and though, in the disease of the Cow, convulsions are sometimes present, yet they are far from being a constant symptom.

The symptomatology of the two diseases, indeed, is widely different. In the woman there are premonitory signs—such as uneasiness, headache, nausea, twitchings, sudden vertigo. Then the attack begins by rapid contractions of the muscles of the face, eyelids, and eyeballs: the latter rolling about in their orbits. These movements soon extend to the head, neck, and other parts of the body, and are rapidly replaced by tonic contraction of all the extensor muscles either of the trunk or limbs. The respiration is stertorous or suspended; the pulse—at first full and strong—is so weak that it is scarcely perceptible; the tongue is protruded from the mouth, and often bitten; foam appears between the lips; unconsciousness is complete. The attack may last for twenty or thirty seconds; then the tonic convulsions are replaced by those of a clonic kind, preceded by a general state of rigidity. The movements are jerking, and so convulsive that they shake the whole body. The respiration gradually returns, the pulse resumes its natural rhythm; the jerking of the limbs and body subsides, perspiration appears, and in from one to five minutes all is tranquil; the comatose condition which supervenes varies in duration, but the patient awakes greatly exhausted, and complaining of pain in the limbs. Exceptionally, there is only one attack; generally there are several, which may succeed each other quickly, when the patient may remain comatose between the pauses, and at the height of an attack death may take place from œdema of the lungs or apoplexy. In favourable cases the intervals become longer, the attacks themselves more imperfect and shorter, until they finally cease. Parturient collapse in the Cow has not the intermittent character of the eclampsia of woman, and there are seldom, if ever, real convulsions; there is, on the contrary, loss of the cerebral faculties, and paralysis of the muscles, particularly of the hind-limbs: indeed, the most marked features of the disease are progressive paralysis, continuous course, absence of convulsions, and rapid death in fatal cases.

But if we cannot at present admit that this bovine disorder and eclampsia of woman are the same, there is a malady which attacks not only the Cow, but also the Goat, Bitch, and Sow, and which certainly closely resembles the human disease. It has been studied chiefly by Hertwig, Zundel (who had only observed it in the Bitch), Mauri (who has studied it in the Cow, Goat, and Bitch), Harms (who describes it in the Goat), and Ellenberger, Seiler, and Wöstendorf (who have seen it in the Sow). It is possible that the disease is rare; but it is more probable that it has been confounded with other maladies. We have only seen one case of it, the victim being a Bitch suckling too many puppies.

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Symptoms.

With the Cow and Goat, the attack appears to come on soon after parturition, but in the Bitch it may occur in from two to thirty days after that event, and always during lactation. In the Sow, it usually begins between three to five days after parturition. With the Bitch and Sow it is not so serious as in the Cow, and with the latter the disease is far less fatal than in woman. It would appear that it is hereditary. In the Cow and Goat the malady closely resembles that in woman, the attacks being multiple, and sometimes accompanied by loss of consciousness; though, as with the Bitch, the two periods of tonic and clonic convulsions are not well marked.

The eclamptic attacks are not sudden in their invasion. They generally begin with tremblings, anxiety, agitation, and very perceptible feebleness in movement. These symptoms progressively increase in intensity, until the animal can no longer stand. This, the first period, is not constant in its duration. When lying, the animal is seized with general convulsions of the voluntary muscles; the limbs are extended and agitated as if by electric discharges; the eyes pirouette in their orbit, or more or less squint; the mouth is half open, the tongue pendent, and spumous foam flows from the commissures of the lips. The Bitch appears to retain its consciousness, but the Cow loses its senses more or less completely. After a variable period of time—from a quarter of an hour to several hours—the convulsions cease, the patient rises, and after standing for a few seconds as if in a state of deep coma, it gradually regains its senses and ordinary condition.

The attacks may be more or less numerous and intense, and consequently constitute a disease of which the gravity is variable, according to Mauri.

Hertwig, who was the first to describe the disease in the Bitch, and Zundel, give a similar account of the symptoms in that animal. The latter had never witnessed premonitory signs of the disease, though Hertwig had. He says that with Bitches which are suckling, and particularly those kept in the house and well fed, it is not rare to observe a state of tetanic rigidity and incomplete paralysis, with the following symptoms: The animal suddenly commences to be uneasy and anxious; the eyes are haggard, sometimes the nose is a little hot; the respiration is very short and quick, though pressure on the chest or abdomen does not cause any pain. In a short time—about a quarter of an hour after the difficulty in respiration was observed—the animal cannot stand, but falls on its side, and lies with the limbs extended; even when raised it cannot stand. The breathing becomes still quicker—from 60 to 100 per minute; while the pulse is small, hard, and irregular, and beats 100. Consciousness appears to be retained, but the animal refuses food and drink, and the alvine and urinary excretions are suppressed. The mammary glands are greatly engorged, hot, and abundantly provided with milk, the quality of which does not appear to be altered or injurious to the young, which usually continue to suck as before. This state continues for forty-eight hours, when death generally occurs from apoplexy and paralysis; though by proper treatment the disease may always be quickly cured. Zundel's description is almost the same, except that he says there are tonic convulsions, with clonic contractions extending rapidly to the whole of the body; that sometimes there is trismus, with grinding of the teeth; constantly there is a white foam at the mouth and muscular tremblings of the jaws; the breathing is stertorous, and sensibility much diminished; that there are cases in which the eclampsia appears to be merely partial, affecting only the hind-limbs for instance, and the animal sits,

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with the head unaffected, and whining; that the disease is continuous and without intermittences, the attacks last for one or two days; and if no relief is afforded the creature dies from total paralysis, due to congestion of the meninges of the brain, or from asphyxia after a spasm of the glottis.

In the Sow, according to Ellenberger and Wöstendorf, the symptoms are not very unlike calf-fever in the Cow, with which disease it is described by Franck. In the cases Ellenberger (*Gurlt and Hertwig's Magazin*, 1869) had an opportunity of seeing, the animals were attacked from three to five days after easy parturition. The appetite was partially or totally lost, the young were neglected, and the animal seldom moved about; soon it persisted in lying, and there was suppression of fæces and urine, with diminution or cessation of milk secretion. The animal lay on its side, the eyes closed, and the body temperature low; at times there were feeble convulsions. The respiration was irregular, deep-drawn, and moaning; the pulse 80 to 90 per minute; and great loss of sensibility. Nothing was observed about the generative organs. After twenty-four to thirty-six hours improvement took place, fæces were voided, and the animal began to pay attention to surrounding objects; the temperature rose; the pulse and breathing became normal; the appetite and milk secretion returned; and in from three to five days recovery was complete. All the Sows survived the attack. In one case reported by Seiler (*Canstatt's Jahresbericht*, 1862, p. 48), the symptoms were more of a convulsive or epileptic nature.

Nature and Causes.

This disease, it appears, never attacks any but animals in the parturient condition, and it has affected Bitches, especially those well-fed and in a plethoric state, after each parturition.

With regard to the nature of the disease, much cannot be said, as there do not appear to have been many opportunities for *post-mortem* examinations. No albumen has been discovered in the urine, and uræmia has not been noted. The cause which has been attributed by Franck as operating in the production of parturient collapse, may be in operation in the development of eclampsia—viz., increased pressure in the arterial or aortic system, and brain anæmia.

As occasional causes, Hertwig mentions for the Bitch, chills; the loss of the offspring, and, consequently, "stagnation" of the milk; mental emotions, and especially those due to loss of offspring or master. In the only case we have observed, which was in the Bitch, we attributed it to suckling too many puppies.

Treatment.

The disease does not appear to be at all serious, and many cases recover without medical treatment. Hertwig recommends the abstraction of blood from the jugular, the quantity varying with the size and condition of the animals; and he asserts that frequently all the symptoms diminish considerably, or even disappear, while the blood flows. After the bleeding, he administers a spoonful of tea every four or six hours, with small doses of nitrate of potass. If the bowels are constipated, an enema is to be given. Zundel has been particularly successful with the syrup of chloroform, which, in small and frequent doses, keeps the animal in a state of semi-anæsthesia; the cure being terminated by a dose of laxative medicine and one or two enemas. The syrup of ether produces the same effect as the chloroform, though less quickly

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and surely. In the case which occurred in our own experience, and which we believed to be due to hyper-lactation, some of the puppies—a large litter—were removed, and the bitch had a warm bath and a laxative; recovery quickly ensued.

1. Boissonneau (*Journal des Vétérinaires du Midi*, 1858) relates that a Cow, three days after parturition, which had been natural and spontaneous, showed symptoms of an attack of metritis. The following day, a quarter of an hour after abstracting blood, the animal began to manifest great anxiety; the respiration became laborious and hurried, like that of a Horse *pris de chaleurs*; the limbs were wide apart, as if to prop up the body, and the head rested on the manger—the body being balanced by a kind of undulatory movement. Soon the Cow fell—an inert mass, the limbs rigid and immovable, the eyes turned backwards and fixed, the mouth half open and the tongue pendent. The animal bit at objects within its reach, and the foaming saliva flowed from the commissures of the mouth. This fit, during which all the instinctive and sensorial faculties seemed to be in abeyance, lasted about twenty-five minutes, and five attacks occurred during the day. Next day there were three attacks, and the fourth day only two. The fifth day passed without any, and it was thought that recovery had set in, when, on the sixth day, the fits re-appeared with the same intensity as at the commencement. In the middle of one of these attacks, the Cow got entangled in the stall and was strangled. At the autopsy, dark blood was found in the lateral ventricles of the brain, the envelopes of which were congested and its texture softened. Death in this case was accidental, and the lesions may have been due to strangulation.

2. Mauri (*Revue Vétérinaire*, 1876, p. 65) describes the case of a Cow, four years old, and a primipara, which had calved, and the placenta was expelled two hours afterwards. On the following morning the animal was seized with tremblings, refused all food, manifested breathlessness, and looked anxious. On being led to the pasture to give it more air, it was perceived that it was weak in the hind-quarters, and in the short distance it had to travel it fell several times. It was put in a shed with a northern exposure, and its calf being brought, it remained completely indifferent to it. At two o'clock it fell, and Mauri was sent for. He found it lying extended on the right side, the respiration appeared to be suspended, and it was difficult to perceive the movements of the flanks; the pulse was imperceptible, but the heart's beats were strong. The tongue hung out of the mouth, and the air expelled during perspiration carried a large quantity of foamy saliva with it. The senses appeared to be completely abolished, and the eyeballs—turned greatly upwards—looked fixed in a remarkable manner. The limbs were rigidly extended, and they, with the trunk, jerked in such a violent manner, that the whole body was shaken without being displaced. The udder was not flaccid, and milk of a good quality was readily obtained from it.

Mauri thought it was a case of vitulary fever, and ordered the necessary treatment. After six o'clock in the evening, while preparations were being made to carry out his prescriptions, the Cow got up and stumbled towards the side of the shed where its calf was standing. During the night it ate and ruminated. Next morning at eight o'clock there was a new attack. The premonitory symptoms lasted for about half an hour, and the animal lay until half-past nine. At mid-day it did not present any signs of disease. It had no more attacks, but the owner, apprehensive of future danger, sold it two months afterwards, and Mauri lost sight of it.

3. Calmettes (*Ibid.*, p. 67) mentions that a four-year-old Cow gave birth to a calf during the night in quite a natural manner, and during the following day it ate and ruminated as usual. Towards six o'clock in the evening it suddenly commenced to tremble, and to stagger in its hind-limbs, so that it could only walk with the greatest difficulty. At seven o'clock Calmettes noted that the hind-quarters were very feeble, the general sensibility appeared to be increased, pressure on the dorso-lumbar region caused much pain; the skin was very hot, and the respiration deep and hurried; the pulse was strong and quick, the mucous membranes somewhat reddened, and the muffle damp. Counter-irritants were applied to the hind-quarters, and draughts and emollient enemas administered. At one o'clock in the morning he was again called. The animal had fallen on its side; the general sensibility was diminished, and the skin was very cold. From time to time it was remarked that all the extensor muscles of the limbs were convulsed, which threw the latter into rigid extension; though, when seized by the hands, they could be flexed and moved about. The sensorial functions were completely abolished, and the skin could be pricked or incised without inducing

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the least movement; the eye, which was generally fixed, pirouetted in its orbit from time to time, while it could distinguish nothing, and could be touched without betraying any sensation; there was also loss of hearing. At this time the respiration was about normal—eighteen to twenty respirations in the minute; the pulse was small and imperceptible; the heart's beats strong; the mucous membrane rather pale than red, and the muffle dry. During expiration there was a labial *souffle*, and an abundance of foamy saliva escaped from the mouth. The animal remained in this condition for six hours.

Towards seven o'clock next morning, when about to send for a butcher, the limbs became rigid and were seized with convulsions, which extended to the entire body. As if by enchantment, the animal placed itself on its sternum, raised its head in the normal position, and finally got up, though with difficulty; it remained in a somewhat deep coma for about an hour.

In the evening it had a second attack, there being general agitation, with hurried respiration and weakness of the hind-quarters. Soon it fell, had numerous convulsions, and manifested the same general insensibility it displayed in the morning; remaining paralysed, however, for only three hours. Next morning it appeared to be quite recovered.

Fifteen months previously, and eight days after parturition, this Cow had another attack when returning from pasture; being suddenly seized with tremblings, it staggered and fell. In half an hour afterwards it was completely insensible, and sensationless; the respiration was almost normal, the pulse imperceptible, though the contractions of the heart were powerful, and all the symptoms already enumerated were present, but became more rapidly developed. The convulsions continued for two and a half hours.

4. Lafitte (*Ibid.*, p. 70) mentions that a Cow calved in the most favourable manner, and four hours afterwards became agitated and restless; soon afterwards, there were convulsions of the muscles of the trunk and limbs, and so much weakness set in that the animal could not stand. The tongue was often projected from the mouth and foam flowed therefrom: the Cow could hear and see during the attack. The pulse was intermittent, and the respiration moderately increased. In about ten hours it arose and gradually recovered. Two days after, it had another and a final attack, which lasted for three hours.

5. The same writer (*Ibid.*, p. 70) relates that a Cow, which had calved a few hours before, was seized with persistent convulsions and great general weakness, which rendered standing impossible—presenting, in fact, all the symptoms of the previous case. This attack continued for three hours, and another followed on the same day. Then an interval of a day elapsed, when the fits succeeded each other so frequently, and with so much intensity, that the animal died from asphyxia.

6. Lafitte (*Ibid.*, p. 71) describes the case of a Goat affected with metro-peritonitis after parturition, and for which it was treated. Two days afterwards, the creature appeared to be agitated and restless; convulsions were manifested in all the muscles, and particularly those of the jaws; the eyes rolled about; there was abundant salivation, etc.; the animal could not stand. There was only one attack, which lasted for several hours.

7. Mauri (*Ibid.*, p. 18) relates that a Bitch, four years old, and which had been ill since the previous evening, was sent to the Toulouse Veterinary School. Fifteen days previously it had given birth to four puppies, which it suckled. That morning, about three o'clock, its owner was awoke by its plaintive cries and its restlessness. It was then anxious, its mouth was open, and it breathed as if it had been running fast on a hot day; it also appeared to be weak in its hind-parts. On its arrival at the school, it was lying on its side in a large hamper, with its four puppies, which were at the teat; the respiration was very hurried, short, irregular, and noisy; it was executed in a jerking, irregular manner; the ribs appeared to be limited in their movements, as in a horse affected with tetanus. The mouth was half open, the tongue pendent, and the saliva flowing in a frothy, abundant stream. The animal convulsively closed its jaws, and withdrew its tongue from time to time, in order to swallow a portion of the saliva; the buccal and conjunctival mucous membrane was greatly injected; the physiognomy expressed great anxiety rather than pain; the eye was widely open, bright and animated, and the visual axis was not deviated. The limbs were kept extended and immovable, without tetanic rigidity. At intervals the animal attempted to get up, and managed to raise itself on its fore-limbs; but the hind-legs moved in different directions, and automatically, so that the Bitch could not co-ordinate them in a determinate manner. The joints could be easily flexed on each other, by seizing the bones like the branches of a pair of compasses, but when left to themselves they immediately became extended. The pulse was strong and quick. The senses were

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unimpaired, and when its name was called the animal directed its eyes towards its master, and attempted to move its tail. This did not always happen, however, for the creature generally appeared to be completely absorbed by its condition—a circumstance which might have led to the belief that its general sensibility was diminished. There was no appetite, and the excretion of fæces and urine was completely suppressed since the commencement of the disease.

Mauri, never having had an opportunity of witnessing such a malady, was much troubled to give a name to the collection of symptoms. As, however, paraplegia appeared to be imminent, he ordered sinapisms to the limbs and the spine, and enemas of tepid water. In the evening the symptoms were ameliorated; the animal, instead of lying extended on its side, was curled round as in health, and when excited it got up, staggered, and fell on the litter; a deep coma had given place to the excitement observed in the morning, and on some bread and milk being offered, it slowly took a small quantity. Next day all the symptoms disappeared, and though the animal remained for five days in the hospital kennels, no relapse occurred.

8. Mauri, in another instance (*Ibid.*, p. 20)—that of a two-year old Bitch, which had nursed two puppies for a month, and during that time seemed to be in perfect health, but which was suddenly seized with agitation and anxiety, appeared to be suffocated, could scarcely stand, and appeared to be paralysed in its hind-limbs—noted the following symptoms: General agitation of all the muscles, anxious physiognomy, and all the characteristic features described in the preceding case. The respiration was very laborious, though the ribs were immovable. The gait was unsteady, and the hind-quarters were feeble, as in confirmed rabies. The animal appeared to be impelled to move about incessantly, and if it stopped it fell; then the limbs became rigidly extended. In the midst of its convulsions, it endeavoured to rise, but could not co-ordinate its movements—it turned itself on its back, so as to lie alternately on the right or left side. After numerous attempts it sometimes succeeded in getting up, and commenced to walk, but only to fall again; it could only stand on its rigid paws by resting against a wall or tree. An hour after its arrival at the school, it could not rise unaided. Its senses did not appear to be affected; the appetite was lost, and there was neither defecation nor micturition during the attack. The case in every respect appeared to be similar to the preceding. No treatment was adopted, and in the evening the Bitch had almost completely recovered, though it was rather sleepy and dull. Next day it was taken away cured.

9. The same authority (*Ibid.*, p. 22) records the case of a Bitch brought to the Toulouse Veterinary School, and which caused anxiety about three hours previously by its agitation, breathlessness, and anxious look. It had fallen, was seized with contraction of the limbs, got up, and staggered about in different directions, until at last it became so weak that it could not stand. When Mauri saw it, it was lying on its side, the limbs extended, and agitated from time to time with clonic convulsions. The animal could not be induced to get up, the head only being raised towards the shoulder. The symptoms were altogether similar to those observed in the two preceding cases. No treatment was adopted, and next morning all the symptoms had disappeared.

10. Lafitte (*Ibid.*, p. 23) attended a Bitch which, two days previously, had brought forth two puppies which it suckled. It appeared to be very weak and staggered in walking. Soon after, the feebleness in the hind-quarters was extreme, and clonic convulsions affected all the muscles; the eye-balls pirouetted in their socket, the jaws were incessantly moved, and saliva ran from the mouth continually; hearing and seeing were unaffected. Two hours subsequently the animal could not rise. A belladonna draught was given, narcotic frictions were applied along the spine, and emetised enemata administered. In the evening the Bitch was dull, weak, and stupid. In the morning every trace of the malady had disappeared. Next day there was another eclamptic attack of shorter duration, and on the fourth day another still briefer and weaker. The puppies were put to another Bitch, and in about eight days they had attacks similar to those of their parent, though shorter and less intense. One, a female, had three attacks on successive days, and then died—the other, a male, had only two attacks.

11. Lafitte (*Ibid.*, p. 25) reports that a Bitch, four days after pupping, had clonic convulsions in all its muscles; its jaws were agitated, it was much salivated, and respired with difficulty. Its expression was animated, but it could not stand, and was compelled to lie. During the night the convulsions ceased, and the animal, although a little somnolescent, appeared quite recovered; at ten o'clock next morning, however, it had another attack, and in the evening it died.

12. The same veterinarian (*Ibid.*, p. 25) alludes to the case of a Bitch which, three days after pupping, had convulsions in the muscles of the trunk and limbs, and the

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hind-legs were so feeble that it could not stand. Its gaze was unsteady, and at times the eyes rolled about in the orbits. The masseter muscles participated in the convulsive movements of the other muscles, so that there was a continual champing of the jaws, and an abundant salivation. The senses were not impaired, however. An antispasmodic treatment was adopted. The attack lasted four hours, when recovery took place.

13. Mauri (*Ibid.*, p. 201) reports another instance of this malady occurring in a Bitch, eight years old, and very fat. It had pupped twelve days before, and suckled four puppies. When brought to the Veterinary School it was lying on its side, though it could raise itself on its sternum—it panted much, its mouth was wide open and much saliva flowed therefrom—the tongue was pendent. The respiratory movements were much quickened, but very shallow. The eyes were wide open and slightly squinted to the left. Violent convulsions, as if produced by electric discharges, agitated the limbs, and threw them into a state of forced extension; if a group of extensor muscles—such as the patellar—were seized in the hand, the energetic contractions, rapidly repeated, could be easily felt. Nothing of the kind could be distinguished in the flexor muscles. The senses were not affected. The urine did not offer any trace of albumen. In the course of the day the symptoms disappeared, and the animal recovered.

Mauri alludes to four additional cases of eclampsia—two in the Cow and two in the Bitch, all presenting similar symptoms to the foregoing.

CHAPTER VII.

Epilepsia Uterina.—Mania Puerperalis.

A PECULIAR nervous affection to which the designation of "Epilepsia Uterina" has been given by Storrar (*Veterinary Journal*, Vol. IV., p. 53), might be classed with the disease which, in the previous chapter, has been named "Eclampsia," did it not differ somewhat from it, and rather resemble epilepsy, or what Harms has called "Mania puerperalis." Until its exact pathology is better defined, we think it most convenient to retain Storrar's designation.

Symptoms.

The disease appears to affect the Cow only, and is marked by great agitation, sometimes fury. We cannot do better than give the symptoms in two cases, and then refer to Storrar's and Harms' evidence.

1. Rolls (*Veterinary Journal*, Vol. II., p. 17) was sent for in great haste to see a Cow, five years old, which had calved a fortnight previously, and had eaten the placenta. For two days before he was called in the animal had not been well, and its calf had been removed the previous night. It had a wild excited expression; eyes staring; ears warm; pulse full; rather strong and quick; jaws continually moving, as if in the act of biting; foaming at the mouth; the under part of the tongue purple and livid-looking. The movement of the jaws could not be stopped by holding them together, and when the animal was left to itself it was continually biting at its fore-legs, though without making a wound; when interrupted it gnawed the manger, woodwork of the stall, or anything presented to it. If hay was offered it would seize it, masticate it with the continuous and violent movement referred to, and swallow it. It took some bran-mash and chilled water, and though it partook of nothing else, it looked full, and there was the peculiar sour odour often met with in cows suffering gastric derangement, and especially when it occurs soon after parturition. Blood was abstracted and belladonna and linseed oil administered. In about three hours afterwards, the convulsive movements ceased and the Cow appeared to be much better. Next day the excited expression was still apparent. Under further treatment it recovered.

Thirteen months afterwards it calved again, and when a fortnight old the calf was removed from it. Next morning it was found to be suffering from a similar attack: the jaws moving in the same convulsive manner, but not so violently. Rolls noted

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that the Cow looked wild and excited; the pupils of the eyes were normal; ears warm; pulse eighty per minute, and full and strong; foaming at the mouth; under part of tongue livid; grinding the teeth occasionally; the fore-legs were wet and covered with saliva, from gnawing them. The animal was again bled and had opiates, and recovery soon took place.

2. Robellet (*Recueil de Méd. Vétérinaire*, 1874) gives a similar instance, in which the symptoms closely resembled those of rabies. The Cow—four years old—calved four days previously, parturition being normal. On the day on which Robellet was sent for, it had refused to eat at pasture, left its companions, and constantly licked its fore-legs. In the evening it was restless, and bit everything about it. Robellet found that it had bitten the manger, rack, and food—allowing the latter to fall from its mouth without masticating it; it also seized its breast and fore-legs, but without breaking the skin. The pulse was full and sixty per minute; the eyes, unnaturally open, were red, fixed, and haggard, and the pupils dilated; the buccal mucous membrane was slightly inflamed, and a frothy saliva surrounded the borders of the lips; the respiration was normal. At times the Cow stretched out its fore-limbs, bellowed, pawed the ground with the fore-feet, and seemed to defy an invisible enemy. The handle of a stable-fork being presented, the animal seized it in a frantic manner and bit it, shaking the head violently.

These symptoms gave rise to the suspicion of rabies; but no evidence as to inoculation could be obtained. The Cow was separated from the others, secured by a double chain, and an ounce and a half of chloral administered in two doses in tea—a quarter of an hour between each dose. Several minutes after the second dose, the Cow, which had continued to show the same symptoms, hung its head, and without staggering, fell like an inert mass on the ground, then rose at once of its own accord. Ten minutes afterwards the same occurrence was again noted—the Cow once more falling and jumping up; it remained in the excited condition already described. Next day all the alarming symptoms had subsided; there was no fever or excitement—nothing except slight weakness and prostration. It had fallen a third time on the previous day, then became drowsy, and remained lying for about three hours; after which it arose, apparently quite well.

Robellet's father had seen two similar cases.

Storrar relates that, in one of his cases, so savagely did the Cow bite the timber forming the front of its stall, that with one desperate effort it broke all the incisor teeth, except one, entirely out of its jaw, and fractured the alveolar processes. Another Cow, some years before, so severely injured the lower jaw, that the incisors could not be employed for some time; though the molars could be used when the food was placed in the mouth.

Günther (*Geburtshülfe*, p. 145) and Landel (*Repertorium*, vol. viii.) have observed similar cases. They describe the animals as extremely excited and violent, biting everything around them—even people, climbing into the manger, running against the wall, roused to fits of fury at the slightest noise, foaming at the mouth, and sometimes tossing the head and bellowing. The pulse is hard and quick, but the heart's action is weak.

Cause.

Rolls thought that in the case he describes, depriving the animal of its calf was the cause of the attack; Harms ascribes the symptoms to chills, which cause brain congestion; while Storrar looks upon the malady as epileptic, dyspeptic, and uterine. "The animal affected has calved some few days previously—say from four to fourteen, or even more days; she has been heartily eating her food; giving milk very largely, or, more correctly, her milk has been remarkably rich, and throwing up, when left for a time, a very heavy layer of cream; and the usual uterine lochial discharge has been suppressed. Or the case might be thus stated: An excessive drain upon the system by the mammary glands, causing, perhaps, the suppression of the uterine cleansing, with the peculiar smell about the animal, and more marked in her milk, which is referred to by Mr. Rolls, followed by a more or less

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severely developed attack of indigestion. These causes act upon the nervous centres, so as to produce the extraordinary excitement which has been described. The dyspeptic signs are the more prominently shown—such as a desire to eat anything unclean in preference to good food, or coarse straw in preference to roots or hay. The bowels become torpid, and the supply of milk nearly ceases."

We can scarcely bring ourselves to believe that this condition is due to psychical influences, and are rather inclined to attribute it to cerebral irritation from some physical cause—either indigestion, constipation, or deranged circulation in the brain, and connected with the parturient state.

Treatment.

If indigestion or constipation are present, purgatives should be administered, with stimulant or tonic medicines, according to the indications. When there is much fury or excitement, narcotics in large doses may be given—the best, perhaps, being chloral hydrate. Great attention must be paid to the diet. Günther abstracted blood in large quantity, and gave extract of stramonium. He also, on the supposition that the brain was congested, applied strong stimulants to the back of the head and to the spine.

CHAPTER VIII.

Parturient Laminitis.

With the Mare,* a few days after foaling or abortion, there has been sometimes observed an attack of congestion or inflammation of the feet, which closely simulated the painful and serious malady known as "Laminitis," and appeared to be related to the parturient state. The disease does not seem to be very common; though Obich (*Wochenschrift für Thierheilkunde*, 1869, p. 105) asserts that it and metritis are the most frequent sequelæ of parturition in the Mare. It appears to have been first described by Tisserant in 1846 (*Journal des Vétérinaires du Midi*, vol. ix. p. 347); since then it has been alluded to by Gloag and Smith in England (*Veterinarian*, 1851, pp. 14, 258), Fabry, Guilmot, Lecouturier, Windelinck, and Deneubourg in Belgium (*Annales de Méd. Vétérinaire de Bruxelles*, 1860, 1861, 1868), Obich in Germany (*Op. cit.*), and Ayrault in France (*Recueil de Méd. Vété-*

* It would appear that bovine animals are liable to a foot inflammation after parturition, as well as Mares. Roloff (*Mittheilungen aus der thierarztlichen Praxis in preussischen Staate*, 1865, 1866, p. 154) observed a peculiar inflammation of the feet of Cows, supervening on parturition. Some days after that event, the skin between the claws was observed to be reddened, swollen, and moist, and gradually the inflammation extended to the coronet and heels (*Ballen*); the skin became more tumefied and dense, and immediately above the claws was uniformly thick and red. In some cases abscesses formed at the coronet, the horn became separated, and finally the whole claw was shed. The inflammation extended to above and behind the fetlock, and the pain was so great that the animals ate but little, and, consequently, they soon lost condition. The hind limbs were most frequently affected: first one, then the other, one being always more affected than the other. The Cows had only calved a short time previously. Roloff supposed that the disease was due to contact of the skin, towards the hind feet, with some substance which had escaped from the vulva after calving. He, therefore, insisted on the utmost cleanliness being observed; had the stalls cleaned out, and sprinkled with chloride of lime every day, and the hind feet damped with chlorine water, particularly between the claws, and afterwards smeared with oil. By these measures, the extension of the disease was at once checked.

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rinaire, 1866). At page 621 (line 7) of this work, it will be found that Hudson alludes to this parturient laminitis as a complication of ruptured vagina.

Symptoms.

The symptoms of the disease are those of laminitis occurring under ordinary conditions. They are suddenly developed on the second or third day after foaling, or abortion, more rarely on the fourth day, and very seldom later. In a small number of cases, inflammation of the feet has been noticed either during or immediately after parturition. Exceptionally, it has taken place within twenty-four hours after the contents of the uterus have been expelled. As a rule, there has been nothing remarkable in the case—birth having taken place naturally; sometimes, however, parturition may have been difficult.

The attack is either sudden, or only very indefinite premonitory indications are present. The animal becomes unusually restless, and moves its limbs—the fore one especially—continually, while it exhibits signs of great suffering. There is fever, quick and hard pulse, hurried respiration, and all the other signs of this most distressing foot-inflammation, the most marked of which at this time is the disregard of the progeny. In other cases, the attack is more gradual; there is loss of appetite, great thirst, depression, hurried respiration, full, hard, and quick pulse, constipation, etc.—premonitory symptoms which may continue for two, three, or four days. The fore or hind feet may be affected. Tisserant and Guilmot say the former, Deneubourg the latter; though in some instances all the feet may be involved. The position of the animal, if standing, indicates the feet affected, and they are found to be extremely hot, the plantar arteries throbbing, and percussion of the hoof causes intense pain. During the inflammation, the Mare evinces the greatest agony. If all the feet are implicated, standing may be impossible; the expression is anxious and pinched; the respiration is hurried, jerking, and plaintive, and the nostrils widely dilated; the skin is usually covered with perspiration, and the production of milk is completely checked. Indeed, the rapid disappearance of this secretion has attracted the attention of nearly every observer. In the evening, perhaps, there will be an abundant supply of milk, and in the morning mulsion or suction will only obtain a few drops of a transparent or reddish fluid, though the mammæ may look as full and as well-developed as usual. This suppression of its supply of food is soon testified to by the foal, which betrays its sensations of hunger by becoming less timid, and making itself familiar with those around it.

The *duration* of the disease is from four to eight days; Franck says from eight to fourteen days. The symptoms are certainly most intense between the fourth and eighth day. The termination is generally recovery, if proper treatment has been adopted; though in some cases the malady assumes a chronic form, with the accompanying deformity and disorganisation of the feet. In rare instances, death may ensue from nervous exhaustion caused by the excessive pain; or the inflammation may run on to suppuration, and a fatal result arise from pyæmia, with purulent deposits in the lungs, brain, or other organs.

A favourable or unfavourable prognosis may, according to Guilmot, be drawn from the lacteal secretion. If this returns in the course of a few days, it is a good sign.

Causes.

