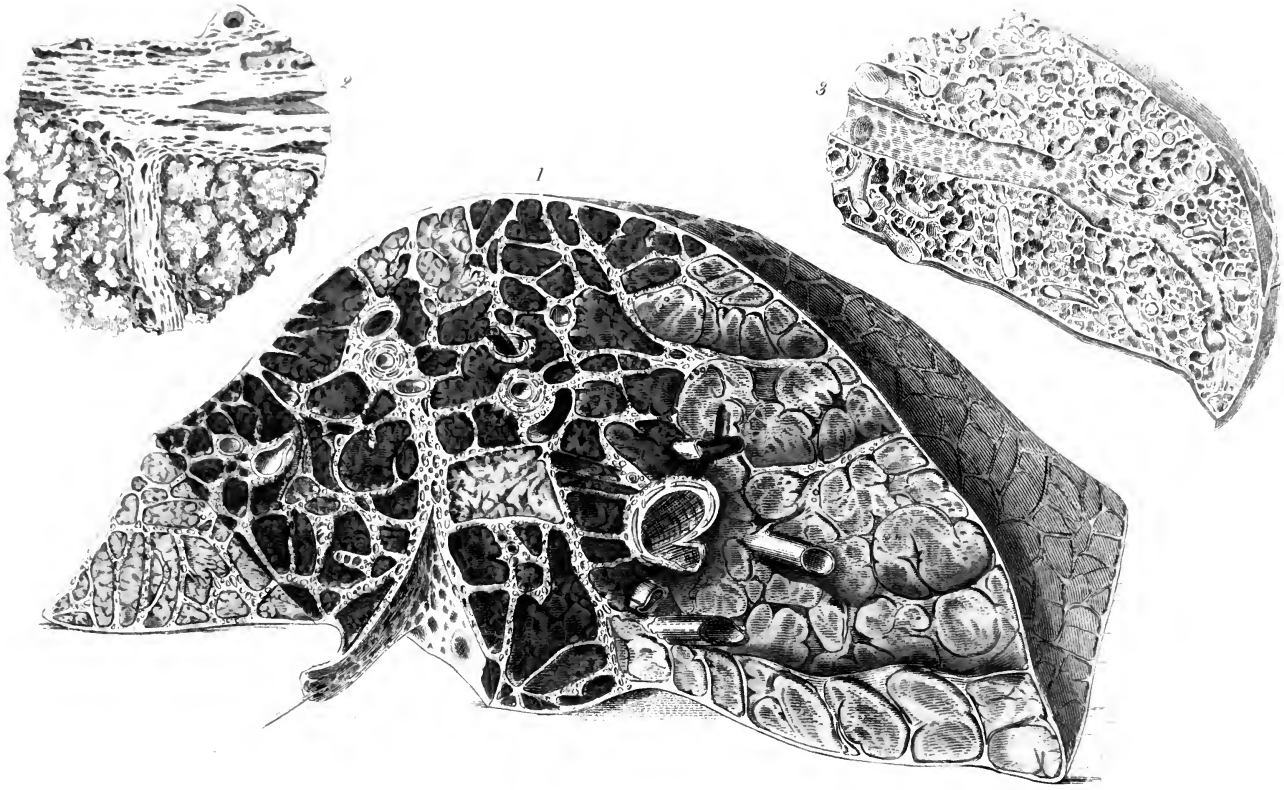
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A TREATISE

ON THE

DISEASES OF THE OX;

BEING A

MANUAL OF BOVINE PATHOLOGY.

ESPECIALLY ADAPTED FOR THE USE OF VETERINARY PRACTITIONERS AND STUDENTS.

BY

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LONDON:
LONGMANS, GREEN, & CO.
1881.

To

PRINCIPAL JAMES BEART SIMONDS,

PROFESSOR OF CATTLE PATHOLOGY AT THE ROYAL VETERINARY COLLEGE, HONORARY MEMBER OF THE AGRICULTURAL SOCIETY OF ENGLAND, ETC.

WHO FOR

SO MANY YEARS PASSED HAS ENCOURAGED THE STUDY OF

CATTLE PATHOLOGY,

AT ONCE BY PRECEPT AND EXAMPLE,

AND HAS THEREBY MATERIALLY ASSISTED IN GIVING

TO BOVINE PATHOLOGY IN GREAT BRITAIN SUCH

SCIENTIFIC TENDENCIES AS IT MANIFESTS

IN THE PRESENT DAY,

THIS WORK IS

DEDICATED BY HIS FORMER PUPIL,

THE AUTHOR.

1881.

PREFACE.

Bovine pathology has not been hitherto adequately represented in British Veterinary Literature, but the time has now come when it ought to take up its proper position as a distinct section of veterinary science. Under these circumstances it is somewhat surprising that none of our leading veterinary surgeons have produced a scientific work of a comprehensive nature on diseases of cattle. It seems that some, owing to their professional engagements, have had little time left for literature, while others have been deterred by supposing that there must already be many preparing to fulfil so urgent a task. An opportunity of preparing a work on this subject having presented itself, I have not hesitated to avail myself of it; and in doing so I have not advanced to my work heedless of the amount of labour involved in it, or of the uncertainty of the data on which it would have to be based. My ideal of a work on special pathology necessitated, in the first place, the somewhat dogmatic summary of the general study of disease comprised in the Introduction, Section 1. With the data thus afforded I was in a better position to specially consider diseases of the ox. No trouble has been spared in assigning to each part of the work its proper position, with a view to practical convenience and facility in study. The table of contents is, to a certain extent, an expression of the careful arrangement which I have adopted. The intimate matter requires some comment; my aim has been to tersely indicate the bearings of the subjects dealt with, to point out that which has been based on science and confirmed by experience in contrast with crude theory and superstitious empiricism. In following out this plan I have been compelled

to omit the arguments which have been advanced in support of many theories. It may be fancied that in these cases I am dogmatic, but a full statement of each controversy would have trespassed too much on my space and perchance on the patience of my readers, to many of whom the work will, even in its present form, seem quite large enough. I the less regret that I have not been in a position to exhaustively treat my subject, since simultaneously with the announcement of this manual appears that of a larger and more pretentious work on the same subject, by an author whose ability has been already proved by an excellent volume on 'Canine Pathology,' Professor J. W. Hill, F.R.C.V.S. My treatise on 'Bovine Pathology' is specially prepared for the veterinary practitioner and student. I desire that for the former it may be a useful means of recalling facts, which in the rush of daily business are apt to slip the memory, and may also afford a ready reference to past periodical literature, through which he would neither have time nor inclination to wade. At the expense of severe literary research I have summarised and arranged the facts which have been communicated to the profession through the medium of our journals. But while I have thus endeavoured to produce an exact statement of the present condition of cattle practice, I have not aimed at a record of profound investigation. Neither the state of the profession nor of science demands this, so I have been content to think at every point "how does this concern the practitioner?" The requirements of the student are similar, also his knowledge must be comprehensive and exact for the emergencies of examinations. Thus, I have specially aimed at method, the application of general principles, and precise statement of facts and conclusions. Also I have inserted accounts of methods of administration and other details which might to the practitioner seem trivial. I have endeavoured to as much as possible indicate the relations of diseases of the ox to those of other animals, and have, wherever necessary, alluded to liability of communication of disorders to man, as by contagion, meat,

milk, &c. The time has not yet arrived when in consideration of special pathology we can afford to omit a hasty summary of the leading points of the anatomy and physiology of the object of our investigations. My method has been chosen in the hope that it will refresh but not burden the memory of the reader. Having thus, to the best of my ability, prepared this work for the veterinary profession, it will be observed that I have made free use of technical terms (all of which, I believe, are explained in the introduction), and have not encouraged empiricism by the insertion of numerous prescriptions; I have indicated the line of treatment, but the exact means to be used must be adapted to the emergencies of each case. The few formulæ given are such as from their general usefulness or repute ought to be remembered by the reader. It will be constantly found in practice that the difficulties arising from complications of disease or from surroundings necessitate special modifications of the methods here suggested. Much of the success of a practitioner depends on his skill in applying general principles to special cases, and acting accordingly. I may by some be considered to have too much curtailed the list of symptoms of special disorders; in this matter I have in each case acted advisedly, wishing to economise the labours of the reader. Thus, "general signs of febrile disorder" frequently does duty for the somewhat prolonged list of these in detail, and so on in similar cases.

There being much difference of opinion among our leading authorities on cattle pathology, it has seemed to me best to express my own opinions, while stating and acknowledging those of others. Thus, I am fully prepared to find that many of my views do not meet with general acceptance. I await the verdict of the professional public, however, since I have proceeded throughout on scientific methods, and have supplemented such practical experience as was at my disposal by most careful literary research. I have endeavoured to express my acknowledgment of the assistance which I have derived from the few comprehensive works on bovine

pathology, and the numerous works on veterinary surgery and medicine which allude to diseases of cattle, as well as from some very excellent writings on special sections of my subject. Accordingly a bibliographical list of these has been inserted, which will, I hope, prove a useful guide to any reader who may wish to work up a special subject. Lastly, I have to acknowledge the kind courtesy by which the publishers and authors of the following works have afforded to Messrs. Longmans & Co. the numerous engravings, which have been inserted in the hope of rendering the work of greater value :—

Armatage, 'Clater's Cattle Doctor' (Messrs. F. Warne & Co).

Harley & Brown, 'Practical Histology' (Longmans & Co.).

Fleming, 'Veterinary Obstetrics' (Ballière, Tindall & Cox).

Colin, 'Traité de Physiologie Comparée' (Ballière & Co.).

Cobbold, 'Internal Parasites of our Domesticated Animals' (The Field Office).

Dobson, 'On the Diseases of the Ox' (Messrs. Longmans & Co.).

Erichsen, 'Surgery' (Messrs. Longmans & Co.).

Cut 4 has been copied by permission from *Gant's* 'Science and Practice of Surgery.'

Messrs. Arnold and Son, the well-known veterinary instrument makers, of West Smithfield, have supplied me with some cuts of instruments, for which I hereby convey my thanks.

Thus I submit my manual to the veterinary profession, and in appearing for the second time as an author, I venture to hope for such favour and consideration as my first effort has received.

JOHN HENRY STEEL.

NOVEMBER, 1880.

CONTENTS

CHAPTER V.—DISEASES OF THE RESPIRATORY APPARATUS.

CHAPTER X.—WOUNDS AND OTHER SURGICAL CONDITIONS.

CHAPTER XI.—THE GENERATIVE ORGANS.

LIST OF ILLUSTRATIONS.

LIST OF SURGICAL OPERATIONS AND DIAGNOSTIC MEANS.

LIST OF TABLES.

BOVINE PATHOLOGY.

CHAPTER I.—INTRODUCTION.

Section 1.

Disease is a departure from a healthy condition, and is consequently modified in its characters and effects in animals of different species by special anatomical and physiological peculiarities. In by far the larger number of cases functional disorder is present, dependent on structural changes, and it seems that, with the improvements which will be made in our methods of minute examination of tissues in health and in disease, we shall in direct ratio find that diseases supposed to be purely functional are due to alterations in structure. This has already been done in many cases, and we may take it as a law, sufficiently proved for working purposes, that disease is a departure from healthy structure of constituents of the body. These constituents of the body are elements, such as cells, fibres, membranes, and granules, which are combined together to form tissues, which produce by union in various ways the organs which co-operate to accomplish the various processes essential to life. In the highest animals these organs are collected into systems for the accomplishment of the various functions which high complexity of vitality necessitates. Thus, in pathology, we have to deal with elements, tissues, organs, and systems, and all of these are bound together so intimately in the animal mechanism, that alteration of any one of them tends to throw the body into an abnor-

mal state. Alteration of structure as present in disease is often brought about by changes from ordinary states of parts in situation, relations (either among themselves or with foreign bodies), and form. Such changes may result occasionally from inherited and other intrinsic influences, but are almost always due to agency from without. Every living being is adapted to certain external conditions, and is capable of undergoing modification in accordance with any variations which these conditions may show within certain limits, but the complexity of organisation in such an animal as the ox requires gradual transitions, or disorder ensues. Thus, we generally seek the cause of any attack of disease in changes of surrounding agencies, as weather, food supply, &c. This branch of study is termed Etiology.

Causes are predisposing or exciting. The greater the amount of activity in a part or animal the greater the liability to disease. Thus may be explained a number of facts, such as that highly organised animals are most often diseased, when we develop one system specially for economic purposes it most frequently of all the body systems is liable to disorder, and the most active body tissues are similarly susceptible. But a part may be in such a highly active condition and yet able to do its duties, until some sudden change disturbs its relations with surrounding parts and alters its structure. These states of verging on disease are termed Predisposing Causes. Thus, the milch cow is predisposed to mammitis, and the fattening ox to diseases of the digestive apparatus. By an extension of meaning, predisposition has come to imply also liability to disorder from any external surrounding conditions; thus, we hear of predisposition to choking in the fact of animals being fed on improperly prepared turnips, and to hair accumulations in the rumen, as a result of the habit oxen have of licking themselves and each other. Determination of *all* predisposing causes present is highly necessary, for counteraction of them is essential to success in treatment.

By some authorities intrinsic causes are termed *Predis-*

positions, in contrast with simple predisposing causes which act from without. Among these, hereditary predisposition is of great importance. When we consider that the parent transmits to the offspring similarity of external structure, with the specialities of function resulting therefrom, we shall hardly deny that peculiarities of internal structure are also transmissible. So intimate is the connection between the various parts of the body that each must be affected by the others. Thus, the germ-cell and sperm-cell have special family characters manifested only in the product of their development. The parent and offspring being alike in most structural points, and special structure giving special liability to disease, we can understand how it is that hereditary predisposition to disease of special form occurs in such disorders as tuberculosis and cancerous diseases. The reverse of predisposition is termed immunity.

Exciting Causes are the direct producers of disorder; sometimes they are enabled to act deleteriously in spite of the absence of predisposition, but generally they find certain favouring states, so, the cautery always arouses diseased action, but a mild external stimulant may simply arouse the activity of the part to which it is applied; the latter, however, becomes an active promoter of mischief when the part is already in a disordered state. Removal of the cause, *of all causes,* is the grand principle in treatment of disease. Our inability to draw a sharp line of demarcation between health and disease is a direct result of deficiency in our acquaintance with structure and function. We cannot yet tell whether structure exists in the protoplasmic contents of cells; and when we see that a white blood-corpuscle is capable of exhibiting all the properties of life, we cannot doubt that profound secrets of nature, as carried on in the laboratory of cell structure, remain yet to be explored.

Diagnosis of Disease is determination of the seat and nature of a malady. An animal is brought to us "ill," as manifested by certain *symptoms.* These may be general or special. All animals have certain ways of

showing that they are unwell, and we shall have to notice such among bovines. These depend upon special structural or physiological peculiarities, so that one of our earliest duties will be to indicate these as distinctive of the ox and his allies.

These *general symptoms* are often the first which appear, and then are PREMONITORY; they do not always persist throughout the attack, being obscured by special symptoms in many cases. They especially come under the notice of caretakers of animals, and the value of such depends much upon their ability to mark at the earliest stage departure from the usual habits of the animal.

SIGNS, DIAGNOSTIC or SPECIAL SYMPTOMS, serve either to enable us to determine the seat or nature of a malady. They may be simply manifested in the diseased part or parts, but we often find that local disorder becomes systemic, as a result of the close relations existing between all parts of the body, especially in their functions.

SYSTEMIC SYMPTOMS are found in inflammations and debilitating diseases, for example; they prove useful in determination of the nature of the disease, but observation of LOCAL SYMPTOMS is essential to complete diagnosis. The latter indicate to us what parts must be especially affected by treatment, the former show us what the nature of the remedial means must be. Sometimes the systemic symptoms are present, but no local indications can be observed. This occurs in "blood diseases" in which the blood, a tissue with liquid intercellular substance, being circulated in every part of the body, gives a generally diffused manifestation of disease, which is the condition known as fever.

Some practitioners err in treating only symptoms. In each case these must be taken merely as indications of the conditions of the diseased parts. Any clue they give as to the causes which produced, or tend to continue the disease must be specially noted; for, our aim in each case must be to "remove causes that effects may cease." Such is the accuracy of mechanism in the economy of a living being that it returns to true working when disturbing

agencies no longer act. In the diagnosis of disease COMPLICATION is an important element. As a rule, we have to do with disease of more parts than one, and have to come to a clear understanding in each case, for the disease which causes the others, the PRIMARY DISORDER, must be that against which our medicinal efforts are directed. If we succeed in removing it, SECONDARY DISEASES resulting from it will generally disappear. Thus, dropsy is a secondary condition often dependent on heart disease. Secondary pathological conditions may be due to co-operation in function, or to continuity or contiguity of structure. The instance just given illustrates the first method, for the dropsy results from escape of watery constituents through the walls of the overloaded vessels which cannot perfectly pour their contents into the heart. Extension by continuity of structure is seen when the pleura becomes involved by extension of disease which originated in the lungs. Contiguity is less frequently a means of spread; sometimes we see a gangrenous patch on the wall of a serous cavity opposite a gangrenous portion of a contained viscus. This means is also exemplified in joint diseases, and wherever living cells lie together without organic connection. Occasionally we find in a special disease some symptoms by means of which its nature may be at once determined; such a symptom is termed PATHOGNOMONIC. Thus, the presence of the anthrax Bacillus in the blood is pathognomonic of charbon, and the changed condition of the urine similarly enables us at once to determine the presence of hæmo-albuminuria.

The HISTORY of every case of disease should be ascertained with the utmost care, and when possible a written record should be kept for future reference. It should comprise *all* ascertained particulars of the case, from its commencement to its termination. It will prove not only a more sure guide to diagnosis and prognosis than the memory, but will enable the practitioner to perform his duty to the profession in recording the case if it prove interesting. We can never be assured of the professional value of a case until it has terminated. Much of the

value of good cases is often lost from paucity or inaccuracy of records of the early stages. In each case a regular system should be adopted; dates especially should be insisted upon, and all records should be made *at once*. We have found the following a satisfactory system of record:

Case.	Colour.	Sex.	Age.	Date of admission to treatment.	Date of discharge.	Disease.	Progress.
Pulse, Respirations, Internal temperature, Excretions, Appetite,				On special chart.	State of the blood, if any has been removed. Conditions of mucous membranes. Temperature of surface of body and condition of the skin. Special features of case.		

The PULSE is due to periodical enlargement of arteries such as results from their distension with blood in consequence of the heart's beat. It is one of the most useful indications of the state of an animal's health, and can be taken at any accessible artery; but, under ordinary circumstances, we utilise for this purpose only such vessels as are but slightly separated from the surface of the body, and are so placed in relation to hard structures that they can be compressed against the hard adjacent tissues by the fingers, and thus their beats rendered perceptible to the observer. These beats vary in number with the heart's contractions, and are perceptible sooner after the heart's beat in vessels near that organ than in those more remote. They depend upon the conditions of the arteries as well as of the heart, and the vessels passing from the heart are so constructed that the pulse is less marked in the smaller arteries than in the larger ones, even relatively, and disappears in the smallest of these vessels. The sphygmograph is an instrument used to obtain a written record of the condition of the pulse; it has not yet been applied to veterinary surgery. The pulse assumes various characters according to its rapidity of beat, frequency of occurrence, resistance to pressure, regularity, and perceptibility. Thus we have the quick and slow, frequent and infrequent, hard and soft, full and imperceptible, large and

small pulses, the characters of which may be determined from their names, also that form known as the intermittent, either regular or irregular. In the latter case the beats and intervals are uncertain, in the former at regularly recurring intervals the pause is prolonged. The dicrotonous or double pulse is found in blood diseases; it consists in a double rise of the arterial wall for each beat of the heart; physiologists debate its nature; it is a symptom of importance. The thready pulse is extremely small, and scarcely perceptible. The "running down" pulse occurs just before death, especially in cases of hæmorrhage, and consists in rapid loss of force of beat, with increasing frequency, until the pulse becomes imperceptible. It is a very grave symptom. The "venous pulse" is a sign of which we shall make use when treating of heart diseases. The sharp beat of the "quick" pulse must be distinguished from the increase in number of beats per minute characteristic of the "frequent" pulse. Sometimes the enlargements of the artery vary in successive beats, then the pulse is termed unequal, while extreme irregularity, and difficulty in perception and appreciation of its characters constitute the confused beat. The oppressed beat is prolonged and not very marked, while the vessels are much distended. We are not desirous of drawing attention here to the exact method by which these conditions of the pulse are produced, but will merely state that variations in frequency and rapidity of beat are connected directly with the action of the heart, and, therefore, especially dependent on states of the nervous system and fever, inducing rapidity, and certain brain disorders, reducing the beats below the normal number per minute; while the quick pulse shows an irritable state of the heart, slowness of beat often depends on impediment to egress of the blood. Hardness and softness depend upon the *tone* of the arteries, which consists in slight persistent contraction of their white muscular fibres adapting them to their contents; while largeness or smallness depends upon the amount of blood in the arteries, resulting from the state of supply from

the heart and outfall into the capillaries. With largeness of the pulse may be associated hardness, constituting the "corded" beat; the "wiry" pulse is small and hard, and a soft pulse may be large or small. The complicated vaso-motor mechanism, by means of which these variations in the states of the artery of the living subject, together with the intrinsic and extrinsic nervous mechanisms of the heart are brought about, are explained in all modern works on physiology. We have given enough information to enable us to complete our remarks on this point, by observing what states of our patients may modify the pulse. The beats vary with age, being generally frequent in very young animals and declining until old age; somewhat more frequent in the female than the male, they are especially increased by conditions of pregnancy (varying with the stages) and lactation. Individual temperament may affect the number, but especially alters the character of the pulse. The nature of the animal's work and mode of life, as also various processes of digestion (especially rumination) and some minor influences also affect the pulse.

The Respiratory System, by means of which much impure matter is removed from the blood and much oxygen is added to it, gives us indications of importance, as serving for diagnosis and prognosis of disease. Variations occur in the manner of introduction of air into the lungs, and of its expulsion after utilisation, also in the frequency of these processes. The extent of this system renders it liable to become affected by contiguity to many parts. Also its nervous connections are of considerable importance. Hence, in every case we should examine the number and kind of breathing efforts, and we shall often find it necessary to note the presence and character of a cough or other sound produced by respiratory acts. It has been observed that under healthy conditions the pulse and respirations bear to each other a definite numerical relation, one to four, but this is hardly exact. Fevers, inflammations, and other diseased conditions affecting the system, cause increased frequency of breathing.

Respirations consist of two acts, inspiration and expiration. The former is brought about by elevation of the ribs, and contraction of the diaphragm—both acts of muscular exertion. The effect of contraction of the diaphragm is to lessen its concavity towards the abdomen, hence it presses on the abdominal viscera and causes bulging of the walls of the belly. Expiration under ordinary circumstances depends upon elastic recoil of the elevated walls of the thorax, resulting in expulsion of air through the trachea and larynx. Respirations vary with their depth, frequency, quickness, facility, and the nature of the movements by which they are brought about. Thus, they may be quick or slow, frequent or infrequent, deep or imperfect, laboured, unequal, irregular, &c.

Dyspnœa is a term used to imply difficulty of breathing of any kind.

Apnœa is the extreme of infrequent respiratory effort, dependent upon the circulation of highly oxygenated blood through the medulla oblongata, where the respiratory centre resides. Until its natural stimulus, venous blood, is supplied to this centre, no respiratory effort will occur.

Orthopnœa is that condition in which difficulty of respiration is marked except when the animal is in a standing position.

Asphyxia (literally pulselessness) is a complicated condition due to insufficient supply of air for respiratory purposes. It commences as dyspnœa, convulsions with violent expiratory efforts succeed, and, finally, exhaustion sets in, leading to death. In the later stages of asphyxia the animal is stretched out in a recumbent position, with dilated pupils, loss of general sensibility, scarcely perceptible pulse, visible mucous membranes dark purple in colour, respirations deep and slow. Finally, he gasps for breath, extends the limbs, shudders, and dies. And on post-mortem examination the lungs, right side of the heart, medulla oblongata, and various body tissues are found in a state of venous engorgement. Lungs, heart, and medulla are all concerned in the fatal result,

neither of these organs being stimulated because of the deficiency of oxygen. Inhalation of such heavy gases as prevent access of oxygen to the lungs, suffocation, and many other diseased conditions bring about death in this way. Sometimes the expulsion of air from the lungs is laboured, and accompanied by a harsh rattling sound; the breathing is then said to be STERTOROUS. It depends upon the movement of velum pendulum palati by the expiratory current, and may be observed in cases of parturient apoplexy, for instance.

COUGH is brought about by a deep inspiration, the glottis is then closed until the outward current of air suddenly forces the vocal cords apart, when the air escapes with a sharp sound, and emerges either through the nostrils or mouth with some force, carrying with it any foreign body, such as a mass of mucus, &c., which may have been about the glottal opening. Cough depends upon reflex nervous action, and may be *primary* when the irritation exists in the lungs or air passages, or *secondary*, when due to irritation of the stomach, intestines, or other parts having nervous communications with the respiratory apparatus. We speak of harsh, difficult, paroxysmal, suppressed, and other coughs which do not require special description. Some coughs are considered pathognomonic signs, such as that of pleuro-pneumonia zymotica.

Oxygen introduced by the process of respiration into the blood is the grand agent in the production of animal heat. It combines with various matters, whether in the blood or in the other tissues, and produces with them carbonic anhydride and water (which are passed off by excretory organs, especially the lungs) and heat, which enables the several parts of the body to perform their functions. Observation has proved that for each species of animal we may determine a standard internal **temperature**, which proves useful in the diagnosis of disease, especially when of an epizootic and contagious character; to a slight degree individuality modifies the readings. Though thermometry is yet in its infancy many valuable results have been obtained

from it. The clinical thermometer (self registering) is the instrument used, and proves a most valuable aid to the veterinary inspector of contagious disorders. The vagina, mouth, and preferably the rectum, are the seat of insertion. The instrument requires to be "set" to near the expected reading, as by warmth from the hand, to be introduced a short way and then moved farther in, and to be rested against the walls of the cavity for about three minutes. These precautions are mentioned, as neglect of them may lead to imperfect observation. Ordinary physiological influences as exercise, digestion, &c., give rise to slight variations of internal temperature, but a rise of 2° or 3° is sufficient to lead us to suspect some febrile disturbance, and it has been found that a rise of the internal temperature is the earliest perceptible indication of various eruptive fevers. It therefore is a valuable indication of the advisability of separation when it occurs in animals which have run risk of contagion. A marked fall in temperature below the normal occurs in most cases shortly before death, and a low temperature is observable in typhoid fever and other diseases of a low or asthenic type. When this instrument is not available we must resort to the *usual methods of investigation of the surface temperature.* Coldness or the reverse of the extremities, of the mouth, of the expired air, must be estimated by our sense of touch, while care is taken to note any variations of these points, either at different times or at one and the same time among similar members. Any tendency to coldness or unequal temperature of these parts must be viewed with suspicion, as indicating deficiency or perversion of the blood supply whereby heat is diffused throughout the body. Excessive warmth indicates febrile conditions. A fall in temperature of the surface is generally a precursor of death, so we often read of "deathly coldness of the extremities." The conditions of the skin also require attention, it is the principal regulator of internal temperature, and the effects of its disorder are well seen in the rise of the mercury in fever cases. Its supply of blood and its nervous organisation are very marked, so it is

liable to disorder, and very early indicates systemic disease. It varies under diseased conditions in its moisture and smoothness as well as temperature. We see it dry and harsh, with an erected condition of its hairs, "staring," as it is termed, in most disorders. It may be bedewed with moisture, locally or generally, as a result of pain. While coldness with dampness—"cold sweats"—are a sign of approaching dissolution. The mucous membranes exhibit variations in conditions visible to the eye, and thus serve to supplement the conclusions arrived at from the state of the skin; they become reddened in fever, purple in certain morbid conditions of the blood, pale in low fever and other debilitating conditions.

The *various excreta* should be most carefully examined as to their quality, quantity, and mode of expulsion. Each excretion has a definite normal composition as exhibited by certain physical and chemical characters. Odour, appearance (including colour, form, and arrangement of components), consistence, and in some cases even taste, exercise the special sense faculties of the observer. Specific gravity is especially altered in the fluid matters given off from the body, such as urine and milk; it is tested by modified forms of the hydrometer, or by sp. gr. balls, which sink or float according to the density of the liquid in which they are placed. The fæces and urine should be subjected to physical and chemical tests. Sweat, saliva, and especially milk should be likewise examined. We shall hereafter note the special features of various excreta and secretions as altered by disease. Among other ejecta the expired air must not be forgotten; its odour often leads to diagnostic inferences. Microscopical examination enables us to determine whether those constituents of excreta which have a definite form present their ordinary characters, and are in proper proportion. The microscope is a most useful aid to diagnosis, and as having a wide utility may be here mentioned. Moderate powers, as the $\frac{1}{5}$-inch and $\frac{1}{2}$-inch by good makers, are sufficient for ordinary diagnostic purposes. The blood

may be obtained for examination in any case; its characters in such disorders as leucæmia and anthrax are diagnostic. Morbid products of various kinds, as discharges from membranes and new growths, may disclose their nature to the microscopical observer. Parasites, as ova, immature forms, or adults, may by this instrument be proved to be present in active disease reasonably attributable to them. The spectroscope is now used by pathologists and physiologists; its application to veterinary surgery affords an untrodden path to reputation for some future observer.

In our examination of the patient we require next to examine the special features of the case. The indications derived from the observations above mentioned are usually of a general rather than a special character, and at every stage of the examination we must endeavour to determine whether the conditions observed are due to local or general disorder; the special features of the case have generally somewhat of a diagnostic character, so much so that from the messenger sent to request our services we may sometimes learn the sort of case which we are about to take in hand. The popular names of disorders are not without their use (thus farm labourers can understand the nature of "dropping after calving" to a certain extent), and though not always correct, will enable the practitioner to select such instruments and medicaments as are most likely to be urgently required.

Some means of determination of symptoms with a view to diagnosis are special in their application. Thus, mensuration, auscultation, and percussion will be considered when treating of diseases of the thoracic viscera.

These means, nevertheless, have somewhat a more extended application; thus, auscultation has been recommended for determination of the presence of a fœtus in utero, and it is a most important means in diagnosis of deep-seated fractures, while percussion assists in the distinction of tympany from impaction. We must especially lay stress upon the value of MANUAL EXPLORATION, either by introduction of the lubricated hand into the rectum, vagina, or

mouth, or by manipulation of the surface, whereby we are enabled to ascertain by touch the form of superficial structures, their relations, and size, determining whether these are normal or abnormal. Their consistence is detected by palpation, skilled touch. The "*tactus eruditus*" reveals many obscure states, such as deep-seated abscesses, aneurisms, &c.

The ophthalmoscope and other valuable instruments are limited in their application. The exploring or grooved needle must be mentioned here, for its value in deter-

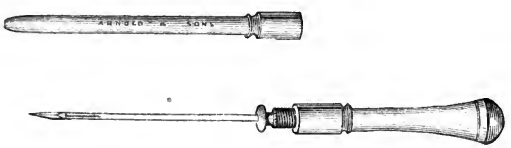


FIG. 1.—Exploring trochar (used for the same purpose as the grooved needle).

mining the contents of fluctuating swellings, cavities, and the constituents of tumours. It is so small as not to seriously injure the parts into which it is introduced. Its groove or cup brings up sufficient material for microscopical examination. It is to us what the dredge is to the deep-sea explorer. It must not be supposed that the methods of observing symptoms suggested by us require to be all adopted in every case. Our aim is to ensure *systematic* examination of those symptoms of disorders which from their general prevalence may be deemed of minor importance. The determination of the seat of disorder will suggest to us which of the less general aids should be adopted in any particular case.

Prognosis must depend upon extended diagnosis. It too frequently assumes the character of simple guesswork or of empirical surmise. The practitioner should in fancy "see through" his patient, should know what parts are diseased, their pathological conditions, with the possibility of renovation, the resisting power due to constitutional energy of the patient; also the probable influence of medicinal means. He must note how the disease tends to interfere with essential vital functions, and especially its influence upon the "vital trio," the brain, heart, and lungs.

DEATH may be either systemic or local. This is a direct result of the composition of the body of cells bound together to form a complicated mechanism. Local death is of two kinds, molar and molecular. In the latter form cells die by themselves and at different times, and thus a gradual loss of tissue occurs; the former results when a number of cells and other tissue elements simultaneously succumb to some injurious influence. Ulceration is molecular, gangrene is molar death. Local death results from systemic as soon as the amount of nutritive material supplied to each tissue by the last blood which entered it has been exhausted. So the most active tissues die most readily, while less highly-organised parts retain vitality for some time after systemic death. It must be remembered also that the life of each part of the body varies in its duration,and that in the course of life of such an individual as an ox, every element of a tissue is not always the same, but consists of a number of short-lived minute bodies which succeed one another. The blood is the most important bond of connection between all the body-cells. Of the value of the nervous system in this respect we are not so assured. The action of each cell depends upon a due supply of fresh blood containing nutritive matter. Cessation of the circulation of the blood is in every case the immediate cause of death. "The failure of the heart may arise in itself, on account of some failure in its nervous or muscular elements, or by reason of some mischief affecting its mechanical working. Or it may be due to some fault in its internal medium, such for instance as a want of oxygenation of the blood, which in turn may be caused by either a change in the blood itself, as in carbonic oxide poisoning, or by a failure in the mechanical conditions of respiration, or by a cessation of the action of the respiratory centre. The failure of this centre, and, indeed, that of the heart itself, may be caused by nervous influences proceeding from the brain, or brought into operation by means of the central nervous system; it may, on the other hand, be due to an imperfect state of the blood, and this in turn may arise from the imperfect or perverse action of

various secretory or other tissues. The modes of death are in reality as numerous as the possible modifications of the various factors of life; but they all end in stoppage of the circulation, and the withdrawal from the tissues of their internal medium" (Foster).

The following methods of death may be remembered:

Death from ANÆMIA, due to cessation of blood-supply, as after profuse hæmorrhage. The symptoms observed in such cases are running down pulse, respirations irregular, pallor of visible mucous membranes, coldness of extremities and of general body-surface, which may be bedewed with cold sweats; dilatation of the pupil, and loss of sensibility of the retina; loss of voluntary power, and, finally, convulsions. The first vital organ which fails in this case is the brain. The recumbent position, therefore, tends to prolong life by mechanically keeping up the supply of blood to that important organ.

Transfusion of Blood has been successfully resorted to in such cases in man. It is a dangerous operation to the healthy animal from which the blood is taken. It has been accomplished experimentally in the lower animals by connecting the carotids of two individuals by a tube, such as an ureter (Percivall). Thus, it has been proved that the blood must be from individuals of the same species.

Death from NECRÆMIA occurs in blood diseases where the vital fluid has lost the stimulating power by which it excites the heart to action, as a result of putrid decomposition.

Death by ASTHENIA is sudden cessation of the heart's action, and may be due to poison or shock, as in lightning injury. After death the right side of the heart is found to contain venous and the left arterial blood. This form of death is also known as *syncope*, but this term is generally also applied to anæmic death. Asthenia sometimes occurs gradually, then the pulse becomes irregular, and the blood supply to distant parts of the body is defective. This culminates debilitating disorders.

Death by ASPHYXIA has been elsewhere described. *Apnœa* does not cause death, it accelerates life.

Death by **coma** commences at the brain. The symptoms present are, firstly, those due to deficiency of cerebral energy, loss of sensation and power of voluntary motion, stupor, with slow stertorous breathing, and later the medulla becomes involved, and the respiratory centre ceases to perform its function, and the right side of the heart becomes blocked up with dark blood. Apoplexy causes death in this way. Prolonged artificial respiration may enable the medulla to regain its energy, as when coma results from certain poisons.

Our prognosis requires especially diagnosis of the pathological conditions of the diseased parts, and makes a knowledge of MORBID ANATOMY, sometimes termed INTIMATE PATHOLOGY, a matter of the highest moment. The anatomical changes which occur in organs during the progress of disease vary according to the structure of the parts and to the nature of the diseased action. The objects of morbid anatomy are to determine exactly the changes which structures undergo as a result of diseased processes, how those changes are related to each other, how their causes have operated to produce them, and how they are liable to affect the wellbeing of the animal. The methods of morbid anatomy comprise examination of all organs, tissues, and elements which have been altered by disease. These parts may be procured in many cases from the living animal, but in others only on post-mortem examination. They require to be subjected to all available processes, physical, chemical, microscopical,—indeed, the study of morbid anatomy is but a branch of diagnosis—the extension of its methods as above enumerated. Our determinations of the changes which have occurred in an organ are only made in some cases after death, and the information thus gained must be applied at an earlier stage of future cases. The changes which structures undergo during disease may be in situation, structure, form, and size; also it seems that in some cases their function may be changed either by increase, decrease, or perversion without *appreciable* alteration in structural characters. *Displacement* of elements, tissues, and organs results in

interference with function when such displacement also causes change of structure. Thus, most of the non-malignant tumours are said to consist of normal tissue-elements out of place, and may exist without seriously disturbing vital functions until their bulk causes them to interfere with neighbouring parts in a purely mechanical manner; and as soon as structural changes of these neighbouring parts causes them to become secondarily involved, the disease assumes a more urgent character. Again, a displaced bowel in a case of hernia causes no inconvenience nor true pathological condition until it becomes strangulated, and thus structurally disordered. Displacement simply of tissues seldom occurs. *Changes in size* of a tissue-element may be of increase or decrease, and these may be due to alteration of constituents, or to simple variations in their quantity. The various degenerations are changes in constituents generally either of a retrograde or a retrospective character. To understand this, we must recall to our minds the elementary structure of the body. It originates as a simple cell, or even earlier, perhaps, a simple mass of protoplasm. This cell is endowed with all the properties of a living organism, dependent upon the high vitality of its protoplasm; hence it exhibits the phenomena of irritability, contractility, spontaneous power of movement, and reproductive energy. All the elements of the adult body are lineal descendents of this primitive element, but each has progressed in a special line; hence, in a muscle-cell contractility is the prominent property; in a nerve-cell spontaniety or irritability, and in white fibrous tissue-corpuscles probably the control of local nutrition. Under certain diseased conditions, each of these forms of cell is liable to regain some of its lost or dormant powers; thus, the tissue-corpuscle becomes a reproductive cell, and proliferates freely in suppuration; the muscle-cell exhibits spontaneity. Such are *retrospective degenerations. Retrograde metamorphoses* are much more frequent, the principal being mucoid, colloid, and fatty degenerations.

Mucoid Degeneration consists in such an alteration of the tissues that they assume a mucus-like character. It

is considered to be generally a retrospective change, whereby the primitive characters of the tissues are resumed; it occurs especially in connective tissues and cartilages, affecting generally the intercellular substance.

Colloid Degeneration depends upon the conversion of the protoplasmic contents of cells into a tenacious jelly-like material. The cells are burst by accumulation of this matter, and considerable lumps of gelatinous material are produced. The thyroid body is the most frequent seat of this change, but both mucoid and colloid changes may occur in tumours, whether of a malignant or non-malignant type. Neither of these has any bearing of importance upon cattle pathology, though we shall find it occasionally necessary to allude to them.

Fatty Degeneration is extremely liable to occur in organs which have nerve or blood supply interfered with, for it is a retrograde process resulting from deficient supply or appropriation of nutritive matter. It is a conversion of the contents of the cells of a tissue into fat, which may accumulate so considerably as to burst the cell-walls, whereby a secondary process of diseased action

Fig. 2.—Fatty degeneration of the Heart. × 200 diameters. After Harley and Brown.

occurs. It affects especially the muscles, as also the lining membranes of arteries and the bowels (in which case the epithelial cells are involved). This process is of very considerable importance, for it occurs often when a morbid product is to be absorbed and passed into the blood. Sometimes caseous change supervenes upon this

form of degeneration, the part affected becoming a mass of substance of a cheese-like character, yellow in colour, inelastic, and rather soft. Tuberculous deposits are very liable to undergo this change, as also certain malignant growths.

Calcareous Change depends upon the deposition of lime salts in the intercellular substance of a tissue, whereby it assumes a gritty character and becomes opaque and resistant. It occurs very frequently as a result of excessive activity of the process which normally hardens the costal and laryngeal cartilages of old animals, and is a means by which deposits are rendered permanent and prevented from absorption.

These processes of degeneration take place normally in certain parts of the body, and when they occur in disease are either in excess in normal situations, or in abnormal sites. The mucoid and colloid degenerations tend to softening of tissue. Fatty degeneration places the matter in that condition under which it is most fit for removal. Caseous change tends rather to permanency, while calcification exhibits this to a still more marked degree. The calcareous change generally assumes the character of an infiltration, involving intercellular tissues rather than the cellular elements of a part, and resulting from the deposition of matter from the blood instead of its production as a result of change in the protoplasm of the cells. Fatty infiltration is very common, involving such organs as the liver and muscles (especially the heart) in animals fattened for slaughter. This proves prejudicial when the accumulations of fat pressing upon the tissue elements of the affected part impair their nutrition. Accumulations of fat of this nature occur physiologically in the processes of fattening, then the connective-tissue corpuscles are affected, and this very frequently occurs also in disease.

Pigmentary Infiltration especially affects the lungs of old animals.

Amyloid Infiltration has been observed in the liver, and consists in the deposition from the blood of a starchy

material, which gives to the organ in which it occurs a waxy character. The process generally commences in the small vessels of the part. It has not been found, as yet, to have much clinical importance. Special chemical, microscopical, and physical tests enable us to determine the presence of these changes in parts. These will be found recorded in more special works. Fatty, calcareous, and pigmentary changes, when sufficiently advanced to produce serious disorder, can readily be detected by the unaided senses of the observer. Let it be clearly understood that all these degenerations and infiltrations are physiological processes in excess or out of place; they may also be deficient, as occurs in rachitis where there is deficient deposition of lime in the bones. They result from perverted states of nutrition, dependent upon conditions of the blood or of the cell-elements themselves. Certain forms of degeneration lead to increase in the size of organs, and very considerable modification of form. The tissues are so arranged as to form solid or hollow organs. When the former are the seat of changes their increase in size and change of form causes them to press upon neighbouring parts, and thereby interfere with functional duties; or softening with rapid enlargement may lead to rupture, as is sometimes seen in the liver. It must be remembered that very considerable degeneration of an organ may occur without alteration in bulk, increase in size of some parts atoning for diminution of others, and *vice versâ*. Here we have a case of degeneration with atrophy. When a hollow organ is involved in these degenerative processes they may lead to thickening of its walls with or without diminution of its cavity, or to thinning of the walls—atrophy—a condition which, with concomitant softening, tends to produce rupture. When an organ is subjected to free supply of nourishment, with high functional activity, it becomes HYPERTROPHIED, this condition consisting of an increase in the number (hyperplasia) or size of active tissue elements; such a change must be carefully distinguished from other forms of enlargement. It occurs often as a provision against disease;

thus the bladder may have its walls thickened when any obstruction in the urethra interferes with the passage of urine. The reverse of this is ATROPHY or wasting, which is described as of two kinds, simple and numerical. The former depends upon decrease in size of the proper elements of a tissue dependent upon deficient supply of nutritive matter, the latter is a more advanced stage of the same state in which actual removal of tissue elements has occurred. Atrophy may result from an imperfect supply of blood or from imperfect ability to appropriate nutritive matter, such as often results from inflammation. It may be difficult to ascertain this state from simple inspections of organs, for as the useful elements are removed the connective elements may be increased in quantity, or displacement of some material into the organ may serve to maintain its size. The ADDITIONS OF MATERIAL TO AN ORGAN in almost all cases take place from the blood, and hence have the character of infiltrations. They may be solid, liquid, or gaseous. Liquid matters most frequently overflow from the blood, or are removed in excess from that fluid by over-excited tissue elements. They contain solid matters in solution, and as their fluid portions are most readily removed by absorption, solid *deposits* may remain behind. These latter either become organised by extension of vessels into them, undergo calcareous change and become permanent (but in the condition of foreign matters), or undergo retrograde changes, especially the fatty, and become absorbed. We shall have more to say about these processes when treating on inflammation. Accumulation of liquid added material constitutes DROPSY. Gas sometimes occurs in a tissue either as a result of gangrenous change of the tissues (the blood for instance) as in black quarter, or as a result of ill-explained nutritive changes in a part, or entry of air through an external or pulmonary wound. The gases which occur are such as normally exist in the blood or the atmosphere. Having dealt with the general changes which structures undergo as a result of diseased processes, we must next examine the characters of those processes themselves.

PHLEGMON or INFLAMMATION is defined to be "perverted nutrition of a part resulting from the application of a stimulus not sufficiently powerful to cause immediate death." It is a familiar but complicated series of phenomena of the highest pathological importance, since it occurs in all tissues, and varies considerably according to its seat. We may consider it is nature's method of rising to the emergencies of injury, whereby repair is brought about. In all cases it seems to follow injury of the part affected; thus it ensues in the majority of cases of wounds, and originates in internal organs either as a result of local injury, or when impressions made upon the surface of the body have proved injurious to more deeply seated parts through the intimate nervous unions which occur between the structures. Of these nervous unions we are not yet assured by physiologists. It cannot be expected, therefore, that the pathologist will be in every case able to determine how any cause which he suspects of having originated internal inflammation acts. We accept this theory of the nature of inflammation since it sufficiently explains all the phenomena of that condition to afford us a good practical basis. Inflamed parts are found to be the seat of stagnation of blood in the vessels, of transudation of its fluids with migration of its formed elements, also of an altered condition of the tissue elements. Probably the latter change is the most essential, for it is marked in cartilage and other tissues which have only indirect blood supply. It consists of high reproductive activity of these cells (*proliferation*), the products not being so highly developed as the parent cells. The stagnant condition of the blood in the vessels is brought about gradually through certain stages. It is found, by observations of the circulation in the blood-vessels of an artificially inflamed transparent membrane, that dilatation of the vessels first occurs with acceleration of the flow of blood, which, however, very soon becomes retarded, then irregular and oscillatory until stagnation—"stasis"—ensues. Then a large number of colourless corpuscles are found to have accumulated in the affected vessels near the walls,

while red corpuscles, aggregated into bundles, lie nearer the centre of the vessels. Migration now occurs as a result especially of the amœboid activity of the white corpuscles, whereby they are able to penetrate the protoplasmic, and, therefore, living walls of the capillaries. Thus they, and sometimes a few red corpuscles, pass into the tissue interspaces, and intermingle with the new generation of cells produced by the proliferation of the tissue elements. At the same time the serous portions of the stagnated blood transude through the walls of the vessels, and thus originates EFFUSION as well as EXUDATION, for they are rich in solids. Effusion of serum and exudation of lymph are early accompaniments of inflammation; they occur, to a more or less degree, in almost every case, and are the principal cause of SWELLING. This depends, also, to a certain extent, upon the conditions of the vessels in the parts bordering on that inflamed. They are very full of blood coursing rapidly through them, are in a state of hyperæmia or congestion. The presence of this large quantity of rapidly flowing blood, with, perhaps, also the rapid tissue changes in the inflamed part, generates the characteristic *heat;* to the congestion and amount of blood, even in the seat of disease, the REDNESS, characteristic of inflammation, must be attributed; while pressure from effused material and distended vessels is the cause of the painful nature of the process. The pain present must also be attributed to heightened sensibility of the nervous structures. It is related to the hardness of the part, hence inflammation of unyielding organs is most painful. The reproductive activity of the tissue elements replaces their normal function, and the rapidity of new cell formation prevents the elaboration of intercellular substance, hence the intercellular material accumulates in a state of imperfect development as fluid, and tends to increase the added liquid and plastic material which has been thrown out. Effused liquid material can be taken up again by the capillaries and lymphatics of a part with facility if the vessels have not themselves undergone change. When the latter complication is

present fluid accumulations occur, which constitute Œdema when they are in areolar tissue, and Dropsy (hydrops) when into cavities of various kinds. These may take place apart from inflammation when an excess of liquid material exists in the blood, or when the vessels are over-distended. The former condition occurs in cases of debility resulting from defective supply of nutritive matter; also certain poisonous materials aggravate their effects by causing excessive fluidity of the vital fluid. An illustration of the latter condition may be drawn from general dropsy, whereby excessive distension of the veins is relieved when any obstruction prevents return of the blood to the right side of the heart. When the material added to a part has a more solid character, it primarily assumes the form of Coagulable Lymph. This is fibrinous material which is deposited between tissue elements, rendering the parts abnormally hard, or as bands extending across cavities, also membranes lining them, and it will be noticed in the straw-coloured liquid portion of the serous effusion. When all active inflammatory change has subsided, the lymph tends either to permanency or to disappearance. It may be rendered permanent either by organisation, when vessels shoot into it by ordinary processes of development and it thus becomes vascular and in process of time somewhat like areolar tissue, or by calcareous deposition in its substance. The former change occurs in the repairs of any large gap of living tissue which has resulted from injury. It causes filling up of abscess cavities, and of deep penetrating wounds, but is not always so salutary; for when it occurs in such a cavity as the pleural sac, by uniting the lungs to the wall of the chest, it may seriously impede respiration. Calcification is the process which normally occurs in the hardening of lymph between the fragments of a broken bone forming the mass known as callus. Its appearance is not always desirable, thus when it takes place in the walls of arteries it renders them liable to rupture, and frequently its presence acts as an impediment to movement, as when false anchylosis results from the calcification of ligaments around joints.

Suppuration is that result of inflammation which is manifested by the production of the fluid which is familiar to us as pus. It results especially when inflammation runs high in a very vascular organ, but may occur under different circumstances. Pus consists of highly active corpuscles, which closely resemble white blood-corpuscles, and float in serous fluid—Liquor Puris. It has a sp. gr. of 1030. This fluid is simply the effused material with a large number of cells resulting from proliferation of tissue elements, and migration of leucocytes. This result

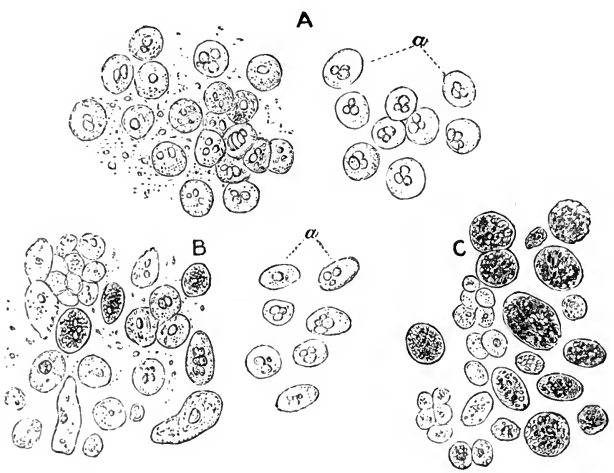


Fig 3.—A. Pus corpuscles from an abscess; (*a*) the same after treatment with acetic acid. B. Mucus corpuscles from the Schneiderian membrane; (*a*) after a drop of acetic acid has been added. C. Mucus corpuscles speckled with pigment granules from a case of chronic irritation of lining membrane of the larynx. After Harley and Brown.

of inflammation is most frequent when a natural moisture of the part and capability of yielding to swelling are properties of the diseased organ or tissue. While exudation most frequently occurs on serous membranes, the mucous surfaces generally when inflamed produce pus; but pus may be produced by a serous membrane and plastic deposits by a mucous membrane, such as that of the bowel or trachea. When suppuration assumes a local character,

and the pus which is formed accumulates in the areolar tissue, it exerts a solvent action upon the white fibrous elements, and thus produces an Abscess. Ordinarily we may observe that the inflammatory process, where less acute at a distance from the centre of pus production, causes exudation of lymph which limits the infiltration of pus into the neighbouring tissues, and constitutes the boundary of the abscess cavity, though forming no distinct membrane. This firm limiting tissue gives way with extension of suppuration, and at the same time, the parts external to it, which previously were only the seat of effusion of serum, have lymph exuded, and thus in turn prevent infiltration of pus into the undiseased areolar tissue. So, in puncturing a large or a small deep-seated abscess we pierce first tissue with serous effusion, then tissue with lymph exudation, and so arrive at the abscess cavity. In chronic abscesses the inflammation has subsided, as also has the serous effusion. The lymph deposit has become organised to form a wall of the abscess cavity in which has accumulated pus, often of a fœtid character, but sometimes broken up into the liquid serous portion and the solid materials, the latter being converted into more or less regularly rounded and hardened masses of a curdy or cheesy character, which are bathed by the fluid. These abscesses are sometimes termed *cold;* they are seen in deep-seated positions where the inflammation has been only moderate in intensity.

Purulent Infiltration occurs when collections of pus are allowed to enter the areolar tissue of an organ, either by non-deposition of lymph circumscribing the seat of pus formation and leading to abscess, or by the giving way of only a thin layer of this material. It is especially liable to occur in the less active forms of inflammation, and in organs with a considerable amount of areolar tissue; thus, it may be observed in scrofulous disease of the lungs, and leads to rapid spread of diseased action. Sometimes pus is found in serous cavities. When the pleura is the seat of this the disease is termed *empyema*. This state seldom,

if ever, results from pus production by the serous membrane, but from bursting of an abscess into the serous sac. It has been observed that layers of fibrous tissue, fasciæ, aponeuroses, limit the extent of abscesses. A knowledge of the position of these is, therefore, important from a surgical aspect, for when externally placed to the pus accumulation they oppose that extension of the abscess towards the surface which leads to evacuation of the pus by bursting through the skin. The *local symptoms of formation of an abscess* are primarily hardness of the diseased parts, with an œdematous condition of the tissues around, with elevation of temperature, and throbbing of the arteries of supply; then the centre of the seat gradually becomes softer, and at length fluctuates on pressure. The part is swollen and most prominent centrally. After this the fluctuation extends from the centre, where the hairs fall off, and a slight amount of serous fluid exudes until the pressure of pus in the abscess bursts the skin, which has been much attenuated by absorption, and thus the pent-up fluid escapes; and any which forms after this also escapes, for nature has produced an opening with a jagged edge, such as does not readily close. As the pus, which is now produced, exerts no pressure on the abscess-walls, a rapid closure of the cavity results from deposition of lymph around its walls, each layer undergoing changes which terminate in conversion of them, in order of seniority, into an organised tissue somewhat resembling the white fibrous. This process is termed granulation. By it, finally, the cavity is filled; then the external wound closes. Escape of pus by bursting of an abscess on to the surface of the body, or of a mucous membrane, is a very salutary process. But it may take place into serous cavities and other internal spaces when the result is not so satisfactory. Evacuation of pus from a mucous membrane is often to be encouraged as being nature's method of relief of its inflamed state. When pus does not become removed by natural or artificial evacuation, its permanence or the reverse will depend upon the state of the vessels of the parts, and also on whether its corpuscles undergo the

retrograde process of fatty degeneration, pus-cells seem to be never absorbed. When they have undergone fatty change, and with the Liquor Puris form the so-called Pathological Milk, this may be taken up, just as so much chyle would be, by the lymph-vessels. The blood-capillaries probably assist, but when neither blood nor lymph-vessels can take up the metamorphosed or unchanged pus, a cold abscess results. **Pus** is of various kinds:

Laudable, when it has a creamy, whitish-yellow appearance; is devoid of smell and rich in corpuscles. This is the form which is familiar to us as occurring in well-matured abscesses.

Fœtid, when it has undergone decomposition, either from a long pent-up condition, or from a depraved state of the parts producing it.

Sanious, when it is thin and watery, and intermingled with blood in small quantity.

Ichorous, when thin, watery, almost devoid of corpuscles, largely made up of cell *débris,* and often with a marked odour, and an acrid, irritating character. This is produced in parts which are of low organisation, or have been reduced in vitality by long continued diseased action. It occurs in diseases of the feet in long standing fistulous ulcers, where the healing process is at a standstill.

Specific, when it contains the virus of some specific disorder, as when it is produced by the mucous membranes in cattle plague. Such pus when used for inoculation transmits the specific disorder.

Strumous, when resulting from the breaking down of tubercle. This is white, watery, and has specific characters.

Pus may be mixed with other fluids as in muco-purulent discharges from mucous membranes. The characters of *Inspissated Pus* which occurs in chronic abscesses have been already alluded to.

Caries and Ulceration are processes of molecular disintegration, which sometimes occur when inflammation cuts off the nutritive supply of a part in a gradual manner.

Caries especially affects articular surfaces of bones as well as those portions invested by fibro-cartilage. In it no tendency to repair is exhibited but the process of extension of the disorder progresses slowly, and removal of the articular lamina of the bone by molecular disintegration leads to death of the cartilage which it supports, and so to roughness of a surface which for due performance of its functions ought to be smooth. Hence results secondary disease of the opposing surface, whether articular or tendinous. The process of caries is remarkable for the small amount of liquid product, and hence generally the absence of marked distension of the joint capsule or wall of the tendinous sheath. Ulceration is of much more general occurrence, and as removal of tissue occurs at one part, repair takes place at another. Pus is produced often in very considerable quantity by ulcers, and may be of any of the different kinds mentioned above. Ulcers are local deficiencies of structure, which generally appear on mucous membranes or the skin as breaches of the epithelial layer, with the deeper layers of the membrane more or less involved. In the cornea we sometimes see ulcers consisting in local deficiency of the tissue of the cornea propria, in which the conjunctiva is not involved; this is due to the fact that the latter membrane is supplied with nutriment from a different source than the cornea. As a rule, the epithelium is nourished by the deep-seated structures, and is early involved in the diseased process. We must not in all cases consider ulceration due to death of tissue-elements; it probably much more frequently results from cell proliferation, which, replacing the parent by numerous corpuscles in a fluid medium, leads to breach of tissue, and formation of a fluid with suspended cells, which either escapes as pus, or is removed by the action of absorbent vessels. The breaches of tissue resulting from ulceration and suppuration are repaired by GRANULATION. This consists in the production of small pointed projections over the exposed surface, which are found to be composed of cells, the deeper seated of which undergo organisation, while the superficial degenerate into pus. By their

growth these projections coalesce, and new blood-vessels shoot into them from the neighbouring parts. Thus, by formation of successive crops of granulations, their fusion and organisation, the ulcer is constantly reduced in size whenever the activity of repair exceeds that of disintegration. Thus, also, we generally see pus produced in considerable quantity from a granulating surface; but it seems possible by means of dressings to increase granulation at the expense of suppuration, and thus promote rapidity of healing of a wound. The granulation tissue tends to the conversion of its cells (exudation corpuscles)

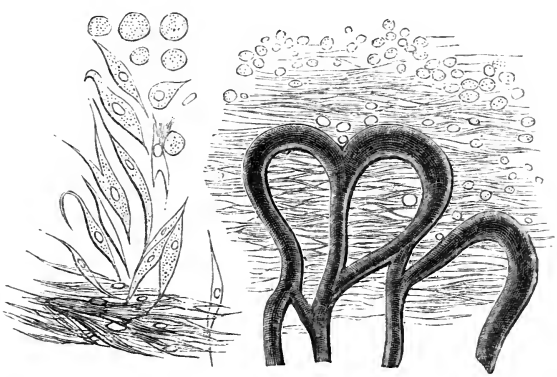


FIG. 4.—Granulation tissue. (After Gant.) To the left, granulation corpuscles with rounded pus cells. To the right, the newly formed vascular loops.

into proper tissue-elements resembling those of ordinary fibrous tissues. The process of cicatrisation, whereby the breach is "skinned over," will be dealt with when we treat especially of wounds. **Ulcers** are of various kinds, according to their shape, products, causes, and granulations.

The *Simple* or *Healthy Ulcer* occurs in animals of healthy constitution, presents small, vascular granulations, uniform in size and in diffusion over the surface, which is concave. Laudable pus is produced, and the edges are not hard.

The *Inflammatory Ulcer* depends upon an irritable state of the constitution, and presents few granulations, a raw

appearance, and ichorous or sanious pus. When the irritation is local, it gives rise to excess in size and extreme painfulness of granulations, while the surrounding parts are congested and œdematous—such is an *Inflamed Ulcer.*

Weak Ulcers have large, œdematous, pale, flabby granulations; they occur on œdematous organs.

Callous Ulcers are usually deep with pale base, presenting small, imperfectly formed granulations, and having an ichorous discharge of tissue *débris.* The borders of the ulcer are thickened, hard, and project considerably.

A *Fistula,* or *Sinus,* often has this character. Fistulæ penetrate deeply into parts, and open at each extremity. Sinuses have only one opening to each; but we may have fistulæ and sinuses which present all the characters of healthy ulcers except their shallowness.

Specific Ulcers are such as occur in specific diseases. Sometimes these lesions are diagnostic, but often their special character may be proved only by the nature of the pus produced by them.

A *Cold Ulcer* is surrounded by a purple ring of congested tissue, and is of a very painful character. It is very often specific, and results from marked deficiency in circulatory energy in the affected part. It occurs under a special form in those parts of old animals which are far from the centre of circulation. It is then termed "*Senile Ulcer,*" and is characterised by a deficient tendency to repair with a liability to rapid spread by sloughing of tissue. Thus, several ulcers "run together," producing a widespread breach of tissue. They are then said to be *Confluent Ulcers,* and this tendency to blending of ulcers is marked in several specific disorders.

The *Phagedænic Ulcer* rapidly spreads by sloughing of masses of neighbouring tissue. A large foul surface with an ichorous discharge is thus left. This serves to draw our attention to molar death, which may result from inflammation, and is termed GANGRENE, depending upon the processes which constitute *sphacelus* or *mortification.* When the supply of blood is cut off from an organ or any

part of the body it dies, and chemical forces are enabled to bring about its decomposition. Sometimes the blood is not permitted entry into a part through obstruction of the arteries of supply; then dry gangrene may take place, which consists in the drying up of the tissues, their diminution in size, and complete loss of all vital properties. The dry, mummified mass remains as a foreign body, perhaps becoming invested by a coating of lymph. This has been observed in the case of pleuro-pneumonic lung. When a part is the seat of moist gangrene, it becomes very dark in colour, pits on pressure, swells in consequence of the liberation of gases by decomposition and their accumulation beneath the epidermis, which they raise in spots forming *blebs*. A sanious discharge with fœtid odour takes place from the surface of the mass, which is sodden with a similar material, and has lost all sensation and other physiological processes, and is very cold. Moist gangrene is more frequent than the dry form, and depends on impeded return of blood. A part which has thus undergone mortification is removed by *sloughing*. Salutary inflammation sets in on the line of junction of the dead with the living parts, and here consolidation by exudation takes place to prevent infiltration of gangrenous material into healthy parts. Suppuration of this consolidated layer occurs, and thus the dead mass is thrown off. Molar death of bony tissue is termed Necrosis, and the portion of removed material is a Sequestrum. During this process of gangrene the constitutional powers are much diminished, the pulse being small and weak and frequent, and the strength rapidly failing. The animal has a wild, apprehensive look, and is very restless; cold sweats bedew the skin, and there is a gangrenous odour. Sudden cessation of pain often announces this result of inflammation. The termination of the case will be favorable or otherwise, according as the strength of the body proves equal to removal of the slough or the reverse. In old age senile gangrene may occur as a result of deficiency of vital energy, affecting especially those parts most remote from the central organ of circulation.

Resolution is a termination of inflammation most to be desired; it consists in the gradual resumption of healthy conditions of the diseased part. In it the products of cell proliferation are absorbed, lymphy deposits and serous effusions undergo the same fate, and the blocking up of the vessels which has resulted in *stasis* gives way, so that healthy circulation is resumed. When this process occurs very suddenly, as when only stasis and effusion of serum have to be overcome, a few hours suffices for resolution, which is then termed DELITESCENCE. Occasionally this is related to appearance of inflammation in some other organ, when it is termed METASTASIS, a phenomenon which occurs very frequently in rheumatic affections. How this is brought about we are not in a position to say. Cases of false metastasis have been found to be due to direct continuity of structure, and true alteration of the seat of an inflammation may be due to the ill-ascertained conditions of nerve continuity. There are various terms used to indicate the forms assumed by inflammation as dependent on consitutional or local conditions :

SPECIFIC, when it depends upon the presence of special *materies morbi.*

TRAUMATIC, when it is due to local injury from without through mechanical, chemical, thermal, and other agencies.

IDIOPATHIC, when not attributable to any such cause.

STHENIC, when occurring in a constitution with high vital energy, and tending to the throwing out of plastic lymph, which rapidly undergoes organisation, or to suppuration. The pulse being full and strong, and the internal temperature high, and the nervous system in a state of high activity, these cases run their course in a short time.

ASTHENIC, when tending to assume a low character with imperfect lymph deposits which do not circumscribe the accumulations of badly matured pus, which, therefore, tends to spread widely by infiltration into neighbouring parts. This leads to extensive destruction of tissue, and a depressed state of the constitution, the pulse being

weak, quick, and often irregular, and the temperature being liable to marked variations. This depends upon a depraved condition of the blood in the majority of cases.

Acute Inflammation is of the sthenic type, running its course with well-marked symptoms, and passing rapidly either to resolution or to suppuration, ulceration, or gangrene.

In the chronic form both local and general symptoms are slight; the tendency is to firmness and organisation of deposits with permanency of effects, and the conditions which are set on foot by it are slow. Inflammation is considerably influenced in its course and effects by the tissue in which it is located; thus, we shall notice that mucous membranes thus affected tend to suppurate, fibrous tissues to undergo calcification, serous and synovial to exudation of lymph, cartilage to caries and ulceration, &c.

Congestion is a form of diseased action, second, indeed, to inflammation in importance and complexity, but nevertheless exercising an important influence upon pathology. Dr. Williams distinguishes between congestion and hyperæmia, considering the former to differ from the latter in that retardation of movement of blood through the affected part has occurred. In both cases there is excess of blood in the part, but in hyperæmia the flow is rapid and the outfall as great as the income. Hyperæmia is, therefore, not disease; it occurs in every organ or tissue which is in a state of activity. Congestion may be active, passive, or mechanical.

Active Congestion is that accumulation of blood in a part which occurs when the income is great but the outfall is small. It occurs as a result of irritation, precedes the inflammatory process, and often is confused with hyperæmia.

Passive Congestion results from a relaxed condition of the small arteries and the capillaries of a part depending upon deficiency of tone, so the flow of blood becomes slow, and the vessels distended. It may arise either from local or general disorder of the vessels, from imperfect

action of the heart, or from a depraved condition of the blood.

Mechanical Congestion depends upon impediment to return of blood from a part in consequence of pressure on the veins; it generally assumes the passive character. In active congestion there is swelling, pain, redness, and heat, with an exaltation rather than a perversion of function, but practically it is extremely difficult to distinguish from inflammation upon which it verges. Passive congestion is indicated by swelling due to serous extravasation, coldness and deficient vitality of the part, which has a dark blue colour. The swelling is influenced by position of the patient, for it is caused by a watery fluid devoid of plastic elements. Such swellings may disappear very rapidly and occur in pendulous positions. Congestion terminates either in inflammation or resolution, and may persist for a long time, giving rise to EXTRAVASATIONS, either serous or sanguineous, or mixed (sero-sanguineous).

SEROUS EXTRAVASATION may occur either on a serous or mucous surface, or into intercellular spaces. It may be seen in the early stages of catarrh of various mucous membranes, and, mingling with mucus, constitutes the discharge of the early stages of inflammations of those structures. When serum is extravasated into a serous cavity as a result of congestion, it is a salutary relief to the diseased parts, and the liquid can be readily returned into the blood, for the serous cavities are only large dilatations of lymph-vessels. Intercellular collections of serum are similar in their pathological importance. Sometimes, however, accumulations of serous or sero-sanguineous fluid appear on the surface of the body as a result of injury; the surrounding areolar tissue becomes condensed and retains the fluid. Incision into these "serous abscesses" is sometimes necessary.