The cause or causes of parturient laminitis are not well known. The

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predisposing cause is generally recognised to be the parturient state, though there is a wide divergence of opinion as to the way in which the disease originates. Tisserant believes that it is due to a disturbance in the functional equilibrium existing between the various organs. After parturition, and particularly after abortion, there is manifestly a disturbance of this kind; there is, as Rainard correctly states, a general superabundance of blood, and consequently a tendency to disease until the equilibrium between production and consumption is restored. Guilmot thinks that the space left by the fœtus must necessarily bring about a series of exceptional phenomena, whose point of departure is perhaps the superfluous supply of blood thrown into the circulation after parturition. Deneubourg sees in this disease and the so-called vitulary fever of the Cow, two different "modes of expression" of the same disease; and while recognising the justness of the expression employed by the old hippiatrists that "the fever has fallen into the feet," he is inclined to think that the morbid localisation is due to sudden suppression of the lochia. "The larger animals," he writes, "are not exempt after parturition from the depuratory process which takes place on the internal surface of the woman's uterus after delivery, and known as the *lochia;* and its abrupt suppression gives rise to a disturbance—a *fever*, which physicians designate 'puerperal fever,' and veterinary surgeons 'vitulary fever.' The disease proper to the Cow is, in our opinion, *simple vitulary fever*, which, in concentrating itself on the tendinous, articular, and perhaps muscular tissues, may become a *rheumatismal vitulary fever*. That of the Mare, until now unrecognised, is evidently due to the same cause; we cannot deny it the parent *traits* with the vitulary fevers which are witnessed in the Cow, and we propose to designate it by the name of *vitulary laminitis*, to distinguish it from *essential laminitis*."

Bouley, quoted by Saint-Cyr, is of opinion that parturient laminitis may be allied to that other form of laminitis which so commonly succeeds intestinal congestions from accidental causes, or from drastic purgatives; and that both varieties may well be the result of a momentary paralysis of the vasomotor nerves of the keratogenous apparatus of the foot, under the influence of a profoundly depressing action.

The *occasional* causes are quite as obscure. Tisserant asserts that none of the ordinary causes of laminitis are special in their operation here; while Deneubourg adds that it equally attacks Mares without distinction as to age, constitution, condition, or hygienic circumstances. Guilmot, however, remarks that Mares which are submitted to moderate work, and which receive an allowance of food in proportion thereto, are not attacked by this disease; while those which are fed on oats have always been the subjects affected, so far as he has been able to observe.

There is the same diversity of opinion with regard to the influence of parturition in the production of parturient laminitis. Tisserant has noticed it occurring, in the great majority of cases, in Mares which had aborted at a somewhat advanced period of gestation, or whose delivery had been laborious or very difficult, from the wrong position of the fœtus, or from some maternal obstacle. Deneubourg, on the contrary, has observed it following parturition effected in the most favourable conditions, as well as after abortion or difficult labour; with Mares which had expelled the fœtal membranes, as well as those which retained them; but never after a laborious parturition which required manœuvres more or less protracted and cruel; though he adds that his brother had witnessed a case following laborious and artificial delivery.

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It may be noted that Gloag gives an instance (*Veterinarian*, 1851, *p.* 14) in which it followed an abortion at three months.

Obich attributes the disease to the action of cold upon the skin.

Treatment.

In the treatment of this disease, the rules observed in the ordinary attacks of laminitis are usually applicable. In the majority of cases the treatment need not, and should not, be heroic. If the fever runs high, sedatives—as the tincture of aconite—should be given; and it may even be necessary to administer narcotics—as chloral or opium—if the pain is very great. Some authorities recommend the abstraction of blood, either generally or locally; but we are decidedly averse to this treatment.

The inflamed feet should be treated with the greatest care, and for subduing the inflammation nothing can equal cold applications—either cold water, cold poultices, or even ice. We prefer the continuous irrigation system; the water being applied to the feet by means of india-rubber tubing, which carries the fluid direct from the water-tap to the foot. The latter is thickly covered with pieces of thick flannel or tow, so as to diffuse the water around it. The shoes should be previously removed, and the wall of the hoof lowered, so as to allow the sole and frog to sustain as much of the weight as possible. It is a good plan to litter the animal on saw-dust.

Warm applications should never, on any account, be employed for the feet.

When suppuration is apprehended or has set in, or even when the effusion or exudation are serious, an outlet may be made between the sole and wall, towards the toe of the hoof, for their escape. Astringent and antiseptic lotions or foot-baths may then be useful. At the commencement of the disease, and sometimes at a later period, when it threatens to become chronic, stimulating applications—even blisters—may be applied with advantage to the limbs above the fetlocks.

The diet should be light, and limited to mashes, grass, a small quantity of good hay, and nitrated water or gruel as drink. The body should be comfortably, if not warmly, clothed, and friction to the skin is often beneficial.

The foal should be allowed to remain with the Mare, as its frequent sucking is likely to hasten the return of the milk, which is, as has been already remarked, a most favourable sign.

If constipation is present, laxatives should be administered, and emollient enemas are then, as well as at other times, most useful.

CHAPTER IX.

Mammits or Mastitis.

In treating of pregnancy, we alluded to the function of the mammæ, and pointed out that this function—except in rare cases, when it may be in operation independent of pregnancy or the parturient period, and even manifest itself in the male sex—is in mammals peculiar to the period of parturition and rearing of the young. Some time before the progeny are born, the mammæ begin to enlarge, to become pendulous, and their density increases; they are more often vascular; if not marked by dark pigment, their colour

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is observed to have changed, and the teats are considerably developed. So that, at parturition, the glands have attained dimensions and offer appearances very different to those they exhibited a short time previously; while the fluid—the milk—provided by Nature for the sustenance of the young creature after birth, is secreted in more or less considerable quantity—generally in proportion to the development of the mammæ.

With the exception of some species—such as the Cow and Goat, sometimes the Ewe and Ass (and also the Mare among the Khirgiz), in which the secretion is maintained artificially for some time beyond its natural duration, and, with the former animal especially, almost permanently—the function is essentially intermittent: being most active during the parturient or, if we may use the term, "puerperal" period, and ceasing when the progeny no longer require milk. It is during this period that the activity of the mammæ exercise so much influence on the health of parent and offspring, and it is also at this time that these glands are most liable to derangements, which are more or less serious. Even their normal physiological development, when it occurs rapidly and considerably, under certain conditions, often occasions uneasiness and pain. The temperature of the glands is increased, and they are much more sensitive than usual. But this disturbance is usually ephemeral, and rarely continues for more than a day or two. It may be relieved by "stripping" the teats—the importance of which, as a preventive of parturient apoplexy in deep-milkers and plethoric Cows, we have already pointed out—rubbing the udder with olive-oil, or fomenting it with decoction of marsh-mallows. This might be termed the *normal* or *physiological* engorgement of the mammæ; but there is also a *pathological* engorgement, to which attention has been drawn by various writers, and particularly by Zündel, and to this we will now refer, as it is often the commencement of inflammation of these glands.

Pathological Congestion of the Mammæ.

Hyperæmia or congestion of the mammæ is not very uncommon, and all female animals are liable to it; though it is most frequently observed in the Cow, Mare, Ewe, and Bitch, in degrees varying rather with the causes which determine, than the phenomena that accompany it.

Causes.

Congestion of the mammæ is due to various causes: among which may be cited injuries, exposure to cold air or water, or over-repletion—the stings of insects have also been blamed. There is generally a sympathetic excitement existing at this time, either from the animal having been immediately or recently delivered, or even when it is in œstrum. Most frequently, however, it occurs either when the progeny cannot empty the glands, when it has been removed from the parent, or when the latter has not been milked at the proper time. The tendency of the mammæ to become engorged when the lacteal secretion is not removed, is often made available with a fraudulent motive, when disposing of Cows for milking purposes. The milk is not withdrawn for some time, the glands become greatly distended, and assume an excessive development ("over-stocking"), which may impose upon the unwary, and give rise to the belief that the animal possesses extraordinary lactiferous properties. Franck is of opinion that this congestion may be due to obstruction of the circulation in the posterior vena cava, towards the end of pregnancy. It may also arise from obstruction in the milk ducts.

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Symptoms.

When the congestion is due to accumulation of milk, the symptoms are, of course, only gradually developed; but if arising from injury, then they may appear suddenly, a certain part becoming all at once swollen, hard, and tense, but without altogether losing its softness and elasticity. There is neither redness nor great sensibility; the swelling is not œdematous, and does not "pit;" there is but little fever, and the appetite is not much affected.

An important consideration in these affections of the mammæ, is that relating to their anatomy. As we have shown at pages 31—34, in the Mare, Ewe, and Goat, they are formed of two perfectly distinct glands placed together in the inguinal region; while in the Cow they are composed of at least four glands or "quarters" in close contact, and apparently forming one mass in the prepubic region; and in the Sow, Bitch, and Cat, they are numerous and distinct from each other, and extend from the inguinal to the thoracic region. When we know that all the glands may become congested or inflamed, or only one—or even only a certain number of *acini* in each gland—we see at once that morbid conditions may give rise to very diverse symptoms, due to these anatomical peculiarities.

With the Cow, congestion may, therefore, be limited to one gland or "quarter;" though at the commencement the whole udder may be swollen, and localisation only occur at a later period. The same is observed with the Bitch and all the other animals with numerous mammæ: there is always at first general engorgement, before it is finally localised. The tumefaction partakes somewhat of œdema, from its readiness to pit on pressure, and there is often a doughy swelling around the udder, which, in some instances, extends to the other parts of the abdomen. The latter symptom is most noticeable in Mares, in which, in the course of a few days, the mammary swelling altogether disappears, leaving only an œdematous tumour towards the umbilicus.

The secretion of milk is diminished; at first it may be normal in consistence, and exceptionally it may offer streaks of blood, which give it more or less of a rose tint. When this condition continues, however, its degree of fluidity is changed, and it becomes lumpy and clotted, being partially coagulated in the lactiferous sinuses and canals, and the coagula of casein are evacuated at the same time as the other portions of the milk, which is sometimes nothing but pure viscid, yellowish serum, having a sweet taste; sometimes these coagula—round or cylindrical masses—obstruct the canals, and prevent the escape of the milk. Fürstenberg states that he has sometimes found casts of epithelial cells in them, and that about the third or fourth day there are globules of colostrum. This alteration in the milk may be limited to that from the affected gland or quarter; in the others the secretion may be healthy, though less abundant.

This condition most frequently terminates by resolution, and very often without treatment—the tumefaction disappearing in a very brief time, or in the course of four to eight days; though the milk may remain less plentiful for some time, and up to the eighth or twelfth day may still contain colostrum corpuscles. In other cases, the quantity of milk remains less than usual; and when relief is not afforded, we may have inflammation supervening, and the formation of one or more abscesses.

In the great majority of cases, it is probable that this condition commences in, or is limited to, the parenchyma of the gland, which receives an inordinate supply of blood. This leads to a congested condition, and conse-

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quent diminished lacteal secretion, with serous infiltration into the interlobular connective tissue. According to Fürstenberg (*Milchdrüsen der Kühe*), the milk contains more particularly the solid elements of this fluid, and also the epithelium yet undergoing that change which should be completed in the acini.

This condition has often been confounded with inflammation of the udder, though it must be admitted that it sometimes constitutes the initial stage of mammitis. It may be distinguished from the latter by the non-existence of general symptoms, and also locally by the absence of the peculiar density or hardness, and the extreme painfulness and sensibility, which mark the presence of the latter.

According to Franck, this mammary œdema (or *Floss*) is peculiar to many parts of the Bavarian Alps, and he appears to consider it as inflammation of the skin and connective tissue of the gland (*Entzündung der Ueberzüge des Euters und des Zellgewebes*). It always appears some days, on occasions some weeks, before parturition, and the whole udder is involved; though one side may be more affected than the other. The swelling sometimes extends as high as the vulva, and even beyond it. Sometimes the skin is reddened, tense, and shining (*Erythema mammilarum*); in other instances it is normal. The health is seldom unaffected, and this is a characteristic feature of the disease; there is also rarely any pain, or alteration in the secretion—colostrum or ordinary milk flowing from the teat. When, however, the connective tissue is involved, there is swelling and "pitting" on pressure, the skin is reddened, and the finger indentations last for some time; there is also more pain. This latter condition has sometimes been designated the "erysipelatous" form of mastitis; though it must be observed that the secretion of milk is unaltered to any extent. It continues for about eight days.

When the skin is much inflamed, as in the erysipelatous form, Franck thinks it probable that a special cause—a kind of infection of the skin—is in operation.

Treatment.

This malady, in the greater number of cases, does not require any special treatment. If the animal eats well and is not much inconvenienced, the mammæ should be relieved of their contents either by allowing the offspring to suck, milking by hand every two hours, or draining of the fluid by the teat-syphon. When the swelling is great and the skin tense, smearing with lard, butter, or olive-oil will often give relief, and aid in dispersing the tumefaction.

When mammitis is apprehended, Zündel highly recommends inunction with camphorated pomade, which, he asserts, is almost specific in its deobstruent action. At the same time salines, and particularly the bicarbonate of soda, are to be administered internally; while a moderate quantity of easily-digested food is to be given.

When the redness or inflammation of the skin has a tendency to become erysipelatous, Franck prescribes an ointment composed of sulphate of iron (one part) and lard (eight parts); or, a liniment of carbolic acid (one part and olive oil (thirty to forty parts).

Inflammation of the Mammæ.

All the domestic animals are liable to inflammation of the mammæ; and it is somewhat frequent after parturition, though it also appears after abortion. The Cow is oftenest attacked, and from the importance of the lacteal

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secretion in this animal, it is always more or less serious, especially as it may continue during the whole period of lactation, and generally affects the best milk-producers. It is not so common in the Goat and Sheep, and is still more rare in the Mare. It is seldom witnessed in the Bitch, Sow, or Cat; though when it does occur in the former, it is liable to lead to the formation of neoplasms of different characters in the glands.

Various kinds of inflammation of the mammary glands have been described —such as *superficial* or *subcutaneous*, and *deep; acute* and *chronic*, *active* and *passive* or *latent*, and a *rheumatismal* form; while Saint-Cyr gives a *catarrhal*, a *phlegmonous*, and a *parenchymatous*.

The *catarrhal* form is—so far as its symptoms are concerned—allied to that which we have described as due to congestion, and consists in an inflammation of the mucous membrane lining the teats and lactiferous sinuses. This inflammation is generally caused by the retention of the milk in the gland; this fluid becomes altered and coagulated, and the clots irritate the membrane and inflame it, the inflammation extending to the acini after a time. In the Cow the inflammation usually commences in one quarter or gland, and may remain limited to it; or it may extend to the other quarter of the same side, and even to one or both of the opposite side—though this is rare—by an extension of the morbid process from the acini to the interstitial and interglandular connective tissue. When more than one quarter is involved, then the disease in each varies in intensity.

When limited to the mucous membrane, the inflammation induces a kind of catarrh or special galactorrhœa which, according to Gerlach, is not at all uncommon, and accounts for the serous or watery milk sometimes given by Cows; and the same agency may lead to the spontaneous coagulation of the milk, without any acidity being present.

Symptoms.

The animal does not at first appear to be much affected, and the swollen gland or glands are evidently not very painful, the pain being probably of a dull character. The skin is tense and shining, though perhaps not reddened; the teat is greatly enlarged, hard, and somewhat sensitive to manipulation. The swelling is rather œdematous superficially, but deeper the tissue of the gland is found to be somewhat harder, and towards the teat rather lumpy, from the presence of coagula of casein.

By mulsion, a rose or red-tinted fluid is obtained, which looks like decomposed clotted milk.

With careful and frequent milking, and attention to diet and hygiene, complete resolution may take place within three or four days; the secretion gradually becomes normal in quantity and quality, though for more days it may contain numerous colostrum and pus globules. If neglected, however, or mismanaged in treatment, the inflammation may become more serious, and attack the milk vesicles and their parenchyma—the real glandular tissues—giving rise to parenchymatous mammitis; or it may remain localised, though increasing in intensity. Then the secretion of milk is greatly diminished in the gland, and what is withdrawn by mulsion is altered—containing, as it does, mucus, pus, and clots, all emitting a highly ammoniacal odour.

This catarrhal condition may continue for a considerable time, and it may happen that the matter contained in the sinuses and ducts, becoming inspissated, escapes from the teat with difficulty, or not at all; so that, in accumulating in these cavities, it forms deposits—half milk, half pus—which are oftentimes considerable. When they have acquired a certain volume, these

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deposits break up and escape, either through the teats, or by ulceration of the walls of the duct. When opened by means of the lancet, these "lacteal abscesses" discharge a large quantity of fœtid matter. Then the general phenomena disappear, the tumefaction and sensibility diminish, the suppuration—though it may persist for some time—gradually decreases, and the normal secretion of milk is finally established. In other instances, all the symptoms disappear except the clotted character of the milk, and the tendency of this fluid to coagulate in the ducts and sinuses. There it may form solid masses or concretions of variable size—from a pea to that of a nut—which become dense as dried cheese, or hard almost as a stone. They are sometimes cylindrical in shape, at other times elongated, being moulded by the part in which they are formed; they are usually movable, and may be displaced in the operation of milking; but they always constitute a more or less serious obstacle to the flow of milk. When situated at the lower end of the teat, they almost entirely obstruct the canal; higher, they render the flow of milk more or less difficult, and in all cases they may give rise to extreme distension of the gland, and lead to the formation of abscesses or parenchymatous inflammation.

The *phlegmonous mammitis* described by Saint-Cyr, is always more serious than the catarrhal form. It commences with several generally very well-marked febrile symptoms: the animal is dull, loses its appetite, and ceases to ruminate; the temperature is elevated, the pulse becomes frequent and quick, etc. These symptoms of general disturbance, according to some authorities, may manifest themselves three or four days before the local disorder, and occasionally diminish considerably when the latter appears; though Saint-Cyr correctly states that this rule has numerous exceptions. What is certain, is that there are rigors and unmistakable indications of general febrile reaction at the very commencement of phlegmonous mammitis.

In a very brief period the udder acquires a considerable, sometimes a great volume—in the Cow often reaching as low as the hocks, or even lower; the swelling is œdematous, "pitting" deeply on pressure, but it is hot, inflammatory, and very painful, and extends beyond the gland—at times towards the vulva and umbilicus or sternum with the Mare and Ewe. Beneath the œdematory tumefaction, the gland texture can be felt hard, tense, and nodulated in places; while the skin is red, stretched, and shining, and extremely painful to the touch. This painfulness causes an animal, at other times quiet and docile, to be irritable and fidgety, and averse to have the part touched, either for examination or milking. Progression, or even standing, is painful, the animal being evidently afraid of the hind-limbs coming in contact with the gland; so that it either stands or walks with them wide apart, especially on the affected side of the gland. The creature, for the same reason, seldom, if ever, lies down; when it does so, it is on the side on which the gland is least affected. There is often much restlessness and anxiety, and the Mare may show symptoms of colic. The secretion of milk suddenly ceases, and pressure on the teat only causes a small quantity of reddish-coloured grumous fluid to flow.

All these symptoms may become aggravated in four, six, or eight days, when the malady may terminate by resolution, suppuration, gangrene, or induration, according to circumstances.

Parenchymatous mammitis, or inflammation of the proper glandular and connective-tissue structures of the udder, is not, as a rule, so acute in its manifestations as the preceding, nor yet does it differ materially, so far as the general symptoms are concerned. The appetite is diminished, but

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not altogether suspended; there is much thirst, and rumination is irregular; the physiognomy betrays suffering, though not of a very acute kind; the pulse is full and quick, respiration short and hurried, and constipation is frequently present, while the urine is less abundant and dark; the temperature of the surface of the body is variable, and the muffle hot and dry; there are rigors, and muscular twitchings or tremblings, particularly towards the shoulders and flanks. The conjunctivæ are injected, the skin more sensitive than usual, and the Cow manifests pain when the loins are pressed upon; with the Mare the loins appear to be stiff and sore. There also appears to be lameness of the hind-limb of the affected side, due to the cause before-mentioned; and when more than one quarter is attacked, the Cow seldom lies down.

The swelling of the gland is very hard and hot, but not œdematous, as in the other forms, and the skin preserves somewhat of its natural hue, and is not thickened; the subcutaneous veins are much distended over the whole surface of the gland. The intense hardness of the inflamed mass is very characteristic, and is noted throughout the whole mammæ; though it is always greater on one side than another, and sometimes only in one quarter —most frequently a posterior one in the Cow, both mammæ in the Mare. When the inflammation is intense, and it has commenced in a particular part of the gland, it generally spreads rapidly until the whole quarter, frequently the entire mass of glands, is involved.

From the commencement the secretion of milk is almost, if not quite suspended in the diseased gland, and much diminished in the others: mulsion only yielding a very small quantity of a red clotty fluid, mixed with blood; in very acute cases almost blood alone may escape. In other cases the fluid is composed of transuded serum, and small pieces of coagulated casein. In a short time this fluid becomes of a purulent character, at other times it is putrescent and fœtid. Microscopically, it is found to be composed of particles of solidified casein, a few fat globules, epithelium from the milk-vesicles and ducts, but especially pus and red blood-corpuscles; sometimes bacteria and micrococci are noticed to be in considerable numbers. When abscess forms and ulceration takes place, bundles of fibres of elastic tissue are often discovered in this fluid. Chemically, it contains but little casein, milk, sugar, or fat, but much water and albumen.

The progress of the disease is very rapid—more so than in either of the other forms; in twenty-four, thirty-six, or forty-eight hours—sometimes even in less than the first-named period—the disease has reached its greatest intensity. The attack is generally very sudden—the animal being apparently quite well when left for the night, and perhaps presenting all the symptoms described when seen again next morning. When it has reached its culminating point, it may remain stationary for two, three, or four days before passing to one of its ordinary terminations. Towards the third or fourth day the vicinity of the gland becomes œdematous, and this œdema may extend to beneath the chest and as high as the vulva: in the Mare to the inside of the thighs, and down the hind-legs.

Course and Terminations.

The course and terminations of mammitis is a matter of much importance. It, as we have seen, rapidly passes through its different phases until the fourth, rarely until the sixth day, when it terminates either by *resolution*—which seldom indeed occurs without prompt treatment; *atrophy; induration; suppuration*; *gangrene*; or even the *death* of the animal.

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Resolution is, of course, by far the most favourable termination. In the parenchymatous form it can rarely be rendered complete, even by the most rational and vigorous treatment, after the second or third day; in the phlegmonous form it may occur so late as the fourth to the sixth day, but seldom after the eighth. It is marked by a gradual diminution in the intensity of the symptoms—general and local, and particularly in the pain, which first disappears, then the tumefaction and solidity.

Saint-Cyr lays much stress on the decrease in density with regard to prognosis. If it persists beyond the time stated above: if after forty-eight hours in parenchymatous mammitis, or six days in the phlegmonous form, the gland has not, to any marked extent, lost something of its woody hardness, there is great reason to fear that resolution will not be complete, and that some portions will remain indurated, or that the mass will become either partially or totally atrophied.

Though the subsidence of the fever and diminution of the swelling are in themselves favourable signs, yet they may be deceptive with regard to thorough resolution; and it must be recognised as more favourable when the tissue of the gland resumes its softness and suppleness, rather than when the swelling subsides rapidly and the hardness remains but little altered.

It is scarcely necessary to mention that the return of the normal secretion to the affected gland is a most favourable sign, though this does not occur very rapidly. For several days—from ten to twenty, or even more—the fluid obtained from the teat of the affected quarter remains watery, or rather, serous, curdled, contains numerous colostrum cells, and is more albuminous than caseous—coagulating readily by heat; it contains but little cream or sugar. But it gradually recovers its usual composition and increases in quantity, until, at last, in amount and quality, it does not differ from that furnished by the other quarters of the mammæ. It sometimes happens, however, that with regard to the lacteal secretion, though the gland regains its normal size and softness, it does not acquire its full functional activity until the next pregnancy and the next period of lactation. Complete recovery appears to take place during the period when the Cow is "dry."

With the Cow, it generally requires four to five weeks before resolution is complete; with the Goat the period is less, and it is still less with the Mare.

Atrophy of the gland occurs generally when resolution is not complete. All the indications of that change are present, though they occur more slowly; but the lacteal secretion does not return—recovery is not perfect.

The glandular *acini*, obliterated by the proliferation of the interstitial connective tissue or the inflammatory exudate which took place in their interior, are no longer capable of performing their function; and in proportion as these products of inflammation are absorbed after its subsidence, so does the diseased gland diminish in volume, the mammæ become deformed and asymmetrical, the teat retracts and assumes an abnormal direction, and but little, if any, milk can be obtained from it. On manipulation, instead of the gland structure, nothing can be felt save a very firm, dense mass, which feels like indurated connective tissue, with, in its texture, some isolated nodules which appear to be, and really are, lobules of the gland which have remained intact and yet secrete the little milk that is yielded. The loss of a quarter of the mammæ in Milch Cows is, of course, a somewhat serious termination, so far as the supply of milk is concerned, as this is materially diminished. Nevertheless, the other quarters sometimes partially compensate, by their increased activity, for the injury, and the animal is otherwise in good health.

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Induration is not at all an uncommon termination of mammitis, especially in the Cow and Bitch, and is often the point of departure, in the latter animal, of various and serious degenerations of the glandular tissue.

This termination is to be apprehended, in the Cow, when the inflammation persists in a somewhat acute manner beyond the sixth or eighth day. Then the general symptoms diminish, the animal suffers less pain, the appetite returns, as well as rumination, if any œdema was present it has disappeared, but yet the gland does not regain its healthy character. The inflammation has gone, the morbid products are partly absorbed, but in different parts of the substance of the gland there are more or less voluminous, well-defined, and rounded masses which have an almost stony hardness, and are apparently adherent to the surrounding tissues. These are evidently indurated lobules which have not undergone resolution, and their secretory power is therefore lost.

In other instances in which the inflammation has been very intense, recovery does not even proceed so far. The febrile symptoms disappear, and the pain in the udder to some extent diminishes, as well as the swelling; though for a long time the local temperature is higher than usual, and the animal evinces uneasiness when it lies down. The induration of the swollen gland, often visible externally, instead of diminishing, appears to increase, owing to the progressive organisation of the inflammatory products, and from the teat there can only be obtained a small quantity of yellowish turbid serum, with perhaps a few coagula of casein, epithelium casts, and sometimes even veritable diphtheritic false membranes. In such a case, all the parts of the gland so altered are irrevocably destroyed, so far as the lacteal secretion is concerned.

It is from this indurated condition that those degenerations and neoplasms arise, which are met with in the mammæ of animals, but especially the Bitch. These are the adenomatous, sarcomatous, carcinomatous, enchondromatous, and fibromatous growths which have been described so often as found in the mammæ of this animal; but a consideration of which we cannot enter upon here.

Suppuration—by which we mean the formation of abscess—is a rather frequent termination of mammitis, and particularly of the phlegmonous form. The abscess may be single or multiple, and vary in size as well as situation. Sometimes they appear immediately beneath the skin, and between it and the tunic of yellow fibrous tissue covering the gland; in other cases they are formed in the interstitial connective tissue separating the glands, or even in the interlobular tissue; while, though rarely, they may be found in the connective tissue between the mammæ and the abdominal wall.

Suppuration generally sets in from the eighth to the twelfth day, and is marked by an increase, instead of a diminution, in the symptoms—augmentation of the fever, swelling, and pain. If the abscess in process of formation is superficial, the pain and redness appear to be greatest at a certain point; there the skin is at first of a bright red, but changes to a violet hue, and at the same time this part becomes more prominent and circumscribed. Soon there is fluctuation, and the other indication of abscess, and if not artificially opened this takes place spontaneously, and the contained pus escapes. Then the febrile symptoms diminish, and the general condition improves; the swelling in the gland subsides, along with the pain; pus escapes from the opening for two or three weeks, and finally ceases, the wound becoming cicatrised. Recovery has now been accomplished, and nothing remains, save perhaps a small mass of indurated gland where the abscess has been.

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This subcutaneous or superficial abscess is not generally very injurious or serious.

It is not so, however, when the abscess is developed in the interglandular connective tissue, or in that between the mammæ and the abdomen. Here the pus is deep-seated, and burrows or spreads wherever the resistance is least; in this way it leads to the formation of sinuses, sloughing of the skin over a wide surface, isolates masses of the glands—thus destroying their relations with neighbouring parts, and causing their mortification and total destruction. This mammary suppuration is always serious, as, under the most favourable circumstances, it generally ends in the animal losing more or less of the gland; while in some cases it may cause death from the violence of the inflammation and intensity of the pain, or through exhaustion from the long-continued and profuse suppuration.

When the abscess is situated in the interstitial or lobular connective tissue, the case is no better, but perhaps worse. Owing to the nature and disposition of the tissues, which resist distension, the pain produced by the inflammation is most acute and distracting; while the process of suppuration destroys a greater or less number of the *acini*, and the pus, deep-seated, is long before it reaches the surface of the gland, causing great havoc in doing so. Sometimes the interstitial abscess opens into a milk sinus, and partly escapes by the teat during milking. The pus is then mixed with the serum of the milk, and perhaps clots of casein and shreds of glandular tissue, the fluid having a highly ammoniacal odour. The pain is less, but does not cease, and it is generally necessary to make an external opening for the readier and more complete evacuation of the matter. There is generally much destruction of tissue, and cicatrisation is difficult and tedious, particularly when there are lacteal fistulæ. Not unfrequently the abscesses are multiple, and in some instances there are as many as there are inflamed lobules. In other cases one abscess succeeds another, owing to the presence of dead tissue in the mass of the gland.

Even when the abscess opens externally, and the other quarters yield milk, the pus is, of course, liable to pass into it, and to render it most objectionable as food. So that during the whole of the suppurative period, the services of the Cow as a producer of milk are lost. Such milk has usually a greyish tint, and often a peculiar odour—something similar to that of pus.

Fürstenberg has drawn attention to a *cold abscess*, often observed in the udder of Cows more particularly, and due to the spontaneous softening of a chronic tumour or induration—the softening being the result of fatty degeneration. The tumour loses its hardness, and the softening process gradually extends; the skin covering the mass becomes pulpy and thin, and often the tumour opens spontaneously and externally, a thick, yellowish kind of pus escaping; or it may evacuate its contents into one of the milk sinuses.

The secretory function of one or more quarters of the mammæ may be quite destroyed—a serious result with valuable Milch Cows.

Gangrene of the whole or a portion of the udder, is not an unusual termination of mammitis, and is, of course, the most serious one, except the death of the animal. It may be limited or diffused. The first frequently succeeds phlegmonous mammitis, and particularly when suppuration and diffuse or deep-seated abscess exists. In such a case the suppurative process has isolated a large portion—say a quarter—of the mammæ by the pus burrowing around it, and thus cutting off its nutrition—the bloodvessels being the last

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to give way to ulceration. The dead gland is encapsuled by its fibrous covering, and there it may remain for some time unless removed by a large opening—though sometimes the capsule gives way, and the mortified mass is found lying on the ground among the feet of the animal. In this way Nature gets rid of the diseased portion, and recovery becomes possible. The gangrene is generally limited by a dense band of fibrous tissue. In many cases surgical interference is necessary, when the mammæ mortify; and when this is judicious, and the animal is not too weak or exhausted, success is complete; though, of course, the lacteal apparatus is mutilated and greatly damaged.

When diffuse, gangrene of the mammæ is generally fatal. All the domestic animals appear to be liable to gangrenous mammitis, but more especially the Cow, Mare, and Sheep, the latter being oftenest attacked.

The symptoms are described as extraordinarily intense from the very commencement. There is great depression of strength, and the animal looks prostrated; the appetite is lost, rumination ceases, the heart beats loud and frequently, and there is grinding of the teeth and convulsive tremors. At the same time the udder swells enormously, the tumefaction extending along the abdomen and up the perinæum. At first œdematous, hot, and extremely painful, the swelling soon becomes emphysematous, cold, and insensible; the skin, which was previously intensely red, assumes a violet, then a grey, leaden, or dark hue, and is cold and clammy—vesicles containing a limpid or reddish serosity appearing on its surface—the mammary gland can now be readily enucleated by making an incision through the skin.

The general symptoms become more grave; the animal appears to be completely exhausted, trembles continually, and the pulse becomes imperceptible; at last the creature falls extended on the ground and dies—sometimes within ten or twelve hours, rarely longer than a few days, after the commencement of the attack.

Death sometimes occurs in phlegmonous and interstitial suppuration. Then the intense pain continues, or becomes still more excruciating; the animal is continually moaning, lying down and getting up again, as the recumbent posture increases the agony, by making pressure on the mammæ; the temperature is elevated; attempts to milk, which cause the utmost distress, only result in obtaining a few drops of reddish or semi-purulent fluid from the teat. All food and drink is refused; emaciation sets in rapidly; the animal is indifferent to everything around it; the expression is haggard and anxious; the conjunctivæ are livid; the respiration is quickened and often noisy; the muffle is dry and sometimes cracked; the pulse is thready or imperceptible, and there are constant tremblings; the prostration is soon so extreme that the animal falls, perhaps turns its head towards its shoulder, and dies without a struggle.