Sanguineous extravasation is known as HÆMORRHAGE. It depends either upon a depraved state of the blood, or on a giving way of the walls of vessels. Not only in the latter case is unaltered blood displaced, but it is allowed

that a migration of red corpuscles (diapedesis) as well as of white may occur from the vessels under certain circumstances. Hæmorrhage is TRAUMATIC when due to injury from without, and IDIOPATHIC when dependent on intrinsic causes. Traumatic hæmorrhage may be due to injury of arteries, veins, heart, or capillaries, and will be treated more at length under the heading "Wounds." Idiopathic blood-extravasation may be active or passive.

Active Hæmorrhage occurs in plethoric subjects, and is preceded by active congestion. It results from a giving way of the walls of capillary vessels, and the blood which thus escapes is considerable in quantity, of a bright colour, flows rapidly, and coagulates freely. *Passive hæmorrhage* generally depends upon debility and a disordered state of the blood. It occurs in organs which have been weakened by disease, and is often a *symptom* of some value. The escape of blood tends to still further reduce the strength of the patient. In certain blood disorders we find extravasations of blood, either considerable infiltrations of areolar tissue (*hæmorrhagic infarctions*), or circumscribed small patches of blood, *petechiæ*. Rupture of the wall of a vessel, fracture of bone, and other lesions of a like kind, are known in surgery as "SOLUTIONS OF CONTINUITY." These give rise to disorder only when the continuity of structure is essential to due performance of function; thus, a solution of continuity of horn may be present and give rise to no inconvenience if the sensitive structures beneath be not exposed to injury, as from compression. Again, a simple incised wound, when the parts are brought and maintained in contact, may become obliterated by simple growth without the intervention of inflammation. In bones continuity is essential to render them firm bases of support. FRACTURES, therefore, interfere with function, and must be carefully studied. The walls of blood-vessels are constantly subjected to pressure by the contained blood, when a solution of their continuity takes place, therefore, HÆMORRHAGE results.

In the present state of pathology we must admit the

existence of certain FUNCTIONAL DISORDERS, on the understanding that they will probably, with improvement of methods of research, be proved to be due to alteration of structure. The term "Functional disease" is of value clinically, especially in relation to disorders of the nervous system and other parts, with the physiology of which we are not very well acquainted, but as our knowledge of physiology and its relation to structure advances, we trace such disorders to appreciable changes of structure. Functional disease of the rumen occurs in some cases, and leads to accumulation of gas and food in that viscus. Probably the derangement is due to nervous disturbance, for such accumulation is found in many brain diseases. We must be understood, therefore, to imply a certain amount of ignorance when we speak of disorder of function.

In conducting a *post-mortem examination* we must be as systematic and thorough as circumstances will allow, so that we shall be in a position to give evidence on each case to either legal or medical authorities. The note-book should be in constant use, and we must adopt an established routine, to be varied as little as possible with the exigencies of time, place, &c. Thus, the external evidences of disorder must first be noted, position, expression and rigidity of the patient; then the presence of disorder of the skin and visible mucous membranes, any indication of discharges or of injury, the age, sex, condition, and breed of the animal, also special circumstances of history. The carcase of the ox in the field must be supported by means of pitchforks so placed as to sustain the limbs like props. In the cow-house, or barn, or shed, the limbs of one side may be supported by ropes thrown over a beam. In opening the peritoneal sac by incisions through the abdominal walls the conditions of the peritoneum and the position and general appearance of the abdominal organs must be observed, also any abnormality of the contents of the peritoneal sac, which may be bloody, purulent, loaded with flocculi of lymph, contain food material, &c. The stomachs, with the intestines, should then be removed,

and thus the liver, kidneys, diaphragm, and genito-urinary organs are more or less exposed. The situation of each of these should be examined before removal, any abnormal relations and adhesions being carefully noted. To thoroughly examine the genito-urinary apparatus one of the hind limbs should be removed from the hip, and the symphysis of the os innominatum and the neck of one ilium cut through with the saw, and the portion of bone thus loosened removed. Next, the thoracic viscera should be subjected to scrutiny, the articulations between the sterno-costal cartilages and the true ribs having been divided, some of the anterior sterno-costal cartilages of false ribs may be cut through, and thus the sternum drawn away from its position and forwards. To do this the connections of the fore extremities with the trunk must be divided, and the skin reflected from the median inferior longitudinal line of the body. During this process dropsical collections or diseased conditions of the axillary lymphatic glands may be found. The pericardial and pleural sacs must then be examined for they are exposed, and their contents must be observed. The heart and lungs may be then removed *en masse*. Next, the diaphragm and liver may be separated together from the surrounding parts. After this the structures in the lower part of the neck must be separated from their surroundings and examined, but left in position until we have the structures of the fauces ready for removal with them. This is accomplished either by dissection of the skin from the central line of the sub-maxillary space, and a deep incision on either side against the inner surface of the lower jaw, whereby the tongue is freed from its attachments, anteriorly and laterally, and can be drawn between the branches of the lower jaw, or by removal of the skin farther up the side of the face, and amputation of half of the inferior maxilla at the symphysis, and just below the condyle. The mouth, pharynx, posterior nares, and isthmus faucium may thus be examined, and the temporo-hyoid articulations being divided, the tongue, larynx, and pharynx removed with the trachea, œsophagus,

&c. The head having been skinned and disarticulated at the occipital condyles, may be retained for examination of the brain, eye, nasal chambers, &c., *secundum artem*. The subsequent examination of solid organs, variations in size, form, and structure must be noted and determined to be primary or secondary causes of death. The contents of hollow viscera must be retained and examined, and the capacity, form, and structure also placed on record. Finally, a scientific summary of post-mortem results, with conclusions deduced from them, should be drawn up after each organ or tissue exhibiting disease has been specially examined.

Disease may assume various forms dependent upon its method of appearance and the manner in which it runs its course. Thus, *acute* disorders are characterised by short periods of attack and rapid morbid changes leading to death or to resolution in a few days, whereas *chronic* cases last for some time, changes occur more slowly and lead to greater permanent alteration of structure. Such attacks as are active in their phases, but chronic in their effects, are termed *Subacute*. Different diseases generally affect one or other of these characters. Certain blood diseases are very liable to assume the chronic form, rheumatism, for instance, while inflammations of important viscera, as the lungs, heart, &c., are generally acute. When a number of animals of the same species become simultaneously affected with a disease which does not seem to be confined to any special locality the outbreak is said to be Epizootic, but if animals of various species suffer from the disorder it is termed Panzootic. Enzootics are those diseases which affect a number of animals in a circumscribed locality. Thus, eczema epizootica is a panzootic, pleuro-pneumonia zymotica is an epizootic, and anthrax generally manifests itself in enzootic outbreaks. The term Sporadic is applied to those disorders which do not affect a number of animals simultaneously, but now and then an individual becomes attacked, while a number of others subjected to like conditions escape unharmed. Most non-specific disorders assume the sporadic character.

Having determined the nature of the attack under which an animal is labouring, and by the various methods of inquiry above noted, in so far as they are applicable to the special case, having arrived at a conclusion as to the part disordered, and the extent to which it has undergone pathological changes, and to which its altered conditions affect surrounding parts, the practitioner must next determine the method of **treatment** to be adopted and rigidly enforced with a view to restoration of health, or to a condition of fitness for special duties according to the nature of the patient. It has been truly remarked that in many cases a veterinary surgeon has not the opportunity to carry his medicinal skill to its full extent since his patients are almost always viewed as representing so much capital, and not as being in a position to claim moral protection for life so long as it exists. Again, in the majority of cases the veterinary surgeon must *thoroughly* cure his patient, and may find a "patched up" case which would bring his medical *confrère* much credit, is apt to prove even prejudicial to him. Such being the case, it can hardly be a matter of wonder that the study of the treatment of such animals as our bovine patients has not been pursued with such energy as certain other branches of therapeutics. The animal if slaughtered at once will prove useful for food, if kept alive will probably have its system impregnated with medicinal agents, and at the same time will rapidly decline from "market condition." The veterinary surgeon's bill and the keep of the animal until it is again fit for its special duties will mount up very considerably, so the owner is too often tempted to send the patient immediately to the butcher. Promptness is most essential, then, in the treatment of our patients, both in prognosis and in administration of remedies. In all cases we must remember the grand rule "remove the cause and the effect will cease," and must not only remove the immediate cause, but any other influences which are tending to bring about increase of the disorder. We must thoroughly trace out the value of each pathological condition in relation to other morbid

states, and the primary disease must in all cases determine the course of our therapeutical efforts.

All secondary diseases, symptoms of which show that they are liable to destroy the patient, must also receive attention; thus, in a case of indigestion we often require to prevent death from suffocation when distension of the rumen with gas impedes movements of the diaphragm, evacuation of the gas is then urgent and must be adopted as a *palliative measure*, together with the *curative* means directed to reduction of the indigestion. Curative means may be either medicinal or surgical. Medicinal agents of various kinds have been found to have different effects upon the animal system since they increase, retard, or prevent natural processes. A judicious selection of these agents may be made to assist nature in her attempts to restore healthy conditions; in all cases the educated practitioner must apply his knowledge of the action of special medicaments and of the methods which nature adopts as reparative. Thus, with a wound of a sluggish character, he will endeavour to promote salutary inflammation by means of digestives, and in a case of hæmorrhage, he will endeavour to coagulate the fibrine of the blood and so plug up the orifice of escape. Treatment must be of no definite and fixed character, nostrums and recipes occupy too prominent a position in works on cattle diseases; the educated practitioner alone should treat the case, and he will be able to vary the doses and agents administered according to the many and ever variable phases of diseased action.

Human medicine has been facetiously termed "the art of amusing the patient while nature cures the disease." All medicinal treatment consists in a state of constant vigilance and free supply of air whenever the *vis medicatrix naturæ* requires us to restore health equilibrium.

Surgical Treatment comprises all operations performed upon the various parts of the body with a view to restoring the natural condition of the constitution or a satisfactory state of health. Many refinements which have been adopted in human surgery and so materially allevi-

ate suffering and prolong life, have not been able hitherto to find a place in veterinary surgery. For want of co-operation on the part of the patient and his slight pecuniary value if imperfectly restored, and the expense of keep, prove sad opponents of our advancement in this respect. Thus the medical and surgical branches of professional work have not been artificially delegated to distinct sections of practitioners, and as they depend on the same laws of disease, and are at every phase in close interunion, we have not deemed it right to separate surgery from medicine in the work before us. Surgical treatment comprises operations, the use of appliances, and dressings of various kinds.

Operations may be performed with special instruments or by manipulatory methods; they have for their aim either removal of the cause of disorder as in œsophagotomy, or palliation of its effects, as opening the trachea in a case of laryngeal obstruction. Again, they may have a preventive effect, as in removal of a tumour which by its spread tends to involve important organs, and ovariotomy in an animal with some mechanical impediment, to expulsion of a fœtus. Operative surgical skill may, to a certain extent, be acquired in the dissecting-room by the study of topographical or regional anatomy, but can only be perfected by operations on the living subject, preferably in the course of general practice; though some educational authorities consider that the pain inflicted on a few animals during a course of operative vivisectional surgery, will be amply atoned for by subsequent more skilful execution of professional duties. In the performance of any operation the practitioner must have determined beforehand the most favorable methods for the particular case, the complications liable to arise, and the measures of after treatment which will be necessary if everything succeeds according to his expectations. It is in the occurrence of complications that the skill of the operator is best tested; coolness, promptness in emergency, and neglect of surroundings, are valuable qualities under these circumstances. With large patients special means of restraint during all

major operations have to be resorted to by the veterinary surgeon. The animal requires to be cast or otherwise to be disarmed of defensive powers and ability to escape.

Anæsthetics have not been hitherto used much in veterinary surgery. They are not so frequently required as in human surgery because major operations on animals are less frequent, and also because the amount of nervous wear and tear in the lower animals is not so great as in man, with his extremely elaborate and delicate nervous mechanism. The pain of anticipation, also, in animals, is reduced to a minimum. Chloroform requires to be administered in very large quantity to large herbivores, and seems to so thoroughly impregnate the blood as to interfere with subsequent healing processes and to give rise to serious complications. This agent proves more expensive than the owner of the patient generally likes, and the preliminary stage of excitement produced by it induces severe struggling and reduction of the strength of the patient. Local anæsthesia as induced by Dr. Richardson's spray diffuser, has been used for certain veterinary operations; cold water is sometimes continuously applied to produce this effect.

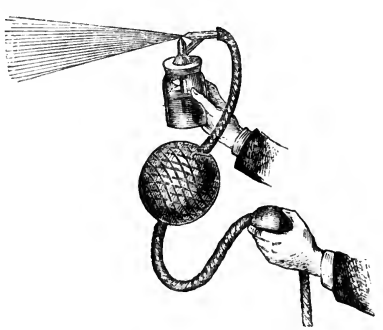


Fig. 5.—Spray diffuser for anæsthetics or disinfectants.

The *preliminary treatment* of a patient must be such as will induce as vigorous a state of the constitution as is compatible with the circumstances. Food of good quality and wholesome, a free supply of air, and exercise, should be adopted when possible. Operations should not be per-

formed when certain blood diseases are present, and organic disease of various organs, together with the special conditions of the patient, should be most carefully considered.

Professor Williams is careful to caution us lest we operate with dirty instruments or hands or near a dissecting room. The operation should be performed in a place where there is lots of room, light and quietude. The subject should be placed in position by skilled assistants, and the necessary instruments and appliances should be clean, in order, and placed under the charge of a special assistant. Thoroughness, cleanliness, and judgment should be the features of all operations. Emergencies as they arise must be met and counteracted. Hæmorrhage, protrusion of viscera, and collapse of the patient, are some of the most formidable.

Collapse consists in sudden interference with the heart's action, the result of nervous shock. The patient ceases to struggle, and loses all voluntary power, the limbs are relaxed, the pulse scarcely perceptible and extremely irregular, sighing, palor of visible mucous membranes, and coldness of the body are present in most cases.

In this state of affairs a free supply of fresh air must be secured, and sometimes artificial respiration resorted to. Stimulants must be administered and frictions applied to the extremities and general surface. Extreme quiet and stimulant tonics must constitute the after-treatment. When death occurs from this cause, the blood is found diminished in consistency and occupying all the cavities of the heart, the right especially being engorged.

In all cases after a serious operation the patient should be kept in a well-ventilated house, and supplied with good and not over nutritious diet, the necessity for stimulant and tonic agents being estimated in accordance with the case.

The various forms of appliances and dressings will require special notice. An important rule to be observed in operative surgery is to preserve every portion of structure which can become useful, while removing all diseased parts

with an unsparing hand. This is the grand doctrine of "Conservative Surgery."

Finally, we must impress upon our minds the extreme value of NURSING and PREVENTION.

Nursing consists in attention to minor details which are conducive to the comfort of the patient. Supply of tempting and palatable food, and water or other drinks, as suited to the state of the patient; free supply of fresh air of an agreeable temperature, prompt removal of ejecta, and the supply of a good clean bed of straw, clothing properly and with judgment, administration of medicines in the gentlest and most effectual manner, and application of dressings of various kinds, also constitute the duties of the nurse.

When it is remembered that very frequently these simple matters prove more valuable than more active treatment, the necessity for good nursing in all cases will be evident.

PREVENTION or PROPHYLAXIS is a most important question. We have seen that conditions are rather unfavorable to curative treatment, but prevention is correspondingly valuable. Veterinary surgeons are called in to prevent disorders of any kind among a herd of cattle, or to adopt special prophylactic means against such a disorder as anthrax. In each case he must carefully adopt hygienic measures with a view to avoidance of predisposing causes. When exciting influences occur they will then be less able to produce marked effects. The quality and quantity of the food must be duly regulated; the purity and temperature of the air and the sanitary conditions of stalls, houses, &c., as well as the general treatment of the beast, must be adapted to the object for which they have been kept. Such individual predispositions as result from age, conformation, breed, and temperament, must as much as possible be obviated; and, lastly, all exciting causes, such as standing in draughts and sudden transitions from heat to cold must be guarded against. There can be no doubt that by such means latent tendency to tubercle and other similar affections can be restrained for a considerable time. The effect of disease of parents may be manifest at birth when it is termed CONGENITAL, or it may remain

in a latent state until the young animal has attained a definite age corresponding often with that in which it first appeared in the parent. For the prevention of outbreaks of special disorders various means are adopted.

Inoculation depends for its value upon the fact that some diseases do not occur twice in the same subject, and when artificially induced have a mild character.

Vaccination consists in securing immunity from a severe disorder by bringing on an attack of a closely allied but very mild disease.

Special Breeding consists in the crossing of animals of a breed predisposed to a disorder with animals of a breed manifesting no such tendency, as in crossing shorthorns with less carefully bred animals.

Special legislative measures, with which we shall afterwards have to deal, are necessary to check contagious disorders.

The treatment of inflammation is complicated in accordance with the complex conditions of that pathological state, and the effects of these processes. We must remember that inflammation is in very many cases *salutary* and that it must therefore be encouraged under the following circumstances; when reparative, constructive, or usefully destructive. *Reparative* inflammation is the means by which injuries are repaired, and when a considerable amount of new tissue has to be produced, as in filling up an abscess cavity, *constructive* inflammation causes granulative repair. In the removal of foreign bodies, whether introduced from without or resulting from death of a part, as in sloughing, inflammation is usefully destructive. Inflammation under these circumstances must be carefully watched, and either promoted or controlled as occasion may require. If the process becomes sluggish, as in indolent ulcers, on account of deficiency either of local or constitutional energy, stimulants must be applied or administered; while if the local changes are intensely acute and give rise to a high state of fever sedative means must be adopted locally, and general sedatives and antiphlogistics be used. At the same time the

cause of excess or deficiency must be sought for and removed. In salutary destructive changes where a foreign body becomes the centre of an abscess, whenever necessary the tendency of the abscess to pass in the direction of least pressure must be directed by relaxing superficial parts by moisture and warmth, also any impediment to such progress towards the surface, as layers of fascia, must be overcome by operation. Our anatomical knowledge will guide us in this matter. Local energy must be promoted in cases of removal of gangrenous parts by sloughing, and when the general or local powers begin to flag they must be assisted by surgical removal of the altered mass. The circumstances of each case will suggest to the practitioner the proper time for operation, and when there is inability to produce a "line of demarcation," removal must be made where the tissues retain vital energy sufficient for repair. When it is necessary to treat inflammation of a non-salutary character the original cause of the disorder must be first removed. Thus, a foreign body in the muscular structures of a part, resting on the conjunctiva, or situated in a passage too small to accommodate it under ordinary circumstances, if not removed artificially will be thrown off if possible by exacting processes of nature, or death will result from the attempt. Occasionally a coating of lymph will be thrown out over a foreign body, and thus its irritating characters obviated. Next, all causes which tend to produce similar inflammation must be removed, for they simply aggravate the case in hand. Thus, in inflammation of the peritoneum quiescence of the bowels is to be sought, for active peristalsis, such as results from cathartics, causes friction between the inflamed surfaces. As activity predisposes to disorder, both directly and by influencing blood supply, we must secure Rest whenever possible; thus we keep the animal in a dark place in cases of ophthalmia, and endeavour to promote the action of other excretory organs in cases of inflammation of the kidneys, to relieve the diseased glands. There is a natural tendency to this which we must endeavour to promote. The substitution of the action

of one excretory organ for that of another is *vicarious activity*. Agents which, when administered internally, counteract inflammation, are termed **antiphlogistics**. Many of them act by promoting vicarious secretion, whereby the blood is purified; also in doing so they act as *derivatives*. There is a marked determination of blood towards a part suffering from inflammation, and a correspondingly diminished supply to other parts of the body. Our efforts must be directed to the diffusion of nervous energy which controls vaso-motor activity, so we resort to general stimulants, clothing, hand rubbing of limbs, and stimulating applications to the surface. It has been long recognised that when blisters applied to the surface of the body during internal acute inflammation act freely it is a favorable sign. We must look upon it as a proof of diffusion of nervous energy and blood which previously had been accumulated in the affected part. Derivatives assist in the process of diffusion. The excess of blood is removed from the zone of congestion and simple hyperæmia around the part where stasis has occurred, and thus the disease limited in its extent. The same effect results from certain modifications in *posture*, and from bloodletting. Certain agents have been extolled as especially efficacious in cases of severe inflammation, either by producing changes in the blood or by their action upon the heart.

Mercury, as calomel, acts on numerous secretory organs, and is correspondingly valuable as a means of purification of blood which is over-loaded with inflammatory *débris;* also it is considered to check or prevent plastic deposit. It is a debilitating agent of a very powerful kind, and so is often contra-indicated.

Potassio-tartrate of antimony is considered valuable in reducing the heart's action as does bleeding, but having the advantage of it being permissible to administer it several consecutive times.

Digitalis also controls the heart's action, but it is cumulative, and thus requires very careful watching. It produces intermittency of the heart.

Opium is valuable "in various ways; by quieting the

nerves, by sustaining the faltering action of the heart, by keeping the inflamed parts *at rest*" (Watson).

In nursing a patient suffering from severe inflammation we must select such food as is very easy of digestion, and therefore not likely to aggravate the disordered condition which the stomach shares with other organs of the body in such cases. The appetite of the patient must be tempted, for it is generally difficult to make him take anything which will assist in husbanding the strength against the emergencies of the attack. Some practitioners rely almost wholly on stimulants in the treatment of inflammation; these, they urge, foster the strength, and hasten the local changes to a favorable issue, while they prevent all those unsatisfactory effects, such as ulceration and gangrene, of deficient local power which are apt to result from the depletory system of treatment; they also prevent the attack from lapsing into a chronic character. There certainly is much feasibility in this line of argument, and the benefit of the system is proved by the undoubted fact that under it cases of true hydrothorax less often result from pleurisy. But we must exercise judgment and discriminate when we can afford to run the risk of plastic results of an acute attack, and when haste is less essential than thorough ultimate recovery. In all cases where vital organs are inflamed stimulating treatment is likely to be of value. With regard to local conditions, too, sometimes stimulation is beneficial. This is well shown in many cases of so-called counter-irritation, as in application of vesicants to the sides in cases of pleuritis. Undoubtedly many cases of supposed inflammation, are at first simply congestion, and nowhere does this more often occur than in the pleura; the stimulus arouses the activity of the congested blood-vessels, and enables them to expel their contents, and thus immediate relief follows. Again, undoubtedly deficient nervous energy in a part is a potent cause of inflammation; stimulation removes this cause. It is even possible that when stasis has occurred a stimulus may so strengthen the blood-current as to enable it to break down the obstruction, and so alter the local

states of nutrition as to give no tendency to renew it. But while admitting this mode of action of external stimulants, we cannot refuse to admit the derivative effect of COUNTER-IRRITANTS.

Recent researches on the vaso-motor system have proved how powerful an effect a stimulus may have in altering blood-distribution. These researches, though by no means complete, are favorable to the view that a deep-seated inflammation may be relieved by originating a similar process in superficial tissues. Setons, blisters, cauteries, and rubefacients are means to this end.

COLD, when applied locally in a continuous manner for a long time, will, in such cases as open joints and similar pathological states, enable repair to occur with a minimum of inflammation, for such, if it set in to a marked degree, would cause high fever on account of the unyielding nature of surrounding parts. Also under this treatment the inflammation is not so liable to involve the joint surfaces. This continuous application numbs the parts, and so lessens pain; but some say that ultimately the white muscular fibre of the arteries relaxes, and passive congestion occurs. However this may be, its practical value in joint diseases has been proved.

HEAT WITH MOISTURE relaxes parts, and so eases pain, it also tends to promote suppuration. It must be used, therefore, to assist the maturation of abscesses, but should be avoided whenever suppuration would be prejudicial. In the earliest stages of inflammation resolution may be brought about by warmth mechanically relaxing the vessels in which stasis has occurred, and thus readmitting the current of blood, or the same effect may be the result of extravasation.

LOCAL SEDATIVES, as Goulard's solution of the subacetate of lead, check the spread of inflammation by lessening the passive congestion around the seat of stasis; they are very useful in cases of ophthalmia, contusions, &c.

LOCAL BLOOD-LETTING must never be brought about by incisions *in* the inflamed part, but rather in the proximity. It seems to temporarily relieve congestion and hyperæmia,

but the effect is evanescent. Occasionally free scarifications allow the escape of excessive extravasated material, which, by pressure, tends to interfere with favorable progress towards resolution. For the removal of effused material pressure and stimulation have been found beneficial. The effects of *pressure* are very gradual, and some mechanical appliance is necessary; the more convenient plan of stimulation is, therefore, generally adopted, compounds of iodine, especially the biniodide of mercury, being most useful. The friction in application also tends to promote absorption.

When *ulceration* is present the treatment must be regulated according to the condition of the sores. Often tonics and stimulants must be administered internally. Indolent ulcers require local stimulation; callous, the application of caustics, whereby a fresh granulative surface will be exposed; inflamed, local sedatives; inflammatory and specific, attention to constitutional conditions; phagedenic, powerful caustics, followed by poultices.

When SUPPURATION has occurred, free exit must be given to the pus by means of a depending orifice, but the abscess must not be opened until fully matured. Purulent infiltrations should be relieved by incision. The system must be well supported by nourishing food and stimulant tonics in the meanwhile, and the animal be clothed carefully, for suppuration is an exhausting process, and causes febrile symptoms, rigors, debility, and fulness and rapidity of the pulse. Tonics will be favorable to the constructive processes by which the abscess cavity will be filled up; locally, carbolic dressings are most useful.

MORTIFICATION necessitates support of the strength of the patient, for not only is the system severely taxed in throwing off the slough, but also gangrenous fluids tend to enter the circulating current, and give rise to an asthenic character of subsequent changes. Stimulants and tonics require to be administered freely internally, while poultices such as Cataplasma Calcis Chlor., or Catap. Fermenti, promote the separation of the slough. We have already indicated that surgical removal of the diseased part is often necessary.

It remains only for us here to state that febrile complications of inflammation will be subsequently noticed, and that inflammation is sometimes induced as a prophylactic means, as when a seton is inserted in the dewlap of young cattle as a preventive against "black quarter."

Congestion requires treatment directed to the removal of causes, such as relaxation of arteries or impediment to return of blood through veins. Often a local stimulant will remove any tendency to stagnation, while astringents, such as cold water, will cause tonic contraction of the previously passively-relaxed vessels. When the congestion is due to weakness of constitution, tonics must be prescribed. Often it is necessary to palliate the accumulation of blood by scarifications, phlebotomy, or application of equable pressure to the part. An elevated posture will prove beneficial. Moisture with warmth may lead to removal of congestion by causing the vessels to relieve themselves by serous effusion.

Hæmorrhage, when traumatic, must be treated as hereafter described. When due to blood disease, and occurring as petechiæ and hæmorrhagic infarctions, they must be deemed of minor importance as secondary to the general disorder of the blood. The other form of passive hæmorrhage, that due to debility, must be treated by strengthening the patient; and in active hæmorrhage we must reduce plethora and tendency to congestions by less food and more exercise, and also laxative and diuretic agents. Local astringent applications, as cold water, act as styptics, restraining hæmorrhage. Certain medicinal substances, when administered internally, are considered hæmostatic, as oleum terebinthinæ.

Dropsy will disappear with the congestive or inflammatory state from which it originated. The process may be promoted by stimulating the water excreting organs, kidneys, and skin; also such agents as lessen blood pressure promote absorption; digitalis is one of the best. If the supply of fluid for drinking purposes be limited, effused fluids will be taken up to maintain the due liquidity of the blood. Iodine and its compounds are

supposed to assist the process of absorption in these cases. When absorption is prevented by lymphy deposits on the walls of a sac, or when the fluid has collected in such quantity as to cause extreme tension, paracentesis (or tapping) must be resorted to. Injection of a stimulating agent may close a serous abscess by lymph exudation. This is, of course, inadmissible in dropsies of serous cavities. Senile dropsy is generally incurable.

Section 2.

The ox, Bos Taurus, is a ruminating, hoofed mammal, and presents certain leading anatomical and physiological characteristics which leave their impress upon his pathological conditions. Thus the alimentary system is remarkably well developed, constituting a considerable proportion of the total weight of the body. It is largely composed of stomachs, which fill the greater part of the abdomen and consist mainly of three compartments, modified forms of the inferior extremity of the œsophagus, adapted for purposes of rumination. The fibres of the tubular portion of the œsophagus are arranged in such a manner as to readily permit either upward or downward passage of the food, and the organs of mastication and salivation are specially adapted for prolonged action.

As in other herbivorous mammals, the molar teeth are large grinding organs, which, by the size of the fangs firmly implanting them in the jaw, necessitate a large condition of the face in comparison with the cranium; and by their weight so increase that of the head that the neck is short and presents superiorly a highly developed ligamentum nuchæ. The weight of the skull is also increased by offensive organs, the horns, developed from the fontal bones at the superior prominence of the skull. But the weight of these is lessened by the fact that into them extend prolongations of those large facial sinuses which contain rarefied air, and buoy up the unsupported skulls of most mammals, as the air sinuses in the bones of birds also buoy up their bodies in adapting them for rising

in the air during flight. As in other ruminants incisors are deficient in the upper jaw, being there replaced by a dental pad, and in the inferior maxilla the canines assume the figure of incisors and form part of a continuous series of eight.

The anterior extremities of the nasal and oral chambers are connected together by a duct of Stenson, leading to the organ of Jacobson, an accessory olfactory apparatus, in all probability closely connected with the mouth that the sense of smell may exercise more direct control against ingestion of poisonous herbs. The upper lip and the anterior nares are occupied by the muffle, a fibrous organ covered with a delicate but firm membrane devoid of hair, but constantly, in health, secreting a dewy moisture, and kept clean by the tongue, an organ developed to a remarkable extent for prehensile purposes. The eyes are prominent and rather far back as in other herbivores, whereby extensive range of vision enables the animal to view an enemy afar and not be disturbed suddenly during the prolonged period of rumination. This act is performed by the animal in the recumbent position, the rumen is full and presses against the diaphragm.

The thorax, under any circumstances, is not remarkable for extent, but has special provisions whereby it may increase in transverse diameter when the animal is lying down. Besides the shortness of the thorax of the ox and other ruminants as compared with that of the horse and his allies, the lungs are more largely composed of areolar tissue, the calibre of the trachea is less, and the anterior nares are smaller and less mobile, and devoid of that remarkable complexity of formation which assists in adapting the horse for rapid movement over the earth. Altogether the respiratory system is less developed than in the horse.

In accordance with this the circulatory system is less developed, the arteries being small and the heart generally more frequent but less powerful in its action, so that the pulse has a somewhat soft beat. The blood does not exhibit that tendency to the formation of the buffy coat

which that of the horse does under normal conditions, though the corpuscles are about equal in size.

The nervous system has a rather small cerebrum, due especially to deficiency in size of the anterior parts of the hemispheres; these also are remarkably short in the ox. The spinal cord is fairly developed, and the ganglionic system large and energetic. The organs of the senses are all well developed, the skin is thick and somewhat loosely applied, and covered with a dense coating of hair; the thermogenic functions are active, hence the internal temperature is high. This we may associate with smallness and insensibility of the organs of exit of heat as compared with those of production. The other excretory organs, kidneys and liver, are large and active; the urine of the ox differing in some marked chemical and physical characters from that of the horse.

The muscular system is less developed for functional purposes than that of the horse, and is less compact. The basement structures of the limbs are less adapted to secure sharpness and precision in movements, and terminate inferiorly in division, which produces the characteristic cloven condition of the hoof in ruminants, while the limbs of the ox are capable of more varied mobility than those of the horse, of which the *forward kick* is a rather forcible illustration. In each case these organs are used simply for purposes of progression, the ox therefore is devoid of ossific union of the fore extremity with the trunk, the clavicle being absent and the scapula large.

The generative system is largely developed both in male and female. Sexual desires are urgent in the male, and he is specially endowed with strength and weapons suitable to enable him to maintain supremely against intruders into the herd of which he is lord and master. A struggle for existence among the males determines at once the numerical excess of females and the continued improvement of the race. The female is prolific, frequently producing twins, with a period of gestation shorter than that of the mare. The mammary gland is largely developed and placed in the hypogastrium.

In a state of nature the ox is gregarious, the females much predominating in numbers over the males. Inhabits prairies and other wide expanses of pasture land, spends his time partly in grazing and considerably in ruminating. Migrates frequently to fresh pasture land or flies rapidly with considerable energy from a foe. When attacked, defends himself with his horns, and by trampling the foe under foot, sometimes also by kicking.

Under domestication these conditions are much modified. The range becomes limited to meadows and straw yards, or to the extreme of stall life, thus the fat producing powers are increased, leading to either general fatness for feeding purposes or to increase in lacteal secretion to a most extraordinary degree. Warmth, such as results from shelter and diminished supply of oxygen due to confinement, operate in the same direction, and tend to diminish vital energy while encouraging fat production. Limited range also lessens the activity and compactness of the muscular system, the "wiry" organism of the wild animal becomes altered into the "soft" state of the domesticated. There is no necessity for frequent migration nor flight when they are protected by man, and the prevention of combats between males tends to interfere with the inherent energy of the race, and probably to generate a more docile offspring. Increased supply of more nutritious food, obtained without the necessity of traversing large tracts of country, and without the disturbing influence of constant dread, causes actual increase in the size of the race.

Artificial conditions to which the ox is subjected are such as tend to diminish the circulatory, respiratory, and cerebro-spinal sensory organs, to lessen acuteness of smell, taste, sight, and probably hearing, and also the secretory activity of the skin. On the contrary, the alimentary and generative systems (with, as a result, the ganglionic centres) are increased in activity in adaptation to our requirements.

In the working ox the conditions of life are not so profoundly altered; he spends his days in the open air

utilising his locomotory system, and not indulging in either excess of alimentary or reproductive pleasures. He is hardy, but gives us examples of diseases of the locomotor system as also of the cloven hoof.

Such marked subjection to the uses of man has led to two results; increase in varieties of the ox and increased liability to disease. As varieties differ from the original stock so in direct proportion do they become liable to disease, and when by culture we generate remarkable activity of an organ we render it correspondingly predisposed to disorder.

In the production of a breed with special qualities there is a transmission of hereditary tendency to special peculiarities of structure and to activity of function, conditions predisposing to disease, and these predispositions are very marked as a result of "breeding in and in," which prevents the counteraction of family tendency to some special degeneration by the introduction of new blood. Excessive development of one part of the body tends to cause a want of reciprocity of different parts of the body, to the prejudice of the whole; only by very gradual development can modifications of species occur; nature shows us this, for variation under domestication tends to disease. The mere fact of breeding from near relatives is not prejudicial, if both be in a state of thorough health.

Gregariousness is not favorable to individual peculiarities, nevertheless, when epizootic disorders occur certain individuals will exhibit immunity under extreme conditions of exposure; this seriously complicates experiments on the transmission of these disorders. A similar immunity from the effects of altered conditions may be noted after the ingestion of medicinal or toxic agents; some individuals require immense doses, while others become seriously influenced by small quantities. The latter condition is termed *intolerance;* the former, *tolerance,* may be due to frequent administration of the same agent when it is of a non-cumulative character. Immunity in certain blood diseases is secured often by an attack either of the same or of a closely allied disorder.

Diet acts as a predisposing cause of disease either by

its quality, quantity, or mode of preparation. A very rich diet predisposes to anthrax and inflammatory disorders, a poor diet to anæmia and dropsies. Food materials may be in themselves prejudicial either by medicinal or poisonous constituents. Mouldy fodder serves to illustrate this, also the various cases of poisoning by oil cake. Excess of food either causes excessive distension of the stomach as in plenalvia, or, when in small quantities frequently administered, gives rise to plethora. Deficiency of food gives rise to debility and anæmia. When not enough food at a time is given to an ox he is unable to ruminate, thus indigestion is produced. The familiar instance of choking from an uncut swede is an example of ill effects from improperly prepared foodstuff. Diet unadapted to the special uses for which an animal is kept will frequently cause disappointment to the owner and require correction by the veterinary surgeon consulted about the case. An extreme instance of this may be seen in pregnant animals, for the nature of the diet will affect the well being of the fœtus *in utero*. Anæmic conditions of the mother will give rise to dropsy of the fœtus and its membranes and perhaps to its death, while not unfrequently an ergotised condition of pasture grass is the cause of abortion.

Pregnancy in itself alters the nutritive equilibrium of parts, and hence predisposes to disease, especially of the generative organs; it produces important though temporary systemic changes. The pulse beats more rapidly, the amount of carbonic anhydride excreted from the lungs is altered, the constituents of certain excretions, especially the urine, are modified, the appetite often becomes depraved, and the state of the nervous system different from ordinary. These changes culminate in the special phenomena of parturition and lactation, and with decline of the latter diminishes the predisposition to disease from pregnancy. The *conditions of surrounding air* may predispose to disease. Many specific disorders originate through volatile contagions conveyed through the air and taken up through the respiratory mucous membrane; this is termed

Infection. Again, the air has an important influence on respiration and cutaneous exhalations. When loaded with deleterious gases it may act as a poison, but if these be present only in small quantities it may simply produce local disorder. Variations in the surrounding air consist principally in moisture, temperature, or purity. When moisture is deficient, but the air warm, the skin acts readily but the muscular system is relaxed, hence the system is predisposed to herniæ. Tetanus is prevalent in countries with such a prevailing climate as this, and diseases become acute. Warmth, with moisture, while determining blood to the skin, lessens the escape of moisture from the surface and from the lungs; thus a sluggish lymphatic condition is induced, and the animal is predisposed to dropsical effusions and low fevers. These conditions are specially favorable to the growth and multiplication of vegetable organisms, fungi, such as give rise to anthracoid disorders and intermittent fevers. Cold, with dryness, produces just the reverse effects, and gives a very low rate of mortality. It is remarked that the first touch of frost checks the ravages of an epizootic. These conditions tend to slowness and stunted growth, but produce hardihood, and are favorable to the healing of wounds without the occurrence of septic accidents. Cold with moisture, tends to a lowering of vital energy, and an accumulation of impurities in the system due to defective excretion by the lungs and skin, diseases tend to an asthenic type, internal congestions frequently occur, and rheumatismal diseases are prevalent and severe. But where currents of air give rise to draughts they are active agents in production of disorder, they disturb the nervous system and originate inflammation in that organ which is most predisposed to disease. While warmth promotes fattening and the production of milk, it must not be procured at the expense of ventilation and drainage. Unless fresh air is admitted, and foul air escapes, and ejecta are not allowed to accumulate, the air in the cowhouse will become overloaded with impurities which predispose to disease, will tend to make

epizootics and other specific disorders of a highly destructive character, will induce any disease which occurs to assume a low type. The *drinking water* supplied to an animal may be so impure as to originate or communicate disease. Besides the conditions already mentioned, *age, sex,* and *conformation* determine individual liability to disease. Young animals respire quickly, have a quick pulse, and high internal temperature, they are particularly liable to diseases of growth, to acute inflammations, and to catarrhal affections of the alimentary and respiratory tracts, also their constitutional energy is hardly able to check and counteract the ravages of entozoa. In adult animals the tendency is to certain disorders resulting from diet, also to diseases of the generative system. In old animals we find the effects of deficient energy of the heart and degeneracy of blood-vessels; hence metastatic congestions, senile gangrene, and heart disorders occur especially in them. Male animals are most liable to acute disorders, as being endued with higher vital energy than females. Castration materially modifies constitutional conditions, and secures immunity from such acute disorders of the generative organs as occur in the entire animal, facilitates fattening, and lessens liability to injury. It causes the disorder known as pelvic hernia or "gut-tie." Females run the risks of parturition and lactation, their respiratory, circulatory, and nervous functions are generally less active than those of the male. Conformation and the uses to which the animal has been put have marked effects as predisposing causes; thus, the shortness of the neck of the ox accounts for his frequent attacks of apoplexy, and too free exercise of generative powers will bring about atrophy of the bull's testes. Previous disease of an organ predisposes it to renewal of an attack. Sometimes only imperfect repair occurs, and the partially formed tissue is liable to again become the seat of morbid changes, even without the action of any appreciable excitant. Recurrent abscesses are of this nature, as also certain forms of dysentery. **Exciting causes** are varied, such as exposure to currents of cold air, sudden transition

from cold to heat, mechanical and chemical irritants. They will be specified under the heading of each disease.

The *general symptoms* manifested by cattle suffering from acute disorders are dulness and separation from the rest of the herd, unwillingness to move, a "hide bound" or "staring" condition of the coat (cutis anserina). The animals do not lick themselves or one another, nor stretch properly on rising; dryness of muffle, failure or deficiency of the appetite, and cessation of rumination. In the milch cow the lacteal secretion is diminished or suppressed. Frequently when these are observed examination by the experienced will detect fever and even local disorder, but generally we have only the history of the case to determine any efforts against special contingencies. *Nursing* must here be relied upon. The patient must be housed in a moderately warm, well-ventilated place, frictions applied to the surface, and laxative, easily digestible matter given as food; change of diet being particularly beneficial, but the appetite must be tempted, not forced. A diffusible stimulant will be useful under these circumstances, it may divert an inflammatory attack, and is so evanescent that it will not influence any disorder which may assert itself shortly after. The experience of many observers has sanctioned also the administration of a laxative saline dose at the same time. The alimentary canal being so extensive in the ox is often laden with matter of an indigestible character, which will tend to aggravate local or general disorder. The PULSE of the ox may be taken at the submaxillary artery, the vessel of the right side being felt by the right hand passed over the neck, while the left hand holds the left horn; at the brachial within and rather to the front of the elbow-joint, the hand being passed round the front of the limb to its junction with the trunk; at the large metacarpal above and behind the fetlock; at the middle coccygeal on the middle line of the root of the tail; at the carotids in the channel of the neck; and at the anterior auricular in front of the root of the conchial cartilage. Different practitioners make a practice of selecting each one

of these vessels. The submaxillary we find the generally most convenient; it is smaller and less firmly bound down, and therefore suffers more displacement than the corresponding vessel in the horse; also the arrangement of the lower margin of the inferior maxilla and masseter externus are less advantageous for accurate determination of its position, and the pulse can not be estimated here when the animal is feeding. The brachial or radial artery will afford useful indications after a little practice; the large metacarpal is a vessel of considerable size, and can be conveniently felt without disturbing a patient who chances to be in a recumbent position. The pulse in the ox is small, slow, and frequent as compared with that of the horse, its beats average 46 per minute. In the young animal it is faster (55—65).

Pregnancy causes irregularity of the pulse, and considerable increase in frequency. Digestion produces increased fulness and sharpness; and Dobson tells us:—"Animals in warm cowsheds and in plethoric condition will have the number of beats increased several strokes per minute as compared with their brethren in the straw-yard and the field." Williams says:—"In the cow during rumination it may be observed that the pulse is 70 or 80 a minute, and the respirations not more than ten. Indeed, the pulse of the cow in a state of confinement, in so far as regards the number of its beats, cannot be depended upon in the diagnosis of disease; the states of pregnancy and obesity, the effects of artificial food, and of the activity of the lactiferous glands, as well as the excitement caused by the act of rumination, generally produce such an impression upon the nervous system as to cause the action of the heart to be much increased, such increase being entirely consistent with a state of perfect health in an animal so circumstanced."

Useful information is gained by examining the heart's action by auscultation, placing the head against the side. The "*venous pulse*" is the periodical change in calibre of a vein, which sometimes results from regurgitation of blood into it. It is seen at the jugulars in heart

disease, but in health generally the action of the carotid artery causes changes in the jugular which lead to apparently pulsating movements.

The normal TEMPERATURE of the ox, as taken at the rectum, is 38° C.—38·5° C., according to Colin; 38·9° C. (Siedamgrotsky); 39° C. (Zundel); oxen and cows 100·8° F. during confinement, and 101·8° F. during work or at liberty; calves and stirks, 100·9° F. to 101·9 F. (Armatage).

Variations resulting from ordinary conditions of the system are but slight, seldom amounting to more than 1° F. Any rise above this must be considered suspicious as indicating the presence of fever. The reading will be higher in a young animal and lower than the normal mean in a very old animal. Ingestion of food, exercise, and change of external temperature cause slight variation. The thermal regulators of the body are very efficient during health. When fever sets in, escape of heat is prevented and its generation increased; in typhoid disorders and shortly before death heat generation is interfered with, and the temperature markedly falls. The rectum should always be the seat of thermometric observations in the ox, and the routine already recommended should be always carried out. The temperature of the vagina is somewhat lower.

RESPIRATION is performed in the adult ox about fifteen times per minute. The acts are slightly more frequent in the calf (18—20). They vary in number somewhat with surrounding conditions, but any marked increase or decrease in number must, if permanent, be attributed to disease. The increase which results from exercise quickly disappears when the animal is placed at rest. We have already alluded to the remarkable difference in position between the horse and ox suffering from pulmonary disorder; while the former stands persistently, the latter rests on the lower part of the chest and on the abdomen. The position which an animal assumes during an acute attack is often diagnostic or even pathognomonic. This may be seen in tetanus, in hoven, and many other diseases.

The COUGH of the ox is shorter and less powerful than that

of the horse. It may become almost pathognomonic in certain diseases, as especially pleuro-pneumonia contagiosa. In our determination of disease of the ox, as in those of most other dumb animals, we have to rely principally on OBJECTIVE **symptoms,** which are independent of the animal's sensations, rather than upon those SUBJECTIVE indications conveyed by the animal himself. Nevertheless, we have a few of the latter to guide us, such as shaking of the feet in eczema epizootica, backing in pelvic hernia, and flinching when pressure is applied to the intercostal spaces in cases of pleuritis. The *expression* of the animal is often the means of conveyance of useful information to us; the retracted condition of the angles of the mouth in trismus, the wild look in rabies, the staring of the eyes under acute abdominal pain, and the altered expression due to opacity of the eye are familiar to most practitioners. *General sensation* is sometimes perverted or lost, and is tested by inserting a pin into a limb presumed to be paralysed. The *movements* of the animal may be stiff as in tetanus, rheumatism, &c., or the interference may amount to absolute lameness, due either to disorder of the affected limb or to sympathy with other parts, as may be observed in the lameness of the right fore-limb in liver disorder. The *visible mucous membranes* of the ox during health somewhat vary in colour. The Schneiderian is moist and pink, but under disease may become livid, yellow, scarlet, or very pale, ulcerated, and covered with discharge of a nature varying according to the case, mucous, purulent, sanguineous, &c. The lining membrane of the mouth is very dense in the ox, developed into horny papillæ on the inner surface of the cheek and the dorsum of the tongue, and modified to form the dental pad at its antero-superior part. It sometimes exhibits abrasions either from coarse material taken into the mouth, or from the sharp prominences of the molar teeth. In other cases it has vesicles of a specific or ordinary character upon it; in febrile cases it is dry. While observing its condition we can note also the characters of the *saliva,* which may be profuse, constituting PTYALISM, as seen in

injuries of the mouth or mercury poisoning, or deficient. Sometimes it is materially altered in quality, thus it may be viscid ("ropy") or fœtid, as in some cases of tetanus. In cases of enteritis and other abdominal inflammatory disorders, the rectum will, on manual exploration, be found markedly elevated in temperature, and its mucous membrane may protrude somewhat through the anus, being of a bright scarlet colour. In prolapsus recti it forms a rounded purple mass, its walls being thickened by gelatinous deposit. This mucous membrane is the seat of tumours (hæmorrhoids or piles) which may protrude after expulsion of the fæces. Manual exploration of the rectum of the ox presents no special features. The *fæces* are soft, pultaceous, and form a rounded cake of a dark greenish-brown colour. They may be altered in quality or quantity, scanty or wanting as in constipation and costiveness, profuse in diarrhœa and dysentery, mixed with much mucus in the former and with blood in the latter case. The nature of the diet and the activity or inertness of the liver alter their qualities, while their odour also is very variable. The mucous membrane of the vulva may be altered in colour, ulcerated, or the seat of profuse discharge of a purulent, mucous, or sanguineous nature; it becomes congested during œstrum. The conjunctiva during health is of a rosy colour where it lines the eyelids, and transparent where it invests the cornea. In the latter position it may become opaque and clouded, in the former of a bright scarlet in cases of fever, yellow in liver disease, pale in anæmia, &c. The tears may be profuse, as in local irritation, blocking of the ductus ad nasum, and in the early stages of catarrh; acrid, as in certain blood diseases; mucous or purulent under inflammation. The eyes may be over sensitive to light, in consequence of which the eyelids droop; frequently the Meibomian secretion is profuse and adhesive, and the eyelids are swollen. The *conditions of the alimentary canal* afford some useful indications. Examination of the mouth may detect diseased teeth, presence of foreign bodies, &c. Enlargement may be present along the cervical portion of

the course of the œsophagus, due either to presence of an impacted body, or to a dilated state of the tube. Deglutition may be difficult (dysorexia) or the appetite impaired or absent (anorexia).

NAUSEA may be present or VOMITION, the former being an uncomfortable sensation, manifested by attempts to return matters from the stomach for expulsion from the body, the latter being a successful performance of the act. These are due to irritability of the stomach, and evacuation of the contents of the rumen somewhat readily occurs in the ox, in consequence of the adaptation of the œsophagus for regurgitation, as well as downward passage of food.

BORBORYGMA is abnormal rumbling of the bowels, such as may be observed after administration of drastic purgatives. Often it depends on accumulation of gas in the stomach or intestines, FLATULENCE, or TYMPANY. The *conditions of the abdomen*, whether diminished in size, "tucked up" as in acute disorders, or distended by gas, tumours, or food accumulations, should be noted. The size, movements, and general conditions of the thoracic walls also vary.

The URINE OF THE OX normally has a specific gravity of 1030—1040, a yellowish-white colour, a special odour, and an alkaline reaction. Its chemical, physical, and microscopical characters vary much with different conditions of life and in disease. The specific gravity may be tested by the urinometer, or by specific-gravity globules. The urine will be found modified, under various circumstances, in quality and quantity, and especially in proportions of its several constituents.

THE SKIN OF THE OX exhibits a fair amount of activity. Animals in health keep it clean by licking, and thus often introduce hairs into the stomach. Perspiration may occur generally or locally under disease, and the perverted conditions of the cutaneous secretions in weak patients, and those with a scrofulous tendency, as also dirt accumulations, predispose to local irritations, and invasion by vegetable or animal parasites.

The EXPIRED AIR has an odour characteristic of the animal, due to effete matter which it carries from the

system. Its temperature and odour vary. Thus, it may be cold in later stages of asthenic disorders, warm in acute attacks, fœtid in gangrenous disease of the lungs.

Our **prognosis,** when medically attending the lower animals, does not hold in view simply the chances of a fatal result; we have to consider our cases from a pecuniary point of view, and to determine promptly for the owner the length of time which will elapse before return to health, and also whether the value of the animal after recovery will be such as to make treatment an advantage to the owner. Prompt decision is especially called in a case of disease in the ox, for the flesh of an animal slaughtered in the early stages of some diseases, before the system has been interfered with by medicinal agents, may be used for human food. This seems to lessen our opportunities of tracing cases of disease in the ox from commencement to termination, and proves a very sharp test as to the correctness of our diagnoses. We often have an animal brought under our notice in sufficiently good condition to fetch a good price from the butcher. The owner propounds the following questions in order:—What is the matter with this animal? Will it be likely to die? How soon will it recover? Will it be reduced considerably? and, if so, how long will it take to regain its present state of flesh? If it seems likely to die, it is at once killed, and our diagnosis verified or the reverse. If it is allowed to live, the prognosis is subjected to similar smart scrutiny. With milch cows the interference with milk supply is the source of the owner's solicitude; while animals kept for breeding purposes necessitate considerations of the bearings of various disorders on the reproductive functions. In no branch of medical study does the practitioner require skill more than in cattle practice.

The milk varies in quality and quantity, and its production has been much increased by artificial selection. The first milk, colostrum or beastlings, is rich in fatty matter and worn-out, tough, epithelial cells filled with fat globules. It acts as a natural cathartic, freeing the bowels of the newly-born calf from the accumulation of biliary and other

matters which constitute the meconium. The milk may be bloody, may contain pus or specific virus. It requires special examination in each case of disorder, for in some instances it can convey disease to animals of other species, even to man. DEATH of the ox may take place by either of the above described methods, necræmia being observable in such disease as anthrax, according to some pathologists, while others attribute the fatal result to asphyxia. With regard to MORBID CHANGES, the degenerations of various kinds are frequent, especially the caseous and calcareous, and the tendency of disease is to the production of deposits of a lymphy or serous character rather than to gangrene and ulceration. Abscesses are frequent, metastases seldom occur, hæmorrhages are rather frequent. Inflammation tends rather to the chronic type, and is less frequent than in most other animals subjected to similarly complex conditions as the ox. Epizootic and enzootic diseases will occupy a great deal of our space as being of great importance, numerous, and widespread, causing immense annual loss to stock owners, and often directly related to human disorders.

In the TREATMENT of the diseases of the ox palliative measures are often important as giving time for fattening or as preserving an animal useful for breeding or dairy purposes. Curative means of medicinal character are often hampered by our deficiency in information as to the specific influence of certain agents on the ox and the doses in which they should be administered. Surgical operations of minor importance as œsophagotomy, tracheotomy, and puncture of the rumen are frequent, while major operations, amputations, lithotomy, laparotomy, &c., are occasionally resorted to and might be more frequent, but we have already mentioned how our bovine patients are frequently handed over to the butcher without our having had a fair trial of curative means. In accordance with paucity of major operations anæsthetics are seldom resorted to, but various means of restraint are adopted. Altogether cattle are not endowed with high nervous organisation, and will therefore stand operations very well,

and are correspondingly seldom the subjects of collapse. Thus artificial respiration is not very frequently required, fortunately so, for when brought about by pressure rhythmically applied to the thoracic walls it is imperfect, and seldom effectual in our larger patients. The ox is usually held by one horn, the thumb and forefinger of the disengaged hand being introduced into the nostrils and pressed together against the septum narium, or the familiar "bull-dog" is fixed to the nostrils in a somewhat similar manner and held in the hand. (See Fig. 6.)

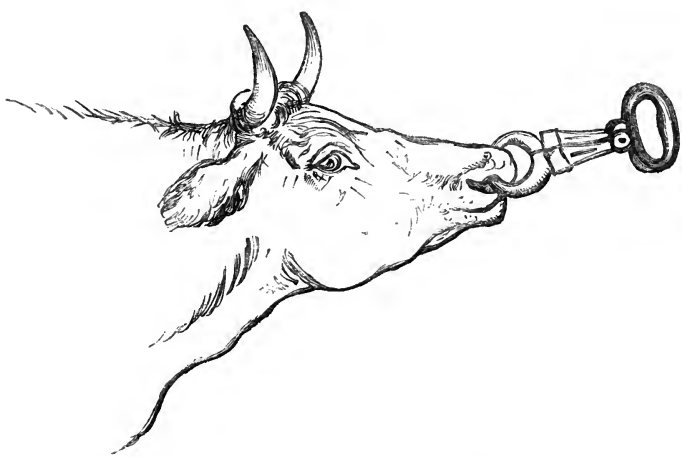


FIG. 6.—The "Bulldogs" applied. (Armatage.)

The SIDELINE is sometimes fixed on the ox as on the horse.

In minor operations on the posterior parts of the body, the hind legs are fixed together by means of a double hobble or tied by a rope, which commences at the right hind limb, involves the left in a loop, and is tied in front to the right fore limb above the fetlock. This is termed "shackling."

HOBBLES are also used for throwing the ox. It is advisable to fix them above the fetlocks. Calves may be thrown by drawing one hind leg forwards with the sideline and pushing at the opposite quarter.

ROPES. The ox is very frequently thrown just as is the

horse when the long cart rope is used for securing the animal for castration. (See Fig. 7.)

Dressing the feet of the ox, as in eczema epizootica, may be effected either by means of a long stick with some tow fixed on the end, or, when the hind feet are to be treated, by raising the foot towards a beam by a hobble

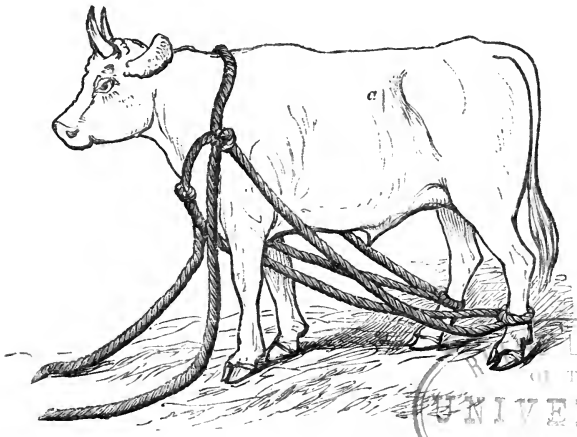


FIG. 7.—An Ox prepared for casting. *a*. Seat of incision in ruminotomy. (Armatage.)

fixed above the hock, the rope passing from it over the beam and its free end held by assistants. Another method is to pass a pole between the hind legs and have the limb supported just above bend of the hock by a man at each end of the pole in such a way as to raise the limb as much as required.

Slinging of the ox is not often resorted to. It too much interferes with digestive and respiratory processes.

Four drachms of chloroform administered to a two-year old heifer caused slow and laboured respirations at the end of a minute, at two and a half minutes the animal staggered, and at three and a half minutes fell to the ground. At six minutes the breathing had become more laborious. At six and a half minutes the animal seemed completely insensible, the pupils were fully dilated, the conjunctivæ congested. The sponge was now removed.

At ten minutes respiration became quick and agitated; at eleven minutes the animal got up but had much difficulty in standing; shortly afterwards it staggered into the straw-yard. Morton gave four ounces of chloroform to a heifer, and it produced no insensibility, the animal only seeming to be intoxicated by it ('Veterinary Record,' vol. iv).

Method of administration of chloroform to large animals.—It is essential that the animal be cast previous to administration, otherwise he will be uncontrollable in the preliminary stage of excitation. Then a due admixture of air must be ensured by the use of an apparatus with two tubes, one of which communicates with the outer air the other passing from the chloroform vessel, each fitting at the other extremity into a nostril; several inhalers varying slightly in form have been suggested. Or a sponge with chloroform poured on it may be held against the muzzle, and the hand and muzzle loosely covered with a cloth, the chloroform being renewed from time to time. The amount of chloroform essential for the production of insensibility to external impressions varies much in different cases, and must be regulated by the judgment of the chloroformist. If after the operation is completed the animal does not regain sensibility sufficiently soon, cold water may be thrown over the body and air freely admitted.

Why *nursing* should not be utilised to the full in treatment of cattle affections, when circumstances are favorable, we cannot say, but in some quarters there seems to be a prejudice against nursing an ox. It must be our duty in every case to ensure such nursing means as we have already indicated, they will very materially assist our medicines; even rough methods of preserving a comfortable warmth of the surface of the body and a due supply of fresh air, and a draught of cool water so refreshing to the palate of a feverish patient, are valuable.

The *prevention* of disease consists in the careful supervision of those details of management which experience has suggested as best for various kinds of animals, but it assumes a special character when we are requested to

check the ravages of an epizootic in a herd or to prevent access of a dreaded disorder.

In such cases ISOLATION must be rigidly enforced, all predisposing and exciting causes must be removed or obviated. The slightest trace of disease, of any kind, in one or more of the animals, must lead to SEGREGATION. Measures of DISINFECTION of houses, utensils, and attendants, must be carried out with energy; and to effect this, the manager of the herd must be a thoroughly reliable man. Under these circumstances we shall probably succeed in our efforts to prevent or limit an invasion.

SECTION 3.

IN the present section we will place before our readers as succinctly as possible the therapeutical actions of such medicinal agents as have been utilised in the treatment of cattle, availing ourselves of modern therapeutical ideas, of the researches which have recently been occupying observers of the actions of medicines, and of the assistance of the several works on veterinary medicine and pharmacy, which have been presented to the profession. We shall follow in the main the system adopted by Headland in his most admirable 'Action of Medicines,' adapting this to our special requirements. We shall use the tabular form as most economical of space, and shall so arrange matters that we may utilise our system afterwards in our notice of toxicology.

For ADMINISTRATION to the ox agents are generally prepared in a *draught* (or "*Drench*"), soluble matters being dissolved in the water, which is usually the principal vehicle, insoluble matters being in a state of powder and suspended. Drenches are preferred for the ox because they can be readily administered, act sooner than solid masses, and probably almost always mainly pass into the third and fourth stomachs directly without delay in the rumen, and the chance of rejection during rumination. In practice a bottle with a gradually tapering neck is found to be useful for ad-

ministering the dose. Generally the head of the patient is straightened on the neck by drawing the muzzle forwards and upwards, the nostrils being grasped so as not materially to interfere with respiration. Preferably, however, the head is flexed to the right, and the administrator stands with his back against the right shoulder, keeps the left hand partially in the left side of the mouth, and gives the draught with the right. The opening of the bottle is then inserted into the mouth, and the contents gradually allowed to pass down towards the pharynx; sometimes the drenching horn is used, but the bottle is preferable as giving continuous, steady, and ready flow. This operation is much easier than administration of a draught to a horse, the ox receives his drench more quickly, and loses hardly any. It is necessary to cease the operation when any sign of coughing appears. An ordinary cattle drench measures from a pint and a half to two pints. Cases of suffocation from passage of fluid into the larynx and trachea occur sometimes, as we shall detail hereafter. This is liable to take place in attacks of parturient apoplexy, and must be avoided by giving any medicines the animal requires by means of the stomach pump. Some practitioners consider *balls* useful

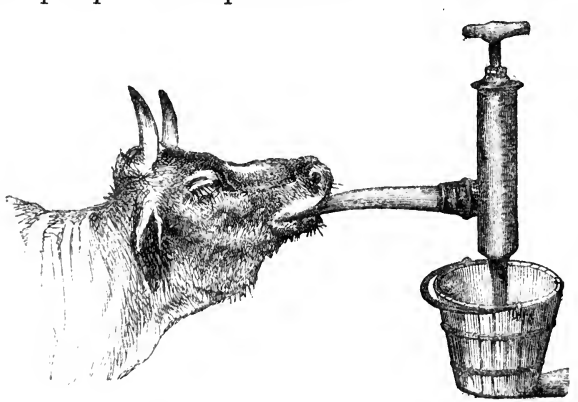


FIG. 8.—The Stomach-pump in use. (Armatage.)

for the ox, others as strongly object to them. Aloes may be conveniently and beneficially administered in this

form; its active principle is soluble in alkaline solutions, such as the secretion of the rumen, and hence becomes more rapidly absorbed than it would have been if it had passed at once into the true digestive stomach. Few other agents are better given in solid form than in a drench, *powders* do not harmonise well with the ordinary food of the ox, and would probably pass directly into the huge mass of masticated matter in the torpid rumen of the diseased animal.

Enemas (injections, clysters, or glysters) may be either gaseous or liquid. The former, as tobacco smoke, &c., are well worthy of more frequent trial. They are easily administrable, and prove local sedatives in enteritic disorders. They are administered with an enema tube connected by a long flexible pipe with a vessel in which tobacco is burnt. Liquid enemas are administered to produce either local or general effect. In the latter case they form the vehicle of such agents as are most readily absorbed from the large intestines such as strychnia. Locally, they act as fomentations, demulcents, and laxa-

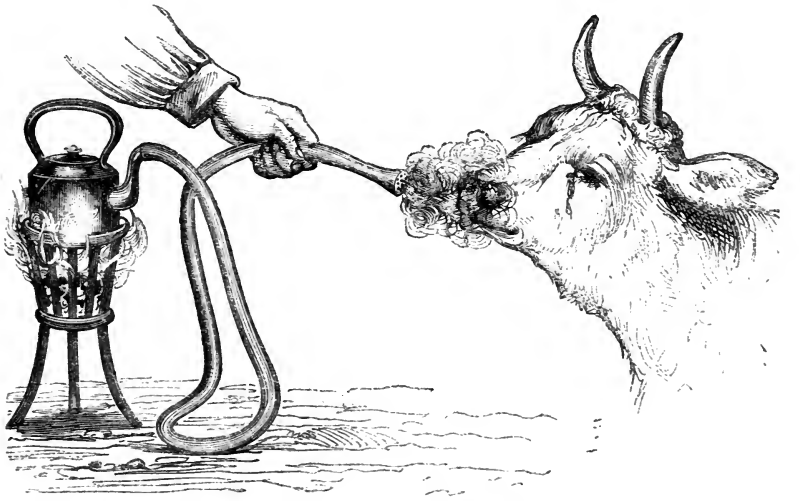


FIG. 9.—Application of steam to the nostrils. (Armatage.)

tive means. In the latter respect they are most useful,

softening any fæcal accumulations, and arousing peristalsis in a simple but effectual manner. They should be administered in such quantity that they will be retained for some time, and may be injected by means of the enema syringe, Reid's pump, or the gravitation funnel.

Inhalations of chloroform, steam, chlorine, and carbolic acid are used in cattle practice, the first has been noticed as anæsthetic. Chlorine, under the form of Vapor Chlori, is generated in a loose box or stable, into which are collected calves suffering from bronchitis parasitica. It acts as a

FIG. 10.—Method of covering the nostrils for steaming. (Armatage.)

very powerful irritant, gives rise to distressing cough, and expulsion of numbers of the strongyles which cause the disorder. Vapor Acidi Carbolici is generated for internal disinfection by pouring some of the Calvert's acid into a pan resting on a tripod, a box in the bottom of the pan holding a red hot flat iron heater. The box and the animals become thoroughly disinfected, but the beneficial effects have not been proved as far as internal disinfection is concerned.

The thickness of the skin of the ox prevents frequent taking up of medicinal matters into the system after inunction. *Intra-venous injection* is sometimes practised, as also is the absorption of medicines from an abraded surface, but administration of agents by the skin may best

be by *subcutaneous injection.* The syringe for this purpose (see Fig. 11) is small, and can conveniently be carried in the pocket; has its barrel graduated, and made

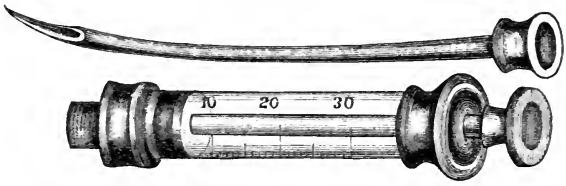


FIG. 11.—Hypodermic Syringe. (Armatage.)

of glass; generally has a handle to its piston, every complete turn of which expels a known quantity of the contents, and a nozzle shaped like a trocar with a side opening of exit. The puncture is scarcely noticed by the animal, and should preferably be made where the subcutaneous areolar tissue is plentiful and the skin thin. By this means extremely small doses of very potent agents may be given with certainty. We must conclude, then, that methods of administration to the ox are seldom other than by drench.

M. Taborin estimates the dose for the ox to average $\frac{5}{4}$ths that requisite for the horse, but specific differences between the animals, as far as the actions of different agents go, render this useful conclusion not always reliable. He also reckons the ox's dose three times as large as that for the sheep.

Hertwig suggests for an animal aged one to two years half a dose, six months to one year one quarter, three to six months one eighth, and one to three months one sixteenth. Pregnancy and lactation and other conditions also influence the dose, and we must remember that many agents administered to the cow pass off by the milk and affect the calf.

It is thought that all "agents which produce their effects upon remote parts of the system must be absorbed and added to the blood." The phenomena of certain cases of poisoning hardly enable us to accept this dictum unreservedly. When very large doses have been taken

death completely and immediately occurs, seemingly similar in its characters to that which has been seen to result from a blow on the epigastrium. These observations on poisoning in man apply to animal poisoning, but this "death by shock" is quite the exception. When agents enter the blood they circulate in its current and act upon various organs. Accordingly they are divided into hæmatics, neurotics, eliminatives, and astringents.

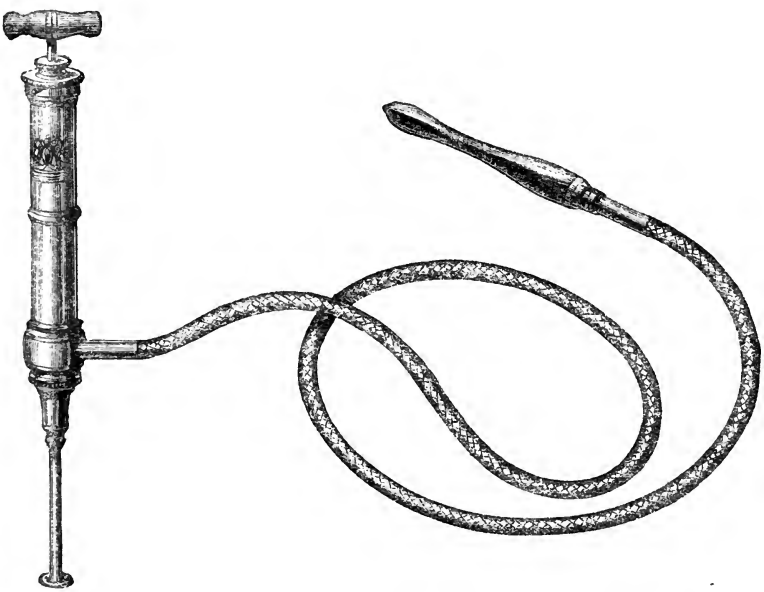


FIG. 12.—Clyster Syringe, with elastic tube and ebony pipe; used also as a stomach-pump.

A.—*Agents which are administered Internally.*

HÆMATICS (Act on the blood) being either—

RESTORATIVES (Which supply again to the blood some normal constituent which was deficient) comprising—

(*Tonics*)

- ***Tonic bitter principles*** (Allied to that found in bile, and to the bitter principles of ordinary food stuffs).
  - Gentian—Dose of powdered rhizome for ox, ʒiv.
  - Oak and other barks—Dose ʒiv; have also an astringent action, due to tannin.
- ***Hæmatinics*** or ***chalybeates*** (Supply iron, for production of red colouring matter).
  - Salts of iron:
    - Ferri sulphas, Ferri carbonas } ʒij; also act as astringents.
    - Ferri peroxidum humidum; antidote to arsenical poisoning.
- ***Aliments***
  - Heat-formers—Principally hydrocarbonaceous matters, as starch, sugar, and fat.
  - Tissue-formers—Nitrogenous matters of albuminoid nature.
  - Solvents—Water and certain salines.
- ***Acids***
  - Mineral acids—Nitric, sulphuric, and hydrochloric—the latter is used as an antilithic, to keep suspended in the blood salts which would otherwise form calculi. Dose of dilute acids, ʒj—ʒij.
  - Vegetable acids.
  - Mineral acids—Lactic (in ordinary milk)
- ***Alkalies*** and alkaline earths and their carbonates often act as antacids, correcting acidity of primæ viæ.
  - Calcis carbonas, chalk. Dose, ʒj.
  - Magnesiæ carbonas, „ bicarbonas, „ oxidum. } Dose, ʒss. Antacid and laxative, for calves in diarrhœa.
  - Sodæ vel potassæ carbonas, „ „ bicarbonas. } Also diuretic. Dose, about ʒiv.

CATALYTICS (" Alteratives," by their mere presence in the blood induce beneficial changes), comprising—

- ***Anti-rheumatics.***
  - Colchicum (meadow saffron) corm, powdered. Dose, ʒj—ʒij. Also cathartic, sedative, and emetic.
  - Potash compounds—Carbonas, and bicarbonas. Dose, ʒij—ʒiv. Also diuretic.
- ***Anti-scrofulosals.***
  - Iodine. Dose ϑj. As iodide of potassium, ʒj. Useful as a deobstruent.
  - Bromine (ditto).
- ***Anti-periodics*** (Counteract intermittent fevers).
  - Quinine. Dose of the sulphate, ϑj—ʒj. Also acts as a tonic.
- ***Anti-squamosals*** (Agents useful in skin disorders)
  - Sulphur. Dose, ʒj (or as laxative, ʒij). Also applied in form of an ointment in skin diseases.
  - Carbolic acid or tar (seldom used internally, but often applied externally).
  - Arsenic. Dose, grs. v—x.

Agents which are administered Internally (continued)—

NEUROTICS (Act on the nervous system) being either—

STIMULANTS (Which excite nerve force) which are—

- **General**
  - Comprising compounds of ammonium
    - Spiritus ammoniæ aromaticus. Dose, ʒij.
    - Liquor ammoniæ. Dose, ʒij. Must be given with liberal supply of water.
    - Ammoniæ carbonas. Dose, ʒij.
  - Phosphorus and the various agents known as stomachics, aromatics, cordials, and "carminatives" such as aniseed, caraway, fœnugreek, cummin, ginger, &c.; of all these the average dose is ʒij—ʒij. Oil of turpentine is also given for this purpose, in doses of ʒj. The "diffusible stimulants" comprise some of these general stimulants as well as certain narcotic agents.
- **Special**
  - Ecbolics or Parturients
    - Agents which act on the pregnant uterus, causing special expulsion of its contents, as ergot of rye (dose, fʒss of liquid extract), and savin, seldom used.
  - Aphrodisiacs, excite the venereal appetite—Cantharides, seldom used.
  - Agents which act specially on the spinal cord, and other nerve-centres. Strychnia (dose gradually increasing from gr. ij of nux vomica) and nitrate of silver (seldom used).
  - Emetics and nauseants excite irritability of the stomach and the par vagum.

SEDATIVES (Which depress nerve force), and are—

- **General**
  - Aconite. Generally given as tincture of aconite
    - Fleming's. Dose, 10 minims.
    - P. B. Dose, 30 minims.
    - May be frequently repeated. Allays febrile excitement, and causes numbness of the body surface.
  - Prussic acid. Dose of dilute acid, 20 minims.
  - Conium. "Hertwig gave a cow the fresh two-year-old herb, in quantities varying from six ounces to three pounds, without any other effect than slight hoven. Conia is a very active poison."—*Finlay Dun.*
- **Special**
  - Acting on the heart. Antimony, as tartar emetic, also eliminative. "Cattle, like horses, can take very large doses of this agent without suffering from any of the physiological action of the drug." Hertwig and Viborg gave quantities varying from ʒij to ʒx, and Jobert gave ten drachms in solution, all without effect."—*Finlay Dun.*
  - Digitalis induces intermittency of heart's action, and is cumulative. Dose of leaves, ʒss.

NARCOTICS (First excite and then depress nerve force and interfere with mental faculties)

- Opium (and other narcotics prove useful as antispasmodics, hypnotics (soporifics), and anodynes). Dose, powder ʒj, or tincture ʒj.
- Ether, chloroform, and other anæsthetics. Ether (sulphuric). Dose, ʒj.
- Alcohol—as
  - Beer. Oj, also a tonic.
  - Wine. ʒiij, spirits about ʒjv.
  - Proof spirit. About ʒjv.
- Camphor. Dose, ʒj (slightly diuretic); chloral hydrate, ʒss.
- Tobacco. Seldom used internally, except as tobacco-smoke enemas.
- Belladonna, henbane, and datura (Deliriants) cause dilatation of pupil. Average dose of extract, ʒj.

ELIMINATIVES

(Agents which pass from the blood through glands and excite those organs to increased action. Their effects are frequently secondary) or

DEPURANTS

Sudorifics or Diaphoretics. (Act specially on the skin)
- Antimonii potassio-tartaratum. Dose, ʒij (but effects not marked).
- Spiritus ætheris nitrosi. Dose, ʒiss (also stimulant and diuretic).

Diuretics (Act specially on the kidneys)
- Potassæ nitras. Dose, ʒiv.
- Resina. Dose, ʒiv.
- Oleum terebinthinæ. Dose, ʒvj (also anthelmintic and antispasmodic).

Sialogogues (Act specially on the salivary glands)
- Unguentum hydrargyri, externally applied, sometimes causes profuse salivation—ptyalism.

Cathartics or Purgatives (Act specially on the bowels) When mild are termed *laxatives* or *aperients;* when severe, *drastics;* and when inducing watery evacuations, *hydragogues.*

- *Salines*
  - Magnesiæ sulphas
  - Sodæ sulphas

  Dose, 1 pound, combined with a carminative, as "cathartic drench." ℞ Mag. sulp. ℔j; Zing. pulv. rad., ʒij; Aquæ, q. s. (Misce ut fiat haust.)
- *Resinous*
  - Aloes. Dose, ʒviij; also tonic and anthelmintic.
  - Croton
    - Seeds powdered, grs. xxx.
    - Oil, gtts. xxx.
  - Gamboge (hydragogue). Dose, ʒss—ʒj (given especially in impaction of omasum).
- *Oleaginous*
  - Oleum olivæ
  - Oleum lini

  Dose, Oj. Seldom used for cattle.
- Also White Hellebore, Veratrum. Action dangerous, but very rapid. Dose, grs. xxx. Also is nauseant and sedative.
- Treacle is a mild cathartic. Dose, ℔j. Sulphur also is a purgative.

Galactagogues (Act on the mammary gland)
- Fennel. Action doubtful.

Expectorants (Act on the respiratory mucous membranes)
- Ipecacuanha. Seldom used; but "Delafond and other French veterinarians consider that it gently opens the bowels and allays irritation, and accordingly prescribe it in cases of diarrhœa in cattle, in doses of ℈j—℈iij, given in gruel" (Finlay Dunn).

General Gland Stimulants
- Calomel. Generally used as a cathartic. Dose, ʒj. Also used as anthelmintic and a *cholagogue* or liver stimulant; it is a powerful *antiphlogistic,* counteracting the changes which the blood undergoes in inflammation; with opium used in dysentery.

Agents which are administered Internally (continued)—

ASTRINGENTS (Agents which cause contraction of white muscular fibre; they also coagulate albumen and discharges which contain it)

- **MINERAL**
  - Alum. Acts markedly in drying up the secretion of milk. Dose, ʒij—ʒiv.
  - Salts of zinc, especially the sulphate. Dose, ʒj.
  - „ copper — Act especially on mucous membranes. — Cupri sulphas. Dose, ʒj. / Cupri ammonio-sulphas (also stimulant and tonic). Dose, ʒj.
  - „ iron. Sulphate. Dose, ʒj. (Also hæmatinic).
  - Also mineral acids. Dose of dilute acids, f. ʒj.
  - *Sheep and Calves Cordial* — Prepared chalk, ʒij; Powdered catechu, ʒij; „ ginger, ʒj; „ opium, ʒiv; Peppermint water, Oj. — Dose for calves. 2—4 tablespoonfuls, morning and night.
- **VEGETABLE**
  - Acids — Tannic (galls, catechu, kino, &c.). Gallic. — Act also as hæmostatics or styptics in restraining hæmorrhage, for which purpose sulphuric acid and turpentine are also useful. Dose of the acids, ϑj. Of the crude forms, ʒss.

Febrifuges are agents which counteract fever; they are either neurotics, catalytics, or eliminatives.
Vermifuges cause expulsion of entozoa, *Vermicides* destroy them. Agents producing either of these effects are termed—
Antiparasitics; under which heading also may be included agents used to destroy and remove ectozoa and dermaphytes. The various agents which produce these effects may be thus classified—

ANTIPARASITICS
- *Vermifuges.* — Tæniafuges. Areca nut, Filix mas. Average dose, ʒiss.
- *Anthelmintics.* — Others. Calomel; turpentine (dose, f.ʒij). Santonin, used for nematodes. Mucuna
- *Vermicides.* — acts mechanically.
- *External.*
  - Ectozoal. Stavesacre, tobacco, carbolic acid. The two former agents are used as infusions, the last as liquor acidi carbolici (1—40).
  - Dermatophytal. Sulphurous acid. "One part of the acid mixed with three parts of water, or two of glycerine, applied to the diseased surface with a sponge." (Tuson.)

ANTIDOTES are agents administered internally to counteract the action of poisons. They are of three kinds—

- **MECHANICAL** — As demulcents, which sheath mucous surfaces and protect them from irritant and corrosive poisons, include linum usitatissimum, amylum, and albumen. Used as mucilages, and administered *ab lib.*
- **CHEMICAL**— Enter into combination with the poison to form inert or less active compounds.
- **PHYSIOLOGICAL** — Either promote expulsion of the poison from the system, as cathartics and emetics, or neutralise its effects on the system by direct counteraction.

DERIVATIVES or REVULSIVES — Determine concentration of blood in one or more parts of the body at the expense of the others. They may also influence the distribution of nerve force. Eliminatives and external stimulants have this action, as also, in all probability, have certain special stimulants and special sedatives.

INTERNAL DISINFECTANTS — Prevent or counteract the influence of contagia on the system. Carbolic acid. Dose, ʒj once or twice a day. Chlorate of potash. Dose, ʒij. And sulphite and hyposulphite of soda. Dose of each, ʒss—ʒij.

ANTITYMPANICS — Combine with or absorb gases generated internally. Charcoal, and ammonia compounds. Chloride of lime (Dose, ʒiv.) Antiseptics and other agents prevent the further generation of gas.

B.—*Agents which are applied Externally, and act on the part to which applied.*

STIMULANTS (Agents which excite the vital energies of the parts)

- **Rubefacients** (Cause no visible change except increased redness)
  - Ammonia. As liniments, applied with friction. Covering the parts increases its action.
  - Turpentine. Applied with friction, as linimentum terebinthinæ compositum.
  - Mustard. Mixed into a paste with warm water, applied over an extensive surface with friction. Not very powerfully.

  Sometimes these act more powerfully and become—
- **Discutients** (Also cause subsequent desquamation of cuticle)
  - They promote absorption, and thus hasten the dispersal of indolent tumours.
  - When they free the ducts of glands from deposits they are *Deobstruents*.
  - Arnica-tincture and iodine act in this way.
- **Vesicants** (Cause serous effusions underneath the cuticle, termed vesicæ when small and isolated)
  - Cantharides. Unguentum (1—6)
  - Mylabris. Unguentum (1—6)
  - Hygrargyri biniodidum. Ung. (1—8)
  - Boiling water.

  Lotio Discutiens: ℞ Ammoniæ, hydrochlor. and spirit camph. āā partes 6. Acid acet. dil. partes 8. Misce.—To be applied with friction. (Morton.)
- **Pustulants** (Cause purulent circumscribed subcuticular collections. Simply act as vesicants on thick skin of ox)
  - Antim. pot. tart. Ung. (1—8)
  - Oleum crotonis. With some other oil, as oleum terebinthinæ.

Traumatics (Promote healing of wounds)

- **Digestives** (Promote suppuration when applied to wounds)
  - Oleum terebinthinæ. Used as unguentum.
  - Hellebore. As unguentum hellebori nigri and unguentum veratri, often a peg of black hellebore root is inserted in the course of the seton in the dewlap to increase suppuration.
  - Resin. Used under form unguentum resinæ.
  - Myrrhæ tinctura.
- **Detergents** (Promote serous discharge from wounds, and thus cleanse them)
  - Salts of mercury. Hydrargyri oxidum rubrum. Used as unguentum.

Caustics or Escharotics (Cause death of parts more or less extensive. These parts then must be thrown off)

- Argenti nitras. In sticks; blackens parts. Very useful for poisoned wounds, as those caused by a rabid animal.
- Antimonii chloridum. Turns parts white.
- Ferri perchloridum, tinctura or liquor. Also used as hæmostatic.
- Zinci chloridum. Used as Burnett's fluid. Also is disinfectant.
- Potassa, Soda — In stick, seldom used.
- Acida hydrochloricum, nitricum, sulphuricum, aceticum, &c. Used for removal of warts, &c.
- Acidum arseniosum. Also antiparasitic.
- Hydrargyri perchloridum. Less liable to be absorbed than arsenic — Used in fistulous ulcers; causes considerable sloughing of parts to which applied.
- Actual cautery (the heated iron). Causes immediate death of parts to which applied; these are subsequently removed by inflammation, which is more sustained than that caused by other external stimulants. Used in cases of obstinate fistula, in restraining hæmorrhage, &c.; but rarely applied to the ox.

Surgical Means—As setons

Agents which are applied Externally, and act on the part to which applied (continued)—

SEDATIVES (Agents which depress normal or abnormal vital energies of the part)

- **Refrigerants** (Lessen the temperature and sensibility of a part; when extreme in effects are local anæsthetics): Cold water, continuously applied. Ether. Acetum. Ammonii chloridum. Potassæ nitras.
  - *Lotio Refrigerans*: ℞ Ammonia chlor. (in powder) / Potassæ nit. / Aquæ, Oj. } āā ʒiiss. Add the chloride of ammonia and nitrate of potash to the water, and directly they are dissolved dip cloths in the solution and lay them on the inflamed part. (Tuson.)
- **Emollients** (Relax parts, hence lessen pain of inflamed organs and promote suppuration): Cataplasmata. Fomentations with hot water, and by the aid of spongiopiline.
- **Collyria.** Sedative eye lotions, as infusion of poppies, Goulard water, &c.
- **Anodynes** (External). Serve to allay pain. Acetate of lead, carbolic acid, &c.

ASTRINGENTS (Cause contraction of muscular fibre, and especially check hæmorrhages and profuse discharges)

- **Styptics** (Check hæmorrhages): Cold, alum, gossypium, tinctura gallæ, ferri perchloridi, et myrrhæ, collodium hæmostatica. (Surgical means.)
- **Desiccants** (Check profuse discharges,. Antacids, alum, corrosive sublimate, infusion of galls, &c.

EXTERNAL ANTIDOTES

- **Deodorizers** (Remove offensive smells by altering the volatile principles which cause them). Charcoal.
- **Antiseptics** (Counteract putrefactive decomposition):
  - By removal of water and other life-conditions of bacteria. Cold, charcoal, chloride of lime.
  - By oxidation or other chemical decomposition of septic organisms. Nitric acid, permanganate of potash, chloride of zinc.
  - By depriving septic organisms of vitality. Carbolic acid, acidum arseniosum, common salt.
- **Disinfectants** (Counteract or destroy contagia). Probably almost all antiseptics. McDougall's and Burnett's fluids, "Sporokton," &c.

LITHONLITICS (Agents which, when injected into the bladder, cause dissolution of calculi). Hydrochloric acid.

Besides the agents administered medicinally, certain drugs gain a place in the Pharmacopœia as constituting useful and convenient means of giving bulk to remedies, whether for internal or external use. Such are—

Excipients, as common mass, formed of equal parts of linseed meal and treacle thoroughly intermingled. Glycerine and linseed meal, or soft soap, vaseline or lard are used for this purpose; but agents of this kind are not used much for the ox, as

Vehicles, fluid media, are more frequently considered necessary. Water is the most common, the active substances being either dissolved or suspended in it. Gruel is also very useful for this purpose, and in many cases the medicines may be given in beer.

The *application of boiling water,* as mentioned above, to the sides or other parts of an animal, must be effected by dipping a blanket in the water and keeping it held up against the part from each side. As soon as it begins to cool, more boiling water is baled into it, and the process is thus continued for half-an-hour or upwards. Then to the surface a little stimulating liniment may be applied to keep up the excitation and prevent a relapse. Considerable serous effusion into the subcutaneous areolar tissue will result. This is a most valuable means of external stimulation.

Blistering should be performed by removal of the hair from the part by means of scissors or the clipper, and well rubbing in the ointment for about ten minutes. The action of the agent seldom runs too high, but in such a case the removal of any remains of the blister is called for, and alkaline or anodyne lotions must subsequently be applied. Occasionally too extensive application leads to absorption of the vesicant and constitutional symptoms of its medicinal or poisonous action.

Fomentations must be continuously applied, of uniform temperature, as much as possible, and when necessary may be medicated.

Poultices or *cataplasmata* must be of soft consistence, moist, but not too watery—generally are made with linseed meal and bran. Boiled turnips are sometimes used

for this purpose. Several special cataplasms are used: Cat. Fermenti and Cat. Carbonis. The substance known as *spongio-piline* retains moisture well, and has all the beneficial influence of a poultice when properly applied.

Disinfection after the outbreak of a contagious disorder in a cowhouse should comprise removal of animals from the house and their quarantine until after the termination of the period of incubation of the disorder, strict supervision being resorted to, and sometimes internal disinfection. Special attendants should be told off to diseased animals, and not be allowed to approach healthy ones except after thorough disinfection; destruction by burning of bedding and minor appliances such as are inexpensive and easily replaceable; thorough scraping, scalding, and disinfection of walls, partitions between stalls, and major utensils. The drains should be sluiced out with bucketfuls of water and carbolic acid (1—40). The walls should be limewashed, each pail of the wash containing half-a-pint of crude carbolic acid. If the flooring is of round flints, these should be taken up, and the sub-soil removed. This soil frequently harbours contagia. Then the doors and windows should be thrown open, and the place remain thus exposed for about a fortnight, and, if possible cattle not be readmitted under six weeks. When animals must remain in the house, chlorinated lime may be sprinkled about the floor after it has been thoroughly cleansed, and also thrown down the drains, or cloths dipped in solution of carbolic acid may be hung up in the place, or the carbolic fumigation may be resorted to. Thorough cleanliness and ventilation must also be secured.

It remains for us to describe two surgical means of treatment of great value in cattle practice:

Bloodletting—venesection, or phlebotomy—is performed at the superficial jugular. This vessel is very large, and is compressed by means of a cord tied round the neck at the posterior part. The knot must be of a special kind, such as is shown in Fig. 12, that it may be easily loosened when it is considered advisable to check the flow of escaping blood. The fleam, or lancet, must have a large blade, and be

sharp and in good condition, that it may penetrate the thick hide freely. The animal having been duly secured

FIG. 12.—Ox prepared for bleeding. The place at which the vein is opened indicated by the mark (*a*) at the lower portion of the neck. (Armatage.)

by an attendant, and the cord fastened, the head is somewhat flexed to the side opposite the seat of operation.

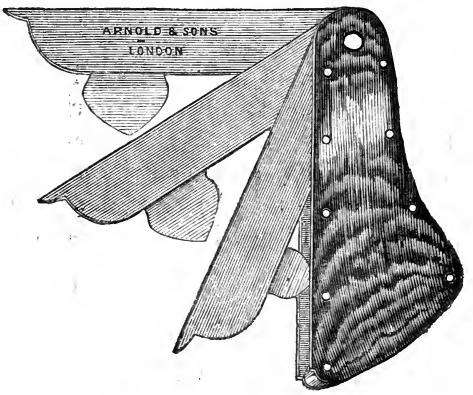


FIG. 13.—Bleeding fleam.

The operator places the instrument longitudinally to the course of the distended vein, and inserts by a single stroke. When a sufficient amount has been removed, as indicated by the state of the pulse, in accordance with the condition of the animal, the cord should be removed, and the wound closed by means of a pin suture retained by a strand of tow wrapped round in a figure of eight manner. Bleeding produces a sudden and powerful impression on the nervous system of a sedative nature, seriously debilitates the

animal, and its effects last for some time. The blood pressure is not affected long after cessation of the operation, for fluid matters are rapidly absorbed from the tissues to keep up the due bulk of the blood. It very seriously diminishes the number of red corpuscles present, but increases the amount of fibrin in the blood. This means is seldom called for except in relief of acute congestions which threaten to bring about speedy death. Local bleedings by scarifications and opening of vessels is seldom resorted to in treatment of cattle. The temporal artery has sometimes been opened in attempt to relieve congestion of the brain, but the vessel is difficult of access. The cephalic, saphena, and superficial abdominal veins are sometimes opened.

Setons produce long-continued and considerable inflammation, resulting in suppuration. They may be inserted by means of the ordinary seton needle, which can be removed from the handle, or by a fixed needle which has the eye near the point (see Fig. 14), it is threaded after insertion, and then withdrawn. The dewlap is the general seat of this operation, but setons may be introduced into other parts, as through fistulæ, &c. They are usually inserted transversely through the dewlap, and may be simple or medicated with blistering ointment or turpentine solution of croton.

FIG. 14.—Seton needle with fixed handle.

CHAPTER II.—DISEASES OF THE BLOOD.

Section 1.—Non-specific Abnormal Conditions.

The blood of the ox forms only $\frac{1}{29}$th of the weight of his body, that of the horse being estimated at $\frac{1}{18}$th. Its red corpuscles are larger (ox, $\frac{1}{168}$ mm.; horse, $\frac{1}{181}$ mm.), and form a greater portion of the bulk of the blood, but do not exhibit such a marked tendency to aggregate into rouleaux as is observable in the horse. The blood does not, under ordinary circumstances, give a buffy coat on coagulation. Fibrin-forming materials and fat are present in larger quantity, water, albumen, and salines being less plentiful. (See Colin's 'Traité de Physiologie Comparée des Animaux.') The vital fluid must be considered as a tissue, the red corpuscles constituting its essential elements. These,

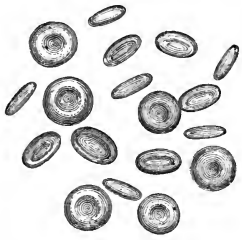


Fig. 15.—Red blood-globules.

from the nature of their duties as oxygen bearers, must occur in a fluid medium, such as is the Liquor Sanguinis. This Liquor Sanguinis consists of an albuminous solution of salines of a most varied character, sufficing for the supply of every requisite to any tissue in the body. Besides the red corpuscles, colourless bodies or leucocytes are found. They are independent cell-like bodies capable of spontaneous motion, and of deriving their support from the surrounding fluid. They become converted into the red

corpuscles in all probability, and in addition have been found to migrate through the walls of the capillaries into the interspaces between the cells of which the tissues are composed; whether or not they thus nourish the tissues is unknown. The blood of the ox has a specific gravity of 1060, and gives off a characteristic milky odour when fresh, or when a little sulphuric acid is added to it. The blood being circulated through the blood-vessels, mainly by the action of the heart, requires for its proper functional activity due bulk and viscidity and a proper chemical composition. It must consist of the right constituents in the right proportions. It may be excessively poor or rich according to the conditions of its nutritive supply. It may be irregularly distributed through the vessels as in congestion with variations in rapidity of flow, and perhaps of tissue interchanges. It is these latter which most materially affect the composition of the blood. Every tissue of the body bears during health the relation of an excretory organ to every other part; by the combined action of all the blood should be kept in a proper condition, its nutritive supplies being especially important. The excretory organs proper have especially the duty of removing impurities; if one of them acts imperfectly the rest may endeavour to atone for its deficiencies by vicarious action, but they do not always do so successfully. Thus, uræmic and jaundice cases occur. Sometimes poisons, whether specific or ordinary, gain entry from without and cause serious disorder. The blood being a generally diffused tissue, we must look for general symptoms during its disorders; there will be an indefiniteness and want of localisation about them which to the unscientific man will make them seem most obscure; but we, armed with our full list of hæmatics and eliminatives, view them with more confidence. While the causes of blood disorders often lie in defective nutrition or elimination, or in the addition of poisonous matter from without, not unfrequently may diseases of this generally diffused tissue be found due to extension of disorder from some of the tissues through which it rushes in its circulatory course. Thus may be

accounted for the frequency of symptomatic fever constituting general disorder as a result of local inflammation. While the tendency to this and other fevers is not very marked in the ox, the liability to specific blood poisons is considerable, and we shall have to treat of many special disorders which devastate our herds and have proved the scourge of the agriculturist from time immemorial. The relatively small amount of blood of the ox and the larger size of the red globules may be, perhaps, considered the cause of the immunity from general fever and from inflammation leading to ill effects after major operations, which is observable in bovine practice as compared with equine. At the same time we must remember, too, that some parts of the body, as the alimentary canal, receive a great deal of blood, and that the venous system is remarkable for its largeness as compared with the arterial.

A. *Nutritive Excess.*—Hypertrophy of the Blood (Watson), Plethora—vulgarly known as Fulness of Blood—results from high activity of the blood-forming organs, whereby the blood becomes loaded with red and white corpuscles. This condition is denoted by redness of visible mucous membranes with a tendency to active hæmorrhages, a full, bounding pulse, high constitutional vigour, and tendency to thrive and lay on fat. Such a state of the body as this can not be considered disease, but predisposition to apoplectic and acute inflammatory affections. We are familiar with the frequency of black quarter in yearling calves in a highly plethoric condition. The causes of plethora are excess of food, vigour to appropriate nutritive matters, and insufficient exercise to bring about a demand for fresh material proportioned to the supply. *Treatment* must therefore consist in urgent cases in abstraction of blood, whereby plethora is at once relieved; in gradual reduction of diet, exhibition of laxatives, and giving the animal a wide and not too rich pasture to graze over. It is the custom to insert a seton in the dewlap that the resulting suppuration may drain away the precursors of the red corpuscles. This certainly lessens the predispositions above mentioned.

When growth ceases to draw largely upon nutritive supplies plethora often occurs, and a somewhat similar throwing back of blood on the system takes place at parturition, to be relieved by lactation.

B. *Nutritive Deficiency.*—ATROPHY OF THE BLOOD, ANÆMIA, debility, poverty of the blood. The principal additions to the blood occur from the alimentary canal, any impediment to this source of supply gives rise to anæmia. Imperfect performance of subsidiary or principal digestive functions, defective absorption, imperfect assimilation, or insufficient or improper alimentary matter and excessive removal of material from the blood will cause debility, hence it results from fluxes, persistent hæmorrhages, &c.

Symptoms, general deficiency in vital energy, excitability and languor, often inappetence and tendency to indigestion. Pulse feeble, frequent, and irregular; heart's action liable to extreme irregularity of beat. Mucous membranes very pale. Coldness of the extremities and a peculiar sound audible over the larger veins, "venous murmurs." Rapid wasting, and frequently the patient is found to be covered with lice. Often this disorder is due to scrofulous tumours internally, or to some specific disorder which has interfered with the nutritive properties of the blood. The essential morbid lesion consists in deficiency of blood-corpuscles. It has been supposed that this results from an abnormally watery state of the serum whereby the red globules absorb moisture in excess and disintegrate. This may be so, but we are inclined in the generality of cases, to consider the excess of water rather the result of the fact that the few red corpuscles do not suffice to stimulate sufficiently the water removing organs, kidneys, and skin, consequently the urine is scanty, and the skin dry and tight on the emaciated body. Sometimes the excess of water in the blood causes dropsical effusions either into serous and synovial cavities or into the subcutaneous areolar tissue. Death may result either from lungs or other parts becoming the seat of congestion, or in the manner which we have already described, as death from anæmia. It is generally preceded by diarrhœa of an exhausting character.

This state predisposes to certain disorders, especially those of a low type and a specific character; even small wounds of anæmic patients may assume an ulcerative character and be very obstinate. Operations are often followed by ill effects.

Pasturage on heath lands where the herbage has an astringent character and is unnutritious, also feeding upon turnips which contain excess of watery material, may be enumerated as special causes. *Treatment* must be directed to removal of all causes which can possibly be in operation, by thorough change of diet and most careful nursing. The transition to good food must not be too sudden, and generally the administration of a laxative dose will rouse the bowels into activity, and remove any accumulation of unnutritious matter from them. Salt sprinkled over the fodder will make it more palatable. Tonics should be administered, generally a combination of iron and gentian will be found useful. Hæmatinic compounds are especially indicated, but care must be taken lest too large doses be given at first. Under such treatment the animal will generally be restored to health, but some cases, where the anæmia is due to specific conditions, are incurable.

The state of the system produced by the ravages of the liver fluke, Fasciola hepatica, known technically as "Cachexia Aquosa Verminosa," must be mentioned here as consisting in a true anæmia. The early action of these parasites, when they are but few and scattered in the bile ducts throughout the extent of the liver, is one of stimulation of that organ, whereby its glycogenic and bile producing powers are increased, the effect on nutrition being favorable. As these organisms increase in number they cause thickening of the walls of the ducts and dilatation of their passages; this is at the expense of the true liver substance, and bile production is thus impeded, the ducts become filled with parasites and a viscid bile. Generally at this stage the constitutional power of the animal enables it to withstand this interference with the production of bile and grape sugar. But this is not always so, for in some years the parasites are so plentiful, and so thoroughly invade the liver substance, as to give rise to

the above-mentioned symptoms of anæmia, and ultimately to death. Such outbreaks occur after extraordinarily wet sea-

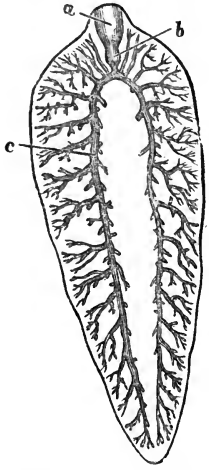


FIG. 16.—Fasciola hepatica, the common liver fluke. *a.*, *b.*, and *c.*, its alimentary apparatus.

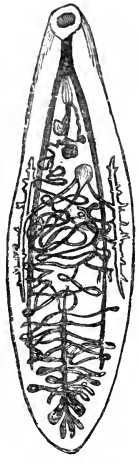


FIG. 17.—Distoma lanceolatum.

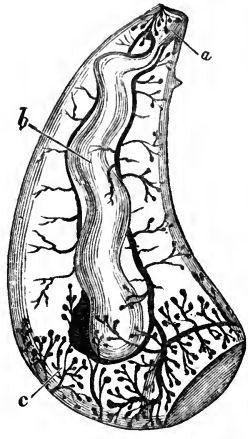


FIG. 18.—Amphistoma conicum.

Certain flukes, Trematodes, found in the ox (after Cobbold).

sons, when meadows have been flooded, and flocks are being decimated by "rot." Usually they may be seen about at Christmas time or in the early spring. The collateral conditions of the case, together with a yellowness of the visible mucous membranes, will enable us to diagnose such cases from those of simple anæmia.

Our efforts must be directed to support of the strength of the patients by the above-mentioned means. Iron and salt are very useful as being anthelmintics. Good oil cake is especially called for. *Prophylaxis* must be observed in wet seasons, and consist of measures based on our knowledge of the life-history of the fasciola. The larval forms abound in meadows (generally low-lying, and well known to shepherds) during the later months of summer or the earlier of autumn, according to the season. At these times young or debilitated stock should not be turned out to pasture in such meadows, or, if circumstances render

this a necessity, they should receive a fair allowance of salt. The parasite which produces this disorder is that which causes "rot" in sheep.

Science tells us that more careful destruction of fæces containing myriads of ova of this parasite, whether of cattle or sheep affected, would be beneficial. A more widely diffused knowledge of the relations of diseases as they occur among his live stock is essential for the agriculturist.

Post-mortem Examination of a case of anæmia, while often disclosing the special cause, invariably shows a bloodless condition of the tissues, absence of fat, which is replaced by gelatinous areolar tissue, muscles small and very pale, blood forms a white clot, often before removal from the larger blood-vessels, frequently ante-mortem clots, which have complicated the case during life, may be observed in the heart; they are supposed to result from the uneven internal surface of the heart, whipping up the abnormally fluid blood. Is the flesh fit for human food? In a case of extreme anæmia, such as has resulted in death, we cannot hesitate to reject it. It probably has distributed through it deleterious matter accumulated from defective excretion; these have not been proved injurious to man but certainly are not beneficial, and the flesh is devoid of nutritive matter, so cannot prove a loss of valuable food material.

c. *Nutrition Perverted.*—Pyrexia, Fever, inflammation of the blood. We have adopted this pathology of fever after due consideration, for it seems to us that all the phenomena of fever may be traced to perverted nutritive conditions of the blood. This state may originate in itself as *simple fever,* or by extension of inflamtion from some of the tissues through which the blood circulates, constituting *sympathetic or symptomatic fever.* It has been debated whether simple fever occurs in the lower animals, but we cannot doubt that it does, and under this heading may be classified those cases which exhibit an indefiniteness of symptoms, an absence of diagnostic signs.

Symptoms.—The attack commences with a shivering fit and general signs of disorder. Pulse quick, rather

hard, and often exhibiting a tendency to dicrotism. Mucous membranes injected. Warmth of extremities, mouth, and general surface of the body, with a dryness of the skin. Respirations slightly increased in frequency. Excretions deficient, hence mouth dry, bowels torpid, and urine scanty and high coloured. Secretion of milk lessened. Irritability of the animal is generally present. Internal temperature elevated. Thirst considerable. As the case progresses there is a tendency for the different organs of the body to become involved in the disorder. The lungs, as being most concerned in alterations of the composition of the blood, are liable to become the seat of congestion. The bowels may also become affected or the liver, and, in a less degree, other parts of the body. Thus, we often find that cases which originate as fever pure culminate in acute inflammation of some important vital organ. The blood has its fibrin-formers increased, and also its amount of fat, while the globules (generally) and the albumen and salines are diminished. The urine owes its high colour probably to the rapid disintegration of red corpuscles, increased specific gravity to deficiency of water and organic salines and increase of extractives, hippurates, &c. *Gant* thus expresses his views of the cause of one important change in the blood, "the flotilla of oxygen-laden cells perishes *seriatim* from overpressed service, and their wrecks are converted into fibrin." Such is the peculiar character of the blood-tissue that it can not exhibit the ordinary characters and changes of inflammation. It is non-vascular, yet more highly nourished than any other, hence the changes must be manifested only in the tissue elements. These, the red globules, have their functions perverted, they no longer convey oxygen satisfactorily to the tissues to stimulate them to action, the energy of oxidation expends itself in the breaking up of the globules. Diminution of globules takes place, proper nutritive interchanges between the blood and the tissues not occurring, the fluid becomes overloaded with impurities, and so causes disease of other organs, the lungs being especially unwilling to allow the

passage of impure blood. Sometimes a *crisis* occurs, one or more of the excretory organs (bowels, liver, and skin) overcomes all difficulties by its inherent energies, removes impurities, and so relieves the blood. Resolution then occurs unless a relapse checks the salutary process. In declining fever a lateritious sediment frequently may be found in urine. Fever may be caused by any conditions which interfere with due removal of matter from the blood. Thus, close and ill-ventilated houses, want of exercise, and excessive feeding all predispose to the disorder, while sudden changes of temperature, long journeys, exposure to draughts or to severe weather prove exciting agencies. Acute inflammation of internal organs, or of any other part of the body, the presence of poisonous material, whether ordinary or specific, in the blood, and defective action of eliminatory organs are causes of the symptomatic affection, which is more frequent than the simple form. Thus, in our examination of many disorders we shall have to allude to complicating febrile conditions, such as those which have just received notice from us. It is remarkable that frequently fevers abate somewhat towards mid-day. Again, they may re-appear periodically, when they are termed *intermittent*, and generally are due to special organisms in the blood, the periodic activity of which accounts for regularity of recurrence of the disorder. Thus, ague in man is due to Spirochæte, which is supposed to be a bacterian organism, and certain intermittent disorders affecting the ox have been described as occurring in low districts which probably are attributable to a similar cause.

In the *treatment* of febrile affections nursing must be resorted to with assiduity, the skin especially being roused into activity by frictions. Stimulants, particularly such as act upon the excretory organs, as nitrous ether, may be used with benefit. The bowels may be acted upon by a saline laxative. The stimulants check any tendency to local disorder by equable diffusion of blood and nervous energy. The beneficial effects of fresh air must not be neglected in symptomatic cases. Though

the impurities accumulated in the blood as a result of defective excretion in fever are not known to act deleteriously on man when the flesh is injested after cooking, we should when possible prevent such meat from passing into the market. The general custom is to destroy the animal when recovery seems hopeless, and to have it dressed for the public; any parts which exhibit signs of disease being rejected.

Necræmia is the term which has been applied to death of the blood *en masse*, such as occurs in black quarter and certain other blood diseases. It may be observed in cases of death resulting from a sudden and powerful alteration in vital conditions, as is seen in animals struck by lightning. Probably the other tissue elements of the body, especially the nervous, are also affected in this case, for they, like the blood, exhibit imperfect tendency to congelation, and rapidly commence to putrefy. The non-coagulation of the blood is not present in every case, but this fluid is always dark in colour, and any clot which forms is deficient in firmness and permanence. Such cases never call for treatment, but not unfrequently for determination of the cause of death. Collateral circumstances must be carefully considered, and the surface of the body examined for local discoloration or singeing; but it is quite certain that death may occur in this manner without any injury to the surface. A lightning shock may cause injury short of death, as paralysis of a part. After such injuries the principal indication is to avoid collapse by means of stimulant agents.

d. *Variations in Constitution.* (*a*) Increase or decrease of normal constituents.

Having already dealt with such diseased conditions as arise from irregularity of distribution of blood in the circulatory organs constituting the phenomena of hyperæmia and congestion, we may now examine those states which result from variations in the constituents of the blood, whether in quality or in quantity. Increase of water, salines, &c., may occur without any appreciable influence upon the health of the animal, simply causing predis-

position to disorder. Such is the case when excretory organs act inefficiently, or when excessive material is added. These states are, therefore, generally purely of a secondary character. The cause being removed they will cease. Decrease of these normal constituents may be similarly of minor importance. We have seen that fibrin is increased in fevers, especially those due to considerable local inflammation. It seems this is associated with disintegration of corpuscles; hence we find products of a highly plastic character generated under these circumstances. In anæmia the fibrin factors are deficient, the blood and deposits wanting in plasticity. Though occurring frequently in disease, variations of amount of fibrin factors have not been proved to constitute distinct disorder.

Leucæmia, or Leucocythæmia, results from excessive production of white corpuscles in consequence of the activity of the spleen, lymphatic glands, and medulla of bone, these being the blood-making organs. The spleen and lymphatic glands undergo enlargement and become altered in appearance. The white globules of the blood, instead of being in the proportion of one to three or four hundred, are as one to thirty or forty. This disease has been described by Siedamgrotzky ('Veterinarian,' 1880, p. 159). He mentions it as occurring in cattle, females being most subject. The symptoms are those of anæmia.

The red corpuscles we have seen are largely increased in plethora, and they may be more numerous in fevers; evidence is rather uncertain on this point. This simply gives rise to increased functional energy; indeed, in health the improvement of a breed and high feeding increase the number of these elements. "Free exposure to fresh air and light seems also to powerfully promote the formation of red blood as much as the deprivation of them tends to destroy it" (Jones). From this we deduce a practical indication for treatment of anæmia. When the destruction of red corpuscles predominates over their formation poverty of the blood results. Mercury seems

to have a special power of disintegrating red globules. Under certain circumstances the red colouring matter becomes dissolved in the surrounding serum, which stains the walls of the blood-vessels. This occurs, more or less, in all cases of stasis or extravasation of red corpuscles, but especially from certain chemical changes in the serum, as admixture of bile salts. As potash and phosphates occur particularly in the corpuscles, while sodium and chlorides are mainly in the serum, we can see that various foods are adapted especially for the formation of special parts of the blood.

(β) Retention of matter in the blood which should be excreted.

There are certain organs which remove effete matter from the blood. Of these the principal are lungs, liver, skin, and kidneys. If either of these organs act imperfectly, and the others are unable by vicarious action to perform its duties with sufficient energy, accumulation of effete matter leads to blood disease.

Carbonic Anhydride poisoning results from defective action of the lungs. It may also take place from exposure to an atmosphere containing excess of this gas, as the "choke damp" generated by explosions in mines. The fact that a chronic form, as it were, of this disorder results from imperfect escape of foul air from cow-houses must make us attend to due ventilation. This chronic state predisposes to disease of a low type, lessening constitutional vigour. Thus, 3 per cent. of this gas in the air lessens the frequency of the pulse and increases the respirations; 1·5—2 per cent. suffices to produce headache in man, and fatal results ensue on exposure to air containing 5—10 per cent. The severity of disorders of the lungs is considerably increased by the accumulation of carbonic anhydride in the blood which results from them. This substance acts as a narcotic poison. Acute cases of carbonic acid poisoning are manifested by laboured breathing and other signs of narcosis, ultimately leading to death from asthenia.

Treatment must consist in exposure to fresh air, ad-

ministration of stimulants as ammonia and artificial respiration. On examination of the body after death, the lungs are found congested and the blood dark.

JAUNDICE—ICTERUS—is accumulation in the blood of matters which should be removed by the liver. This seldom causes acute diseases, and may be due either to non-elimination in consequence of structural derangement of the organ or to reabsorption of bile in consequence of obstruction to its escape into the bowel. The bile constitutes an outlet for much of the colouring matter set free by breaking up of the red corpuscles, also for cholesterine and for certain bile salts, glycocholates, and taurocholates. When these salts enter the bowel they undergo changes, and probably become reabsorbed and utilised for respiratory purposes, as they contain a considerable amount of carbon and hydrogen. But if introduced into the blood before undergoing change they cause solution of the red colouring matter in the serum. They are probably formed in the liver. This is a useful fact as far as diagnosis is concerned. If the bile be not secreted only the colouring matter will be removed by the kidneys, whereas if the bile be reabsorbed the characteristic bile acids will be found in the urine. We will summarise the testing processes from Dr. Legge's useful little work on the urine. The urine is deep in colour, and stains white filtering paper yellow.

Gmelin's Test determines presence of bile pigments. Allow a drop of nitric acid and of the urine to be examined to run together on a porcelain dish, at their line of contact a play of colours will occur, consisting of green, violet, blue, and red. The red colour will appear with any urine. The green colour is most distinctive.

Pettenkofer's Test is for the bile acids. "Pour the fluid containing the bile acids into a test tube; sulphuric acid being then added, at first in small quantity, to precipitate the bile acids, but afterwards in amount sufficient to redissolve them, which renders the mixture perceptibly hot to the hand. A drop of syrup may now be let fall into the liquid, which then shows a play of colours, passing

from pink to cherry-red, and from red to purple." This test must not be applied directly to the urine, but the latter must first be rendered faintly ammoniacal with caustic ammonia, and then diacetate of lead added until it produces a precipitate—this must be washed with distilled water, boiled with alcohol, and thrown into excess of ether—the bile salts will crystallise out and being dissolved in distilled water may be tested by Pettenkofer's test.

Besides the altered colour and chemical reactions of the urine, other symptoms of a marked character may be noted in this disorder, the visible mucous membranes and the skin become yellow; the change in colour of the eye gives a very characteristic appearance; besides the general symptoms of disorder the animal is markedly dull and debilitated. The pulse is slow, and there is considerable disorder of the bowels as shown by torpidity and flatulence, the fæces being scanty, dry, and dark coloured. The bile acts as a natural stimulus to the coats of the intestines, and its loss is felt. In milch cows the milk is deep in colour. If these conditions be not relieved the debility increases, the temperature of the body-surface falls considerably, the patient wastes away rapidly, dropsical swellings occur in various parts of the body, obstinate diarrhœa sets in, and death from anæmia gradually results. The causes which give rise to this affection are organic disorder of the liver, or such functional derangement as occurs in congestion, also any disorder of the excretory apparatus leading to obstruction, such as tumours, either of the walls of the ducts or gall bladder, or neighbouring parts, parasites, calculi, stricture, or disease of the wall of the duodenum around the opening of the bile duct. This disease appears among cows especially in the spring and autumn, altogether it is rather frequent in the ox.

Post-mortem appearances will enable us to conclusively determine the cause of the disorder; there is a diffused yellowness of the tissues and a high colour of the serum; effusions into the areolar tissue, and into serous sacs, as well as other anæmic conditions are present. The flesh of animals which have died from this disease is discoloured, it

contains a cathartic principle not, however, of a very active character, also anæmic conditions are present, therefore its use as food is to be condemned.

Our *treatment* must depend upon extended diagnosis of the case. Derangements of the liver must be removed according to their nature in each instance. Thus, in some cases we need cholagogues, in others sedative agents. In tuberculous and other structural derangements of the organ, as well as when the escape of the bile is obstructed, we must adopt palliative rather than curative means, which latter can hardly prove effectual. Dieting with succulent food of a nutritious and easily digestible character, gentle and regular exercise, and the administration of eliminatives which aid the action of skin and kidneys must be adopted in all cases of jaundice. Stimulant tonics which mildly promote the activity of the liver, such as beer, prove useful, and the nitro-muriatic acid is recommended in cases due to torpidity of the biliferous organ. Animals highly fed, either for the production of milk or fat, are very much predisposed to disorder of this nature, even during health there is a yellowness of the skin and visible mucous membranes in these animals. It is wonderful what an amount of structural derangement and removal of substance the liver may undergo without jaundice appearing. Youatt remarks upon a special scaly eruption which appears on the skin in these cases.

Uræmia is described by Armatage as occurring in the ox. It certainly is not frequent. It is accumulation in the blood of urea and other urine constituents, either as a result of a blocking up of the urinary passages, or of considerable disorganisation of the kidneys. The retained materials act upon the nervous system, producing active toxic effects. The most marked symptoms are the presence of urinary constituents in the sweat, which is profuse, and has a very marked odour, and the slowness of the pulse and respirations, with a marked fall of internal temperature. This is the result, generally, of long-standing organic disease of the kidneys, and rapidly proves fatal, inducing death by coma. Such is the

structure of the urinary passages that absorption of their contained fluid will not occur, but sometimes acute uræmia takes place, when after lithotomy urine infiltrates the areolar tissue around the wound.

Treatment comprises removal of the causes, nursing, and administration of stimulants. The disease is generally only a precursor of death.

Rheumatism seems to be mainly dependent upon decreased activity of the skin and accumulation in the blood of the normal constituents of sweat; whether or not this be the case, the blood is often found to be acid in its reaction, which has been attributed to the presence of lactic acid and lithic acid in excess. The matters which have accumulated in the blood cause inflammation of the white fibrous tissues of the body, especially those situated in connection with joints and the deep fibrous structure of the endocardium and pericardium. This disease is somewhat frequent in the ox, and is due to exposure to dampness and cold. Thus it is most frequent in marshy countries, and during the spring and autumn, affecting old rather than young cattle. It has been observed to follow exposure to draughts, especially when the animal is in a perspiring condition, also it appears in cows exposed during or immediately after calving. Undoubtedly it is hereditary. Rheumatism may assume an acute or a chronic orm, and becomes localised in the fasciæ of the loins (lumbago, or "chine felon"), in the serous membranes of the heart, or in the joints (rheumatic arthritis, "joint felon," 'chrocles"). The animal at first in an acute attack is dull and hide-bound; has a staring coat, and is unwilling to move, and there is generally a peculiar rigidity of the spine, due to affection of the lumbar fascia; shrinks on pressure being applied to the loins, and soon the extremities become involved in the stiffening. There are then local signs of inflammation, with special *hardness* of the swellings around the affected joints; also fever is present, characterised by the hardness of the pulse and the sharpness of its beats. The animal becomes very lame on one or more limbs, when suddenly the disease seems to shift

into another, frequently the corresponding, part of the body. This metastatic character of rheumatism is a very marked feature of the disease. The tendency of the disorder to recur in a part once affected is also very evident. The swellings of a hardened character which appear around the joints seldom lead to suppuration, though the local inflammation runs high, and causes severe fever, the blood containing very much fibrin. The changes which result from this special arthritis are peculiar. Removal of articular surfaces in parts occur, and the exposed cancellated tissue becomes consolidated by deposition of bony substance, and exhibits a high polish, which results from friction. This is termed *eburnation, or porcellaneous deposition.* The urine in rheumatism contains much saline matter, due to increase in amount of hippurates excreted. When the disease assumes the chronic form it is most liable to produce the above-mentioned change of articular surfaces. Calcification, or even ossification, of the fasciæ and ligaments may result from the chronic form; thus, tumours, apparently of a bony character, may be found embedded among muscles, or loosely or firmly connected with bones. They are not truly ossific, being composed largely of hippurates, or urates of alkalies, sometimes, especially when they appear in joints, they are termed gout-stones. The endocardium tends to become the seat of fibrinous deposit, and the pericardium to opacity, calcification, and even ossification in chronic rheumatism. Disorder of this kind renders the heart irritable, intermittent in its action, and the pulse quick, hard, and small. "The soft structures above and below the affected joints in horned cattle sometimes swell, suppurate, and continue to discharge pus for a lengthened period, the animal rapidly wasting, and finally becoming worthless" (Williams); and when suffering from the arthritic form cattle obstinately remain recumbent.

Treatment must comprise most careful nursing of the animal, and avoidance of exposure to draughts; administration of eliminatives, such as will promote the action of the skin, bowels, and kidneys. Colchicum is

found to be especially useful in disorders of this character. Iodide of potassium also has been found beneficial. Also alkalies are valuable to counteract acidity. In arthritic complications fomentations are considered but loss of time. Stimulants are beneficial, especially vesicants, for it is supposed that they draw off the poison from the blood, and lessen its tendency to affect the heart. The general fever must be combated by doses of tincture of aconite. Williams recommends that the bedding be frequently changed to prevent bed-sores, and the inflamed joints wrapped in flannel to prevent bruising. He considers also that if suppuration sets in the animal should be destroyed, as chances of recovery are very slight. Rheumatism tends to assume the chronic form, and may cause death by cardiac complication, or by continuous irritative fever. The flesh, being full of impurities, is unfit for food. The joints, besides the lesions already noticed, frequently exhibit false anchylosis and ulceration of cartilages.

Hæmo-albuminuria—Muir-ill, Redwater, Blackwater—is a disease which is very prevalent in some parts of the country and especially affects cows (just before or) after calving, generally on about the fourteenth day. It commences with general febrile symptoms and diarrhœa. Then the animal stands with arched back, obstinate torpidity of the bowels sets in, and about the same time urine of a high colour in small quantities is expelled with some force by straining; also tenderness over the loins is present. The respirations are laboured, pulse very quick, small, and dicrotous, and the animal very dull and giving no milk, or only a little of a yellowish colour and unpleasant odour. The visible mucous membranes are of a yellow colour. The discoloration of the urine is very characteristic, and undergoes increase in intensity as the disorder progresses. Youatt mentions two forms of the disorder, acute and chronic. The former, manifested by the symptoms above indicated, runs its course in a few days; the latter is more prevalent, and may be slight, and terminated by a spontaneous diarrhœa, or else may extend over a considerable time. All the above-mentioned symptoms ex-

cept fever being present, generally such prolonged cases terminate in death from gradually increasing anæmia. Calves, bullocks, and even bulls may be affected with this disorder, but less frequently than cows.

Causes.—It is very prevalent on certain pastures, and not on others even in the immediate neighbourhood. It has been associated with certain special soils, and particularly with movement of stock from land of one kind to another. Overdriving is considered a cause, as also certain special states of the air and great alternations of temperature. It is on the latter account, probably, that it occurs very much during the summer among animals brought to highland pasture from richer lowland soil. As a rule, the disease is most frequent in spring and autumn, and high condition, as well as difficulty in cleansing after calving, is considered a predisposing cause. Cases have been traced to the drinking of stagnant water, while Harrison attributes its prevalence in some cases to a hot and dry condition of pastures, and to excess of drainage. It has been found very prevalent in woody districts. Also a poor diet of any kind, as turnips, about the time of calving, will prove a cause.

The *Urine* has an average specific gravity, 1041, with alkaline reaction, and a more or less powerful odour of rotten turnips; contains 1·82 albumen, 1·26 urea, and 1·28 extractives in 100 parts of urine, while on microscopical examination crystals of cholesterine, hippurates, phosphates, and epithelial scales were found more or less abundantly (Williams).

Post-mortem examination.—Youatt speaks of considerable inflammation, ulceration, and often the formation of fœtid pus, and occasionally gangrene of the uterus in acute cases, but probably he was labouring under some error, for he also speaks of inflammation of the kidneys, which certainly is not present. The uterus simply contains dark-coloured mucus, while the kidneys, though occasionally they are found congested, usually are paler than ordinary. The bladder contains some of the characteristic red or black urine, according to the stage of the case. The serum of

the blood is very high coloured, as are also the contents of the areolar interspaces and serous cavities, and of the lymphatic vessels. Ecchymoses are perceptible under the endocardium. The first three compartments of the stomach are generally full, and the contents of the omasum especially very dry. The abomasum exhibits congestion of its internal surface. The liver seems to be invariably diseased, being congested both with blood and bile, hence enlarged, dark, and soft. The bile collected in the gall-bladder is generally thick, viscid, and dark.

Pathology.—Numerous theories on the nature of this disorder have been advanced:

(1) It has been attributed to the presence of certain ranunculi in pastures, but it arises under circumstances where animals could not obtain such poisons.

(2) Youatt considers the acute form is inflammation of the kidneys, and "probably may be traced to the quality of the general produce of the soil rather than to the presence of certain plants of known acrimonious or poisonous properties." The chronic form he attributes to an acrimonious condition of the bile, which is absorbed into the blood, and irritates the kidneys.

(3) It was thought that the colour of the urine depended upon the presence of blood in it, but the absence of blood as blood is proved by the absence of red corpuscles. Gamgee considers the disease hæmaturia, and this opinion is held by many continental authorities. In true hæmaturia, however, blood occurs, in the urine in clots and is expelled in this state.

(4) Professor Williams says:—"I am induced to conclude that the disease originates in an impoverished condition of the blood, arising from want of proper food; that the albumen of the blood is thus degraded in quality, and as such is unfit to be appropriated for the nourishment of the tissues, and is consequently excreted by the kidneys, and expelled from the body; that the blood-globules are in a broken-down or disintegrated condition arising from solution of their outer layers or cell-walls, when their coloured interior—hæmatin—escapes, which,

mixing with the serum of the blood, and being eliminated by the kidneys, gives the characteristic tinge to the urinary secretion."

(5) The disordered conditions may all be referred to defective action of the liver, whereby it is rendered unable to elaborate albuminose which is passing from the intestine, and therefore accumulates in the blood. At the same time congestion of the organ seems to lead to excessive bile production, the superfluous material being removed by diarrhœa until reaction sets in, and then entering the blood, and causing disintegration of blood-corpuscles. Until we are more assured of the condition of the liver in this disease, as also the spectroscopical characters of the blood and urine, we shall not be able to state its pathological nature with full confidence.

(6) Armatage attributes it in many cases to the icy coldness of a large quantity of frozen turnips introduced into the rumen, and undoubtedly this is one of the ways in which it may originate. Our knowledge of the physiology of the liver is hardly yet sufficiently advanced to enable us to understand the complex perversions which occur in such a disorder as this.

Treatment.—Professor Simonds, who first showed that this is a disease due to alteration in the blood, and pointed out the presence of blood colouring matters and albumen in the urine, considered bleeding advantageous in the earliest stages of the disorder. Certainly the administration of a cathartic is beneficial, it removes from the alimentary canal indigestible material which tends to cause irritation. Again, it arouses the liver to activity when this is necessary, and enables it to relieve itself of congestion. It follows nature's indication, for a salutary diarrhœa often ushers in a favorable turn of the case. The animal should be nursed carefully, and subjected to a thorough change of diet. The kidneys should be assisted in their endeavours to purify the blood by stimulant diuretic agents. At the same time formation of good fresh blood should be promoted by restorative hæmatics. Professor Williams, in accordance with his theory of the

nature of the disease, suggests eggs and milk, and in addition to this highly albuminous food, stimulants and chlorate of potash.

Scarlatina has been described by Professor Barlow. It is very similar to the disease next described, but differs in the less marked swelling and in the spotted character of the mucous membrane which is covered with red points, and altogether has a scarlet colour differing from the ecchymoses and blood infiltrations of purpura. There is also, generally, sore throat.

Purpura Hæmorrhagica.—*Urticaria tuberosa* (Simonds)? is described as affecting cattle, though certainly it is not so frequent in them as in the horse. Calves are deemed most liable to this disease which consists in a disordered condition of the blood. That fluid is thin and so related to the blood-vessels that extravasations occur especially on the mucous and serous membranes. Swellings appear on various parts of the body which are hot and painful and somewhat sharply circumscribed. From them and from the nostrils flows a reddish fluid. The animal is extremely debilitated. The swellings of the mucous membrane obstruct respiration and deglutition. The depraved state of the blood causes a weak and fluttering action of the heart, and a small dicrotous pulse. Petechiæ and blood extravasations on the mucous membranes are pathognomonic. Undoubtedly these conditions may arise from several pathological states, which interfere with the relations of the blood with the vessels which contain it. It is not essential that capillary ruptures should take place in production of petechiæ and extravasations of red corpuscles. A slight migration of these bodies occurs in health (diapedesis), but doubtless in most cases of purpura there is a true giving way of the walls of the capillaries. By some authorities purpura is considered anthracoid in its nature. This is not the place to minutely discuss the various pathological theories of purpura; the disease follows debilitating influences, as previous disease, exposure, and inhalation of foul air.

Autopsy shows petechiæ of serous and of deeply-seated

mucous membranes, together with extensive hæmorrhagic infiltrations; also sero-sanguineous accumulations in areolar spaces. The disease generally assumes a subacute character, and after about a week terminates in gradual recovery of strength, or more frequently in sinking of the patient, and death from asthenia.

Treatment consists in careful attention to hygiene, supply of nutritious and easily digestible food, the use of eliminatives and stimulants. Oil of turpentine is recommended since it acts on the kidneys, is a stimulant and also a hæmostatic. The tincture of perchloride of iron promotes the formation of red corpuscles, and also acts as a styptic. Sulphuric acid, as a styptic and tonic, is also used with benefit. The disease is rather liable to recur, and the stage of convalescence is prolonged.

Diabetes insipidus sometimes arises from excessive introduction of water into the blood, but as it occurs more frequently from other causes will be treated hereafter.

Diabetes mellitus has not been proved to affect the ox.

γ. Introduction into the blood of matters foreign to it.

(1) Ordinary toxic agents.

Here ought to be considered those cases of ordinary poisoning which result from the entry of matters into the blood, which either act on the blood itself or upon parts distant from the point of entry, and thus cause serious inconvenience and even death. Such poisons, however, must be considered in relation with others which have a local action, and therefore will be examined hereafter.

(2) Specific toxic agents.

Section 2.

These give rise to SPECIFIC DISEASES, under which heading may be comprised all disorders which manifest characters of a highly special kind, whether in their course, cause, or termination. This definition, like most others, does not enable us to accurately limit the thing

defined, but rather while strictly applicable to the central figure of the group allows us to arbitrarily decide its outlying limits. Thus, some authors include rheumatism and tetanus among specific disorders, while others refuse tubercle, cancer, and influenza a place in the list. We have included under this heading diseases which seem to be due to minute living organisms, the nature of which varies in different cases. On the one hand, we have cancer consisting of body cells which have a high degree of vital energy, as manifested by their reproductive power. They resemble certain natural components of the tissues, but are remarkable for retaining their vitality when grafted on to a fresh organism, after removal from that in which they originated. Tubercle is closely allied to cancer in its general nature. On the other hand, we have anthracoid affections which are undoubtedly due to the presence of minute, independent, and entirely foreign organisms in the system. Of the diseases lying between these extremes some have been traced to certain relations with foreign minute organisms, while the cause of others remains a mystery. In no branch of medical inquiry is more progress being made than in the study of specific disorders. This is a direct result of the fact that they, more than any other disorders of domesticated animals, make themselves felt by the community, for they spread rapidly among herds, are generally very fatal in their effects, and not unusually can originate disease of like kind in man. Though it has not been proved in every case that these diseases are due to special organisms, we shall find it advantageous to adopt the "germ theory" as a hypothesis for working purposes. We may safely do so, for it has already explained many previously obscure facts, and no positive evidence has been brought to bear against it. Given this supposition we must then conclude that the organised generators of disease have certain special characters of form, composition, and life conditions. Among the latter we must consider their origination, metamorphoses, habitat, products, &c. On some of these points we are profoundly ignorant, there are many of the

organisms whose existence we can at present affirm only from reasoning, they being probably too small to be seen in the present state of optics. Many have only just been discovered, and their nature and action are by no means decidedly ascertained. Others, as the anthrax organism, we are fairly well acquainted with. These diseases often assume the epizootic or panzootic character, the atmosphere seems to be the temporary habitat of the organisms, which occur in groups,—disease clouds—much as shoal of fish in the sea. Such a theory will account for many obscure facts of cause and propagation of influenza and other diseases. It is well known that blights occur in clouds; why should not also disease germs which are probably closely allied in nature? Certain conditions of climate are found favorable to distribution of disease in this manner. Heat, with moisture, states favorable to the growth of fungi, most readily promote the spread of specific disease. Frosty weather, on the other hand, is very healthy and checks prevailing epizootics. Again, it has been found that currents of air, as prevailing winds, may determine the direction of passage of specific disorders of a certain kind, though not so as to impede less rapid and energetic progress in other directions. Diseases of this kind, then, seem to be communicated without contact of a diseased animal, or of objects which have been in contact with one, with a healthy animal of the same or other species; this is termed *Infection.* But we can readily admit that certain disease-bearing organisms cannot be taken up and diffused by the air, though they may be communicated from one animal to another when actual contact occurs, such is *Immediate Contagion;* when the contact is indirect as when the two animals are fed out of the same bucket or taken care of by the same man, either man or bucket may convey the morbid producers from the diseased animal and thus act as the vehicle, by means of which *Mediate Contagion* is brought.

Inoculation consists in the introduction of the active disease producer directly into the blood-vessels or areolar tissue of an animal, or causing its absorption through an open wound or an exposed vascular surface. It will be

observed that infection, contagion, and inoculation are different only in degree, and directly related to the readiness with which a disease is communicable from one animal to another. Thus, most active and freely communicable disorders are propagated by infection, generally also by contagion, and they may be generated by inoculation. In infection the organic particles principally gain entry through the delicate lining membrane of the air-passages. We can easily understand that some of these particles will be able to produce no effect when they come in contact with the surface of the cuticle through which they cannot readily pass, and thus a disease may be infectious and not contagious. Again, certain of these organisms may require to undergo development probably on a mucous surface before they can cause disorder when they enter the blood. We do not accordingly find that infectious diseases are always communicable by inoculation, though most of them can be thus propagated with facility. Contagion, mediate and immediate, is well illustrated in certain skin diseases, due to animal parasites. Specific disorders affect some animals more readily than others in consequence of predisposition or immunity. Generally, debilitated animals are most prone to disorders of this character, and debilitating influences even *after* exposure to infection or contagion may act as *determining causes* (causes which render the system susceptible after exposure to the influence of the disease producer). Shocks to the nervous system are especially potent in this respect. Immunity may be due to conditions of the species (specific), or of the individual. The latter form is especially marked in epizootic or enzootic outbreak when all of the herd will be more or less victimised, except a few animals, which remain quite free from disease. Immunity is sometimes secured by a previous attack of disorder as is well seen in cases of smallpox in man, this results from profound alterations in nutrition, but it seems that in time this immunity becomes lessened. Again, immunity may be secured by an attack of an allied disorder. When the latter is much milder in its attack it may be artificially

produced to act as a prophylactic. When the morbific organisms are hardy and capable of withstanding considerable variations in life conditions so that animals of very different kinds are invaded by them, the disease which they produce is panzootic; foot-and-mouth disease is a good illustration of this. Our diagnosis of these specific disorders generally must be prompt, to check any tendency to spread. In all cases where any doubt exists the animal must be isolated as suspicious, and other prophylactic measures adopted. Diagnosis is often followed by the stringent test of accuracy of opinion which immediate slaughter affords. Fortunately, therefore, these disorders, especially the most acute of them, are ushered in by considerable rise in temperature. This occurs very shortly after introduction of the poison into the system, and before it has had much time to multiply therein and to become expelled into the air around, or with the excreta. This rise is the first indication of the fever which constitutes the systemic disturbance in all these cases. Later the general signs of fever are manifested, and they run their course for some time before any local manifestations of disease are shown. Indeed, the latter in some diseases (exanthemata) seem to constitute a crisis generally of a favorable character. In all cases, then, febrile symptoms, more or less acute, usher in an attack, and constitute the premonitory indications of disorder. Only when we are aware of the prevalence of a specific disease are we, in the first stage, able to surmise the nature of the coming disease, for the fever does not differ from ordinary pyrexia. Only when local lesions occur can we complete our diagnosis, and we shall generally be able to find some pathognomonic symptoms. It will be observed that the virus in these specific disorders almost always like an eliminative medicinal agent enters the blood, causes certain changes in that fluid, and then is removed by some tissue or other. And as different medicines are severally removed by tissues on which they exert their special action, so in specific disorders we find that in epizootic eczema the feet and the mouth are affected, in pleuro-pneumonia the lungs, and

so on. Often we have to deal with complications of these disorders, non-specific conditions to which they give rise, thus in eczema to sloughing of the hoofs and mammitis; but such especially occur in the less acute disorders which we shall have to mention, cancer and tubercle. It is then that we must be careful to distinguish between primary and secondary disease, for this will considerably affect our diagnosis and treatment.