Ewes are very liable to mammitis during the "yeaning" or lambing period, and in very many instances it assumes an almost epizoötic prevalence, and the fatal gangrenous form. This is more particularly observed in large flocks, where gangrenous mastitis may be said to be the rule. Of this there are many instances to be found in veterinary literature, and particularly those given by Toggia, Yvart, D'Arboval, Roche-Lubin, and others. That recorded by Yvart, as occurring in the Alfort flock in 1833, is interesting. Kotelmann (*Zeitschrift für die p. Thierheilkunde von Nebel and Vix*, 1836, p. 423) gives a very good description of the disease, as he observed it. In the majority of cases, he saw only one half of the udder affected, and generally first around the teat, extending thence in every direction. The seat of the inflamma-

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tion was in the substance of the udder—the gland parenchyma, the swelling being hard, and the skin covering it light red; the pain was very great. Before the inflammation had reached its culminating point, a thin serous fluid (*milchwasser*) dropped from the teat, and when the latter was squeezed, curdled milk, or milk in firm clots, about the size of a pea, was obtained. The affected Ewe kept apart from its companions, did not eat, looked very dull, head and ears drooping, back arched, hind-limbs widely separated, and movement difficult, the hind-leg towards the inflamed side of the udder being most slowly and cautiously extended, as if lame; when both mammæ were affected, the gait was markedly straddling, and the steps short. When the lamb attempted to suck, the Ewe sank to the ground from pain, and could not rise again without assistance. Sometimes in the evening the quarter yielded good milk, and in the morning blood or reddish-coloured serum would be found dropping from the teat. In twenty-four hours from the commencement of the disease, death not unfrequently ensued. If, in the first twelve hours, the malady did not yield to antiphlogistic treatment, the skin covering the part and the hard gland, hitherto hot, became cold, painless to the touch, and assumed a dark-blue, glazed appearance. Then an œdematous swelling showed itself in front of the udder, and which soon extended to the umbilicus and sternum, along the side of the body, and down the thigh to the hocks. The development of this œdema was a sure sign that gangrene had commenced in the mass of the diseased gland, and the sanious fluid which could be drawn from the now insensitive teat was a further proof of this condition. When this change took place, the animal seemed to be much easier; it looked livelier, began to graze and eat, and even to ruminate. But the dark-blue colour of the udder, and the œdema extending therefrom, were unmistakable signs of approaching death, which usually occurred in thirty-six hours, when operations on the udder and scarification of the swelling did not avail.

This form of mammitis attacked young and old, good and bad, among the Ewes, but more particularly those of the improved foreign breeds—the Ewes that reared weakly lambs which could not sufficiently empty the udder, and which were well fed.

Kotelmann believed that this insufficient evacuation of the mammæ, mechanical injury to the teat, etc., was the cause.

Prognosis.

The prognosis of mammitis is generally unfavourable, unless the inflammation is superficial and limited, not severe, and treatment is adopted early.

When the inflammation, and particularly in the Cow, attacks the whole of the mammæ, it is then most serious, and rarely indeed can a favourable result be prognosticated. When the inflammation is localised and not likely to extend, and particularly when the suppuration is superficial, the results may be trifling—provided always that judicious treatment is early adopted and energetically carried out. With cattle and sheep at pasture, mammitis is often a most serious disease, from the fact that its existence is generally not perceived in time to check it, and the causes which produced it are perhaps still in operation. The permanent induration or sloughing away of one or more quarters of the mammæ, are always to be apprehended when the inflammation is interglandular or interstitial, and especially when it is acute. Gangrene, and even death, may result; indeed, the gangrenous termination of mammitis is fatal in nearly every case.

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Complications.

With ruminants, the digestive organs are generally involved in the disturbance and require attention. Inflammation of the joints (arthritis) is a frequent complication of mammitis; any of the articulations may become affected, but the patellar and tarsal appear to be the most predisposed. Septic infection and pyæmia are grave complications, and appear when gangrene or extensive suppuration is present. There are also the degenerations and new formations in the mammæ which complicate the malady when chronic, or subsequently.

Pathological Anatomy.

In the majority of instances, the interlobular connective tissue is the principal seat of the inflammation, particularly when the disease has been neglected. The layers of this tissue enveloping the lobules and acini are swollen and infiltrated, and compress, or even efface, the proper substance of the gland, as well as the vessels of the part. It is this swelling and infiltration which causes the tumefaction of the mammæ; though the inflammation of the proper gland-tissue will bring about the same results. Retention of the milk is caused by the inflammatory infiltration of the connective tissue surrounding the milk-ducts and canals. When inflammation has gone on to suppuration, we find, on section of the affected gland, the gland-tissue more or less occupied by large and small abscesses, adjoining healthy connective tissue; these abscesses may be isolated, or communicate with each other and form one large irregular cavity. Sometimes there is necrosis of the ligamentous bands which form the principal septa between the glands, and in this way are produced fistulæ or secondary abscesses, which may open externally or into the milk sinuses. These latter are generally lined with a large number of cylindrical epithelium; in severe cases their walls are thickened and of a dark colour, their cavity, as well as that of the teat, being dilated with the altered fluid. The matter in the abscesses varies exceedingly in its composition. Along with cylindrical epithelium are blood-corpuscles, fat-crystals, fragments of yellow elastic tissue, colostrum corpuscles, and an extraordinary quantity of micrococci of various shapes.

The interlobular connective tissue is thickened, dense, and like tendon or cartilage (sclerosis). The gland tissue itself has, instead of a yellow tint, a marbled aspect; in chronic cases calcareous salts may even be found in the textures.

When circumscribed gangrene has occurred, and elimination of the diseased part is accomplished, the dead mass may weigh as much as five or six pounds in the Cow; it is somewhat regularly oval, but rather flattened and discoid in the Mare; the colour is a light or pale yellow, and in consistence it is pulpy but not elastic, and the finger cannot be easily passed into its substance; traces of its lobulated structure can still be perceived, and if a section be made of it, all the characters of the mammary gland can be made out in its interior.

In diffused gangrene, however, the glandular tissue is deep-red in colour, softened, and filled with pulpy cavities; the ducts and sinuses are filled or choked with coagulated milk, pus and serum, the whole forming a diversely-coloured fluid. In the veins are sometimes blood-clots, variable in colour and consistence; gas and fœtid fluids escape from the tissue on section; and the œdema is found to be due to infiltrations of yellow serum in which are brown and greenish streaks. This fluid, examined microscopically, has much

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the appearance of that found in animals which have died from septikæmia. Shreds of necrotic tissue are also met with.

Causes.

Mammitis appears to be due to the most diverse causes. Among the principal predisposing causes, the first is lactation—the disease appearing immediately before or soon after parturition; and those animals whose mammæ are most active at this period, are those most frequently attacked. In the great majority of cases in the Cow—in which animal it is most serious—it follows within a month after parturition. It is true that, in certain maladies—as foot-and-mouth disease, cow-pox, sheep-pox, etc.—the udder may be affected at any time; yet the lactation period, that when the mammæ are at the height of their function, is the time when this inflammation is generally met with. With those animals whose milk is only utilised to rear their progeny, the sudden separation of their young without any precautions is often noted as an exciting or predisposing cause. The great activity of these glands in the Cow, and the long time during which this activity is maintained, is, there can be no doubt, one of the chief reasons why this animal so often suffers from this affection.

Mechanical causes may produce this inflammation—such as contusions, wounds,* injuries in milking† or sucking, blows from the head of the young creature, etc. Parenchymatous inflammation of the gland may also be due, according to Franck, to a deep purulent wound in the canal of the teat, especially that produced in dilating this channel, or in the removal of papillomatous tumours from this part.

Noquet (*Recueil de Méd. Vétérinaires*, 1851) alludes to a Cow in which, in consequence of mammitis, for six months the two posterior quarters of the udder lost their power of secreting milk. It afterwards calved, and the sinuses of these quarters were filled with milk; but none could escape, owing to the teat-canals being closed. By means of a knitting needle, artificial passages were made, but these became deep purulent fissures. When Noquet first saw the Cow, three-quarters of the mammæ were enormously swollen and gangrenous. Deep scarifications were made, and repeated dressings applied; while camphorated draughts were administered internally. The three quarters were destroyed, leaving only the left anterior quarter. Half a year afterwards all had cicatrised, and there only remained a fistula. The animal was in good condition, and was therefore slaughtered.

In these cases infection may occur from the wound itself, or through a ferment passing into the canals from without. In support of the latter view, which will be referred to again, we may mention that Viseur has attributed catarrh of the membrane lining the milk-ducts and sinuses to the too frequent employment of the teat-tube or syphon, which more or less paralyses the sphincter of the teat, and through the relaxed aperture the air, charged with germs, irritates and inflames this membrane.

"Overstocking" of the udder with milk has generally been considered a very likely cause in the production of inflammation. The sudden removal of

* Götze (*Sachs Jahresbericht*, 1867, p. 92), quoted by Franck, mentions an instance in which the posterior part of the udder of a Cow became inflamed, and soon there was a severe attack of mammitis. When the animal was killed, a large abscess was found in the gland, and in it two common pins, which Götze thought might have penetrated there from the rumen.

† In those countries where the milk of Ewes is utilised like that of Cows, in the production of cheese—as at Roquefort, where cheese bearing this name is largely manufactured—mammitis appears to be very frequent, and has been attributed very often to the rough handling the teats and udder receive in milking.

Roche-Lubin says that he has often witnessed shepherds acting so violently in milking that the Ewes could scarcely breathe, staggered in their hind-limbs, and sometimes fell from the pain and shock.

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the young, imperfect milking, etc., have also been blamed. Franck, however, appears to doubt the influence of mammary distension, and some observations and experiments would tend to prove that this does not always cause inflammation. For instance, Cows which had suffered from mammitis, and had temporarily lost the function of one or two quarters of the mammæ, were found at the next lactation period to have recovered the secretory power of these glands, but the excretory canal in the teat was obliterated. Consequently, great distension occurred, and this was not relieved by an artificial opening. Nevertheless, no inflammation ensued; after the third day there was a marked diminution in the turgescence of the quarters, and in about eight days they had assumed their normal volume. And Kehrer has experimentally shown that extreme distension may not cause inflammation, by closing two teats of a pregnant Bitch with collodion, and so securely that at birth the puppies could not remove it. The corresponding glands were much distended with milk, but no inflammatory action was set up.

The influence of cold and wet, and especially the former—particularly when animals rest with the udder on the ground—has also been largely ascribed as a cause of mammary inflammation, but probably there is some exaggeration in this; as Cows which are seldom housed suffer less, perhaps, from this malady than those kept in warm cowsheds. Cold winds or draughts in cowsheds have been especially alluded to as operating powerfully in its production; and though we are inclined to think that these and lying on cold ground do not produce the disorder so frequently as is imagined, yet there can be no doubt that while the udder is very active, and is in a state of almost constant hyperæmia, it will be more susceptible to alternations of temperature, particularly if the animal is rendered delicate by high feeding and an artificial existence.

Certain atmospherical conditions—as electrical storms—have been supposed to exert some influence also; and extensive outbreaks of mammitis have certainly been observed to coincide with these disturbances—the udder being attacked with a kind of phlegmonous erysipelas.

Hygiene has been looked upon as aiding in the development of mammitis; filthy and badly ventilated dwellings being greatly blamed as tending to generate a miasma, which exerts a special influence on the udder.

Plethora has been imagined to be, if not an exciting, at least a predisposing cause, and so has hot weather. Bardy, quoted by Rainard and Saint-Cyr, gives a description of an epizoöty of mammitis which was said to be due to the Cows consuming ranunculaceous plants, which were very abundant in the fields where the animals grazed. The people in the locality assured him that this always occurred when these plants were most plentiful in certain years.

Mammitis sometimes complicates or accompanies vaginitis, metritis, peritonitis, etc., according to some authorities.

There is much reason to believe that a particular form of mammitis is due to a putrid or septic infection, and Franck is one of the strongest supporters of this view. Indeed, he asserts that the majority of cases of mammitis are of septic origin; and he has experimentally proved the correctness of his statement. For instance, he has repeatedly injected into the teats of healthy Cows, pus from the udder of those affected with mammitis, or fluid from putrid flesh, as well as putrid blood, and within twenty-four hours an acute inflammation of the corresponding quarters has been observed. This inflammation occurred with Cows whose udder was in active function, as well as those which were "dry." The uninjured epithelium of the milk sinuses and vesicles are, therefore, not protective of the gland like the pavement epi-

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thelium of the vagina; for it has been shown that when putrid flesh or blood-fluid was injected into the uninjured vagina of Ewes and Cows, no inflammation was set up.

One of Franck's experiments is instructive. A Cow which gave only a small quantity of milk, had, on February 26, 1875, a quantity of fresh pus from the udder of another Cow suffering from mammitis, and diluted with ten times its bulk of water, injected into the teat of the left anterior quarter. Next day this quarter had all the appearance of being affected with parenchymatous inflammation. The other three quarters were generally intact. The secretion from the diseased quarter was yellow, creamy, and pus-like. It only contained pus-globules in great quantity, and these were studded with micrococci: there were also some epithelial cells, milk globules and small masses of coagulated casein. On February 28, the inflammation had extended to the left posterior quarter.

In another experiment he injected some putrid-flesh fluid into the milk duct of a teat. Next day this quarter of the udder was affected with acute parenchymatous inflammation; the milk was curdled, purulent, and contained large numbers of pus-corpuscles and micrococci. In a few days the adjoining quarter was likewise involved.

The structure of the teat and arrangement of the milk-sinuses and ducts in the Mare, ruminants, and Swine, are, in the opinion of Franck, favourable for the reception of infection; and this accounts for the readiness with which parenchymatous inflammation of the udder occurs very early in foot-and-mouth-disease, the virus of this specific malady finding its way from the surface of the gland into the teat. The wider prevalence of mammitis in close sultry weather during summer, than in cold winter weather, may be accounted for by the readiness with which organic matters putrefy. By the way of infection, those extensive outbreaks of mammitis which occur among flocks of sheep may also be explained. Those cases of the disease which follow abortion, or accompany metritis or vaginitis, may also be attributed to self-infection, instead of metastasis; indeed, in Franck's view those maladies which lead to the formation of putrid or septic matter—such as parturient fever, omphalitis in the progeny, retention and putrefaction of the after-birth, etc. — may all be productive of mammitis in this way. Disease of the progeny may also give rise to it, the infection being conveyed to the teat by the young in the act of sucking. The hands of milkers or others, or soiled litter or ground on which the animal lies, may also be the means of conveying the infection. Franck believes that the column of milk in the sinuses and ducts is first tainted, and that this is effected through the milk at the end of the teat—a drop or two of which may be suspended therefrom. A chemical change is thereby brought about in the milk, and this altered secretion leads to the inflammation, which is secondary. An alteration in the character of the milk is, it will be remembered, one of the first symptoms—if not the first—of mammitis. Consequently, "dry" Cows, or those to which the infection cannot obtain access, are not attacked by the malady; and "dry" Cows suffering from foot-and-mouth-disease never have parenchymatous mammitis.

In the veterinary journal of the University of Pisa (*Giornale di Anatomia, etc., degli Animali*, 1875) Professor Rivolta describes a form of mammitis prevailing among sheep in the neighbourhood of Pisa, towards the end of winter and commencement of spring, and to which he has prefixed the designation of "septic." He gives it this designation because, when it begins at a certain part of the mammary gland, there is noted a kind of putrefaction of the juices of the skin, as well as of the gland itself; and besides, in the sero-sanguinolent fluid in the connective tissue of the gland are remarked a very active element in the process of putrefaction, in the presence of *micrococci* and *bacteria*.

The disease appears to be perfectly distinct from the gangrenous mammitis, and the gangrenous, or anthracoid erysipelas, described by various writers. It is a local

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malady which usually invades the gland, extending at a certain rate of progress, and most frequently proving fatal. It ordinarily commences in the neighbourhood of, or in, one of the teats; if the latter, it offers a circumscribed œdematous tumefaction, while the surface of the skin thereon is intensely red. This red patch rapidly assumes a grey colour, and finally becomes almost black. Sometimes blood escapes from the affected teat. This œdematous swelling and discolouration gradually extend, and in a more or less brief period of time has invaded one-third or one-half of the udder—not even sparing the tissue of the gland. The whole of the affected part is then tumefied, doughy, somewhat consistent, slightly or not at all sensitive, and dark or black in hue. The line of demarcation between the healthy and diseased portion is perfectly defined; the former being of a rosy colour, and normal in size and consistency. The diseased condition spreads beyond the udder to beneath the abdomen, and when an ulcer appears on the gland, discharging a fœtid sanguinolent fluid, the animal then becomes depressed and feverish, debility and emaciation set in, and the creature succumbs to an attack of septikæmia.

The numerous necroscopical examinations made by Rivolta confirm, in his opinion, the distinction he has established between this special malady and erysipelatous mammitis. With regard to the causes, the shepherds affirm that the malady attacks those sheep which are kept for a long time on a thick bed of litter; others, again, assert that it appears when they are allowed to pasture in the open air, and are not confined. The same uncertainty prevails with regard to its contagiousness. The shepherds carefully isolate the affected animals: and it would seem that, by their doing so, the disease is limited to those first attacked.

Rivolta is of opinion that this form of mammitis is produced and maintained by special *micrococci* and *bacteria*, which penetrate by the teats, or at some part of the skin covering the gland.

Tuberculosis of the udder is sometimes a cause of mammitis, and in all cases, when severe, diminishes the secretion of milk. The mammæ are greatly enlarged, hard, and nodulated, and softening of the tubercular masses may give rise to isolated or diffused abscesses.*

Several Italian authorities, and among them Brusasco, Oreste, Metaxa, and Provinzano, have drawn attention to a peculiar disease of Goats and Sheep, accompanied by the gradual loss of milk. Often lameness is observed, and within fourteen days the quantity of milk is reduced to one-fifth of the usual quantity. This fluid soon becomes sour. The disease appears to be contagious, for it could be produced by injecting the milk from affected Sheep into the teats of healthy Sheep and Goats. All the animals so experimented upon became affected, the period of incubation being six, twelve, fifteen, or twenty days. The secretion of milk ceases in from eighteen to thirty days.

Treatment.

However slight the attack or mild the form of mammitis may be, in view of the serious consequences which it may entail, treatment should be prompt and judicious; as in two or three days alterations may be produced in the secretory apparatus of the gland, which medical skill may be unable to amend.

When the udder or quarter is simply engorged with milk, nothing more has to be done than to thoroughly remove this fluid. This, of course, cannot be accomplished at once, and it may be necessary to milk the animal several times during the day—five or six times, or even every one or two hours. When this causes pain, the milking should be gently performed; and if pressure on the teat causes so much disturbance that the fluid cannot be

* This tubercular affection of the udder is very important, when it is borne in mind that the milk of animals suffering from tuberculosis will, if experimental results be accepted as proof, produce the disease in those creatures who partake of it; and that, when the mammæ themselves are involved, the viruliferous qualities of this fluid may be greatly increased. Is the more and more frequent occurrence of the disease to be attributed to this cause?

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withdrawn by hand, then the teat-syphon (Fig. 207), well oiled, should be passed into the milk duct; should it be necessary to retain it there, then the ring-syphon (Fig. 208) may be employed, its retention being effected by a cord or tape through the rings and tied over the animal's loins. In all cases in which hand-milking causes pain, and is likely to increase the evil it is intended to avert, the teat-syphon should be resorted to.* It may be necessary to remove the progeny for a day or two, or allow it access only to the healthy quarters, if the animal is suckling; and should it be required to lessen the secretion of milk until the gland has recovered its normal condition, this may be effected by a suitable diet, and perhaps a dose of laxative or purgative medicine. Saint-Cyr recommends applications of vinegar to the gland.

Should the gland remain hard, tense, and painful, and the superficial

Fig. 207.

TEAT-SYPHON.

veins be gorged with blood, much relief will be afforded by bleeding from the corresponding mammary or "milk" vein, if a Cow.

The animal should not be exposed to cold or draughts, and it may be advisable to cover the body with a large blanket. If fever is apprehended, enemas may be administered, in addition to the exhibition of nitrated gruel.

Should coagula or solid caseous concretions have formed, they must be removed. This may be accomplished by moving the masses up and down, when possible, by careful and gentle pressure. When it can be easily displaced, it may then be pushed down to the end of the teat, and pressed

Fig. 208.

RING TEAT-SYPHON.

through. A coagulum or concretion of this kind, as large as a nut, has been extracted in this manner. When it is too voluminous, however, it may be necessary to introduce a sound carefully into the canal, in order to break it up; or it may even be required to incise the teat, when the mass is too large and dense to be got rid of in this way.

Retention of the milk is sometimes due to atresia or obliteration of the

* Franck very properly draws attention to the necessity for thoroughly cleansing these syphons in boiling water or carbolic acid solution. The danger of conveying infection to other quarters of the mammæ, or to the udder of healthy animals, is obvious unless this precaution is adopted.

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milk canal in the teat, and will then demand an operation which we will refer to presently.

When phlegmonous or parenchymatous mammitis is present, the treatment must be energetic, and adopted early, in order to prevent those serious alterations in the gland which take place so rapidly.

In the Cow, bleeding from the corresponding mammary vein has been recommended by many excellent authorities, from the speedy relief it gives to the congested gland; in the Mare, if bleeding is necessary, the blood must be abstracted from the jugular, though this can rarely be productive of much benefit. Leeches may be most usefully employed, locally, for the smaller animals, and Bouley has even had recourse to them with great advantage in the Cow.

In inflammation of the gland, emptying it of its secretion or removing from it the products of the inflammation, must be scrupulously observed. Milking by hand must be persisted in for brief but frequent periods, even though only a few drops of serum be withdrawn each time. The teat-syphon may sometimes be usefully introduced; but its employment requires much circumspection when the inflammation is acute. With the smaller animals, as the Bitch, milking is not so urgent.

The general treatment must depend upon the condition of the animal and the nature and degree of the disturbance, and must be, in principle, that of all inflammation. The local treatment is a matter of much importance, and here we find the most diverse recommendations.

Zundel, Baumeister and Rueff, Gillibert, and others, have lauded the advantages to be obtained from the application of collodion, particularly with small animals. With the larger animals, as Mares and Heifers, it has been most successfully employed by Zundel, who adds a few drops of castor-oil to the collodion, which is applied either over the whole gland or the inflamed quarter or quarters, commencing at the teat, the orifice of which must not be covered; a second or a third application may be made. The evaporation of the ether produces a salutary degree of cold, while the continuous layer of cotton closely adhering to the surface of the skin, affords equable compression and support by its contraction when the ether evaporates.

Astringent and refrigerant applications have always held a high place in the treatment of mammitis, and every authority has his own favourite application. In this way we have cold water, either alone or with the addition of ice, acetate of lead, or Goulard's extract; clay tempered with vinegar or salt water; evaporating lotions of various kinds, etc. These applications may be usefully and safely employed when there is merely congestion, or at the commencement of slight inflammation; but when the inflammation has become fairly established, and there is exudation, they increase the tension, and, without allaying the pain, promote induration. So that, as a rule, they are to be avoided until the inflammation has been greatly subdued, when they may be resorted to with some advantage.

Emollient applications, and especially when warm, afford more satisfactory results. In this direction warm fomentations and poultices appear to be most grateful to the animal, and to dissipate the inflammation most readily. They must not be too hot, as the skin of the udder is so thin that it is easily injured by inordinate heat. Poultices of linseed-meal, oatmeal, marsh-mallows, dough, etc., covered with olive-oil, laudanum, opium, or extract of belladonna, are especially to be recommended, in preference to fomentations, which require much time; and as they cannot be applied continually, the

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udder often suffers from the reaction—the change from heat to cold, though this may to some extent be obviated by drying the parts well, and smearing them with lard. An excellent poultice is furnished by *spongio piline*, which, if covered externally by oiled silk, and holes made in it for the teats to pass through, makes an excellent and clean cataplasm when steeped in warm water and applied to the udder. Williams recommends "spent" hops, which are very light, contain much moisture, are soothing, and do not irritate when they become dry. The drying of a poultice can be averted by placing it in a piece of waterproof material or oiled silk. Poultices and other applications of this kind are best retained by a wide and tailed bandage, in which are holes for the teats, and which, passing upwards on each side at the flank, and back between the thighs, is secured over the loins and croup. This bandage is at all times beneficial in relieving the pain and congestion, by the support it affords the swollen organ. It should therefore be adopted early.

Lotions of belladonna, opium, tincture of camphor, poppy heads, etc., are convenient applications, and if warm do good; but to prove efficacious, they must be applied frequently, and at the commencement of the disease. A sponge, or rubbing in with the hand, are the best means of applying them. Fürstenberg recommends continuous tepid alkaline lotions applied by the hand for twenty-four to thirty-six hours; and Schaack, quoted by Saint-Cyr, asserts that employed at the commencement, they have a remarkable effect—often arresting the inflammation in that interval, the swelling disappearing in one or two days.

Rychner states that nothing can equal the success resulting from the employment of alkaline lotions. The owners of cattle in Switzerland are well aware of this, and as soon as they observe the slightest alteration in the milk of a Cow, they take a handful of wood-ashes, which they moisten with milk, and making a lotion of the mixture, they rub it on the udder. Rychner is of opinion that the potash in the ashes prevents the coagulation of the milk in the udder—this coagulation being, according to him, the point of departure or initial phenomenon of mastitis. For this reason he gives the following recipe, which has obtained more success than any other, when applied before the inflammation had attained its greatest intensity:

Potass - - - - - - -	1 part.
Water - - - - - - -	2 parts.
Olive-oil - - - - - - -	5 „

These are to be well mixed, and then four or five parts more water are to be added. Often, after five or six hours, during which nothing could be drawn from the teat except a small quantity of thin curdled milk, there is obtained a whitish-yellow fluid, more like pus than milk, which is a very favourable sign.

Ointments and embrocations of various kinds are also employed—as those of belladonna, henbane, morphia, camphor, laurel, etc. In England, the extract of belladonna is much used as an application to the inflamed gland. Rychner recommends an ointment made with soft soap and this extract; Hertwig gives his testimony in favour of camphorated pomade; while some prefer simple lard. Strong mercurial ointment has been greatly extolled as an anodyne and relaxer of the tissues, and justly so. Its constitutional effects should be watched, and care must be taken that the progeny is not allowed to suck the teat.

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Stimulating applications should not be employed, unless the disease is in a chronic form, and then their effect must be noted.

When suppuration appears to be inevitable, this process should be expedited by every means, so as to concentrate the pus at one point, if possible. The warm poultice or fomentations should be continued, and it may even be advantageous to apply mercurial ointment, ammoniacal liniments, and such other "maturatives" as blisters. The abscess is to be treated according to general principles; it should be opened as soon as fluctuation can be detected, and for this purpose the bistoury or lancet may be employed; though some practitioners prefer the actual cautery, which, they believe, does not entail so much risk of hæmorrhage, favours the exit of indurated parts, affords a better means for the escape of pus, and the resulting wound heals up more readily. When opened, the wound demands only ordinary treatment—cleanliness, detersive or stimulant dressings, carbolic oil or lotion, etc. To prevent the opening closing too early—which it may do when the abscess has been opened by the bistoury, it will be necessary to introduce a small tent of lint or fine tow.

Sometimes several abscesses are developed simultaneously or successively in the tumour, and are separated from each other by thin septa. In such a case, having opened the largest abscess, it often happens that the pus from the others drains through the opening, converting it into a fistula. In such circumstances, a counter-opening must be made; and if there is any necrotic tissue to be found, it should be removed. In all operations on the mammary glands, the incisions should be carefully made, and no larger than is absolutely necessary.

When the abscesses are deep-seated in the texture of the gland or the connective tissue, it frequently happens that, in opening them, one or perhaps more of the milk ducts are wounded, and then we may have "lacteal fistulæ." From these the milk escapes, and this renders their cicatrisation difficult and tedious, if the gland is active. The treatment must chiefly consist in the application of caustics to the walls of the fistulæ, in order to hasten granulation—the nitrate of silver, chloride of zinc, tincture of iodine, or even the actual cautery, being generally resorted to. Sometimes a cure cannot be effected until the gland has become "dry." In some cases a pitch plaster or one of marine glue is useful, or the pressure of a broad elastic band when the fistula is situated at the base of the teat.

The occurrence of gangrene is always serious, though of course it is not so grave when limited than when diffuse. It generally leads to the loss of one or more quarters, or even to the death of the animal from icorrhæmia or septikæmia. When limited, little can be done, and in some cases it is best to wait for the spontaneous elimination of the dead portion: waiting and watching the process, supporting the strength of the animal, accelerating the separation of the dead from the living tissues, favouring the free escape of pus and putrid matters, so as to hinder their absorption, making counter-openings, and applying antiseptic dressings—as chloride of zinc, carbolic acid, permanganate of potash.

In other cases, it may be necessary to expedite recovery by excision of the mortified mass. In order to do this, it is sometimes, but not always, requisite to cast the animal, and to fix it as for castration. The opening by which the pus escapes is enlarged, and the tissues still adhering to the living parts of the gland are separated from it by the fingers, keeping clear as much as possible of the arteries, which should be ligatured, if injured. When the separation is complete, ligatures may be placed round the principal

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vessels—the ligature being a piece of narrow tape or ribbon, as their walls are fragile and easily torn. If any hæmorrhage occurs, the actual cautery or perchloride of iron may be employed to subdue it. The wound is then to be dressed with disinfecting and stimulating applications, until it ceases to give off a bad odour, and is throwing out healthy granulations. The animal must be well fed, and its strength sustained by stimulants and tonics if necessary.

When the gangrene threatens to become diffuse, there must be no hesitation in resorting to deep scarifications, in order to limit its ravages; these allow the escape of the septic fluids, which would impregnate the healthy tissues if permitted to remain; and the isolation of the diseased parts may be still further secured by plunging the actual cautery deeply into them, and applying oil of turpentine, carbolic acid, perchloride of iron, or tincture of camphor to them and into the wounds. It is often advisable to trace a line around the gangrene, so as to circumscribe it. When it is surrounded by a ring of inflammation, then emollient poultices may be applied to hasten its separation; indeed, if the part is quite dead, it may be judicious to cut into and remove as much of it as can be done—cauterising the wound well with the hot iron or perchloride of iron, and afterwards dressing it with chloride of lime, carbolic acid, and other antiseptics. At the same time, antiseptic medicines, tonics, and stimulants, should be administered internally. It might be well worth trying the injection of antiseptic agents—such as carbolic acid, tincture of iodine, etc., into the gangrenous tissues, by means of deep incisions and a Pravaz syringe.

Induration following mastitis can rarely be remedied, but it may be useful to continue the inunction of ointments which contain preparations of mercury—as the iodide—or iodine for a certain time. Armatage recommends the following ointment to be applied once a day, with smart friction:

Soft soap	½ lb.
Mercurial ointment	1 oz.
Camphor ointment	4 „
Extract of belladonna	4 drams.

Or the following tincture:

Tincture of iodine	6 oz.
Tincture of opium	2 „
Soap liniment	4 „

Frequent and gentle milking may also prove serviceable, as well as dry friction.

As a preventive measure when infection is apprehended—as in retention of the placenta, metritis or vaginitis, etc.—it is advisable to inject a weak solution of carbolic acid (2½ per cent.) or alum (2 per cent.), up the teat by means of a glass syringe, always after milking; the fluid should be at a temperature of 95° Fahr. Franck has proved the value of this precaution, and also its utility as a remedial measure; indeed, Armatage had previously recommended the injection of weak solutions of carbonate of soda or potash in mastitis. Franck has employed a ten per cent. emulsion of carbolic acid as an injection in artificially-produced mastitis (sixty grammes daily), and by this means suppressed the development of micrococci and bacteria in the milk, as well as prevented curdling of that fluid in the ducts and sinuses. Solutions of alum—ten per cent., 100 grammes injected daily—appeared to be also beneficial in this direction.

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Armatage recommends that animals suffering from gangrene of the mammæ should be removed from those which are pregnant, "as great excitement will be produced by the odour of decomposition," and abortion is probable.

CHAPTER X.

Agalactia.

"AGALACTIA," or absence of milk in the mammæ, is not uncommon in animals, particularly the Mare and Cow, and more especially in those which have not been bred from for a long time, or which have brought forth their first young, though themselves aged. This absence of secretion may occur, even though pregnancy has been normal and has reached its full limit. The udder is small and soft, and attempts at milking only result in the production of some drops of yellowish fluid, followed sometimes by a few drops of white watery fluid. There appears to be a want of development in the lacteal apparatus, which various causes concur in producing. The principal of these causes are: previous or present chronic disease in the mammæ; atrophy of these glands; exhaustion following disease; severe labour; insufficient food, either during or immediately after pregnancy; natural debility, emaciation, etc. In some instances the milk gradually appears some time after parturition, and a tolerable quantity is secreted; but in the majority of cases it is either not produced at all, or only in very small quantity. This condition is very unfortunate for its young, which must suffer from hunger if not observed, and must either be artificially reared, or put to another animal to be suckled.

The treatment of this condition must frequently prove unsuccessful. It must chiefly consist in giving good food, particularly of a leguminous kind, with aniseed and fennel, fennel-seeds, water fennel, *Meum mutellinum*, antimonials, and other agents which are likely to stimulate the secretory function of the mammæ. Great attention must be paid to the digestive organs, and the teats should be frequently stripped and the mammæ rubbed, either dry, or with some stimulating application.

Macorps (Canstatt's *Jahresbericht*, 1860) records a case in which the udder was rubbed with brandy, friction applied to the abdomen, and warm milk and fennel-seeds administered; in two days the milk began to appear.

When the absence of milk is due to disease of the gland, this must be combated according to the indications.

CHAPTER XI.

Injuries to the Teats.

FISSURES.

THE chief injuries to the teats consist of wounds, in the form of *fissures* or "cracks," which are most frequently witnessed in the Cow a few days after parturition; and though apparently unimportant, they nevertheless may become very troublesome and serious if neglected, and even lead to mastitis and

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icorrhæmia or septikæmia; while they render the animal fidgety and averse to being milked or suckled—the latter being especially inconvenient, particularly in the case of the foal.

Causes.

These injuries are generally produced by the powerful traction of the young creature on the teat while sucking, and mainly when the teat is empty, the milk scanty, and the skin very thin and fine—as in primiparæ. Even when the milk is abundant, but the skin thin, these fissures may occur. The teat is alternately distended by milk—when it is covered and softened by the externally warm saliva and buccal secretions of the progeny, in the act of sucking—then retracted and corrugated when emptied. At the bottom of the folds, the epidermis is rendered soft, and its cells loose and swollen; these finally, instead of forming a continuous layer capable of protecting the subjacent derm, give rise to a whitish unctuous pulp, which accumulates at the bottom of the corrugations. When this is removed, a sore is left, and the development of this sore is hastened by cold, which still further corrugates the part, as well as by want of cleanliness, contact with dirty litter or manure, which irritate the organ, besides the act of milking or suction, which extend the sore in length and depth. It may be that certain conditions of the saliva in the young creature also lead to irritation. Cows with voluminous udders and long teats, are often the subjects of this injury.

Symptoms.

The sore appears as a more or less deep, narrow, and sinuous ulcer, running transversely around the teat, and having indurated, thickened, raised margins, greyish at the bottom, or very red and erythematous, and containing a variable quantity of the thick unctuous matter just mentioned. The teat is apparently not much deformed—at least after milking, when it is retracted; and the fissures might readily pass unperceived. Then it is necessary to draw the end of the teat gently, in order to discover them.

When superficial, they are not so troublesome as when deep, irritable, and bleeding; then they are extremely painful, and the animal refuses to be suckled or milked, while attempts to handle the teat cause the creature to offer great resistance.

These fissures have an almost natural tendency to increase in depth, so long as the young creature is suckled. Sometimes they form at the very extremity of the teat, and the sinus and milk ducts become inflamed, the viscid matter secreted becomes firm and blocks up the canal, which may ultimately be completely obliterated, causing retention of the milk, inflammation of the gland, and perhaps lead to a fatal termination.

Treatment.

Fissures in the teat should not be neglected, however slight they may appear to be. They might be prevented by cleanliness and care, and keeping the animal from draughts of cold air. It is a good plan, particularly with primiparæ, and especially the finer bred Cows, to examine and wash the teats for a short time after parturition, and if there is a tendency to sores, to dress them with some bland substance—as lard, glycerine, or olive-oil.

When fissures are present, and especially when they are deep, an essential condition for their recovery is preventing the progeny from using the affected teat or teats. By this abstention, and the use of the teat-syphon

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(well disinfected every time) to empty the gland, recovery in the most serious cases is comparatively rapid, and sometimes even spontaneous.

Emollient lotions are generally recommended, and the ordinary fluid is the milk drawn from the teat, which is frequently applied during the day, the part being well cleaned with a soft cloth after each application. This and other mild emollients may be useful when the injuries are very slight and superficial; but when they are more serious, or a rapid recovery is important, then recourse must be had to more efficient remedies. For this purpose, perhaps nothing is better than carbolised glycerine (1 to 20), or, in very severe cases, to watery solution of silicate of soda. It may expedite recovery to touch the fissures lightly with nitrate of silver, and to cover the teat with an india-rubber capsule or ring.

Obliteration of the Galactophorus Sinus.

This may result from fissures, disease, or growths of various kinds, or it may be congenital (atresia), and is most frequently observed in the Cow. It may be either partial or complete.

Symptoms.

When due to fissures or disease, the symptoms are gradually developed; but when the occlusion is congenital, they suddenly appear either immediately before or after parturition, when the gland becomes active. Then the udder is distended, but no milk issues from the teat; the distension increases, and if relief is not afforded, inflammation and suppuration may result. On examination of the end of the teat in congenital atresia, pressure, as if in milking, and if the skin alone be the obstacle, will cause a slight prominence where the opening of the sinus should be, the milk being felt in the sinus. Should the occlusion extend higher, and the whole or a portion of the sinus be obliterated, then this prominence will not be produced, and the obstacle will be discovered towards the base of the teat.

Occlusion brought about by inflammation, hypertrophy of the mucous membrane lining the sinus, or the development of any growth—as a wart—does not occur suddenly; and in milking it will be observed that the stream of fluid gradually becomes smaller, until at last it can only be drawn drop by drop, or its flow has completely ceased.

Treatment.

When the occlusion is only due to the skin—which is not uncommon in primiparæ—a small crucial incision made through it by the bistoury or lancet, is generally all that is necessary. The sinus of the teat is distended with milk by pressure from the base, and the prominence at the end is then incised. To prevent the wound closing, a small bougie is introduced into the sinus for four or five days until the wound has cicatrised; it should only be taken out at milking time. Fürstenberg states that he has seen the opening thus made remain permeable during the whole period of lactation, but close again when this period expired; and a second operation had to be performed at the next calving.

When the obstacle is in the sinus of the teat, at the narrow part of the canal, and immediately above the sphincter, a fine trocar or stocking-needle, previously cleaned in boiling water and dipped in carbolic acid solution, must be passed into it and through the obstruction, when the milk will flow. To prevent closure, the cannula of the trocar or a teat-syphon may be inserted for some days, the opening being closed by a cork except at milking-time.

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Or a solid gutta-percha sound may be employed until an artificial mucous membrane is found, removing it when milking.

When the canal is only partially obstructed, and the milk yet flows, the introduction of a small feather—pigeon's—or a piece of thick catgut, will, with a little patience, gradually effect dilatation. But should it not suffice, and particularly if a wart is the cause of obstructien, an incision will be necessary. Various instruments have been proposed for this operation, but Lüthi's sound is perhaps the best. This is an iron wire about eight millimetres long and two in diameter, having a ring at one end, and at the other a steel cone screwed on to it. This cone has a very sharp point, and both sides have cutting edges at the base or widest part. It is passed into the opening of the teat, pushed through the obstacle, and then gently turned round from side to side until no resistance is felt. Then it is withdrawn, and a bougie or teat-syphon, or a piece of thick carbolised catgut introduced. Zundel mentions that Lüthi and Strebel have been very successful by this method of operating.

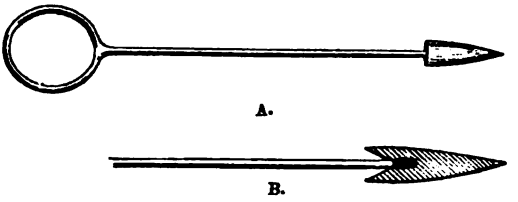

Fig. 209.

LÜTHI'S PERFORATING SOUND.

A. Half the Natural Size. B. Natural Size and Section of the Cone.

In all cutting operations on the teat, every precaution must be adopted for the prevention of mastitis; and this must chiefly consist in following out the antiseptic method of treatment of the incisions as closely as possible.

FISTULA OF THE TEAT.

We have seen several cases of fistula of the teat which proved very troublesome to cure during the period of lactation. From injury or disease, an opening is established between the milk sinus and the side of the teat; so that the milk, instead of passing through the canal in the extremity, escapes in a jet at the side, and its flow is nearly constant. This is a source of loss, and has often an unpleasant appearance. If it is decided to cure the fistula during the lactation period, and the opening is towards the middle of the teat, then the ring teat-syphon must be kept in the sinus for some time, and the fistula treated according to surgical principles. When the fistula is towards the extremity of the teat, however, the case is more difficult, and the teat-syphon only too often renders it worse. Then it is generally necessary to wait until the Cow is "dry," when, with a little attention, the fistula is readily cured.

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BOOK VI.

DISEASES AND ABNORMALITIES OF THE YOUNG ANIMAL.

THE diseases and abnormalities of the young animal, observed immediately after birth, are, many of them, of the greatest importance, and deserve far more attention than they have yet received in this country. Their consideration forms an appropriate complement to what has been said as to the pathology of the parturient state of the female parent; and a notice of them, however brief and imperfect it may be, is all the more necessary, as few, if any of them, are referred to in works on veterinary medicine or surgery. We will describe them in the following order:—(1) *Asphyxia*, (2) *Umbilical Hæmorrhage*, (3) *Persistence of the Urachus*, (4) *Umbilical Hernia*, (5) *Œdema of the Umbilicus*, (6) *Inflammation of the Umbilical Cord*, (7) *Arthritis*, (8) *Indigestion*, (9) *Diarrhœa*, (10) *Retention of Meconium*, (11) *Skin dryness*, (12) *Imperforation of the Anus*, (13) *Imperforation of the Vulva*, (14) *Imperforation of the Prepuce*, (15) *Cyanosis*.

CHAPTER I.

Asphyxia of the New-born Animal.

AT page 240, under the head of "Suspended Animation," we alluded to asphyxia of the new-born animal—a condition similar to that of the new-born child, and briefly alluded to the measures necessary for restoration. We have likewise referred to the immediate cause of this condition. It has been recognised that when animals are submitted during pregnancy to insufficient food, to severe exertion, have suffered from chest disease, or from colic a short time before parturition, or when labour has been difficult and protracted, the young creature at birth is so exhausted that it lies apparently dead—all the tissues being pale and flaccid, the body low in temperature, and the heart's beats and the respiratory movements are very feeble or quite imperceptible.

There may also be syncope or asphyxia from plethora or cyanosis; asphyxia may likewise be due to interrupted circulation in the umbilical cord, and intra-uterine respiration.

Apparent death, or suspended animation, must be treated in the manner indicated at page 240. The mouth and trachea should be cleared of mucus and amniotic fluid, if any of the latter has passed into the air passages, as it may give rise to pneumonia, should the creature be resuscitated and live for a short time. With the calf or foal, it is possible to pass an elastic tube or catheter through the nostril into the trachea, and by means of a syringe to remove much of the fluid therefrom.

Aspersion of the skin with cold water may also be useful in stimulating the respiratory nerve-centre, by the reflex action it induces. This is more particularly indicated when asphyxia is due to an excess of carbonic acid in

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the blood. Stimulation of the skin may also be useful in this direction. Direct electric stimulation of the phrenic nerve should be attempted. Artificial inflation of the lungs should not be tried until the mouth and fauces have been cleared of mucus; this may be effected by suction, which has a very beneficial action otherwise. Indeed, some authorities prefer aspiration to inspiration or blowing into the mouth; and Albert (Henke's *Zeitschrift für Staatarzneikunde*, vol. xxiii., p. 279) has restored 41 out of 47 cases of apparently dead animals, by aspiration or suction.

Transfusion of blood by the umbilical vein might prove useful; between one-half and a litre of blood should be sufficient for a foal or calf, according to Franck. The fumes of ammonia or some other powerful volatile irritant may be applied to the nostrils. A few drops of brandy may also be poured into the nostril.

CHAPTER II.

Umbilical Hæmorrhage.

HÆMORRHAGE from the umbilical cord does not appear to be a very common accident; nevertheless, it does sometimes occur, and in some cases so copiously as to cause death. It may ensue immediately after birth, rarely after some days; and it may continue for a short or long period—producing great debility, and even dissolution. The hæmorrhage is generally due to imprudence in cutting the umbilical cord too near the abdomen, or to laceration of the vessels of which it is composed during difficult parturition, when violent traction tears it close to the abdominal ring; in very rare instances it may be due to a varicose condition of the vessels. Zundel alludes to a predisposition to umbilical hæmorrhage—a kind of hæmophilus. In one or two instances the bleeding has been induced by either the mother, the young creature, or its companions sucking or pulling at the remains of the cord.

In the foal, the hæmorrhage may take place from the artery, as that vessel is firmly attached to the umbilical ring; with ruminants it takes place from the vein, because of the existence of the *Ductus Arantii*, and the retraction of the artery within the abdomen.

Treatment.

When the bleeding is trifling and not likely to continue long, little, if anything, requires to be done; but when it is copious and continuous, active and prompt treatment must be adopted.

When the cord is extremely short, astringents—as alum, tannic acid, etc., may be tried, or such hæmostatic agents as the sesquichloride of iron, nitrate of silver, etc., or even the actual cautery in a fine point. If, however, the cord is sufficiently long, it is better to apply a ligature; this will check the bleeding, and the cord will slough away in four or five days. In applying the ligature, however, the operator must be careful not to include a portion of intestine within it; and when there is much infiltration of the cord, as sometimes happens, the serum should be got rid of, as much as possible, by squeezing with the fingers or scarification, in order that the ligature may exercise sufficient compression afterwards.

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Artificial respiration is sometimes required when syncope or asphyxia is present, and this alone often suppresses the hæmorrhage.

The transfusion of blood may be urgently demanded in extreme cases.

CHAPTER III.

Persistence of the Urachus.

In studying the development of the fœtus, we described the urachus (pp. 75, 86), and pointed out that it was a canal formed by the middle portion of the allantois, which passed through the umbilical ring, and during fœtal life communicated with the bladder, from which it conveyed the urine into the allantoid sac. After birth this canal is obliterated, its walls become a thin cord, and the bladder is retracted within the pelvic cavity, the urine then passing through the urethra. It not unfrequently happens, however, that from accidental circumstances or some malformation, the canal of the urachus is only partially or not at all obliterated after birth; consequently, the urine continues to escape by drops or in a thin stream from the umbilicus or umbilical cord. This condition is far more frequent in solipeds than ruminants, owing to the urachus—like the umbilical artery—being firmly attached to the umbilical ring in the former, and therefore not at once withdrawn into the abdomen, as in the latter, when the umbilical cord is divided at birth. Therefore it is, that escape of urine from the navel is very seldom noticed in the calf; while in the foal it is often witnessed, particularly when the abdominal ring remains very open, or the cord is excised close to the body. This condition has, however, been seen in calves.

It appears to be more frequent in male than female animals, and is most dangerous in the former; in the latter, the discharge of urine by this abnormal channel often ceases spontaneously, only passing at first in drops; whereas, in the male, it generally escapes in a stream, little or no urine being discharged from the urethra.

Treatment.

In some cases scarcely any treatment is necessary, the escape of urine ceasing in a few days after birth; and when interference is demanded, a cure can generally be effected in a short time, if the urethra is pervious. Bénard (*Recueil de Méd. Vétérinaire*, 1828) mentions an instance of this accident, in which death occurred two days after applying a ligature to the urachus; it was then discovered that the urethra was imperforate, so that the urine could not be expelled at all. It is therefore necessary, before adopting remedial measures, to ascertain that the urethra is patent.

When the urachus protrudes sufficiently from the umbilical ring, a ligature may be fastened firmly around it.

When it is close to the abdominal ring, and consequently too short to be secured by the ordinary ligature, it must be secured by a curved needle. The foal is thrown on its left side, and the operator, holding the needle armed with the thread in his right hand, seizes the urachus, which is covered by the skin, between the thumb and index-finger of the left hand, and pulls it outwards; the needle is then passed through behind the canal, including as little of the skin as possible, and the ends tied. If there is any doubt as

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to the patency of the urethra, the ligature should only be partially tightened, until the nature of the obstruction is ascertained and removed. When this is done, then the ligature may be firmly tied when the urine escapes freely by the natural channel.

In those cases in which the urachus cannot be secured by this procedure, astringents or caustics—such as the sulphate of copper—may be successfully employed. Beneficial results have been obtained by the application of a strong vesicant around the umbilical ring, the tumefaction caused by it closing the opening. The actual cautery has also been most successfully employed, particularly in a fine point.

In the foal this accident is not uncommon; in the calf it is so.

1. Ercolani (*Osservazioni di Anatomia Pathologica Comparata*, Bologna, 1872) gives an interesting relation of this accident in a calf about thirty days old.

2. Cingolani (*Giornale di Med. Pratica della Societa Vet. Torino*, 1876, p. 214) relates that a Cow brought forth a well-developed female calf which, five hours after birth, was observed to pass its urine, not in the ordinary way, through the urethra, but in continual drops from the navel. Cingolani examined the creature carefully, and could not discover any indications of atresia of the urethra; but nothing was done for fifteen days, during which time the urine escaped by the same channel, and the urachus protruded like a tap. A ligature was then applied, and the opening closed. On the succeeding evening serious symptoms ensued; the belly was much retracted, and great pain was caused by pressure; there was intense fever, and the calf was comatose. The operation being suspected as the cause of these symptoms, the ligature was untied, but no urine now passed from the navel; neither did any pass from the urethra, though on a catheter being introduced, between 100 to 120 grammes were withdrawn. No relief was afforded; the abdomen became greatly enlarged, and the pain increased; the pulse was small, the extremities were cold, and tetanoid spasms were noticed. In two days the calf died. An examination revealed obliteration of the urachus by plastic exudation, the kidneys were hyperæmic, the ureters opened into a small cylindrical reservoir about 14 or 15 centimetres long, which contained only about 100 to 120 grammes of urine; this appeared to be the bladder, and from it passed the urethra, while underneath was a wide opening into the urachus. In the abdominal cavity was about a litre of urine. The symptoms presented by the animal during life were evidently due to uræmia.

CHAPTER IV.

Umbilical Hernia.

EXOMPHALUS, *omphalocele*, or *umbilical* or *navel hernia* is not at all rare in young animals, and is perhaps most frequently observed in foals and puppies; it does not appear to be so common in calves, and in pigs and lambs it is seldom seen. It would seem to be more prevalent in some countries or regions than in others. Marlot states that in every score of foals or mules bred in France, one is so affected. The hernia or rupture may appear at birth or some time after, and may continue during the life of the animal if no measures are adopted to cure it; it may be *congenital* or *acquired*. The *congenital* form is produced during fœtal life, when a portion of the digestive and biliary apparatus is contained in the umbilical cord, the anatomy of which has been described at page 85. The embryonic connective tissue or Whartonian gelatine, in which are imbedded the two umbilical arteries and vein (two in the calf and pig), is very abundant at the elliptical opening named the umbilical ring, through which also pass the urachus, the omphalo-mesenteric

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vessels, and a portion of intestine. After birth the umbilical cord withers, and the Whartonian gelatine becomes condensed and organised, forming a fibrous membrane which closes the umbilical opening, and gradually contracting, brings the two edges together; these unite, and soon nothing is left to mark the situation of the opening, except a short lozenge-shaped fibrous cicatrix: the intestine had previously been retracted within the abdomen, and the urachus, becoming contracted after birth into a thin ligament, while the bloodvessels are obliterated.

It sometimes happens, however, that the process of cicatrisation is either prevented, retarded, or interrupted; consequently, the umbilical ring remains more or less patent, and certain viscera either remain in it, or are pushed into it by an internal pressure, and lodged in the pouch formed externally by the skin. In this congenital hernia, the vein or veins and the arteries are separated by the misplaced viscera, the former being usually in front, the latter behind.

The lesion may be observed at the moment the animal is born; and after the cord is ruptured it may happen that the abdomen remains open, the viscera being exposed; the creature then generally succumbs quickly.

Acquired or *accidental umbilical hernia* usually appears soon after the cord has withered, or within a few months after birth.

A *true* and *false* exomphalus have been described: the first being that just mentioned, in which hernia takes place through the umbilical ring; while the second occurs through an accidental opening in the neighbouring aponeurotic or muscular tunics of the abdomen, and is in reality ventral hernia—occurring, as it generally does, after birth and in adult animals.

Various kinds of umbilical herniæ have also been alluded to, according as the sac is intestine or omentum, or both; thus we have *enteromphalus, mesentero-* or *-epiplomphalus,* and *entero-epiplomphalus.* The last is most frequently observed in carnivorous animals.

Causes.

We have just alluded to the cause of congenital hernia. Acquired or accidental hernia may be due to severe or sudden muscular exertion; as when the foal or calf runs or jumps very actively during its gambols or when pursued, or in falls. It is sometimes produced when the young creature is separated from its parent, and being kept in an isolated place, it rushes about and cries energetically. Umbilical hernia has also been known to follow an attack of colic, and after constipation or diarrhœa.

There appears to be generally present, in umbilical hernia, a certain organic predisposition, due to the suppressed or imperfect organisation of the Whartonian gelatine; and it has been remarked that common-bred animals are more liable to it than those of the higher breeds. Nevertheless, in all those in which it manifests itself—no matter what the breed may be—there is usually constitutional debility present, due in many instances to the mother having been ill-fed and badly cared for during pregnancy. Zundel says that there are years in which the accident is usually frequent, and particularly when much rain prevails, as then the food of herbivorous animals is more aqueous than usual. Low, wet, marshy pastures are also believed to predispose to hernia; as in them the tissues become soft and relaxed, and the digestive organs inordinately bulky; foals and calves kept in these situations have the belly voluminous, and the extrinsic pressure weakens the abdominal walls. Bénard, Hamon, Cruzel, Bouley, and others believe in heredity as a

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predisposing cause: Mares which were affected with umbilical hernia when young, have produced foals which presented this lesion.

Pathological Anatomy.

The hernial pouch or sac is nearly always lined by peritoneum—the peritoneal investment being produced at the same time as the hernia. In some instances, however, the peritoneum gives way to the pressure of the viscera, and then the walls of the sac are composed only of connective tissue and skin. The latter is frequently so much stretched that it becomes thinner, and in puppies is generally quite transparent.

Marlot says that the sac is usually composed of five layers: 1. The parietal peritoneum; 2. A very fine fibrous layer constituted by the fascia transversalis; 3. A kind of dartos formed by the tunica abdominalis; 4. The panniculus carnosus muscle; 5. The skin: the whole being connected by connective tissue. But this arrangement is far from being constant. The opening of the hernial sac corresponds to the umbilical opening, which is elongated, and measures in the foal from 1½ to 3½ inches in length, its width being variable, but never exceeding two inches. The viscera contained in the sac are usually the small intestine, omentum, free colon, and the point of the cæcum. Lanclot, Bénard, Delafond, Hertwig, and others have sometimes found the urachus in the sac, as well as intestine; but in congenital hernia, the urachus can scarcely fail to be absent, and we may also have the umbilical veins. It rarely happens that there is any adhesion between the hernied organs and the sac containing them, inflammation being rare; the sac seldom indeed contains any serum, and is therefore in immediate contact with the misplaced viscera. When ascites is present, however, serous fluid may then be present, and constitute the diseased condition termed "hydro-enteromphalus."

Symptoms.

The symptoms of umbilical hernia are, as a rule, entirely local. There is a round or pyriform tumour situated in the region of the umbilicus or "navel," varying in size in different individuals and species—from that of a pigeon's egg to a child's head, or even larger. The size also varies in the same individual at different times, according as the digestive organs are full or empty, the attitude standing or recumbent, at rest or undergoing active exertion, or the duration of the hernia—the older it is, the larger the tumour. It is usually soft, fluctuating, easily depressed by the finger, and as readily resuming its ordinary size and shape; when recent, however, it is often tense and not depressible. Sometimes it has a doughy feel and fluctuates much, and at other times it is flaccid, according as the portion of intestine which it contains is empty or filled with alimentary matters. It is nearly always indolent, and in the large majority of cases can be reduced by throwing the animal on its back, by manipulation externally, or by taxis internally. The tumour soon returns, however, particularly when the animal lies down or moves about; closing the nostrils or causing the animal to cough, will also produce its immediate appearance.

When the sac has been emptied by pressure or taxis, the opening in the abdomen can then be perceived. As a general rule, the volume of the tumour corresponds to the dimensions of this opening, which is sometimes elliptical, at other times nearly or completely circular; in false or accidental hernia, it is usually irregular in outline. The borders of the opening feel tense and resisting.

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On applying the open hand against the tumour, the vermicular movement of the intestine can be ascertained; careful taxis may lead to the discovery of a loop of intestine in the sac; while auscultation may detect the rumbling of the displaced viscus.

When the tumour is not reducible, this is generally due to the presence of an accumulation of fæcal matters or other substances in the intestine. Inflammation is rare, and is ordinarily due to contusions or other external influences. Strangulation of the intestine is likewise far from frequent.

Prognosis.

Umbilical hernia is not a serious condition in young animals, except in rare cases. Sometimes spontaneous recovery takes place; in the great majority of instances a cure is easily effected; and even when the hernia persists there is but little danger, health and utility being seldom interfered with. When the hernial sac is occupied by omentum only, and the abdominal opening is small, there is much less danger than when the intestine is involved, while spontaneous recovery is much more probable. In adult animals umbilical hernia is often a serious accident; and its gravity generally depends on the volume of the tumour. Complicated hernia is always dangerous.

Though not at all serious in itself, when affecting young animals, yet from their diminished value, and the expense of treatment, umbilical hernia may become a cause of much loss.

Marlot estimates that in France this accident causes a loss of more than a million francs to French agriculture. We know nothing as to its prevalence in Britain.

Diagnosis.

The diagnosis of umbilical hernia is not difficult, so long as it is uncomplicated. If, however, the tumour is hot, painful, and œdematous, it may be mistaken for an abscess or a recent traumatic hernia; it may also assume the appearance of an indolent fibrous tumour or a "cold abscess," when the contained intestine is filled with fæces.

It is not easy to distinguish between enteromphalus and epiplomphalus, even when there is no complication. Causing the animal to cough may enable the expert not only to diagnose the presence of umbilical hernia, but also whether it is of the omentum or intestine, the effort producing enlargement of the tumour when the intestine is misplaced.

Treatment.

We have stated that umbilical hernia in young animals often disappears spontaneously; and though there are several ways in which it can be remedied artificially, yet unless there are reasons to fear complications, or a cure is desired early, it may be well to consider whether it is not advisable to wait—at least for some time, to see if spontaneous recovery will take place. It is well known that during the lactation period, the small intestine, which is at this time the most developed portion of the alimentary canal—instead of occupying the left flank, lies immediately on the floor of the abdomen; but as the young creature grows and its diet is changed from milk to the food on which it is for the future to subsist, this intestine is gradually removed from the umbilical region by the development of the cæco-colic mass, which occupies its place. In this manner, the natural changes occurring in the digestive apparatus may bring about a spontaneous cure of the hernia.

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It may be, therefore, advantageous to wait for some time before resorting to treatment: allowing the young animals good tonic food, in small quantity at a time, to prevent undue development of the abdomen after weaning, and bathing the tumour with cold water or some mild astringent lotion.

When treatment has to be resorted to, it is generally recognised that, for the foal and calf, autumn is the best season, as the animal is older and stronger, and less likely to suffer from the necessary operations. The methods of treatment comprise (1) *bandaging*, (2) *topical applications*, (3) *constriction*, (4) *operations for complications*.

1. BANDAGES.—A truss or retaining bandage for the cure of umbilical hernia, consists essentially of a wide girth or roller placed around the body, and by the aid of which there is maintained over the tumour, and against the umbilical opening, a pad intended to prevent the viscera from again descending, when the hernia has been reduced. By this means temporary mechanical occlusion of the opening is obtained, until the physiological and

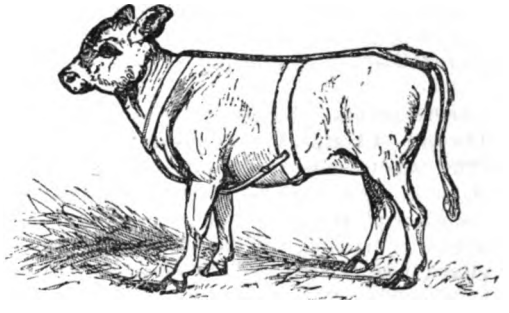

Fig. 210.

ARMATAGE'S TRUSS APPLIED FOR UMBILICAL HERNIA.

permanent closure of the latter can be effected, and its borders are firmly united.

There are various bandages which may be usefully employed with this object—the chief *desideratum* being sufficient solidity, simplicity, fixity, and ease for the animal. Marlot has proposed a truss, for which he claims solidity, fixity, and elasticity. This consists of a kind of well-stuffed saddle, from the four corners of which pass leather straps, which are buckled to two girths—one of which is of canvas webbing, and passes round the chest; the other, of india-rubber webbing, goes round the belly, and maintains a pad against the umbilicus. This pad is a wide, but not very thick, cushion stuffed with horse-hair, and which a broad longitudinal band uniting the pectoral and abdominal girths prevents from slipping backwards. In Italy, the Massiera truss is employed. This is also a kind of small saddle with two wide girths passing under the chest, and pressing against the sternum and epigastrium a plate of iron, the posterior extremity of which, corresponding to the umbilical ring, and covered by a leather cushion stuffed with horse-hair, is applied to the seat of hernia. In Germany, Strauss's apparatus is in vogue. This likewise consists of girths disposed in a similar manner, with a kind

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of martingale to prevent them gliding backwards. If a pad is used, Lafosse recommends that it should not be too convex or elevated in the middle.

Armatage advises the employment of a similar arrangement or harness, which furnishes a compress at the proper part; it is merely a number of straps, capable of being shortened or lengthened, as may be necessary in order to fit animals of different sizes (Fig. 210).

It usually requires from one to three months to effect a cure, the period depending chiefly on the size of the hernia. A tonic regime hastens recovery.

Some veterinary surgeons combine agglutinative agents with the use of the truss—employing, for instance, a pad steeped in a mixture of pitch and turpentine.

Before the truss is applied, it is, of course, necessary to reduce the hernia, and place the pad exactly over the umbilical opening.

Trusses are chiefly objectionable from the long time they must remain on the animal, and the tightness with which they must be applied in order to act beneficially. This inconveniences and often injures the young creature, and not unfrequently causes it to fret, impairs its appetite, and induces loss of condition; and though highly recommended by Marlot, Lafosse, Perosino, Schreger, Strauss, Ungefrohrn, and many others, they are not always to be preferred to other methods of treatment.

2. Topical Applications.—Topical applications have been for centuries employed for the cure of hernia, Celsus having recommended the use of sulphuric acid, which was resorted to at a later period by the early hippiatrists; and since 1833, when it was brought to notice by Hertwig, it has been used in Germany, being applied to the tumour every two or three days. The subcutaneous serous infiltration, and the plastic exudation in the hernial sac, drive the misplaced viscera into the abdomen, and in becoming absorbed afterwards, produce obliteration of the cavity and its opening. Blisters act in the same way; and applications of alcohol, creosote water, and other agents, have been largely resorted to. But Girard, D'Arboval, Bénard, and Mignon have asserted that these topical applications were very uncertain, and even dangerous, as the irritation they produced readily caused adhesion between the wall of the sac and the organs it contained, and thus rendered reduction impossible.

But in 1848, Dayot, and more recently other veterinarians, had drawn attention to the value of nitric acid cauterisation in umbilical hernia. The acid is applied to the skin covering the tumour until at first an eschar is formed, and, finally, detachment of the cutaneous hernial sac is achieved. In order to effect this, the hair is removed from the skin, and by means of a spun-glass brush or cotton-wool fixed on a glass rod, nitric acid of commerce is applied around the base of the tumour at first; then over the other part it is used in sufficient quantity, and with friction, so as to destroy the skin and ensure its speedy mortification and sloughing. Experience has proved that the more profound the disorganisation, the more certain is the beneficial action. According to Lafosse, it requires from 24 to 32 grammes of acid for a hernial tumour the size of a fist; and the friction, which ought to be as equable as possible over the whole surface, should be continued for three to five minutes —supposing the animal to be quiet and the rubbing not interrupted. A smaller quantity of acid and less friction, may be employed to herniæ which are not so considerable in volume, and are covered by fine skin. When the animal has to be thrown and placed on its back, the quantity of acid and

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amount of friction must also be diminished. Dayot recommends that the application be repeated once or twice in the hour, according to the thickness of the skin; but it has been found that one application is generally sufficient, fifteen days being allowed to elapse in order to watch the result. If at the end of this time the skin is not destroyed, the application may be repeated.