It seems that an outbreak of a specific disorder, especially when the disease is epizootic, may be related to the severity of all exciting causes. Thus, if the disease first appears in a place where from neglect of sanitary precautions and the general conditions of health, animals are very predisposed, severe attacks and extensive spreading power are the results; but if it be unable to gain a firm hold on its first victims, it will never "gain head" enough to assume a marked degree of virulence. The tendency of disorders of this kind fortunately is to lessen in intensity with time, a happy condition, whereby they are prevented from annihilating races of animals. Some individuals escape by immunity, others by recovery after comparatively slight attacks, and some by accidental or intentional escape from disease-bearing influences. Thus, an outbreak of a disease of this kind passes over a district, and spreads from it into a new locality, diverging from the centre in every direction, or in lines determined by favorable conditions; finally, its spread is checked by dilution of the original stock of virus, or by influences unfavorable to its progress as reaching the sea, or a range of high mountains, or being subjected to a frost. The question which next suggests itself to us is the source of these disorders. This question is one of the most urgent of the present day. Either they can originate *de novo*, or can be propagated only from centres of disease already existing. The latter method of origin of an epizootic affection is well illustrated in those disorders of which rinderpest is the type. It constantly exists under a comparatively mild form as an enzootic in certain localities as the steppes of Russia and Central China. From these it

periodically extends in whatever direction climatic conditions, war, and trade may determine, sweeping over wide tracts of country, and leaving desolation and terror behind it. Unless introduced into such a country as Great Britain, it does not occur there, but this is no proof that in places with a very different state of climate, produce, and soil it might not be generated spontaneously. Tubercle and cancer, though communicable by inoculation, undoubtedly appear without any communication, either by contagion, infection, or inoculation. But they are hereditary disorders, and the immature cancer or tubercle elements may have been transmitted from the parent, and have remained in a dormant state, resembling ordinary non-specific tissue elements until surrounding conditions became favorable to the display of their full vigour. This view seems to derive support from the fact that just as in due time each feature of development appears in the progeny as in the parent, so tubercle appears at a fixed age, which is the same in each. Tissue elements, hitherto normal, perhaps undergo change when subjected to certain conditions; thus, the epithelium of the lungs may sometimes become converted into tuberculous matter, such as may propagate the disease by inoculation, and disease which is transmissible to the offspring may be artificially introduced by non-specific means, but this has not by any means been proved, for until quite recently the characters of tubercle were not sharply defined, and accumulations of ova of parasites, of Gregarinidæ, of degenerated epithelial cells—in fact, any mass tending to calcareous or caseous change, was termed tubercle. On this account experiments on the spontaneous origin of tubercle are to be accepted with reservation. Both cancer and tubercle are associated with special constitutional conditions, cachexiæ, termed respectively the cancerous and the scrofulous diathesis. The lesions which are observed in these disorders are considered to be local manifestations of a constitutional disorder. The time which elapses between the entry of a specific poison into the system and the manifestation of its presence

is termed its *latent period.* It varies much in different diseases, and while it lasts the poison is undergoing elaboration and multiplication in the blood. We may find this latent period very prolonged in hereditary scrofula or cancer, and by attention to avoidance of all exciting causes it may be extended through even a long life. The lesions of specific disorders are special, and therefore pathognomonic, but they are not always present. The virus introduced into the blood multiplies more or less readily, according to its nature. It has to oppose the efforts of nature for its excretion as well as, in some cases, to struggle for existence with certain constituents of the blood. If the resistance be too powerful the poison may be thrown off before the end of the incubatory stage, or it may persist until the febrile stage; but not until it has produced local effects. Ordinarily it acts locally, but sometimes, especially in young and debilitated stock it may increase in the blood so rapidly as to cause the fever to run very high and destroy the animal before lesions appear. We shall enlarge upon and illustrate these points hereafter. In such cases as I have last described no lesions are detectable after death except such as result from the febrile state of the blood and the conditions of that tissue itself. It is very dark in colour as a rule, and petechiæ and also more extensive blood extravasations in the various tissues occur, especially on the serous and mucous membranes. Specific organisms may be detectable in the blood when examined under a high power of the microscope.

Treatment of these disorders comprises prophylactic measures, including sanitary port and county inspection—measures of isolation, such as quarantine; thorough disinfection of all infected places and things. Such imply Government as well as private enterprise. This is absolutely essential, as has been proved by many a national loss incurred, and a few such disasters prevented. The public must learn that remedies must be proportioned to diseases. Sporadic cases are of individual interest, and must be attended to by individuals; enzootics require

local co-operation to combat them; epizootics and panzootics are of national importance.

Cancer is a general term applied to tumours of a malignant character. The tendency in the present day is to restrict its use to the carcinomata, which are new growths of cells similar to epithelial, grouped irregularly in a stroma. We shall give a detailed account of cancers of various kinds later on, when treating of tumours.

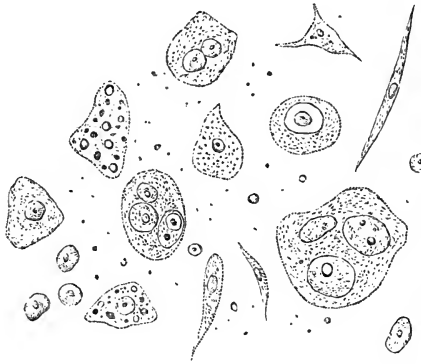


Fig. 20.—Elements of an Encephaloid Tumour. × 200. (After Harley and Brown.)

Certain forms of cancer have been successfully inoculated, but great care is essential to success; the morbid matter must be directly transferred from one body to another, and must be in a definite stage of activity. The process reminds us of "grafting," and seems to indicate the possibility, under certain circumstances, of cells differing but little if at all in appearance from ordinary healthy cells, acting as true contagia. In cases of cancer induced by inoculation, the general constitutional disorder is an effect of local conditions which seems to be the reverse of the ordinary rule in specific affections. This exception is rather apparent than real. In cancer the contagium must attain local vigour and incorporation with the tissues before it can involve the general mass of the blood. This is not essential to any other known specific disorders except, perhaps, scrofula and rabies. In examining a

case of cancer during its progress and post-mortem, we shall ascertain that the parts diseased are involved in two ways—by primary and secondary disease. The latter changes only are similar to those of special tissues in exanthemata. It seems, too, that as the local elaboration and incubation of cancer are remarkably prolonged, so, also, as a rule, its growth in parts secondarily diseased is slow, but from the same cause very potent, and capable of invading all tissues, though some in preference to others, especially those which are actively concerned in cell production. So lymphatic glands and adenoid tissue are most frequently the seat of cancer; the spleen, liver, and mucous membranes also are liable to this disease. We have not only to deal with circumscribed accumulations of cancer-cells, but also with infiltrations, which in this relation are of the highest importance, for the growth and extension of cancer does not actively irritate sufficiently to lead to deposits of lymph circumscribing the diseased parts; the morbidly active cells have, therefore, free scope for migration, and in whatever situation they become placed can originate changes, for in no part of the body do they materially differ from tissue elements, so uniform has been the development of these generalised cells. Cancerous infiltrations or tumours cause death in two ways, by exhaustion when they are numerous and extensive, and by active interference with the function of a part by disorganisation of its tissues. Prognosis must, therefore, be based upon the position, size, rapidity of spread, and length of existence of the cancer. Injuries of various kinds act as exciting causes, probably by lowering vital actions, and hence power of resisting disease in the part. Hereditary predisposition is very marked, and the diagnosis may be much facilitated by use of the grooved needle and the microscope. In cancers of hollow organs, as the bladder or the stomach, the characteristic cells may be seen in the contents either after death, or as expelled before. Complications are brought about by the blood taking up morbid material and diffusing it through the system; by the lymphatics,

whence probably the frequency of invasion of lymphatic glands; or by continuity and contiguity of structure. The systemic symptoms are not acute enough to constitute fever, producing rather a cachexia, or unhealthy state of the constitution. Determination of whether any local cancerous deposit is primary or secondary is of importance from a surgical point of view. When primary, a growth may be excised with some chance of success in permanent removal of the disease. In secondary cases the system is hopelessly invaded; and it will be found that any injury, however slight, is almost sure to take on unhealthy action. Local treatment except by excision has not proved satisfactory, probably in consequence of the difficulty of access to *all* the diseased parts. Acetic acid has been recommended as causing alterations in the cells, of which the growth is composed. Its value is doubtful. When the morbid matter is removed by excision care must taken that not the smallest diseased part remains as a centre for renewed growth.

Scrofula, Tuberculosis, is frequent in cattle, extremely serious in its effects, and has interesting relations with human disorders. It is a constitutional disease, specific, and infective. It seems to increase in frequency *pari passu* with improvement of the breed, and thus shorthorns, especially good milkers, are most predisposed to the disorder. That it is a blood disease is proved by the fact that it very frequently affects many organs of the body, that its local manifestations are varied in position, and that its presence is generally denoted by a cachexia, an ill-disposed habit of the body, which is termed the scrofulous diathesis. It is undoubtedly hereditary, and therefore manifests its presence most forcibly after "breeding in and in."

Scrofula is the disease of the system of which *Tubercle* is the local manifestation. That we may be in a position to appreciate the interesting questions raised in the study of this disorder, we must first note the forms which it assumes in the ox.

Phthisis Pulmonalis is pulmonary scrofula. It is a chronic disorder in which tubercles occur in the lungs, and give rise to a slow local inflammation by the irritation

which they excite. It affects especially narrow-chested animals with long legs. A young animal or a milch cow (well-bred in most cases) is observed to cough slightly, and the characters of this sign of disorder are rather remarkable; it is weak and hoarse. It is almost diagnostic. The affected animals are generally "bullers," ever ready to take the male, but sterile. Attention having thus been drawn to the animal, it is found that the skin is dry, the coat "staring." The constitutional conditions, in fact, are those described by human practitioners as hectic. The mucous membranes are pale, and the respiratory murmur is inaudible on auscultation of some parts of the chest. Pain is evinced on percussion of the sides, and on pressure of the loins. The patient is debilitated with a weak, quick pulse, and the bowels respond too easily to the action of laxatives. The milk is bluish, with an unpleasant flavour, and is said to quickly become sour, and to form only bad butter and cheese. Generally, too, the internal temperature is a little above the normal; appetite capricious. In pregnant animals abortion, in other females irregular œstrum occurs. This state of affairs continues for some time, increasing in severity; the cough becomes hacking, the animal very thin and hidebound, often covered with lice, and the respirations very quick, and death takes place, the patient being carried off by an attack of diarrhœa, leading to anæmia.

Autopsy reveals deposits in the lungs of a nodular character, aggregated into masses by the lung-tissue and inflammatory deposits, and varying in their characters. The tissue in which they are imbedded is inflamed, and they have pressed on the bronchial tubes, preventing air from passing to and from the air-cells. Each of the nodules is a tubercle, and the compound mass exhibits in different parts caseation and softening, perhaps also calcification (also known as cretification). On slitting open the bronchial tubes, we find that many of these softening tubercles have involved their lining membrane, which, therefore, presents ulcers of the true scrofulous character, often confluent, gritty, and irregular on the surface, and of

a sulphur colour. The tubes are occupied by softened scrofulous matter, intermingled with frothy mucus. Accumulations of softened tubercle, surrounded by cretaceous or caseous matter, are termed vomicæ. The anterior appendix of each lung is, perhaps, the earliest seat of deposit. The pulmonary lymphatic glands at the roots of the lungs are involved in the diseased action. The serous membranes are very frequently the seat of scrofulous deposit. The pleura is especially liable to present growths of this nature. Such may occur in phthisical cases, or may exist independently of lung invasion. Very frequently they are found in fat cattle slaughtered for food, animals in very fine condition which have not recently exhibited the slightest appreciable sign of disorder. In such cases we sometimes wonder how respiration can have been sufficiently performed, to such an extent do these "grapes" occupy the cavity of the thorax. The base of the tumour formed by them may be attached to the diaphragm, or most frequently to the pleura costalis. Sometimes the mediastinum and the pericardium are the seat of the deposit. Besides these large main masses, smaller tumours occur in various parts of the membrane, consisting of more recently formed material, the larger masses exhibiting different stages of retrograde change in their various parts.

Tabes Mesenterica is that form of scrofula in which the mesenteric glands are the seat of tubercle. Animals emaciated as a result of tuberculosis, especially the form at present under description, are vulgarly known as "piners." The symptoms present are those of general ill health, and rapidly increasing debility. There may be sympathetic cough. Occasionally the animal manifests slight abdominal pain; diarrhœa is persistent. The appetite is good, and perhaps inordinate. This state of affairs occurs most frequently in young animals, and post-mortem examination, besides the tumefied and tuberculosed condition of the mesenteric glands, shows tumours on many parts of the peritoneum. The mesentery and the omentum are extensively involved, and the stomachs, liver, and intestines, are frequently bound together by deposit. As a concomitant there may

be scrofulous disease of the walls of the intestines, or of the uterus or vagina. In these cases characteristic lesions are to be found on slitting open the organs, and during life there is, in the one case, a discharge of purulent material with the watery fæces, in the other a continuous escape of muco-purulent matter from the vulva, constituting scrofulous leucorrhœa. Cases of tabes, and scrofulous ulcers of the intestinal canal and the generative organs, are generally protracted, and death results from anæmia.

Tubercular Meningitis has also been observed in cattle. The pia mater is the seat of tubercle. The disease may make considerable progress before any signs of ill health are manifested. Suddenly the symptoms of pressure of the brain occur, due to products of the inflammation induced, or to the increased size of the tumours. This leads to apoplectic symptoms, so that our diagnosis must be based on the pedigree and scrofulous diathesis of the patient.

Arthritis is a frequent manifestation of scrofula in young stock. It must be distinguished from the rheumatic disease of these organs by the fact that it appears less suddenly, is less acute, does not lead to false anchylosis, and more extensively involves the neighbouring bones. Also the tendency is to softening rather than hardening of the diseased parts, and when the tuberculous matter undergoes the softening change abscesses form and lead deeply, not only into the cavity of the joint, but into the enlarged extremities of the bones which are the main seat of scrofulous deposition. On post-mortem examination the disease cannot be confounded with rheumatic arthritis, for there is a total absence of porcellaneous deposit and of calcification of surrounding ligaments, while the enlarged extremities of the bones contain tubercular matter. The knee and stifle seem to be most frequently affected, and when the joints of the foot are involved we have scrofulous "foul."

Scrofulous Tumours—("Wens" seem to be scrofulous tumours of the skin)—also known as "Clyers," occur frequently in various parts of the body, especially affecting those parts which have lymphatic glands situated in them; thus, in the parotid and superior pharyngeal region they may

often be found. Though they may take place in other tissues the lymphatic glands are their most frequent seat; thus, when the tumours are in the parotid region these are primarily affected, the salivary gland being only secondarily involved. They increase in size slowly as a rule, but may manifest a first acute stage, which change to a phase of less activity. Softening often occurs, but the inflammatory action aroused by the presence of the scrofulous matter is often not active enough to cause bursting of the abscess, which, therefore, assumes the "cold" character. When it has burst or been opened surgically it gives exit to white, flaky, grumous pus, and the abscess cavity manifests scarcely any tendency to heal. The tumour may undergo calcification or caseation, and thus remain *in statû quo* for a long time. The exploring needle is here very useful for diagnosis, for when drawn out of such a tumour it contains in its groove the peculiar white scrofulous pus, and if this presents the ordinary appearances of scrofulous matter when examined microscopically there can be little doubt of the nature of the case.

Scrofulous Inflammation of the Supra-pharyngeal Glands requires a special notice, since when these organs are enlarged there is an impediment to swallowing, and frequently even to respiration. They seem to suppurate or soften readily, but do not come to a point externally. Insertion of the hand through the mouth will enable us to detect the abscess, and its wall may generally be broken down with the fingers. "Abscesses of the guttural pouches of the ox," described by some practitioners whose anatomy has rather gone to the wall in the rush of general professional practice, are of this nature.

Scrofulous lesions are often congenital. Tabes and phthisical tubercle are frequently present at birth. It will be observed that in all cases of scrofulous lesion we find *tubercle* present, this, then, is deemed the distinctive product of scrofula. If taken in its earliest state a tubercle is a rounded mass of cells of a peculiar kind, united together by a stroma, which is often very scanty, and penetrated to a certain distance from the periphery by blood-vessels. Though the outer part of the tubercle is

well defined, its stroma is continuous with the areolar tissue of the part in which it is placed. Tubercle cells are generally small, but some few are large, and in the nodule are also present free nuclei in abundance and

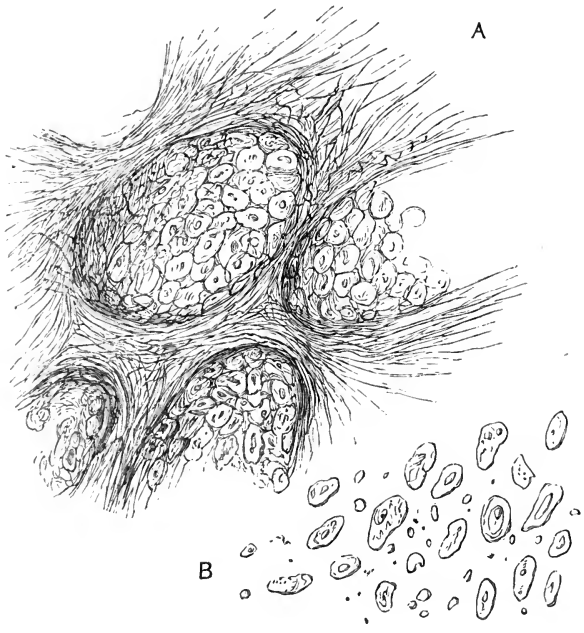


FIG. 21.—Tubercle. A. Deposit in the air-cells of the lungs. B. Miliary Tubercle. × 200. (After Harley and Brown.)

granules. The small cells are most frequently seen; they are rounded, with irregular margins, and each with a large nucleus. "They sometimes approach, both in size and appearance, the white cells of blood and lymph. We believe that sometimes a tubercle does develop into a structure like a lymphatic gland (adenoid)" (Jones). A tubercle, such as we have just described, is termed "miliary" or "grey," it being semi-transparent and about the size of a millet seed. It is remarkable that it does not increase in size, but new cells which are produced are deposited in its outer vascular zone, and the interior undergoes change. This alteration is degenera-

tive, being either calcareous, caseous, or softening. These changes have nothing specific about them, with the exception, perhaps, of the softening, the product of which is a special kind of purulent fluid. The frequency of caseation and calcification account for the chronic tendency of scrofula. We must now determine what the tubercle is. Some says it results from changes of epithelial cells, others from connective-tissue corpuscles, others consider it a special *materies morbi* deposited from the blood or formed anew in a formative extravasated fluid, and some say it is a hyperplasia of lymphoid tissue. Gerlach says, "the presence of a tubercle virus is evident." There are other theories of its nature. In the state of the question we may be allowed to take the view which most readily chimes in with clinical facts, and consider tubercle cells specific organisms resembling those of cancer, to which the large cells sometimes seen in tuberculous matter are remarkably similar. The pathological analogies between cancer and tubercle are very marked; Jones says "a tubercle thus seems to be a structure intermediate between the products of inflammation, and the new growths properly so-called being less transitory than the former, less permanent than the latter, and less capable of developmen than the latter." Sanderson indicates three essentials to the development of tubercle—a constitutional predisposition, local irritation, and subsequent infection. A freshly developed tubercle consists of animal matter, albumen, fibrin and fat, and earthy matter, insoluble phosphates and carbonates of lime, and the soluble salts of soda (Glover). Calcification consists in increase of the earthy and decrease of the animal matter. "Grey tubercle" results from caseation; the fat has considerably increased. The fact that inflammatory products undergo these retrograde metamorphoses has long complicated the pathology of scrofula; many pathologists still hold that tubercle owes its origin to the absorption of metamorphosed products of inflammation. Diagnosis of scrofula post-mortem must be based on the presence of the *miliary tubercle.* Hence, a doubt frequently exists as to

the tuberculous or non-tuberculous characters of deposits in connection with serous membranes, as the pleura. Our decision in each case must be carefully arrived at. Generally, the occurrence of isolated tumours of rounded lobulated masses and of indications of other scrofulous lesions will enable us to diagnose scrofula. There is but one *cause* of scrofula, the specific element, but there are many determining influences. Neglect of sanitary measures, exposure, changed climatic conditions (notably cold, with dampness). Debilitating influences, especially excessive and prolonged lactations, all act in this direction, and must be corrected as a prophylactic measure; but they in themselves are not able to originate the disorder in so far as we know. The specific element comes from the parent or from without. Fresh blood must be introduced into a herd with a scrofulous tendency, breeding in-and-in avoided; also, perhaps, we shall shortly admit that measures of disinfection are necessary in this disorder, for it has been shown that animals standing side by side and feeding out of the same manger and drinking from the same trough or bucket have both succumbed, one only having been at first affected. It has been stated that tubercle is communicable by inoculation, but this is not yet absolutely proved, for it has been found that local irritation of any kind will determine development of tubercle. Chauveau long ago caused tuberculosis in cattle by feeding them on scrofulous products ('Gaz. Med. de Lyons,' 1860, p. 550). The intestines were affected in this case. The experiment has been frequently successfully performed on other animals, as dogs, poultry, and guinea-pigs. Bollinger's experiment with milk is remarkable. He took half of a litter of pigs from a healthy sow, and fed them with milk from a phthisical cow. The state of the cow was proved by autopsy. The pigs were destroyed at regular intervals, and those kept on the milk of the sow were found to be healthy, while those fed with the scrofulous milk were all more or less affected with tuberculosis.

It is most important to decide what relation tubercle in man bears to tubercle in the lower animals. The milk

of scrofulous cows, though much altered from healthy conditions, finds its way into the market; numbers of children and weak persons are fed on uncooked milk. Cases of intestinal and mesenteric scrofula are frequent in man. We cannot avoid the conclusion that many human beings share the fate of Bollinger's pigs! Next we must ask ourselves about the flesh of scrofulous animals. This is almost invariably consumed as food, and is not often thoroughly cooked. We are not yet in a position to say that ill effects result from this, but since such flesh is under grave suspicion, would reject it, for we consider the chance of causing serious human disease must not be run, even though meatwhich may be harmless must be sacrificed. Certainly all scrofulous deposit must be removed before the meat is sold, *under protest,* if it is found necessary to let it go into the market. For we are sure that feeding animals on scrofulous tumours has given rise to the disease.

Gerlach, the discoverer of the transmissibility of tubercle through the digestive organs, as a result of most careful investigations, decided that "the flesh of a tuberculous cow is infectious, and is unfit for food when there is decided disease of the lymphatic glands, when the tubercles are breaking up and becoming cheesy, and when tubercles are found in different parts of the body" ('Veterinary Journal,' v, 203, &c.).

Quite recently Virchow has decided that human tubercle is not the same as the disease in the ox; and in the 'Lancet' for 19th June, 1880, Dr. Crighton gives this matter a new aspect by stating that in the human subject two tuberculous diseases occur, one of these being the true pathological equivalent of bovine tuberculosis, bearing to it the same relations which human "glanders" bears to equine.[1]

Treatment.—In phthisis and tabes the prognosis must be decidedly unfavorable. As a rule they end in death,

[1] While this sheet is passing through the press, receipt of 'Tuberculosis from a Sanitary and Pathological point of view' reminds me that in justice to the persistent efforts of the author, *Mr. George Fleming,* P.R.C.V.S., I must mention him as the most forcible exponent in this country of the ill effects which may result from feeding on milk, meat, and tuberculous material from cattle affected with this serious disorder.

but some cases of rallying have been recorded. However, animals suffering from these conditions are unsafe to use either for breeding, milking, or for human food; besides, they never become fat properly. The expense and constant trouble of keeping them is not such as will be atoned for by subsequent value of the animal. In arthritic cases, which occur in young stock, treatment is not satisfactory. Some of the patients recover, but the scrofulous tendency hangs about them, and they do not do well. Very frequently the suppuration against the joints wears out the patient. Stimulating applications locally applied are beneficial as promoting nature's efforts to throw off the tuberculous matter in abscess. Tonic agents must be administered, and deobstruents, especially the compounds of iodine and bromine. When the abscesses have formed we shall have to resort to stimulant injections to promote granulation. Scrofulous tumours must be treated much in the same way. Generally external manifestations of the disorder are but accompaniments of internal changes.

In speaking of the lesions of phthisis, we have alluded to the scrofulous ulcer of mucous membranes. It occurs not infrequently in the larynx (tubercular laryngitis), and animals fed with tuberculous matter almost always exhibit lesions of this nature throughout the length of the alimentary canal. Green tells us that the development of tuberculous nodules in these ulcers is secondary to a hyperplasia of the lymphoid tissue of the mucous membranes, which leads to formation of an ulcer, with thick and prominent margins, in the bottom of which the nodules appear. In the intestine these changes have their seat especially in the solitary Peyer's glands, which also are affected in typhoid fever. The tubercular differs from the typhoid ulcer in that "its edges and base are thickened and indurated. And the tuberculous nodules, tending to become caseous, are seen scattered over its floor." The nodules develope around the blood-vessels. It seems these changes of the mucous membrane are brought about by actual contact with diseased matter (Gerlach).

PLEURO-PNEUMONIA ZYMOTICA, *vel* CONTAGIOSA, *vel* EXUDATIVA—"*Lung disease.*" *Pleuro-, Peripneumonia* is a specific disease affecting only horned cattle (some say also the deer), spreading with rapidity in consequence of its highly infectious characters, and causing remarkable changes of the lungs and pleura. At first introduced into this country by importation of diseased animals, it has now become domiciled here, and destroys large numbers of British cattle. Sometimes a case of apparently sporadic pleuro-pneumonia occurs in a neighbourhood, and results in an enzootic outbreak. The animal first affected has, perhaps, recently arrived in this part of the country, her history being unknown; or, having been purchased from a known farm, this on inquiry may turn out to have been invaded by the disease. Unfortunately, the period of incubation of pleuro-pneumonia is long, ranging even from two weeks to two months, or even more than six months (Walley). While this lasts, changes are going on in the lungs, and certainly during the later periods of incubation the disease is communicable from one animal to another. The general means of communication is by infection (*i. e.* through the air). Many animals in a herd manifest immunity, but beasts of all ages and sexes are liable to take the disorder. They may be rendered more susceptible by exposure to severe weather, bad feeding, an insanitary condition of cowsheds, &c., and by some authorities it has been supposed that such conditions may result in spontaneous origin of the disorder; this, however, can hardly be, for countries where sanitary measures for domesticated animals were scarcely thought of and never carried out, remained free from lung complaint. The contagium probably enters the system through the respiratory organs, for, as we shall see, it has been determined that the bronchial mucous membrane is the seat of primary lesion. The blood is not seriously contaminated, for it has been found that transfusion will not communicate the disease (this, however, requires to be verified), and animals fed on portions of diseased lungs did not take the disease, showing that it is not readily communicable through the

alimentary tract. Until quite recently the analogy of this disorder with other specific diseases was a matter of obscurity, but recent pathological researches, notably those of Dr. Yeo, have thrown important light upon the subject. An infected animal introduced into a pasture, or into a cowshed, remains apparently well for a long enough time to communicate the disease to others. If careful thermometric examinations are made daily, the temperature of some of these will be found to rise as high as 103° F.—104° F., but 102° is suspicious (especially if accompanied by sudden improvement in condition), and calls for prompt isolation and disinfection. This rise in the temperature takes place some days before the disease manifests itself. It ushers itself in slowly and stealthily. There are visible the ordinary signs of ill-health, separation from the herd, unthriftiness, and staring condition of the coat, and an irregular condition of the bowels, appetite, and rumination, together with diminution of milk. Auscultation will enable us to detect, often in only one lung, the mucous râle. The respiratory efforts are slightly more frequent than in health, and there is a cough which at first is only observable after drinking and in the morning and evening, or when the patient is hustled, or pressure applied between the ribs, disappearing during the middle of the day. The second stage is marked by more decided fever, the cough is more persistent, harsh, and frequent. The respirations are quickened and laboured, and the expirations are accompanied by a pathognomonic grunt; the animal generally stands with muzzle protruded, dilated nostrils, and heaving flanks. The breath also becomes fœtid. There is a watery discharge from the nose and eyes, which later assumes a purulent character, and is of an unpleasant odour. The skin, already dry, harsh, and tight, now becomes yellow and dirty. The pulse at first beats firmly, and is full though fast (70 or 80). Afterwards it becomes very small and scarcely perceptible. The back is arched, and pressure on the loins produces shrinking; percussion of the intercostal spaces is evidently very painful, for it causes the patient to moan, and the sound yielded is dull

and devoid of healthy resonance. Auscultation determines dulness, more or less marked in certain parts of the thorax, this being dependent either upon fluid in the chest or lung consolidation. Sometimes only one lung is affected, then there is increased resonance in the other; also a "friction sound," indicative of pleuritic changes, is present. With the progress of the disorder the milk becomes reduced to a very small quantity, and sometimes entirely suppressed. There is expulsion of colourless, or white, pale, straw-coloured and blood-tinged casts, by coughing or expectoration (Walley). The bowels remain constipated, as before, until the mouth becomes clammy, and signs of debility (œdematous swellings, diarrhœa, hoven, and pallor of mucous membranes, &c.) usher in death.

Post-mortem examination.—No appreciable alteration in the blood except such changes as are characteristic of diminished excretion and anæmia. Pathological conditions observable only in the thoracic viscera. The pleura presents extensive false membranes, and its sac is full of serous fluid of a somewhat milky colour, with numerous shreds of lymph floating about in it. Adhesions unite the pleura pulmonalis to pleura costalis, and the deposits have a markedly plastic

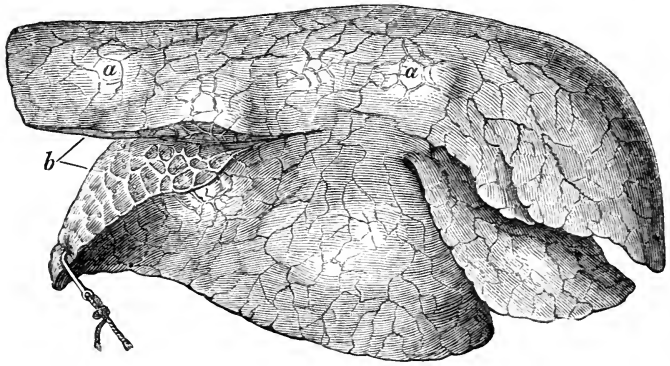


FIG. 22.—Incipient Pleuro pneumonia epizootica. *a*. Diseased patches as seen from the surface. *b*. A section into the healthy and diseased parts. (Simonds.)

character. Occasionally, it is said, but very rarely, there is pus in the pleural sac. The membrane itself is

thickened, opaque, and varying in colour in different parts. The pericardium is also involved; the intercostal muscles are darkened. The lungs are the main seat of disease; sometimes only one of them (generally the right) is affected, and there is disease of only one pleura (see Fig. 23).

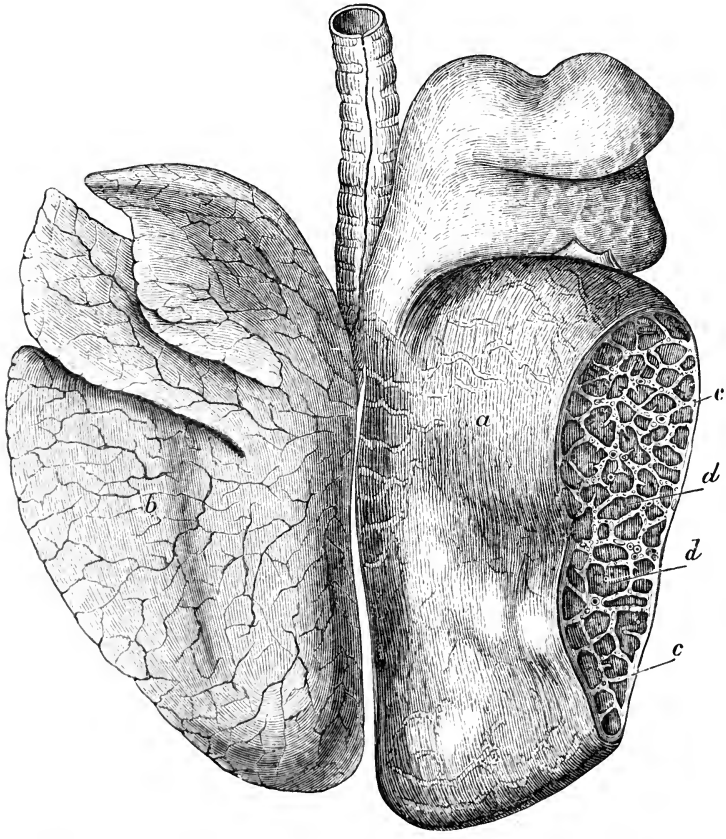


Fig. 23.—Pleuro-pneumonia zymotica. Right lung affected. *c*. Interlobular bands. *d*. Lobules. (Simonds.)

A distinctive peculiarity of the lesions of the lungs is their circumscribed character, whereby a diseased portion exhibiting very marked changes may lie against a piece which is either but little affected or even healthy. Hence results the well-known mottled condition of the

section of a pleuro-pneumonic lung. The diseased organ is consolidated, and hence very remarkably increased in weight. This depends upon extravasation of gelatinous material into the interlobular areolar tissue, whereby the yellow bands of the section are produced. Lymphy deposits plug up the bronchial tubes. The lobules are congested, presenting a reddish-brown colour, or altered by deposition of gelatinous matter in the *lobular* areolar tissue. Sometimes the pulmonary cells have collapsed, yielding to the surrounding pressure; at other parts they are filled with deposits, and are in the condition termed hepatization. The bronchial lymphatic glands are enlarged by gelatinous deposit. The lung in the early stage presents only circumscribed hardened portions, owing their solidity to gelatinous effusion (see Fig. 22). In the later stages the part which is most extensively involved is gangrenous and friable, and of a greenish colour and putrid odour. The diseased lungs in every case have a special sickening odour. The excellency and thoroughness of Professor Yeo's work will render his summary interesting to our readers, and must be an apology for its insertion:

"To recapitulate, then—

"The various items in the pathological sequence may be thus enumerated:

"1. Irritation of the mucous membrane of the smaller bronchi, probably by some infective material (specific virus?).

"2. Chronic ulcerative bronchitis, localised to a few minute bronchi.

"3. Occlusion of the affected air-tubes.

"4. This produces such changes in the air-cells belonging to the affected tubes that the lobular parenchyma becomes solid.

"5. As the bronchial disease progresses the walls of the air-tubes become thickened and infiltrated with the products of chronic inflammation.

"6. The peri-bronchial lymphatics are implicated by the extension of the infective process from the bronchus, and are soon filled with dense exudation.

"7. The block in the lymphatics of the broncho-vascular system impedes the flow of lymph from the corresponding territory.

"8. The tributary lymph channels are thus mechanically engorged, and at the same time they are irritated by infective materials.

"9. The inflammation of all the coats of the air-tube gradually spreads towards the root of the lung.

"Thus, we have a deep-seated cone of typical consolidation, traversed by numerous wide whitish lines, corresponding to the swollen interlobular connective tissue (marbling). In fact, the essential features of the disease are all established.

"The morbid process seldom stops here however. It spreads in two ways. First, by the broncho-vascular lymph passages:

"1. The irritating and infective materials find their way along the lymphatics towards the root of the lung, following the normal course of the lymph stream.

"2. The wall of the bronchus becomes affected after a time by the irritative matter in its surrounding lymphatics.

"3. The lymphatics of tributary bronchial tubes, met with as the disease thus advances, are choked, and the drainage of their territory impeded.

"4. The interlobular lymph spaces of the newly affected territory soon become filled with exudation. Thus, the clear kind of consolidation is produced.

"Secondly, by the pleura:

"1. The pleura becomes affected over the focus of consolidation by means of the subjacent lymphatics.

"2. The pleurisy soon extends far beyond this limited region, or the serous membrane becomes generally inflamed.

"3. The inflamed pleura infective materials reach the lymphatics beneath it, and also those lying between the neighbouring superficial lobules.

"4. Extending along the interlobular lympathics, the irritation and exudation may pass towards the deeper

parts, so that an immense tract of lung is converted into a semi-translucent mass, with swollen interlobular spaces. The consolidation formed in any of these ways may become intense induration if the animal live long enough.

"With regard to the origin of the disease of the vessel-wall, we must also start from the peri-bronchial disease.

"1. The lymphatics of the bronchus readily allow the morbid products to pass to those immediately around the vessels.

"2. The wall of the vessel becomes greatly thickened by chronic inflammatory products.

"3. The inner coat, which resists the disease for some time, ultimately becomes diseased in small patches.

"4. The blood coagulates over the diseased inner coat, and may occlude a small branch at its origin, or even the entire vessel.

"5. Particles of the clot may break off, and, passing into the minute arteries, form these embolic plugs.

"6. Thus numerous arteries of varying size may be stopped up.

"7. The most varied forms of hæmorrhagic infarction are thus produced.

"8. The infarction may become gangrenous, cheesy, or may dry up into a crumbling mass.

"9. A capsule may form around the most diseased part, and shut it off from the rest of the lung."

Thus we are advanced a stage in our knowledge of the pathology of this disorder. We see that in it, as in other specific affections, the poison localises itself in a special tissue, and there originates specific lesions. Sometimes the disorder rapidly runs its course, leading to death from congestion of the lungs; more frequently it progresses as above described, lasts for six weeks or two months, and causes death by anæmia. In other cases, making an average which varies much (from 20 per cent. to 70 per cent.) in different outbreaks, recovery takes place. The animal passes through a prolonged convalescence, *during which, it is said, he is capable of communicating the disease,* and ultimately may be fattened for the butcher. Animals

which have recovered from an attack are exempt from the disorder in future. When an animal has been slaughtered after recovery from pleuro-pneumonia, his lungs will be found to exhibit traces of the diseased action. Old adhesions to the walls of the thorax, consolidation, atrophy of certain parts; while often it will be found that the portion of the lung which formed the main seat of disease has been thrown off as a slough, and encapsuled by lymph; or it may have become calcified. An important question for the verification of our diagnosis here presents itself. How are we to distinguish the lungs in this disease from those presenting the conditions observed in sporadic inflammation of the lungs and pleura? Many skilful veterinary pathologists state that in some cases of sporadic disease the marbled state of the lung occurs, and that hence we are not in a position, from simple inspection of a portion of lung, to determine the nature of the case. Generally the sporadic disorder affects both lungs, and the stage of the disease is uniform throughout, we cannot note the abrupt transitions found in the infectious disease; also the lymphatic glands are not so much involved. The history of the case will assist us in our inquiry. During life sporadic cases differ from specific in that they are more acute, cannot be traced to contagion, and may generally be put down to some other cause of a non-specific nature. Also abortion takes place; the grunt is present (see Walley, "Four Bovine Scourges," for a full list of distinguishing features).

Cases of pleuro-pneumonia are liable to be confused in diagnosis with those of pleural scrofulous deposits known as "grapes." Professor Williams considers that these deposits are very frequently due to changes of pleuritic adhesions, and says that cough during swallowing is diagnostic of their presence, for they tend to compress the œsophagus. His views are not generally accepted. In some cases the differential diagnosis of these two conditions is very unsatisfactory. The history of the case will help us, and we must carefully look for any scrofulous lesions.

Treatment.—Sometimes, during an enzootic of this

affection, animals fall sick, are feverish for a short time, and then resume their originally healthy state. Probably they have been subjected to the action of the virus, and nature has enabled them to throw it off. Some authorities, during the more acute periods of the attack, recommend application of blisters to the side, a cathartic dose, and even bleeding when performed early. It is questionable whether these measures prove beneficial, except by debilitating the patient, and so shortening the case. More success seems to have attended the administration of mineral tonics, especially the Cupri Ammonio-Sulphas, together with stimulants, eliminatives, and hyposulphites; also attention must be paid to careful nursing. Isolation of diseased and suspected animals, and disinfection, are most useful prophylactic means, and the administration of iron tonics has been suggested. It is often best in the long run to *stamp out* an outbreak. The Contagious Diseases (Animals) Acts require special measures for eradication and prevention of spread.

An animal after recovery should not be reintroduced into the herd before the lapse of three months, and the virus is said to be potent for as much as six months after the animal's death.

Inoculation.—It had been noticed that one attack of certain blood diseases ensures immunity more or less permanent against a second of the same disorder. It was therefore suggested that a first attack of a mild character might be artificially induced by direct introduction of morbific material into the system. This was first tried with smallpox in man, and succeeded in so far as immunity was secured; but the disease as artificially generated proved severe, communicable, and frequently even fatal. The practice of inoculation was falling into disrepute when *Jenner's* observations of the diseases of animals in relation to those of man enabled him to discover vaccination. Here an artificially induced attack of a very mild disorder acts as a prophylactic against a more severe one of not the same, but a closely allied disease. Vaccination has been tried haphazard for certain diseases of lower animals, in no case with markedly beneficial

effect. Inoculation for pleuro-pneumonia is at present much advocated by professionals and non-professionals. It is performed by taking the lungs of an animal which has died in the early stage of the disorder, cutting up the diseased yellowish portions of lung, and allowing a serous fluid to escape and accumulate in a vessel. This is the lymph. Some of it is injected subcutaneously with a syringe, or shreds of cotton steeped in it are inserted into the tail near its tip; the shreds are removed after twenty-four hours. Subsequently, in favorable cases, a considerable amount of swelling occurs here, and may extend up the tail to the quarters of the patient, giving rise to violent inflammation of the caudal appendage, which often results in the end of the tail sloughing and gangrene involving even the upper parts of the hind extremities. Cases of this kind are common in dairies where the animals have been inoculated. It is necessary to amputate the tail when gangrene sets in. Caussé describes pustules of the size of a franc-piece as resulting from inoculation. Intravenous injection of virus has not been found effectual. The irritative fever depending on these processes is sometimes fatal. To understand whether this means is prophylactic, we must put it to the crucial test by exposing animals which have been inoculated to contagion; some of them succumb. These, the advocates of inoculation urge, did not thoroughly take, or had the seeds of the disease in them before they were operated upon. They say that where the process is systematically carried out pleuro-pneumonia has almost disappeared; though their opponents will not admit this. That inoculation does not produce pleuro-pneumonia they allow, but believe that it expends itself in producing changes at the seat of inoculation, while the system is imperceptibly affected and immunity secured. On the other hand, it is urged that inoculation does not cause any general disorder except sympathetic fever, and cannot, therefore, be useful; that it causes a certain loss by the ill effects which result from it; that the practice is based neither on a sound theoretical nor practical views. The ill effects

consequent upon the operation are reduced to a minimum when it is properly performed, the exuded matter from the lungs being fresh, devoid of gangrenous material, and introduced in a proper manner. The so-called sympathetic fever may be somewhat specific, and it must be remembered that in ordinary cases of the disease the blood has been found remarkably free from virulent properties, so it is quite possible that the disease may take place after inoculation, and run its course at the seat of puncture, without the lungs becoming involved specially. A slight cough is said to frequently succeed the inoculation, and cases are on record of origination of pleuro-pneumonia from inoculated animals. Cattle owners, as a rule, have strong faith in inoculation. The experiments which have been most carefully conducted in this country have failed to show that it is beneficial. These have been rather on a small scale, and are, therefore, not conclusive. The important question of inoculation as a prophylactic means is not settled. It seems to have been proved that the flesh in this disease is not prejudicial to man except in the advanced stages; the milk, too, has been consumed freely without any ill effects resulting. There seems, then, no true reason why flesh and milk should not be utilised. Of course, thorough cooking should be insisted on.

Pleuro-pneumonia has been considered the pathological equivalent of rubeola or measles of the human subject, and of typhoid fever of the pig. No evidence of any weight has been advanced in support of these theories.

Eczema epizootica, *v.* Contagiosa, Aphtha epizootica, Vesicular epizootic, Murrain, *Foot-and-mouth disease*, &c., is a specific eruptive disorder, panzootic in its characters, and has been prevalent in all parts of this country at different times, having been first imported from abroad about 1839. Its special lesions consist in vesicæ, which may occur on any mucous membrane, but especially affect that of the mouth. The skin of the inter-digital space also is the special seat of disorder.

Symptoms.—After an animal has been exposed to con-

tagious influences, the incubation lasts from twenty-four hours to four days; and the first appreciable alteration of the normal conditions of the animal is a gradual rise in temperature. This may be so marked that the thermometer at the maximum may reach 107° F. Shivering and other febrile signs are present in the first stage of the disorder, the mouth is sore and has hanging from it a little viscid mucus, the animal does not feed, grinds its teeth, and exhibits general signs of ill health, the bowels are constipated, and the breath fœtid. This lasts for about two days, and then the characteristic eruptions appear. In the mouth they occupy the dental pad, the gums, lateral parts and dorsum of the tongue and the palate; generally rounded or oval, they are of considerable size, averaging about that of a shilling, but often as large as half-a-crown. They consist of elevations of the somewhat dense epithelium, which is softened and macerated by the saliva, and so rendered white. Soon they are broken by the action of the tongue and other influences, and a red raw surface is exposed. The discharge of saliva is now profuse, and hangs in shreds from the mouth, or collects like foam around that opening. There is a peculiar smacking of the lips to get rid of this. Sometimes smaller vesicæ appear on the transitional membrane of the muffle, and in some cases the nostrils are similarly diseased. There are vesicles developed on the udder in milch cows, which especially affect the teats, and sometimes the diseased action is said to involve even the lining membrane of the milk ducts. These mammary vesicles are ruptured by the calf, or their contents become absorbed and a dark brown scab remains, and aggregation or confluence of these vesicæ may take place. The lesions of the feet are preceded by pain, manifested by restlessness, frequent lifting and shaking of fore and hind feet, and the back is arched and thus all four feet brought together. Swelling of the coronet appears, and is quickly followed by the development of vesicæ, generally between the digits, but often extending almost all round the coronet. There is considerable lameness,

and the animal lies somewhat persistently. Here, also, the vesicles rupture. The serous fluid, when exposed to the air, dries and forms a yellowish layer of material which readily pulverises. The last stage is marked by disappearance of acute febrile symptoms, increase in quantity of milk, which has been much reduced, obliteration of the exposed surfaces by development of new epithelium and cessation of lameness. Sometimes the disease assumes a more virulent type, dependent upon defective hygienic arrangements, or upon obscure climatic influences. Then the nasal, laryngeal, conjunctival, bronchial, gastric, and duodenal mucous membranes present vesicæ; the anus and vulva are similarly affected; there is a tendency to sloughing of parts in connection with the vesicæ, and extensive removals of epithelium. In such cases young animals will die before the eruptive stage, the only lesions manifested on post-mortem examination being congestion of the lungs; while older animals suffer from severe irritative fever, rapidly lose flesh, and are liable to succumb from exhaustion. In these cases, too, there is a marked liability to the various *complications* of this disorder. In whatever part they occur the vesicæ may be associated with acute inflammatory action of deeper tissues, such as glossitis leading to extensive sloughing or induration, mammitis, and inflammation of the structures of the foot, with production of sinuous ulcers and a tendency to sloughing of the claws, open joint, and casting of the hoofs.

Mammitis may result either from extension of inflammation along the lining membrane of the ducts of the milk glands, or from a blocking up of the openings of the ducts leading to over-distension with milk. Abscesses, induration, and blind teats supervene upon these cases, also the frequent irritation in milking a cow with sore teats may render her permanently vicious.

When the alimentary mucous membrane is involved in the disease diarrhœa replaces the constipation which is generally present. Œdematous swellings, too, sometimes are manifested. In each of these latter complications there is extreme debility. Under ordinary

circumstances the *prognosis* must be favorable, as recovery will take place after from eight to twelve or fifteen days from the premonitory rise of temperature. The various complications which we have just noticed necessarily protract the case, but our prognosis, too, must include grave loss to the owner, especially when milch cows are affected. From the first stage of the attack the milk is yellow in colour and gradually diminishes in quantity until it becomes about one fifth the natural yield. Its specific gravity is low, 1024, and it generally has a fair proportion of cream. White corpuscles, having the characters of pus-globules, are always present, their number varying with the severity of the symptoms. Some of these were seen three weeks after recovery. Monads and bacteria were observed in every specimen, and remained unaffected by boiling (Professor Brown). The produce of a dairy, then, is *very* seriously diminished by an attack of eczema. In the severer forms, too, abortion occurs, and in all cases the animals are very much reduced in condition ; 10 per cent. is given as the average loss by death when the disease is most severe. One attack of this disorder does not secure immunity from others ; it is not rare to see animals which have been affected three times. From cattle, who are especially affected by it, and are the most important bearers of contagion, it will spread to the sheep, pig, poultry, and also to the human subject and the horse. The cases which have been recorded can leave no doubt of this latter fact. The contagion is both fixed and volatile, so that the disease is contagious and infectious. The characters of the materies morbi have not yet been determined. Professor Brown mentions the occurrence in the blood and other fluids of monads, bacteria, and vibriones, but does not attribute a specific influence to any of the observed forms. The viruliferous principle resides in its most concentrated form in the saliva. In 1839, Professor Simonds communicated the disease by feeding an animal on hay saturated with saliva ; vesicles appeared in the mouth in forty hours. He also found that warm milk from a

diseased cow given to pigs generated the disease. Thus, it seems that the virus may gain entry into the system through almost any mucous membrane. Nature endeavours to throw off the contagium after it has entered into the blood through the mucous membranes and such parts of the skin as we have indicated as being involved. Inoculations at first failed, but Contamine produced the disease by inoculation of the mouth, and since then this process has been resorted to, not with a view to prevent recurrence, but in order to ensure all animals of a herd being simultaneously affected, whereby the period of isolation, as enforced by law, is shortened. This inoculation is a measure of questionable value, since some animals might have escaped by proper segregation and disinfection, and also the same animal may be several times affected. The virus may be conveyed by attendants or by appliances; also it is said to be carried for a distance of 120 yards, but this probably depends upon the direction of prevailing winds and other atmospheric influences. The virus is said to retain its vitality for at least three months.

Diagnosis.—Eczema epizootica may be confounded with aphtha simplex, and undoubtedly has been by some authors. The latter appears under an enzootic form, dependent upon special characters of the food. The lesions are confined to the mouth, and consist of very numerous true vesicæ, surrounded by an areola or ring of redness, due to inflammation, and pointed. These contrast markedly with the large blebs of eczema epizootica, which are few in number, and occur in definite positions. A difficulty is presented to inspectors in the later stages of this disorder in determining whether foot lesions are specific or simply due to the disease called foul. Complicated foot lesions succeeding eczema are really one form of foul. All chronic cases of this kind may be passed as incapable of communicating the disease. The same remark applies to glossitis and disease of the mammary gland.

Treatment, as in other eruptive disorders, must be directed to avoidance of complications and assistance of

nature's efforts to expel the contagium. To remove the causes we must divide the herd into diseased, suspected, and unsuspected lots. The latter should be examined daily to detect any rise of internal temperature; the suspected should be isolated and drafted into the diseased lot as they become affected. Disinfection should be rigidly enforced, and the animals not removed from quarantine until about a week after the last case of disease has been removed from among them. The diseased should have soft diet as much as possible, and those but slightly affected require little more attention. Where the patients are seriously debilitated they will require tonics. When the eruptions on the teats tend to block up the milk passages, the milk must be drawn off with the syphon. When the udder is inflamed it must be duly supported and treated as in ordinary mammitis. The diseased feet must be kept as clean as possible and protected by bandages, complications receiving the attention recommended in "foul." Calves ought to be removed from cows affected by this disorder and hand-fed with good milk, for these young animals are liable to suffer severely from the disease, the whole alimentary tract being involved. Fairs, markets, and other centres of cattle traffic are the sources of introduction of this disease into farms; and high roads are often traversed by diseased flocks and herds, which thus leave virus behind them for those that follow. The farmer must be advised, therefore, to keep newly purchased animals away from the rest of his stock for a few days after their arrival, to avoid pasturing animals on fields bordering on high roads when the disease is rife in the neighbourhood, and, as a public duty, not to place diseased animals there; also all measures of disinfection should be strictly enforced. Especially the same attendants should not have charge of both sick and healthy animals. Unless sanitary measures be strictly enforced the disease may assume its severest forms.

Post-mortem examination shows the mucous membranes variously involved in different cases. Thus, the larynx, nasal chamber, and alimentary canal, sometimes present

vesicæ and other inflammatory conditions. Sometimes the abrasions of the palate and the lesions in the stomachs resemble those observed in rinderpest. Frequently hæmorrhagic spots are observable on the serous membranes. In fatal cases the blood is anæmic. When extracted during life the red corpuscles are found to be stellated, and to exhibit changes of form. White corpuscles are increased in number. Bacteria and masses of living matter, together with minute spherical bodies, are constantly present. In the saliva are small stellate crystals and actively moving monads. In the fluid from the vesicles, and in the discharge from the eyes, are monads, bacteria, masses of germinal matter, and large nucleated cells. We owe these conclusions to Professor Brown's observations. Abscess, induration, and even gangrene of the mammary gland, may be present. Open joints, fistulous ulcers burrowing beneath the hoof, and extensive sloughing, also separation of the hoofs, may follow the foot disease.

This disease is certainly communicable to man through the milk; thus, children are liable to become affected. Suspected milk should either be rejected or boiled before consumption. We have no evidence to prove that the flesh is injurious to man. Cases are on record where attendants upon diseased animals have taken the disease. Since it is intercommunicable between all the animals which can become affected, our prophylactic measures must embrace all animals on the farm. By law animals affected with foot-and-mouth disease, or herded with affected animals, are not to be removed, nor are animals from contiguous buildings, except for immediate slaughter under the regulations of the local authorities, or if not for slaughter, under permit from the officer of the local authorities. All sheds occupied are to be disinfected and cleansed.

Rinderpest—Cattle Plague—Puschima (Hindustanee). —This disorder is the most formidable specific disease of cattle; it is enzootic in the steppes of Russia, China, and it seems, also, in some parts of Burmah, occasionally visits Great Britain, and requires most active measures of re-

pression. It is of a most highly infectious and contagious character, affects also deer and sheep, and generally gives rise to a very great fatality, estimated at 90 per cent. An attack here proves fatal about the seventh day after the first manifestation of signs of the disorder. Its period of incubation varies somewhat considerably, in some cases being supposed to extend to the fourteenth day but generally it lasts from four to eight days. The first indication of disorder is a rise in internal temperature, which occurs twenty-four to twenty-eight hours before any other appreciable symptoms; then the animal exhibits evident signs of disorder, extreme dulness, rapid loss of strength, irregular rumination and feeding, and diminished supply of milk, also generally a certain amount of constipation is present, the coat stares, and there is a persistent shivering. Later the visible mucous membranes assume a pink and then a dark purple colour, most perceptible at the vulva. Twitchings of the voluntary muscles take place, and there is a husky cough, which Professor Simonds describes as "like that of a broken-winded horse with sore throat." The *pulse* at first is scarcely affected, later it becomes frequent and full, and afterwards loses tone, becomes feeble, thready, and double, and towards the last is imperceptible, and the beats of the heart are irregular and feeble. The breathing, at first not materially altered, afterwards is frequent, complicated by the muscular twitchings, so that it presents a double expiratory movement, and at each expulsion of the air the animal moans. The breath is fetid. The temperature of the surface is variable, but the diffusion of heat throughout the system is very irregular, and as the debility of the patient and the weakness of the heart's action increases, extreme coldness of those parts distant from the centre of circulation sets in. The nervous system is in a very disordered state; sometimes the animal is delirious in the early stage, while in the later there is extreme debility, so that the recumbent position is persistently maintained. Abdominal pains are present, marked by the usual signs, and diarrhœa early supervenes, the evacuations being

watery, of a dirty yellow colour, highly offensive with a peculiar odour, containing flocculi of lymph, and sometimes a little blood, and being expelled suddenly and with great force at first, but later trickling away involuntarily. The back is arched, the skin dry and tense, the loins are tender, and emphysematous swellings occur, especially about the back in the region of the loins. A similar disengagement of gas takes place into the interlobular areolar tissue of the lungs. Non-emphysematous tumours are described as sometimes appearing about various parts of the body. In some cases the secretion of milk is suddenly and completely arrested, but in others this fluid continues to be produced in small quantity, until an advanced stage of the disorder, its "specific gravity being diminished, its salines less plentiful, its fat increased, and sometimes it is reddish and acrid." The urine is scanty, often albuminous, and contains a diminished amount of salines, but an increase of urea. The blood is dark and coagulates imperfectly, has an excess of fibrin, and an altered condition of its albumen. The conjunctiva, at first reddened, produces acrid watery tears, which trickle down the face and cause removal of the cuticle; later the secretion becomes gelatinous, accumulates at the inner canthus, and the membrane becomes pale, saliva is produced in considerable quantity, and the mucous membranes undergo special and definite changes; the congestion above indicated is succeeded by proliferation of the epithelium, with an altered condition of the products. The buccal mucous membrane about the lips, gums, and palate, presents elevations of some extent, which are considered to be liable to be confounded with those lesions which occur in foot-and-mouth disease. They are not due to separation of the epithelium from the corium, but to alterations of the former. The yellowish masses of thickened epithelium are but slightly adherent to the corium, and they can be readily removed as branny scales, leaving patches of highly vascular sensitive tissue, surrounded by the white mucous membrane, as yet unaltered. These lesions are first marked in the conical papillæ of the cheek and

the tongue. The altered epithelium, when thrown off or removed, passes out of the system with the profuse discharge of saliva. After the mucous membrane of the vulva becomes of a very dark purple colour, the epithelium undergoes changes similar to that of the mouth, and there is an albuminous discharge, which hangs from the lower commissure. The Schneiderian membrane, after exhibiting the early congested condition, becomes pale, petechiated, and its blood-vessels are very evident; then its epithelium becomes altered. There is a discharge which hangs about the nostrils and dries there. The skin is involved in diseased action; the parts covering the udder, teats, inside of the thighs, and those neighbouring the mucous membranes are especially affected, though we often see the general surface implicated. In the male the præputial membrane and the scrotum are very liable to become affected. The lesion may range from a scurfy condition, through a papular stage to the pustular, exudations taking place which mat the hairs together, or the pustules become confluent, and form brown patches of a considerable size.

Prognosis.—Williams says: — "Some cases of cattle plague recover, and in these cases it is observed that the skin over the neck, withers, &c., becomes covered with a yellowish sebaceous secretion, but there are no vesicles or pustules." It is found that recovery from one attack secures future immunity. It must be remembered, however, that an animal himself exempt may convey the contagium. The complications of this disorder, alterations of the intestinal mucous membrane, persistent diarrhœa, and excessive debility, are such as prevent frequent recovery; but in its enzootic abode many mild cases are seen. No known race of cattle is exempt, but it is said that animals native to the districts whence it comes can resist its influence much more frequently than others. Some few animals enjoy immunity during an attack even in Western Europe.

Causes.—The climatic and hygienic conditions of animals in the enzootic abode of this disorder are peculiarly trying to the constitution. Drought, starvation

and plenty, extreme cold and almost tropical heat, being peculiarly combined on the wide grassy expanses of the steppes. Thus, the animals there become much predisposed to this as well as other disorders, but we must coincide with the opinion at which Professor Unterberger has arrived, that even here the disease does not originate spontaneously. From this enzootic centre the disease is carried along the great traffic roads towards Western Europe, and follows the course of armies in the field. Thus, as trade facilities increase the disorder will be liable to spread to a greater distance in a shorter time; also certain definite rinderpest routes from Central Russia might be noted; also times of war prove times of pestilence, a fact which has long been observed. Meat food for troops in Central, Eastern, and Western Europe must be drawn from the large supplies of Eastern Russia, and in the hurry of the transport and the commissariat duties veterinary inspection is too often neglected.

Nothing is really known about cattle plague contagium. It is said to diffuse through the air to the distance of 500 yards (Gerlach, 40 mètres; Hayne, 30 to 1000 mètres), bringing about infection of other stock, but most observers are inclined to consider the latter estimate must be taken to apply to mediate contagion rather than true infection. The discharges may retain their power of communicating the disorder for eleven months (Jessen), three months (Camper and Viedazyr), six years (Weiss and Hering). In the latter cases it was retained in capillary tubes, or between two pieces of glass, and hence not exposed to the air. So we can bring to bear weighty arguments against the theory of spontaneous origin of this disorder; any statement that it may occur as a result of ordinary causes must not be admitted. Practically, all efforts must be directed against the contagium which already exists. This may be conveyed by an unaffected animal, by hides of affected ones, by attendants, &c; and the persistence of the virus renders disinfection, and, where possible, destruction of things which have been in contact with any diseased animal

imperative. Burning tar in byres and sheds used to be recommended as a means of disinfection, but now we prefer the use of the numerous agents of tried value, which are mentioned in our Pharmacopœias—carbolic acid, sulphurous acid, chloride of zinc, &c. Special attendants must be told off to infected animals; these must be strictly prevented from approaching any healthy cattle, and ought to be disinfected daily. All carcases of diseased animals should be burnt in their hides, together with the straw upon which they have been lying. The virus may remain in a latent condition after the animals have been buried, and render the soil a medium of contagion (except when they have been buried in quicklime). The sheds should be sluiced down with strong disinfecting solution, so that no excreta bearing virus in a harmful condition may pass into the sewers. The patients should for the most part, and, as a rule, be slaughtered at once, and their hides slashed. If some of the milder cases are kept for observation or treatment, an endeavour must be made to support the strength of the patients by stimulants, combined with vegetable tonics, as beer or gentian, with nitrous ether. Numberless recipes have been submitted, tested, and proved worthless. We can name no agent capable of acting as an antidote to rinderpest poison. The strength requires to be supported by every available means, especially the administration of gruel and other easily digestible but nutritive matters. Internal disinfection has been much recommended, and in this direction future endeavours to treat specific diseases must be made. But inspection, stoppage of cattle traffic from diseased countries, stamping out any outbreaks which occur, and quarantine of all suspected animals must be adopted.

Inoculation has been tried as a prophylactic, but it reproduces the disease in all its fatality and communicability. Vaccination, too, was unsuccessfully resorted to during the 1865-66 outbreak, under the supposition that rinderpest is a form of smallpox. Neither of these measures, therefore, is advantageous.

Post-mortem examination.—Considerable variations of

internal temperature or a rapid fall of the mercury are signs of approaching death. The local lesions observable in the mucous membrane are principally due to plugging of even large vessels by lymph deposits, whereby the nutrient supply of the epithelium is cut off, and it undergoes fatty change. This reminds us of the plugging of the minute vessels which occurs from accumulation of bacteria in anthrax, septicæmia, and other diseases of their class. The specific organisms of rinderpest have not yet been recognised. During the great outbreak in this country medical observers noted the presence of ovoid bodies in the muscles between the sarcous fibres, and termed them "cattle-plague bodies," more careful examination showed that they are harmless parasites of the division Gregarinæ. The mouth, pharynx, and first three compartments of the stomach are generally congested, the œsophagus having undergone no change in the majority of cases. The glandular structures of the velum palati, tonsils, and of the base of the tongue are diseased, their ducts being plugged up with strings of lymph. The rumen sometimes shows somewhat extensive patches of congestion of a "port-wine" colour, or of epithelial proliferation. The omasum almost invariably has its contents in a very hard condition, its epithelium separates somewhat readily, showing a congested surface, and sometimes the leaves are the seat of more severe lesions, and may be ulcerated, as a result of sloughing, to such an extent that they are perforated. The abomasum is congested, and, especially near the pylorus, shows extensive blood extravasations and sloughing after the formation of the characteristic false membranes. The contents are reddish-brown viscid mucus, intermingled with blood. Sometimes it is noted that both in the abomasum and the intestine a certain amount of pigmentary degeneration occurs. The small intestines are rendered dark in appearance by the altered characters of the mucous membrane. This is congested in a streaked or patchy manner, which is rather distinctive of this disorder. Extravasations of blood are present, and the contents are something like those of the abomasum. Where the epithelium has separated from the

corium the latter is covered by a lymphy deposit, which hides the bright red colour of the erosions. Peyer's patches are generally diminished in size, and are covered with a layer of lymph. Sometimes, however, they are enlarged (as also are the solitary glands), and are covered with false membranes of variable colour. The large intestines may be more or less diseased than the small. The ileo-cæcal valve is very frequently the seat of change; in other parts the bowel exhibits congestions, extravasations, and false membranes, the latter often being in process of removal by sloughing. The rectum especially is intensely diseased. The lining membrane of the gall-bladder is similarly altered to that of the intestines, and the gall-ducts contain lymph. Wherever these congestions occur the capillary vessels become very much distended with micrococci (according to Klebs). Also some of these invade the submucous-tissue, of which they cause thickening, and others pass off in the discharges. The respiratory mucous membrane in the trachea, bronchi, and larynx is congested, and the latter exhibits ulceration and œdema against the arytenoid cartilage. In very bad cases along the whole length of the air-passages the mucous membrane will often show ecchymoses and false membranes. There is an emphysematous condition of the lungs. The kidneys are enlarged, and their lining membrane, as well as those of the uterus, urethra, and bladder, are characteristically altered. The urine is scanty and bloody. The conditions of the blood, skin, &c., have been already noticed. No marked lesions of the nervous system are present. The mammary gland is congested. The flesh varies but little from the healthy in physical properties. Sometimes it has a bluish colour or is of a darker red than usual. The heart is soft, and there are often extensive extravasations beneath its lining membrane. Petechiæ and ecchymoses are observable on most of the serous membranes. The little milk produced by affected animals should be thrown away, but, according to the best authorities, we have no evidence that the flesh of animals in the early stage of the disease will prove prejudicial

to man. Such flesh should be thoroughly cooked, and it may convey the disease to other cattle. It was concluded at the International Veterinary Congress at Vienna, after evidence from Professors Rawitsch and Jessen, that hard dried hides will not communicate the disease. It is interesting to inquire into the question whether rinderpest has intimate affinities with any disease of man. This matter is fully discussed in Professor Gamgee's valuable and exhaustive work on the Cattle Plague. It was thought to be equivalent to typhoid fever of man, but the patches of Peyer do not undergo the changes characteristic of that disease. Again, smallpox has been considered the pathological equivalent, especially by Dr. Murchison, who very ably supports his view, but skin lesions of the true pustular character are seldom present in rinderpest. Also it is difficult to understand how, if the diseases are one and the same, smallpox is always present in this country and rinderpest only when introduced from without. The false membranes formed in cattle plague are described frequently as diphtheritic and croupous; the disease is often termed typhus, and some superficial resemblances to certain other human disorders may be noted. Suffice it to say, with regard to these, that it has not been found that rinderpest is the equivalent of either of them. We can only consider it as a disease of a peculiar character due to a special pathogenic organism—which, probably, Klebs is right in considering a bacterium.

Cattle plague and eczema epizootica are **exanthemata,** eruptive disorders. In addition we find that variola and a special form of aphtha are mentioned under this heading in bovine pathology. Recently stomatitis pustulosa has been added to the list. These are specific disorders, generally communicable with facility by contagion and inoculation. They run their course with remarkable regularity, exhibiting a number of consecutive changes of a special character, culminating in the formation of vesicles by accumulation of serous fluid between the corium and epithelium of skin, or mucous membrane, or both. The fluid of the vesicle contains the materies morbi in a

concentrated state, and is therefore very useful for inoculation purposes. The virus is thus thrown off from the system, so that generally these diseases have a benign character but under defective sanitary arrangements, and in animals with vitiated constitutions, they may become malignant, and highly destructive. In all of these disorders we see a well-marked incubative stage, a period of invasion, an eruptive stage, and, lastly, the stage of repair. It is noticed that certain specific poisons are eliminated by certain membranes, and in special ways. We cannot explain this any more than why particular medicinal agents act on special organs. The nature of the contagium is still obscure; by some it is considered to be corpuscular, by others bacterian. These diseases are little influenced by medicinal treatment, but may be altered very much for the worse by neglect of sanitary precautions. Then we see considerable and permanent disorganisation of structure, complications tending to render the animal useless, even if it recover. The eruption must be encouraged in every possible way, and its various changes promoted. The animal's strength must be supported. Measures of isolation and disinfection are essential. These diseases, especially vaccinia, derive great interest and importance in their relations to diseases of other animals.

Vaccinia, Cow-pox, Variola Vaccinia [with which are noticed *Varicella*, vel *Vaccinoides, and Smallpox in cattle*]. Variolæ constitute a class of diseases, one form being peculiar to each species of animal; thus, the eruptions of this nature which occur in our domesticated animals and in man are not identical, but only allied. Equine and bovine variolæ are sometimes considered exceptions to this rule. Jenner observed that milkmaids took this disorder from milking cows affected with it, and were thereby exempt from smallpox, so he originated the system of vaccination to the great and lasting benefit of mankind. The same observer also assented to an observation of a contemporary of his (Dr. Loy), that the disease vulgarly known as "grease" in the horse, also termed eczema

impetiginodes, is really equine variola, and its virus introduced into the system of the ox originates variola vaccinia. These diseases of the two species of animal were, therefore, by him considered identical. This communication of virus may be direct or indirectly through attendants. Human variolous matter, when introduced into the system of the cow is stated to cause a *smallpox* eruption, while vaccine introduced into the human system does not produce smallpox, only vaccinia. From the eruptions in the latter case may be collected lymph, which, when preserved in capillary tubes or on ivory points, is available for other vaccinations. It always produces the milder disease, and always proves effective against smallpox if the lymph be good and the inoculation successful. Thus, much lymph derived by linear descent from that which originally came from the cow is in circulation. Two important questions arise in connection with it :—

1. Has it degenerated by successive passages through the systems of numerous human beings, so as to prove less effectual in securing immunity now than formerly, and, if so, will it not be better to renew the stock? Certainly, lymph just taken from the cow produces more marked effects than humanised lymph, but this is not always a benefit. The lymph of the present day ordinarily acts with quite sufficient potency and seems to be very effectual.

2. Has it become admixed with human specific poisons—scrofula, syphilis, and the like, which would not be present in animal lymph. There is much feasability in this argument in favour of animal vaccination. Undoubtedly there is much vitiated lymph in circulation. Some lymph "stocks" are very pure, in consequence of great care in selection of lymph for preservation. The production of fresh supplies of lymph from the cow is, therefore, by all means to be encouraged, but good old lymph is not to be rejected, as it is decidedly better for weakly subjects. Vaccination and other inoculations are performed by removal of the epidermis, and insertion of the virulent fluid on the exposed surface of the cutis. Blood should not be drawn, for this would tend to wash

away the virus; also the seat of inoculation may be advantageously protected by adhesive plaster. Chauveau has made some most interesting researches on vaccine. It is said that the disease may be communicated through the digestive organs, or by intravenous injection.

Variola ovina is not the same disease as variola vaccinia. Zundel relates how two beasts became affected by living with sheep suffering from their pox. Professor Simonds' conclusions with regard to vaccination for sheep-pox are indefinite. He quotes Sacco :—"In the event of an outbreak of sheep-pox, if we cannot procure lymph to vaccinate the animals, we may ovinate the human subject or the cow, and thus destroy the virulence of the virus," and "the vaccination of sheep gives immunity," also Mayer, whose researches ('Veterinarian,' xx, p. 629) showed him that the French experiments lead to the conclusion that vaccination does not secure immunity from sheep-pox.

An attack of vaccinia secures immunity from the disease in future. Outbreaks, which are apparently spontaneous, occur among cows, especially when confined to close sheds, and shortly after calving. The disease does not seem to originate spontaneously in the bull, but it occurs as a result of inoculation. We must look with suspicion on the asserted spontaneity of this disease, remembering that horses, as well as other cattle, may be the source of an outbreak, and also some attacks in the cow are very slight, and there are several conditions with which they may be confounded if due care be not exercised. Thus, eczema epizootica and cattle plague often present an eruption on the teats and udder, and there are several forms of disease which run through a herd, and are communicable to many, being known under the common name VARICELLA, or VACCINOIDES, of which Fleming mentions three—the acuminated, the papular or warty, and the emphysematous forms. All these may be distinguished from the eruption of the true vaccinia, which never assumes either the acuminated or emphysematous character, and only passes through a papular stage, which lasts about

four days. Vaccinia is not a severe affection; it renders the milk unfit for food, and diminishes the supply *pro tem.*, though febrile conditions seldom run very high, and present nothing very special in their characters. The first manifestation of local lesion is redness, at first diffused, subsequently circumscribed, in patches over the mammary gland and teats, also pain and general swelling. When the parts are reddened, small hard nodules appear and increase in size until they attain about the size of a sixpence. This is the *papular stage;* next comes the *vesicular.* A serous accumulation extends from the centre, rendering the vesicæ bluish, though they are still surrounded by a congested ring (areola). The central point, however, does not project, but remains somewhat slightly bound to the corium. Consequently the vesica has an umbilicated appearance. About the eighth or tenth day these vesicæ attain their maximum development. Then comes the *pustular stage,* which lasts for two or three days, and then the contents of the pustule, if not set free by rupture, become absorbed, and a peculiar brown scab remains (siccative stage) for a varying length of time. Vaccine lymph should be collected only from the matured *vesicæ,* and should contain neither pus nor blood, neither should it give the slightest evidence of putridity or milkiness. An attack of cow-pox generally extends over several weeks; the disease prevails especially in the spring, and in certain parts of the country. It seems to be less frequent now than formerly. In warm countries it becomes malignant; thus, in India it is manifested by high fever, confluence of the vesicæ, and the mucous membranes in general becoming involved in the diseased action. Thus, there is a discharge from the nostrils, profuse salivation, diarrhœa, and abdominal pains. Young animals and weakly subjects even succumb to the disorder.

Treatment.—Prevent retention of milk, such as is apt to occur by scabbing over of the extremity of the teat. Draw off the milk regularly with the syphon. Occasionally mammitis results from extension of inflammation along the mucous membrane of the gland. This will require the

ordinary antiphlogistic means. Avoid communicating the disease from sick to healthy animals when milking; isolation is seldom necessary. Reject the milk.

Sometimes customers bring dogs to the veterinary surgeon that they may be vaccinated as a preventive against distemper. We have no proof that this is of the slightest value; on the contrary, evidence is not wanting to prove the fallacy of this method.

Infectious Aphtha is described by some authors as affecting cattle. Eczema epizootica is frequently called aphthous fever, and a form of aphtha, of an enzootic character, is sometimes seen as a result of special characters of food supplied to a number of animals. Probably the true "infectious" form is the acuminated varicella mentioned above, the mouth being involved. The vesicæ are numerous, conical in shape, and occur in all parts of the mouth; thus, the disease may be distinguished from eczema epizootica. This aphtha is said to be most frequently met with in India and other warm countries; we are inclined to think that in the majority of cases it is simply foot-and-mouth disease. Our knowledge of the cattle diseases of India is scanty and indefinite. Doubtless, when scientific investigations of them have been made, we shall find our list of exanthemata enlarged.

Stomatitis Pustulosa Equi, described by Professors Eggeling and Ellenberger (see 'Veterinary Journal,' vii, 306), is communicable to cattle by inoculation and from one cow to another. Nodules first formed; these became pustules, which burst and produced superficial ulcers; these increased in size, and then commenced healing, a scab being formed. The contagion may occur from the skin, but takes place most readily from the mucous membrane. The virus, when passed through several animals, seems to lose its potency.

Fleming, in his 'Veterinary Sanitary Science and Police,' mentions a *bovine aphthous disease of the genital organs* as observed by Numan, of Utrecht, in 1831, since when it has several times appeared in Holland. It is anthracoid, gives rise to malignant carbuncle in man, and

is communicable by cohabitation and contagion. Inflammatory swelling affects the vulva and vagina in the female, the anus and rectum in the male, and phlyctenæ are produced. Fever not generally detectable is accompanied sometimes by general inflammation of mucous membranes and bloody evacuations per anum and vulvam, the conjunctiva being so injected as to look like a clot of blood. Autopsy showed infiltrations into the subcutaneous connective tissue, and the fourth compartment of the stomach and small intestine filled with bloody fluid. *Treatment* in Numan's hands proved very successful. Isolation and disinfection are important.

Anthracoid Affections, Charbon.—A number of diseased conditions of cattle, apparently distinct from each other, may be associated under this heading. They are of the highest importance, for they are communicable; we know their contagium; they are highly fatal, are to a certain extent preventable, and are intimately related to the health and wealth of mankind. Ordinarily enzootic or even only sporadic, under favoring circumstances they become epizootic and traverse whole continents, causing fearful loss of animal wealth. The researches of Pasteur, Toussaint, Feser, and other continental observers have thrown great light on their nature, causes, and prevention. Anthrax literally means a boil; the name was derived from the manifestation of this disorder in man as malignant carbuncle. Charbon is a term derived from the black condition of the blood. This results from the presence in that fluid of the *Bacillus anthracis*, a very large bacterium, a full account of the life history of which may be seen in our paper on Bacteria in the 'Veterinary Journal' for 1879. This vegetable organism gains entry into the blood, and there multiplies by rapid reproduction. It is imagined that it wars with the red corpuscles for the possession of oxygen. While the bacteria are few no symptoms of disorder are detectible in very many cases, in others only a rise of the internal temperature. Acute disorder may suddenly set in and run its course in a few hours, in other cases the attack may extend over days.

It has been proved that these bacteria are the producers of anthrax, and they generate also an irritating matter which heightens their tendency to give rise to inflammatory action. The beautiful researches of Toussaint seem to prove that they accumulate in enormous numbers in the small capillaries of the lungs, and, by blocking them up, cause "mechanical asphyxia." Some authorities still deny that they are the sole producers of charbon, and consider this disease may originate spontaneously and the organisms be accidentally present in the blood. They also state that organisms of this kind may be present without causing disease, but we note :

1. That these bacilli are invariably present in cases of anthrax.

2. That when bacilli of this kind have been cultivated in a solution of known chemical composition and are injected into the blood they generate anthrax.

3. That these bacilli in the condition of spores have a remarkable vitality, and will bear any extremes of temperature and dryness to which they may be subjected in nature.

4. That since all animals are liable to charbon, undoubtedly wild ones diffuse the bacteria and bring them into parts of the country where they have been hitherto unknown. Flies may be vehicles of contagium.

5. That bacilli capable of producing disease have been found in the soil of meadows well known for their power of generating the disorder, and especially from those parts where post-mortem examinations of victims of this malady have been made, or where these victims have been buried.

6. That these bacilli in the spore condition can persist for a very long time, and subsequently enter into the animal system and generate anthrax.

7. That anthrax is most frequent in marshy places and during warm weather, heat and moisture being very favorable to growth of bacteria, as of all other fungi.

8. That when anthrax assumes an epizoötic form, climatic conditions are extraordinarily favorable to the growth of other fungi.

9. That harmless bacteria closely resembling those forms

found in the blood in anthrax have been observed; it is these which have been found in the system of healthy animals.

10. That the severity of the symptoms is proportional to the ratio of the number of parasites present to the strength of the animal.

11. Whereas cases of supposed spontaneous anthrax used to be considered common, we can now prove that they are rare. Their diminution has been exactly proportioned to our advances in knowledge of the bacillus.

12. That the opinion that anthrax originates only from the bacillus gaining entry into the animal system, is more likely to lead to good practical results, as preventive measures and curative means, than any other opinion which has been advanced; the theory of spontaneous origin of disorders of this kind being particularly liable to discourage hygienic prophylactic measures.

The mode of entry of the Anthrax bacillus into the organism has been the object of recent research. MM. Pasteur and Toussaint simultaneously arrived at the result that in almost every case the food is the vehicle, and wounds are the points of entry. Toussaint proved this by careful post-mortem examinations, in which he found the lymphatic glands in connection with the mouth and pharynx in the large majority of cases earliest involved. Pasteur found that only animals with injured mouths who fed on forage watered with culture fluid containing the bacillus became affected, and that when harsh irritating food was given almost all the animals experimented upon succumbed. A low percentage of cases which naturally occur in a pasture may be traced to entry through wounds on the limbs and other parts of the body.

Death is brought about either, as above indicated, by mechanical asphyxia, or by deoxidation of the red corpuscles, or by decomposition of the blood before death (necræmia). The presence of the organisms in the blood gives rise to high febrile disturbance and direct stimulation of various tissues as denoted by erratic nervous energy and muscular twitchings, thus death may result from exhaustion. In some cases (especially of young and weak

patients) death occurs very early, No marked lesions are present, except that the lymphatic glands are high coloured and the lungs are congested. It seems almost as if the animal had collapsed under the shock of invasion.

Certain definite *post-mortem appearances* may be observed in all cases of charbon. Decomposition sets in even before death, so the body is disfigured by gaseous accumulations in the subcutaneous areolar tissue; also the abdomen becomes enormously distended. Signs of mucous or watery discharges mixed with blood are apparent at the natural orifices, and red spots or blotches frequently occur on the mucous and cutaneous surfaces. The areolar tissue is the seat of a sero-sanguineous fluid, and similar material is collected in somewhat large quantities in the serous sacs. The endocardium and other serous membranes present petechiæ, ecchymoses, and blood infiltrations. The blood is black, fluid, and iridescent on the surface; it contains the bacilli (perceptible with $\frac{1}{5}$-inch power), and stains the walls of the vessels. The heart is soft and relaxed. The other muscles are the seat of serous and lymphy deposit, more or less marked, and frequently present red blotches, probably due to rupture of vessels: the blocking of minute blood passages leads to over distension, then rupture, whereby ecchymoses are produced: the hæmopoietic organs are considerably altered. The spleen is enlarged and gorged with the dark blood; the liver enlarged, and with its blood-vessels distended. The kidneys are also increased in size and congested.

We must next see what indications for *treatment* present themselves. These diseases occur especially on low-lying lands periodically flooded, by the sides of rivers and pools; on clay-lands, which retain moisture; also on chalk, but seldom on granite. In spring these diseases are most frequent, but they often occur in the summer and autumn. Special winds also have been associated with their prevalence; the south-west is most remarkable in this respect. Fogs are sometimes concomitants of outbreaks of anthrax, but whether related to them as cause it is difficult to say; for doubtless the spores are diffused

through the air and carried about, probably aggregated into spore clouds. Of this nature may be some "blights," for often the presence of fungus mycelium has been recorded as a feature of anthracogenic pastures. Communication of anthrax by true infection is not generally admitted; certainly mediate and immediate contagion best explain the phenomena of almost every outbreak. It is certain that once the bacilli gain entry into the system they will be little, if at all, influenced in their progress of invasion by medicinal agents. Chlorate of potash, hyposulphite of soda, and carbolic acid may be tried in various cases in the endeavour to accomplish internal disinfection; as yet we cannot hold out prospects of success.

Prophylactic means are most important. M. Chauveau has shown that certain breeds of sheep have immunity from anthrax, and this question of pathological immunity of special races promises to give good results in the future. All pastures known to be favorable to the development of anthrax ought to be kept free from cattle for a number of years. All animals dying from anthrax should be removed from the pasture before post-mortem examination. The carcases should be burned in the hides, or, the skins having been thoroughly slashed with cross-cuts, should be buried in quicklime. Ordinary burial is not sufficient, for Feser's researches show that the spores of the bacilli pass to the surface of the superincumbent ground (some say they are carried thither by earth-worms); thus, each grave becomes a fruitful centre of contagion. All ejecta, blood, &c., from diseased animals should be collected and mixed with quick lime. All stables, sheds, &c., occupied by cattle affected with anthrax should be thoroughly disinfected. Pigs, dogs, and poultry should not be allowed to feed on blood, flesh, and ejecta of anthrax victims. Attendants should be warned that the disease is communicable to man by inoculation, and every care should be taken in making post-mortem examinations of these cases. The time-honoured method of prevention is a full bleeding and insertion of a seton in the dewlap. The former means we are not inclined to consider of the slightest

value ; the latter is supported by very many accurate observers as producing alterations of the blood the reverse of those observable in charbon. It relieves plethora, which lessens the resisting power of the constitution, and so also proves beneficial. The most useful preventive means are those which tend to promote constitutional vigour, administration of laxatives, good but not too high feeding, supply of *pure* water, also internal administration of common salt. Fresh air and a certain amount of physical exertion should also be secured for the patients. The dark colour of the flesh, blood extravasations, and lymph exudations, and the tendency to putrid decomposition will enable us to detect the flesh of animals which have died from or been destroyed for anthrax. Also, sometimes, here and there may be seen a congested small lymphatic gland. This flesh ought never to be used for the food of any animal ; it has been known to give rise to malignant carbuncle in man, and even after cooking retains a trace of the unpleasant odour, which depends on a principle so noxious as to give rise to severe headache, nausea, and giddiness when any one spends much time in an elaborate investigation of an anthrax carcase. The milk of animals suffering from anthracoid diseases is a vehicle of contagion ; its properties are altered, and its odour and colour changed. Under no circumstances should it be used as food for man or other animals. The list of human disorders of an anthracoid nature obtained from animals is increasing, a happy indication that they will in future be prevented by removing their causes. Some day, doubtless, we shall see human and veterinary practitioners co-operating in this matter for the benefit of mankind. Malignant carbuncle and woolsorters' disease are the most fatal of these disorders known as yet.

On the prospects of inoculation for anthrax.—Some animals can withstand anthrax. The high temperature of birds, or their highly oxygenated blood, defends them in the majority of cases. On the other hand, we have a well-authenticated case of anthracoid disease of fish. When bacilli are introduced into the subcutaneous areola tissue

of an animal which will not become affected, an abscess forms, and so the organisms are confined and then thrown off. M. Pasteur has announced that by a special method of culture he has so modified the bacterium of fowl cholera that inoculation with the altered fungus secures immunity from future attacks of this invariably fatal disorder. When confirmed, the learned Frenchman *may* be able to apply his method to the similar disease, anthrax.[1]

Splenic Fever, Splenic Apoplexy, Essential Charbon, is one of the most frequent forms of anthrax in cattle. It is remarkable for its sudden invasion, its extreme fatality (99 per cent., Simonds), and its rapid course. It occurs among cattle of all sorts, especially those at pasture, and supplied with water contaminated with excreta and sewerage. It is also attributed to bad or too nutritive food, to sudden changes of diet, and other ordinary influences; but almost every outbreak may be traced to contagion, either direct or indirect. This used to be and still is cited as an example of a disease of a specific character, originating spontaneously; but now we know the apparent commencement of the attack is simply when the bacilli begin to manifest their effects. For some time they must have been multiplying in the system. Until lately, then, investigators have not been accustomed to look for causes in the past, except the most recent, and until actual experiment proved conservation of the spores in all their power of development, we were right not to attribute cases of this kind to others which preceded them some time. Also we have only just learned the various forms which anthrax may assume.

Symptoms.—The appearance of the disorder among a number of cattle is denoted frequently by death of some of them in even so short a time as two hours. Thus, several may be found dead when the shed is entered in the morning. Others are affected, but withstand the disease longer, though death generally occurs before twenty-four

[1] Since the above was written, Professor Toussaint, the distinguished teacher of physiology at the Toulouse Veterinary School, has announced that anthrax blood from which the bacilli have been removed by filtration is effectual for what he terms "Anthrax Vaccination."

hours have elapsed. Febrile and general symptoms are present, and in the early stages the patient is excited. The internal temperature is considerably elevated. Next signs of abdominal pain appear, the animal is very uneasy, the pulse becomes rapid, small, and fluttering; respirations accelerated, and somewhat laboured. There is pain on pressure of the loins, stiffness, and staggering gait; also a discharge of mucus and saliva from the mouth, and muscular twitchings over the body. Rapid debility sets in; there is a discharge of bloody fæces, and the urine also contains blood. The pulse is lost, and paralysis supervenes, so that the animal is recumbent. Williams speaks about cases of this disorder assuming the characters of remittent fever, and lasting for several days. Convulsions occur in the later stage, and the animal dies generally by necræmia and coma. In all cases death is ushered in by rapid and extreme fall of the internal temperature.

Treatment.—Curative means have not been found useful. We could hardly expect them to be so since the animal is all but dying when we are sent for. Prophylactic measures comprise those recommended for anthracoid cases in general. Dogs and pigs have been known to die from consumption of the evacuations.

Post-mortem examination shows the spleen enormously distended, even to five times its natural size and weight, by the dark blood, which gravitates freely, since the tissue of the organ is broken down. The blood, tissues in general, serous mucous, &c., present the characteristic anthrax lesions, which are especially marked in the bowels. The contents of the intestines and bladder are mixed with blood.

Texas Fever, Spanish Fever, American Splenic Fever is a form of anthrax endemic in the region of the Gulf of Mexico, whence it is spread through the cattle districts of the United States by contagious influences. It presents several peculiarities, though it closely resembles splenic apoplexy. It differs in the following points, which I venture to collect from a paper by Mr. Myers in the 'American Veterinary Review.' Urine reddish-black, sometimes coffee coloured, turbid, sometimes with a foul

odour. After standing for twenty-four hours gives a brick-coloured precipitate. Sometimes this urine is streaked with blood. Colicky pains seldom present. Mucous membranes greyish. Fæcal matter soft and streaked with blood. Blood more arterial than venous gives a reddish yellow-tinged serum.

Autopsy. — Subcutaneous blood-vessels very seldom engorged. Muscles pale, epithelial lining of intestines often partially detached, and of a greyish-green hue and gangrenous odour, the denuded muscular coat being congested. Peyer's patches large and livid.

The disease generally lasts from two and a half to four days, and is prevalent during the hot summer months. Texan cattle convey the disease without necessarily suffering from it. Whether animals which receive the disease can transmit it to others has been questioned. This disease shows that sloughing of patches of the intestinal mucous membrane (such as occur in swine plague) may be seen in undoubted anthrax of cattle.

Gloss Anthrax—Malignant Sore Throat; *Blain*—*"Hawks."* Sometimes the fauces become the special seat of anthrax lesions, the tongue being enlarged especially at the base, livid in colour, and the seat of putrid decomposition. The mucous membrane covering it and

Fig. 24.—Gloss anthrax or blain. Early stage. (Armatage.)

inside the lips being raised in the form of blebs or phlyctenæ, which may be especially observed at the lateral

parts, and give exit to a foul smelling, yellowish, or dark red fluid. Large sloughing ulcers remain behind. The surrounding parts are congested and swollen by extension of inflammation. Saliva mixed with the putrid serous discharges pours profusely from the mouth. Respiration is considerably interfered with, fever runs high, and debility early sets in and increases rapidly. The pulse very soon becomes small, double, and scarcely perceptible. Sometimes recovery occurs, when there is considerable sloughing of the tissues of the tongue, and the animal has to be nursed through a long period of convalescence. Generally death takes place early, and post-mortem examination shows general anthrax lesions besides the local morbid conditions.

Treatment.—Care must be taken lest the discharges from the mouth fall on an abraded surface. Cases of this kind ought to be isolated. Free incisions should be made into the gangrenous organ, and antiseptic applications be used locally. The strength must be husbanded in every possible manner, especially the patient must receive soft nutrient food. Where the swelling of the throat threatens suffocation tracheotomy must be performed.

Charbonous gangrene of the lungs is described by Professor Williams as a secondary anthracic condition. He mentions it as appearing like a relapse on about the tenth day, the breath becoming very fœtid, the respiratory movements much accelerated, and the animals sinking rapidly, the lungs after death being gangrenous, emphysematous, and loaded with black, tarry, and decomposing blood.

Emphysema Infectuosum, *Black Quarter, Black Leg, Carbuncular Erysipelas* (*Armatage*), *Quarter Evil, Speed, Inflammatory Fever, &c.*—This is an anthracoid disease, but is probably not anthrax, not due to *Bacillus anthracis.*

It used to be considered "external or symptomatic charbon," an endeavour of nature to throw off anthrax poison from the system, and was by some thought rather a favorable condition; but quite recently the identity of splenic fever and black quarter has been successfully called

into question (see "Synopses of Continental Veterinary Journals," 'Veterinarian,' February and April, 1880; also Dr. Greenfield's Lecture IV, February number of 'Veterinarian,' 1880) by MM. Arloing, Cornevin, and Vernaut. These diseases are not reproducible one from the other, do not occur together in a herd subjected to deleterious influences, and no bacteria have been generally recognised as occurring in the blood in black quarter, nor did inoculations with that fluid give rise to any attack of anthrax or of the emphysematous disease (except in Dr. Greenfield's case). Cattle of all ages are liable to become affected, but this disorder generally appears in young stock aged from six months to two years, which have been changed from poor to rich pasture, especially low-lying land. Such animals thrive with rapidity until they attain a high state of plethora, when some of them, perhaps, become lame. A swelling commences in some part of the body, especially the hock. This is very hot and painful; it is apt to be mistaken for an injury. It rapidly extends up the limb, causing very considerable tumefaction, at first highly painful. Later insensibility may be observed in the parts, they become gangrenous, cold, and crepitate on pressure, in consequence of accumulation of gases in the subcutaneous areolar tissue as a result of decomposition. When cut into it is found to be produced also by accumulation of putrid, sanious, and yellow gelatinous material underneath the skin and between the muscles of the part; also patches of black pulpy substances may be observed in various parts of the tumour. Similar swellings in other cases occur in the fore limb, breast, back, or sides, manifesting the characteristic changes mentioned. Constitutional symptoms run high at this stage. The earliest signs may be observed before any local disorder when a herd is under close supervision. They are those of general disorder and acute fever. The occurrence of tumefaction is said to be accompanied by diminution in the constitutional symptoms, but we can hardly regard this as correct; the change consists rather in inability of the constitution any longer to maintain the acute fever. The animal rapidly loses strength, maintains

the recumbent position, becomes tympanitic and comatose, and death may occur even within twelve hours after the first manifestation of lameness. In the early stages the bowels are torpid, and during the acute attack the fæces may be bloody, and the urine is highly coloured from admixture with blood. This is an acutely painful disease; the animal at first stands with straightened neck and muzzle protruded, breathing rapidly, and sometimes moaning. Some few cases recover, the constitutional energy being sufficiently powerful to throw off those parts which have undergone mortification. The tumours burst spontaneously, and by ordinary processes large masses of dead tissue are removed, whereby deep and extensive ulcers are left which heal by granulation, or, in some cases, it is said, by cicatrisation with a considerable breach of surface. The skin sometimes sloughs in patches, and phlyctenæ may be observed in the mouth. Delitescence or metastasis of the tumefactions is recorded. On post-mortem examination, besides the local conditions, the general signs which we have mentioned as occurring in anthrax are present. The lungs are congested, and the bronchi filled with sanious and frothy mucus.

Causes.—Dr. Greenfield has observed in a case of this disease which he reproduced by inoculation of a guinea pig, not *Bacillus anthracis,* but *Bacterium termo,* or an organism like it, in the blood. Arloing speaks of certain refractive corpuscles which do not by culture develop into the anthrax bacillus as being visible in the blood. The disease is prevalent at certain times and in certain places. It is seen most often in summer, and on low-lying or undrained pastures; never occurs in winter, and seldom in animals which are housed, or in poor beasts. It seems to have some predilection for well-bred stock, and generally has somewhat a sporadic character. Its communicability by contagion is questionable.

Treatment.—Free incisions should be made into the tumours, and the living parts around stimulated. Stimulant tonics and internal disinfectants should be freely administered, and the strength should be supported in

every possible manner. When sloughing has taken place, antiseptic dressings must be applied to the exposed surfaces. For prevention of outbreaks among the rest of the herd, bleeding is often resorted to, but its value is doubtful. Administration of a cathartic dose and insertion of a seton in the dewlap are recommended by experience. Antiseptics should be freely administered, and the animals should be removed from the pasture to which the attack is attributed. When the disease is seen in its earliest stages bleeding may be practised with benefit.

Pyæmia and Septicæmia (except the "parturient fever" forms) are not often noticed in works on cattle pathology, but we must devote a few lines to them here, because of their importance in any system of classification of diseases, and because, though they have not often been observed, they probably do affect bovines. The latest views concerning their nature may be seen in the 'Veterinarian" for January, 1880, where Dr. Greenfield draws a distinction between these two diseases, which are too often confounded.

Pyæmia is an invasion of the system by micrococci, very simple bacteria, which are developed when atmospheric germs fall on pus. .They enter the system, cause fever, and the formation of "secondary" abscess is in various parts of the body. They are enabled to produce the abscesses by accumulation in branches of small blood-vessels and migration into the surrounding intercellular interspaces, there giving rise to irritation. The patient frequently succumbs to the weakening effects of considerable suppuration and fever. Cruzel treats of this disease at some length.

Septicæmia results from the entry into the blood of one of the organisms which abound in putrid solutions. It is probably not the ordinary bacterium of putrefaction (*B. termo*). The blood undergoes putrefactive changes, and the whole system collapses, yielding to gangrenous results in various parts of the body. It supervenes on poisoned wounds, &c.

Parturient Septicæmia, "Parturient Fever," has been

confused with parturient apoplexy. It is apparently only ordinary septicæmia, originating through lesions of the genital organs, and, frequently, putrefactive decomposition of genital products. Thus, it has been observed after abortion, when laceration of the cotyledons of the uterus occurs. Also it is associated with cases of retention of fœtal membranes, decomposition of the fœtus, or the introduction of instruments, hands of an operator, &c., contaminated with septic matter. It generally appears within a week after calving, and is almost always accompanied by metritis. The ordinary symptoms of this latter affection are modified by the septicæmic condition. Ecchymoses take place on serous and mucous membranes. Characteristic gangrenous ulcers and diphtheritic deposits are to be seen in the vulva, vagina, and uterus. The labia are swollen, tender, and from between them is discharged a fœtid brownish matter. Tympany, ascites, and other complications appear. The temperature falls very low, the pulse becomes imperceptible, and the respirations very quick, and there is loss of power in the hind limbs before death.

Treatment.—Remove from among other cows, for they are liable to infection. Disinfect the discharges and hands of the operator, remove the decomposing fœtus or envelopes, and inject a solution of carbolic acid into the uterus. Apply glycerin and carbolic acid directly to any ulcers within reach. Stimulants must be administered freely. Quinine has been highly recommended in such cases.

By some authors all forms of "parturient apoplexy" are attributed to specific organisms. We are not assured of this, however, and shall see that our best authorities are not of this opinion.

Here we ought to notice that a Septic Mammitis of contagious character is recorded by continental observers. Professor Diekerhoff investigated an outbreak in Oldenburg ('Veterinary Journal,' viii, 335). It commenced in 1873 and "still continues." It commences in the teats, and the inflammatory action extends thence into the milk

ducts and intimate structure of the mammary gland. It produces changes similar to those which result from ordinary mammitis; there is slight fever present. It affects all female bovines, even before the functional activity of the gland commences, and persists until the next calving. It often destroys one or more quarters of the gland. Occasionally suppuration takes place, and sometimes the gland loses secreting power by complete induration of its lining membrane. It is attributed to local contagion, the virus being either conveyed by the milker's hand, or obtained when the animal lies down where diseased milk has been spilt. Franck (see Fleming's 'Veterinary Obstetrics,' p. 695) injected pus from the udder of an affected animal into that of a healthy cow, and thus communicated the disorder. He considers most cases of mammitis septic, and has found bacteria (micrococci) in the milk in this disease. But we must remember that milk is one of the best culture fluids for all forms of bacteria, and so the forms he observed may have been harmless. The disease is attributed to a septic ferment, causing decomposition, which leads to inflammation-producing substances, when undergoing development in stagnant milk in the udder. Milking every two hours and destruction or disinfection of the milk are suggested as the best measures in these cases.

Glanders and Farcy have been described as affecting the ox. This results from mistaken diagnosis, malignant catarrh and certain eruptive disorders having been thus confounded with the disorder, which is with difficulty, if at all, communicable from the horse to ruminants. The farcinous form of equinia may be confused with ordinary inflammation of lymphatics such as results from a poisoned wound of any kind,

Strangles, too, has erroneously been stated to affect the ox, scrofulous enlargement of the parotid and submaxillary glands, as well as sporadic inflammation of the salivary glands, having been recorded under this heading. We are not aware whether any attempts have been made to communicate this disease from the horse to the ox by inoculation.

Erysipelas is probably somewhat similar in its nature. There are on record some cases of its occurrence in cattle, but this point is contested. It is a specific inflammation of the skin and subcutaneous areolar tissue, which sometimes also affects the mucous membranes, and is considered to be infectious. There is a highly congested condition of the cutaneous vessels, so that the skin has a scarlet colour temporarily removable by pressure. Is remarkably tense, and the seat of a peculiarly intense burning sensation. This spreads rapidly and terminates in resolution, effusion of a considerable amount of serum (forming blebs), and gangrene of patches of skin. The latter is seldom followed by recovery. In phlegmonous erysipelas the areolar subcutaneous tissue is involved, and deep-seated suppuration is liable to occur. Treatment comprises disinfection and fomentations of affected parts, and such constitutional measures as may seem necessary to support the strength of the animal. This disease may attack one animal several times. When there is a constitutional tendency to this disorder an erysipelatous patch appears around any wound and rapidly spreads. In this disease the fever generally runs high.

Diphtheria of man is attributed to micrococci, which invade the system and bring about changes in the mucous membranes, especially that of the air passages, resulting in a characteristic highly consistent false membrane, which forms casts of the larynx, trachea, and bronchi. When a firm cast of a passage results from deposition of lymph on the surface of a mucous membrane it is a *crupous* layer, but when the deeper structures are involved so that the membrane adheres more firmly to the surface from which it is not removable without leaving an ulcer it is *diphtheritic*. Probably crupous formations are non-specific, while diphtheritic are due to special organisms destroying the texture of the corium. Armatage speaks of croup as having "been observed in the cow with greater frequency than other lower animals," and Williams mentions the same disorder as affecting "young cattle, varying from a few weeks to a few months old, when kept on low,

damp pastures, more especially in meadows near rivers, and during the fall of the year." And he says, "I have seen this disease in one district only." Still he views it as non-specific. Mr. W. Beach worked up this subject in the commencement of the present year, and came to the conclusions, which he expressed in an essay read before the Veterinary Medical Association, that diphtheria affects cattle, and is probably originated by outbreaks of the same disease in man, also that the disease termed croup does not exist in lower animals, cases which have been described under this heading being diphtheritic. He has sufficiently supported his views to sanction our insertion of an account of the disease known as diphtheria or croup here, but we would have it clearly understood that we believe our data on the subject are not sufficiently numerous to warrant any permanent conclusions. Some day, perhaps, the question will be elucidated by experimentation.

Symptoms.—Fever, giving rise to a quick, hard pulse; sore throat with swelling, difficulty in swallowing, paroxysmal cough, discharge of mucus from the nostrils and of saliva from the mouth; breathing quickened; a crowing sound during inspiration, also laryngeal spasm, which is very liable to come on suddenly when the animal is excited; debility, denoted by the usual signs, brought about by the inability to introduce a due amount of air into the lungs, also by imperfect feeding. Later, the pulse becomes weak, and the coughing more violent, until on about the third day either casts of the bronchi or flakes of lymph are coughed up, and the animal may recover. Sometimes suffocation occurs before this has had time to take place.

Autopsy discloses the larynx, trachea, and bronchi, and also the tonsils, lined more or less perfectly by a greyish consistent membrane, which in a fresh case is firmly attached, but in one of some standing is loosened by effusion or suppuration beneath it. Micrococci have been observed in these deposits taken from man.

Treatment.—Nurse with great care, especially giving liquid diet. Steam the air passages. Give a free supply

of water with nitre and chlorate of potash in it. Secure as much fresh air for the patient as possible; if suffocation threatens perform tracheotomy. The seat of the operation must be determined by auscultation of the trachea. Where false membranes are present a peculiar vibration results from the rush of air. As a precautionary measure we should disinfect. In each case we should endeavour to prove or disprove relation with a similar outbreak in man. Pigs and other domesticated animals are said to be affected by this disorder. Diphtheria of man has been attributed to "garget" in cattle (at a meeting of the Pathological Society). The idea was originated by Dr. Power, who totally ignored the intimate acquaintance which veterinary surgeons have with mammitis. His ideas were soon refuted, but, as Mr. Beach suggested, may there not be a diphtheritic form of mammitis of the cow? We are not in a position to disprove this. It must be considered a question for the future.

Hitherto among specific disorders we have remarked communicability from one animal to another. There are specific diseases, however, which cannot be transmitted in this way; they occur as epizootics or enzootics, and seem to be associated with special conditions of the air. These atmospheric states may be electrical, chemical, or, as is most probable, due to the prevalence of minute organisms. This view is strongly advocated by the celebrated observer Leydig, who goes so far as to compare ordinary contagious disorders to trichiniasis, which disease one warm-blooded animal directly communicates to another, and these non-contagious diseases to trematode invasion, where externally to the warm-blooded body is an intermediary bearer in which the parasite develops until fit to enter the body of the high vertebrate. In the latter case it will be observed that no *direct* communication of disorder can occur. So it is with influenza and its allies. Higher animals can only become affected as a result of the maturation of the (probably organic) poison in the air. We mention this as the most plausible explanation of influenzoid affections with which we are

acquainted. The epizootic attack of influenza seems to extend in a definite direction with varying rapidity; from the subtle nature of the poison it is difficult to guard against. It affects the majority of animals in a neighbourhood, and often its progress in the system is marked by extreme and rapid debility. It has been observed in islands, whither it must have been conveyed by the air, since they have not been visited from the mainland during an outbreak. Many of the phenomena of these affections may be explained on the theory of clouds of disease-producing bodies in the air. One of the most remarkable of the diseases of this nature is enteric fever of man. It can generally be associated with ingestion of impure water polluted with the filterings of drains and cesspools, the intermediary phase of the disease-generating organism being passed in human ejecta. Some have attributed outbreaks of this disease among men to consumption of diseased milk, and also of diseased flesh, but the diagnosis of enteric fever in man is not accurate. Trichinosis, for instance, is mistaken for it, and is liable to be confounded with any gastro-enteric disturbance. Where there could have been no doubt about the diagnosis, the typhoid or enteric fever has been traced to polluted water admixed with the milk. When influenza is prevalent as a panzootic it is said to sometimes affect the ox, but the most remarkable influenzoid disease of cattle is known as MALIGNANT CATARRH, CORYZA, or "glanders" (but with the disease of the same name affecting the horse it has not the slightest relation). It is a specific febrile disorder, the lesions of which are most marked on the mucous membrane, especially that of the facial sinuses. It is non-contagious, and generally affects only two or three animals in a herd. Old animals seldom, if ever, suffer from it. Fever is marked at the commencement, but later there is extreme prostration and the animal dies asphyxiated. The visible mucous membranes are purple and dry, and later tend to undergo ulceration. There is an abundant flow of saliva from the mouth in the early stages, and the bowels are torpid, but soon diarrhœa sets in, the urine becomes offensive, and

the breath fetid. The eyelids are swollen, admission of light into the eye proves painful, and there is profuse lachrymation. There is also a painful cough.

Sloughing ulceration then sets in, the discharges from mouth, eyes, and nostrils become purulent, and the latter often sanguineous. Ulceration of the cornea may occur, ulcers are visible in the Schneiderian membrane, and

Fig. 23.—Malignant catarrh. Second stage. A horn lost, and nostrils, lips, &c., ulcerated. (Armatage.)

since these extend into the sinuses the pus becomes pent up in these cavities. The vascular investment of the horn-cores is involved in the diseased action, so that the horns drop off. Red patches form in the mouth, and then slough away. It is said the hoofs also sometimes fall off, so that severe lameness is present. Pregnant animals abort.

On *post-mortem* examination the sinuses are found full of fetid pus, and their lining membrane very considerably ulcerated. Superficial lesions and ecchymoses are evident on the mucous membrane of the air and alimentary passages. Ecchymoses also occur on the serous membranes, and there is general venous distension with dark blood.

Treatment.—Change of air as much as possible, nursing, liberal steaming of the head. Administration of stimu-

lants combined with vegetable tonics. During the stage of convalescence mineral tonics, liberal diet, and fresh air. Nutritive and laxatives enemas are rendered particularly useful by the swollen and irritable state of the fauces. The ulcerations may be treated with solution of carbolic acid or chloride of zinc, and the same application may be made to any exposed keratogenous structures. Death gradually occurs in less than a week after the attack.

Rabies (erroneously called Hydrophobia).—The poison which exists in its greatest virulency in the saliva of the mad dog induces disease when introduced by inoculation into the system of the ox. It has been proved that from the latter animal the disease may be conveyed to man by the saliva falling on an abraded surface. The virus of rabies is remarkable in many respects. Thus, its incubatory period is long, usually in the ox about a fortnight, but in man it has been found to extend over years. In this respect rabies reminds us of scrofula and cancer. It is held by most authorities that the virus remains during this time undergoing changes at the seat of introduction, and this view, is confirmed by the local irritation almost invariably present when acute symptoms set in, which again reminds us of the above-mentioned diseases. Many animals are able to resist the virus, so that often true inoculations do not result in acute symptoms, and it seems that the virulence very soon passes from the carcase.

Symptoms.—Some three weeks or so after the animal has been bitten it manifests general signs of disorder and is very excitable, and probably the sexual functions are perverted, as indicated by increased sexual appetite, especially in the male. The appetite is depraved, the fæces scanty, and the patient is either in a dull state or vicious, charging at and "riding" other cattle, and occasionally attempting to bite them. The excitement becomes more marked, the patient bellows, but the voice is said to be altered in tone. A profuse discharge of frothy saliva flows from the mouth, there is a constant champing of the jaws, the eyes are projecting, and the conjunctivæ injected. Painful tenesmus is present. This lasts for some time,

and the animal loses flesh rapidly, paralysis of the hind limbs occurs, and death soon ensues. The recurrence of irritation at the seat of injury takes place in the ox as in other animals, and the patient may endeavour to tear his inoculated limb to pieces. The ox thus affected plunges his nose into water when it is presented to him, but is prevented from drinking by spasms of the throat. The period of incubation is shorter when the head is the seat of inoculation than when other parts of the body are injured.

Post-mortem appearances.—Congestion of the brain and its meninges and accumulation of serous fluid in the arachnoid sac. Accumulation in and around the cerebral vessels of corpuscles of a special character. Small circumscribed spots of blood extravasation in various parts of the body. Congestion of the mucous surface at the base of the tongue and of the lining membrane of the abomasum and bowels. Foreign bodies in the rumen. Blood dark red, viscid, and imperfectly coagulable.

Treatment.—Curative, ineffectual and dangerous; therefore, except for experimental purposes, not to be attempted. Prophylactic: when an animal has been bitten by a rabid dog shave off the hair around every injury, and deeply cauterise with the red-hot iron, or excise with a considerable part of the surrounding tissues. Nitrate of silver and other caustics have been recommended in these cases, but it is difficult to ensure application to all the wounds, and especially to their depths.

Diagnosis.—Rabies has been mistaken for phrenitis. In the latter disease the wildness of the animal is perfectly uncontrolled, but in the former there is a "method in his madness." It also resembles mania puerperalis (which see). The flesh of animals which have died from rabies has been eaten with impunity, but ought preferably to be destroyed.

It has been observed for a long time that even ordinary febrile attacks become less severe towards midday, but aggravated in the morning and at night. This we have been accustomed to vaguely associate with the phases of rotation of the earth, &c. Certain researches upon *remittent fever*, which have been lately made by Dr. Manson and

others, promise to elucidate our pathology of these disorders, and to explain occasional or regular access of intensity of febrile diseases. *Spirilla* are corkscrew-shaped organisms, which occur in the blood in intermittent fevers; they were considered special life phases of bacteria; by observers of high standing they are thought to be nematodes. Manson notes that they are absent from the blood of the patient during midday, but are generally diffused through that fluid at night, when their intermediary bearers, the mosquitoes, are actively blood-sucking. We have already observed that disorders of this intermittent character affect the ox, especially in low lying, marshy places. Quinine is the most useful of the antiperiodic agents suited for these cases.

Parasites in the blood, or which are distributed throughout the system by the blood, and thus are found in many parts of the body.—Hæmatozoa, parasites whose habitat is the blood, though frequent in some animals, have not yet been observed in the ox. Many entozoa are supposed when immature to enter into the blood, and by that fluid to be carried to their special habitats, and when they arrive there instinctively to migrate through the walls of the blood-vessels, just as we may imagine the contagia of specific eruptive disorders do in selecting special membranes as their seat of lesion. Of these we need only instance *Strongylus micrurus*, the producer of parasitic bronchitis. Other entozoa are carried in an immature condition indifferently to various tissues. Of these the most important clinically is *Echinococcus veterinorum*, the cystic phase of *Tænia echinococcus* of the dog.

Echinococcus Disease is especially prevalent in certain localities, as, for instance, the Vale of Aylesbury, and consists in the growth in certain organs, notably the lungs and liver, of cysts, frequently multilocular, and always enclosed in a dense capsule and filled with a watery fluid. The true cysts is thin-walled, of a pure white colour, and soft. As these grow very gradually they cause little, if any, functional disturbance, so that often their presence is not even suspected, the bearer being slaughtered, and the

liver, for instance, found filled with enormous cysts, being thereby much enlarged and deformed, and with comparatively little secreting substance remaining. These parasites

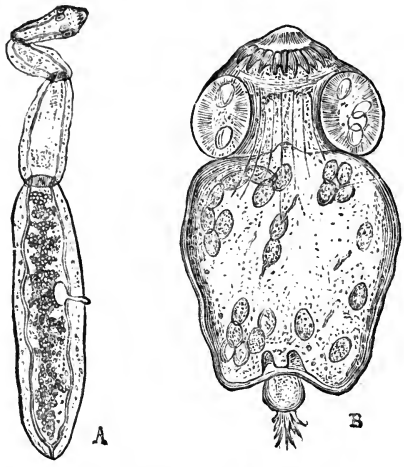


FIG. 26.—*Tænia echinococcus.* A. Mature form. B. Tænia head or scolex of cyst (Cobbold).

have been observed in many parts of the body, even in bones; they seem to prefer protected situations, as parenchymatous or soft viscera. Dogs, foxes, and other canine bearers of *Tænia echinococcus* pass the segments of that parasite with their fæces, and thus act as diffusers of this disorder. Parts containing the cysts should never be given to dogs, but destroyed. Intimate association of dogs with cattle is related to prevalence of this disorder. The eradication of this disease is of great importance, as it causes a certain mortality among human beings, especially in Iceland.

In concluding our notice on specific blood diseases, we must observe one remarkable argument in favour of the hypothesis of their parasitic nature. As methods of research have improved diseases previously classed among the exanthemata have been traced to animal or vegetable parasites; favus and scabies prove this. Hurtrel d'Arboval was only in accordance with his times when he gravely discussed the value of vaccination as a preventive of the latter disorder.

CHAPTER II (*Continued*).

Addendum 1.—Poisons.

In the consideration of matters which act deleteriously upon the animal system some difficulty is experienced in defining the term poison. For if we accept the common interpretation of the term, anything taken by an animal which causes sickness or death, we are at once faced by the difficulty that certain parasites and mechanical impediments to passages, as calculi or a turnip in the œsophagus may be thus considered, and any alimentary matter would thus be a poison if taken in sufficient quantity or in an unprepared state. *Dr. Taylor's* definition is about the best with which we are acquainted: "A poison is a substance which, when absorbed into the blood, is capable of seriously affecting health or of destroying life." But it seems to exclude certain corrosive agents which we must consider as poisons. A poison is any substance which, when introduced into the body in moderate doses, is capable of producing serious disorder or death, without acting mechanically or by vital growth and propagation. We thus exclude, on the one hand, impactions of foreign bodies, on the other, parasites, and especially bacterial organisms, which are the active principles of the majority of animal poisons (so-called) or preferably "virulent" matters. A considerable analogy exists between poisons and medical agents, and no small difficulty will be found in distinguishing one from the other. This arises from the fact that there is no true distinction but that of degree in action; every therapeutical agent has a maximum dose, which varies according to the special circumstances of each case, and if this be exceeded will act as a poison. Thus, our most powerful poisons, when given in moderate doses are our most useful

medicines. Thus, we may revert to our table of medicinal agents as classified, and shall be able to examine poisons under the various headings there indicated. Of Hæmatics, acids, alkalies, tonics, and chalybeates do not exert a toxic action by passing into the blood, but by their irritant and astringent effects upon the surfaces with which they come into contact. Hence they must be considered somewhat as astringents and arranged with astringents in the Irritant division. Again, general stimulants cannot be considered poisonous in the same sense of the term, for they simply accelerate vital process. It is only the most powerful of them which exert any direct toxic effects, as oxygen gas when inhaled in an undiluted condition. Thus we classify poisons as—

- Neurotics
  - Special stimulants, as strychnia.
  - Narcotics, as belladonna.
  - Sedatives
    - General, as prussic acid.
    - Special, as digitalis.
- Irritants
  - Simple irritants, as mustard.
  - Corrosives, as bichloride of mercury.
  - Astringents, as oak shoots.
  - Eliminatives, as nitrate of potash.

With regard to the particular conditions of the animal to which poisonous agents are administered, we must remember the phenomena of idiosyncrasy and toleration. Large quantities of most vegetable agents are necessary to exert a poisonous action on herbivora, and a small amount of animal poison is effectual, but there are marked exceptions to this as to all other rules. The phenomenon of *tolerance* is the condition of becoming accustomed to the remedy, so that larger doses are required than at first to produce medicinal effects. Sometimes, however, agents are *cumulative*, so that successive doses at length simultaneously exert their action and may thus destroy the patient. This results in the case of those agents which are not readily thrown off from the system by the excretory organs. We see this in the action of digitalis, which only after several doses is removed by the kidneys. Certain diseases may be confounded with poisoning, and it is a matter of extreme difficulty in some cases to make a correct diagnosis. We shall not be surprised at this if we consider that poisons

are but special causes of certain and varied disorders, such as gastero-enteritis, tetanus, and inflammation of the kidneys. Taking this view of our subject, we shall not here enter into unnecessary details, but shall confine our attention to special points in the etiology, symptomatology, and pathology of cases of poisoning.

Causes.—Poisons are obtained by cattle in various ways. Of these, the principal are *overdose of medicinal agents*, either as a result of mistake or ignorance or its accumulation in the food; *presence of deleterious matters in the food*, as poisonous plants or lead refuse on pastures, or poisonous seeds incorporated with the proper ingredients of cakes. In these cases we see that the matters have been passed into the alimentary canal, and this is generally the method of entry in cases of malicious poisoning. Thus, it behoves us in cases where the slightest suspicion of foul play or poisoning is indicated to inquire closely into the surroundings of the patient, whether it has recently been subjected to medicinal treatment, either openly or secretly, by the attendants. This must be judged more by the evidence of surroundings than by verbal statements. The accidental observation of a medicine bottle or of a piece of waste paper may sometimes give us more information than an hour's conversation with individuals who are apt to endeavour to conceal the truth either from shame or guilt. Again, the nature of the diet and its composition should be noted, and in this respect the practical investigation of pastures is of the highest importance.

When called in to a case of supposed poisoning of animals out at pasture, the practitioner must set about the inquiry with an entirely unprejudiced mind. He will often find that the outbreak is one of anthracoid or other enzootic disease not due to poison properly so-called.

It is in a case of this nature that the scientific practitioner finds the value of a knowledge of botany. When called in to put a stop to some unusual fatality in a flock or herd, after duly recording the history of the outbreak, the symptoms, post-mortem appearances, and

general treatment of the animals, he directs his investigations to the nature of the pasturage. Careful inspection of all parts of the field or fields is necessary, for the growth of some plants is confined sometimes to very small spots, and one individual plant may destroy a herd. The general and special nature of the flora must be examined, all known plants being duly noted, all unknown plants suspected and investigated. The hedges, trees, and substances around the field, which are accessible to the occupant, must be observed, and the general character of the ground, as nature of soil, elevation, irregularities; also the kinds of manure which have been used to it must not escape notice.

Poisons, however, gain entry into the system also *through the respiratory mucous membrane,* as in carbonic acid poisoning and overdose of chloroform, or *through the skin,* as where poisonous dressings have been applied for skin disease, especially when surface abrasions are present. Cases are sometimes seen in which agents are absorbed from wounds, as arsenic in cases of fistula; and the *subcutaneous areolar tissue* may be the seat of introduction of the poison, as in overdose of agents by the subcutaneous-injection method of administration. However they gain entry into the system these agents either give rise to great local disorder or undergo absorption, and thus produce their poisonous effect as medicinal agents act. They are in the latter case sooner or later removed by the excretory organs, which is a fact of great clinical value, for thus, by an examination of the fæces or the urine, a diagnosis may be confirmed or otherwise, and sometimes guilt be brought home to a culprit who would otherwise escape unless his victim died. Death is produced in the usual ways; by the action of poisons, either directly or indirectly, cessation of the heart's action is brought about. It must be remarked that in cases of proved or suspected poisoning the greatest care should be exercised in making a plain record of the facts, as, perhaps more frequently than any others, these prove the cause of litigation.

Treatment comprises certain general principles of great importance. The poisonous action may be arrested, if we be called in and make our diagnosis in good time, either by preventing the taking up of the poison or its irritant action on the tissues by intermingling it with mucilaginous matter. In the case of irritants this measure might be supplanted by dilution, but this only tends to promote absorption, and therefore is inadmissible in the case of those poisons which act from the blood. Administration of such bland and mucilaginous agents as white of egg, wheat flour, and meal, or even of blood, should be one of the first measures resorted to in cases of poisoning through the alimentary canal. It has this advantage, that the albuminous matters in some instances chemically unite with the poisons, and so convert them into insoluble and harmless albuminates. This is the simplest means of antidotal treatment. Antidotes are of two kinds, chemical or physiological. The former when they meet poisons exert chemical action upon them, giving rise to harmless products. The latter are available in the case of those agents which act from the blood; they produce the reverse physiological action, and thus tend to neutralise the excessive effects of the agent. These effects also must be counteracted as much as possible by such measures as the case, viewed purely from a clinical point of view, seems to require. Sometimes we are enabled by direct methods to remove the poison from the system, as by washing it off from the skin or by causing its expulsion from the alimentary canal with greater rapidity than is compatible with absorption. Thus, emetics, the stomach-pump, and cathartic agents are valuable in the hands of the toxicologist.

In observing the *post-mortem appearances* we must carefully examine the position of the animal, the state of rigor mortis, also the tendency to putrefactive changes in relation to the length of time which has existed since death. The conditions of the surface of the body, as indicating an easy death, or the reverse, should be noted, and the markings of the animal, for purposes of

identification. Examination of the various organs must then be made in the usual way, and specially the eye and nose must be exercised to detect any unusual lesion or noteworthy contents of the alimentary canal or any special odour, for some agents are at once detectable by their special odour which they impart to the blood (chloroform). The contents of the alimentary canal are of the greatest importance, for small particles of mineral poison may be found, or leaves of special plants, or some vehicle of a poisonous dose surreptitiously administered, such as food material not recently administered by the owner, generally of a tempting nature. Some of the contents of the stomach, intestines, and bladder, should be put aside in a closed and sealed vessel for chemical analysis, and it is advisable to similarly preserve portions of the walls of the stomach, and of the bowels and liver, as in these will often be found traces of the poison. Here the practitioner's duty comes to an end, unless he be willing to adopt the methods of testing suggested in works of toxicology. We may remark that the complexity of these processes generally renders the opinion of an expert desirable, if any importance is to be attached to the case. It is advisable to be careful as to the manner in which parts and liquids impregnated with the poison are disposed of, for pigs and dogs may involuntarily afford a verification of our surmises by the physiological test.

In special consideration of the various kinds of poisons we must observe certain characters general to the groups, and then those points of importance with regard to particular noxious agents. General stimulants pass into the blood and are rapidly removed; they never act as poisons after absorption, but the Special Stimulants are less readily eliminated, and, therefore, produce toxic effects varying with the agent. Thus, *strychnia*, under its various forms, nux vomica, strychnine, and Ignatius bean, stimulates the spinal cord and the nerves passing off from it, and thus increases sensibility to a slight degree (Headland), and causes tetanic spasm. It is seldom used for malicious poisoning, but may be given in overdose. It can be

detected in the contents of the stomach by Stas' test. The prolonged and exaggerated post-mortem rigor is also distinctive. The contents of the alimentary canal are generally poisonous. The body decomposes slowly. *Ergot of rye* and other ergots may be obtained from the pasture, as this fungus grows not only upon the rye, but on many other grasses. It is apt to prove the cause of epizootic abortion through its special action on the muscular fibres of the pregnant uterus. Professor Robertson attributes the nervous disorder, "louping ill" of sheep, to its action. It is seldom given in overdose, but then has a dangerous action on the brain, producing at times narcotism, at other times syncope. It is considered to have a special action also on the white muscular fibres of the small arteries, and hence has been used as a hæmostatic, but it has been known to cause gangrene of parts distant from the centre of circulation. The symptoms and a careful examination of the food must prove our guide in diagnosis of these cases. Cathartics, sedatives (local and general), and an immediate change of pasture, are indicated in an enzootic of abortion due to this poison.

NARCOTICS are distinguishable from sedatives by their preliminary stimulating effects, and by the fact that they cause perversion of the mental faculties. Thus, they cause inebriation and delirium, and bring about death by coma, whereas sedatives produce syncope.

Opium is essentially soporific. It is obtained by feeding on white poppies, overdose, and by malicious administration. The principal symptom is an uncontrollable tendency to sleep, the animal stands or lies with eyes closed, breathing slow and deep, pulse full and rather slow, opens the eyes sleepily when roused by any sound, and then rapidly dozes off again. There is a contraction of the pupil of the eye and a cessation of any pain from which the animal may have been suffering. These signs become exaggerated, the pulse imperceptible, breathing infrequent, and, finally, apnœa causes the death of the animal as a culmination of coma. After death the blood, contents of the alimentary canal, and tissues are found to

smell of opium, and meconic acid and morphia may be detected. The blood is dark, there are ecchymoses of serous membranes, and the contents of the alimentary canal are hard and dry. With regard to poisoning by the red poppy (*Papaver rhœas*), Weiss (as quoted by Gamgee) says :—" Grimm observed that cattle having eaten much of the red poppy had a weak, awkward gait, uttered a groan at every step, were affected with diarrhœa, and remained in a stupid sleepy condition. Schmager and Lichte witnessed trembling, foaming at the mouth, loss of consciousness and sensibility, rolling of the eyes, loud bellowing, restlessness, amounting even to raving, tympanitis, shivering and twitching movements of the eyes, fixed and widely dilated pupil, agitated pulse ; the secretion of milk is stopped. According to Gaullet, the secretion of milk was watery, without fat or caseous matter, and diminished in quantity, the pulse small and quick, skin dry, staring coat, grinding of teeth ; the animals flew as if rabid on the people that approached them, and bit themselves in the legs. There was constipation, the fæces dry and tinged with blood. As the symptoms of raving and roaring subsided, the animals became dull, stupid, and sleepy ; sometimes they lay down, at others they stood, but every now and then the signs of furor supervened. In one, case the cattle got loose, ran madly up the village, and struck their heads against the walls and posts. The mad stage lasted for about two hours ; the animals fell like dead, but awoke again after several hours. The food taken by these animals was examined by an apothecary, who found it to consist of about three fourths of the corn poppy, ripe and unripe seed capsules ; *Adonis autumnalis* (pheasant's eye) ; delphinium (larkspur), and the remaining fourth was clover."

Camphor, alcohol, and ether are also narcotic poisons.

Chloroform also may be detected by its odour. Its preliminary stimulating effect is more powerful than that of opium.

Tobacco is also a narcotic, but inebriant rather than soporific. It is not a frequent poison of cattle.

Hyoscyamus and *Belladonna* are obtained by accidental ingestion or overdose, but the fresh hyoscyamus herb is said to be eaten with impunity by Herbivora. The symptoms induced are dilatation of the pupil; falling to the ground, due to loss of power over the hind extremities; convulsions and delirium; relaxations of the various sphincter muscles, with diarrhœa; coma sets in, and then death.

Treatment comprises ruminotomy, with complete removal of contents; stimulants; bleeding and cold applications to the head. Poisoning by *Solanum dulcamara* is also on record. The conditions are similar to those just described.

SEDATIVE POISONS comprise hydrocyanic acid, aconite, conium, colchicum, and yew. They produce death by asthenia and syncope. In large doses they cause giddiness and convulsions, which supervene rapidly, and death takes place in a very short time. On post-mortem examination no very marked lesions can be noted; the vessels are full of dark blood, and there may be the peculiar smell of the agent. Testing for the active principle is not always satisfactory, but a careful examination of the contents of the rumen will generally show the presence of portions of the poisonous plant.

Hydrocyanic Acid.—Poisoning results from overdose. The patient, some little time after the administration, falls, breathes quickly, and is convulsed; the pupils are dilated. After death there may be observed a slight reddening of the lining membrane of the stomach, and the blood smells strongly of the poison.

Treatment: stimulants and iron salts. Detection in recent cases results from its characteristic odour and chemical reactions,

Aconite (*Aconitum napellus*), the monkshood or wolfsbane, is a plant grown in gardens, and wild in some parts of this country. It is easily recognisable by its peculiarly dark-green pedatipartite leaves and its blue irregular calyx. This agent produces numbness of the surface of the body, excites vomition and tympany; the pupil is contracted; over-dose causes hiccough; ammonia is the best antidote.

Conium (*Conium maculatum*), the hemlock, is a white-

flowered umbellifer, rather common, and readily detectable from similar plants by its spotted stem. It causes rapidly spreading paralysis of the voluntary muscles, then of those of respiration, leading to death by apnœa. The pulse is small, feeble, and slow, the pupil dilated; these cases must be treated by evacuation of the rumen and stimulants.

Colchicum autumnale, the meadow saffron, is a bulbous, lily-like plant, with purple flowers, frequent in this country. When consumed by cattle it causes violent catharsis, the fæces being nearly liquid and fetid, tympany and other signs of abdominal disorder, pupils dilated, perspiration, loss of power, coldness of extremities, syncope, and death. After death there are found blood extravasations in the alimentary canal and ecchymoses of serous membranes.

Treatment: careful nursing, emollients, also enemas; opium, to counteract the tendency to anæmia of the brain.

Yew (*Taxus baccata*).—When fodder is scarce cattle will feed on this plant. Dr. John's, in the 'Treasury of Botany,' says: "It appears, from all accounts, that the poison is more virulent in the young shoots than in any other part of the tree, but that it exists in greater or less quantities, both in the leaves and in the green bark. The leaves are more dangerous in a half-dry state than when fresh." Yew shoots are too often carelessly left about after cutting. They produce a powerful sedative effect. Sometimes the animal is found dead with yew in his mouth. When seen before death the patient is found to have a rapidly sinking pulse and the ordinary sedative signs. On post-mortem examination, blood extravasations in the alimentary canal may be noted, but sometimes they are entirely absent. The stomach is full, and generally contains the yew shoots. Little can be done in such cases, except the administration of stimulants and cathartics, and clearing out the stomach by means of the stomach-pump, or ruminotomy. Why cattle should be able to eat much green yew with impunity is uncertain.

Digitalis (*D. purpurea*), foxglove, a well-known British

plant, grows on banks exposed to the sun. When an excessive dose of this special cardiac sedative has been administered it causes irritation of the alimentary canal. The symptoms are those characteristic of a sedative poison, together with a peculiarly violent action of the heart, and subsequently diuresis. Signs of irritation of the alimentary canal are visible post mortem, and the heart is soft and ecchymosed. Agents containing tannin are suggested as antidotes.

Lead, when taken into the system, acts as a local and general sedative. This metal and its salts are highly important to us from a toxicological point of view. It may gain entry in the water, since several of the compounds of lead are soluble, from the lead diffused in a state of minute division over the pastures near smelting works or near rifle butts, or from refuse paint brought with manure and spread over fields. These lead salts are sweet, so that cattle readily consume them. In some cases of lead poisoning there is indigestion with colic, due to paralysis of the stomach in which food accumulates, and tympany sets in; this is accompanied by general signs of disease, depression, and a small pulse. Later, deposits of lead may be seen, of a greyish colour, in the gums. There is paralysis throughout the alimentary canal, paralysis of the hind limbs sets in, and the animal dies after a somewhat prolonged illness. On post-mortem examination the hardened condition of the intestinal and gastric contents may be noted, and the blackness or reddened state of the mucous membrane. The presence of lead may be shown in many of the tissues. Sulphuric acid and the sulphates of soda or magnesia and alum are the best chemical antidotes, forming the insoluble lead sulphate. Cathartics must be given to remove the poison. In other instances lead produces the symptoms of "stomach staggers," with a slow pulse, delirium, and death.

Laburnum, as described by Dobson, seems to act as a sedative poison, producing paralysis of the hind limbs, and an accumulation of food as a dense mass in the rumen. Besides the special characters of their contents there may

be noted inflammation of the small intestines. Purgatives sufficed to save some of the calves attacked (Dobson).

Irritant Poisons.—Stimulating agents, when taken internally, exert a local irritant action, and thus give rise to enteritis or gastro-enteritis, which do not in any essential respect differ from these diseases when they arise from other causes—sometimes the systemic action of the agent is apparent after its absorption. We have seen that some neurotics exert a local irritant action, but all of them cause death by their effects while acting from the blood.

Oxalic acid, lime, and ammonia, act as irritant poisons. Among vegetable substances which thus act are *Anemone pulsatilla*, *Mercurialis annua* (which causes hæmaturia), *Mercurialis perennis*, certain Ranunculi, Bryony, Rhododendron, and *Veratrum album*. *Helleborus niger* and *H. fœtidus* also act similarly; the root of the former is sometimes used for increasing the irritant action of setons. It is inserted as a peg into the subcutaneous areolar tissue, and when the fresh root is used may give rise to most acute inflammation. The most active general and local antiphlogistic measures are necessary to save the animal. Charlock (wild mustard) sometimes acts as a simple irritant when taken in with the food. Sometimes the various kinds of cake contain mustard-seeds, and act as irritants. The taste and odour is sufficient to enable us to determine whether or no this is the case with any particular specimen of cake.