The nitric acid produces a yellow eschar, which, if not dry on the first day, soon becomes soft, unctuous to the touch, and easily destroyed. With the formation of this eschar, there is much swelling, either immediately on the application of the acid, or soon after; in some cases there is but little if any swelling. The tumefaction is due to the action of the nitric acid on the subcutaneous connective tissue, which is infiltrated, and causes a uniform pressure on the hernied mass; this leads to the latter being pushed into the abdomen and kept there as if by a truss. The œdematous swelling established external to the tumour, is oblong and depressed in the centre, in consequence of the diminished elasticity of the central portion of the escharified skin; in a few days it is gradually absorbed and becomes more consistent, while the skin in the centre becomes dry and hard, like parchment. Instead of the hernia, there is now only a newly-formed mass of fibrous tissue, which is gradually lessened in volume, condensed, and partly absorbed, like cicatricial tissue. At the same time the cauterised skin begins to be thrown off at the margin, the process of separation extending to the centre, where it takes a long time to be completed, because of the remains of the umbilical cord. When completely detached, there is a granulating healthy-looking wound left, which may have some fibrous masses in its middle. This suppurates, dries, becomes covered with a crust, and is gradually furnished with epithelium. In retracting, the wound contributes largely in closing the hernial opening, while the indurated skin which continues for some time to adhere to the abdominal walls, through the medium of the condensed connective tissue, contributes its share. In about a month cicatrisation is finished; the cicatrix remains destitute of hair and often of pigment.

According to the testimony of Zundel and others, this mode of treating umbilical hernia is prompt and speedy. There is generally no occasion to throw the animal down, and one assistant only is necessary; it is rarely followed by accidents. These do occur, however, and the most serious and frequent is the escape of the intestines through the eschar, about eight days after the nitric acid has been applied. This unfortunate result has been attributed to excessive cauterisation when the skin is thin and fine, though it may also occur from the animal rubbing or tearing off the sloughing cuticle when the pain or itching are troublesome. To obviate this accident, Rey, Lafosse, Legoff, and others recommend the employment of a bandage, and quietude after the operation. Reynal has observed peritonitis as a consequence of nitric acid cauterisation, and Lafosse mentions a case of tetanus due to this treatment.

When the cauterisation has not been sufficient, a relapse is likely to occur; Lafosse has observed one in twenty successful cases. This insufficiency is generally noticed on the following day, in the absence or trifling amount of swelling; but the cauterisation must not be attempted again in less than two or three weeks.

Hertwig, as has been mentioned, recommends sulphuric instead of nitric acid, and applies it in lines, night and morning, for two days, by means of a glass rod. Œdema soon sets in, and it may be increased by rubbing the cauterised surface with oil of turpentine and oil (one to two). The sul-

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phuric acid, however, appears to be less prompt than the nitric. Strong blistering ointment applied at intervals of three days; chromate of potass ointment (one to three) rubbed in once a day for five minutes at a time, on two consecutive days; solution of bichloride of mercury, and other topical irritants, have all been more or less successfully employed. Even the actual cautery, in lines and points, has been resorted to; but the beneficial effect to be derived from it is uncertain, and at best it is very painful.

Bouley (*Recueil de Méd. Vétérinaire*, July, 1877) draws attention to Luton's method of subcutaneous injections for the cure of congenital herniæ in infants, and believes it will be found more advantageous than any other treatment yet attempted for umbilical hernia in animals. Luton's method consists in the subcutaneous injection of a few drops of common salt solution around the hernial tumour, by means of the ordinary subcutaneous injection syringe.

Under the irritating influence of this injection, œdema sets in, and this mechanically repels the contained viscus, the margins of the abdominal opening come into apposition, and, with the connective tissue, are inflamed and soon unite.

The needle of the syringe must not pass beyond the subcutaneous connective tissue.

3. Constriction.—Constriction of the hernial sac has been largely resorted to for the cure of umbilical hernia, with the view of destroying it by mortification, causing adhesion above the part where this has taken place, and inducing secondary cicatrisation when the sac has sloughed away. The constriction is produced by *ligature*, *clams*, and *suture*. To apply these, the animal must, in nearly all cases, be thrown; but before this is attempted, the tumour should be well examined, in order to ascertain if it is reducible, if there are adhesions, the extent of the abdominal opening, and the limits within which the constricting apparatus should be applied.

The best position for reduction and constriction is the dorsal. The animal, if a foal, should be cast on a good bed of litter, and placed on its back. Very often the change of position reduces the hernia; if not, gentle manipulation and pressure will effect this, and then the empty sac is pulled well away from the body, and the operation completed.

The oldest procedure is ligaturing the entire mass of the hernial sac by a piece of cord tied firmly round it, close to the body. This produces at first a merely mechanical occlusion, but subsequently this is physiological —exudation and organisation of the plasma thrown out by the inflammatory process set up, producing adhesion of the peritoneal surfaces. A piece of whipcord answers very well for this ligature, but it must be drawn very tight around the neck of the sac, in order to produce its immediate and consecutive effects.

To keep the ligature in place, some practitioners pass one or two wooden pegs through the sac where it is encircled by the ligature; these prevent the twine being displaced by the swelling which quickly supervenes. Sometimes a ring is employed, which is less in diameter than the umbilical opening, and through which the hernial sac is passed before the ligature is made.

Some authorities prefer a double ligature, made by passing a double cord through the base of the sac by means of a sacking-needle, and tying each separately or entirely round the sac. Sometimes the ligatures are multiple; and Legoff has recommended the employment of several ligatures passing through the sac from apex to base, each becoming tighter as the abdomen is neared.

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Ligatures are very simple and easily applied, but they have their drawbacks, and these have led to their disuse. Among their disadvantages are uncertainty in their action—which is sometimes too intense, at other times insufficient; the sac often sloughs off before adhesion has taken place to such a degree as to sustain the weight of the abdominal viscera; and it has been pointed out that there is risk of including or wounding the intestine.

Very favourable results obtained by the *elastic* ligature in castration, are recently reported by Guérin (*Recueil de Méd. Vétérinaire*, July 30, 1877); this ligature might prove very effective in umbilical hernia.

The procedure by *clams* is often resorted to, particularly when the hernia is serious. The ordinary wooden clam (Fig. 211) may be employed, or one

Fig. 211.

UMBILICAL CLAM.

of iron, either hinged at one end or tightened by screws. To render the coaptation of the two branches of the clam more perfect, and to prevent the instrument slipping when tumefaction sets in, as well as to produce more prompt inflammation, adhesion, and gangrene, various contrivances are in use. Borhauer has used a clam, in the branches of which are a number of holes placed opposite each other, and through which wooden or metal pins can be passed when the instrument is fixed on the sac. Other practitioners use a clam with toothed branches, the teeth perforating the walls of the sac.

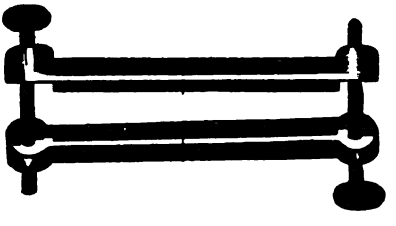

Fig. 212.

ARMATAGE'S IRON UMBILICAL CLAM.

Armatage recommends an iron screw clam, one branch of which has a long deep groove, and into this fits a narrow projecting ridge on the opposite branch (Fig. 212).

To apply the clam, he gives the following directions: "The animal is secured and placed on its back. The skin over the rupture is drawn together by the fingers in a flat fold, corresponding with a central longitudinal line through the abdomen (*linea alba*), and elevated from the parts beneath, in order to cause the intestines or omentum to descend. The clam is then put over the skin, as close to the abdomen as possible, and the screws tightened. The pressure must not be too severe, or the parts will

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drop off too soon, and possibly the intestines may escape. The operation, therefore, requires to be carefully watched."

Sutures are frequently employed, and there are various ways of using them. One method is the "twisted" suture, which is applied as follows: The hernial sac is included between two round pieces of hard wood or iron, which are drawn tightly together by whipcord passed round their extremities before and behind; double sutures are then passed through the sac, one of which is tied to the piece of wood on one side, and the other to that on the other side—so that the sac is completely invested between the wood and ligatures, which divide it into two portions. Another procedure by suture is to make a thick longitudinal fold of the skin covering the hernia, to pass the suture needle—armed with a waxed thread or cord—as near to the muscles as possible, and about three to four inches from the ring, from before to behind, or one side to the other; the needle is again passed through in the contrary direction, about half an inch from the first perforation, and the two portions of suture firmly tied, so as to draw the skin together like the mouth of a sac. Sutures are then passed through the sides of the pedicle and tied, so as to include the whole of the skin in the multiple loops. A cure by this procedure is usually effected in about fifteen days. The only objection to the operation appears to be the danger of wounding the intestine by the needle. To obviate this, some operators, after reducing the hernia, pull the empty sac well away from the abdomen, and pass it through a partially split piece of lead which is applied close to the belly; then the needle can be used without risk, as the lead—which is secured *in situ*—forms a shield as well as a truss, and prevents the descent of the intestine until adhesion has taken place.

When the hernia is irreducible or strangulation has taken place, then it will be necessary to carefully open the sac. Should adhesion have taken place between the latter and the intestine, or between the skin and peritoneum, this must be broken up; if the umbilical ring has to be incised in order to return the viscus, this may be effected by a probe-pointed bistoury. The incision should be no longer than is absolutely requisite.

The after-treatment of operation for hernia must be conducted on surgical principles, and according to the necessities of the case.

CHAPTER V.

Œdema of the Umbilicus.

TUMEFACTION, or rather "œdema" of the umbilical region, is not at all rare. Often it is simply due to an effusion of serum in the connective tissue of the umbilical cord, and sometimes to an infiltration of blood in this part and the surrounding connective tissue.

This accident is usually produced by contusion and laceration during birth, though at times it may also be caused by the young creatures, when two or more are together, sucking and pulling at the remains of the umbilical cord. It may also be due to chronic inflammation of this part, or the formation of abscess in the umbilical ring.

The accident is readily recognised; the swelling is often very considerable, and always cold to the touch. It often persists a long time in bovine animals; and Zundel says that it then constitutes a grave defect in young bulls, which

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it mechanically prevents from copulating.' When due to sclerosis of the connective tissue, it is usually persistent.

Treatment.

Cold applications and compresses have been recommended in the way of treatment, as well as lotions of arnica, camphorated spirits of wine, preparations of iodine, mercury, etc. These often fail, however, and it is generally better to resort to scarifications or leeches at once, to be succeeded by hot water fomentations. When the swelling is chronic, and due to a blood clot, which is sometimes the case, Baumeister recommends enucleation.

CHAPTER VI.

Inflammation of the Umbilical Cord.

INFLAMMATION *of the umbilicus*, or *omphalitis* (the so-called "*navel-ill*" of shepherds), is a serious accident, and often terminates fatally. It consists essentially in inflammation of the umbilical vein, which sooner or later involves the adjoining tissues, and is often followed by suppuration and pyæmia, which causes the death of the young creature. It is rare indeed that the inflammation remains of a simple kind throughout its course. As a rule, it is not merely an omphalo-phlebitis, but involves the abdominal portion of the umbilical vein. There is a thrombus, which soon suppurates; a fistula appears at the umbilicus, the umbilical vein is inflamed as far as the liver, to which the thrombosis extends, and the portal and hepatic veins may even be affected. As a consequence, the most serious accidents may arise. Embolic infarction of the lungs, liver, or other organs is likely to occur, with gangrene, septikæmia or pyæmia.

Symptoms.

The inflammation commences soon after birth. The remains of the umbilical cord, in the normal condition, quickly dries up and withers, as it were, within a few days after the creature is born. When inflamed, however, the part appears to be moist, and projects from the abdomen as an enlarged, compact, and hard mass, from the centre of which flows a small quantity of thin, unhealthy, purulent-looking fluid that soils the surrounding skin. The peculiar tap-like appearance of the umbilical cord, its density and high temperature, with the discharge therefrom, will lead the careful observer to recognise the existence of omphalitis.

A probe can be readily passed into the umbilical vein, which remains patent to a considerable extent. The local symptoms are often overlooked at the commencement, and the first general signs of omphalitis observed are usually dulness, arched back, indifference to the teat and to surrounding objects, persistent recumbency, fever, and hurried panting respiration when general infection takes place, and embolism of the lungs exists. As the malady progresses, great prostration is manifest; there is swelling at the umbilicus, and intense pain on manipulation of that region; the eyes are dull and injected, the mouth very hot and dry; the pulse is so small and quick as to be scarcely perceptible; the bowels may be constipated and the fæces scanty, or obstinate diarrhœa may supervene; the urine is greatly diminished

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in quantity; the mucous membranes often assume a yellowish tint; soft, fluctuating swellings, containing a yellow gelatinous fluid, often appear on various parts of the body; the creature refuses to suck; indications of colic or peritonitis are sometimes manifested, with enterorrhagia; and in the majority of cases death rapidly ensues.

Not unfrequently the phlebitis is most intense in the internal abdominal portion of the vein, and the pus, instead of freely escaping from the external opening, accumulates in the canal to such a degree as to form a large swelling at the umbilical ring, which might be mistaken at the first glance for a hernia. When this swelling has been opened, about half a pint of pus has escaped in some instances.

When a fatal termination does not quickly follow from septikæmia, or from embolism of some important organs, through detached portions of the thrombus being carried into them by the circulation, we may have chronic morbid conditions of a pyæmic character set up, which are characterised by metastatic inflammation of the serous membranes in various parts of the body, and particularly of the articulations. Indeed, it is now recognised by the highest continental veterinarians that the destructive arthritis or "joint disease" of foals, calves, and lambs is attributable to omphalo-phlebitis. Inflammation of the joints—especially those of the hocks—has often been accidentally produced by the inflammation excited through ligaturing the umbilical cord.

Metastasis to the iris, choroid coat of the eye, diarrhœa, tumefaction of the lymphatic glands, abscesses in the muscles and other parts, and other accidents, have been observed as a result of inflammation of the umbilical cord.

Pathological Anatomy.

In animals which have died or been killed in consequence of this disease, the walls of the umbilical vein throughout the course of the vessel, are much thickened, and the communication with the portal vein entirely interrupted by a blood clot. The vessel is filled by a yellow pulpy mass, foul-smelling in some cases, odourless in others; while its *intima* is detached, and forms part of the contents. In the abdominal cavity we may find effusion, exudation, and adhesion of various viscera, with peritoneal hæmorrhagic spots. The portal and other abdominal veins often contain matter similar to that in the umbilical vein; the liver is enlarged, in some cases atrophied, clay-coloured, and almost bloodless. The lymphatics of the liver and mesentery are usually nodulated, swollen, and infiltrated. The lungs in many instances exhibit intense hæmorrhagic infarction, lobular pneumonia and its consequence, and particularly purulent broncho-pneumonia. In special cases, to be alluded to hereafter, the joints are swollen and inflamed, and their capsules contain pus. When the creature lives until it becomes cachectic, fatty degeneration of the muscles, with ecchymoses in various parts of the body, are nearly always noticed.

Causes.

The causes of omphalitis are numerous. They may be enumerated as follows: the admission of air or foreign matters to the interior of the umbilical vessels; bruises or injury to the umbilicus, either during birth or afterwards; irritation of this part either by the litter, manure, or urine; the habit which certain females have of licking the umbilicus of their progeny, or of young creatures to suck the remains of the umbilical cord of each other; rupture of

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the cord close to, or within the abdomen; improper food given to the mother; exposure to cold and wet; and infection. Bollinger admits that in certain establishments, in consequence of over-crowding, the omphalitis of young animals may become erysipelatous, and be due to an analogous infection to that which produces the oftentimes fatal inflammation of the umbilical cicatrix in the new-born children in maternity hospitals. Rueff asserts that omphalitis is more frequent in some years than others.

There can scarcely be any doubt that, as Franck remarks, this inflammation is largely due to contact of the atmosphere with the umbilical wound, and to the ingress of germs which excite zymosis; or to contact with filth or putrid matters.

There can scarcely be a doubt, also, that the manner in which the umbilical cord is divided at birth has an influence in the production of this inflammation; indeed, this division or rupture of the cord necessarily produces a wound which is readily absorbent under all circumstances, until the remaining portion attached to the umbilicus becomes dry and shrivelled. The exposed umbilical vein and artery in the foal, the double vein in ruminants, also increase this readiness to receive infection, and consequent tendency to phlebitis; and these vessels are occasionally laid quite bare when the cord is divided close to the umbilical ring, and their protecting sheath is removed.

Franck gives an instance of this accident, which was witnessed in the breeding sheds of the Munich Veterinary School. A Cow brought forth twin calves, one of which—A—had the umbilical cord ruptured in the usual way, while the other—B—had it torn asunder in a markedly abnormal manner.

Alongside this Cow stood another which had recently calved, then was attacked with puerperal fever, and eventually succumbed to that disease. The after-birth of this animal was allowed to lie behind the Cow which had given birth to the twins; so that there was no lack of infection-producing material—the floor, straw, implements, as well as the hands of the cowmen, being impregnated with it.

The calf—B—which had the umbilical cord abnormally ruptured, became affected with omphalitis; while the other—A—with the wound better protected, escaped infection and remained in good health.

This cause of omphalitis must be frequently and extensively in operation among the lambs of flocks of Ewes when abortions occur among these, or when putrid matters are discharged from the vulva, or even when gangrenous or septic mammitis is present among them. It is often remarked that omphalitis sometimes appears among a larger number of lambs on a particular pasture; and it is extremely probable that careful investigation will lead to the discovery that many of these outbreaks are largely, if not entirely, due to septic infection of this kind. Franck has observed such occurrences in extensive cowsheds, when sometimes of ten to fifteen calves born within a few days of each other and kept together, half the number has become affected with this inflammation of the navel, and the remainder has escaped.

It must be remembered, too, that the discharge from one diseased umbilicus may afford sufficient material to infect a great many newly-born animals, should circumstances prove favourable.

Not only may contamination take place through actual contact with objects soiled or impregnated by such infective material, but the air itself, or flies, may prove media for its conveyance to the umbilical wound. There may also be a special infection, as a consequence of over-crowding in badly-

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ventilated dwellings—something analogous to the puerperal infection observed in certain maternity and other hospitals.

A malignant and a benignant form of omphalitis have been described by various authorities; but the distinction, if it really exists, is of no practical importance, and it is perhaps advisable, in so far as treatment is concerned, to consider the disease always as malignant. It would appear to be fully ascertained that septic infection gives rise to a far more serious and destructive inflammation than that due to entrance of the air, or an aërial ferment, into the wound or open vessels of the cord.

As has been remarked, this inflammation of the umbilical cord is more frequent in calves and lambs than in foals; and the reason for this is probably due to the fact that in the former there is a *ductus Arantii*, which is absent in the latter. There may also occur a kind of aspiration of air into the umbilical vein. However this may be, it must not be forgotten, when considering the etiology of omphalitis and its frequency in different species of animals, that putrid or septic diseases are much more common in Cows and Ewes than Mares, and that the latter do not so often receive manual assistance during parturition; so that they are less liable to parturient fever and other septic disorders which might involve their offspring.

When the remains of the umbilical cord are once fairly dried and shrivelled, omphalitis is very seldom, if ever, witnessed.

Ulrich (*Canstatt's Jahresbericht*, 1860, p. 41) reports that he saw a wide outbreak of the disease in a flock of lambs, many of which died from abscess in the liver. He attributed the outbreak to feeding the Ewes on rape-cake. Changing the food to oil-cake, and administering Glauber salts to the Ewes, checked the malady. Franck is inclined to think that infection may have had something to do with the outbreak.

Treatment.

The *prophylaxis* of omphalitis, or purulent phlebitis of the umbilical cord, is very important, and must be based on our knowledge of the etiology of the malady. This we have just alluded to. Cleanliness is absolutely necessary, and the young creature should be protected from every possible source of septic infection. The danger of infection may be greatly obviated, if the extremity of the umbilical cord be dressed with a concentrated solution of carbolic acid, which destroys atmospheric germs, keeps away flies, and renders putrid matters innocuous, while it quickly shrivels up the cord itself. This preventive treatment is strongly to be recommended for lambs, and particularly when there have been abortions among the Ewes, retention of dead lambs or the placental membranes, or any other likely cause of putridity on a sheep-run or pasture. The same measure is applicable to the calf and foal, but in all care must be observed not to apply the acid to the parts surrounding the umbilicus.

Curative treatment must be chiefly of a disinfecting and antiseptic kind. At the commencement it must be chiefly local, and the applications most likely to prove beneficial are lotions of carbolic acid, salicylic acid (particularly if fever runs high), salicylate of soda, permanganate of potass, borate of soda, alum or other astringent. If the umbilical vein is readily accessible, one of these lotions may be introduced into it, either by a fine bone probe wrapped round with lint, or by a syringe. Franck states that a five per cent. solution of carbolic acid may be passed in this way into the abdominal portion of the vein of small calves; this vessel can be penetrated to a distance of

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nearly ten inches. He does not approve of injecting the solution, because of the danger of injuring the portal vein.

If the suppuration is superficial, the same lotions may be used, or the part may be cauterised with solid nitrate of silver.

When the inflammation is very intense, several authorities recommend recourse to vesicating agents; others employ ammoniacal liniment, and Rueff advocates tartarised antimony ointment.

When there is danger of general infection, or this has already occurred, then the internal administration of antiseptic agents must be resorted to. Franck recommends salicylate of soda in doses of about one gramme every hour. Carbolic acid, sulphite of soda, or other agents of this class may also be given with advantage.

Constipation may be averted by castor-oil or a suitable diet—skimmed milk alternately with new milk. Preparations of iron may also be administered; and if the young creature is still at the teat, its dam should be well fed.

Franck notes that, during omphalitis, the most serious complication is inflammation of the umbilical artery, the existence of which can generally only be detected on a *post-mortem* examination of an animal which has died, or has been killed because of the disease. This complication is more frequent in the foal than the calf, probably because the vessel is torn at the umbilical ring in the first, and in the abdomen in the second. The peripheral portion is thickened, and contains a reddish-coloured thrombus, or is filled with a puriform breaking-up mass, and often the vessel is surrounded by, or imbedded in, an abscess; a sharp line of demarcation separates the inflamed from the healthy portion. General infection or pyæmia rapidly follows umbilical arteritis.

CHAPTER VII.

Arthritis.

Disease of the joints of young animals, occurring soon after birth, has been for a long time recorded in districts or regions where breeding is largely carried on; the animals affected belonging to the equine, bovine, and ovine species—much less frequently are dogs and pigs attacked. In France it is usually known as the "Arthrite" or "Paralysie des Jeunes Animaux," in Germany as the "Fohlenlähme," "Kalblähme," and "Lämmerlähme," and in this country—where it has evidently been but little studied, it has been popularly known as "Joint Ill," and technically as "Scrofulous Disease of the Joints," or "Specific" or "Constitutional Synovitis."

The disease was first described, we believe, by Brugnone (*Trattato delle Razze de' Cavalli*, Turin, 1781); then it was noticed by Roupp (*Recueil de Méd. Vétérinaire*, 1825), Lecoq in 1828, Strauss in 1831 (*Darrsucht der Föhlen*, Vienna, 1831), Benard in 1832 (*Recueil de Méd.* etc., 1832) Träger in 1839 (*Föhlenkrankheiten*, Berlin, 1839), Noll in 1840, Darreau in 1842 (*Recueil de Méd.* etc., 1842), Anker in 1848 (*Kalberlähme*, Zurich, 1848), Roloff in 1865 (*Fohlenlähme*, Berlin, 1865), and Bollinger in 1873 (*Zur Kentniss der Fohlenlähme, Virchow's Archiv*, Bd. 58, 1873), and in 1875 (*Deutsche Zeitschrift für Thiermedicin*, 1875). In England, the most valuable

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description of the malady which has appeared, is to be found in a paper by Walley ("Joint Ill in Lambs," *Veterinary Journal*, 1876, p. 406). It has been more particularly described as it occurs in the equine race in Normandy, by Lecoq and Darreau, and in Poitou by Terai; in North Germany by Träger, Bollinger, Strauss, and Roloff. In the bovine species, it has been portrayed as it prevails in Bourbonnais, by Bénard and Gay; in Switzerland by Anker, and in Bavaria by Bollinger. In the ovine species, Röll describes it as existing in Hungary, Haubner in Saxony, Kuers in Prussia, and Chambert and Cauvet in the South of France. Walley alludes to its principal features, as it is witnessed in lambs in England.

In some years it prevails very extensively, and appears to be almost enzoötic in some portions of the above-mentioned countries.

By some authorities it is supposed to be a constitutional disease, by others as scrofulous in its nature; while others, again, consider it as essentially pyæmic, and a sequel of purulent omphalo-phlebitis.

Roloff is of opinion that the affection is due to an alteration in the blood —to a diminution in the amount of mineral salts in that fluid—a veritable cachexia, in fact, allied to rachitism or osteomalacia. In this view, the inflammation which attacks the joints and is symptomatic of the disorder, should be attributed, primarily, to a cachectic or scrofulous diathesis, and, secondarily, to the traction exercised by the ligaments, connective tissue, and periosteum imperfectly attached to the soft and unequally consistent bones, when the animal moves.

Walley defines it as an inflammatory affection of the synovial membrane of the joints, of a specific character; hence the terms "Specific Synovitis" and "Specific Arthritis."

Causes.

If there is some diversity of opinion as to the etiology of this joint disease of young animals, there is absolute unanimity as to its predisposing cause—the period of youth, as it only appears during lactation. This fact disposes of its constitutional or hereditary nature, and has inclined some veterinary pathologists to attribute its occurrence to an alteration in the composition of the milk of the parent.

Darreau believed that the malady is more frequent among foals which do not receive the first milk, which contains colostrum; but this view is not borne out by other observers. Roloff has witnessed its advent in such a manner, that he thought it must be sometimes congenital. Walley states that the causes are entirely local, and can be traced to an impure or anæmic condition of the milk of the dam, as the result of improper systems of management, or giving food deficient in the necessary constituents of the blood. Hence, he asserts, it is seen when Ewes have been fed on an abundance of turnips, without a sufficient allowance of hay or corn, particularly if the turnips are decaying, or have been unduly forced with artificial manures.

It has also been remarked that it often occurs on heath lands which are much exposed, and have been top-dressed with marl; but the appearance of the malady only when the young creatures are at the teat, rather negatives the idea that exposure has anything to do with it. It has likewise been noted, that when Ewes are fed on decaying turnips or mangold wurtzel, the lambs are frequently the subjects of effusions of lymph between the muscles—the effusion being arrested when corn is given to the Ewes.

Walley insists upon an altered condition of the milk as the cause of the disease. "That it is due to, and must be associated with, an altered condi-

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tion of the mother's milk, is proved by the fact that it only attacks young animals while sucking the dam; that the Ewes coincidentally die from malignant parturient fever (though it must be borne in mind that it is not necessary that the Ewe should exhibit any external symptoms of a diseased condition of the blood); and that it is frequently found to disappear on farms which have been heavily limed and drained, and also when a different system of management has been adopted. Again, the general *post-mortem* appearances bear a strong resemblance to those of distemper in the dog, especially of the hepatic form of the disease; and the enlarged and softened state of the liver, where external symptoms have not been manifested, points to disease of a typhoid character, brought on by the imbibition of impure milk." He enumerates the exciting causes as "exposure; cold, damp pastures (hence the more frequent localization of the disease in the joints); neglect at birth, allowing the young animals to become covered with mud and dirt, thus preventing the dam licking them; excess of wet weather, etc."

Roloff, as just mentioned, thinks the development of the disease is due to the insufficient ingestion of calcareous salts; and as the malady is originated during intra-uterine life or the sucking period, it is evident, he adds, that it is in the regime to which the dam is submitted during gestation, when the osseous system of the fœtus is being developed, and when suckling, that the cause of the disorder must be especially sought for. Careful analyses have shown that the ash of the herbage or hay in the localities where the malady makes the largest number of victims, does not contain more than six to eight per cent. of lime salts, while that of good quality should have from eleven to thirteen per cent. It is also remarked that this form of arthritis sometimes prevails in those places where the osteoclasty of cattle is frequent; and this coincidence, it is affirmed, should indicate a common origin of the two affections—a defective supply of calcareous salts, and particularly of the phosphates. This deficiency is sometimes noticed when the food is relatively of a rich character; though then the amyloid and proteic constituents are in excessive proportion.

Bollinger, whose scientific and most valuable researches in comparative pathology entitle his opinions to the greatest consideration, entertains different views as to the origin of the malady; and his anatomo-pathological investigations in this direction are of the highest interest and importance. His observations on this disorder commenced in 1869, at the Government Stud at Graditz, Silesia, where it prevailed enzoötically and caused considerable loss. In that year forty-seven foals were attacked, and in 1870, twelve. Nineteen cases were not very serious; but of the other forty, twenty-nine succumbed—a mortality of 72 per cent., of those affected. The foals were generally seized with it (75 per cent. of the cases) during the three weeks succeeding birth. Of the forty foals above alluded to, twenty were ill within the first eight days, ten in fifteen days, and the others in the fourth or sixth week. The period of the malady was, of course, related to the foaling season—April, May, and June. After an attentive study of the symptoms, and making *post-mortem* examinations, Bollinger came to the conclusion that there is a complete analogy between the arthritis of foals—particularly in the lesions observed—and the results noticed as a consequence of omphalitis in infants. In his opinion, this joint disease, with its complications, is due to metastatic pyæmia, which has its point of departure in the purulent omphalo-phlebitis described in the preceding section of this work.

In a more recent publication, Bollinger returns to this subject; and after

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alluding to his former opinion, founded on literary studies and clinical observations, that the lameness or disease of the joints which attacks foals and calves during the first weeks after birth, are due to primary alterations in the apparatus of the circulation, viz.—inflammation of the umbilicus and umbilical vessels, he gives further evidence in support of this supposition. The autopsies of the calves which form the subject of his second communication, we will notice hereafter; but we may mention that they afford indubitable evidence of the existence of purulent omphalo-phlebitis, and its consequences. As in foals, so in calves, he traces the origin of joint disease to violent inflammation of the umbilical veins. He notes that in calves—which have a *ductus venosus Arantii* and foals have not—the direct opening of the vessels into the posterior vena cava, as well as the general implication of the latter, causes a proportionately larger number of cases in them than in foals. The influences at work in the production of omphalitis we have enumerated, but Bollinger lays great stress on the want of care, which is, as a rule, bestowed on the navel in newly-born domesticated animals, and compares this neglect with the scrupulous attention paid to that of infants, which is severed and bandaged immediately after birth; while the former have to lie with an open wound in all kinds of filth, and are thus exposed in the readiest manner to inoculation with poisonous or injurious matters, which cannot be excluded even from stables built especially for the purpose, and kept thoroughly clean. If the navel wound of an infant was exposed to the filth which young foals and calves have to lie in, it would be quite as liable to blood-poisoning as animals, and to the consequent affection of the joints.

Bollinger contests the influence of food in the production of the disease, as the strong, no less than the weak animals, are attacked; and it appears when every kind of diet is given to the parent.

He also denies that it is produced by chills, and attributes its advent chiefly to pyæmic or septic infection. He compares the enzoötic appearances of joint lameness with the endemic outbreaks of pyæmia and septikæmia (or puerperal fever), and points out that the only real difference between man and beast lies in the simultaneous appearance of puerperal fever epidemics with pyæmia in infants. One point is certain, he adds, and that is that there is a physiological and anatomical difference between woman and the domestic animals. The anatomical structure of the placenta and its villi, and its relations with the *placenta materna*, are of such a nature in these animals, as to prevent (on the normal detachment of the placenta) any rupture of the bloodvessels, and consequent hæmorrhage. In other words, if delivery has been successfully accomplished, no injury in the shape of wounds or abrasions is inflicted on the inner surface of the uterus; and owing chiefly to this fact is the inflammatory reaction and consecutive lochial fever reduced to a minimum among animals, and the introduction of poisonous matters (be they vegetable organisms or other injurious substances) into the uterus is rendered much more difficult; while we frequently find instances of the pyæmic process, due to inflammation of the navel and its vessels, among sucking animals, though with the parent—except in the case of the Cow—this process is rare.

Symptoms.

The symptoms of this form of arthritis are variously enumerated. The principal is extreme difficulty in moving, which is often noticed without any other premonitory indication. The movements are painfully and reluctantly performed, so that the young creature generally persists in lying. Around

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the epiphyses of the bones, and consequently near the articulations, there is swelling not only of the proper tissues of the joints, but also of the surrounding connective tissue; with hot, œdematous, and very painful infiltration of the region. From the very commencement the symptoms are most acute, and similar to those of ordinary arthritis; and they are rendered more marked by the least movement, the lameness being then extremely great, and generally all the joints are involved. The fever is extreme, the respiration hurried, and the visible mucous membranes highly injected; sometimes, and especially with lambs, there are *quasi*-tetanic spasmodic contractions. The appetite is lost, but thirst is intense, and the suffering creature will often be observed dragging itself along the ground to reach water or the teat of its dam. Not unfrequently there is at the same time a debilitating diarrhœa or dysentery, and sometimes in lambs a purulent nasal discharge.

The progress of the disease is sometimes very rapid, death occurring in twenty-four or forty-eight hours after the manifestation of the earliest symptoms. This rapid course is, however, rare, and the animal may live for twenty or thirty days, or even longer. Recovery is also rare, and death is the usual termination; it is quite exceptional that the disease becomes chronic. The malady usually ends in suppuration, which nearly always becomes general; numerous abscesses forming around the joints, whose capsules contain pus, as well as purulent deposits in other regions of the body. Generally after the fourth day, when the joints are greatly swollen, the hair falls off in these parts, and a yellowish or citron-coloured fluid, then pus, begins to exude through the skin, which sloughs away; the ligaments are also involved in this sloughing process, and at last the articulations are completely disorganised. In some cases the limb is only retained by remains of tendons, the bones being exposed, the articular surfaces destroyed, and the odour almost insupportable. As complications, we may have pneumonia, pleurisy, pericarditis, and the usual indications of pyæmia.