Cicuta virosa (the water hemlock), *Æthusa cynapium* (the fool's parsley), and *Œnanthe crocata* (the water dropwort), are poisonous umbellifers, which exert a narcotico-irritant action.

Astringent Poisons are generally irritant in their effects. They cause symptoms such as we shall enumerate under the heading "Gastro-enteritis," Pantas or Moor-ill. Acorns, fern, and oak shoots are the principal of these agents.

Corrosive Poisons, by their chemical action, cause disorganisation of the parts with which they come in contact, and thus, in treating of them, we have to deal with their

irritant effects, and also with ill consequences resulting from sloughing of the corroded tissues, the principal being actual loss of useful substance, perforations, and strictures. Thus, corrosives are much more formidable than simple irritants. This obtains with the symptoms as well as with the effects. Enormous doses generally cause immediate collapse.

Corrosive Sublimate is the best representative of this class. It is administered maliciously or by mistake for calomel. It causes acute gastro-enteritis and death when given in doses of two drachms. It causes an exhausting cough in ruminants (Gamgee). Albuminous materials are the best antidotes. Copper, zinc, silver, and iron salts are corrosive poisons. When given in large enough doses concentrated alkaline solutions especially disorganise the epithelial layers of the membrane with which they come in contact. Mineral acids act as corrosives, nitric turns the parts with which it comes in contact yellow, sulphuric renders them black, and hydrochloric white. Dilute alkaline solutions and demulcents should be given in these cases.

ELIMINATIVE POISONS enter the blood and are removed thence by the excretory organs, which they over-irritate in the act of passage, and so inflame. Thus, the symptoms vary much with each agent, and we have more time for treatment. The poison, once it enters the blood, is singularly inaccessible.

Aloes, castor-oil beans, euphorbium, and gamboge act in this way on the intestines.

Arsenic is obtained by malicious administration, overdose, or accidental presence in cakes and other articles of food. It is eliminated by the stomachic and intestinal glands, of which it causes very extensive inflammation. The hydrated peroxide of iron is recommended as an antidote. The tests are numerous and very definite.

Antimony, besides its influence on numerous glands of the body, is a sedative.

Calomel affects especially the salivary glands and liver. It must be opposed by albumen and astringents.

Nitrate of Potash may be detected in the urine by the

fact that blotting-paper dipped into that fluid and dried becomes "touch paper."

A peculiar form of arsenical poisoning is known as the Copper-smoke Disease. It is supposed to be due to finely divided arsenic spread by the copper-smelter's furnace. "Young animals are most susceptible of this influence; and among the most marked effects are a disposition to ophthalmia, which in general quickly terminates in cataract, enlargement of the knee- and hock-joints, and periosteal exostosis of the bones of the extremities. The first indications of animals being thus affected are dulness and refusal of food. On examination the teeth will be found incrusted with a *bluish* concretion, the gums humid and red, and the saliva secreted in increased quantities, symptoms analogous to ptyalism" (Morton).

Post-mortem.—It is observed that the bones are friable, and have a peculiar reddish-brown colour. Such are the most frequent poisons of the ox.

Addendum 2.—Parasites and Parasitismus.

Among the special causes of the various diseases of the higher animals those which are themselves distinct organisms, whether of an animal or vegetable nature, demand special notice, whether it be on account of their clinical importance or of the peculiar features of their life-histories.

That one animal should live inside another was at first thought to be such a very strange matter that it was attributed to evil agencies generating such beings *de novo*, and it was then, and is sometimes even now, thought that the presence of parasitic organisms in the body constitutes disease. But so far from this being so, we now know that large groups of animals have their typical habitat within other beings, and some observers have even gone so far as to attribute to the gastric infusoria of herbivora (see Fig. 27), a decidedly beneficial effect in the elaboration of chyme. Far-fetched as this idea is, we can well believe, that under certain circumstances animals and

plants may be beneficial to the organisms in which they live. On the other hand, in parasites we often note that nature finds a means of removing a surplus animal population. Thus, in some years, sheep, cattle, and horses, fall victims to the "worms" in large numbers, as seen in the diseases rot, husk, &c. The obtaining of parasites also depends on the nature of the diet; vegetable food cannot prove the direct bearer of the majority of parasites, but many can be taken in with meat.

It must be distinctly understood that it is quite the exception for a few parasites to cause serious mischief, since they generally give rise to disorders only when they are present in large numbers. The manner in which these few act is either by producing functional nervous disease or destroying the walls of the organ in which they are situated. These actions are rarely, if ever, seen in the ox. Some parasites do not live upon the structures of the host, but simply inside or upon other animals not being dependent directly upon them for nutriment. Such are *fellow-boarders;* a barnacle on a whale is an example of this relationship. From this the interests of the two individuals tend more and more to clash. The fluke resides in the liver, and consumes the bile which would be useful to its host; other forms prey on mucus, some on the contents of the alimentary canal, and some, finally, are blood-suckers, and thus prove to the highest degree exhausting.

Though these parasites are intimately associated with the pathological conditions to which they give rise, and often dependent on them at certain phases of their life, the processes prove more or less troublesome to the host; and if the invaders have been numerous the conditions to which, by their combined efforts, they give rise may lead to severe disorder and even death. Thus, the ill effects of parasitic organisms are, in many cases, directly related to the number of them present.

Yet it must be remarked that except where essential to the well-being of the parasite, the disorder which it causes is not nearly so severe as that which would result

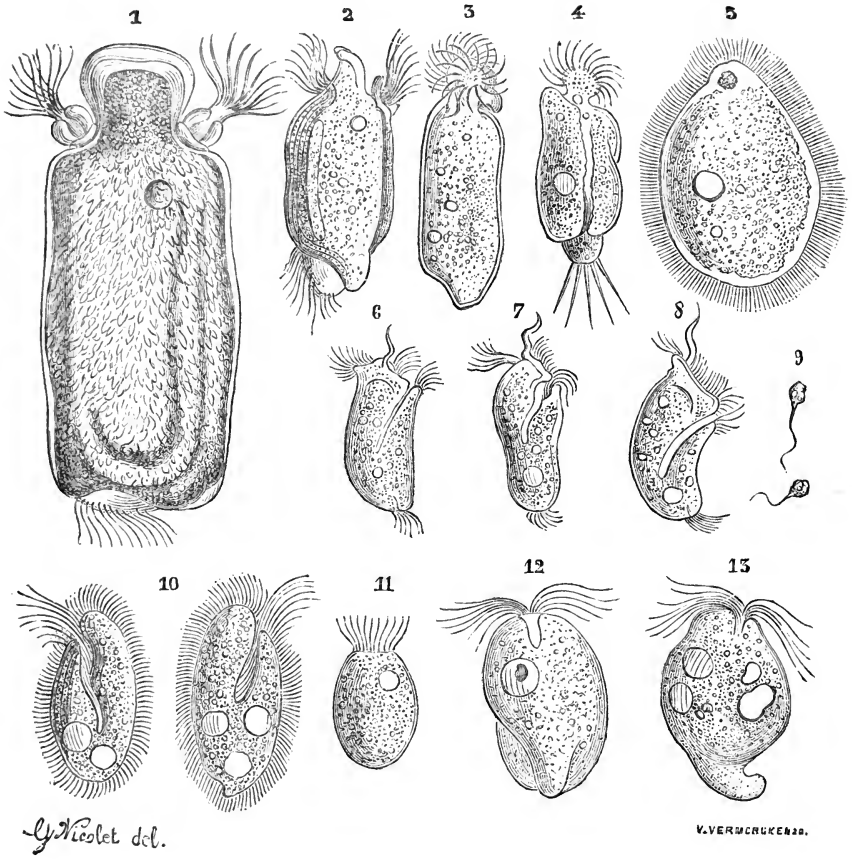


FIG. 27.—Infusoria from the alimentary canal of the horse, similar to those which have been found in the contents of the rumen of the ox. (From Colin, 'Physiologie des animaux domestiques.')

from a portion of dead material of similar size and form. The living state seems to produce an absence or imperfectiou of the tendency which is observable in the system of the ox to throw off anything which does not belong to it, as foreign matter. Since the ill effects of parasites are so often proportional to the number of worms present, we find that when the climatic conditions of any season have been especially favorable to their growth and development epizootic outbreaks of parasitic disorders are noted,

and this is most marked after a warm wet season with frequent floods; and those animals pastured on lowland soil are most liable to become affected. These parasitic living beings, endowed with a power of motion, and to a certain extent of selection of their special abodes, in their migrations through the system cause irritation, and this occurs as well with the movements of the larval as of the mature forms. The former sometimes bore through the tissues until they come to a desirable place to stay at, the latter generally limit their movements to those which suffice to enable them to traverse the canal or organ in which they are found. The irritation causes slow local changes, condensations, sometimes abscesses, and so on. And it often gives rise to a debilitated state of the constitution which kills animals, either being induced by some impediment to function, by drain on the constitution, or by excess of nervous irritation.

Thus it is that debility (and constitutional deficiency of energy, as seen in young or old animals) is a marked phenomenon in disease of a parasitic nature; it supplements that caused by the parasites, and the two together suffice for the production of death, which would not have resulted from either of them operating by itself. In this sense we must take the statement that debility is a cause of parasitismus, and not infer that a weak state of the patient will tend to the generation of parasites *de novo*. According as parasites live in or upon their *bearers* or *hosts*, as the affected animals are termed, they are classified as Entozoa and Ectozoa. Whereas the former are Anumloida, such as tapeworms, fluke-worms, and round worms, the latter are generally allied to spiders, being truly Annulose; insecta, or arachnida. There are, of course, exceptions to this rule; thus, the larval form of the insect œstrus, and the spider-like pentastoma, are found internally in the horse and dog respectively, but in the ox the œstrus is an external parasite, and the pentastoma in its larval form only is harboured by this animal.

The phases of development of the various parasites are of the highest interest and practical importance. Thus,

the Cystic, or larval tæniæ, are found in animals other than the bearer of the adult tapeworm, and some connection between the hosts of larval and adult forms must occur or the race will die out.

Under these circumstances it may seem astonishing that this event has not happened long ago, but we must recollect that each of the usually numerous segments of a tapeworm contains an enormous number of eggs; that these eggs can remain exposed to weather and to other such influences for a long time without injury; that the hydatids produced are sometimes many-headed, each head being capable of becoming a distinct individual; that, in other cases, the hydatids are capable of producing a number of secondary cysts within themselves.

To prevent excessive action of these favorable influences many of the ova are lost; the embryo does not always succeed in obtaining a bearer. Many of the bearers of hydatids are not sufficiently infested to die, and are not killed and eaten sufficiently soon for the parasite, which, therefore, undergoes calcification after dying. The hydatids are not always sufficiently fortunate to obtain a nidus for development into the adult. Thus, under ordinary circumstances, the chances of invasion by Tæniæ are about even. When intermediary bearers are prevalent, when conditions are favorable to development of the embryos, and under other special circumstances, a severe outbreak of parasitismus occurs. If we can break through the chain of development at any one link we shall arrest parasitic invasion, and the enemy, being thus cut off from reinforcements, will be defeated in its attempts to produce disease. Thus, in the case of Tæniæ, communication of dogs with cattle, and the former running over pastures is to be avoided as much as possible. All parasites passed, and all livers and lungs containing hydatids should be destroyed, and not given to dogs or used as manure. Thus, we may hope to succeed in eradicating tapeworm. Flukes have a free stage of existence when, as cercarians, they frequent the drinking-water, and thus gain entry into the alimentary passages of the higher ani-

mals. At one stage they inhabit the tissues of molluscous animals. Their ova are numerous, the developmental forms multiply by budding, and numbers simultaneously gain entry to the system. The contingencies of the lives of these parasites are less numerous than those of Tæniæ. Flukes, therefore, are often most prejudicial. The best means to counteract them are to endeavour to remove animals fitted to act as bearers from the grounds in which fluke larvæ abound, and to ensure a pure water supply. Another means is to check the passage of mollusca across pastures, either by a well-limed border against every portion of marshy land and every stagnant ditch, or by salting the pastures. Our evidences as to the action of antiparasitics is not very good. We know of some Tæniafuges and some Tæniacides, but flukes and certain round worms are very inaccessible, and we can only back up the system against their attacks by tonics. Parasitism degrades; animals not entirely dependent on their own resources lose many organs essential to independent life, therefore much difficulty has been found in placing parasites in their proper position in the animal kingdom. The Nematodes and Acanthocephala puzzle even HUXLEY. Thus, some of these comparatively high organisms respire simply by means of the general surface of the body, like the Amœba and other Protozoa. In some also, the general surface takes in nutritive matter. There is evidence to show that in the present day some forms are becoming parasitic which have hitherto been living in independence, and perhaps the reverse also holds. The phenomenon of *partial parasitism* is shown when an animal only lives as a parasite through one or more of its developmental phases, in the others being free and independent. This is a lazy method of life adopted by gad-flies and the like, which feed remarkably when in the larval stage, at the expense of their animal hosts, remain for a time in the chrysalis stage, and then spend a brief but exciting existence in the acts of reproduction and provision for the preservation of their own race, to the discomfort of that of far higher beings. We may now draw up a short classificatory notice in a tabular form of bovine parasites.

Parasites. (*After Cobbold.*) See work on 'Parasites,' published by Churchill, 1879.

ANIMAL—ENTOZOA, wholly parasitic

CESTODES *v.* TÆNIÆ (Tapeworms)

- ***T. expansa*** — Found in the intestines. Causes acute indigestion (see 'Veterinarian,' xvii, 487). Is very long, and has a reproductive papilla on each side of each segment.
- ***T. denticulata*** — Also found in intestines. Averages one foot in length, and has segments twenty times as broad as long.
- ***Cysticercus bovis*** (Fig. 29, 30.) — "Beef measle," inhabits the flesh. Has been seen frequently in India, and produced experimentally in this country by Dr. Cobbold and Prof. Simonds. Is the larval form of the Tænia mediocanelata of man.
- ***Cyst. tenuicollis*** (Fig. 28.) — Found directly underneath the peritoneum. Produces Tænia marginata of dog. Affects also sheep, deer, &c.
- ***Cœnurus cerebralis*** — Found pressing on brain and spinal cord, causing "sturdy" or "gid." Produces Tænia cœnurus in the dog. Affects especially the sheep.
- ***Echino. veterinorum*** (Fig. 26.) — Found in various organs, especially the liver and lungs. Gives rise to "Echinococcus disease." Larval form of T. echinococcus of dog (see p. 183).

TREMATODES (Flukes)

- ***Fasciola hepatica*** (Fig. 17.) — Found in the liver. Causes cachexia (fascioliasis). Is characterised by its sole-shape, and its ramified alimentary canal. Its cercarian larvæ probably occur in a common water-snail, Planorbis marginata (see p. 93).
- ***Distoma lanceolatum*** (Fig. 18.) — Is also found in the liver and gall-bladder, but is smaller and narrower proportionately, and has an unramified alimentary canal.
- ***Amphistoma conicum*** (Fig. 19.) — Found in rumen, the papillæ of which it somewhat resembles in size and appearance. Has one of its suckers at each end, the distinctive feature of the Amphistomes, of which A. crumeniferum and A. explanatum have been also found in the zebu, the former in the rumen, the latter in the liver and gall-bladder, A. tuberculatum in intestines of Indian cattle, and Bilharzia bovis (Sonsino) in Egyptian cattle.

NEMATODES (Round worms)

- ***Ascarides—*** *A. lumbricoides.*
- ***Strongylus*** —
  - ***Str. micrurus*** — Found in the trachea and lungs, and causes "parasitic bronchitis" (see text). Larval form resides in the earth-worm.
  - ***Str. ventricosus*** — Found in small intestines.
  - ***Str. inflatus*** — Found in large intestines.
  - ***Str. radiatus*** — Found in the gall-ducts.
  - ***Str. gigas?***
- ***Trichocephalus affinis*** — Found in intestines.
- ***Filaria*** — ***F. lachrymalis***, ***F. papillosa*** — Found in the eye (for effects, see text).

PROTOZOA

- **GREGARINÆ** — "Cattle-plague bodies." Harmless. Found in the interfibrillar spaces of muscles. Consult a paper by Dr. Cobbold, 'Lancet,' Jan., 1860. Also "Parasites" (see p. 153).
- **INFUSORIANS** (Fig. 27.)—Seen in stomachs and intestines. Harmless. Microscopic (see p. 200).

TRACHEARIA

- **PENTASTOMA** (Fig. 31.) — ***Denticulatum*** — Found free or encysted in the viscera. Obtains access to the facial sinuses of carnivora, where it develops into Pent. tænioides, the adult form.

- ECTOZOA,
  - wholly parasitic
    - ARACHNIDA
      - Acaridæ
        - Symbiotes bovis.
        - Dermatodectes bovis.
        - Psoroptes longirostris, var. bovis.
    - Hæmatopinus vituli, H. eurysternus, and Trichodectes scalaris ("Lice").
    - Ixodes—bovis (Tick).
  - partially parasitic
    - INSECTA
      - "Maggots." Larvæ of Dipteræ.
      - "Bot." Hypoderma bovis; H. lineata; Dermatobia noxialis; Cephenomyia bovis (Cobbold), larva found attached to root of tongue.
    - Also Musca bovina, Tabanus bovinus, T. autumnalis, Chrysops, Asilus, Stomoxys, and Rhagio columbaschensis (This latter fly proves fearfully destructive to cattle in Hungary and Servia (Cobbold).
- VEGETABLE PARASITES
  - Achorion Schönleinii. Causes "honeycomb ringworm."
  - Trichophyton tonsurans. Causes "common ringworm"

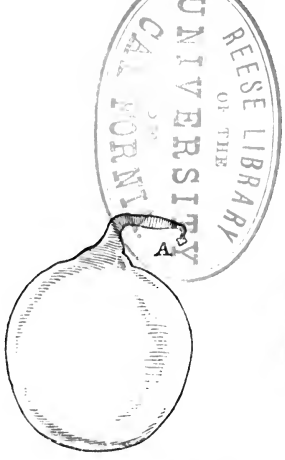


FIG. 28.—*Cysticercus tenuicollis.* The slender-necked hydatid. A. The whole animal. B. Head, showing circlet of hooks, also suckers. (Cobbold.)

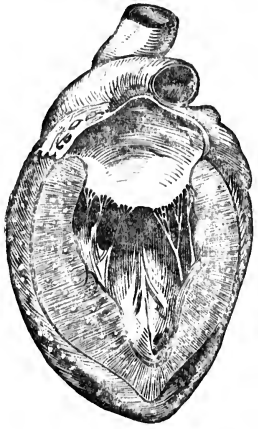


FIG. 29.—Beef measles in heart of a calf. (Cobbold.)

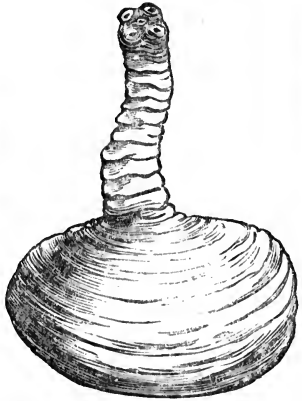


FIG. 30.—A beef measle removed from its cyst. Larval form of *Tænia medicocanelata.* (Cobbold.)

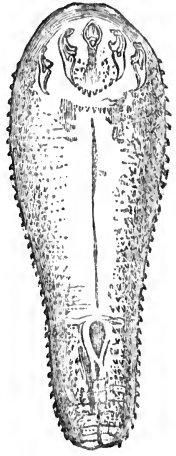


FIG. 31.—Pentastoma. (Cobbold.)

Vegetable Parasitic Organisms are either fungi or closely allied to them, consequently they are not, as are our ordinary plants, dependent on the surrounding air for much nutriment, but they are adapted for the appropriation of all their nutritive material from the soil in which they are growing. When this is rich they grow with the greatest rapidity and luxuriance, thus the ringworm plant attains a high development on the ox. They consist of tubes and spores produced by them. The former appropriate the nutritive material, the latter become free, and, being very minute, can be conveyed by contagion, immediate or mediate, or wafted through the air. They are also endowed with high resisting power. The larger and more conspicuous of these fungi grow on the surface of the body of the host, causing disorders due to irritation, varying in intensity with the activity of growth of the cause. Those more minute and infinitely more important fungi, which develop internally, acting as Entophyta, are known under the name Bacteria. We have already dealt with them at length in our description of "Blood diseases." We are aware of some agents which eradicate those organisms which flourish on the surface; such have been suggested for the treatment of ringworm. Anti-bacterian agents are by no means so well known. Our main efforts in the management of vegetable, as of animal parasites, must be directed to prevention of contagion and development, and to rendering the system an unsuitable soil, or sufficiently strong to resist their attack and throw them off.

It will be remarked how gradual the transition is from parasitic disorders to those specific blood affections which have not been proved to be parasitic. Rheumatism and some other diseases serve to connect these latter with ordinary diseases, which, in themselves, are simply modifications of physiological conditions. Physiological action of parts depends upon the vitality of cells, and these are in their most generalised forms exactly similar to low non-parasitic organisms, which in their turn do not differ essentially from parasites. Thus, pathology, physiology, and biology form a grand cycle.

CHAPTER III.—DISEASES OF THE CIRCULATORY SYSTEM.

Section 1.—Of the Heart.

It will be remembered that the heart of the ox is small as compared with that of the horse, and averages about $3\frac{1}{2}$ to $4\frac{1}{2}$ lbs. in weight. It is estimated by Colin at $\frac{1}{174}$ to $\frac{1}{265}$ parts of the weight of the body, that of the

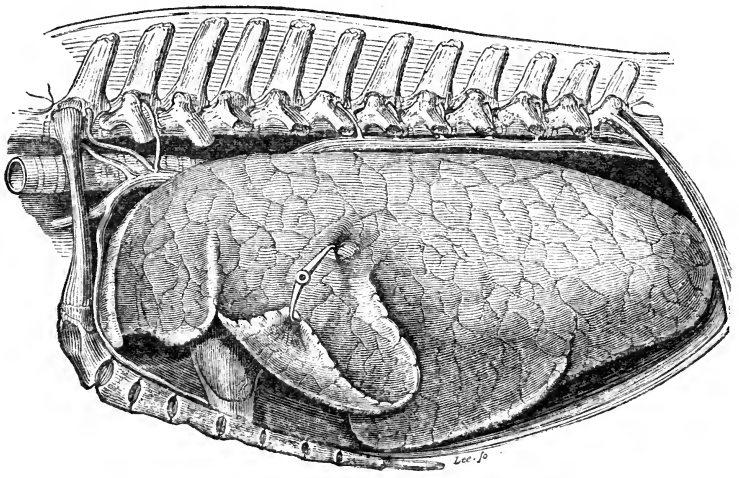


Fig. 32.—Thoracic contents, as seen from the left side. (Simonds.)

horse being $\frac{1}{103}$ to $\frac{1}{171}$. The apex is very pointed, and there are three ventricular furrows. There is a very stout muscular moderator band in the right ventricle, below which is a large tendinous band. In consequence of the comparative shortness of the chest in the ox, the pericardium extends nearly to the antero-inferior part of the

diaphragm. The heart, therefore, at its base corresponds to the second and sixth ribs and those which intervene

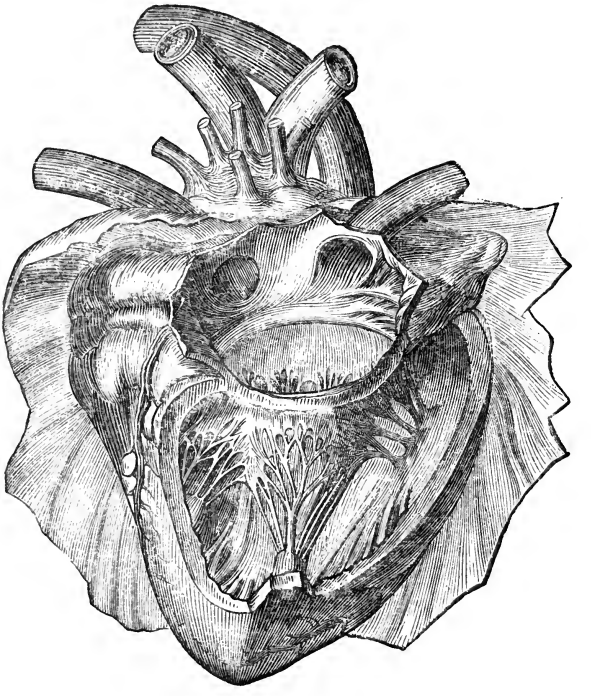


FIG. 33.—The heart, with its right cavities opened, part of the pericardium in position, and the large vessels at its base. (Simonds.)

between them. The thorax of the ox being wide and the pulmonary mass large, the heart is more separated from the thoracic walls, and less exposed than in the horse. Its beat may be best felt at the fifth intercostal space at about the level of the point of the elbow, at the meeting of the ribs with the sterno-costal cartilage, but it is not so clear and distinct as is that of the horse. For satisfactory auscultation of this organ the left fore limb requires to be drawn forwards and the ear applied as closely as possible behind the muscular mass of the shoulder. The heart of the ox very frequently has a large amount of fat deposited in its furrows. Such

deposits have been erroneously described as fatty degeneration. They are generally seen, to a more or less marked degree, in prize beasts, and must be considered normal, for in no case has it been proved that they interfere with the heart's action.

Os cordis is the name applied to a bony nodule, generally somewhat triangular in form and flattened on each side, which constitutes a basis for attachment of the muscular fibres of the heart, and is situated at the base of the ventricles in connection with the aortic opening. It is an ossification of the fibrous ring of the heart, such as is seen in the horse in exceptional cases. Sometimes this bone consists of two parts, and frequently it involves the whole aortic ring.

Diseases of the Heart are primarily divided into functional and organic. In the former we have not yet been able to trace the lesions upon which the disorder depends. Such probably exist in the complex cardiac nervous mechanism. Dr. Pettigrew has especially investigated this mechanism in the ox (see his 'Physiology of the Circulation in Plants, in the Lower Animals, and in Man'). When we consider that the pneumogastric nerve, pulmonary plexus, and the medulla oblongata, certainly are sources of nervous supply to the heart, we shall be inclined to attribute "*functional*" *disease* of the heart to our present want of knowledge of structural changes in the case rather than to absence of disorder of so complex a mechanism.

Palpitation is the form which this nervous disorder generally assumes, but it is rare in the ox, this animal not as a rule being subjected to extremes of exertion, nor to high strains upon the nervous system. Dyspepsia causes this disorder probably by reflex inhibition through the vagus, while in blood poisoning the impurities in the blood probably do so by acting directly upon the cardiac ganglia and the muscular fibres of the heart; perhaps, too, there is perverted stimulation of the inner surface of the heart, as in anæmic palpitation, when venous murmurs are marked and the impoverished blood tends to clot around the

prominences and cords inside the cavities. The principal symptoms are powerful and jerky action of the heart, frequent and small pulse, anxiety, and loss of appetite.

Organic Diseases :—Inflammation of the Heart—Carditis—Myocarditis.—Is not of frequent occurrence, and it is doubtful whether it is ever present as a distinct disease, being generally a complication of pericarditis. Traumatic carditis has been recorded, and sometimes it is found that penetration of the heart by a foreign body leads to instant death. Circumscribed inflammations occasionally affect this organ, leading to the formation of small abscesses in its walls. The principal symptoms are extreme quickness of the pulse, considerable elevation of internal temperature, increased respirations, coldness of the extremities, and rapid death. An instance of this disease is mentioned by Armatage. If a case of this nature is diagnosed it may be treated in the same way as pericarditis in the early stage. Formation of abscesses in the walls of the heart may result from certain forms of blood poisoning.

Hypertrophy of the Heart may be *simple* when the walls are thickened, but the cavities normal in size; *excentric* when the heart and its cavities are proportionately dilated; *concentric* when the walls of the organ are thickened at the expense of the cavities, which are, therefore, small. Simple hypertrophy may be seen in some working oxen, and is not to be considered disease when it clearly is an attempt of nature to perform the duties necessitated by the special labour of the animal. It must be remembered, however, that there should be a due uniformity between this increase and that of other parts of the body. The other forms ensue generally from impediment to escape of blood from the heart, either as a result of disease affecting the arterial valves, or of pressure upon or disease of the large arteries, while hypertrophy of the right side may accompany chronic lung disease. Excessive force of the heart's contraction, with sometimes a laboured effort and irregularities of the pulse, indicate these conditions, which, however, are very rare. The

animal must be kept as quiet as possible, and fed for the butcher.

Atrophy of the Heart, usually termed *fatty degeneration*, must be carefully distinguished from the above-mentioned deposition of fat normally in the furrows. Here the muscular fibres waste, and their protoplasm is transformed into fat. It is a disease of old age, and as such is seldom, if ever, seen in the ox. To the naked eye the organ is pale, with yellowish patches; it feels soft and flabby, and breaks with a granular fracture; often the visceral pericardium is depressed, here and there, through diminution in size of the structure internal to it. Carditis, pericarditis, or senile degeneration of protoplasm, are causes of this condition, which predisposes to rupture of the heart.

A case of *Cretaceous Degeneration* is recorded in the 'Veterinarian,' vol. xxxv, p. 800 (1862). The pericardium and brain were also affected in this instance. Yellow calcareous spots were diffused through the heart-substance.

Under the heading "Atrophy" must be included those cases in which the walls of the heart are thin, while the cavities are dilated. This condition known as *pouched heart* is frequent in the ox as in many other animals. A paper on this subject is given in the 'Veterinarian,' vol. xxv, pp. 50 and 105 (1852).[1] On examination of the organ after death the flabby clay-coloured condition of its walls, which retain the impression of the finger, is evident.

Endocarditis, like inflammation of other serous membranes, leads to thickening and roughness of the surface; these conditions are unfavorable to the passage of the blood, which deposits coagula on the diseased parts. The roughness of the membrane is due to cell proliferation of its substance, whereby granulations are produced, which

[1] The author mentions this as a dangerous and incurable disease, incidental to cows and oxen in fattening; present in seven out of every ten animals unduly fattened; generally affecting the right side of the heart, commencing at the conus arteriosus; associated with congestion of the lungs; sometimes due to over-driving.

sometimes undergo calcareous and fatty degeneration. The arterial valves, but much more frequently the auriculo-ventricular, are the most important seat of deposit. Sometimes ulceration of the valves occurs, and they are perforated. These changes almost always result from rheumatic disorder. Sometimes post mortem no depositions are found, simply reddening of the lining membrane of the heart, and sometimes ecchymosis.

Symptoms.—With the general symptoms of disorder and acute febrile disturbance are associated the peculiar rushing sound known as the "bellows murmur," which varies according to the parts affected. "A bellows murmur with the first sound indicates mitral insufficiency, stricture of the aortic orifice, disease of the aortic valves, or deposits on the ventricular surface of the mitral valves; or it may depend upon an altered condition of the blood itself, as in anæmia, in which case it resembles a churning sound, heard also in the large arteries and veins. A bellows murmur with the second sound indicates aortic insufficiency, roughened auricular surface of the mitral valves, or mitral obstruction" (Williams). The pulse is intermittent and irregular, "a rapid but violent tremor," and does not correspond to the cardiac impulse. The venous pulse is present. Sometimes endocardial growths develop gradually, and do not materially affect the patient, until sudden death occurs, and the slaughter-house furnishes us with specimens from animals to all appearance in a good state of general health.

Treatment.—In a chronic case the animal should be fattened for the butcher, but in an acute inflammatory attack such measures may be adopted as are suggested for pericarditis. External stimulation, say some authorities, should never amount to vesication, for the inflammation thus excited would tend to increase the already excessive amount of fibrin in the blood; but it must be remembered that inflammatory blood coagulates more slowly than healthy. Salines, especially such as are useful in rheumatism, should be administered. Aconite may be used to counteract the excessive sympathetic fever.

Sequelæ.—Portions of the valvular clots separating from their attachments may pass into the general blood stream, and, becoming fixed in the smaller vessels, give rise to embolic disease. Pneumonia may thus result.

Prognosis of this serious disorder can seldom prove favorable. In acute cases death may occur at any moment. In chronic cases recovery cannot be expected. Often, however, where the inflammation is circumscribed, endocardial growths and fibrinous deposits result in large "cardiac polypi," which seem sometimes to completely block up the cavity.

PERICARDITIS.—INFLAMMATION OF THE PERICARDIUM seldom exists as a disease *per se*, being a complication of rheumatism and other blood diseases, or the result of penetration of the membrane by a foreign body which has been swallowed, and found its way from the reticulum. Again, in pleuritis and pleuro-pneumonia, this membrane seldom escapes invasion by the disease. The *traumatic form* is rather frequent. The foreign body which gives rise to it is generally a knitting-needle, hair-pin, or nail, which has accidentally gained entry into the stomach with the food, or been ingested by the animal under the influence of depraved appetite. Why such bodies pass into the reticulum in particular it is difficult to say, but in almost every case the foreign body has started from this viscus. Probably it is only those which start from here which give rise to appreciable mischief, or these foreign bodies may be brought by the rumen to the œsophageal groove for regurgitation, and on being rejected they fall into the reticulum. Pressure of the diaphragm leads the sharp body to puncture its structure after penetrating the wall of the stomach, and thus to enter the pericardial sac (we have a case on record in which it penetrated the pleura, and escaped by abscess in an intercostal space), which is just anteriorly placed to the reticulum, separated from it only by the diaphragm. Perhaps the contractions of the heart exert a suction influence. This organ becomes penetrated, and thus the body enters generally, it seems, the left auricle. Gamgee mentions an interesting case by

M. Camoin, in which a large thorn thus entered the heart, and became fixed by the chordæ tendinæ.

Symptoms.—Sometimes after ingestion of the body, the animal remains apparently in full health. Then signs of indigestion may be present as indications of abdominal pain, tympany, and loss of appetite. Later, and especially, as Williams has shown, after efforts in parturition, the animal manifests signs of general disorder and acute febrile disturbance. Also the pulse is found to be small, frequent, irregular, and intermittent, with a quick and irritable beat. Respirations short, sometimes slow, in other cases frequent, abdominal, and with a double expiratory effort; cough may be present.

The internal temperature is low, and the blood being imperfectly diffused through the system, the muzzle is dry and cold, the limbs are cold, the mucous membranes are pale, and rigors as well as superficial muscular twitchings (clonic spasms about the neck and pectoral region) may be observed; there is general stiffness and œdematous swellings occur in various parts of the body, as under the belly and in the dewlap. The action of the heart is irregular, sometimes sharp, at others extremely quick and scarcely perceptible. The larger veins are distended with blood and the venous pulse is generally present. The patient usually suffers a considerable amount of pain, and sometimes lies preferably on the right side, grinding the teeth, moaning, and looking back anxiously every now and then towards the seat of the heart; pressure over the cardiac region causes a groan. Tympany is sometimes present, and there are gaseous eructations. Auscultation detects a friction sound, which differs from that of pleurisy in coinciding with the heart's movements; also a rushing or gurgling sound, which M. Boizy, as quoted by Gamgee, attributes to the consistency of the fluid and gaseous admixture. Williams, however, insists that cases of traumatic pericarditis occur without gaseous eructations, splashings, and gurglings. Percussion gives dulness of sound over the inflamed membrane.

Port-mortem examination.—Stomach and intestines con

tain gas. Reticulum, containing sometimes clotted blood or food intermingled with blood, presents a fistula extending to the pericardial sac; sometimes several are present. The walls of the passage are formed of lymph, which firmly binds the rumen, diaphragm, and pericardium together. Generally the passage is blocked up with lymph. Fluid may be present in the subcutaneous areolar tissue and in the abdominal and thoracic cavities, attributable in the two former to the impediment to the circulation, in the latter case also to congestion or inflammation of the pleura, such as is generally present. The mediastinal layer of the pericardium is involved in this inflammation. The fibrous layer is thickened by interfibrillar deposit, and the two layers of the serous pericardium are the seat of thick deposits of organised lymph, which is firmer as it is more distant from the serous cavity. Hence it projects into the latter as a flocculent layer, and in some places the parietal and visceral layers are bound together either over an extent of surface or by bands of lymph. An amount of serous fluid, rendered milky by admixture of lymph, or sanguineous, occupies the sac. Sometimes the lymphy deposits have undergone cretaceous degeneration and fatty change. Often a lesion of the heart can be detected, and generally the foreign body is found in the passage somewhere between the reticulum and the heart-cavity; it being more or less altered by its strange journey. The muscular structure of the heart is the seat of interfibrillar lymphy deposit, and sometimes the fibrous bands of the cavities are lacerated.

Prophylaxis consists in the rigid exclusion of needles, large pins, &c., from the dresses of dairymaids and other female attendants on cows, also careful examination of the food of the horned beasts.

Curative measures are deemed useless in such cases, and on diagnosis, immediate slaughter is to be suggested. A French practitioner was recently successful in curing a case by operation.

In 'Veterinarian,' vol. vi, p. 128, is recorded a case in

which the needle seems to have passed back from the pericardium and re-entered the rumen, in the walls of which it became fixed.

Prognosis unfavorable. The animal lives under the acute attack several days.

The *idiopathic form of Pericarditis* depends upon exposure, change from a hot to a cold atmosphere, and other influences of a like nature which determine visceral inflammation. Mr. Litt describes a case due to a wound through the thoracic walls.[1] This disease assumes an acute character, and is very painful. Its symptoms in the main resemble those of the traumatic form, but differ in the less marked audibility of the diagnostic sounds, and in the absence of signs of indigestion and the gaseous eructations. But, as we have seen, these differences are not always reliable ('Veterinary Record,' vol. i, p. 119). In one case the patient had every appearance of a horse suffering from laminitis; also the pulse was full and bounding, 100, with irregular intervals of vibrating jerks; the heart's action conveyed a singular tinkling noise. In early stages of this disorder the pericardium is congested, and later it is rendered opaque and then obscured by false membranes. It may become gangrenous, serous effusion and lymph exudation into the serous sac may take place, as in the traumatic form. A heart covered by flocculent false membranes is a very pretty specimen. Sometimes a heart which has been affected with this disorder is found here and there covered with opaque spots of thickened pericardium. This has been attributed to rheumatism.

Treatment. — Comprises careful nursing, stimulant applications to the sides of the chest, aconite to control the action of the heart and to lessen the amount of fever present. Digitalis, too, proves very useful through its sedative influence and its tendency to promote absorption. In the advanced stages of the disease stimulants are required, and tonic agents promote resolution. The iodide of iron seems to be especially indicated if all febrile

[1] See 'Veterinary Record,' 1845.

disorder has subsided. After-treatment must be directed to fattening the animal as the deposits around the heart constantly tend to impede its action.

Complications have been already indicated, the most frequent are carditis and pleuro-pneumonia sporadica.

Hydrops Pericardii—Dropsy of the Pericardial Sac—is generally that stage of pericarditis in which effusion has taken place. The accumulation of liquor pericardii may occur in connection with other dropsical disorders, especially hydrothorax. And in cases of anæmia the normal amount is increased, but in such instances the accumulation does not interfere with the action of the heart or with respiration. "Tapping" the pericardial sac has been tried in this disease of the horse. The symptoms and treatment are those of the advanced stage of pericarditis.

Rupture of the Pericardium.—A case of this nature is recorded in the 'Veterinarian,' vol. viii, p. 319; complicated thoracic and abdominal disorder existed, and on post-mortem examination, the pericardium was found ruptured on the right side, forming a foramen of about $1\frac{1}{6}$th inch in diameter, and it appeared as if the edges of the opening on one side had receded from the surrounding parts. Adhesive inflammation had formed a complete duplicature of the pericardium, which "presented the appearance of tanned leather."

Cardiac Polypi, *or Hæmatomata,* are tumours inside the heart, generally resulting from endocarditis, with granulation or subendocardiac blood extravasations and deposition of coagula upon the roughened surface. They generally grow on the valves, but may appear on any part of the lining membrane of the heart. Frequently they assume the shape of casts of the cavity in which they are placed. They seem often to cause no appreciable symptoms, not being suspected before the animal's slaughter. A tumour of this kind may extend from the wall of the auricle through the auriculo-ventricular opening into the cavity of the ventricle, impeding the action of the valves. These masses of fibrin are often attached by

a peduncle of fibrous or fibro-cellular tissue. Sometimes the tumour is gritty in parts. These polypi may cause sudden death, in other cases the action of the heart is irregular and intermittent, and there is gradually increasing debility leading to paraplegia before the animal dies.[1]

Gamgee alludes to melanosis and cancerous infiltration of the heart in domesticated animals, and mentions a specimen which he saw in the Bologna Museum, consisting of a large mass of echinococcus cysts hanging from the apex of the heart. *Cysticercus tenuicollis* has been met with in the pericardial cavity. *Cysticercus bovis* and *Trichina* invade this as well as other muscles. The same author makes the following valuable remarks on this subject. "The temperament, habits, and manner of keeping cows tied up in a stall, lead to the observation of cases in these animals which would give rise to symptoms at a comparatively early period in the hard-worked horse. With regard to external tumours, their weight is sometimes very great, and, when connected with the apex, they may attain a size far exceeding that of the heart itself, without inducing very serious symptoms. This is not the case when the deposits invade the base of the heart, where they obstruct the vessels and arrest the circulation."

Professor Walley's valuable paper on "Hæmatomata and Thrombi, or ante-mortem Clots," in the 'Veterinary Journal' for July, 1877, may be consulted with benefit in this relation. He attributes the ante-mortem clots, among other things, to elevation or injury of the endocardium by foreign bodies penetrating from the stomach, or by the lodgment of entozoa beneath it.

Rupture of the Heart sometimes causes sudden death. Atrophy of the organ and pulmonary disease predispose to this, and it is most liable to occur in working oxen, as it results from violent efforts or from blows. It is, however, very rare in the cattle. The right auricle most readily gives way.

[1] See case recorded by Messrs. Houlden and Varnell ('Veterinarian,' vol. xxxix, p. 975). Emboli were found in the heart, spleen, and kidneys.

Malformations.—In the second volume of the 'Abstract of Proceedings of the Veterinary Medical Association' (p. 355), will be found an account of a heart consisting of three cavities only. Other imperfections of development have been recorded. The most frequent is Cyanosis, which consists in a pervious condition of foramen ovale, whereby the venous and arterial currents of the blood are constantly intermingled. Thus, every part of the body is supplied only with partially purified blood. The animal is practically in the condition of a reptile as far as blood supply goes. Its functions are performed slowly, its constitution is weak, its internal temperature low, and its visible mucous membranes are constantly of a purple or blue colour. Such animals generally die young. This condition is seldom seen in the lower animals.

Misplacements of the Heart—Ectopiæ Cordis.—The heart may be situated in front of the chest, in the neck,

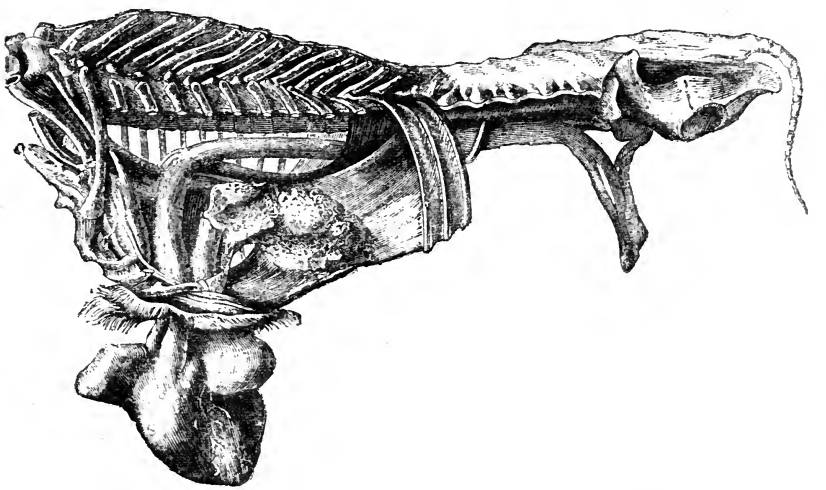


Fig. 34.—Ectopia cordis. (From Fleming's 'Veterinary Obstetrics.')

or be pressed backwards through an opening in the imperfectly developed diaphragm into the abdomen, or, as is more frequent, may be situated below the chest suspended by the large blood-vessels of its base below the sternum, the lateral elements of which have not united along the

central line. Animals with the heart exposed in any of these abnormal positions soon die from injury to the organ.

Section 2.—Of the Arterial System.

In injected specimens we are struck with the smallness of the arteries of the ox as compared with those of the horse. They are, in fact, proportional rather to the size of the heart than to that of the veins or the general bulk of the body. The posterior aorta is an exception to this, for the cœliac axis is remarkably large. The principal diseases of arteries are DEGENERATIONS of various kinds, which generally occur in old animals. These are *atheromatous,* where chronic inflammation has brought about fatty degeneration of the endothelial cells of the inner coat with thickening and cholesterin deposit in its deepest layer. This condition results from over energetic action of the heart long continued. We have no record of acute arteritis. A case of tuberculous degeneration of the ovarian arteries is given in the 'Edinburgh Veterinary Review,' vol. i, p. 379.

ANEURISM is abnormal saccular dilatation of an artery whereby is produced a pulsating tumour. A "false aneurism" is a sac formed by condensed areolar tissue with a free communication with the channel of an artery. True aneurism generally constitutes one of the elements in a case of atheroma, for the walls of the vessel, weakened by degeneration, gradually yield to the blood pressure. Cases of this condition have been recorded as affecting the ox, but the absence of the usual causes, severe labour, powerful action of the heart, and old age, prove material preventives. "Spurious varicose aneurism" of the remnant of the spermatic cord sometimes affects oxen, as denoted by swelling of the scrotum, pulsation of the part, and a peculiar *bruit.* Cases of this nature require removal of the end of the cord with the clamps (See 'Edinburgh Veterinary Review,' vol. i, p. 387). In the same volume is mentioned a case of aneurism of the vertebral

artery. In 'Veterinarian,' vol. xii, p. 125, is recorded a case of false aneurism outside the elbow, which appeared suddenly.

THROMBUS.—Partial or complete plugging of a blood-vessel with fibrin somewhat resembles aneurism in its effects, for in each case successive layers of clot line the wall of the vessel, the outer being the oldest and having undergone most extensive organisation. The cause of this clotting of the blood in the vessels of living animals is generally some degenerative change of the inner coat of the artery rendering it rough. The pathological condition resembles that which we noticed in endocarditis. The tendency of plugging of an artery is to cut off more or less the supply of blood to the part to which the branches are distributed. Generally anastomoses of vessels atones indirectly and gradually for this. Plugging of a vein is still less important. Sometimes a portion of fibrin broken off from the thrombus is carried in the round of the circulation and becomes forced into a vessel through which it cannot pass. It becomes fixed, therefore, and proves more or less detrimental according to the part affected. It is termed an *embolism*. The capillaries of the lungs, spleen, and kidneys are small and so sometimes become involved in this manner. Emboli and thrombi are formed in some blood diseases, especially in the lungs in pleuro-pneumonia epizootica.

WOUNDS OF ARTERIES present no special features in the ox. They are comparatively unimportant since the arteries are small and are denoted by a jerky flow of bright blood. Transverse cuts when the vessel is not completely severed and oblique wounds are the most persistent in bleeding. Such are best treated by completing the incision. The ligaturing of arteries is an important part of all surgical operations with the knife (see Figs 35 and 36).

IRREGULARITIES OF ARTERIES occur in the ox as in all other animals, and are due to imperfection of development, or to recurrence to previous type, or to higher specialisation. They are seldom so important as to interfere with surgical operations.

Section 3.—Of the Capillary System.

Capillary Hæmorrhage, due to rupture of minute vessels, occurs in acute congestion, and sometimes in in-

Fig. 35.—The Artery Ligature Knot.

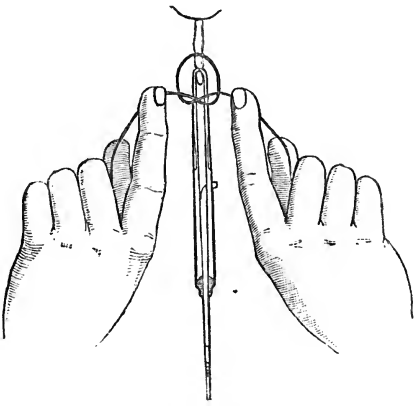


Fig. 36.—Showing the proper method of tying an artery. The Artery Forceps in use. (From 'Erichsen's Surgery.')

flammation. It is a very frequent condition in blood diseases, when it is due to a depraved state of the blood, which exudes through the unbroken walls of the vessels, giving rise to hæmorrhagic discharges, petechiæ, and ecchymoses. It is seldom so important as to necessitate those measures suggested for internal hæmorrhage.

Section 4.—Of the Venous System.

This set of blood-vessels in the ox is remarkable for large calibre, and, therefore, for very considerable total capacity.

Phlebitis.—Inflammation of a vein sometimes takes place as a result of injury (as bleeding with dirty and rough instruments), or from extension of inflammation of neighbouring parts. It most frequently affects the external jugular vein, which differs from that of the horse in being larger, and in having an accessory vessel—the internal jugular, which runs with the carotid artery. This

latter anatomical point shows why obliteration of the vessel, which may result from phlebitis, is less likely to interfere with the grazing capabilities of an ox than of a horse. The changes which take place in the inflamed vessel are, roughening of the coats with exudation from them, stagnation of the blood, coagulation, and organisation of the clot; abscesses also form along the course of the vessel.

Treatment consists in general and local antiphlogistic measures, and subsequently blisters along the course of the affected vessel. Embolic pneumonia may result from this (see 'Veterinarian,' vol. xii, p. 717).

Thrombus of veins has been observed. Sucking of air into the heart through the jugular, and the occurrence of concretions, have not been recorded in bovine practice in this country.

Rupture of Veins, as a result of lacerated and incised wounds, is not unfrequent, and sometimes this lesion follows injury of other kinds. Thus, Gamgee observed, in Italy, cases of rupture of vena azygos to be very frequent in animals destroyed by "pithing" between the atlas and axis. On this point Professor Maffei told him that he noted the ruptures in 57 out of over 3000 oxen and cows killed in the way indicated. The ruptures took place at various parts of the vessel, and the extravasated blood trickled between the laminæ of the mediastinum or beneath the parietal pleura ('Domestic Animals,' p. 360, second division). Wounds of veins, denoted by free and even flow of dark blood, are not serious, since it is impure blood which is lost; the escape is less rapid, and its "welling character facilitates coagulation, whereby nature temporarily repairs the lesion."

A remarkable case of rupture of the jugular has been recorded by Mr. Hill, of Wolverhampton ('Veterinary Journal,' 1880, vol. i, p. 291).

Varicosity is undue distension of a vein, giving it a saccular character. It depends upon any debilitating influence temporarily affecting the wall of a vein. It is most frequent in those which pass from important organs. Thus, it affects the veins of the udder of the

cow, and has been seen in the spermatic veins of the bull constituting *varicocele*. It seldom is seen except in old animals, and appears gradually. Sometimes the dilatation is the seat of active inflammation; then antiphlogistic treatment is required. Less urgent cases are preferably left alone, but a bandage or plaster may be required to protect the enlarged vessel and to support its walls by gentle pressure.[1]

Tumours of Veins.—Messrs. Hill and Duguid give a case of tumour of the anterior vena cava, materially reducing its calibre, due to circumscribed hypertrophy of its muscular coat ('Veterinary Journal,' 1876, vol. ii, p. 14).

Addendum 1.—Diseases of the Lymphatic System.

The lymphatic system of the ox is distributed much as in the horse. The thoracic duct is remarkable for its frequent variations (Colin). The mesenteric glands are situated close against the small intestines, instead of at the root of the mesentery, where they are in the horse. Large glands occur in certain positions, notably the posterior mediastinum and the space between the cranium and the pharynx. These become inflamed when any irritating absorbed material passes through them. Of this nature are the so-called cases of strangles of the ox as has been described, the intermaxillary or parotid glands being the seat. These glands are also the seat of scrofulous, cancerous, and other forms of deposit, while in many blood diseases, especially anthracoid affections, they are enlarged, reddened, and disintegrated. Cases of "farcy" in the ox, which have been described by some writers, were probably inflammation of the lymphatics, resulting in the formation of series of abscesses along their course, accompanied by infiltration of serum into the

[1] Mr. J. H. Cox, of Ashbourne, gives a most interesting case of varicosity of the posterior vena cava, in which obscure abdominal pain was present, and the vein was enormously distended ('Veterinarian,' vol. xxxix, p. 891). Cruzel tells us that asphyxia from the introduction of air into the veins is frequent in places where venesection is often performed.

surrounding parts. In such cases the cause must primarily be removed, and poulticing and other emollient measures taken in regard to the poisoned wound. Sometimes the system will require stimulation and support. The abscesses must be treated in the usual manner.

Lymphadenoma or Lymphoma is hypertrophy of lymphatic glandular structure, resulting in tumours, which often are said to be malignant. This disease of the glands causes and accompanies leukæmia.

Addendum 2.—Diseases of the Vascular Glands.

The vascular or ductless glands are occasionally diseased in the ox. The Spleen in this animal is situated on the upper part of the rumen to the left; it is oval and flattened, and is smaller than in the horse. Its normal weight is about two pounds. It undergoes enlargement periodically during active gastric digestion, but it sometimes is considerably increased in bulk, having become *hypertrophied;* in anæmic animals it is often found in an *atrophied* state.

Inflammation of this organ is described by several British authors, but a careful examination of their accounts makes it evident that they were dealing with splenic fever. This error occurs especially in older works. Cruzel describes it as frequent among working oxen. Lymphomatous and scrofulous deposits may have their seat in this organ. In cases of tuberculosis sometimes it is firmly fixed to the stomach, liver, and intestines, by tuberculous masses invested by peritoneum.

Hydatid Cysts (*Echinococcus veterinorum*) sometimes grow in the spleen, causing considerable diminution of its proper structure.

Lastly, *Rupture* sometimes takes place. The walls of its venous sinuses give way, and the extravasated blood either accumulates beneath the peritoneal capsule, or, that having ruptured, escapes into the peritoneal sac. The former condition may be seen in splenic fever, the latter results from blows, falls, or other injuries. The symptoms of the

latter are those of internal hæmorrhage, together with subacute abdominal irritation. Such cases are not amenable to treatment, but the usual means adopted for internal hæmorrhage must be tried; administration of hæmostatics, as sulphuric acid, and tannic and gallic acids, &c. Death, however, generally comes on rapidly.

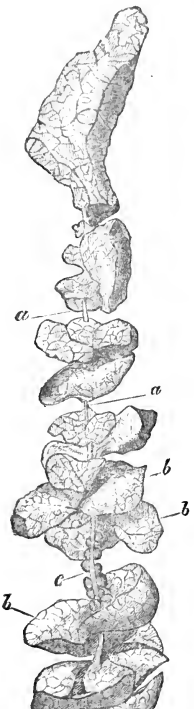


FIG. 37.—A piece of thymus of a calf spread out. Natural size. *a*. Central canal. *b*. Lobules. *c*. Isolated gland granules seated upon the principal canal. (After Harley and Brown.)

The THYROID BODY is large in the ox. It is sometimes the seat of *induration*, but more frequently becomes large, either as a result of colloid change, to which this organ is very liable, or in consequence of the development of cysts within its substance. Two cases of disease of this body are given in the 'Veterinarian,' vol. xvi, pp. 194 and 498. It may be removed by operation, if so large as to cause inconvenience. Generally its excessive size is only an eyesore, but it may interfere with respiration.

The THYMUS BODY of the calf is large, extending far up the neck und into the anterior mediastinum. Sometimes it is enlarged. In the 'Veterinarian,' 1852, p. 691, is an account of a case of this nature, in which the organ had undergone tubercular softening, weighed forty-nine ounces, and measured twenty-three inches in its greater circumference. Mr. William Lyon, of Forfar, removed it successfully by operation.

We have no record of disease of the ADRENALS of the ox.

CHAPTER IV.—DISEASES OF THE DIGESTIVE SYSTEM.

Section I.—Of the Alimentary Canal.

Being a ruminant, the ox has certain characteristic differences of structure and form of the digestive organs as compared with those of the horse; also there are special features in which this animal differs from other ruminants. The large size of the abdomen and the considerable bulk of the mass of the alimentary canal, together with its extent of surface and its large supply of blood, lead us to anticipate numerous and complex disorders of the digestive system. In this we are not mistaken. The weight of the stomach and intestines is considered 14·3 per cent. of that of the whole body (Lawes). The *lips* are liable to become involved in malignant disease of the face, but most frequently come under the notice of the surgeon as the seat of laceration or other wound. In the treatment of such lesions no part which can possibly be saved must be removed. These organs, with the dental pad, hard palate, and gums, also are the seat of vesicular eruptions in foot-and-mouth disease, and of some of the characteristic lesions in cattle plague. Cruzel describes *inflammation of the lips* at some length.

The *Incisor Teeth* of the ox (fig. 38) are eight in number, all in the lower jaw, placed with their crowns arranged "like the keyboard of a piano," their upper surfaces meeting the dental pad. They have very small fangs, and are loosely fixed in the jaw, the yielding of this part being increased by the non-union of the symphysis. They may be fractured or forced out; if only one or two are injured this will not materially interfere with the obtaining of

food, otherwise the animal may require to be house-fed. Professor Simonds, in his work upon the 'Age of the Ox, Sheep, and Pig,' notices certain irregularities of the in-

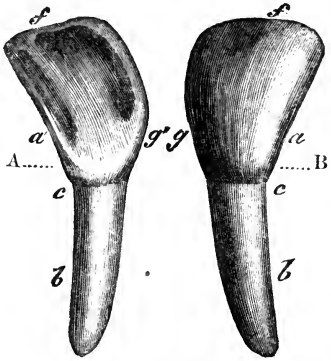


FIG. 38—Incisors of the ox. *a*. Crown. *b*. Fang. *c*. Neck. *f*. Nipping margin, *g*. Inner edge. A. Superior surface. B. Inferior surface. (Chauveau.)

cisors of the ox, due to persistence or non-appearance of temporary teeth. Such have not much practical importance.

The *Molars* of the ox (fig. 39) differ from those of the horse mainly in the fact that the three anterior ones are small, as compared with the three posterior in each series. The fangs are smaller and more subdivided. The tables are less complex and more rough and irregular, with jagged points, which often injure the insides of the cheeks (and such lacerations acquire importance, since it has been proved that they are the breach through which the bacteria enter in many cases of anthrax). These teeth are loosened by epitheliomatous or osteo-sarcomatous growths. They may be affected by *caries*, and those other pathological conditions which have been seen in the horse, but such cases seem to be *extremely* rare. We also seldom find records of their displacements abnormally. Cattle also do not seem to suffer from teething. Our researches have disclosed a case where the sole of a boot became fixed on the molar series of one side of the lower jaw, giving rise to dysphagia (difficulty in feeding). And in 'Veteri-

narian,' vol. xii, p. 143, is recorded a most remarkable case of a normally formed incisor being developed in the centre of the palate of a young bull.

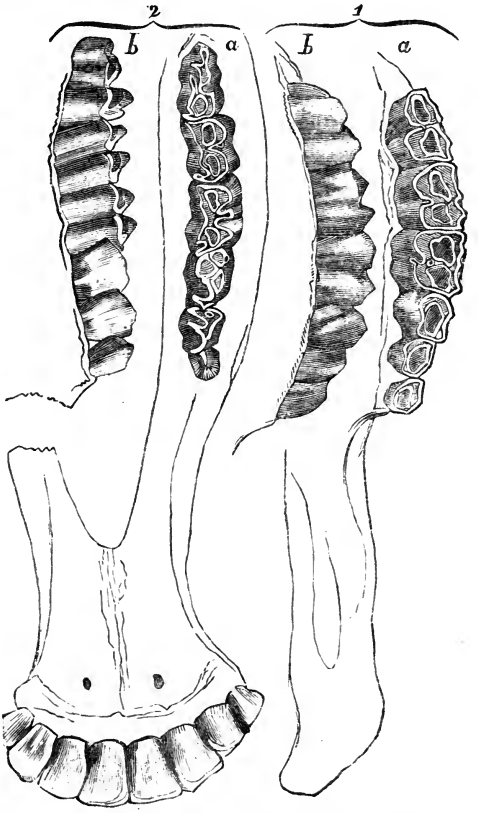


FIG. 39.—Teeth of the ox. 1. Upper: *a*, from below; *b*, from side. 2. Lower: *a*, from above; *b*, from side. (Chauveau.)

The hard palate of the ox is wide and roomy posteriorly at its intermolar portion, but in front of this is narrowed by the ridges, convex inwards, which afford attachment to Canini. These muscles contract during mastication, and thus diminish the anterior opening of the mouth, at the same time leaving the lips free to act. The muscles of mastication in ruminants are well developed. Pterygoideus and masseter internus are large, and masseter

externus may be divided into several superposed layers, and anteriorly receives a tendon of Panniculus, representing Sterno-maxillaris. Digastricus has but one belly, and runs directly from the occipital styloid process to the inferior maxilla. Stylo-maxillaris is absent. The temporo-maxillary joint is arranged to allow of very free lateral movement, the glenoid surface being convex. In mastication and remastication the jaw is moved for a number of times to one side, and then the action is reversed. Thus, the right and left molar series are periodically, but not alternately, brought into use.

"Dropping the Cud" takes place in certain diseases of the mouth where mastication is painful, but is also one of the symptoms of certain subacute forms of indigestion dependent upon bad, bulky, and innutritious food. In such cases the animal is unthrifty, with irregular bowels, staring coat, and depraved appetite. A cathartic dose, with change of diet, will generally effectually remove this irregularity.

Salivary Glands.—The parotids are smaller propor-

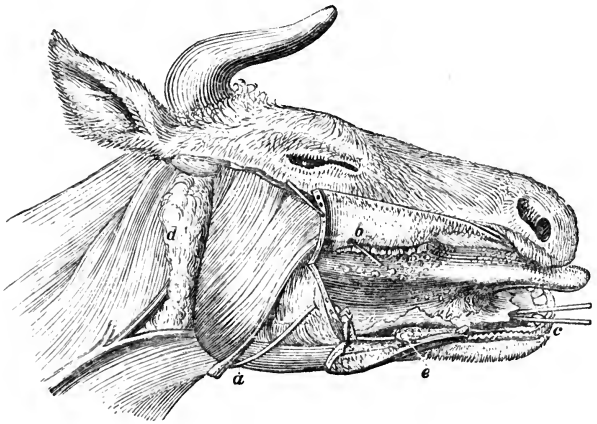


Fig. 40.—Salivary glands with their ducts. *d.* Parotid; *a*, its duct. *c.* Probes in submaxillary ducts. *e.* Sublinguals. *b.* Termination of parotid duct. (Simonds.)

tionally than in the horse, but this is compensated for by the large size of the inferior buccal glands. They secrete

constantly, but most markedly when alimentary matters are in the mouth being masticated; then the alternate action of each gland, in accordance with unilateral mastication, is marked. During abstinence the flow is about a quarter as great as during mastication, and the fluid passes generally into the reticulum. Though about equal in size to the submaxillary, this gland produces four or five times as much fluid [Sp. gr. 1·0108 (Lassaigne)]. The flow of submaxillary saliva is unaffected during rumination. The total quantity of mixed saliva produced by an ox, taking three hours to feed and five to ruminate, was estimated at 40,000 grammes during the eight hours' mastication and 16,000 grammes during abstinence, making a total of 56,000 grammes in twenty-four hours; this is probably under-estimated (Colin). Submaxillary saliva is constantly produced during abstinence in small quantities; it is abundant during feeding, and its quantity is related to the quality and taste of the food and to the rapidity of mastication. Sublingual saliva may be obtained from the accessory duct which runs from the posterior lobe of the gland and opens near the submaxillary duct; it is constantly produced and is very viscid; probably it serves to coat the pellet of food. The well-developed condition of the salivary apparatus accounts for the fact that it is readily acted upon by even small doses of mercury, whereby excessive secretion, PTYALISM, is produced. It also explains how sufficient fluid is passed into the rumen to thoroughly macerate the large quantity of material it can contain. Mr. Cox, of Ashbourne, in the 'Veterinarian,' vol. xxv, p. 695, gives three cases of ptyalism, due to paralysis for they were accompanied by inability to raise the eyelid and a pendulous condition of the ear and of the upper lip. A blister around the base of the ear and a laxative dose cured these cases in a month. In two other cases no paralysis was present.

Inflammation of the Salivary Glands seldom takes place as a disease in itself, though these organs are generally involved in cases of sore throat. Cases of PAROTIDITIS sometimes are seen, but it is the lymphatic,

and not the salivary parotid gland which is affected in almost every instance. Youatt tells us that "this condition is an almost invariable accompaniment of catarrhal affection of the upper air passages, and there is scarcely any epidemic (*sic*) among cattle, one of the earliest symptoms of which is not swelling of the head and neck." There are swellings, with heat and pain on pressure, on the seat of the parotid, abscesses form and burst, and thus produce obstinate sores. Youatt says, "In inflammation, apparently of only an inconsiderable portion of the parotid gland, we have known ulcers of the most offensive character extend from ear to ear, and expose the most important vessels of the upper part of the neck." He apparently here alluded either to scrofulous tumours or to the condition known as osteo-sarcoma or spina ventosa (*vide* infra). Ordinary parotiditis needs no special measures of treatment. Fomentations will be found most valuable, and steaming the air passages is useful. In the 'Veterinarian,' vol. xxxii, p. 433, is given a case of *cuticular cyst in the parotid*. Congestion of the buccal mucous membrane sometimes interferes with the flow of saliva into the mouth, since the openings of the submaxillary ducts below the tongue, and sometimes those of the sublingual in the channel between it and the molars, become tumid and congested, a condition vulgarly known as *barbs* or *paps*. This will disappear with its cause. Cruzel, however, says decidedly, that operative removal is necessary.

Salivary Calculi do not seem to occur often in cattle.

The *tongue* of the ox is pointed, more conical, and thicker than that of the horse, and has stouter muscles. It is used as the main organ of prehension, for, curling round a tuft of grass it draws this into the mouth, while the incisors meet the dental pad and bite off the morsel at a short distance above the ground. The tongue is furnished with conical papillæ, and, since it is much exposed during the performance of its prehensile functions, is protected by a stout horny epidermis. Conical papillæ, resembling those of the tongue, are found inside the cheeks. These probably serve to retain the food in the mouth.

The protrusibility of the tongue results from the well-developed condition of those lingual muscles attached to the symphysis, and from the presence of a well-developed middle cornu of the os hyoides. This highly important organ is liable to disease of different kinds—inflammation, degeneration, and malignant glossitis.

Glossitis (*inflammation of the tongue*) is a disease of by no means rare occurrence, attributable to ingestion of rough course food, frosty grass, and injuries (mechanical or chemical). It also is a complication occasionally seen in eczema epizootica when badly treated or neglected. The whole organ may be diseased or only part of it. The resulting changes are induration, suppuration, or gangrene.