With foals, Bollinger noted, as the chief symptoms, a violent fever with very hurried respiration; the animals did not suck so much as usual, and if lively and attentive at the commencement of the disease, they were quickly prostrated and extremely weak. They became emaciated, and the coat was harsh and lustreless; often there was a nasal catarrh and discharge, tumefaction of the submaxillary lymphatic glands, sometimes capillary bronchitis, and generally diarrhœa. With the majority there was tumefaction of certain joints, and particularly of the hocks. In addition to the swelling, there were heat and pain, with great lameness. Not unfrequently there were immense subcutaneous abscesses. Stupor eventually set in, and the creatures looked as if half asleep; coma was soon manifested; there was dysenteric diarrhœa, the dejections being quite fluid, greyish-coloured, and extremely fœtid; while the visible mucous membranes had often a yellowish tint, in consequence of the existence of icterus.

In lambs the symptoms are similar to those just enumerated. Walley describes them as follows:—A general febrile condition of the system, as shown by the injected state of the mucous membranes; quick, irritable pulse, irregularity of the bowels, hurried respiration, and refusal to suck. The animal persistently lies, and if made to move does so unwillingly and very stiffly, with the back arched, and placing as little weight as possible on the affected limb or limbs, which are usually flexed, even in recubation, to remove pressure—this persistent flexion ultimately leading to contraction of the tendons and distorted limbs. If the disease continues, the muscles waste, causing the affected joint to appear larger than it really is. The cha-

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racteristic swellings usually appear in the hocks, knees, and stifles, though they are not by any means confined to these particular joints. In character, they are round, have a doughy feel, are intensely painful to the touch, very hot, immovable, and increase in size. Thus they are like, yet dissimilar to, rheumatismal swellings: like them in being located in the joints, and being hard, round, and tender; unlike them in being stationary, and attacking the internal structures of the joints—the primary lesions in rheumatism being confined to the external ligamentous structures of these organs, and when attacking the interior of the joints formative processes are evidenced; while in "joint ill" degenerative processes predominate. As the disease progresses, and life is prolonged, the animal becomes emaciated, diarrhœa sets in, the wool falls off, and a variety of changes are detected in the joints. Erysipelatous inflammation makes its appearance in various parts of the skin of the body, especially at the external orifice of the urino-genital organs, at the postero-inferior part of the abdomen, and round the navel, in the latter position constituting "navel ill." Local dropsies are frequent under the jaw and other dependent positions—as the navel, which is said to be *pocked*. If blood is abstracted during life, or collected after death, and set at rest for a time, it deposits a peculiar dark-coloured, grumous mass at the bottom of the vessel, composed, so far as can be seen by the microscope, of altered blood-cells. This deposit lacks the firmness of the other parts of the clot, and bears a close resemblance to half-fermented damson pulp. Bacteria are developed in the blood shortly after death, and long before any putrefactive odour can be detected. Absorption of pus into the blood—pyæmia—is indicated by elevation of the temperature, fœtor of the breath, diarrhœa, dark yellowish-red colour of the mucous membrane, gnashing of the teeth, rigors, and hectic fever—the latter being present also in ulceration of the joints.

In the latter, the swellings become softer and more irregular in outline, from bulging of the more flaccid portions of the synovial membrane and skin; and, from portions of the effused lymph becoming liquefied, fluctuation is produced—other portions remaining solid. The fluctuating swellings extend along the thecæ or sheaths of the tendons—two joints often becoming in this way connected with each other; finally, the skin over the most prominent portions of the joint becomes absorbed, ulcerates, and if not divided with the lancet or by accidental violence, bursts—allowing the escape of the contained fluids and semi-solid matters, and being followed by sinuous ulcers, caries, or abscess proper, of the joint. The sinuses may extend a considerable distance from the joint, and discharge an ichorous unhealthy fluid, accompanied by fœtor if bony or ligamentous structure is involved. In some cases the exuded lymph simply becomes liquefied and absorbed, without any external opening being formed; in others—*i.e.*, when the lymph is plastic and the constitution strong—it undergoes healthy organisation, and remains as a part of the joint, producing, however, permanent thickening, distortion, and stiffness.

Prognosis.

From what has been stated, it will be seen that the prognosis with regard to this disease must always be unfavourable, especially when the creature is very young. The mortality reaches as high as forty, fifty, sixty, and even more per cent. Indeed, Darreau states that eighteen out of every twenty foals die; and Lecoq says that the breeders in Normandy have an axiom, "Poulain boiteux, poulain perdu."

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Pathological Anatomy.

According to Roloff, the predominant lesions are the characteristic alterations of rachitism and periostitis. The cartilage uniting the epiphyses to the body of the bones, is soft from cellular proliferation, and injected in places by hæmorrhagic spots; the periosteum is also thickened, injected, and here and there detached from the bones; while towards the diarthrodial surfaces the bone tissue is greatly involved. There are, in fact, all the lesions of arthritis, but of a much more serious character than are observed in adult animals. The synovial membrane is highly inflamed, and there is great infiltration of the connective tissue around the joints.

Reynal has found in the intra-articular cavities of the joints, deep-yellow-coloured clots, streaked with red, and elastic and firm, which are nothing more than false membranes that have had time to form in the short space of two to five days.

Walley remarks that, in lambs, the *post-mortem* appearances are *general* and *local*. The *general*, in the earlier stages, are effusion of lymph between the intercostal muscles, and beneath the pleura and into the lungs and other organs; with hyperæmia or engorgement of the small bloodvessels of the mucous membrane of the stomach (fourth compartment) and intestines.

If the disease has existed for any length of time, erysipelatous exudations will be found under and within the structure of the skin of dependent parts, or effusion of serum (dropsy) into the connective tissue, and into the various cavities of the body. The large bloodvessels—even those of the brain—are filled with dark grumous damson-coloured blood; the structure of the brain is dark; the liver is often enlarged, friable, and full of minute abscesses, which give it a mottled appearance that is frequently mistaken for scrofula; all the organs and tissues are tinged with the colouring matter of the bile; the small vessels of the omentum are charged with blood, and the mucous lining of the fourth stomach is congested and black wherever the milk has lain in contact with it. In many cases, the urachus is black—a bluish-black hue extending some distance along the mucous membrane of the bladder. The umbilical vein is also black, and filled with a cheesy material—degenerated lymph, or coagulum of blood.

The *local* appearances—*i.e.*, in the joints—are, in the first stages, inflammation of the synovial membrane, which, in a short time, extends to the ends of the bones and ligamentous structures—the whole having an intensely scarlet hue, which in a few days diminishes. Coagulable lymph becomes effused into the cavities of the joints, forming perfect casts of their interior, and filling up the interspaces between the bones. In time, the exuded lymph commences to soften and break down. From the contraction of the mass, the fluid portion is pressed out, and intermixes with the degenerated lymph. Fluid is also thrown out from the irritated vessels of the joint, and aids in the softening of the lymph. After a time, suppuration is thoroughly established, and pus cells are distinguished by the aid of the microscope. The sheaths of the tendons running over the fronts of the joints become excessively inflamed, and the bloodvessels of the ligamentous structures are filled with scarlet blood. The cartilage covering the articular ends of the bones becomes ulcerated and blackened, as also the cancellated structure of the bones; extravasations of blood, from ulceration through the coats of the vessel, take place, the coagula either undergoing degeneration or healthy organization. In the latter case, distinct granulations are formed, which, on recovery of the animal, fill up the cavities formed by the lymph. The flakes

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of lymph which are found floating in the fluid contents of the joints or adherent to their sides, are often mistaken for scrofulous deposits. If animals have lived sufficiently long, multiple pyæmic abscesses are found in the various organs and structures of the body. Blood from diseased lambs introduced into the veins of a dog, gives rise to the formation of multiple hepatic abscesses.

From this description of the pathological anatomy of the malady, there can scarcely be any doubt as to its pyæmic or septic origin, and this is further demonstrated by the following account of its morbid anatomy by Bollinger (*Deutsche Zeitschrift für Thiermedicin*, 1875):—

A male calf born at the Agricultural School of Strickhof, near Zurich, showed symptoms, soon after birth, of inflammation of the umbilicus. As the joints began to swell, and there appeared to be no hope of saving the animal from the effects of the dreadful joint disease—"gelenkseuche"—it was destroyed eight days afterwards. The body was dissected an hour after death, but the examination was imperfectly made. The umbilical ring was discovered to be still open; it formed a circular aperture about two centimetres in diameter, the sides of which were covered with ulcers and a greenish-yellow pus. The umbilical veins and the joints had been thrown away, and therefore the investigation could not be continued. Projecting about the upper margin of both lungs were several cuneiform tumours of a dark-red colour, and of a solid consistency. In the pericardium was a quantity of pale serum, in which floated loose stringy fibres. In the cavity of the heart were a few detached fibres and blood-clots. Beneath the endocardium were various-sized patches of ecchymoses and blood extravasations. Nothing abnormal was observed in the liver and kidneys, except bloodlessness.

Another calf was produced at the same establishment on February 6th. Its birth had been laborious, and the umbilical cord was divided in the ordinary natural manner. The animal did not appear to be as lively as it ought. About eight days after birth a swelling showed itself in the neighbourhood of the navel; this, however, disappeared after the application of poultices. Fourteen days after birth, the calf could not stand, and painful swellings appeared on the inner aspect of the knee joints. Until this time, the creature had a good appetite, and had taken a plentiful supply of milk regularly every day. On February 27th, the appetite entirely failed, and on the 28th the calf was killed, in order that the carcase might realise something. The most important organs were sent to Bollinger, and their examination yielded the following results:

There was *purulent omphalo-thrombo-phlebitis, with thrombosis of the portal vein; fibro-purulent gonarthritis of the stifle joints, and purulent peri-arthritis; purulent tracheo-bronchitis, embolic infarction of the lungs, commencing endocarditis of the mitral valves, and generalised icterus.* The parts surrounding the stifle joints were of a pale-yellow colour, infiltrated with sero-purulent fluid, and moderately thickened. In the cavity of the joints there was a tolerable quantity of dark-tinted serum, and on the synovial membrane more especially was a mass of yellowish-green, firm fibro-purulent matter, about two centimetres thick, which projected into the synovial cavity. The cartilages of the joints were covered with similar matter, and in some places they were quite rough. The entire capsule of the joint was inflamed, softened, and purulent. The trachea and bronchial tubes contained a quantity of muco-purulent fluid, which, in the latter formed itself into one mass. The mucous membrane was pale: the almost bloodless lungs had ecchymosed spots beneath the pleura, and in one place were two wedge-shaped masses the size of a pea, which on being cut open were found to contain pus in the centre. The heart and pericardium were normal, with the exception of the mitral valve, which showed alteration in being of a dark-red colour, thickened, and exhibiting hæmorrhagic infiltration in places; by means of the microscope, a notable cellular opening could be perceived in the connective tissue close to the hæmorrhage. The spleen was of normal size, but pale and bloodless; the liver was enlarged, full of blood, icteric in tint; in parts were small subperitoneal hæmorrhagic deposits. The umbilical vein was distended throughout its entire length, its walls were considerably thickened, and the inner surface was of a dirty-grey colour, rough, uneven, and studded with greyish-white puriform deposits. This alteration in the umbilical vein extended as far as its junction with the posterior vena cava, which, owing to the closure of the *ductus venosus*, is not in direct communication with the umbilical vein. Where the umbilical vein enters the portal vein

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was a purulent cloaca, beyond which was a large thrombotic puriform mass that obliterated the cavity of the latter vessel as far as its bifurcation. As fatty degeneration of the heart was suspected from its appearance, the tissue of that organ was examined microscopically, but it was found to be normal. The voluntary muscles in the vicinity of the diseased joints, and which appeared very pale to the naked eye, were only clouded with granular matter, The puriform contents of the umbilical vein consisted of fatty granular detritus, in which it was difficult to detect pus corpuscles; bacteria could not be found in any number. The liver offered indications of a violent icterus, and exhibited all the alterations of acute parenchymatous hepatitis, with marked granular degeneration of the hepatic cells.

In the three autopsies of foals made by Bollinger at Graditz (*Virchow's Archiv.*, 1873), he found double broncho-pneumonia of the anterior lobes of the lungs, pulmonary abscesses, purulent arthritis, intra-muscular abscesses, caries of the bones, and fatty degeneration of the muscles of animal life, particularly in the neighbourhood of the affected joints; fatty degeneration of the heart tissue, liver, and kidneys. In the intestinal canal were lesions of catarrhal enteritis, accompanied by hyperplasia of the mesenteric glands. Neither in the animals when alive, nor at their autopsy, were there any of the signs of rachitism mentioned by Roloff. The umbilical cord was unfortunately not examined.

On another occasion, the same excellent veterinary pathologist examined the bodies of two foals—one three weeks, the other five weeks old—which had succumbed to this malady. In these there was inflammation and thrombosis of the umbilical vessels, continuation of the thrombosis of the umbilical vein (in process of suppuration) into the portal vein, which was also affected with thrombosis, as well as its hepatic ramifications. In one of these cases there was likewise thrombosis of the pulmonary artery, double pleurisy with pericarditis, purulent arthritis affecting several joints, vast intra-muscular or subcutaneous abscesses, and cutaneous erysipelas. In the other case, there were pulmonary abscesses, circumscribed pleurisy, purulent irido-choroiditis, and, finally, in addition to general anæmia, there was great tumefaction of the bronchial and mesenteric glands.

The result of these autopsies, together with the symptoms observed during life, led Bollinger to the conclusion that the development of the pathological process is solely as follows: inflammation of the umbilical vessels, notably the vein, its decomposed and softened thrombus which communicates with the vena portæ, and forms the point of departure or the source of a metastatic pyæmia, whence embolism of the lungs is sometimes directly originated; or at other times, in consequence of the alteration in the blood, which is septic, and of the general character of the inflammations, there are metastatic inflammations of the serous and synovial membranes (pleurisy, pericarditis, arthritis), of the lungs, iris and choroid coat of the eye, abscesses in the muscles and connective tissue—in a word, the entire series of clinical and anatomical alterations which constitute the complicated arthritis of foals.*

* The great importance of this subject in a sanitary point of view, induces me to notice it so fully as I have done. The septic or pyæmic nature of the malady has not, to my knowledge, been pointed out, or at least insisted upon, in this country. And yet it is a matter of vital importance that this be recognised, when we consider that very often the flesh of calves and lambs which have been affected with joint disease, is utilised as food when the creatures have been purposely slaughtered, which is generally the case before the malady has reached its worst stage. Doubtless such flesh, when well cooked or cleaned, is very much relished, and may often be eaten without any ill effects; but, on the other hand, as Bollinger has pointed out, many cases of illness in human beings are due to its consumption. Poisoning from eating veal can often be traced with great certainty to the pyæmic or septikæmic infection of the calf; and that authority quotes an instance in support of this assertion. The occurrence is communicated by Zannger (*Archiv für Thierheilkunde*, Band xxiv., S. 204, Zurich, 1871) to Zehnder's official report, and which, notwithstanding its urgent importance, has not been taken notice of by the medical journals.

During the epidemic of cholera in Zurich in 1867, in August, twenty-seven members of six families living at Fluntern (a suburb of Zurich), were attacked with diarrhœa, accompanied by varied cerebral disturbance. All those who were taken ill had eaten the flesh of a five days' old calf, which was the progeny of a diseased Cow, and which had yellow water (*gelbes wasser*) in the knee-joints. The Cow was suffering from a large dark swelling on the udder, and which extended along the belly to beneath the breast.

The milk from this Cow produced, in a number of people who consumed it, vomiting and

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Treatment.

Curative treatment of this form of joint disease being, under the most favourable circumstances, very unsatisfactory unless it is adopted at the very

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diarrhœa. The calf at birth was small and weak, and had swellings on its joints and limbs. As soon as it was killed, its carcase was sold and the flesh eaten. No examination of the body was made. Chemical analysis was made of its remains for the detection of inorganic substances, as well as a microscopical examination for trichinæ, but with negative results. The outbreak, which was followed by fatal consequences, was ascribed to the cholera; though it ensued within from twenty-four to forty-eight hours after eating the flesh. The different members of some families—in one instance nine individuals—were seized within a few hours of each other, and the violence of the attack varied according to the quantity of the diseased veal they had eaten. The chief symptoms were: vomiting a thin greenish matter, watery stools of the same colour, great and continued prostration, often preceded by shivering fits; stupor, combined with delirium; involuntary evacuations; and, in the milder cases, headache and giddiness were observed. Convalescence was most tedious. The vomiting lasted, as a rule, for several days, and when it ceased it left the patients very weak and prostrate. In some cases, œdematous swellings made their appearance, and of those who recovered, twelve individuals were helpless for from two to four weeks. In one instance, in which death took place on the eleventh day, and in which the patient—a man fifty-two years of age, and who had eaten a comparatively large quantity of the partly raw, partly cooked liver—there were found petechiæ over the entire surface of the body, in the epicardium, kidneys, stomach, intestines, and brain, as well as great œdema of the lungs—all of which corresponded with the appearances presented during life, and which led to the conclusion that the alterations were due to intense blood-poisoning through putrid organic matter—the appearances closely simulating those often observed in poisoning by sausages (*wurstgift*, "Botulismus"), through some change in the flesh of which they are composed, but the chemical nature of which is not yet ascertained.

It may be noted, however, that decomposition had not begun in the flesh of this calf; as veal is usually sold on the day on which the animal is killed, or on the following day, and at once eaten; and that the creature was affected with septikæmia or pyæmia at birth. As, for various reasons, the existence of anthrax cannot be accepted in this case, the illness of the calf may reasonably be compared to what in children is called "congenital pyæmia or septikæmia." Bollinger concludes his notice of the outbreak, by adding the following remarks:—"Although I do not wish to go into any further discussion on the sanitary aspect of our food supply, I may be allowed to give my opinion that the celebrated epidemy at Adelfingen (Greisinger, *Handbuch der Speciellen Pathologie und Therapie*, Art. *Ileotyphus*), the nature of which, according to the latest discoveries—and particularly those of Biermer—was not typhoid, but was to be attributed to a similar poisoning of the flesh eaten by the people, to that occurring in this calf. In this epidemy five hundred people were seized with illness from eating diseased meat. Although the nature of the septikæmic and pyæmic poison is not well defined, we are, I think, justified, after the numerous experiments made, in considering it identical with certain substances, be they of a chemical or vegetable nature, or in fact both chemical and vegetable. In other words, this poison belongs to that class of poisons which can multiply both in and out of the human body. In conclusion, the general remark may be ventured upon that, with regard to the etiology of the diarrhœa, and the multiple hæmorrhagic and petechial appearances which marked the progress of the disease in the people attacked at Zurich, the dates given in Zohnder's report on the meat poisoning are of the greatest importance. If such cases occur sporadically—as, for instance, in large towns—it will always be difficult to discover their etiology. Anyhow, it is certainly the fact that, in the latest treatises on the subject, the occurrence of meat poisoning—with the exception of poisoning from eating unsound sausages—is completely proved. To assert that, as a rule, such poisoning does not occur, seems to me to be scarcely right, and especially when one knows the numberless tricks of the meat-market in preparing the flesh for sale. On the other hand, it is an indisputable fact that, notwithstanding the vast importance of our food supply, for the so-called official and legal meat inspection there is no proper basis to work upon. The cause of this deficiency, the repair of which must be of the greatest moment to human hygiene, can be traced to the complete neglect of the pathological anatomy and histology of the domestic animals. The study of these subjects can alone place the onerous and responsible duty of the meat inspector on a surer footing.

In connection with this subject, it may be interesting and important to remark that a very melancholy case of wholesale poisoning from the consumption of diseased meat, was reported from Wurzen, a small town in Saxony, in the summer of 1877. A local farmer, finding one of his recently-calved Cows to be suffering from puerperal fever (not puerperal apoplexy), with accompanying abscess and ulcers, and beyond all hope of recovery, employed the services of two neighbouring butchers to slaughter the beast and dress the carcase; after which the trio managed to dispose of the meat, partly in the form of sausages, and partly as joints. Among those who partook of it, at least 206 cases of illness occurred, and in seven instances such illness terminated fatally. The symptoms observed during life were analogous to those of Asiatic cholera, and in the fatal cases decomposition of the bodies rapidly set in. In six of these cases, *post-mortem* examinations were made, and in all were found most extensive inflammation of the mucous membrane of the stomach and intestines, with peculiar extravasations of blood in the mucous

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commencement, the greatest importance must be attached to *preventive* measures, and especially if the malady is enzoötic. On the Continent, those veterinarians who adopt Roloff's view lay great stress on the necessity for preserving the young animals, and particularly the female parents, from the effects of improper feeding. These are to be well fed during pregnancy, and aliment rich in earthy salts is to be given. In addition, bone-dust may be mixed with their prepared food, or with bran, meal, or oil-cake.

When it is continually prevalent in districts, it is recommended to improve the pasture lands, and to restore to them, by means of top-dressings, the mineral elements abstracted by the growth of forage, or the herbage consumed by the animals grazing upon them. Attention is drawn to the fact, that in a hundred days a medium-sized Cow will remove from the soil about a kilogramme of phosphoric acid, which is present in the milk yielded during that period.

If we have reason to believe that the malady is of septic origin, as Bollinger and others are, from clinical and anatomical investigation, assured of, then the preventive measures recommended for omphalitis must be adopted. In all cases where the affection is enzoötic, or even sporadic, every means should be resorted to, in order to discover the predisposing and exciting causes, as on the successful removal or suppression of these must loss be mainly averted. And with modern means of investigation and clinical and physiological knowledge, there should be no difficulty in arriving at correct conclusions in this direction.

Curative treatment, as has just been said, is generally unsatisfactory, and this not only from the comparatively small value of the animals affected, and the difficulty in applying remedies to them, but also from the very serious nature of the disease, and the character of the tissues involved. Even when the life of the creature affected with arthritis is preserved, only too frequently its health and condition are irretrievably impaired.

Zundel remarks that counter-irritants to the joints augment the pain and increase the debility, and emollients have only a doubtful effect. In the hands of Strauss, refrigerants were productive of good results, the inflamed joints being enveloped afterwards in linen bandages. Anodyne lotions and embrocations have also been recommended, in order to allay the pain and irritative fever; as well as the application of tincture of iodine, before the suppuration period. When suppuration is established, the abscess should be opened at the proper time.

Tonics have been given with advantage, as well as cod-liver-oil, castor-oil, and even ordinary oils and fats. These not only aid in the assimilation of earthy salts and nitrogenous matters, but to some extent act as a laxative—a service of some importance. Small doses of sulphate of magnesia or soda, or aloes, may also be given with the last-named object, or even to produce continuous purgation for some time.

With regard to the treatment of the disease in lambs, Walley advises that those affected be removed from the dam, and receive milk from healthy animals. This milk may be mixed with beaten-up eggs, and good nitrogenised gruels may also be allowed. "Place in dry, warm houses, and give gentle aperients—as castor-oil—or better, a small dose of mercury with chalk; follow up by febrifuges and diuretics, as nitrate of potash and camphor, with

membrane, and marked swelling of the glands of the small intestine. The other sufferers recovered, though convalescence was slow, and in many instances attended with serious relapses. Inquiries instituted by the authorities clearly showed the origin of the outbreak; and the heartless culprits, whose miserable cupidity had led to such sad results, were committed to prison, to await their trial.

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nitric ether, or carbonate of ammonia; if much pain is evinced, give small doses of opiates—Dover's powder being the best agent of this class; or inject a small quantity of the solution of morphia underneath the skin of the joints. In the course of a few days, tonic treatment should be adopted, as the administration of iron, alternated with iodide of potassium; or mineral acids with cinchona, or other vegetable tonics; and allow a little wine, good old ale, or porter." The same authority recommends, as local treatment, the application of a strong blister—as the compound tincture of iodine ointment—all round the joint, at the commencement of the disease; and when the subsequent inflammation has subsided, to keep the joints at rest and in their proper position by the use of light splints and bandages, leaving the joint exposed for further observation. As soon as any tendency towards "pointing" in suppuration is perceived, the joint is to be opened freely, the inflammatory products removed, and the interior washed out with a solution of carbolic acid in glycerine and warm water—one part of the first, two of the second, and forty or fifty of the last. Afterwards, pads of soft lint or linen and tow, saturated in carbolised oil (one to eight or ten) should be applied, leaving an aperture inferiorly for the escape of discharge; the dressings are to be renewed every day. Mild caustics or astringent lotions are to be applied if granulations project above the skin. If the ends of the bones are carious, they must be scraped, and nitric or muriatic acid applied; should sinuses have formed, they must be obliterated by the use of setons, or laying them open with the knife, and treating them afterwards as ordinary wounds. "In treating the results of this disease, it must be borne in mind that in young animals the reparative processes go on very rapidly; and that what appears to be a very formidable wound, is soon converted into a comparatively simple one. Animals, too, may, with a little trouble, be fattened and their flesh utilised; few can be preserved for breeding purposes."

As salicylic acid is unrivalled for its antipyretic properties, and particularly in inflammation of the fibro-serous membranes, its internal administration should be tried in the arthritis of young animals. The soda salt (salicylate of soda) is the best form, perhaps. The internal administration of other antiseptic remedies—as preparations of carbolic acid and boracic acid, sulphite of soda, etc., might also be tried in those cases in which the joint disease is suspected to be due to septikæmia as the result of omphalitis.

CHAPTER VIII.

Indigestion.

INDIGESTION sometimes attacks young animals soon after birth, and is perhaps most frequently observed in calves, seldomer in lambs; in foals, and the young of carnivora, it is rarely met with.

Causes.

The principal cause would appear to be too rich milk, or even milk difficult of digestion from its poorness, or its containing some extraneous ingredient to which the young creature is not accustomed. The quantity of milk may also prove as potent a cause as its quality. Therefore it often happens, that

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too copious sucking after abstinence will give rise to an attack, and among calves reared by hand, those which receive artificial food of improper quality or in undue quantity, are frequently the subjects of indigestion. An alteration in the milk of the Cow, produced by fatigue, or bad food or water, will also lead to the same accident; while altered secretions in the stomach of the calf —as too much acidity—will undoubtedly cause coagulation of the milk, and, as a consequence, indigestion.

Indigestion is often witnessed in high-bred calves which are unnaturally forced, in order to produce greater and premature development.

Symptoms.

The young animal looks dull and dejected, and evinces uneasiness or suffering; the movements are torpid; the coat is dry and staring; it yawns now and again, and there are sharp gaseous eructations which cause the animal to elevate its head. Soon it refuses to suck or to partake of food, and the nausea is more marked; there may be vomiting of coagulated milk; the breath has an acid odour, and the tongue is coated with a white or greyish matter; the abdomen is swollen and tympanitic; and pressure made towards the upper part of the right side, as well as along the cartilages of the ribs, causes pain; flatus is expelled when diarrhœa—the fæces being yellow and fœtid—sets in, which is frequent—though constipation is not rare; and at this period symptoms of colic are often noted, and the respiration is at times hurried. The diarrhœa is a means of cure; though should it persist too long, inflammation of the stomach and intestines may ensue. Then there is emaciation, the abdomen is retracted and flanks tucked up; fever is present; great pain is manifested, and the dejections are small in quantity, and consist of a yellow glairy mucus, mixed with lymph or false membranes.

Indigestion runs its course rapidly in the calf—in the majority of cases only occupying two, three, or four days. It may be considered a serious condition, as death often occurs. As it is frequently induced by causes which remain in operation for some time, even when recovery takes place relapses are to be apprehended; and at last the stomach and intestines become inflamed, and enteritis brings about a fatal termination. At the best, it causes loss of condition, and often retards growth.

Treatment.

Preventive treatment is to be based on the predisposing or exciting causes just enumerated. Over-repletion with milk should be guarded against, and if the animal is being reared artificially, great care must be paid to the diet. If at the teat, the food and water of the mother should be attended to; and if the milk is too rich, this may be remedied by giving less stimulating food. With Mares which are worked during the suckling period, the milk is often retained for a long time in the udder, and becomes altered; on returning to the foal, the latter is ravenously hungry, and over-gorges itself with this unhealthy fluid. The preventive measures are obvious in such a case. Indigestion may be due to an insufficiency of oily matters in the milk of the mother; here, the diet of the latter must be altered.

The *curative* measures in mild cases are simple. Some French and Italian veterinarians recommend the administration of barley-water or very weak beef-tea, and if there is not speedy amendment, they prescribe a spoonful of rennet, which, they assert, readily effects a cure.

When the indigestion is due to acidity, alkaline agents—as carbonate of potass or soda, lime-water, calcined magnesia, etc.—and afterwards castor-oil

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—are generally effective. A mild purgative—such as castor-oil, manna, cream of tartar, olive-oil, or a dose of glycerine in albuminised water—is very useful, even when diarrhœa has set in. Manna has proved an excellent remedy for lambs, and even calves. When constipation is present, enemata of soap and water may prove serviceable. Vegetable bitters—as tincture of gentian—and mild stimulants, are often beneficial; and much success has attended the administration of a spoonful of very finely-powdered vegetable charcoal, given twice a day mixed with water in which an egg has been beaten up.

When there is pain and uneasiness, chlorodyne will be found an excellent medicine, particularly if diarrhœa has persisted for some time. Of course, a change of regime is generally necessary. In chronic indigestion of calves, Philippi omits all medical treatment, which he asserts is usually found to be inefficacious in these cases, and puts them to be suckled by Cows which have newly calved, dieting them carefully at the same time.

CHAPTER IX.

Diarrhœa.

The peculiar diarrhœa which attacks young animals while at the teat, has for very many years attracted particular attention because of its specific nature, its almost incurable character, and the great mortality which attends it. Known by various names in different animal-rearing countries (as "White Scour" in England—the "Weisse Ruhr" of the Germans, and the "Diarrhée des Jeunes Animaux" of the French), it is generally acknowledged that calves are far more frequently attacked than other animals; though it is also an extremely fatal disease among foals. Brugnone (*La Mascalcia*, Turin, 1774) long ago asserted, that it is one of the maladies which cause most destruction among the foals in breeding establishments; and to our own knowledge, it is a most serious scourge among the young thorough-bred stock in this country. It is also a fatal malady among young lambs; and it is observed in piggeries and kennels, as a very destructive disorder. It appears to be much more frequent among animals reared in dwellings than those at pasture, and seems to be a malady due to the artificial way in which they are kept.

It presents itself in somewhat diverse forms; but in the majority of cases it arises from disturbance in the secretory functions of the intestinal mucous membrane, without any very marked anatomical alterations—being merely an intestinal catarrh. It is rare indeed, and only consecutively, that there is inflammation—unless the young creature is somewhat old, when we may have the ordinary lesions of gastro-enteritis, as it occurs in infants. The idiopathic mucous diarrhœa of young animals has a special character, seldom indeed observed in the diarrhœa of adult creatures, and is therefore to be studied apart from those inflammatory conditions of the intestinal tract which affect young and old alike.

The malady, though very common and fatal, does not appear to have been much studied; but from what has already been learned with regard to it, it appears to be one of the most dangerous and infectious disorders to which new-born animals are liable. The diarrhœa often manifests itself as an epizoöty, and runs its course rapidly, death taking place within one to

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three days. It sometimes haunts breeding stables and cowsheds for years. It is extremely difficult of cure, and among calves is seen more frequently in some localities than others—low-lying districts being, perhaps, more often and severely visited than elevated situations. It is said to be particularly prevalent in districts where the spent grains of distilleries and breweries are generally used for feeding purposes. When a number of newborn animals are crowded together, if one is attacked by diarrhœa, all are likely to suffer.

Symptoms.

The disease generally appears suddenly in a shed: an apparently healthy calf being seized all at once, and without any notable alteration in the food or hygienic management. The diarrhœa manifests itself most frequently during the first eight days after birth, though in calves it may not show itself until the tenth or fifteenth day. In many cases it is present almost immediately—within twenty-four hours—after the creature is born; and death ensues in from twenty-four to forty-eight hours—from the second to the fourth day after birth. In a number of instances, Franck has known the diarrhœa to appear immediately the calf was born, and before it had time to suck; indeed, it never sucked, as it was dead before it could do so. As a rule, according to the same authority, the calf has two or three good meals before the acute diarrhœa sets in.