Symptoms.—General signs of fever; profuse flow of saliva from the mouth, which is very hot, the tongue then becomes enlarged and reddened, and hangs from the mouth. Sometimes the epithelial layer is raised from the deeper portion of the mucous membrane by serous effusion, so that separation of it may take place to a limited extent. The enlargement of the tongue and the surrounding swelling causes some interference with respiration, of course the animal is not in a position to take in food; deglutition also is interfered with. In very acute cases either abscesses form in the organ or mortification sets in. In the former case pointing takes place, and as soon as possible, but not prematurely, the abscess should be opened. In the latter the protruded organ becomes livid, cold, and loses all feeling and power of retraction; it has a peculiar odour with phlyctenæ on the surface, and the general symptoms assume a typhoid character. In less acute cases exudation of lymph into the substance of the tongue takes place; this undergoes organisation, and compressing the muscular structure of the organ, produces atrophy. Thus occurs the so-called *scirrhus of the tongue.*

Treatment. — Active measures are essential. In the earlier stages, besides nursing, the animal must receive an aperient dose, and some suggest the necessity for bleeding; preferably sedative and febrifuge agents may

be administered, the doses being so arranged that they may prove refrigerants to the diseased organ. Steaming the mouth is valuable. The animal should always be allowed a bucketful of nitrated water. One of the most serious effects of this disease is that it cuts off the animal's food supply. Nutritive enemas must therefore be given with assiduity, and all drinks administered in gruel and with vegetable tonics. When gangrene of the affected organ sets in, but little hope of a favorable result must be entertained. Free incisions must be made into the tongue. Extensive sloughing may remove the dead parts, and the animal retain a portion of the organ sufficient for house-feeding, but generally death takes place. At best these cases are prolonged, the chances of recovery are poor, and the animal will fall away much during the treatment. Under these circumstances, our duty is to suggest immediate slaughter if the animal be in anything like condition in the early stages of a case of glossitis. Gloss anthrax may be confounded with this disorder, but it is more acute.

Induration of the Tongue (*Scirrhus*).—Generally this is the above-described atrophy of the tongue, due to substitution of lowly organised fibrous tissue for muscular fibre. Thus, there is no loss of bulk, indeed, the organ is increased in size and very hard, but markedly of contractility. This atrophy may involve part or whole of the organ; sometimes it affects only the tip, arising without appreciable cause, unpreceded by inflammation. In any case it interferes with prehension and mastication, and the animal becomes emaciated, and should, therefore, be slaughtered early. Interference with rumination and excessive salivation are the most marked symptoms.

Cancer of the Tongue.—In this disease the organ is the seat of small nodules of carcinomatous deposit, which more or less replace the proper substance of the organs, and some of them bulge beneath the mucous membrane of the dorsum. Some undergo softening, and the submaxillary and parotid lymphatic glands are generally involved through absorption of cancerous matter. This

disease progresses slowly and materially interferes with the development of the animal. It is incurable, and the flesh of cattle thus affected is not good meat, though always consumed. The condition of the dorsum linguæ is diagnostic. The earliest account of this with which I am acquainted is in the 'Edinburgh Veterinary Review,' 1864, p. 153. Some authorities consider this disease scrofulous rather than a form of carcinoma.

Cramp of the Tongue.—This disease has been described by Eberhardt (see 'Veterinarian,' xvii, 153). It seems to be enzootic in certain parts of Germany; is liable to recur, and proves rapidly fatal unless relieved. "The tongue is curled like a corkscrew and drawn backwards towards the upper part of the throat, on which it presses so violently as to make it evident that this is the cause of the convulsions, and that it is only necessary to bring the tongue into its natural position to relieve the animal. The attacks usually come on suddenly when the animal is feeding. It starts suddenly back from the manger, begins to breathe heavily and sonorously, stretches out the head, and sways to and fro. It appears to be uneasy, it moves restlessly from side to side, becomes swollen or half suffocated, and voids much dung. There is an expression of suffering in the countenance; the eyes are protruded, they roll in their sockets, and have a fiery glittering appearance. The veins of the head are enlarged, and project in bold relief like cords. If one of them is pressed with the finger the flow of blood can be distinctly felt. The ears stands erect, the nostrils work convulsively, the mouth is held open, and the whole face plainly speaks the agony which the animal is suffering." Tracheotomy may be performed if considered necessary.

Cystic Diseases of the Tongue.—An account of fibro-cystic disease is given in the 'Edinburgh Veterinary Review,' iii, 216, and a most interesting case of pilous cysts in the tongue, possibly an inversion of the skin, is recorded by Professor Varnell ('Veterinarian,' xxxix, p. 712).

The tongue of the ox is comparatively seldom injured. This is due to the absence of the bit and the twisting

of a halter-rope into the mouth, which are fruitful sources in the horse. Sometimes the organ is lacerated, and sometimes bitten. This organ must be preserved as much as possibly in its entirety.

Paralysis of the Tongue has been seen as a result of disease of the cranium or of the brain. It is of rare occurrence, and generally necessitates slaughter.

Ulcers of the Tongue persist after foot-and-mouth disease, sloughing of gangrenous portions, and injuries. They interfere very materially with condition, and occasionally require stimulation by caustic dressings. The mucous membrane of the mouth of the ox being thicker than that of the horse, is not so frequently affected by careless administration of caustic alkalies imperfectly diluted. Such accidents do occur. As a result the epithelial layer may peel off the organ in a continuous sheet, leaving the red surface of the corium exposed. This is highly painful. Demulcents acidulated are especially indicated in such cases.

Aphtha, or "*thrush in the mouth,*" is a mild inflammation of the buccal membrane, leading to the formation of a crop of minute conical or acuminate vesicles or pustules. The number and smallness of these suffices to distinguish them from the blebs of foot-and-mouth disease; they appear especially on the tongue, burst, and leave ulcers, which may run together. It results from direct local irritation, and more frequently from ingestion of indigestible matter. There are present the ordinary signs of inflammation in the mouth, salivation, heat, and redness, also imperfect mastication. Febrile symptoms may be present.

Treatment.—An aperient saline dose is admissible to expel the irritant substances from the alimentary canal. Locally, astringent dressings may prove useful.

The *Tonsils* of the ox are depressions extending from the lateral parts of the isthmus faucium. These are deep, and in their walls are embedded ductless glandular bodies. These are the parts which undergo most marked change in diphtheria. They are enlarged in sore throat of various kinds, and are involved in cases of anthrax.

The velum pendulum palati of the ox is short as compared with that of the horse; thus, vomited matter can be expelled and the animal can breathe through the mouth.

Congenital Malformation of the Palate is sometimes seen in calves. We have on record a case of complete divergence of the lateral halves of the facial portion of the upper jaw. A case of cleft palate is recorded in 'Veterinarian,' vol. xlii, p. 612; in this, alimentary matters and saliva passed from the right nostril during rumination or feeding.

The *Pharynx* of the ox has a single opening into the nasal chambers, which run together posteriorly, where a space exists between the lower margin of the vomer and the palatine suture. The openings of the Eustachian tubes are rounded, and the organ is not separated from basis cranii by guttural pouches—simply by large post-pharyngeal glands. The muscles of the pharynx present nothing peculiar, and do not seem to undergo paralysis.

Pharyngeal Polypus is an outgrowth, of generally an ovoid figure, from the pharyngeal mucous membrane. It acts as an impediment to deglutition, and sometimes, by falling over the glottal opening, causes intermittent severe dyspnœa and coughing. These require to be removed by means of the écraseur or ligature. The operation must be performed through the mouth when possible, but sometimes the growth hangs from the posterior nares and causes stertorous breathing. In a case recorded by Mr. Younghusband, of Greystoke, "the head was kept protruded nearly straight out."

The *Œsophagus* is of a red colour throughout, is large in calibre, terminates posteriorly in the œsophagean groove above the reticulum at the supero-anterior part of the the rumen. Its internal layer of muscular fibres presents a spiral arrangement, resulting in double obliquity. Thus, it is adapted for deglutition and regurgitation of the food in pellets, which seem to be formed in the groove at its posterior extremity. Strictly, the first three compartments of the stomach of the ox should be considered modified portions of the œsophagus. Transitional stages

from the simple stomach of man or the dog to the complex gastric arrangement of ruminants may be seen in the horse and the pig.

Œsophagitis, *Inflammation of the Œsophagus,* has been described, but it is not of frequent occurrence, its symptoms are heat and swelling along the channel of the neck, profuse flow of saliva, difficulty in deglutition, and fever more or less marked.

Probably from a condition of this kind results Fibrous Degeneration of the Œsophagus, as sometimes seen ('Edinburgh Veterinary Review,' vii, 27). There is nothing special in this, for the ordinary result of inflammation of muscular structures is the substitution of organised lymph for contractile fibre. Its effects are important; they are stricture and dilatation.

Dilatation of the Œsophagus is less frequent than in the horse, partly because the œsophagus is naturally larger, partly because it performs a double function in the ox, and, therefore, when deranged leads, to more rapid emaciation, so that any relaxation of the walls is not so liable to go to extremes. In a case of this kind but little can result from surgery. The muscular coat is weakened or degenerated, a state which can seldom be repaired. It is best to endeavour to feed the animal for the butcher. This must be done with great care, and manipulation over the course of the œsophagus from above downwards, after a meal, will tend to remove any accumulation which may take place in the weakened part when it is in the cervical region, where the tube is most exposed to injury. The diet must be soft and nourishing, so that there may be little need for regurgitation. In mild cases a blister over the affected part has been found beneficial. Vomition, periodical choking, and excessive appetite are signs of those cases in which the œsophagus has a saccular dilatation at its inferior extremity, which is the most frequent seat of the disorder.

Stricture of the Œsophagus is due either to hypertrophy of the muscular coat, to its fibrous degeneration with shrinking, or to injury to the mucous membrane, with

thickening and obliteration of its folds. The most frequent cause is injury from too large a pellet or mass of food being swallowed, or from excessive force applied to the impacted body by the probang in cases of choking. A lesion of this nature follows corrosive poisoning, and may necessitate destruction of the patient after recovery from the toxic effects of the agent. Dilatation of the tube above the stricture occurs as a complication. The thickening may extend along a considerable portion of the length of the œsophagus as a result of inflammation.

Symptoms.—Swelling along the channel of the neck, frequent choking, and attempts to vomit. More or less impediment to swallowing and accumulation of food above the stricture, giving rise to a swelling, which, largest at first after feeding, gradually disappears until after the next meal.

Treatment has been successfully adopted in such cases in the horse, but the method suggested for dilatation should be adopted in the ox. The passage of probangs, of gradually increasing size, periodically, may be tried in cases of circumscribed stricture; stimulation, by means of a blister, will tend to remove lymphy deposit. When the stricture involves the thoracic portion of the œsophagus (or its terminal extremity), it is even less amenable to treatment. When due to pressure of a tumour it may be cured by surgical removal of the cause. Certain parasites—*Spiroptera scutata œsophagea bovis*—take up their abode in the mucous membrane of the œsophagus. They have not been observed in this country, but Müller gives an account of them (see 'Veterinarian,' vol. xliii, p. 632). They may cause stricture.

Rupture of the Œsophagus results from force applied from within, as when the probang slips round the impacted body, or forces it through the wall of the tube. Lacerated or punctured wounds from without, or extension of ulceration, too, cause perforation. An abscess has been known to burst into the thoracic portion of the œsophagus, and thus evacuate its pus. In these cases there are two unsatisfactory points: first, the food constantly tends to

escape through the wound, and keep it open; secondly, when healing occurs, stricture is very liable to ensue. The indications for treatment are: feed the animal only on soft food—liquids are preferable; after feeding remove all foreign matter escaping through the wound; dress with oil or glycerine of carbolic acid. It is a good plan to support mainly on gruel administered through the hollow probang. The use of the latter acts as a preventive against stricture. When rupture has followed choking, and the wound is subcutaneous, the alimentary material which escapes tends to accumulate in the areolar tissue. It must be cut down upon and removed, then the edges of the œsophageal wound brought together with wire sutures or carbolised catgut, and the case treated as above mentioned. Sometimes only partial rupture occurs when the force applied to the probang is in the proper direction, but too great. Complete transverse rupture of the mucous membrane then takes place, and the probang passes onward with a jerk, which to the experienced practitioner is diagnostic. The symptoms of choking, in such a case, generally persist after the canal has been cleared, and it ultimately becomes necessary to destroy the patient.

Under the heading "*Degeneration of the Mucous membrane of the Œsophagus*" in the 'Edinburgh Veterinary Review,' vol. iv, p. 235, is given a case of those warty growths, benign epithelial tumours which are not unfrequently found growing from the œsophageal mucous membrane. These are sometimes enormous, and give rise to choking since they materially diminish the calibre of the tube. Their presence can only be surmised in cases of intermittent choking. They constitute one of many causes. The frequent passage of the probang and other treatment of ordinary stricture may suffice to secure fitness for the butcher.

Choking is a condition which commonly depends upon impaction or blocking up of the œsophagus by some foreign body. Symptoms of choking, however, arise from other causes, as injuries of the œsophagus from sharp bodies swallowed, also disease of the pneumogastric nerve.

Impaction of foreign bodies in the œsophagus occurs very frequently in the ox. The *symptoms* resulting from it are not so urgent as in the horse. The animal stands with the muzzle projected, coughs, champs the jaws, and there is a profuse flow of saliva from the mouth. Appetite and rumination are suspended, but there are gulping efforts. The eyes are projecting and bloodshot, and the patient is very uneasy; there is frequent passage of urine and fæces. When any matter is ingested it is returned by vomition through the mouth and nose. The impaction may be up against the pharynx, in the cervical, or in the thoracic regions of the tube. In the former case the coughing is most marked and respiration is interfered with, in the latter, fluid seems to pass, but simply fills the passage up from the obstruction, and is then returned by vomition; also auscultation detects frequently rushes of gas past the obstruction (Nelson), while altogether the symptoms are less urgent. When the body is lodged in the cervical region, swelling may be perceived on the left side in the channel of the neck. This may be large or small, hard or soft, movable or immovable, according to the nature of the body and the conditions of the œsophagus. Tympany early sets in, except in those cases, which are not numerous, in which liquids and gaseous matters can pass the obstruction. The swelling of the rumen threatens suffocation, and requires relief either by puncture or by passage of the hollow probang. On performing the latter operation we determine the presence of a solid body preventing its entry into the stomach. This body may be a turnip, mangold, or potato. All such roots should be sliced or bruised, especially when animals receive them as a change of diet, for then they are greedily stowed away in the rumen, and a too large one causes choking. Whole eggs given to improve the animal's condition are much less frequently the cause of choking in the ox than in the horse. The bulimia (or depraved appetite) from which cows especially suffer causes them to consume strange bodies, which may become impacted in the œsophagus. Imperfect salivation of coarse food seldom causes

obstruction in the ox, indeed this is natural, for food is taken in hastily and thoroughly mixed with the saliva only when it gains the rumen. Accumulation of food material in a dilated œsophagus and spasm of the muscular coat are occasional causes. Stricture is very liable to cause impediment even when pellets are passing up from the rumen for remastication. Sometimes "hair-balls" thus cause choking.[1]

Treatment.—When we have reason to suspect pharyngeal impaction we must have the animal's mouth kept open by means of an ordinary balling iron, and pass the hand through the mouth to explore the pharynx. Sometimes it will assist us if an assistant presses the throat on each side behind the maxillary angle inwards and upwards. In the cervical region the tumour may be manipulated, and attempts made to move it upwards or downwards. These may be aided by passing a small quantity of oil into the œsophagus. Sometimes manipulation will disintegrate a mass, which will then slowly disappear. Any movement of the body is a favorable sign. If this method fail, the probang, well oiled, may be passed, and gentle but continuous pressure exerted upon the impediment, which may often be felt gradually yielding and passing onward into the stomach. In less favorable cases it will not yield. This frequently depends upon spasm of the œsophagus behind it, and consequently persistence in passing the probang at intervals and applying gentle pressure may be crowned with success. Some practitioners recommend morphia and aconite doses to allay the spasm. Carters' whips, ropes, and other rough instruments are sometimes used instead of the probang; this is reprehensible. Probangs are of various kinds. They almost all consist of an elastic tube, kept open by a spiral wire, and perforated by a central free stilette. One extremity is arranged like a mouth-piece, the other has a bulb, which is sometimes egg-

[1] Cases of chronic choking are sometimes seen in which a portion of turnip or other substance, of a triangular or irregular shape, becomes fixed in the œsophagus, and allows passage of food downwards. This generally takes place near the stomach. A case has been known to last for six weeks.

shaped and perforated; this is apt to slip off a rounded body, as a turnip, and rupture the œsophagus. Others, preferably, have a concave extremity, which allows firm and even pressure on the body. Mr. Reed reminds us that the metal ends should not be of lead, which is indented by the teeth, and thus becomes liable to tear the œsophagus.

In *passing the probang*, a wooden gag, perforated centrally and with a projecting handle at each extremity, is placed in the mouth and fixed by straps which pass behind the horns. Two men ought to hold the head, each having a

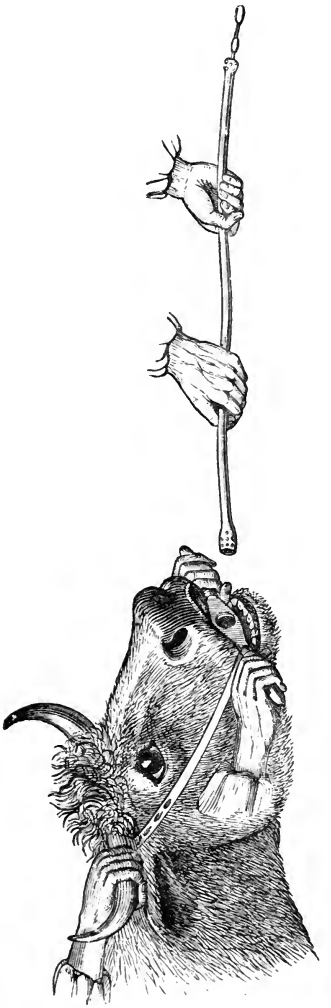


FIG. 41.—Ordinary method of passing the probang. (Simonds.)

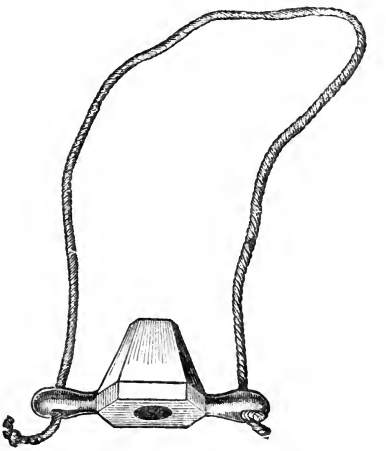


FIG. 42.—Armatage's wooden Gag.

handle in one hand and the horn of the opposite side in the other. Thus, the head is straightened upon the neck

by the elevation of the muzzle. The probang, then, with its cup-shaped end foremost, is passed through the opening in the gag under the pendulous palate, carefully over the epiglottis, which it forces downwards somewhat, and so into the œsophagus. Sometimes slight taps with the heavy end of the probang serve to start the body forwards. A little oil may be introduced through the tube by removal of the stilette. Thus, also, the gas can be drawn off when the bulb enters the rumen.

The *Forceps Probang of* Professor Simonds serves to grasp the root, and so to accomplish its withdrawal. It is

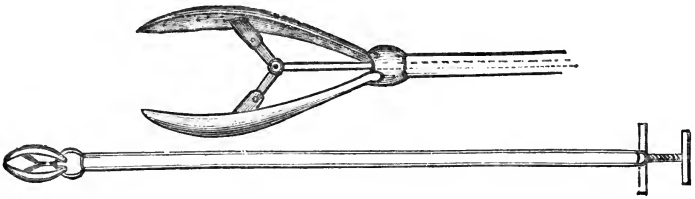


FIG. 43.—The Grasping or Forceps Probang of Professor Simonds. (Armatage.)

furnished at the top end with a screw-handle, at the other with a pair of spring forceps, the latter being drawn into the bulb when the instrument is passed and secured by a check and screw to the other end. The forceps are serrated on their inner surface, and their edges are made somewhat tapering, for the purpose of passing readily between the root and the side of the œsophagus. The bulb being brought in contact with the root the screw check is removed and the forceps expanded and turned in different directions to grasp the root. That the obstructive is grasped is indicated by the stilette not being entirely withdrawable.

The *Corkscrew Probang* of Lord is so arranged that, when a foreign body is reached, a corkscrew can be introduced into it, with the result either of bringing about its withdrawal or lessening its cohesion. In the latter case, after being punctured in several places, the root may break up and pass readily into the rumen. The screw terminates the stilette; it can be retracted into the tube

of the probang while it is being passed, and when the obstruction is reached can be introduced into it by turning the handle; another probang is a stout rope unperforated, with a cap at each extremity. Sometimes the obstruction becomes perforated, and allows the probang to pass it, and a large body fixed in the cervical portion of the œsophagus, when moved from here, may become fixed in the lower extremity of the tube. These measures failing, we must resort to *œsophagotomy*. The muzzle of the patient is elevated, and thus the lower part of the neck rendered tense. An assistant is placed on the right side of the animal and required to press on the œsophagus at the seat of obstruction, causing it to bulge towards the left. The impaction serves to separate the neighbouring vessels upwards and downwards, and the œsophagus bulges beneath the skin and a thin layer of muscle. The operator, standing on the left side, makes a clean incision on to the body of sufficient length to at once and freely allow its escape. The margins of the œsophageal wound are then brought together by catgut sutures, and the external wound similarly closed. The carbolic acid spray may be made to play during the operation, and will materially increase the chance of union by first intention, so desirable in wounds of the œsophagus. The animal must be fed on soft food, which may be injected directly into the rumen through a canula (Dycer); or sometimes another method of performing the operation, preferable in many respects, is to simply cut down upon but not into the œsophagus, to endeavour then by *gentle* manipulation to break down the obstructing body, but if this fails, to insert an extremely fine probe-pointed bistoury through a very small opening and cut in various directions through the body, thus breaking it up, its parts being removed by manipulation as they separate. The advantages of this are obvious; it was suggested by Freneh veterinary surgeons.

In cases of choking, after-treatment is very necessary, for recurrence is frequent. Soft diet must be continued for some time, and the animal kept under strict supervision.

Such complications as occur are sometimes troublesome; tympany often requires to be relieved by puncture with the trocar, even before any measures are adopted against the choking. Rupture and stricture, as results of injury with the probang, have been already noticed. Often a very considerable formation of false membranes occurs at the seat of impaction. When the free end of the probang is brought up covered with blood, laceration of the lining mucous membrane or rupture of both the walls has taken place, and the case is probably hopeless; there is a free flow of any fluid which is administered, and when the obstruction is in the thorax, this may pass into the pleural sac and give rise to pleuritis. The animal continues in pain and the breath becomes fœtid.

Prophylaxis consists in having all roots cut or bruised, in giving cattle only a little at a time of any fresh food, and in fattening for slaughter animals which have been thus affected.

Vomition is an expulsion of material from the alimentary canal as a result of reversed peristaltic action. Thus, it is clear that it may vary much in its nature and severity in the ox. We have noticed that it is one of the symptoms of choking where the obstruction is near the rumen. In other cases it is simply expulsion of matter from an over-loaded rumen, and is one of nature's methods of relief in cases of hoven. This form is rather frequent; the ejected matter mainly passes by the mouth, and sometimes amounts to an enormous quantity. It differs from "dropping the cud" mainly in the rapidity with which the aliment is ejected, and in the fact that it accompanies indigestion. Rarely, the contents of the true stomach are thrown off; this, which Youatt terms "true vomition," he illustrates by a case from M. Cruzel, in the 'Journal Pratique,' 1830, p. 322. The patient, an ox, was unthrifty, ruminated seldom and slow, and had slight tension of the left flank. "Rumination commenced, preceded by deep and sonorous eructations having a penetrating odour. This lasted about ten minutes, after which the animal got up, backed himself in his stall,

hung on the chain, his fore limbs trembled, he brought his hind extremities as much as possible under him, and bent his neck and depressed his head, and, after a deep and powerful inspiration, he vomited fifteen pounds of semi-fluid matter, perfectly triturated. The vomiting ceased, the ox remained for a moment motionless, and then lay down again and ruminated afresh. He continued thus about thirty-five minutes, when he had a renewed fit of vomiting perfectly similar to the preceding." The

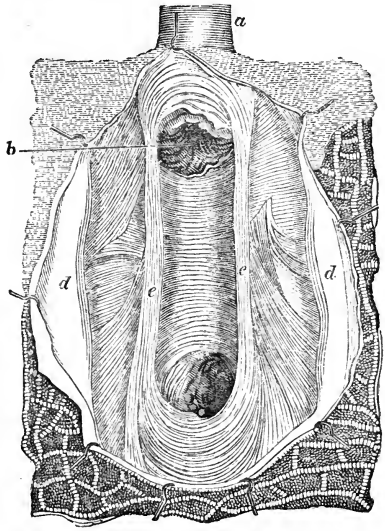


FIG. 41.—Œsophageal groove. *a*. Œsophagus, with (*b*) its opening into the groove. *d*. Mucous membrane dissected back. *e*. Rumino-reticular sphincter. (Carpenter.)

act of vomiting is regulated by a special centre in the medulla oblongata, is reflex, and is brought about by a deep inspiration fixing the diaphragm, contraction of all the abdominal sphincters, and then of the abdominal muscles, and of the walls of the stomach, together with reversed peristalsis of the œsophagus. Impaction of the rumen has been treated by injection of fluid until vomition took place. Vomiting, too, is a symptom of foreign bodies in the reticulum, and of impaction of the œsophagus near the rumen, where the knot of a straw or hay band is apt to become fixed.

The œsophagus terminates in gaining relations with the first three compartments of the stomach by the *œsophageal groove.* This is a half canal open below, the margins of which are mainly composed of longitudinal white muscular fibres, which form a loop at its termination around the opening into the omasum. These fibres are connected together by others, which run transversely beneath the mucous membrane, which resembles that of the œsophagus. The opening of the groove below is into the reticulum

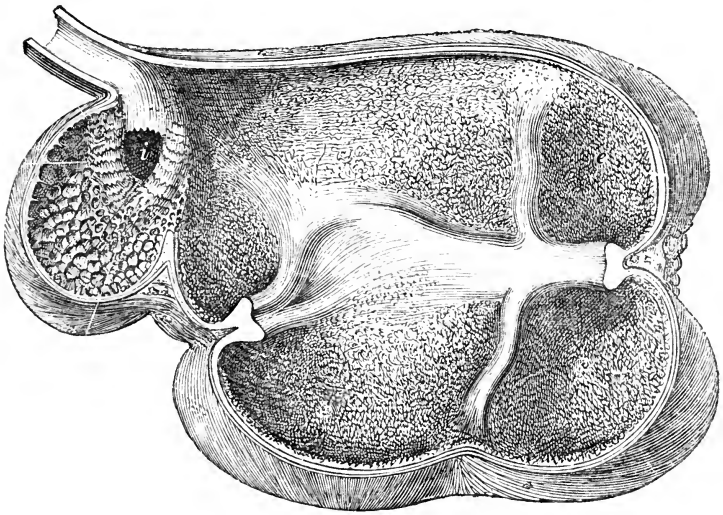


FIG. 45.—Rumen and reticulum seen from left. Their left walls removed. *i.* Opening into omasum. (Simonds.)

anteriorly and the rumen posteriorly. The *rumen or first stomach* occupies three fourths of the abdomen, being situated on the left side, all of which it occupies except the extreme posterior part. It has a capacity of many gallons. The spleen lies upon its supero-anterior part. It is mostly covered by peritoneum, its muscular coat presents fibres often transversely striated, and is arranged to form bands in certain situations; some of these are arranged transversely, others longitudinally, consequently the cavity of the rumen is divided into four compartments, of which the left are the largest. The

mucous lining membrane presents few glands, has tesselated stratified epithelium, and is elevated to form leaf-like papillæ, which are largest in the depths of the pouches, and disappear towards the muscular bands. The *reticulum,*

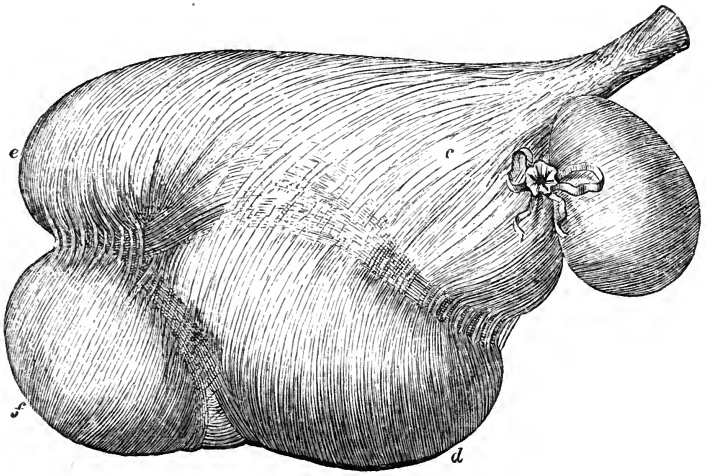


Fig. 46.—Rumen and reticulum. Muscular coat. *c, d, e, f.* Pouches of the rumen. (Simonds.)

or second stomach, hangs below the termination of the œsophagus between the rumen and the diaphragm. Its lining membrane presents a "honeycomb" arrangement, having hexagonal depressions separated from each other by narrow ridges, and in them are secondary hexagonal depressions. The spaces are largest at the deeper part. The whole surface presents conical papillæ. The cavity is separated from that of the rumen no more than one pouch of that organ from another. This is the smallest of the stomachs, and functions as a pouch of the rumen. In passing above this stomach the groove inclines from left to right, it terminates in the *omasum, manyplies, or third stomach.* This is situated on the right of the anterior part of the rumen, and is curved and oval in shape; its lining membrane, with fibres from the muscular coat, projects inwards, forming folds or laminæ, which are largest at the greater curvature, at the centre of the organ.

They decrease in length towards each orifice; only the four or five largest extend the full length of the organ;

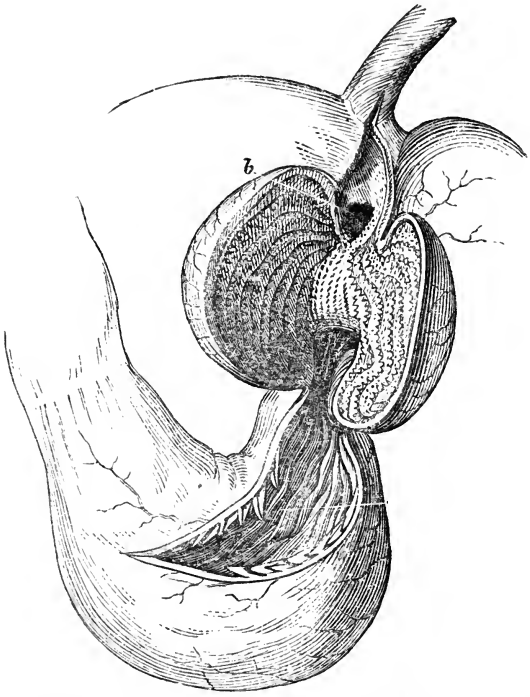


FIG. 47.—Omasum and abomasum, opened longitudinally. *b*. Rumino-reticular opening. (Simonds.)

between them lie the smaller ones. The lesser curvature bears no folds; papillæ occur over the surface of the membrane, some conical, others clavate.

The *Abomasum or True Digestive Stomach* lies to the right of the antero-inferior and central parts of the rumen, extending from below and to the left of the omasum, obliquely upwards and backwards. Thus, it has a lesser curvature superiorly placed, and a greater postero-inferiorly. It commences at a rather wide opening from the omasum, and terminates at the pylorus. The mucous membrane presents folds, which vary in their direction in different parts. It is villous and bears gastric follicles, whereby the succus gastricus is secreted. The

pylorus has a well-developed sphincter. There are various theories as to the act of *rumination*, and the manner in which the different cavities are related to this and other digestive processes. A full account of the various views is given in Colin's 'Physiologie Comparée.' Rumination comprises the production of a pellet of the slightly masticated food which for some time has been macerating in the rumen, its regurgitation through the œsophagus and pharynx into the mouth, its mastication, and redeglutition. The matter is complicated by the fact that one portion of food is regurgitated a variable number of times, depending on the amount of preparation it requires. Liquids and pultaceous material pass at once into the omasum as well as into the rumen and reticulum. Coarse food may be remasticated as many as four or five times. Until thoroughly softened it passes from the œsophagus indifferently into the rumen or reticulum. When the rumen is occupied by a sufficient amount of food it exerts a churning and to-and-fro movement, whereby the alimentary matters undergo a certain amount of division, and are thoroughly intermingled with the large quantity of saliva which is poured down from the mouth; so the contents are softened and undergo those changes which are due to thorough insalivation. There is a considerable depth of rumen cavity below the edge of the septum which separates it from the reticulum; the most fluid portions of the contents of the rumen most readily pass over this "high-water mark," so the contents of the reticulum are very fluid. The muscular bands of the rumen are so arranged that when they contract they concentrate the organ, as it were, towards the terminal extremity of the œsophagus. At the same time contraction of the reticulum also occurs, and thus the alimentary material is pressed into the lower end of œsophagus, and passed upwards in pellets into the mouth. Such is the arrangement of this œsophageal groove that, when its longitudinal bands contract, they tend to place the terminal opening of the œsophagus and the opening into the omasum opposite each other, connected practically by a canal

cut off from the cavity of the rumen by the contraction of a sphincter. When food has been pressed into the canal

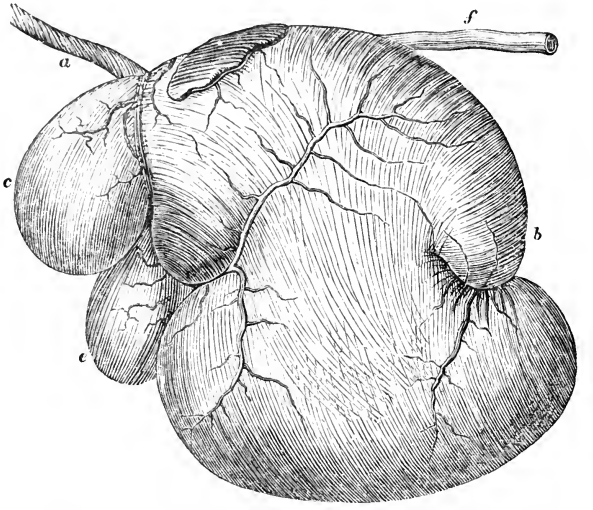


FIG. 48.—Gastric mass viewed from the left. *a*. Œsophagus. *b*. Rumen. *c*. Reticulum. *e*. Abomasum. *f*. Duodenum.

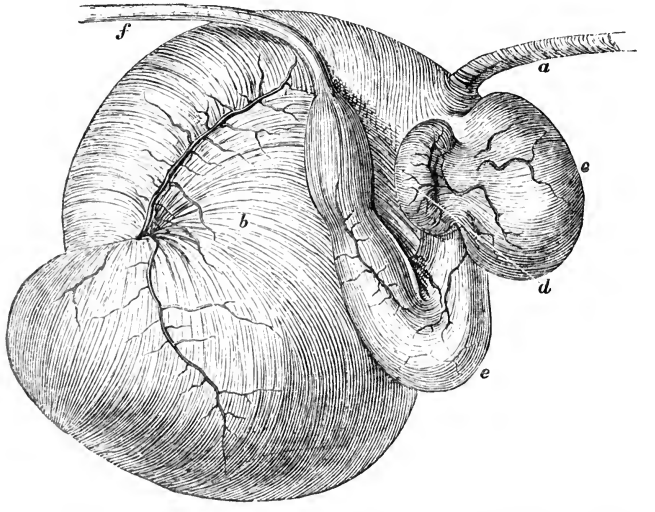


FIG. 49.—Gastric mass viewed from the right. *a*. Œsophagus. *b*. Rumen. *c*. Reticulum. *d*. Omasum. *e*. Abomasum. *f*. Duodenum.

by contraction of the first and second stomachs a suffi-

ciently large portion is cut off from the rest by contraction of the sphincter, and thus the pellet to be returned to the mouth is formed. Reversed peristalsis commences against the omasum at that part of the canal which is occupied by fluid material from the reticulum. Some of this is forced into the omasum during the contraction of the canal. The action of the rumino-reticular sphincter is similar in nature, but reverse in its action to that of the pylorus; the latter guards against passage of solid masses, the former sometimes contracts to guard against liquids, as probably during drinking. Sufficiently elaborated food passes directly into the omasum, and here is subjected to compression. The laminæ are so arranged that matter can pass in between them and lie there, being gradually moved outwards towards the abomasum; but the arrangement of their muscular structure is such that when the stomach contracts they also diminish in length, and thus do not block up the channel at the lesser curvature of the viscus, along which, as through part of the œsophagus, a passage generally is open for liquids or very pultaceous material. The anatomical arrangement of the œsophageal canal shows no reason why, if peristalsis is regular (not reversed), the soft material from the reticulum should not pass into the omasum. Probably a handing on of prepared matter thus takes place. The omasum seems rather a means of sustaining the groove during rumination, and a protector of the abomasum from the influx of coarse food particles, than a reservoir in which any important quantity of the food is stored up for a time. These deductions from anatomical facts are confirmed by several experiments by *Flourens* on living animals. Other theories of rumination are:

I. That food handed from the rumen into the reticulum is by it moulded into a pellet and handed into the œsophagus, and that when it again descends it is soft, and, therefore, enters the omasum, for it passes over the floor of the groove without separating the pillars (Dauberton).

II. That the food for remastication is driven into the

œsophagus by the rumen, and returns into that compartment after its second descent (Duverney, Simonds, Bourgelat, &c.).

III. The groove acts as a band, grasping matter which it takes from the rumen (Perrault).

IV. In formation of the pellets a special apparatus is employed, which consists of the groove, and the openings into the œsophagus and omasum *closed* (Flourens).

V. Energetic contraction of rumen and reticulum forces food into the enlarged extremity of the œsophagus, which "nips off" sufficient for a pellet (Colin).

Contraction of the diaphragm and of the abdominal walls are adjuncts to regurgitation. The pillars of the diaphragm of the ox are specially arranged; this peculiarity seems to favour rumination by preventing compression of the œsophagus when the diaphragm contracts. True gastric digestion in the ox presents no special features. Chymification is rapidly performed. According to Tiedemann and Gmelin the omasum secretes an acid juice, which materially assists in the conversion of the albuminoids into peptones. We can well understand that, to enable the gastric juice to act efficiently, a large amount of the profuse alkaline salivary secretion must be drained off, and the mass may thus be strongly impregnated with acid throughout by the action of the omasum.

The *rumen* is subject to various disorders and lesions, some of which are very important from a practical point of view. They sometimes necessitate operative interference, and are very liable to recur.

Tympany—"Hoven" or "Blown"—Distension of the Rumen with Gas, known also as *fog sickness, dew blown,* and under numerous provincial terms. It is designated by the French *météorization,* and is one of the most frequent affections of cattle.

Symptoms.—The patient commences to exhibit signs of uneasiness, rising and lying down frequently, and kicking at the belly, for this disease is very painful. The rumination is suspended and food is refused. There is depression, protrusion of the muzzle, projection

and congestion of the eyes, increased flow of saliva, and moaning at expiration, differing from the grunt of pleuro-

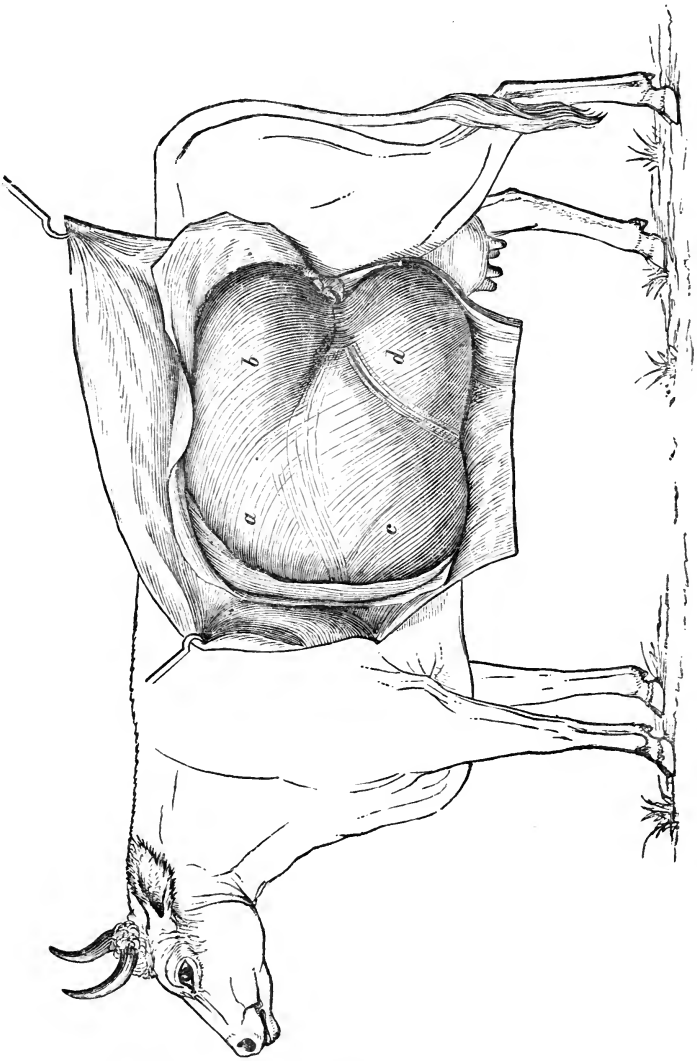


FIG. 50. The rumen exposed in position. The organ is in a state of distension, and its divisions are indicated by the letters *a*, *b*, *c*, and *d*.

pneumonia in being more prolonged. The back is arched,

and there is marked swelling of the left side, which, if percussed, is resonant like a drum, whence the name tympany. Distension of the rumen impedes the action of the diaphragm, and increases unduly its bulging into the thorax. In some cases there is ejection of the contents of the viscus. Almost always there are eructations of gases with a special odour. The bowels do not act, and the interference with the breathing increases in severity; also the brain becomes involved to a certain extent, the animal loses sight, staggers, becomes insensible, and falls. Death occurs either from rupture of the rumen, or from suffocation, or from absorption of noxious gases. The most recent analysis of the gases generated in these cases is given in the 'American Veterinary Review,' vol. i, p. 100: 74·3 carbonic acid, 23·46 carburetted hydrogen, 2·2 nitrogen. Neither oxygen nor sulphuretted hydrogen could be traced (Reiset). Guérin, however, found 80 per cent. of sulphuretted hydrogen.

The most fruitful cause of this disorder is green food of various kinds; it generally occurs from the voracity with which cattle that have been kept on dry food all the winter consume fresh provender. Hence it is most prevalent in the spring. It results from feeding on any kind of green food, especially that collected when the dew is on the grass; sometimes from turnips, but generally only when these are frosted or rotten. In cases of choking, the mechanical impediment proves the cause. Hoven is present in many cases of disorder of other organs. In some cases of prostration gases are evacuated spontataneously from the lining mucous membrane, but this is very rare. Again, sudden change of diet, of any kind, may cause this disorder, or deficient secretion of saliva may produce the same effect. The latter cause acts as a preventive to redeglutition, since the proper formation of the returning pellet requires liquid admixture. "Hoven" is of two kinds—acute and chronic. The latter depends upon disorders of the digestive apparatus, such as a want of tone of the rumen in particular, due to a similar state of the system in general, and also the pre-

sence of disease of the reticulum. Elimination of gas in the rumen always occurs to a certain extent. The causes of excess in this matter are either dependent primarily on the state of the stomach or on the nature of the ingesta. Fresh green food, introduced in too large quantity, undergoes fermentation, for it is placed under conditions favorable to that process—a temperature of about 100° and moisture. Thus, in the earliest stages, carbonic anhydride is the gas given off; but if these matters remain too long in the stomach they decompose, and then sulphuretted hydrogen is eliminated. Probably this gas is given off in extreme quantities at once, after ingestion of rotten turnips. Considering the conditions of the full rumen, fermentation must occur in it if its contents are not expelled in due course so that only a small quantity remains, since it seems the organ must never be thoroughly emptied. This residuum, however, is subject to almost perfect renewal with each digestion in consequence of the churning action, which ensures thorough intermingling of the gastric contents.

Torpidity of the rumen occurs in debilitating diseases—in fact, in most disorders of the ox; also from introduction of excessively cold material, as turnips which are frosted, and grass covered with hoar frost. The gas can escape in two ways—through the œsophagus or through the omasum—but this may be prevented by œsophageal spasm—or by contraction of the rumino-reticular sphincter. The latter probably occurs as a result of ingestion of cold food, but when green food has been passed into a torpid rumen this probably accumulates unduly about the opening of the first and second stomachs, and thus prevents both the ingress of medicaments and the egress of gas from the deeper parts of the cavity of the rumen. In some cases of difficult parturition considerable hoven is present, and delivery does not take place until this state is relieved.

Treatment.—The practitioner called in to a case of hoven probably finds the animal in danger of suffocation from extreme abdominal distension. When a fatal result threatens every minute it is generally advisable to

Puncture the Rumen as a preliminary and palliative measure. It must be clearly understood that this departure from the rule, "Remove the cause and the effect will

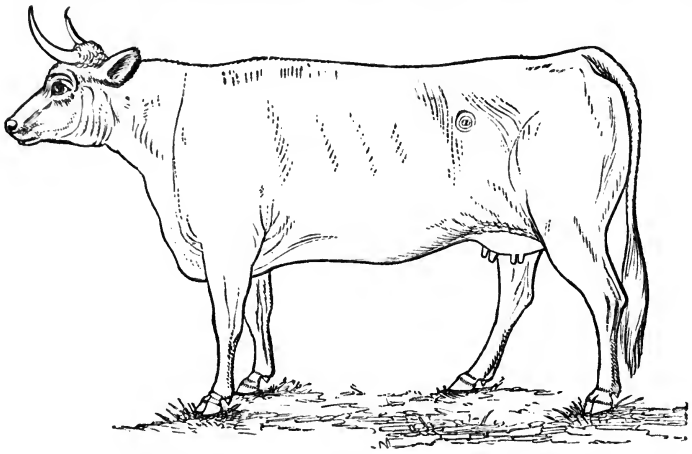


FIG. 51.—The seat of puncture of the rumen (*a*).

cease," is only an expedient for gaining time for further measures.

FIG. 52.—Trocar and Canula.

The instrument used is the trocar and canula, which is large, about eight inches long and nearly half an inch in diameter. The puncture should be made on the left side, at a point equally distant from the point of the hip, the last rib, and the lumbar transverse processes (see Fig. 51). The tube is then opened by removal of the trocar; the canula may be left in as long as required, and retained by string. Sometimes the rush of gas suddenly ceases before much has escaped; this is due to solid matter having accumulated round the end of the canula. This must be removed by insertion of a probe or movement of the canula. The length of the tube allows for a certain amount of collapse of the rumen after puncture. "Sucking calves are occasionally subject to hoove. Little more

will be necessary in this case than the introduction of the probang. This distension of the rumen arises from some accidental and temporary cause, and there is rarely any continued manufacture of gas within the stomach; some calves become blown from the trick they frequently have of sucking each others pizzle or ear" (Youatt).

In cases of choking, the probang must next be passed, and every obstacle removed. The tube should be made to penetrate into the rumen, and thus tend to remove mechanically any food accumulated round the cardia. Through it, or directly through the cannla, may be introduced some agent which will stimulate the torpid rumen and chemically condense the gases pent up in it; sometimes these will rush out with force through the probang and the relieved organ regain its tone; more often medicinal agents are required. Compounds of ammonia are most valuable in these cases. Liquor Ammoniæ or the Spiritus Aromaticus (of course largely diluted) form with the carbonic anhydride the ammonium carbonate, which is a useful stimulant. "Chloride of lime" is usually to hand, and acts on the carburetted and sulphuretted hydrogens which are present, forming hydrochloric acid. Any excess of the bleaching powder acts as an arrester of putrefaction and fermentation. This agent is available, therefore, either in the early or late stages. The sulphites and hyposulphite of soda also serve to condense the gases which are causing over-distension. Some farmers practise throwing cold water over the abdomen of an animal which is "blown;" this, of course, acts by causing reflex contraction of the rumen, which might lead to rupture if the openings were occluded and thus the escape of gas prevented. Cases have been relieved by means of the stomach-pump, cold water being thrown in through the probang; nature herself adopts the method of relief by vomition in some cases. Almost always eructations take place, but the amount of gas thus removed does not equal in amount that which is constantly being set free. The administration of stimulants and removal of accumulated gas generally requires

to be accomplished several times, and early administrations of a cathartic dose will facilitate perfect recovery. In chronic cases, small doses of nux vomica have been recommended, as especially valuable where the disorder depends on defective nervous energy. In other instances, iron or vegetable general tonics are required, but the most important indication is to regulate the diet as a preventive means both for animals which have suffered from this disorder and those which have not. It is very liable to recur.

Impaction of the Rumen—*distension of the rumen with solid matters—plenalvia—" grain-sick "—" maw-bound "* —a pathological condition similar to that last noticed, but differing in the urgency of its symptoms, and in its method of treatment, depends upon the introduction of solid matters in such amount as to paralyse the organ by over-distension. Some foods seem more liable to produce this disorder than others, as grain food, chaff, potatoes; but anything particularly palatable to the animals may be thus taken in excess if placed too freely before a beast.

Symptoms.—As in tympany, there is swelling on the left side of the abdomen. The animal is dull and suffers pain, the bowels are confined, and the pulse small and quick; but these symptoms are less urgent, appear more gradually, and the abdominal swelling is not resonant on percussion, and it pits on pressure, and when the animal lies down it does so on the right side. Also eructations do not occur. The symptoms, later on, resemble those of hoven, which sets in as a complication; then the respiration becomes affected; there is a moan on expiration, grinding of the teeth, persistent standing, with muzzle protruded and arched back; or Alvitis, *inflammation of the rumen,* may set in when the general febrile symptoms for the first time manifest themselves, in addition to those already present; also the animal will manifest pain when pressure is made on the left side.

Treatment must be directed to the removal of some of the impacted food-mass, and also to restoration of tone to the over-distended walls of the viscus. To increase our knowledge of the conditions in the case we must pass the

probang, by which means any gas present may be drawn off, and to a certain extent the degree of distension may be determined. Cases have been cured by throwing in water, whereby vomition is brought about, but this is not always successful. When the distension is not excessive a stimulant with a cathartic must next be administered. Oil is particularly useful to lubricate the passages and soften the masses of food. Manipulation applied externally over the food-mass is sometimes beneficial, and exercise increases tone, but its influence on the rumen is doubtful. These measures failing, before the animal begins to sink exhausted, or the brain become congested, or alvitis supervene, *Ruminotomy* (*"paunching"*) must be performed. The animal is placed with the right side against a wall, just at the end, so that the tail may be held to the right. The nose is held, and pressure on the left shoulder and hip prevents the patient from moving too much to the left. An incision is then to be made about the seat of puncture of the rumen, and carried directly downwards for about six inches. This first incision is made through the skin and outer layer of muscle; the inner layer and peritoneum must then be divided, and so the rumen exposed. A slight incision having been made in this above, and the edges grasped with hooks, they may be either retained in firm grasp by means of the hooks, being drawn through the wound in the abdominal wall as the incision in the rumen is prolonged downwards, or the two wounds may be stitched together temporarily. In the latter case a handkerchief may be introduced through the wound and spread out over the lower part, on which any droppings of ingesta may fall. With his hand the operator then removes the accumulated mass until only a small quantity of soft material remains in the organ. It is also advisable to ascertain the state of the reticulum and omasum as much as possible. Some then inject a stimulant cathartic dose into the organ, but this, when necessary, can be given through the mouth. The wound in the rumen must then be closed by carbolised catgut sutures, care being taken that the

edges are *inverted*. The muscular wound may be retained also by catgut, or, preferably, metallic sutures, the ends of which protrude through the external wound, which is then similarly closed. Where feasible the operation should be performed under the carbolic spray. The wound generally heals readily, the rumen becomes attached to the abdominal walls in most cases, therefore it is advisable, after the operation, to fatten the patient for the butcher as soon as possible. Sometimes it is found necessary to reopen the wound, as in a good case recorded by that able and respected cattle pathologist, Mr. John Steele, of Biggar, in the 'Veterinarian,' 1834, p. 98. After-treatment consists in administration of stimulant aromatics and feeding the animal on soft diet until the rumen has thoroughly regained its tone. When alvitis has set in the chances of recovery are materially reduced, and after the operation of ruminotomy, which must be resorted to, even though the conditions present render it an affair of desperation, external stimulation and administration of febrifuges internally must be persevered in, while the cathartic dose is assisted by enemas, and the general measures of nursing are to be carefully attended to. Fortunately, alvitis is rare. It is interesting to note that peritonitis of a diffused character seems never to result from this operation, unless the matter from the rumen has been allowed to escape into the peritoneal sac. It is wonderful to see the extent to which the peritoneal membrane of ruminants may be operated on with impunity.

Rupture of the Rumen sometimes takes place as a result of primary hoven or gaseous accumulation in cases of plenalvia. Sometimes wounds penetrate the walls of this organ, and it is possible for rupture to occur as a result of injury from the animal falling in an advanced case of plenalvia. Puncture of its walls may be due to ulceration resulting from the presence of irritant foreign bodies, which act either chemically or mechanically. In these cases escape of partially elaborated food takes place, either into the main peritoneal sac or into omentum major. The result is peritonitis, but before this sets in the animal

may die, the symptoms being those of abdominal pain and collapse.

Foreign Bodies in the Rumen and Reticulum are of various kinds. The most extraordinary are those which the animal has ingested in consequence of depravity of appetite. Sometimes these are large and of peculiar form, since they become variously encrusted. These give rise to indigestion, such as is frequently seen in cattle, irregular rumination, increased depravity of appetite, and an unthrifty condition; sometimes also vomition is present. They are also said to act deleteriously by becoming entangled in the œsophageal groove and the stomachic openings. Sharp bodies penetrate the walls of the viscus, and their course is indicated by inflammatory changes. This is found to be the case most frequently in the reticulum. Passage of needles, &c., from that stomach into the heart has been already noticed. Vomition, tympany, and symptoms of abdominal pain, as well as intermittent hoven and general signs of anæmia, are present in these cases.

Parasites and calculi (especially those consisting essentially of hair concretions) are sometimes found in the rumen. Of parasites *Amphistoma conicum* is remarkable as being somewhat similar to the papillæ in the deep saccules of the rumen. Certain Tæniæ have been found in this cavity. Also *Cysticercus tenuicollis* is sometimes found attached to its outer surface.

"Hair Balls" are of considerable interest. Cattle when in health delight in licking themselves or one another, and the roughened condition of their tongues causes a considerable removal of hairs which are swallowed, and in the rumen are intermingled with food particles and fibres, with which they are bound together by mucus. The movement of the stomach give these a rounded form, and a definite spiral direction to the hairs. When several are present they assume the form of polygons with rounded edges. These concretions are light and vary much in size. Some have been observed which weighed between six and seven pounds. Generally they weigh only a few ounces. Their

structure is laminated, and almost invariably they are arranged around a small piece of metal or a stone which has been swallowed as a nucleus. These bodies have little pathological importance; they have been known to choke an animal during regurgitation. They are passed up into the mouth, and thus rejected when of moderate size. It is doubtful if they ever pass from the rumen into the omasum. Probably they do not, though "hair balls" are found in the abomasum, as we shall see. Sometimes they are coated with a thin layer of lime salts, with which they are more or less impregnated throughout. Finally, they are sometimes present in very young animals. They are termed Ægagropiles.

Hernia of the Rumen and Reticulum sometimes occurs, and *fistulæ* of the rumen have enabled Continental observers, more especially Flourens and Colin, to accurately determine the conditions of this viscus and its contents during rumination.

Impaction of the Omasum, known as "*Staggers*," "*Vertigo*," "*Fog sickness*," "*Clue bound*," &c.—This is by most practitioners considered a very frequent and serious disorder, but Professor Williams has thus expressed himself in his 'Principles and Practice of Veterinary Medicine:'—"This is a very popular disease, some writers ascribing every case of constipation to impaction of the omasum, basing their conclusions upon the fact that the contents of this viscus are in a dry and hard condition when examined after death; but seeing that this is its natural state, and that, when animals have died from what appeared to be obstinate constipation, its contents have been found moister than natural, I have arrived at the conclusion that what is supposed to be impaction of the third stomach is in reality an inflammation of the mucous membrane of the true stomach — abomasitis, or true gastric inflammation." Undoubtedly the professor is right in denying that all cases of constipation depend upon this condition, and he has done the profession good service, by drawing attention forcibly to the fact that the hard condition of food between the laminæ of the omasum

and a separation of its epithelium on the surface of the cakes are neither of them solely due to inflammation or impaction. The condition of the contents of the omasum *post mortem* depends very much on previous conditions of the viscus and the nature of the diet. If the organ has been inactive food material will accumulate in it, as in any other inert saccular dilatation of the œsophagus, and that to a very great extent, and the matter accumulated will not be subjected to such firm muscular contraction as is always supposed to occur and make the contents hard. Rigor mortis, on the contrary, tends to bring about this contraction, and, no doubt, solely on this, a dry condition of the contents of the omasum often depends. Nevertheless, we must allow that impaction of this organ occurs as a result of the consumption of indigestible materials, such as autumn grass which has been allowed to remain in the pasture until spring, straw, and washed hay, also the coarse and indigestible herbage sometimes found in old pasture with many trees about. Astringent herbage, as heath, has a somewhat similar effect.

The *Symptoms* found in these cases are :—At first the frequent passage of small quantities of hard glazed fæces, succeeded by obstinate constipation. The patient stands persistently, and can scarcely be moved. Its pulse is hard and frequent. It is dull, and evidently suffering from acute abdominal pain. There is the grunt indicative of this, which has caused the disease to be mistaken for pleuro-pneumonia. General signs of disorder are also present. Later, the brain generally becomes affected, and the symptoms are considerably modified, there being muscular tremors over the surface of the body, staring condition of the eyes, which are insensible to light, staggering gait, terminating in paralysis, or wild rushing about, protrusion of the tongue, which becomes much swollen. Tympany often occurs as a complication. The urine, too, is sometimes mingled with blood. Youatt has a theory that the hard distended omasum pressed on vena portæ against the liver, and thus prevented return of blood from the intestines, which brings about a determina-

tion of blood to the brain, but by most observers the nervous complications are considered analogous to those seen in "Stomach Staggers" of the horse. Sometimes the disease of the omasum assumes an inflammatory character, and the general signs of fever are marked. Omasitis does not seem to take place under any other circumstances.

On *post-mortem examination* a congested condition of the lining membrane of the abomasum and duodenum is generally found, which may seem to support Professor Williams' view, but, on the other hand, it is urged that this depends on the large cathartic doses generally resorted to in the treatment of these cases. Ecchymoses sometimes may be noted in these congested parts as well as in the omasum, where the vascular structure of the laminæ is exposed by separation of the epithelium in layers on the impacted cakes of food, which may be either hard and dry, or moist and soft. There is sometimes congestion of the brain and its membranes, and of some parts of the spinal cord. Cases of this disorder may last a few days, or for two or three weeks.

Treatment.—Bleeding has been recommended, and seems advisable when the brain is markedly involved. The majority of practitioners rely upon strong cathartic doses, especially hydragogue agents. Thus, gamboge is suggested as a valuable remedy in this disorder. Croton oil is preferred by some. Generally, however, a mixture of sulphate of magnesia with aloes solution is used, the latter being supposed to involve the stomachs in the catharsis, whereas Epsom salts act almost solely in the bowels. We are recommended to repeat the dose in twelve hours, if no appreciable effect has resulted, and to give oil as an adjunct in the interval. We must consider that we have either a relaxed organ to restore to tone, or, less frequently, an organ in a state of spasm, to deal with. Thus, we can easily understand how Professor Strangeway's treatment of oil with sedatives, followed by sulphate of magnesia, quinine, and sulphuric acid, proved beneficial in restoring the tone of the omasum, after lubricating it and the other

parts of the œsophageal passage with oil, and stimulating them with a mild cathartic. Such treatment seems most satisfactory in simple impaction, and where actual inflammation is present should be supplemented by external stimulation. Enemas ought to be regularly administered and the animal carefully nursed. The thirst which is present in the inflammatory stage may be relieved by nitrated water *ad libitum*.

A remarkable case of *atrophy, with almost total disappearance of the laminæ of the omasum,* was recorded in the 'Veterinarian,' 1833, p. 454.

Abomasitis, *Inflammation of the True Stomach.*—If the views of Professor Williams are accepted, the account of the impaction of the omasum as given above is to be transferred to this heading. In this view he seems to follow and coincide with Professor Dick's opinions. It is certain, however, that we get abomasitis in some cases of poisoning, and according to some authors, an idiopathic form, in which no such symptoms of cerebral disorder are present, only those of acute fever, severe abdominal pain, and "a curious stretching out of the fore limbs, with the brisket almost to the ground" (Youatt). The *causes* of this, apart from poison, are not well ascertained, for certainly the idiopathic form is very infrequent.

Post-mortem lesions comprise congestive redness, with considerable production of flaky mucus, and sometimes blood, intermingled with the contents of the organ, the duodenum being generally almost equally involved.

In this mucus are often found "hair balls," which consist almost wholly of hair matted together by mucus. These may have passed directly from the reticulum through the omasum, or during redeglutition have made their way at once into the fourth stomach; or, as is perhaps more probable, have been formed by the churning action of the stomach in which they are found.

We find one case of *Impaction of the Abomasum* on record. We can easily understand that the complex and thorough preparative apparatus at the lower extremity of the œso-

phagus, will prevent such a disorder from being of frequent occurrence. Occasionally the omasum and abomasum become displaced. Thus, in the 'Edinburgh Veterinary Review,' vol. iv, p. 139, a case is recorded in which both these organs became dislocated into the chest. *Rupture of the Abomasum* also occasionally takes place, due to external injury, or, as in the case recorded in the 'Veterinarian,' vol. xvi, p. 269, to extensive ulceration.

Parasites are sometimes seen in this organ, and *Rupture of the Blood-vessels of the Stomach* sometimes occurs in the ox.

Various forms of INDIGESTION, of ill-ascertained cause, which may be included under the headings bulimia, pica, and obscure chronic disorders of the digestive apparatus, are not unfrequent in cattle. Certain nervous conditions, as those which accompany the pregnant state, sometimes seem the sole cause of these, whereas, in other cases, when it is deemed advisable to hand the animal over to the butcher, or gradually increasing anæmia leads to death, on post-mortem examination are found organic changes of long standing and unusual characters, such as cancerous disease of the organ and *Stricture of the Pylorus*. In the latter disorder there is gradual emaciation and a fœtid condition of the breath; it is not infrequent in cattle. Cruzel attributes one form of indigestion to too frequent ingestion of too large draughts of water.

Perhaps some of these cases of indigestion are due to dyspepsia (pica), induced by irregular and bad feeding, want of exercise, exposure, or deficient sanitary arrangements. Sometimes also by the presence of parasites or other foreign bodies. The animal becomes unthrifty, as denoted by the dry, harsh, staring coat, depraved or irregular appetite, irregular and imperfect rumination, a tendency to tympany, flatulence, and torpidity of the bowels, a tucked-up appearance, and rapid loss of flesh. In such cases treatment must comprise change of diet and of general surrounding conditions, and the administration of stimulant tonics after the bowels have been cleared out by a brisk

cathartic dose. Small doses of liquor arsenicalis are admissible.

In dealing with the effects of irritant poisons, we shall have to touch upon *Gastro-enteritis* as it especially occurs in adults, but there is a disease known under this name to which calves are subject. In the young animal the abomasum is the largest of the stomachs, and it is only after weaning that the rumen comes to so greatly exceed the remainder of the gastric mass. The milk accumulates in the fourth stomach and undergoes coagulation, after which it is digested. For the proper performance of these processes it is necessary that the milk be taken in moderate quantity, and be of good quality.

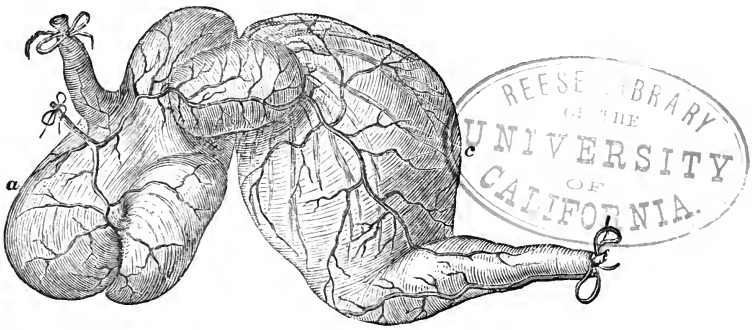


FIG. 53.—Stomachs of the calf. *a*. Rumen. *c*. Abomasum (considerably the larger). (Simonds.)

Pail-fed calves are apt to obtain too much milk, also animals brought up by a foster-mother are apt to indulge in excess in this respect, and disorder is promoted by want of the healthy stimulus which exercise is to digestive processes. Thus, the stomach becomes laden with a hard mass of curd, which proves a source of irritation, and causes death from the effects of impaction. Inflammation sets in, extends to the intestines, and thus gives rise to an acrid irritating discharge, whence the disorder is termed "*white scour*" or "*skit.*" Another form of accumulation of material in excess in the abomasum is seen in partially weaned calves, when the first and third compartments have not been able to properly prepare hay

and such other food material for digestion in the true stomach. Here, as often in the former case, obstinate constipation sets in. Usually in such cases as are characterised by diarrhœa, resort is had at once to the sheep and calves' cordial (see page 81). This is not always good treatment. It is preferable to first administer oil, whether constipation or laxity is present, and it has been found that alkaline drinks in considerable quantity are most useful in breaking up the mass of curd and also in checking the excess of acid and acrid secretion which gives rise to disorder of the bowels. At the same time carminative agents may be given to promote the digestive processes. When the constipation gives way, and as is sometimes the case, is succeeded by profuse diarrhœa, it will still be advisable to give cordials to assist these natural processes, and at the same time stimulant tonic doses will prove beneficial. As a change of diet, Dobson's recommendation of substituting linseed gruel for half of the allowance of milk may be adopted.

The *Intestines of the Ox* are from twenty to twenty-two times the length of the body, and entend for an average distance of 150 feet, of which 120 feet are small. Though thus half as long again as those of the horse, they are much smaller in calibre. The duodenum is short; the floating portion of the small intestine is arranged along the free margin of the mesentery, being here thrown into complex convolutions by the sudden considerable increase in extent of the mesentery close against its free margin. Besides the usual structures (the mesenteric glands being remarkably near the free margin rather than the root), the mesentery contains the major portion of the large intestines.

The *Cæcum* is club-shaped, largest at its free extremity, and gradually tapering until it gains the size of the commencement portion of the colon. It is not puckered, for it is devoid of muscular bands. Also it hangs freely downwards and somewhat backwards.