The fæces are very fluid and mucus in character, they have a sour or fœtid odour, are yellow-tinted and then whitish, or of a greyish-green hue, but most frequently light-coloured. The evacuations are more or less numerous in a brief period—from five to fifteen or twenty in twenty-four hours, and the excreta are projected with some force. The first indication of the presence of diarrhœa is usually the soiled condition of the tail, and the animal ceasing to suck. The creature seems suddenly to lose its strength, remains nearly always lying, and when it gets up it staggers about; it is indifferent to surrounding objects; the eyes sink deeply in their orbits; saliva flows from the mouth, no attempt being made to swallow it, and it wets the throat and breast. Emaciation is astonishingly rapid, and the hair is dry and erect. Nevertheless, the belly is not painful to pressure, neither is meteorismus present; no gas is mingled with the alvine evacuations, borborygmi are not heard, nor are symptoms of colic manifest. There may be slight tenesmus, and the anus is dilated as if it were paralysed; while the air passing into the rectum produces a peculiar sound. Towards the end, the creature remains immovable, as if paralysed, and dies without a struggle.

Zundel and others state, that if the disease continues for any length of time, the diarrhœa is accompanied by congestion and ulceration of the intestinal mucous membrane, through the acridity of the secretions, as well as inflammation and excoriation of the skin around the anal opening. Then there is fever with its attendant symptoms, and the abdomen is very sensitive to pressure and becomes more and more retracted; while the evacuations are increased in frequency, are more fœtid, and finally become serous and sanguinolent.

Brugnone has observed as a complication in the diarrhœa of foals, a kind of ophthalmia more particularly involving the anterior chamber of the eye, accompanied by tumefaction of the cornea and lachrymation.* A similar

* The following are the symptoms observed in the foal by Brugnone. "The diarrhœa commences two or three days after birth; a yellow, acrid, sometimes purulent-looking fluid, is evacuated; the foal becomes rapidly emaciated and is nearly always lying; it is weak and

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complication has been noticed in calves; and in the diarrhœa of poultry this ophthalmia is often noticed.

Zundel alludes to constipation alternating with the diarrhœa; and also to the occurrence of convulsions, similar to those present in infantile diarrhœa. Rainard mentions consecutive pneumonia, with suppression of the diarrhœa, as a termination of the disorder.

Pathological Anatomy.

Rainard was of opinion that the diarrhœa of young animals is due to an irritation of the colon and rectum. There is a kind of atony, and a special catarrhal condition of this portion of the intestinal tract, with frequently pseudo-ulcerations due to an alteration in the follicles, but without any trace of inflammation. He never found any lesions in the small intestines or stomach. The lymphatic glands corresponding to the diseased intestines are voluminous, reddened, and infiltrated with a reddish fluid. Zundel thinks these alterations are caused by microscopic entozoa, and he is of opinion that the malady is especially due to the influence of microphytes, which are developed in excess in the posterior portions of the intestinal canal, which the bile does not reach. This excessive development is simply owing to the superabundance of fluid in the tube; and the growth of these minute organisms, again, still further increases the secretion of intestinal mucus. Billard and Valleix, a long time ago, announced that the diseased condition known as "thrush" (*aphtha*) of children is produced by a cryptogamous parasite, and that this, extending along the mucous membrane of the intestines, has been found in infantile diarrhœa. Hallier and Zurn have proved the presence of micrococci in the diarrhœa of animals.

Franck is the most recent authority on this malady, and his observations are of great importance, not only from the care with which he has studied it, but also from the scientific manner in which he has investigated its pathological anatomy. He examined a number of bodies of calves which had recently died of the disease, and always found the same characteristic alterations, of which the following are given as typical:

A bull-calf of the Algäuer breed, which died on the third day after birth, the second day of the disease. Weight 37·4 kilogrammes. The remaining portion of the umbilical cord is perfectly dry. The hind parts are somewhat soiled by fæces, the eyes are deep in their sockets; there is no meteorismus. Eight incisors are cut. There is a remarkable and general bloodlessness observed, and this is more particularly noted in the digestive organs, which look very white. (This anæmia was present in all the cases to the highest degree: so much so, indeed, that the tanner who bought the skins thought they were from calves which had been slaughtered in the ordinary way, *i.e.*, bled to death—"white veal.") The umbilical artery is, at the torn extremity, contracted, dark-red in colour, and retracted towards the pelvic opening; it is distended by a dark-red blood-clot, which extends as far as the aorta. The umbilical vein is not inflamed, but contains a quantity of dark, small blood-clots (these were not always present); it had been torn through towards the outer half of the navel-ring, so that both divisions were visible. The urachus is ruptured at the inner portion of the umbilical opening. Around the latter are a number of generally small ecchymoses. The abdominal cavity is filled

staggers about, sucks little or none at all, and finally falls into a state of complete marasmus. During the first period it is not rare to observe a general ophthalmia occur; the humours of the eye are turbid, the eyes are painful, tears flow continually, the eyeball becomes buried in its socket and atrophied, and vision appears to be lost."

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with a dark fluid, which extends through the second and third compartments of the stomach, as far as the fourth compartment. This fluid is also found in the mouth and pharynx, as well as in the trachea; though none is observed in the lungs. In the true stomach is discovered a greater quantity (about one and a half-litre) of curdled milk, in which were dirty-white masses of casein; this fluid has an acid re-action—making litmus paper double-red: its normal condition. The mucous membrane of this portion of the stomach is œdematous, of a dirty yellowish-red colour, with traces of *post-mortem* solution. In the third compartment are a number of isolated ecchymoses about the size of a pin's head. The intestines are quite empty, and their lining membrane is covered by a thin layer of purulent-looking matter, which has a feeble alkaline reaction. Peyer's glands are slightly swollen, somewhat injected, but otherwise normal. The cæcum is remarkably void of solid or fluid contents, and is full of gas. The liver is very small, pale, clay-coloured, and bloodless; the little gall-bladder is completely empty; the spleen is normal. The lungs are speckled red; at some points the patches are reddish-brown; the organs are permeable to air. The cavities in both sides of the heart are full of dark coagulated blood, and beneath the epicardium are a number of small ecchymoses. Otherwise the heart and its valves are very healthy. The dura mater of the brain is strongly attached to the cranium. The sinuses are dark-coloured, and full of coagulated blood. The brain is remarkably anæmic; its lateral ventricles are distended by a clear serous fluid; the rete mirabile at its base, and the neighbouring membranes, are also distended by coagulated blood.

Microsopicc examination of the blood and the blood-clots in the heart, umbilical vein and artery, proved that these were perfectly normal. The red and white corpuscles in them were unaltered, and there were no special organisms; the colour of the blood was not diminished. All those appearances which are particularly noted in putrid diseases—as in puerperal fever, and particularly in septikæmia, were absent. The liver-cells were certainly partly filled with fat granules, but there was otherwise no indication of fatty degeneration.

A very special feature of the disease was always found in the microscopical examination of the contents of the true stomach and small intestine. In these were discovered great quantities of epithelium, and crowds of minute organisms. This purulent-looking matter appeared to be a kind of bacteria pulp (*Bakterienbrei*). Besides innumerable micrococci, there were also immense numbers of vibratile staff-shaped bodies (*schwingende Stäbchen*). In the present state of uncertainty of the question with regard to minute vegetable organisms, Franck declines to give an opinion as to the species to which the last-described bodies belongs.

Causes.

Zundel is of opinion that the most ordinary cause consists in a modification in the food of the young creatures, and most frequently in an alteration in the mother's milk, under the influence of some inscrutable agency. Brugnone admitted the existence in the mother of constitutional maladies—as mange, grease, and other skin affections—which might produce the disease in question in their progeny: just as Bouchut asserts that the *herpétisme dartreux* of woman may similarly affect the child. Delafond thinks that the more frequent causes are too rich food given to the mother, the use of highly nitrogenous aliment, too poor régime, innutritious food—and particularly that which is in bad condition. In the milk of Cows fed in this manner, is a superabundance of white granular corpuscles, which are particularly numerous

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in the colostrum, while the other constituents of the milk are relatively deficient.

These colostrum corpuscles are supposed to be agglomerated, generally granular, leucocytes—the granules being probably nothing else than the spores of some mycoderm. These leucocytes are greatly increased in the milk when the Cow is excited or disturbed in any way, according to Zundel; and he fancies this may lead to the production of diarrhœa in the offspring. But he also insists strongly on the influence of unfavourable hygienic conditions, when the animals are fed without care, and lodged in unhealthy dwellings.

The supposed causes of this form of diarrhœa Franck enumerated as follows: bad, deficient, or improper food; an undue proportion of lime salts in the food; milk too rich in fatty constituents, housing at night, chills, defective stabling, stable miasma (Roloff), or a volatile contagium (Obich). That the nature of the fodder or the milk, or even chills, will not induce the disease, Franck is certain; and he points to the fact that ample stable room and good food is no safeguard against it. And he also alludes to what is another fact, that some time after birth, young animals are only exceptionally attacked, though the food and stables may be the same. Even when the food or the milk is changed, there is no difference.

The malady is most intense during permanent stabling; and with the advent of grazing, when the cattle are driven to pasture it begins to disappear, and is no more heard of until the pregnant Cows are again stabled and begin to calve. All this would indicate, according to Franck, that there is an agent at work in the production of the disease, to which the designation of "stable-miasma," for want of a better, may properly be given. This view as to the existence of an infecting agent, would seem to be borne out by the circumstance, that whenever one young creature in a large breeding-shed is affected, other cases soon follow. Obich (*Wochenschrift für Thierheilkunde*, 1865), who was the first to direct attention to the infectious nature of the malady, gives several strong illustrations, which not only support this opinion, but would also tend to prove that the infecting agent can be spontaneously developed. Franck could not produce the disease spontaneously, however; for though he administered in milk, and to sheep, goats, and rabbits, a quantity of the intestinal matter which swarmed with bacteria, no positive result was noted.

This, however, can scarcely be deemed a satisfactory experiment; and it would be better to try the effects of the morbid products on sucking calves or other creatures at the teat. If nothing is at present known as to the manner in which the contagium acts, or its origin, as little are we acquainted with its mode of transmission or its vital tenacity. We can only assert that such contagium must exist, from the manner in which the disease spreads, and from the other evidence already adduced.

It is interesting to note in this respect, that a case is recorded in which, in an infected shed, of twin calves one was attacked with "white scour" and died, while the other remained sound. And when pregnant Cows are transferred from an infected to a healthy stable and soon after calve there, yet their progeny may still be attacked. But if the transfer has taken place so long as six weeks or two months before parturition, then there is indeed but little risk of the young creatures being seized with the diarrhœa.

Roloff (*Mittheilungen aus der Thierärztlichen Praxis*, 1875, p. 119), from his experience of the disease, concluded that it was due to a "stable miasma." "The malady will suddenly appear in a cowshed, and vanish again after a time, without any alteration having been made in the feeding or management of the Cow. I was consulted in a case of this kind, where, in a large cowshed, during eight weeks every calf produced

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therein had perished. The calves were generally, about the second day after birth, uneasy, bellowed, appeared to be suffering from abdominal pain, had no appetite, rapidly lost condition, passed watery stools, and died within twenty-four hours. All remedies tried—among them, large doses of opium—were useless. Some of the new-born calves were fed on skimmed milk, others on boiled milk diluted with water, while others received no milk at all, but were fed on oatmeal gruel with which preparations of iron were mixed—but all to no purpose, as they died all the same. The feeding of the Cows was in every way good, and had not varied from that of other times, when this disease did not appear. Roloff therefore concluded that the mortality was due to a miasma in the shed; consequently all the Cows which had not yet calved were removed to another dry and airy shed. In this they brought forth at various times, and the calves remained healthy."

In a second instance, the malady broke out suddenly in a cowshed at the commencement of 1874. The calves were apparently healthy when born, but in about two days they became unwell and soon died in the usual way. As an experiment, some new-born calves were not allowed to get milk from their parent, but were fed on milk from Cows in other sheds the disease did not exist. On the second day, however, the calves sickened all the same, and succumbed. The feeding of the Cows was modified, but without benefit.

In a third instance, Roloff mentions that, for a long time, all the calves in a large cowshed had perished in a similar manner, and though many of them had not received any of their mother's milk—some of them no food at all—yet it made no difference. This instance was particularly conclusive that the milk of the parent was certainly not the cause of the disorder. The Cows near their time for calving were moved from this shed into another some distance away, and the change was attended with the happiest results.

With regard to the disease in lambs, we find Benedikt (*Sächsen Jahresbericht*, 1871, p. 140) describing it under the head of "typhus diarrhœa in Sheep" (*Typhöse Ruhr bei Schafen*). He writes: "At the commencement of lambing-time, the lambs are observed, soon after birth, to be dull and dejected; they do not care to suck; there is great debility; the eye is dull and sunken; there are involuntary evacuations of a fœtid, brownish-yellow colour, which is ejected some distance; and in three or four hours death ensues. In all the cases the lambs, when born, appeared to be quite healthy; but in two or three hours after they began to exhibit these symptoms, and during the first, seldom the second, day, they perished. On examination of the carcase, bright-red spots are observed in the true stomach and intestines, which contain matter having an unpleasant odour. The Ewes remain healthy. With regard to the cause, this was probably in the fodder, which consisted of damp oats, and also in the dwellings, which were hot and steamy. The Ewes in lamb were therefore fed with maize and good fodder, sulphuric acid was put in the water they drank, and every week they received two draughts of a solution of sulphate of iron with vegetable bitters, the dwelling was changed, and the disease ceased.

Prognosis.

The prognosis of this disease is generally unfavourable. Nearly all the young animals seized with it perish; and when a few recover, it is either through energetic and appropriate treatment, being attacked in a less severe manner, or from being endowed with greater vital tenacity. And even those which recover are usually so reduced in strength and condition, and convalescence is so protracted and unsatisfactory, that there is little if any profit in rearing them. As a rule, all those born about the same period succumb; but after the malady has prevailed for one or two years in a shed, it assumes a milder form, and more recoveries are recorded. When the disease appears in small cowsheds, where there are fewer calves and comparatively more space, it is much less to be dreaded. Sometimes it disappears from a cowshed for some months. Old calves are not so readily affected, and recover more readily. Weaned calves which are fed on fodder, appear to enjoy immunity from attack.

Treatment.

As with every other animal malady, *preventive* treatment is the most im-

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portant, with regard to this diarrhœa of young animals. Attention to hygiene is very necessary at all times, and more so when the disease has shown itself in a stable or shed. It is much the safer plan, however, to remove all pregnant animals from the dwelling in which it has appeared, and the longer the interval which elapses between their removal and parturition, so the more likelihood there is of their progeny escaping. If moved three to four, or four to six weeks before parturition, their safety may be fairly assured. The stable or shed in which the malady has occurred should be well disinfected, and if possible left unoccupied, during the grazing season. The floor particularly demands attention, as it is not at all improbable that the infection is retained there; if possible, the floor should be renewed. Strong carbolic acid or chloride of lime-wash, must be freely employed, and especially where the excreta from the sick animals have fallen. Thorough disinfection of the building with sulphuric acid or chlorine gas is advisable.

With regard to *curative* measures, but little, unfortunately, can be said. The history of the outbreak may suggest the nature of predisposing causes, and furnish indications for their removal.

In the *Milch Zeitung* for 1877, is a good paper on the malady in calves, by Kessel-Zeutsch, who says, with regard to treatment:

"When only isolated cases occur among the sucking calves in a herd, they are usually of a mild and tractable form, and due to cold or temporary unsuitability of the mother's milk, or to a natural predisposition to weakness of digestion. The external symptoms generally observed are the frequent passage of slimy motions, marked tenesmus, and a disinclination to suck. Consequently the calves soon become weak, and the primary consideration is, therefore, to support their strength while treating the attack. To this end it is absolutely necessary that any calf having diarrhœa to an extent requiring medicinal treatment should immediately be placed with the mother, so as to benefit by the animal heat of the Cow, and by its own instinctive inclination to suck. Diarrhœa caused by over-sucking is rarely met with except when the calves have been separated from the mother shortly after birth, in which case they naturally feed too greedily when allowed access to the teat, and so overburden their still immature digestive apparatus.

"The colour of the motion is always an index to the cause of the diarrhœa, and, with this point established, its treatment by appropriate means can be rationally conducted. When the motion is yellowish-white, the diarrhœa is chiefly dependent on simple weakness of digestion, and in such cases a couple of raw eggs, with their shells, or the whites of two eggs with some chalk, may probably be of service; or should this treatment not suffice for the cure, it may be followed by the administration of an infusion of oak bark, or peppermint root in starch. On the other hand, when the motion is of deep golden yellow colour, slimy and tough, and the orifice of the anus irritated, the liver is at fault, and laxative and strengthening medicines are called for. These are best given in the form of rhubarb and Epsom salts, three or four times a day, in half a pint of linseed tea. Again, if the motion be slightly coloured, and have no appreciable smell, but is still accompanied by pain in the passage, the diarrhœa is dependent on the inflammatory condition of the intestines, and is best treated by decoctions of linseed, or by infusions of marsh-mallow or of camomile flowers, either given internally, or administered as clysters. A decoction of bruised bitter almonds (125 grammes in a pint of new milk) has also proved useful in such cases. In Switzerland, and in the Tyrol, diarrhœa dependent on inflammation is generally treated by camomile infusions, and that caused by weakness of digestion by coffee. In France the former class of cases is treated by mallow flowers, and the latter by broth made from mutton bones, or by rennet. In Holland and Oldenburgh the means chiefly relied upon are infusions of hops.

"All the above methods are good if applied early, and if the cases are sporadic only; but when the calves generally are attacked soon after birth, presenting such symptoms as diminished appetite, debility, constant passage of yellowish-white motions and fits of cramp, they are generally of little avail. In such cases the calves are but secondarily affected, and the proximate cause of mischief must be looked for in the mother Cows, whose condition of blood will generally be found at fault. Till

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this fact is recognised, all treatment of the calves is but lost. Where diarrhœa is generally prevalent among the calves, the Cow's coat will usually be found in an unhealthy condition—the hair rough and dull, its roots colourless, and its skin covered with a crust or scale. The milk of such Cows, tested with litmus paper, invariably exhibits an acid reaction. To correct this faulty condition of blood, it has been my practice to give them a lick-bit of bitter aromatics three or four times a week. The preparation employed is a mixture of equal parts of calamus root, juniper berries, and gentian in powder, to which a spoonful of salt is added. A handful of rye meal is sprinkled over it, and the powder placed in a dry state at the bottom of the crib, food being withheld for an hour or so after the dose has been taken. At the same time, to promote an increased action of the skin, the ordinary curry-combing and brushing is supplemented by a vigorous rubbing-down of the whole body, more especially of the flanks, belly and back, with wisps of straw. In a few weeks such treatment proves successful, a healthy appearance of skin and hair gradually returning, while the milk regains its normal wholesome condition, and can be taken by the calves without danger of a return of diarrhœa. Of course, careful attention is also given to the diet, all injurious substances being scrupulously avoided. Such calves as fell victims to the disease were examined after death, and in no case were any organic changes detected, but the stomach and neck of the bladder were invariably found swollen, the intestines inflamed, and the milk contained in them curdled. The *rationale* of treatment is to promote the secretion of bile, to neutralise the acidity of the mother's milk, and to support the strength. Powerful medicines are too drastic in their effects, and even if successful in checking the diarrhœa, bring on convulsions which often prove fatal. I have found the administration of small powders of opium and carbonate of magnesia, given once, twice, or thrice a day, according to the severity of the attack, extremely useful.

"To all bleeding and issues, often so strongly recommended, I am decidedly opposed, since they cannot possibly exercise any influence on organic disease, and simply serve to weaken the patients still further. As a preventive against diarrhœa, it is often recommended to place lumps of chalk in the rack for the calves to help themselves from. To this practice also I am strongly opposed. Though commonly eaten readily enough by young animals, chalk is far too irritating and constipating in its effects to be good for them. The occasional use of bicarbonate of soda is in all respects far preferable.

"In many districts it is the practice to draw off by hand the first portion of milk found in the udder after calving, before allowing the calf access to the teat. Nature has, however, specially provided this peculiarly constituted milk for the benefit of the new-born calf, and many later ailments of digestion would undoubtedly be avoided if it were allowed this gentle natural purge. Any one who can overcome this prejudice against its use, and let Nature have her way, will be saved endless worry and trouble in the constant physicking of young live stock."

Hertwig recommends the following as a specific remedy:

Pulv. rad. rhei	- - - -	4·0 grammes.
„ magnes. carb.	- - -	1· „
„ opii pur	- - - -	0·3 „

This is to be given in 100 to 120 grammes of camomile tea or in fifty grammes of whisky—the dose to be repeated in twelve hours if necessary.

Obich gives a recipe which he speaks confidently of. It is the following:

Decoct. rad. althæ concis.	- -	250 grammes.
Tinct. opii simpl.	- - -	7·50 „

Two table-spoonfuls to be given every two hours, according to the size of the calf or the urgency of the symptoms.

Sulphate of iron, nitrate of silver, phosphoric acid, hydrochloric acid, sulphate of zinc, opium and rhubarb, chalk, strong coffee decoction, etc., have all been recommended, tried, and failed. Beltz, Auloge, Rueff, and others recommend castor-oil or glycerine, or even magnesia, to which a little rhubarb or gentian has been added.

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Armatage gives the following as an astringent mixture for calves, lambs, and pigs:

Powdered opium - - - - -	2 grs.
Tincture of cardimoms - - - -	2 drs.
Sulphuric ether - - - - -	20 to 30 drops.
Linseed-tea or starch gruel - - -	4 „ 6 oz.

Half an additional quantity is the dose for a calf; half the above is that for lambs and pigs. He mentions that alum whey is in common use. This is made by mixing together half an ounce of powdered alum and two quarts of milk, and boiling them for about ten minutes. The mixture, after being strained and cooled, is ready for use, and is given twice a day to calves, and proportionately to other animals. This compound is also useful as an injection, together with mixtures of starch or wheaten flour, and tincture of opium in water.

Zundel speaks of enemeta of starch or dextrine, or water slightly carbolised; and he particularly recommends those composed of a dilute solution of permanganate of potass (1 to 2 to 100). Franck suggests the employment of tepid enemas of the neutral salicylate of soda (about ten grammes *per diem*), in doses of one or two grammes. The same medicament might be tried in draughts. Chlorodyne might likewise be most usefully resorted to.

Careful attention, as has been stated, must be given to the feeding. Either from a Cow, or in a bucket, the calf should have, three times daily, a small quantity of fresh milk—if possible from a recently calved Cow. In severe cases, it is recommended that the milk be supplied from the same Cow; and where these precautions are not very effectual, each meal of milk is to be diluted with about a fourth of lime-water, which is said to prevent the formation of curd in the stomach. In more serious cases, milk should be withheld, and instead of it may be substituted well-boiled gruel made with wheaten flour, Liebig's farinaceous food, or even eggs and beef-tea may be administered.

The patient should be kept warm and comfortable, warm baths have sometimes proved useful, as have also poultices of camomile flowers to the abdomen, when symptoms of pain are manifested.

CHAPTER X.

Retention of Meconium.—Constipation.

THE contents of the intestines—the meconium—are generally expelled immediately after birth, when the umbilical circulation is first interrupted. When the meconium is retained much longer it is abnormal; and this occurs more frequently with the foal, perhaps, than other creatures. The prolonged retention of the meconium gives rise to constipation, and this is often a serious condition. The animals in which it occurs are generally weakly, and not well developed.

Causes.

Constipation is usually observed in foals which have been dropped in February or March, and whose dams have been fed exclusively on dry fodder

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during the winter. This result is still more likely to follow if the dams have been worked until near foaling-time. Their milk is then deficient in those purgative qualities which are so necessary for the new-born animal. It is the same with Cows which have been stall-fed all the winter with dry food; and the calves are almost certain to suffer from retention of the meconium if deprived of the first milk of the Cow, no matter whether the latter may have been properly fed.

Symptoms.

One or two days after birth, the foal appears to be uneasy, refuses to suck, has tenesmus, makes efforts to defecate, shows symptoms of colic, rolls on the ground, and often looks towards the abdomen; the back is arched, micturition is suspended, pulse and respiration frequent, the eyes injected, and the teeth ground against each other. Enteritis sets in, and death takes place in struggles and convulsions.

The symptoms are similar in the calf: the abdomen is very much retracted; the respiration hurried; back raised when the creature is standing, though it generally persists in lying; it moans continually; refuses to suck; and is very restless.

Treatment.

The *preventive* treatment consists in attending to the feeding and condition of the pregnant animal some time before parturition. The young creature should be fed on the first milk its parent gives.

The curative treatment must be directed towards removing the meconium from the intestines. This may be effected by giving a soap or oil enema, or previously removing as much as is accessible to a well-oiled finger.

That which is beyond reach of the finger, Franck recommends to be brought away by means of a flexible, but not too weak, noose of wire. The Cow should have an abundance of fluid to drink, and this may be rendered slightly laxative by the addition of cream of tartar or sulphate of soda.

If the constipation persists, purgatives may be administered. These may be castor-oil, manna, sulphate of soda, aloes, etc. Frequent enemas will aid the action of the purgatives.

Sometimes constipation is due to giving too rich food, and, in artificial rearing, to an excessive allowance of meal or flour. The treatment is the same.

CHAPTER XI.

Skin Dryness of the New-born Animal.

OBICH (*Wochenschrift für Thierheilkunde*, 1869, p. 105) is, to my knowledge, the only writer who has alluded to this peculiar condition of the foal at birth. He says: "In the case of some primiparous Mares, a fatal accident often happens to their progeny. When parturition takes place without any one being present, the young creature, on being expelled from the mother, continues lying away from her until its skin is dry. The consequence is that the Mare does not care for it, does not lick or attend to it, and opposes all attempts to compel her to suckle it. For some days constraint is necessary,

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and much trouble and danger may be incurred before she is accustomed to it. This may be averted if the new-born creature is rubbed over with the 'after-birth' (placental membranes). The instinct of the Mare impels her then to lick and fondle her offspring, and to take to it kindly and in a natural manner."

CHAPTER XII.

Imperforation of the Anus.

IMPERFORATION of the anus is not a very rare occurrence in new-born animals, and this vicious conformation has been observed in foals, calves, pigs, and lambs. The latter appear to furnish the largest number of cases. This condition is, of course, very serious unless surgical aid is quickly afforded, and even then the young creature cannot always be saved.

The meconium cannot be evacuated, nor yet the residue of the milk the animal may have ingested after birth; whence results an accumulation of irritating matters in the intestines, which give rise to inflammation, and this quickly causes death.

This occlusion or imperforation may exist in various degrees. There may be merely a membrane covering and occluding the anal opening; the borders of the anus may be adherent to a greater or less extent; the rectum may be more or less absent or incomplete; or it may open into the genito-urinary passages instead of at the anus.

Symptoms.

When no fæces can be expelled, usually towards the second or third day after birth, uneasiness and symptoms of acute colic are manifested; the animal does not suck, the abdomen becomes distended, expulsive efforts and pawing are observed, yet nothing is passed. The animal shows signs of great pain and misery, and if help is not afforded it dies in agony.

In young female animals in which the rectum is absent, it often happens that the intestine opens into the vagina, and the fæces are expelled by that canal. Rainard has witnessed this malformation in several fillies, and his attention was also drawn to four young pigs—males and females—in which the anus was absent. They were the litter of one Sow. It is therefore well to ascertain, in the case of female animals destitute of an anus, whether the meconium or fæces pass by the vulva.

Treatment.

The symptoms lead the veterinary surgeon to examine the defecating organs, and to discover the character of the obstruction. If there is only a simple membrane occluding the anus, this projects like a large vesicle through the pressure made upon it by the fæces. This membrane, which is really the skin, has usually a deep red tint, and is soft and thin, offering but little resistance. The prominence it forms is altogether soft and pits on pressure. In such a case all that has to be done is to incise the membrane—in a crucial manner, if deemed best. A long, narrow, pointed bistoury is the most suitable. After well ascertaining the entrance to the rectum, the skin is punc-

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tured, care being taken not to allow the knife to pass too deep; a director may be enployed to complete the incision, and to guard the intestine from injury. No sooner is this incision made, than the meconium escapes; then the crucial division may be made with a pair of sharp scissors. The index finger should be introduced as far as possible into the intestine, to make certain that all is right there.

In order to prevent the opening closing by cicatrisation, a suppository or tent may be introduced into the rectum, and withdrawn every now and again in order to allow the fæces to be expelled—injections assisting in the latter; or the angles of the divided skin may be snipped off by scissors, so as to hinder their union. The lips of the wound are subsequently lubrified by a little oil or grease, and, provided inflammation does not set in, recovery is certain.

When the prominence is not present, and yet there is complete occlusion, with all the symptoms above-mentioned, the operation is more difficult. The perineal raphe is sought for, as on its track the anus should be found. This is carefully felt, when the prominence formed by the end of the intestine will be discovered. Then a short incision is made through the skin only on the middle line; the subcutaneous tissues are dissected away until the bulging of the intestine is reached; this is drawn outwards between the lips of the wound by forceps or a ligature, and an opening made into it, and the contents removed. The margins of the opening are then secured to the borders of the external wound by some fine sutures, and attention is paid to the parts during the healing process, in order to prevent the artificial anus becoming too contracted.

When the rectum is absent to a more or less considerable extent (in some cases it is reduced to a mere fibrous cord), then but little benefit can be conferred. In a few instances nature has effected a partial remedy, by establishing an artificial opening by ulceration through organs and textures, and the fæces have escaped by the fistula.

Rainard mentions this natural colotomy as occurring in two young horses. An artificial opening may be made either in the perineal or abdominal region; but it is rare indeed that the animal is worth the trouble and risk.

In those female animals in which the rectum communicates with the vagina, Rainard makes the following remarks with regard to operation. As the part of the vagina which has the opening into the rectum is never very deep, a half S-curved sound is introduced by one of its ends into the normal track, and pushed into the rcetum until it reaches the *cul-de-sac* in it. With a bistoury, an incision is then made where the anus should be; the skin and subcutaneous connective tissue being divided, the index finger is passed into the wound in search of the curved sound in the rectum. When met with, an assistant takes the sound, while the blade of the bistoury is made to glide over the nail of the index finger, and the intestine opened by it. The same finger is plunged into this new opening, and serves to guide the bistoury in dilating the incision as much as may be deemed necessary. After the skin and connective tissue is incised, a trocar of sufficient size may be employed to puncture the intestine.

Landel (*Journal Vétérinaire Belge*, vol. i., p. 95) met with a case of this kind in a Cow, aged one and a half year. On examining the creature, he found that the anus was occluded, and that the vagina contained fluid fæces which had passed into it by a narrow opening leading to a canal communicating with the rectum. Landel decided to make an artificial anus. He made an incision in the perinæum about two and a

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half inches in length, through which the fæces escaped. On the following days enemas were administered; the margin of the wound tumefied slightly; the recto-vaginal fistula became obliterated, and the young animal made a perfect recovery.

From among many recorded instances of anal atresia, we select the following as illustrative:

1. Rossignol (Rainard, *Op. cit.* vol. ii., p. 492) states that a calf, soon after birth, did not offer any trace of an anus. Hoping that the *cul-de-sac* formed by the rectum was not too distant from the perineum, and that he might feel it when the calf attempted to defecate, he gave it a dose of almond and castor-oil. In a few hours violent colicky pains seized the creature, and nothing could allay them; no bulging appeared at the perinæum, and death soon ensued. At the autopsy, made next day, the rectum was found to be completely absent; the colon terminated in a large dilatation the size of a hen's egg, in the neighbourhood of the left kidney, and from it was a transparent ligamentous prolongation which was attached to the commencement of the sacrum. The colon was congested and full of fœtid gas and meconium.

2. Ammon (*Jahresbericht der Münchener Zeutral Thierarzneischule*, 1846–47, p. 22) mentions that a new-born calf sucked for a day, when symptoms of constipation-colic were manifested. The enemas administered did not appear to penetrate as far as usual, and they and other treatment afforded no relief. In another day vomiting ensued, and in thirty-six hours from the appearance of the colic death ensued. The digestive organs were found healthy as far as the colon, which terminated in a *cul-de-sac;* the urinary bladder was absent, and the ureters terminated in what should have been the rectum.

3. Dinter (*Sächsischer Jahresbericht*, 1873, p. 87) operated on a new-born sow which had atresia of the anus, but yet no fæces were passed. The creature died in eight weeks (?) after birth, without any defecation. The cæcum and large intestine were found to be enormously dilated.

4. Hartmann (*Œsterreichischer Vierteljahresschrift f. Wiss. Veterinärkunde*, 1874) reports that some hours after birth, a foal was observed to have no anal aperture. Hartmann was shortly after called in, and it was decided that an artificial opening should be established. An incision was made through the skin along the median line of the perineum, and the connective tissue separated, but the finger could not discover the extremity of the rectum. Enemas were tried, but without success. In the pelvis, at a distance of about four inches from the incision, the finger came upon a sac with a convex extremity, and containing a fæcal mass.

The first longitudinal incision was enlarged by a second transverse one, and then the finger could explore three-fourths of the extremity of the sac. From it the meconium was passed in small quantity, but it was eventually completely evacuated by the administration of enemas. Into the aperture, a bougie covered with lead ointment was introduced.

On the fourth day the opening was nearly closed, and though various measures were essayed to re-widen it, it was necessary at length to have recourse to multiple incisions in the skin. But notwithstanding these incisions, in spite of all attempts at dilatation, and although enemas were frequently given, no favourable change could be effected, and the foal succumbed on the sixth day.

The autopsy demonstrated the existence of peritonitis, as well as a notable distension of the intestines. The rectum was about four inches shorter than is natural, and the surrounding connective tissue was ulcerated.

5. Siebenrogg (*Repertorium für Thierheilkunde*, 1875, p. 52) gives a case which derives its importance from the subject of it being a nine-months-old Sow. Defecation took place by the vagina, between which and the rectum there was a free communication. So long as the fæces were soft, the recto-vaginal opening sufficed for their ejection; but when the animal began to be fattened with potatoes, etc., this did not permit defecation, and the contents of the intestine were arrested. The Sow was in the latter condition when seen by Siebenrogg, and the case was so urgent that he decided on making an artifical anal orifice. After removing the skin at this point and exposing the extremity of the rectum, the latter was incised to a sufficient extent to allow of its being emptied; this afforded the animal immediate relief. The fæces afterwards continued to pass through this surgical opening, as well as that between the rectum and vagina.

In six months the Sow was slaughtered, and on examination it was found that the borders of the wound were cicatrised, and the opening into the rectum about two inches deep and large enough to admit the little finger.

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CHAPTER XIII.

Imperforation of the Vulva and Vagina.

Imperforation, atresia, or occlusion of the Vulva does not appear to be very rare in new-born animals, they being not unfrequently found after birth without any apparent opening into this passage, the labia of which are adherent. The adhesion may be general or partial. In the former case the urine cannot escape, and is therefore retained; or it may be expelled through the urachus, by the umbilical opening. When the retention is complete, the bladder soon becomes distended and ruptures. From this death soon ensues.

Complete occlusion is always a serious condition, as there is no precise indication as to where the urethra opens, or even if it exists at all; so that it is scarcely possible to make an artificial opening for the passage of the urine with perfect and permanent success. When the labia are merely adherent, then there is no difficulty, and not much danger, in the case. The adhesion being destroyed and the labia freed, the urine is no longer retained and the malformation is remedied: the only precaution necessary is to prevent their again becoming united—this is easily effected by dressing the raw margins with oil or grease, and, if need be, keeping them apart until healed.

When occlusion is only partial, the interference of the operator may or may not be deemed necessary, according to circumstances; but it will be generally most judicious to enlarge the opening to its natural dimensions before the animal becomes full-grown.

Imperforate Vagina is much less frequent than imperforate vulva. Nevertheless, it is sometimes met with in new-born creatures. The danger is the same as in the other malformation, as the external opening of the urethra is situated below the pubic symphysis, immediately anterior to the entrance to the vagina. Consequently, the urine may be retained, and the animal will soon perish from rupture of the bladder, peritonitis, etc.

All that can be done in such a state of affairs, is to compensate for the absence of the natural canal by making an artificial opening, and to prevent it from closing by introducing a dilator, and keeping it there (removing it, of course, from time to time) until there is no danger of closure.

When the obliteration is only partial the case is not so serious, and provided the urine escapes at all freely, surgical interference may not be necessary—at least until breeding-time arrives.

CHAPTER XIV.

Imperforation of the Prepuce.

IMPERFORATION of the prepuce of new-born creatures is apparently a very unusual occurrence, as it is scarcely mentioned in veterinary literature. Brugnone notices it as occurring in foals, and he recommends that an artificial opening be made in the prepuce where the natural aperture should be; the lips of the wound to be kept apart by any suitable contrivance, which may be secured *in situ* by attaching tapes to it, and passing these round the body,

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securing them over the loins. When this artificial opening is not made, the same grave results follow as in complete occlusion of the vulva.

This operation is successful only when the urethral canal is patent throughout its length; when it is occluded also, the operation will no longer be attended with benefit, and the operator must then endeavour to discover where the obstruction is, and either overcome it, or make an opening somewhere for the escape of the urine.

In some instances, when the orifice of the urethra is occluded, the urine escapes by a congenital opening in some part of the canal. When this opening exists at its upper surface, the defect receives the name of *epispadias*, and when at its lower *hypospadias*. Such a malformation has been seen in the dog, lamb, and goat, and it is not of much importance, so far as the flow of urine is concerned. If the opening is near the end of the urethra, the urine runs into the prepuce, and passes thence; but if it is more behind, between the scrotum and ischiatic curvature, it then flows over the skin, abrades it, and the dust and dirt accumulate; this, together with the repulsive odour of the decomposed urine, renders the case very unpleasant to the eye and nose.

Treatment is only too often unsuccessful and always troublesome. It is least so when the opening is near the termination of the urethra, as then the defect is more accessible and easier remedied.

There are other two regions which may suffer from congenital occlusion, but to the description of which we have not deemed it necessary to allot separate chapters: we refer to the visual and auditory.

Occlusion of the eyelids has been witnessed in foals, calves, and other young animals. Of course we do not allude to the natural occlusion of the eyelids of puppies, kittens, and young rabbits, which prevents their seeing for some days after birth.

This accidental occlusion of the eyelids presents itself in two forms. In one, the margins of the upper and lower eyelids are only adherent; and in the other, the eyelids are, in addition, adherent to the eye itself throughout their entire surface.

The first variety is alone curable, and in order to disunite the eyelids, the operator proceeds as follows: Securing the head of the creature in the hands of an assistant, the upper eyelid is elevated by another assistant by means of a pair of forceps. The operator himself seizes the lower lid by the same means, and pulls it as far as possible from the eyeball beneath; then taking a pointed bistoury or sharp scissors in his right hand, a small puncture or notch is made between the margins of the lids, in such a manner as to injure neither, if possible, and much less to wound the eye. A grooved director is passed into the puncture in the direction of one of the canthi of the eye, and the bistoury or scissors run along it, separates the two lids; the director is then turned towards the other canthus, and the same procedure is followed. If the scissors are used, the director is not necessary. All that is required after the operation, is to apply a little lard to the borders of the lids, should there be any tendency to re-adhesion.

Occlusion of the auditory canal is much less rare than that of the eyelids, and when it exists deafness is the consequence, as well as dumbness. It is the latter condition which most frequently attracts attention, and leads to the discovery that the real and serious defect is deafness. Then a small prominent tumour is detected in the place of the ear, or where the external auditory canal should be. This tumour is rather soft, and can be readily

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seized by forceps, when it may be punctured with a bistoury or a lancet, and a crucial incision made through it, or it may be resected by forceps and scalpel or scissors.

When the membrane forming the covering of the tumour is removed, a quantity of grey cerumen is found obstructing the canal; this can be removed by pressure, injections of tepid water, or a small scoop. To hinder the closure of the canal, a little morsel of lint or fine tow is placed in the ear, and retained there by a bandage round the head. With the dog, which is most frequently affected in this way, the bandage requires to be more carefully fixed than with other animals, as it uses its paws and does not rest until it is removed.

If both ears are affected, one only should be operated upon at a time; and, as a rule, it is better to wait until the slight inflammation which follows the operation subsides, before the other ear undergoes the same treatment.

So far as hearing is concerned, the result is often negative; indeed, Rainard confesses that of the large number of dogs he operated upon, not one recovered its hearing.

CHAPTER XV.

Cyanosis.

At page 98, in describing the fœtal circulation and the modifications which occur in it at birth, we mentioned that the lungs then become the organs of respiration, and rapidly increase in capacity, while the thorax enlarges in a commensurate degree; the pulmonary artery also dilates to admit the increased flow of blood, and the ductus arteriosus is obliterated to prevent the mingling of arterial and venous blood. It was also stated that the ductus venosus likewise aids in the isolation of the two kinds of blood by becoming atrophied, as does also the occlusion of the foramen ovale, though the latter opening not infrequently remains intact in young animals. Remarking upon the patency of the foramen ovale, it was said that, as a rule, this accident did not greatly affect the circulation; for when the heart contracts, the auricles are isolated by the narrowing of the orifice and the elevation of a valve.

Cases occur, nevertheless, in which, either from the persistence of the foramen ovale, with perhaps defective auricular contraction, or an abnormal disposition of the large bloodvessels at their origin, the arterial and venous blood is mixed, and we have the condition known as cyanosis or the "blue disease." Then there is a deep-blue or violet colouration of the visible mucous membranes, more or less debility and difficulty in respiration, especially during exertion, coldness of the limbs and surface of the body, and a great predisposition to hæmorrhage.

Cyanosis may occur in otherwise well-developed individuals, and be due to a congenital adhesion between the lungs and pleura or pericardium; it is also a symptom of asphyxia, and is sometimes witnessed in colic in the horse, complicated with meteorismus; it likewise accompanies certain forms of poisoning.

When due to the first-named causes, this condition is manifested during, or immediately after, birth; it is only in rare instances that it is developed

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at a later period. It is needless to mention that such a conformation is beyond remedy, though animals so affected will often live for a long time; Zundel has seen a horse seven years old which was in this condition.

Vernant (*Recueil de Méd. Vétérinaire*, 1877, p. 592) was called to see a calf which had been born the previous evening, and with such ease that it was found behind the Cow, no one being present at its birth. It was viable, in very good condition, fat, and so well developed that it looked as if fifteen days old. But it could not stand, and lay constantly in the sternal position, refusing to suck. The symptoms it presented were markedly those of asphyxia: the tongue was half-protruded from the mouth, the eyes prominent, the respiration plaintive and hurried, and the flanks very agitated. When raised it could not stand; its limbs were constantly and convulsively moved, and were unable to sustain the weight of the body.

The animal was bled at the tail, but this afforded no relief, and in forty-eight hours after birth it died. The lungs were then found to be collapsed, and looked very congested. The anterior extremities of the lobules floated well in water, but the mass of the lungs was rather heavy.

The foramen ovale was incompletely closed, so that the two auricles could communicate with each other; the opening was as large as a five-franc piece, and the auricular septum was extremely thin.

Another congenital malformation to which we have not devoted a special chapter, is "tongue-tie" in young animals, and particularly calves.

Tyvaert (*Annales de Méd. Vétérinaire*, June, 1877) has observed this condition on six occasions in calves. It is similar to tongue-tie in children and certain birds, and is characterised by the frænum linguæ being too narrow from above to below, and too much prolonged forward—sometimes extending to the root of the incisor teeth. This anomaly greatly hinders the prehension of food and swallowing of fluids; the calf, if drinking out of a bucket, vainly plunges its face into the fluid as far as the eyes. The teat is seized with difficulty, and the tongue is so limited in its movements that it cannot be protruded to lick the nostrils, as is the custom with bovine and some other creatures. The defect is often unperceived, and the young creature loses condition, becomes weak, and eventually succumbs.

The treatment is very simple. It consists merely in dividing the frænum to such an extent that the tongue may recover its liberty of movement. Immediately after the operation, the creature protrudes its tongue to lick the blood which escapes, and it can drink with ease. The wound heals in a few days without any precautions.

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INDEX.

A.

Abdominal evisceration, 538.
Abdominal fœtation, 157.
Abdominal taxis, 303.
Abnormal quantity of placental fluid, 368.
Abnormal retention of the fœtus, 186.
Abortion, 193.
„ artificial, 269.
„ epizoötic, 204.
„ sporadic, 194.
Accessory cotyledons, 81.
Accidents of pregnancy, 177.
Accidents incidental to parturition, 557.
After-pains, 244.
Agalactia, 702.
Aid after labour, 239.
Albuminuria, 177.
Alimentary canal of fœtus, 99.
„ „ annexes of, 100.
Allantoic fluid, 77.
Allantois, 75, 76.
„ differences in, 77.
Amaurosis, 177.
Amnion, 72.
„ differences in, 75.
Amputation of the limbs, 533.
„ „ fore limbs, 534.
„ „ hind limbs, 536.
„ „ uterus, 593.
Anasarca, 376.
Anatomy, obstetrical, 522.
Anidian monsters, 165.
Annexes of the fœtus, 68.
Anomalies in gestation, 152.
„ fœtal membranes, 366.
„ placenta, 350.
„ umbilical cord, 369.
Ante-partum prolapsus of the vagina, 177.
„ rupture of the uterus, 180.
Anterior position, 224.
Anterior presentation, 222.
Anus, atresia of, 746.
Apoplexy, parturient, 644, 657.
Arthritis, 723.
„ causes of, 724.
„ pathological anatomy of, 729.
„ prognosis of, 728.
„ symptoms of, 726.
„ treatment of, 732.
Articulations of pelvis, 12.
„ differences in, 14.
„ ischio-pubic symphysis, 13.
„ sacro-coccygeal, 14.
„ sacro-iliac, 12.
„ sacro-lumbar, 12.
Artificial abortion, 269.
Artificial passage for fœtus, 272.
Asphyxia of the new-born animal, 240, 706.
Ascites, 376.
Atresia of anus, 746.
„ os uteri, 347.
Attention to the offspring, 240.

B.

Bandages, or trusses, 587, 713.
Bladder, inversion of, 604.

C.

Cæsarean section, 316.
Cancerous, carcinomatous, or sarcomatous tumours, 322.
Capacity of pelvis, 20.
Cephalotomy, 529.
Cervix uteri, digital irritation of, 270,
„ induration of, 341.
„ rigidity of, 332.
„ structure of, 38, 39.
Changes in the ovum, 62.
Chorial cotyledons, 81.
Chorion, 69.
„ differences in, 71, 72.
Chorion, scirrhous, 350.
Cleft palate, 93.
Collapse, parturient, 644.

Digitized by Google

Colostrum, 246.
Complete deformity of the pelvis, 264.
Complications of ruptured vagina, 617.
Complications caused by deviation of the hind limbs of the fœtus, 466.
Condylomatous, papillomatous, and lipomatous tumours, 322.
Constipation, 173, 744.
Constriction of vagina and vulva, 356.
Contorsio uteri, 283, 317.
Contention or retention of the uterus, 582.
Contractions of the fœtus, 382.
Cords and bands, 491.
Corpus luteum, 50, 51.
Cotyledonous milk, 82.
Cotyledons, 81, 118.
Cough, 177.
Cramp, 172.
Craniotomy, 530.
Crochets or hooks, 500.
Cup-and-ball pessary, 583.
Cyanosis, 751.

D.

Death of fœtus, 235, 385.
Decapitation, 531.
Decidua serotina, 83, 84.
Decidua vera, 251.
Development of embryo, 65, 66, 67.
" of ovaries, 48.
Deviation of the uterus, 280.
Diagnosis of multiple pregnancy, 146.
Diarrhœa, 736.
Differences in pelvis, 10, 25.
Diffused placenta, 83.
Digital irritation of cervix uteri, 270.
Diminution in the size of the fœtus, 271.
Diseases of the fœtus, 370.
Diseases and abnormalities of the young animal, 706.
Diseases of pregnant animals, 171.
Diseases peculiar to pregnancy, 172.
Distorted monstrosities, 407.
Division or detruncation of the fœtus, 536.
Dorso-lumbar position of the fœtus, 225.
Dorso-lumbar presentation, 222, 225.
Ductus arteriosus, 98.
Ductus venosus, 96.
Duration of pregnancy, 135.
Dystokia, iii. 253.
" general considerations, 253.
Dystokia fœtal, 359, 253.
" maternal, 253, 263.
" due to anterior limbs incompletely extended in the pelvis, 431.
Dystokia, head deviation upward and backward, 454.
" " downward, 441.
" displacement or changed relations of the uterus, 272.
" dorso-lumbar presentation, 479.
" extreme abduction of head and limbs, 456.
" fetlock presentation, 467.
" fore limbs, 431.
" fore limbs completely retained, 437.
" fore limbs crossed over the neck, 432.
" fore limbs flexed at the knees, 433.
" head, 440.
" head and fore limbs in the posterior presentation, 477.
" hind limbs in the pelvis, 457.
" hock presentation, 468.
" lateral deviation, 445.
" lumbo-ilial positions, 466.
" lumbo-pubic position, 464.
" lumbo-pubic and lumbo-ilial positions, 464.
" misdirection of hind limbs in the anterior presentation, 456.
" morbid alterations in the genital organs, 319.
" right or left vertebro-ilial position of the fœtus, 437.
" pelvic constriction, 263.
" posterior presentation, 463.
" sterno-abdominal presentation, 484.
" thigh and croup presentation, 472.
" transverse presentation, 478.
" vertebro-pubic position, 436.
" vertebro-sacral position, 433.

E.

Eclampsia, parturient, 669.
Embryo, development of, 65, 66, 67.
Embryotomy, 522.
" instruments for, 523.
" preliminary arrangements for, 529.
Emphysema, 381.
Employment of force in dystokia, 513.
Endo-metritis, 631.
Enlargement of the genital canal, 271.
Epilepsia uterina, 675.
Epispadias, 750.
Epizoötic abortion, 204.
Eutokia, iii. 5.

Digitized by Google

Evisceration, 537.
„ abdominal, 538.
„ thoracic, 537.
Evolution in dystokia, 428.
Excess in volume of the fœtus, 360.
Exostoses on pelvis, 266.
External generative organs, 27.
Expulsion of the fœtus, 216.
„ membranes, 219.
Extra-uterine pregnancy, 156, 157.

F.

Fallopian tubes, 44, 103.
„ „ differences in, 45, 46.
Fecundation, 60.
Female generative organs, 26.
Fibroid tumours, 323.
Fistulæ of teat, 705.
„ vesico-vaginal, 624.
Fœtal cotyledons, 81.
„ dystokia, 359.
„ envelopes, puncture of, 270.
„ „ retention of, 557.
„ membranes, anomalies, and disease in, 366.
Fœtus, abnormal retention of, 186.
„ annexes of, 68.
„ artificial passage, 272.
„ death of, 235.
„ development of, 87.
„ „ circulatory system, 94.
„ „ digestive apparatus, 99.
„ „ genito-urinary organs, 101.
„ „ locomotory apparatus, 92.
„ „ nervous system, 88.
„ „ organs of sense, 89.
„ „ respiratory apparatus, 98.
„ „ skin and appendages, 91.
„ diminution in size of, 270.
„ diseases of, 370.
„ forcible extraction of, 270.
„ mechanical means for extraction of, 491.
„ periods of development of, 105, 106.
„ physiological phenomena in, 108.
„ „ absorption, 110.
„ „ circulation, 111.
„ „ nervous functions, 109.
„ „ nutrition, 111.
„ „ secretion, 113.
„ positions of, 222.
„ „ in uterus, 125.
„ presentations of, 221.
„ weight and dimensions of, 115.
Forceps, 505.
Forcible extraction of the fœtus, 270.
Fractures of pelvis, 266.
Free-martins, 146.
Frequency of monstrosities, 406.
Functional modifications in parturition, 244.
Funis, 85.

G.

Galactophorus sinus, obliteration of, 704.
Gastro-hysterotomy, 316, 543.
Gelatine of Wharton, 85.
Gemelliparous gestation, 139.
Generative organs, 26.
„ external, 27.
„ female, 26.
„ internal, 35.
Gestation, 106.
„ anomalies in, 152.
„ duration of, 135.
„ influence of, 171.
„ multiparous, 139, 140, 141.
„ pathology of, 152.
„ pluriparous, 139.
Glandulæ utriculares, 39.
Graafian vesicles, 46.
„ „ maturation of, 59.
Gubernaculum testis, 103.

H.

Hemorrhage from uterus, 615.
„ post-partum, 566.
„ umbilical, 707.
Head-collar or head-cord, 459.
Hernia of bladder into vagina, 328.
„ intestines, 610, 615.
„ umbilical, 709.
„ uterus, 179.
Horizontal diameter of pelvis, 26.
Hippomanes, 77.
Hydatid kysts, 169.
Hydrocephalus, 370.
Hydramnios, 173.
Hydrometra, 169.
Hydrops amnii, 173.
Hydrops uteri, 169.
Hydrothorax, 376.
Hygiene of pregnant animals, 149.
Hymen, 355.
„ persistent, 355.
Hypospadias, 750.
Hysterocele, 179, 272.
Hysterotomy, vaginal, 305.

I.

Imperforation of anus, 746.
„ prepuce, 749.
„ vagina and vulva, 749.
Indigestion of young animals, 734.

Digitized by Google

Induration of the cervix uteri, 341.
Infectious abortion, 204.
Inflammation of the mammæ, 683.
,, umbilical cord, 719.
Influence of food on the fœtus, 363.
,, gestation on ordinary diseases, 171.
Injuries to the teats, 702.
Internal organs of generation, 35.
Intestines, hernia of, 610, 615.
Intestitial fœtation, 157.
Inversion of the bladder, 604.
,, ,, uterus, 570.
,, ,, vagina, 600.

K.

Kysts, serous, 328.

L.

Labour pains, 211.
Laceration of uterus, 608.
,, vagina, 614.
Lactation, 246.
Laminitis, parturient, 677.
Laws of teratology, 402.
Left vertebro-ilial position, 224.
Leucorrhœa, 630.
Liquor amnii, 74.
Lithopœdian, 189.
Lochia, 244, 251.
Lordosis, 265.
Lumbo-sacral position, 225.

M.

Mammæ, structure of, 31.
,, congestion in, 681.
,, differences in, 33, 35.
,, inflammation of, 683.
Mammitis, 680, 683.
,, parenchymatous, 685.
,, phlegmonous, 685.
Mania puerperalis, 675.
Manual and mechanical force compared, 520.
Mastitis, 680, 683.
Maternal cotyledons, 80.
Maternal dystokia, 253, 263.
,, ,, causes of, 350.
Maturation of Graafian vesicles, 59.
Means for developing necessary force, 517.
Mechanical means for the extraction of the fœtus, 491.
Mechanism of parturition, 221, 227.
Meconium, retention of, 744.
Menstrual discharge, 56.
Menstruation, 55.
Metritis, 631.
Metro-peritonitis, 631.
Metrorrhagia, 185.
Metrotomy, 593.
Milk, 247.
Milk fever, 245.
Moles, 165.
Monstrosities, 386.
,, classification of, 387.
,, distorted, 407.
,, double, 390, 415.
,, double-headed, 408.
,, frequency of, 406.
,, origin of, 402.
,, simple, 387.
,, treble, 390, 415.
Acephalian monstrosities, 397.
Acephalus, 387.
Amorphus, 387.
Androgynus, 389.
Anencephalian monstrosities, 396.
Anidian or zoomylian monstrosities, 398.
Aschistodactylus, 388.
Atretocephalus, 388.
Atretocormus, 388.
Autositic, 392.
Campylorrhacchis, 389.
Campylorrhinus, 389.
Celosomian monstrosities, 394, 410.
Cryptodidymus, 392.
Cyclocephalian monstrosities, 396.
Cyclopean monstrosities, 408.
Cyclops or monophthalmus, 389.
Dicephalus, 390.
Dicranus, 390.
Diphallus, 389.
Diprospus, 390.
Dipygus, 390.
Emprosthomelophorus, 391.
Ensomphalian monstrosities, 398.
Epigastrodymus, 391.
Exencephalian monstrosities, 396.
Gastrodidymus, 391,
Gastro-thoracodidymus, 39.
Hermaphrodites, 389.
Heterocephalus, 390.
Heterodidymus, 391.
Ischiodidymus, 392.
Megalocephalus, 389.
Megalomelus, 389.
Monocephalian monstrosities, 400.
Monocranus, 390.
Monomphalian monstrosities, 398.
Monosomian monstrosities, 400.
Nanocephalus, 388.
Nanocormus, 388.
Nanomelus, 388.
Nanosomus, 388.
Octopus, 391.
Omphalo-chronodidymus, 392.
Opisthomelophorus, 391.
Perccephalus, 387.

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Monstrosities—*continued.*
Perocormus, 388.
Peromelus, 388.
Perosomus, 387.
Pleuromelphorus, 391.
Pseudencephalian monstrosity, 396, 408,
Pseudo-hermaphroditus, 389.
Pygadidymus, 392.
Schelodidymus, 392.
Schistocephalian monstrosities, 398.
Schistocephalus, 388.
Schistocormus, 388.
Schistomelus, 388.
Schistosomus, 388.
Symelian monstrosities, 394.
Syncephalian monstrosities, 400.
Sysomian monstrosities, 400.
Tetrachirus, 391.
Tetrasculus, 391.
Trigeminal monstrosities, 390.
Thoracodidymus, 392.

Morbid adhesion between the fœtus and the uterus, 350.
Multiparity, dystokia from, 417.
Multiparous gestation, 139.
Multiple pregnancy, diagnosis of, 146.
„ position of fœtuses, 147.

N.

Necessary aid in normal parturition, 232.
Normal parturition, 209.
„ necessary aid in, 232.

O.

Obliteration of the galactophorus sinus, 704.
Obliteration of os uteri, 347.
Obstacles independent of presentations and positions, 360.
Obstetrical anatomy, 5.
„ operations, 490.
„ physiology, 52.
Occlusion of auditory canal, 750.
„ eyelids, 750.
„ uterus, 352.
Œdema in pregnancy, 173.
„ of umbilicus, 718.
Œstrum, 55, 56, 57, 59.
Offspring, attention to, 240.
„ general care of, 241.
Omphalo-mesenteric vessels, 86.
Organic modifications in uterus, 250.
Origin of monstrosities, 402.
Os uteri, 38.
„ obliteration of, 347.
Os tincæ, 347.
Ovarian fœtation, 157.
Ovaries, 46.
„ development of, 48.
„ differences in, 48, 49, 50, 51, 52.
Oviducts, 44.
Ovula Nabothi, 39.
Ovulum, 48.
Ovum, changes in, 52, 63, 66.

P.

Paralysis, post partum, 667.
Paraplegia, 176.
Parturient apoplexy, 644, 657.
„ collapse, 659, 644.
„ eclampsia, 669.
„ fever, 631.
„ laminitis, 677.
Parturition, 209.
„ accidents incidental to, 557.
„ causes of, 210.
„ expelling powers in, 211.
„ mechanism of, 227.
„ necessary aid in, 232.
„ normal, physiology of, 209.
„ pathology of, 629.
„ sequelæ of, 243.
„ symptoms and course of, 209, 214.
Pathological congestion of the mammæ, 681.
Pathology of gestation, 152.
„ parturition, 629.
Pelvic cavity, tumours in, 269.
„ cellulitis, 615,
„ openings, 17.
„ symphysis, relaxation of, 625.
Pelvimetry, 21.
Pelvis, 5.
„ articulations of, 12.
„ bones of, 6.
„ capacity of, 20.
„ cavity of, 15.
„ complete deformity of, 264.
„ diameters, 26.
„ differences in, 10, 25.
„ exostoses on, 226.
„ fractures of, 226,
„ openings in, 17.
Perinæum, 31.
„ rupture of, 621.
Peritonitis, 610, 615.
Persistence of the urachus, 708.
Persistent hymen, 355.
Physiology of parturition, 209.
Pica, 173.
Placenta, 79.
„ anomalies in, 350.
„ differences in, 80.
„ functions of, 84.
„ prævia, 81.

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Placentæ, 80.
Placental fluid, 74.
„ abnormal quantity of, 368.
Placentulæ, 80.
Pluriparous gestation, 139.
Polycotyledonous placenta, 83.
Polysarcia, 382.
Porte-cord, 449.
Positions of fœtus, 222.
„ „ in multiple pregnancy, 147.
„ „ in the uterus, 125.
Posterior presentation, 222, 225.
Post-partum hæmorrhage, 566.
„ paralysis, 667.
Pregnancy, 116.
„ accidents of, 177.
„ course of, 163.
„ diagnosis of, 164
„ diseases peculiar to, 172.
„ duration of, 135.
„ „ in bitch, 139.
„ „ cat, 139.
„ „ cow, 137.
„ „ mare, 136.
„ „ sow, 139,
„ „ sheep and goat, 138.
„ extra-uterine, 156.
„ signs of, 126.
„ symptoms of, 163.
„ termination of, 163.
„ treatment of, 164.
Pregnant animals, diseases of, 171.
„ „ hygiene of, 149.
Prepuce, imperforation of, 749.
Presentations of the fœtus, 221.
Prolapsus of vagina, ante-partum, 177.
„ vesicæ, 604.
Prolonged gestation, 360.
Protracted labour, 234.
Pseudo-pregnancy, 164.
Puberty, 54, 55.
Puncture of cranium, 529.
„ fœtal envelopes, 270.

R.

Reduced number of fœtuses, 360.
Relaxation of pelvic symphysis, 625.
Reproduction, 52, 53, 54.
Repulsion, 428.
Retention, abnormal, of the fœtus, 186.
„ fœtal envelopes, 557.
„ meconium, 744.
Retropulsion, 423.
Right vertebro-ilial position, 224.
Rigidity of the cervix uteri, 332.
Rotation, 427.
Rupture of abdominal muscles, 627.
„ bladder, 626.
Rupture of diaphragm, 627.
„ intestines, 627.
„ perinæum, 621.
„ sacro-sciatic ligament, 628.
„ uterus, ante-partum, 180.
„ „ post-partum, 611.
„ water-bag, 237.

S.

Sacro-sciatic ligament, 14.
„ „ „ rupture of, 628.
Scirrhous chorion, 350.
Sequelæ of parturition, 243.
Serous kysts, 328.
Signs of pregnancy, 126.
„ „ material, 128.
„ „ rational, 126.
„ „ sensible, 131.
Skin dryness, 745.
Sporadic abortion, 193, 194.
Spurious or pseudo-pregnancy, 165.
Sterility, 60, 61, 62.
Sterno-abdominal presentation, 222, 226.
Stricture or occlusion of uterus, 352.
Super-fœtation, 152.
Sutures, 585.
Symphyses, pelvic, relaxation of, 625.
Symphysis, ischio-pubic, 13.
Symphysiotomy, 556.

T.

Taxis, abdominal, 303.
„ vaginal, 305.
Teats, anatomy of, 31, 33, 34.
„ fistulæ in, 705.
„ fissures in, 702.
„ injuries to, 702.
Teratology, laws of, 402.
Thoracic evisceration, 537.
Thrombus or hæmatoma, 327.
„ of vagina and vulva, 625.
Tongue-tie, 752.
Torsion of the uterus, 283, 317, 318.
„ degree of, 295, 299.
„ diagnosis of, 295.
„ direction of, 295.
„ history of, 283.
„ in other animals, 318.
„ pathological anatomy of, 299.
„ presence of, 295.
„ symptoms of, 292.
„ treatment of, 303.
Traction on fœtus, 237.
„ degree of, 514.
„ direction of, 513.
Traumatic lesions of genital and neighbouring organs, 608.
Tumours, 384.

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Tumours, cancerous, 322.
„ condylomatous, 322.
„ fibroid, 323.
„ in genital organs, 332.
„ „ pelvic cavity, 319.
„ „ vicinity of genital organs, 332.
Tubal fœtation, 157.
Tumultuous labour, 234.

U.

Umbilical cord, 85.
„ „ anomalies in, 369.
„ „ differences in, 86.
„ „ dimensions of, 86.
„ „ hæmorrhage from, 707.
„ „ inflammation of, 719.
Umbilical hernia, 709.
Umbilical vein, 85, 96.
Umbilical vesicle, 78.
„ „ differences in, 79.
Umbilicus, œdema of, 718.
Urachus, 77, 86.
„ persistence of, 708.
Uterine kysts, 167.
Uterine milk, 82.
Utero-vaginal tumours, 319.
Uterus, 37.
„ amputation of, 593.
„ deviations of, 280.
„ differences in, 40, 41, 42, 43.
„ direction of, 123.
„ form of, 121.
„ hernia of, 179, 272.
„ influence on neighbouring organs, 123.
„ inversion of, 570.
„ laceration and rupture of, 608, 611.
„ modifications in, 117.
„ occlusion of, 352.
„ reposition of, 578.
Uterus, rupture of, 180.
„ sensibility of, 119.
„ situation of, 122.
„ structure of, 117.
„ torsion of, 283, 317.
„ volume of, 117.

V.

Vagina, 35.
„ complications in rupture of, 617.
„ differences in, 37.
„ imperforation of, 749.
„ inversion of, 600.
„ laceration of, 614.
„ rupture of, 614.
„ thrombus of, 625.
Vaginal constriction or atresia, 356.
„ cystocele, 328.
„ hysterotomy, 305, 539.
„ irrigations, 270.
„ taxis, 305.
Vaginitis, 629.
Venereal œstrum, 55.
Ventral fœtation, 157.
Version, 427,
Vertebro-pubic position, 224.
Vertebro-sacral position, 224.
Vertical diameter of pelvis, 26.
Vesicle, umbilical, 78.
Vesico-vaginal fistulæ, 624.
Vulva, 27.
„ differences in, 30, 31.
„ imperforation in, 749.
„ thrombus of, 625.

W.

Water-bag, rupture of, 237.
Whartonian gelatine, 85.
Womb, 37.

Z.

Zonular placenta, 84.

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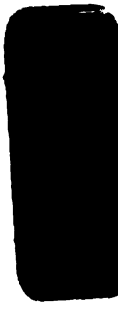

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