The *Colon* is double throughout the greater part of its course, and arranged in a spiral manner between the

layers of the mesentery. It is very small, devoid of puckerings, and has no special peritoneal investment. It

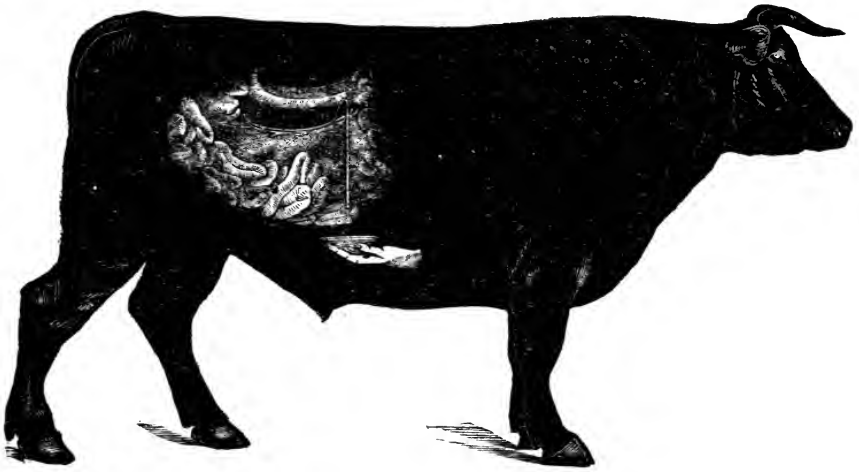


FIG. 54.—The position of the intestines of the ox, with the method adopted for the collection of chyle for physiological purposes. (From Colin, 'Physiologie des animaux domestiques.')

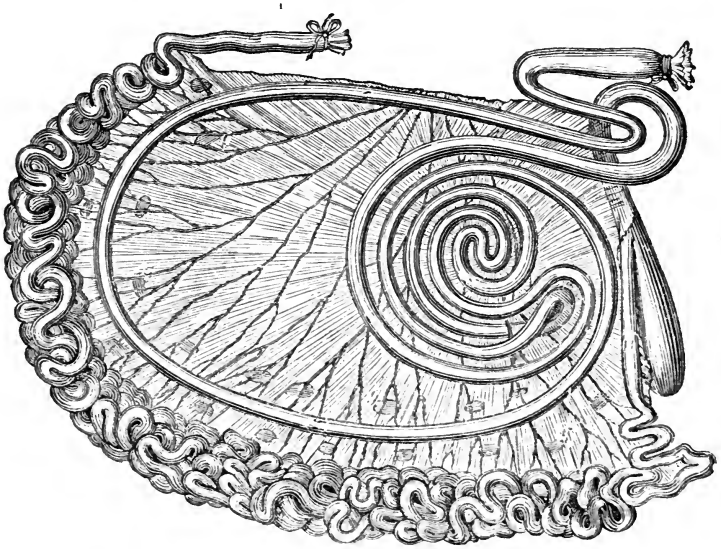


FIG. 55.—Intestines, large and small, viewed from the left side.

enlarges somewhat to terminate in a fairly long and straight rectum.

The glands of Peyer of the ox are elongated and very large, ranging from four inches to twelve inches in length, and from about half an inch to one inch in width. Thus we see that food which has been thoroughly elaborated in the stomach passes into a long but narrow passage, not very capacious, but arranged so as to secure contact of the contents with a very considerable extent of surface, so that thorough absorption of useful matters takes place. However, at the end of its passage through the intestine useless excreted matter is expelled as fæces, having about 75 per cent. of water, therefore markedly pultaceous, varying in this respect according to the nature of the diet and method of feeding. As com-

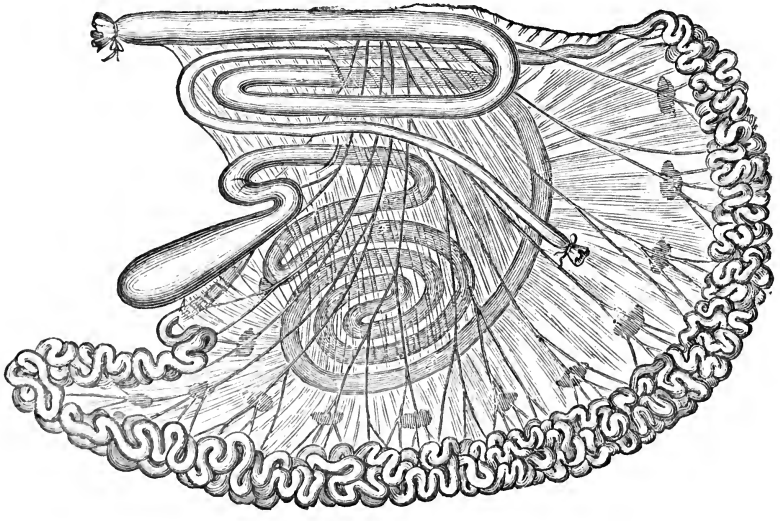


FIG. 56.—Intestines, large and small, viewed from the right side.

pared with the intestines of the horse, those of the ox are less important digestive organs, and are, therefore, not so frequently involved in disease; their disorders are not so urgent. We have already seen how numerous

and fatal are the diseases of the stomachs of the ox. The ordinary seat of indigestion in the horse is the bowels; in them gases are liberated and tympany occurs, in them impactions take place and ruptures, they also are generally the parts dislocated in abdominal herniæ. We find that these lesions and disorders affect the stomachs of the ox. Lastly, improperly prepared food, or alimentary matter in excess or of bad quality, acts on the stomachs of the ox, on the intestines of the horse.

Colic, defined as "any abdominal pain not due to inflammation," is capable of more exact limitation. It is distinguished by certain symptoms, which are more or less marked in other abdominal disorders, and are known as "colicky pains." The animal ceases to feed and ruminate for a time, and the pulse during the paroxysm becomes full and bounding; moaning, grinding of the teeth, striking the belly with the hind feet, extreme restlessness, indicated by movement and constant rising and lying down, are present, and the animal may turn his head round, and bring the muzzle against the seat of pain; there is sweating and frequent passage of urine in small quantities, or of small dry portions of fæces. Herniæ of various kinds, strangulations, and impactions of the bowels, as well as certain disorders of liver, stomach, or urinary apparatus, may be the cause of this. In such cases other signs may be present, and enable us to complete our diagnosis. But, failing these, we may attribute the signs of disorder to Simple Colic, *spasm of the bowels*. Then the pains are paroxysmal, and during the intervals the patient seems in thorough health; but the pain is very acute while it lasts. This is sometimes brought on by changes of diet, the passage of imperfectly prepared food from the stomach, and, it is said, ingestion of very cold or hard water. Reflex colic may occur, but we are not assured of this; indeed, spasmodic colic is not frequent in the ox, for obvious reasons. In cases of this nature a saline cathartic; with stimulant cordial agents, should be at once administered. This will generally prove effectual, and no further resort to antispasmodics

required; if necessary, these may be given, but an obstinate case is probably more complicated than was at first supposed. *Flatulent colic* also is not frequent; it may be diagnosed from the spasmodic form by less urgency, but more persistent character of the symptoms, by gaseous eructations and emissions of flatus *per anum*, and sometimes by tympanic distension of the right side of the abdomen. In such cases ammonia stimulants must preferably be administered with the carthartic dose. The patient should be walked about, and friction applied to the right side. These seldom prove very obstinate cases. We insist on the cathartic because it tends to remove the cause, and its administration is not open to the objections urged against prompt adoption of such a course of treatment of colic in the horse. In all cases of abdominal disorder manual exploration of the rectum should be made, and enemas utilised to facilitate supervention of catharsis. We must now proceed to some other causes of colic.

Impaction, or Distension with Obstruction, of the Bowels may be due to calculous concretions, bodies which have gained entry through relaxed vigilance of the gastric protective apparatus, also tumours of various kinds, among which may be enumerated the enormous swellings of the mesenteric glands of a case, of which Mr. Brown of Melton gives an account in the 'Veterinarian' for February, 1830. The tumour weighed 160 lbs., and had a scirrhous character. In one case a potato became impacted in the colon ('Edinburgh Veterinary Review,' vol. iv, p. 212); in another, a tumour of a non-malignant character was found in the duodenum ('Veterinarian,' vol. xxii, p. 617).

Calculi in the intestines are neither large, solid, nor frequent. They consist of concentric layers, and are found in the large intestine; they are neither so large nor so prejudicial as those of the horse.

Intussusception, or *Invagination*, is the folding of one portion of intestine within the canal of a preceding or succeeding portion, the result of simultaneous distension of the investing, and spasm of the enclosed portion with irregular or suddenly reversed peristaltic action. It is rare

in the ox, both on account of the special structural peculiarities of the intestines, and because of the comparative rarity of colic, of which it is a sequela. The cæcum is the most frequent seat of intussusception in the ox; it may become completely fixed in the colon. The mesentery is in some cases torn away from the involved part, in others remains intact.

Symptoms are those of colic which lose their intermittency without access of fever. The patient retains the recumbent position, looks at and strikes the flank, and either there is obstinate constipation or a discharge of blood per anum. The rectum seems very liable to become involved in this manner. The portion of bowel being strangulated and gangrenous when death ensues, but cases have been known in which the enclosed part sloughed away and recovery occurred.

Treatment.—If the presence of a lesion of this nature is suspected a tobacco-smoke enema may be resorted to. In other animals artificial tympany thus induced has been found useful against intussusception. Stimulant and anti-spasmodic doses also may prove effectual against the early and rapid prostration and the spasm which is present.

Prognosis, however, is unfavorable.

Volvulus, Ileus, or *Twist of the Bowel,* is another sequela of colic. In it the bowel is twisted upon itself or one portion of the intestine has passed round another, resulting in obstruction and strangulation. There is nothing about the symptoms which is diagnostic of this condition from that last mentioned. It very seldom occurs in the ox, but when it does so a small knuckle of bowel only may be involved, and thus no obstruction to the intestinal canal take, place. Exploration per rectum may prove useful from a diagnostic point of view in these obscure abdominal affections, and Professor Walley's paper on the "Differential Diagnosis of Abdominal Affections" should be carefully perused by all members of the veterinary profession ('Veterinary Journal'). *Laparotomy* might be resorted to in extreme cases of this kind. It is recommended by continental

writers, and the ox, of all animals, is least liable to be seriously affected by it. The operation should be performed on the right side opposite the seat of incision in ruminotomy; and similar measures taken for closure of the wound, and after treatment. Pedunculated fatty tumours hanging from the outer surface of the intestine may be twisted round the bowel. These are enlarged apendices epiploicæ. Most often the volvulus is the result of violent struggles during abdominal pain.

Hernia is protrusion of an organ from its natural cavity either into another cavity of the body or into an accidental pouch. Abdominal herniæ are the most frequent in the ox, as in other animals. They may be *congenital*, present at birth, or *acquired*, when they appear suddenly later in life. Are *reducible* or *irreducible* as the organ can or cannot be returned to its proper place; *strangulated* when it is subjected to pressure, and so becomes disordered; and *recurrent* when, having been returned, the part again becomes displaced. According to the nature of the contents the hernia is a *gastrocele, enterocele, epiplocele, cystocele;* the stomach, bowels, omentum, bladder, respectively being displaced. The opening through which the herniated viscus passes varies in position, and thus we have the ventral, inguinal and scrotal, umbilical, mesenteric, and phrenic forms. Sometimes this is a natural opening, sometimes the result of giving way of the tissues in consequence of injury. The parietal layer of the peritoneum is forced out before the viscus, forms the serous sac of the hernia, and becomes vascular, thickened, and subsequently indurated. It frequently contracts adhesions with the peritoneal coat of the viscus. In the ventral and umbilical forms the skin yields to gradual pressure, and thus seems too large after reduction of the hernia. In chronic cases the passage through which the organ passes becomes thickened and rounded at the margins, and assumes a circular figure. Peristalsis of the viscus may force more of it into the hernia sac, or the imprisoned part may become overladen with contents, or there may be swelling of the neck of the tumour. Either of these conditions leads to strangulation, whereby the imprisoned

portion becomes extremely congested, because of prevention of the return of blood from it; gangrene results, and may involve the peritoneum, in general extending from the hernia as a centre. Internal herniæ may exist for some time without causing any appreciable inconvenience, except when they become strangulated. When superficial, as in the umbilical and ventral forms, they produce a swelling which is soft, elastic, and often disappears as a result of properly applied pressure. The tumour communicates a diagnostic impulse to the hand when the animal coughs. Sometimes the characters of the tumour differ from those above described, as when the omentum is the part imprisoned; then the swelling is plastic, lobulated, and gradually disappears on pressure. These lesions are mainly attributable to exertion and injuries. Thus they occur as a result of straining during parturition, constipation, or coughing. The symptoms of strangulation are those of acute abdominal disorder, stamping, kicking the belly, rolling, and violent straining, whereby a contracted state of the rectum, which prevents the entry of the hand, is produced (this has been thought to be diagnostic), also general or local perspirations, rapid breathing, and a quick, hard pulse. When gangrene supervenes we have sudden cessation of the pain, anxiety, running down pulse, marked fall of internal temperature, and extreme coldness of the extremities, and, finally, a delirous condition terminating shortly in death. *Treatment* comprises return of the viscus, and prevention of the recurrence of the hernia.

Umbilical Hernia, Exomphalos, mostly is found in young animals, and is not unfrequently congenital. In older beasts it may result from injury and straining. Sometimes, through want of tone in the system, due to scrofulous and other debilitating tendencies, the umbilicus remains in a relaxed condition after birth, so that the straining of the young animal to expel the hardened meconium *per anum* is apt to cause hernia. We may expect to find this condition also more frequently in animals born prematurely than in those which have passed the full time of utero-gestation. This form of hernia

often is an epiplocele, and enlargement of the abdomen being more rapid than growth either of the omentum major or of the mesentery, spontaneous reduction soon takes place. If it does not the influence of a truss may be tried. This consists of a pad supported by straps, which are fastened over the loins. It is kept from slipping backwards by a back strap, and others passing between the fore legs and becoming attached anteriorly to a collar, from slipping forwards by a crupper. Difficulty may be experienced in keeping this in position, so that other means require to be resorted to; the truss returns the viscus and retains it, and thus removes the cause of

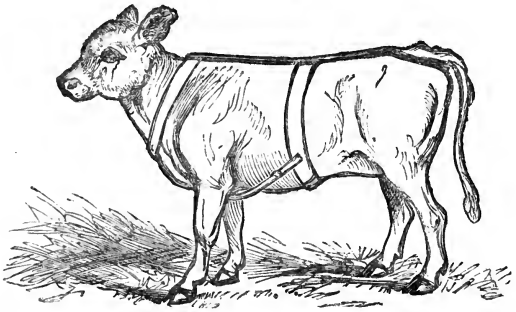


FIG. 57.—Truss applied for umbilical hernia. (Armatage.)

constant distension and enlargement of the umbilicus, which is then free gradually to close. Powerful external

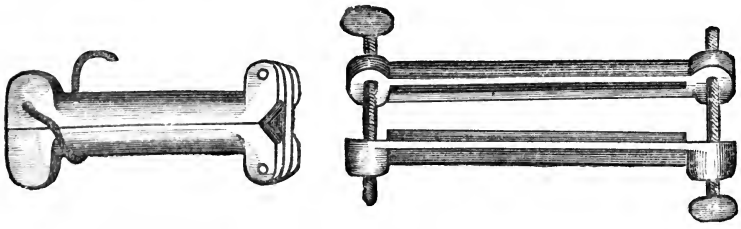


FIG. 58.—Clamps for umbilical hernia. Wooden, and "iron screw." (Armatage.)

stimulation of the tumour, or subcutaneous injection of irritants locally, as tending to excite adhesive inflammation and closure of the umbilicus, have been suggested, but are not often effectual; a preferable method is com-

pression of the skin after return of the bowel, either by clamps or ligature. Two forms of clamps are suggested, the *wooden,* somewhat resembling the ordinary caustic wood clamp for castration, jointed at one end, and arranged for retention at the other by a ligature, and the *iron,* consisting of bars, averaging about seven inches in length, connected together at each extremity by a screw (Fig. 58.) The ligature treatment consists in careful return of the protruded viscus, after which skewers are passed through the loose skin covering the hernia at right angles to one another. A cord is then tied round the skin between the abdomen and the skewers, but too great pressure must not be exerted, for the aim must be to excite extravasation of plastic lymph to block up the umbilicus, and not rapid strangulation of the puckered skin leading to sloughing. An elastic ligature or ring is admirably adapted for these cases, since it accommodates itself to diminutions in size of the peduncle as they occur. In either of these operations the animal must be thrown and kept on its back, which will facilitate the return of the contents of the sac; and as such cases in young animals as are operated on are not liable to be adherent, there is but little chance of injury of the intestines with the skewers, and will be none if proper care be taken.

Ventral Herniæ.—Protrusions of portions of abdominal viscera through ruptures in the abdominal muscular walls. The case is generally one of enterocele, and most frequently results from cattle butting one another and from "staking." It appears suddenly, and the tumours present all the characters of a hernia as above enumerated. These cases are apt to become chronic, and a fibrous state of the margins of the opening occurs. They are not likely to become strangulated, but a hernia is always liable to injury. When small and recent, they may be treated by application of a powerful blister, which will promote repair, but when small and chronic, they may be left alone; but in cows they are liable to become enlarged during parturition. The operation for radical cure consists in careful incision through the skin after return of the contents. The edges of

the rent in the muscles are then to be brought together and retained by metallic sutures. The wound in the skin is to be closed subsequently. In a case of extensive hernia, the sooner this operation is performed the better, for the edges of the muscular lesion will have undergone less profound changes, and therefore lymph will be more readily thrown out. Of course the animal must be cast for the operation, and must be placed in a position varying with that of the hernia. The patient must be kept on soft food, and apart from the herd in a quiet shed, until the external wound has healed. When a ventral hernia is injured, the intestine enclosed may ulcerate with the skin and a *false anus* be formed.

Phrenic, or Diaphragmatic hernia in the ox, is generally a gastrocele. Thus in one case the reticulum and a portion of the rumen passed into the chest. In another the omasum and part of the abomasum (?) In such the symptoms are those of strangulation in general, together with special disturbance of respiration. Sometimes chronic cases of this nature are found in cattle after death. Concerning such, Youatt says, "The attack has been sudden (at some time previously), but the colicky pains have not been violent, they have intermitted, disappeared; but an habitual difficulty of breathing has been left behind, disinclination to rapid motion, fright when suddenly moved, anxiety of countenance, perhaps impairment of condition, and certainly, impossibility of acquiring any considerable degree of condition."

Mesenteric Hernia is passage of a portion of bowel through a rent in the mesentery; it seldom occurs in the ox; is liable to become strangulated, but cannot be accurately diagnosed, in so far as we know at present.

Inguinal and Scrotal Herniæ differ simply in degree. When the bowel—for it is generally enterocele—passes through the internal abdominal ring, and so into the inguinal canal, it is an inguinal hernia, but if it passes through the external ring and enters the scrotum it is scrotal. This form of hernia is frequently congenital, and thus is very likely to disappear as the animal grows

older and the abdominal rings grow smaller, and the inguinal canal is occupied by the spermatic cord after descent of the testis. It is sometimes seen in adults, and is apt to become strangulated. It is by far more frequent in bulls than in castrated males.

Treatment.—In cases of strangulation, attempts may be made by taxis (manipulative means) to remove the imprisoned portion of bowel, traction being applied by the hand in the rectum. This means failing, and it seldom is successful, the animal must be cast and placed on his back to facilitate the gradual return by direct and special manipulation. If this succeeds the animal, if a bull, should then be castrated by the covered operation. But if the hernia is irreducible the constricting portion must be divided with a bistoury, as described in works on the Surgery of the Horse (especially 'Williams' Surgery'). Youatt mentions "a species of rupture, very difficult to be treated, and occurs in cows in an advanced stage of pregnancy. An excessive accumulation of fluid has take place in the womb or calf bed, and the tendinous expansion of the muscles which support the lower part of the belly has given way. The farmer says that the 'rim of the cow's belly is ruptured;' a portion of the womb escapes through the opening and descends into the groin or seems to occupy the udder. Mr. Allison, of Idle, relates a case ('Veterinarian,' 1831, p. 555) in which the head of the calf had been forced down into the groin. The calf was extracted with no great difficulty, but the bowels then descended through the rupture into the place that had been occupied by the fœtus and the animal was irrecoverably lost."

Pelvic Hernia.—"*Gut-tie,*" "*Bound,*" is a form of displacement of the bowel which is seen in certain districts, and is most frequent in mountainous countries; thus it is prevalent in Switzerland. Among English counties, Hereford, Northampton, and Lincolnshire afford the greater number of these. It is seen only in bullocks and most frequently about the second or third year.

Symptoms.—Colicky pains, often of a very acute character, so that the animal alternately arches and curves

the back; in the latter process, stretching the fore legs forwards and the hind backwards, and almost bringing the abdomen into contact with the ground. Moving the hind quarters from side to side, crossing the legs, and a tendency to press the hind parts against some standing object, as a wall or fence. Much pain is manifested when the hand is introduced into the rectum; there is difficulty in inserting it, but when it has been passed in and pressed to the right the strangulated portion may be felt. Throughout the attack the fæces are scanty in quantity, they are sometimes bloody, also there is continuous straining. In addition to the above, there are the general signs of strangulation, which may lead to those indicating that the bowel has become grangrenous.

Cause.—This is evidently a result of castration, and is found to supervene on the "tearing" operation, when the cord remains too long and becomes fixed in the internal abdominal ring, and between this and the brim of the pelvis the bowel passes, pushing the peritoneum before it as the hernial sac. It is supposed that the gradual shortening of the cord as it atrophies causes it to strangulate the imprisoned bowel. Williams considers that it is in some cases due to twisting of the remnant of the cord around the intestine. Working oxen are very liable to become affected, especially when they are on rough uneven ground. This form of hernia may result from strains and intestinal commotions like the other kinds. When the conditions are otherwise favorable the attack seldom, if ever, lasts more than eight days.

Treatment.—Causing the animal to take a "drop leap," and rolling him about on his back after casting have been suggested, and are sometimes effectual. Preferably we may explore per rectum, and having detected the mass of fæcal matter obstructed near the hernia, exert pressure upwards and forwards, and by special manipulative means the adhesion of the cord may be broken down ('Edinburgh Veterinary Review,' vol. i, p. 73).

Generally, however, abdominal section is necessary. The hernia usually takes place on the right side, though it may be on the left. The animal is kept in the stand-

ing posture, with the left side against a wall. An incision is made, large enough to admit the hand, downwards from the point opposite that of puncture of the rumen, and the muscles are first divided; subsequently the peritoneum is perforated, and the hand is introduced and passed upwards and backwards to behind the kidney, where the remains of the cord may be felt and traced downwards. The bowel may be then gently drawn away, but if it does not yield to very mild traction a probe-pointed bistoury must be passed in, and the adhesion of the cord to the abdominal ring divided, to prevent recurrence. This is generally sufficient to permanently effect relief; the colicky pains cease, and a free discharge of fæces takes place. We need not further describe the operation, for the abdominal incision must be closed in the usual manner.

Prolapsus differs from hernia in that the protrusion occurs through one of the natural orifices. The *rectum* is the only bowel which can thus become displaced, and cases of this are not uncommon. The *causes* are, violent straining, such as is symptomatic of the various conditions which cause obstruction of the intestinal passage; also, it sometimes results from parturition throes, or where impediment prevents evacuation of the bladder. After protrusion the part becomes strangulated, assumes a bright-red colour, and then becomes very much enlarged by gelatinous extravasation between the intestinal coats; subsequently it becomes cold and purple.

Treatment.—If possible, remove the cause of straining; then carefully clean the protruded bowel by washing it with cold water, after which apply even pressure over the organ, gradually returning it from the centre. There is no serious objection to diminution of its bulk by scarification. If all measures prove unsuccessful, and the organ becomes purple, it may be amputated, and the edges of the two cut portions of the bowel united together by sutures. Subsequently anodyne agents, as opium, may be given, and the diet be soft for some time. This lesion is sometimes termed *prolapsus ani.*

Torpidity of the action of the bowels is a constitutional peculiarity of some individuals, and it may arise as a result of disease of other parts of the body. More or less marked torpidity is found in fever. This must be distinguished from CONSTIPATION, in which there is a cessation of passage of fæces on account of some impediment, mechanical or organic. Thus, it is a symptom of strictures and impactions of the stomach or intestines, may be due to tumours, either within, in the walls of, or pressing on the bowels; it is a symptom of volvulus, intussusception, and intestinal calculi, and concretions of various kinds, such as fæcal accumulations. The cause should be determined as exactly as possible, and counteracted when this is possible. Fæcal concretions are very rare in the ox. When constipation depends upon organic disease it is liable to recur, unless the animal be fed on very soft food and an occasional laxative given. Relief of constipation is indicated by the passage of hard fæcal masses with a considerable coating of mucus, sometimes also intermingled with a small quantity of blood. If unrelieved, a fæcal accumulation may give rise to gangrene. The following note, after Youatt, seems to show that we are, perhaps, not often sufficiently bold in treatment of obscure intestinal affections of the ox:—"Dr. Cheselden relates a very extraordinary case of healing power, and does not forbid hope, although the intestines may have been injured to a very great extent. 'An ox,' he says, 'was suffering under constipation of the bowels. Thomas Brayer, a doctor for cattle opened the ox in the flank, and took out a great part of his bowels, upon searching which he found that there was a perfect stoppage in the guts, and that the gut was, about the stoppage, putrefied for about three yards; whereupon he cut off so much of the gut as was putrefied, and took it quite away, and then drew the ends of the guts which remained sound, after what was cut off, together upon a hollow keck, which was about three or four inches long, and sewed the said ends of the guts together upon the said keck, leaving the keck within the guts, and then sewed up the hole cut in the hide upon the flank of the said ox.

Within the space of one hour after this operation was performed the ox dunged, and the piece of the keck which the said end of the gut were sewn upon came away from the ox with the dung, whereupon the ox recovered, and lived to do the owner service for several years.' "

We may here discuss the value of cathartics in cattle practice. All practitioners of experience advocate prompt exhibition of a full cathartic dose when a beast is taken ill. Undoubtedly, in the majority of cases, this is good practice. It is useful in all inflammations, except of the alimentary canal, and when this tube is affected symptoms are generally manifested sufficiently long before the inflammatory stage occurs, and so one cause of these disorders is removed, and congestion probably relieved by the timely use of a saline cathartic. Again, the quality or quantity of food ingested is the cause of many disorders. The cathartic generally administered to the ox—Epsom salts—is not so drastic as that given to the horse; and notably, catharsis can be produced with greater facility and more rapidly in the former animal than in the latter. This is probably due to the less complexity and digestive importance of the intestines in the ox. A direct result of it is that in this animal we seldom see *superpurgation*, and when this does take place it must not be hastily checked, but the food must be dry, and the animal protected from exposure. It will seldom fail to cease spontaneously, but too hasty administration of powerful astringent agents might do serious harm. We must remember that cathartic agents may remain in one of the œsophageal compartments of the stomach for a considerable length of time without producing any effect, and when the function of the rumino-reticular sphincter is perverted, as in disease, the whole of a cathartic dose may fall into an inert rumen; it cannot pass from here very freely when the movements of this stomach are irregular. This state of affairs is especially liable to take place when impaction of the omasum tends to obstruct, if it does not actually block up the lower part of the œsophageal passage. In some cases stimulants or other cordial agents will rouse the

rumen to action. The degree to which constipation may exist in the ox, and the large amount of cathartic doses which may be given, are well illustrated in a case recorded in the 'Veterinarian,' 1829, p. 357, by Professor (then Mr.) Simonds. Obstinate retention of fæces has been attributed to fatty deposition around the rectum, since in prize beasts accumulations of this nature are sometimes most remarkable.

Hæmorrhoids—*piles*—tumours in the terminal portion of the rectum or about the anus, are described by Armatage as of occasional occurrence in the ox. They are varicose conditions of hæmorrhoidal or rectal veins. The principal symptoms to which they give rise are pain in defæcation, protrusion of the anus, bloody fæces, the presence of tumours, and often some constitutional disturbance. They depend upon liver disorder or habitual constipation.

Treatment comprises soft diet, occasional administration of laxatives, removal by ligature when practicable, and astringent injections. Such measures, of course, are only palliative. Cruzel describes as "*Irritation venteuse du rectum,*" a disease which he attributes to the frequent egress and ingress of air through the anus, as it occurs in animals which work with their tails elevated.

Diarrhœa.—Frequent evacuation of excessively fluid fæces is a symptom of many disorders, or else is a diseased condition of the lining mucous membranes of the intestines, which is congested and, in some cases, inflamed. The latter state is verging on dysentery, in which diarrhœa when long continued and uncontrolled terminates. The fæces, besides being very liquid, are often highly fœtid, and are expelled suddenly with force. In acute cases there is an injected condition of the lining membrane of the rectum, and tenesmus is a marked feature. Colicky pains may be present. The animal either feeds but little or the appetite is depraved; rumination is irregular and imperfect, the urine scanty, and the patient stands apart from the rest of the herd with arched back and anxious expression.

Causes.—Any irritation of the alimentary canal may give rise to this disorder, thus coarse and badly saved

food, certain acrid plants in a pasture, even excess or sudden changes of food. Sometimes when an animal is turned out after being kept in a stall an attack comes on, also any exposure to cold is a very fruitful cause, since thereby the excretory function of the skin is arrested, and extra work is thrown on the internal organs, lungs, kidneys, and bowels. Sometimes chronic diarrhœa results from long-continued improper dieting, whereby the mucous membrane of the alimentary canal becomes organically altered, and its secretory function perverted. When calves are being weaned they are very liable to become affected in this way, and they have little strength of constitution to enable them to withstand an attack. Indeed, in the majority of cases of obstinate diarrhœa there is a debilitated state of the system which is a result of the flux, but also proves an accessory cause. This explains the obstinacy of the disorder. In diseases of the liver, and it is said also of the pancreas, diarrhœa may be present. When the flow of bile is excessive the evacuations become dark-coloured, watery, and profuse. The presence of parasites is occasionally the cause, but in many cases diarrhœa is merely an indication of blood disease. Thus, this is the case in rinderpest, certain forms of anthrax, and notably of scrofula, when either the mucous membrane of the intestines or the mesenteric glands are affected. Sometimes a relaxed state of the bowels occurs as a critical symptom in disorders, of this "red water" is a notable instance.

On *post-mortem examination* a general anæmic condition is found associated with congestive blush of the gastric and intestinal mucous membrane, and perhaps the organic changes which produced the disorder will be detectable.

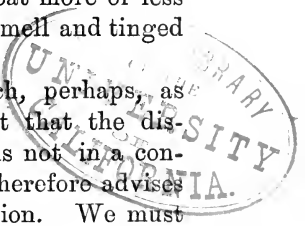
Treatment.—When called to a case of this disease we must determine whether it be due to blood disease or local irritation. In these cases it may even be advisable to promote it by administration of laxatives, preferably oleaginous agents. At the same time the patient should be carefully nursed and stimulant tonics administered internally. In all cases the diet must undergo a thorough change. Where organic disease exists tonics must prove our main resource.

Mild astringents also may be given with judgment. The mineral tonics are very useful in diarrhœa. Where colicky pains are present tincture of opium is most useful. Water must be given in only small quantities, the food should be dry, and starch gruel is an astringent beverage. Where there seems to be a perverted condition of the secretions, the administration of calomel with opium is advisable. Creta preparata is very useful as an antacid. When scrofulous tumours are probably present, but little hope of recovery can be entertained, but iodine compounds and copper salts may be tried. Of the latter, the ammonio-sulphate and iodide are most likely to prove beneficial. In cases of enzootic outbreaks of diarrhœa something more than curative influence is required from the practitioner. The food must be carefully examined. Cakes may contain mustard, the water may be prejudicial, or, lastly, the herbage may be laxative, as in the *scouring lands* of Somersetshire and other parts of the country.

Dysentery—*bloody flux*—is inflammation of the lining membrane of the bowels, accompanied by ulceration. It follows protracted diarrhœa, or may originate as a disease in itself from exposure to cold, coarse innutritious provender, and almost any debilitating influence which acts slowly but persistently. Thus, it is a sequela or culmination of some cases of scrofula, and may be found as a complication in other blood diseases. It may be an after-effect of poisonous agents.

Symptoms.—Sometimes the disease is *acute*, but more often *chronic*. In the acute cases there is fever, together with the signs of slight abdominal pains. The patient stands with back arched, and constantly strains, passing only a small amount of watery matter tinged with blood; sometimes vesicles may be seen in the nostrils (Armatage). As the disease advances signs of abdominal pain increase in intensity, and the rapid emaciation takes place, and the patient sinks and dies from exhaustion. In the chronic form, which generally results from the acute, the symptoms are those of extreme debility (as described under the heading "Anæmia"); the patient is hide-bound, and

often œdematous, in a state of extreme emaciation; with coat dry and staring, mucous membranes pallid, eyes sunken, ears pendulous, dull glazed appearance of the eyes, relaxed condition of the anus, from which there is constantly a slight sanguineous discharge, and the rectum protrudes a little; back arched, pain on pressure of the loins, and staggering gait. Generally, the skin is thoroughly invaded by lice. When fæces are passed in quantity they are found to be highly offensive, sanguineous, glairy, and viscid, in consequence of the amount of mucus present. The animal will remain in this state for a very long time, in spite of the most active measures of treatment; and when at length death occurs from asthenia or slaughter, *post-mortem examination* shows that the stomach may be involved, as well as the intestines. Thus, the abomasum has its lining membrane reddened, with a gelatinous effusion into its substance, and into the submucous areolar tissue. The small intestines are sometimes somewhat similarly affected, but not unfrequently present only a slight congestive blush of the lining membrane. The large intestines are the main seat of the disorder, and show spots of extravasation and ecchymosis, also congestive streaking, giving them a bluish colour, also ulcerations, penetrating the mucous coat more or less deeply. The contents are of an offensive smell and tinged with blood.



Treatment is very unsatisfactory, which, perhaps, as Mr. Armatage suggests, is due to the fact that the diseased membrane of the alimentary canal is not in a condition to allow of ready absorption. He therefore advises treatment by means of subcutaneous injection. We must adopt those measures already recommended for diarrhœa due to organic change, but in chronic cases may use powerful astringents. Astringent enemas should be administered, and, according to some authorities, doses of carbolic acid, chlorinated lime, and hyposulphite of soda, are beneficial. Careful nursing is absolutely necessary, though these cases are so tedious that they are generally left to take their chance. The food must be judiciously

selected, dry, and nutritious. Calomel with opium has been followed by the best results, but this treatment needs constant supervision by the practitioner. Animals which are affected with dysentery are known as "*scanterers*" in some parts of the country, or are said to be "rotten."

The disease known as PANTAS, MOOR-ILL, or WOOD-EVIL, may here be mentioned. It is a form of gastro-enteritis due to coarse or acrid food material; it affects whole herds, especially in long, dry summers, when there is a deficiency of herbage, so that plants ordinarily avoided are consumed. It is sometimes attributed to free consumption of astringent buds, as of the oak tree, and of heath; also scarcity of food may be due to over-stocking of land, and so an outbreak of this disease may occur.

Symptoms.—The attack lasts from six days to about a fortnight, and is ushered in by dulness and constipation. The latter sign is found throughout, except in the latest stages, when profuse dysenteric discharge precedes death. A small amount of fæces, in dry, hard, small lumps, coated with mucus of a thick, stringy character, and sometimes with blood, is expelled occasionally with some difficulty. The urine is scanty, high coloured, and voided with difficulty. Lactation early ceases, and the appetite, from the first, is irregular and depraved. Acute febrile signs soon are manifested, and there is tympany with acute abdominal pain. Yellowness of the visible mucous membranes indicates that the liver is also involved. Sometimes the brain seems affected, or the animal becomes almost wild with pain. Rapid emaciation takes place, and all the symptoms of acute dysentery precede death.

Autopsy shows the lesions of advanced dysentery.

The *treatment* differs only from that of the last-mentioned disease in that the necessity of clearing the alimentary canal is even more urgent, and more powerful cathartics than Epsom salts should be given, to be followed by salines and oils, if necessary. Stimulants and tonics are especially indicated. Mucilaginous drinks are valuable as sheathing the diseased membranes. Thorough change of diet to laxative but nutritious food and liberal supply

of pure water are essential, and of course the patient must be removed from the pasture which has caused the disease.

Prophylaxis consists in administration of occasional laxatives, a proper supply of water in dry seasons, and avoidance of placing more animals on a limited pasture than it will support.

ENTERITIS.—Inflammation of the intestines, especially affecting the muscular coat, but extending to the mucous and peritoneal, is not frequent in the ox, except in working animals. Plethoric adults are most liable to become affected. It is due to exposure to rough weather, drinking cold water when in a state of perspiration, and ingestion of irritant substances; it also results from extension of inflammation, and may be brought about by volvulus, intussusception, and impaction.

Symptoms.—There are general signs of disorder, with pain on pressure of the loins, frequent passage of a small amount of dry fæces, and perhaps some abdominal distension. Shortly acute febrile disturbance takes place, and the patient stands obstinately in one place, with muzzle protruded, and the hind limbs seem inclined to give way. Thirst is excessive, but all inclination for food is lost; the animal moans, grinds his teeth, looks round at the right flank, and flinches when pressure is made on the abdomen. The pain is continuous, which, with the acute fever, serves to distinguish this from colicky disorders. Shortly before death the patient becomes unconscious and falls, moaning continuously. The passage of fæces becomes suppressed, and "a little stream of liquid excrement forces its way through the hardened mass, by which the rectum is distended, and that which is voided has an exceedingly fœtid and putrid smell." Youatt considers this diagnostic. Sometimes death is preceded by cessation of pain, but the animal is anxious, the extremities are extremely cold, the pulse imperceptible or "running down," and the internal temperature falls rapidly. This is indicative of the occurrence of gangrene. Throughout the attack the pulse is very quick and small, and the rectum, when examined with the hand, is evidently very much increased in tem-

perature. The torpidity of the bowels is due to cessation of peristalsis, for the inflamed muscular coat loses its contractile powers.

Post-mortem examination.—The intestines become very soon distended with gas. The peritoneum is congested, inflamed, or gangrenous over the parts of the intestine, which are the centre of diseased action. The peritoneal sac contains a considerable quantity of sero-sanguineous fluid, sometimes also flocculi of lymph. Both small and large bowels are generally involved. The walls of the bowel are thickened and various in colour in different parts, from the redness of simple congestion to the green condition found in gangrene. There is much gelatinous effusion and some blood extravasation between the muscular fibres, and the contents of the bowels are mainly blood and mucus.

Treatment.—Careful nursing, external stimulation of the abdomen by means of hot-water rugs and ammoniacal or turpentine applications, manual removal of accumulated fæces from the rectum, with anodyne and mucilaginous injections. Cathartics must be avoided, for they cannot make the intestines act, and will only irritate. Aconite, or preferably opium, should be admistered internally, while the extreme thirst of the patient may be relieved by nitrated water. In this disorder the early abstraction of blood has been found highly beneficial, and the animals affected are usually well able to stand the depletion. Hot-water applications are used as follows :—The furnace or copper having been set going to ensure a free supply of boiling water a blanket is folded and placed transversely beneath the belly of the patient; it is held on either side by a man, while a third pours fresh water in when the blanket begins to cool. During the intervals the blanket is kept well up against the abdomen. This should generally be continued for about half an hour, when the parts should be rubbed thoroughly dry, and a little ammoniacal solution applied with friction. This active method of treatment proves most effectual in some abdominal disorders. It can be repeated if necessary.

Fibrinous Casts of the Intestines are not rare in the

ox. Specimens of considerable length are sometimes described as parasites, and we are told that the animal has "passed a snake." The casts are flaky on the surface, generally have been thrown out from the mucous membrane of the small intestines, and are of a croupous nature. Hence, the form of enteritis in which they are expelled is sometimes termed Croupous Enteritis. It is less acute than the other form, and after expulsion of the false membrane recovery rapidly takes place. The treatment in no way differs from that of the ordinary form of the disease.

Intestinal Apoplexy—Rupture of the intestinal blood-vessels is rare in the ox except in blood diseases. It, however, sometimes results from injuries and in inflammation and partial obstruction. The blood diffuses between the layers of the mesentery. Colicky pains are present, but no diagnostic symptoms. In the 'Veterinarian,' vol. xlii, p. 768, M. Genée records a case of enzootic outbreak of this disorder leading to sudden death, attributed to feeding on the refuse of beet-root.

Perforation or Rupture of the Intestines may be brought about by external injury, ulceration, the giving way of the disorganised wall of the bowel during operations for relief of hernia, and the use of drastic cathartics in cases of intestinal obstruction. When the rupture is large the signs are those of collapse, but when it is small peritonitis gradually supervenes. If the bowel be exposed and rupture take place catgut sutures may be inserted and the bowel returned. Cases thus treated have been known to do well. Injury of an umbilical or ventral hernia sometimes causes ulceration of the skin extending into the enclosed bowel. From the opening thus formed the intestinal contents constantly escape. It is a "*false anus*," and must be closed either by ligature or suture.

Rupture of the Rectum may occur in cases of prolapsus, or the leg of the fœtus may be passed through the wall of the vagina and rectum in cases of difficult parturition. These cases are not necessarily fatal, for the terminal portion of the rectum is not invested by peri-

toneum, and, therefore, the fæces do not pass into the peritoneal sac. Their entry into the wound tends to prevent it from healing, and a *fistula in ano* or *recto-vaginal fistula* forms. This is not very liable to take place in the ox, for the fæces are pultaceous. The presence of a recto-vaginal fistula gives rise to passage of fæces through the vulval opening, also chronic irritation of the generative passage, and the opening may be felt on exploration.

Intestinal Parasites are comparatively rare in the ox, and seldom give rise to serious disorder. The principal are *Ascaris lumbricoides*, and various Strongyles. *Tænia expansa* is described by Law as causing serious indigestion and abdominal disturbance in America, Australia, and some parts of Germany.

Intestinal Tumours are generally fatty on the peritoneal surface; cancerous when projecting into the intestinal tube, hæmorrhoidal when in the rectum. The effects of these and of calculi have been already noticed.

Malformation of the Intestines.—Of these *proctatresia* or *impervious anus* is the most frequently seen in calves. Sometimes the anal opening is closed by skin; in other cases the anus is perfectly formed, but at a short distance from the external orifice there is a membranous septum separating the passage in which the meconium is situated from the anus. In another form the large intestine terminates in a *cul-de-sac* in the posterior part of the abdomen. These latter cases are hopeless, but in either of the former relief may be afforded by division of the obstructing membrane by two crucial incisions. Attention is called to this condition by violent straining of the young animal, which has not passed fæces since birth. The first milk excites the bowels to action for expulsion of the meconium, but this relief is prevented.

Mechanical Distension of the Rectum with hard pellets of meconium is sometimes a cause of similar symptoms. The accumulated material must be gradually removed with the oiled forefinger. Sometimes the quantity present is enormous.

Section 2.—Of the Liver.

In the ox this organ is large, mainly confined to the right side, has rounded margins, and is scarcely divided into lobes, but a fairly large caudate lobe is present. The excretory apparatus differs from that of the horse in that a gall-bladder with a cystic duct is present, also the bile-duct does not open with the pancreatic, but terminates by itself at a distance of about two feet from the pylorus. The gall-bladder lies on the posterior surface of the liver, with its fundus projecting downwards; it rests in a groove

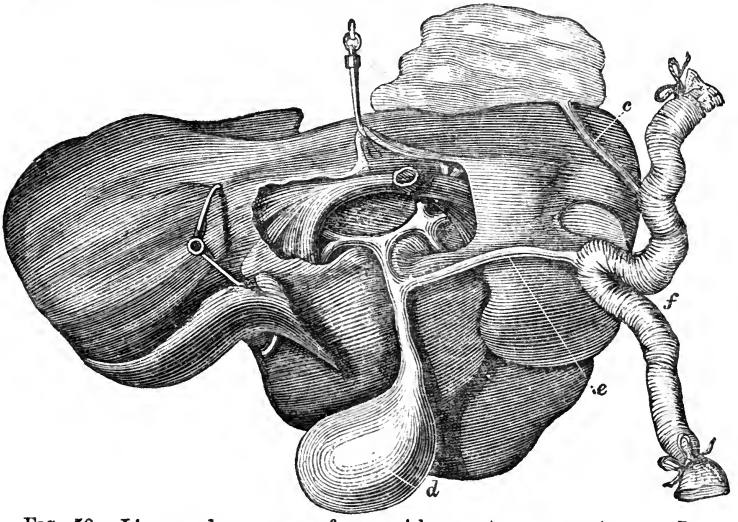


Fig. 59.—Liver and pancreas of ox, with excretory apparatus. *c.* Pancreatic duct. *d.* Gall-bladder. *e.* Common bile-duct. *f.* Duodenum. (Simonds.)

in the liver substance, but is not surrounded by it to such an extent as in the dog.

Hepatitis, *inflammation of the liver,* is sometimes seen in high-bred plethoric animals, as a result of feeding with an excessive amount of highly stimulating food, associated with want of exercise. It is most prevalent in hot weather. It is also attributed to changes of temperature and of food, as well as to expose of various kinds.

The *Symptoms* of some forms of liver disorder are

somewhat obscure. Yellowness of the visible mucous membranes and of the skin is considered a diagnostic of derangement of the bile-secreting organ, but it is not always so, for it may depend upon the nature of the food, and is constantly present in some of the best breeds. When this organ is inflamed a certain amount of abdominal distension is observable, and the animal flinches, moans, and grinds the teeth, when pressure is applied to the right side over the seat of the liver. Its functions are arrested; thus, the secretion of bile is not carried on, hence the bowels are torpid and the fæces are dry, scanty, and of a chocolate colour; generally they are thickly coated with mucus. Lying continually on the right side and fainting fits are sometimes present. The milk is yellow and scanty, and its cream thick and "ropy." There are occasional colicky pains, and the skin is harsh, staring, and coated with a yellowish-browny matter (which is considered a favorable sign). The urine is excessively yellow, and the various mucous membranes are all more or less tinged with the same colour. The respiration is somewhat impeded, and the pulse is soft, weak, and generally frequent. Lameness of the right fore limb has not yet been observed in cases of this kind in the ox. The animal is very dull, as in most affections of this organ.

In *Chronic cases*, with the generally diffused yellowness and the unthrifty and scurfy state of the skin, and the dry clay-coloured condition of the fæces, there is persistent dejection and falling off from condition, a want of inclination to move. The pulse and respiration are unaffected. In one case of the acute disease the patient was so violent that it was thought he was mad—the head extended, eye fixed, shoulders cold, belly hot, pulse strong and rapid, striking of head against the flank, and endeavouring to bite those around. Here, on *Autopsy*, "the liver appeared withered and dry, as if it had been exposed during several days to an ardent sun." In other cases we may find atrophy of the organ, the areolar elements (Glisson's capsule) having been increased in size at the expense of the more important secreting part. Sometimes the

liver is much enlarged and softened, as a result of inflammation, whilst, in other cases, abscesses are present. Inflammation of several parts of the liver simultaneously is not infrequent, and this may lead to multiple abscesses. Generally the peritoneal investment is either rendered opaque or is the seat of deposits of lymph. Remains of these latter indications are not infrequent in old animals. In more recent cases the accumulation of gelatinous material beneath the peritoneum somewhat obscures the normal brown chocolate colour.

Treatment.—The indications in cases of this kind are to apply external stimulants over the seat of the diseased organ. Administer a saline cathartic, which will act without materially affecting the liver, while it will also act as a febrifuge. Aconite may be used to follow this up as soon as any severe febrile disorder sets in. Of course careful nursing is necessary, and the food, when convalescence has set in, must be light and nutritious, but in small quantity. Enemas must be utilised. In the chronic form, where atrophy has occurred, we can do little except give an occasional liver stimulant to rouse the torpid organ into activity, at least so much of it as remains fit to perform its duties.

Congestion of the Liver is manifested by dulness succeeding a meal, slight interference with respiration, swelling on the right side (which is painful), constipation, and a little yellowness of membranes. This must be treated by a laxative, change of diet, fresh air, and some exercise. It is generally of short duration, but when it occurs frequently may give rise to chronic changes.

Hepatirhœa—Hæmorrhage from the Liver—Rupture of the Liver—occasionally results from congestion and in cases of degenerative changes of the organ. The symptoms are simply those of internal abdominal hæmorrhage, rapid sinking, and sometimes abdominal pain. In other cases the peritoneal capsule does not give way, but the blood accumulates beneath it. In the latter, recovery is possible if the animal be kept very quiet and the

strength supported, and subsequent feeding carefully regulated. In the former case recovery is hopeless. Any one accustomed to examine the changes which the liver undergoes as a result of disease will be aware of the very considerable absorption of liver substance which may take place as a result of parasitic invasion or of morbid deposits, without the function of the organ being materially interfered with. It seems as if each lobule were an independent organ, and not in any way concerned in the state of its fellows. A direct consequence of this is that very extensive changes of this nature may take place, andno appreciable signs of them be manifested during life; of these changes tubercular are most frequent. We find also on record "osseous deposits," which, however, hardly answer this description. Thus, in a case the post-mortem examination of which reads very like that of traumatic pericarditis, Mr. Younghusband describes the liver of a milch cow, "which was three times the size of one in a normal state, containing in its substance an immense number of calcareous deposits, of the size of a horse chestnut, which, when crumbled betwixt the finger and thumb, gave a feeling of sand or grit. There were some dozens of these deposits, but in none did I perceive anything like the suppurative process." These were perhaps calcified hydatids, but the case was peculiar. The enormous extent to which this organ may become invaded by *Echinococcus veterinorum* is satisfactorily illustrated by a case recorded by Messrs. East and Steel in the 'Veterinarian' for 1878. The specimen came from the Vale of Aylesbury, where parasitic disorders are prevalent. Considerable diminution of the secreting liver structure results in advanced cases of invasion by *Fasciola hepatica*, in consequence of thickening of the walls of large and small bile-ducts, the result of irritation.

Ramollissement (*softening of the liver*).—Enlargement with structural change does not seem so frequent as we would be inclined to expect from the frequency of excessive fattening of the ox, together with the want of exercise during preparation for exhibition or sale. A good illus-

trative case of fatty liver is given in the 'Transactions of the Veterinary Medical Association,' vol. iii, p. 234, by Mr. Read.

Interesting cases of *Congenital Hepatic Hernia* are given in the 'Veterinary Journal,' vol. iv, p. 344 and 423, by Mr. Swarry of Selby and Mr. Kirk. In them it seems a portion of the right lobe of the liver was connected with the posterior part of the lung by the right lateral ligament, there being a foramen through the diaphragm.

Addendum 1.

The gall-bladder of the ox has a capacity of several ounces, and its duct decreases in size somewhat after its commencement. The bile of the ox is of a greenish colour, and consists of the following:—Water, 90·44 per cent.; biliary and fatty matter, 8 per cent.; vesicular mucus, ·30 per cent.; osmazone, chloride and lactate of soda, ·74 per cent.; sodium, ·41 per cent.; phosphates of lime and soda, ·11 per cent. (Berzelius). Diseases of this excretory apparatus have been observed, but are almost always secondary in their character, due to disease of the bowels or biliary ducts. The bile accumulated in the gall-bladder is liable to undergo inspissation and to form *biliary calculi*. These consist of the bile salts, also pigment and cholesterin, arranged in concentric layers around a small mass previously formed, which acts as a nucleus. They vary in form, but have rounded margins, and in size upwards to the average size of a walnut. They have a low specific gravity, and so float on bile. Often they are extremely numerous. So long as they remain in the gall-bladder they seem to cause no inconvenience, but during their passage through the central portion of the cystic duct and the terminal part of the common bile duct, cause excruciating agony, due to spasm of the muscular fibre of the wall of the duct. These cannot be distinguished from ordinary colicky pains, our only aid to diagnosis being the occurrence of some biliary calculi in the fæces.

Addendum 2.

The *Pancreas* is large and lies to the right of the abdomen in the root of the mesentery; its ducts open separately into the duodenum at a distance of over three feet from the pylorus.

Scirrhous, tubercular and cancerous deposit, hypertrophy, and abscess of this organ are described, but nothing more seems to be known about these disorders than that, when chronic, they give rise to malnutrition, since they interfere with the due elaboration of fat-forming material. *Calculi* in the pancreas or its duct are occasionally found. They are generally of a milky-white colour, dense and rough, and about as big as a pea.

Section 3.—Of the Peritoneum.

This membrane of the ox is only remarkable as forming a large and well-developed omentum major, which generally contains much fat.

Peritonitis—*inflammation of the lining membrane of the abdomen*—is very rare in the ox, and we have often above had occasion to remark the impunity with which very formidable operations may be performed in which it is subjected to injury. The various abdominal sections and castration affect it, and it is more or less involved in inflammations of various abdominal viscera, but its disease passes unnoticed in the general disorder, and it is only after wounds and occasionally climatic changes that it thus primarily becomes inflamed. Then the animal suffers from obscure pain, and is, therefore, dull and anxious, looking round occasionally at the flank, moaning, grinding the teeth, stamping, and with hind limbs trembling. The bowels do not act, the pulse has the hardness characteristic of inflammations of serous membranes, the extremities are cold, and these cases rapidly terminate fatally. It will be observed that the respiration is characteristically thoracic, the diaphragm being as much as possible relieved from its duties, which cause extra pain.

Post-mortem examination.—Sometimes we find after slaughter of a healthy animal that parts of the peritoneum are united by adhesions, while others are opaque and flocculent from the presence of white shreds of organised lymph. These are indications of a previous attack of this disease. In recent cases the membrane is in various parts reddened, opaque, and hidden by lymphy deposits, which bind the different abdominal organs together and vary in the degree of organization according to their age. These lesions are most marked around the point of injury. The peritoneal sac contains a considerable quantity of fluid, which is straw-coloured, milky, or sanguineous. Of traumatic lesions giving rise to this disease passage of sharp foreign bodies from the stomachs is not infrequent, hence we generally find that peritonitis is present in cases of traumatic pericarditis, bringing about union of the reticulum with the diaphragm, so that a cyst-like passage is formed, which generally contains a milky serous fluid or a blood-clot.

Treatment.—That suggested for enteritis. As in that affection cathartics should not be administered, for increased peristalsis will give rise to increased irritation of the inflamed peritoneum. Opium is specially indicated to check peristalsis.

Ascites (*dropsy of the abdomen*).—This is sometimes the result of acute inflammatory disease of the peritoneum, but more frequently of general debility or of mechanical impediment to return of venous blood, such as exists in liver or heart diseases, also tumours pressing on vena portæ. It is a complication of other dropsical disorders. It is not frequent in the adult, but is met with in obstetric practice, since congenital ascites is an impediment to expulsion of the affected animal from the womb. In these cases it seems to result from debility or scrofulous disease of the parent; the sickly fœtus may therefore be sacrificed, the fluid being evacuated either by direct incision with the concealed knife through the abdominal walls, or by the passage of a special long trocar and canula through the chest into the abdomen.

Symptoms.—Of the acquired forms are abdominal distension, and on auscultation a wave of fluid may be detected striking against the abdominal wall when the opposite side is percussed. Anasarcous swellings appear on the abdomen and underneath the chest. Respiration is thoracic, and there is gradually increasing anæmia with all its characteristic symptoms (see page 92).

Treatment.—While endeavouring to remove the originating disease we must do all in our power to sustain the strength of the patient by stimulant tonics, as beer or gentian with nitrous ether; also liberal diet of not too watery composition. Iron salts (as the iodide) also are indicated, and may be alternated with vegetable tonics. Digitalis proves useful primarily as a sedative, but secondarily by acting on the kidneys. Where the distension is very great *paracentesis abdominis,* "tapping the belly," will afford temporary relief. A small trocar-and-canula is used, and the puncture is made just a little to one side of the umbilicus, the instrument being inserted gently. The reason of the obstinate resistance to absorption is that the peritoneal stomata become blocked up by false membranes and plugs of lymph. Besides the diseases indicated it must be remembered that the peritoneum is often one of the seats of "grapy" deposits of scrofulous origin. These give rise to subacute inflammation and ascites. Opacity is generally produced in the opposite portion of the peritoneum against which they rub.

CHAPTER V.—DISEASES OF THE RESPIRATORY APPARATUS.

The calibre of the air-passages of the ox is not so great as that of the horse; the lungs are practically smaller, and M. Colin has shown us that an ox breathes only about 82 per cent. of the amount of air required by a horse, throwing off a proportionately small amount of carbonic anhydride. This would lead us to anticipate that the ordinary diseases of the respiratory organs of the ox are less numerous and important than those of the horse. It adapts the animal less for rapid and prolonged locomotion, and is in accordance with the conditions of other parts of the system; thus, the large gastric mass of the ox prevents rapid exertion after a meal, and the full conditions of these organs remains for a long time. During this the action of the diaphragm must be, to a certain extent, impeded as far as its respiratory functions are concerned; it facilitates regurgitation constantly during rumination. Again, its position is more upright. The conformation of the skeleton of the ox gives us information that he is less adapted for respiratory emergencies than the horse. Ordinary respirations of the ox are frequent and not deep, 15 to 18 in the adult, 18 to 20 in the young animal; they are liable to considerable increase in number even during health. Similarly the healthy cough of the ox is rather short and weak. The horse suffers so frequently from disorders of the respiratory organs because he is pushed to extremes of exertion, is pampered in hot, close, and improperly ventilated stables, and is subjected to sudden changes of temperature of the surrounding medium, and also exposure to draughts, and under certain circumstances to extremes of weather. With the skin acting profusely he

is left standing in a current of air, and is otherwise exposed. The working ox is somewhat similarly treated, and hence of all bovines is most liable to diseases of respiratory organs, but he is not by any means pampered, and seldom overworked. Cattle, especially when fat, are sometimes overdriven, but ordinarily are in a state of quietude in the stalls of not overclosed shippons or in pastures. Under these circumstances traumatic causes are the main influences which generate diseases of the breathing apparatus. Dairy cows and prize fattening beasts are certainly continuously subjected to the close and foul atmosphere of byres, but they are not exercised and do not change from heat to cold, so the predisposition engendered by ammoniacal fumes and constant inspiration of warm air laden with impurities seldom receives the exciting cause necessary to give rise to acute pulmonary disorder. The effect is more marked in arousing hereditary or acquired tendency to scrofulous disease, especially phthisis. We have previously made some general remarks on the nature of respiratory processes, but must now recall to our minds certain special means of diagnosis, which acquire particular importance in relation to the diseases under consideration.

Auscultation depends on the motion of air through the air-passages, and the movements of the chest and other parts during breathing. It is termed *immediate* if the ear is applied directly to the surface, *mediate* if the acoustic connection is indirect. The former method is open to the objection that the surface is often not fit for contact, as when the animal is covered with lice. It is most useful as avoiding extra friction sounds, which result from the intervention of a foreign body between the ear and the chest. Generally a handkerchief is placed on the surface, and a little practice enables the observer to automatically ignore any complications due to its presence. The stethoscope is a long tube with a trumpet-shaped extremity for even contact with the surface, and an ear-piece; it is seldom used in veterinary practice. It is an artificial prolongment of the external

auditory canal. Auscultation is resorted to in cardiac and certain abdominal diseases, but is mainly used for determining the states of the lungs and air-passages. These, especially the former, are less accessible than in man, on account of the greater bulk of surrounding substances, the pectoral position of the fore extremities, and the restlessness of the patient. Also the animal cannot be made to give us the various phases of respiration on demand. Though our diagnoses cannot, therefore, be so exact as those of human practitioners, auscultation is most valuable to us.

Nasal sounds.—The normal rushing sound of air passing through the nasal chambers is interfered with in cases of tumours and other obstructions of these passages; also when the mucous lining membrane is diseased. The stertorous character of breathing, as seen in coma, depends on the state of the posterior nares and velum palati.

Laryngeal sounds.—The passage of air through the healthy organ gives rise to a rushing sound. In cases of thickening or impediment the sounds known as roaring and whistling (which are familiar to us) will be distinguished. A peculiar crowing sound is considered diagnostic of "croup." The voice, of which this organ is the seat, is sometimes modified; its tones are not varied, for the organ is very simple, but it is not difficult to distinguish the peculiar lowing indicative of pain.

In the trachea and bronchial tubes we still find the rushing sound; in health it is prolonged, almost uniform in expiration and inspiration, and with an even transition through its various modulations; under disease it may become the *mucous râle,* when fluid exists in these tubes in excess, and air bubbles through it, the *cavernous râle,* when the air rushes from a comparatively small tube into a large space containing fluid, so that there is a special gurgling sound. This, of course, can only be heard in connection with disease in the lungs; it is found when a cavity has been formed in those organs by suppuration, or by bronchial dilatation. *Sibilus,* when the air rushes through small tubes with a dry condition of their mucous lining, such as is seen in incipient inflammation. *Rhonchus*

is a similar state when the larger tubes are involved. Other refinements are distinguishable, but their characters are rather indefinite. The *Vesicular sound* observed during health depends upon the tension of the walls of the air-cells during inspiration, together with the rush of air through the narrow terminations of the bronchial tubes into these dilatations, consequently it is appreciable also to a modified degree during expiration. It can only be heard in some parts of the lungs, for it is liable to be obscured by the bronchial rushing sound. It is most perceptible in young animals, for with age the cells are much dilated, and the transitions from the tubes less abrupt. Determination of this sound is important, as informing us of the pervious condition of the air-passages and the air-cells. It is early supplanted in cases of inflammation of the intimate structure of the lungs by a peculiar crackling sound known as *crepitation.* The intensity of these sounds varies with disease; when a part of the lung is lost for functional purposes the parts which remain pervious give increased sound. Solidification and deposition between a bronchus and the ear may render its rushing sound more evident. In other cases there is partial or complete loss of sound, due to an impervious condition of the passages, as in lung consolidation or collapse, or else to the presence of some bad conductor of the sound, as in cases of hydrothorax. Our diagnosis of the extent of disease also depends upon the stationary or migratory condition of the sounds, as shown by frequent examinations. The movements may be either abrupt, as when some obstruction has been removed by coughing, or gradual, as in hydrothorax.

The pleura, when inflamed, is the seat of the *friction sound,* due either to two dry surfaces moving in contact with one another, or to a similar application of two surfaces roughened by deposition of false membranes.

Examination of the Chest of the Ox, by Auscultation.—The extra lobe of the right lung extends rather in front of the heart. The thorax is wide and rounded posteriorly, but the diaphragm bulges into it to a marked extent, and gains firm attachment to the inner surface of the

last rib but one, so that the last intercostal space is not lined by pleura. The rumen, therefore, giving its various sounds, occupies a large part of the posterior division of the left side, while the liver lies on the right, and gives an area of dulness. "We must determine the natural sound when the animal ruminates, which may be heard at the lower part of the chest at the level of the xiphoid cartilage of the sternum. It resembles the gurgling sound when fluid passes from a bottle, and doubtless is due to the liquids in the reticulum; since cattle, when sick, do not generally ruminate, this noise will not be confounded with abnormal sounds. Nevertheless, we have thought right to note it here. We must also distinguish a crepitation with a frothy sound, which originates in the rumen when its muscular walls contract; it is audible at the postero-superior part of the left side of the chest" (Delafond). Since the shoulder occupies the anterior part of the lateral surface of the chest as far back as the fourth rib, and the diaphragm bulges posteriorly, the area over which auscultation can be profitably performed in the ox is very limited. However, the shoulder may be drawn forwards to a certain extent, so that even the first rib may be felt from behind, and considerable care will enable us to distinguish lung sounds in the posterior region.

The lateral surface of the chest is divided into superior, middle, and inferior thirds. "*Right side.*—In the superior region the vesicular sound is well marked from behind the shoulder to the level of the tenth rib, from which it gradually decreases in intensity to be lost opposite the eleventh. In the median region a loud and sometimes rather rude respiratory murmur is heard over the fourth and three following ribs, which, however, gradually decreases from the seventh, and is lost over the tenth or eleventh. In the lower region the sound may be said to be bronchial over the fourth and fifth ribs, evidently on account of the considerable tube passing to the fourth lobe of the right lung. From the sixth to the ninth rib it is vesicular, and its force decreases from before backwards. *Left side.*—The superior region simply repeats that of the right side. In the median

region the only difference is that the sound is more feeble over the fourth, fifth, and sixth ribs. In the inferior region a feeble respiratory murmur is heard over the fourth rib; this increases over the fifth and sixth, and then decreases as far as the eighth or ninth" (Gamgee). Delafond warns us against misinterpreting the crepitating sound, which results from the looseness of the areolar tissue beneath the skin of the chest of the ox. And Gamgee suggests that useful information may be gained by auscultating the chest of the ox from below through the sternum, since so much of the lung is inferiorly placed.

Percussion.—Applying blows to the surface in a special manner, we have already seen, is useful in diagnosis of tympany. It is *direct* or *indirect*. In the former case the ends of the fingers brought together are sharply applied to a part, generally to the skin rendered tense over a bone, as a rib, or the nasals. It is possible to determine, from the resulting sound, whether the cavity within is empty or blocked up by some material of a solid or liquid nature. The healthy resonance of the chest is very characteristic, and is most marked over the course of the bronchi and larger bronchial tubes. Dulness on percussion indicates consolidation or accumulation of fluid in the pleural sac.

Percussion of the Chest of the Ox, "*Left side.*—The superior region is very resonant over the eighth, ninth, and tenth ribs. If it be struck very gently between the latter and the twelfth rib, the diminished resonance of the posterior border of the lung may still be brought out, though, if struck at all forcibly in this region, a tympanic sound is produced, due to gas in the rumen. The median region is very resonant over the fifth, sixth, and seventh ribs, much less so over the eighth and ninth, and quite dull over the lower third of the tenth and half the eleventh; this dulness proceeds from the abdominal organs. The lower region, unlike in the horse, shows considerable resonance over the fourth, fifth, and sixth ribs, from this part lying over the anterior lobes of the right and left lungs, which almost completely

envelope the heart. From the seventh to the ninth ribs the resonance diminishes and is entirely lost in the lower fourth of the latter, as well as over all the ribs behind it. In young and emaciated subjects, by drawing the limb forcibly backwards, and applying the pleximeter as firmly as possible over the first two ribs, a clear sound may be obtained. *Right side.*—The resonance of the right side differs little from that of the left; the resonance sometimes being perceptibly less posteriorly, on account of the presence of the liver. In very thin animals a clear sound is produced by percussion in the fossæ of the scapula." (Gamgee).

Manipulation.—Pressure on the intercostal space causes flinching and other manifestations of pain in pleurisy and pleuro-pneumonia. A fractured condition of the rib and the presence of a needle which has migrated from the reticulum have been determined by this means.

Succussion and Mensuration have not yet been found of much value in cattle disorders.

The anterior nares have no false nostril, and are connected with the upper lip by the smooth humid pad which is termed the muffle. The organ of Jacobson runs from the anterior part of the mouth to that of the nasal chamber. In consequence of separation of the lower margin of the vomer from the palatine suture the nasal chambers communicate posteriorly, so that we can speak only of one posterior naris opening into the pharynx. The facial sinuses are very extensive, and separate the outer from the inner plate of the frontal bone everywhere, except at a point on either side of the centre of the forehead. They pass into the horn cores, rendering them hollow, and through the parietal bones, and partly into the occipital. The maxillary portion is prolonged into the bony palate. The nasal peak is trifid. There are described three turbinated bones, but of these the one known as the middle is simply the great ethmoid cell very much enlarged. The lower margin of the vomer is remarkably sharp. The posterior nares, as in other ruminants, are very deep.

The *muffle* becomes involved in certain exanthemata, for it may be the seat of eruption. Its condition is a useful but not infallible guide in determining the health of the animal, since during fever it becomes dry. The protrusible tongue is capable of removing excess of moisture from this organ and the nostrils. The anterior naris is less liable to laceration than that of the horse. The Schneiderian membrane, as seen through it, is of a reddish colour, but varies much in shade and humidity with the state of the health.

CATARRH—*Flux from the nostrils*—is due either to congestion or inflammation of the Schneiderian membrane. Also, as a rule, the lining membrane of the nasal sinuses and those of the pharynx and larynx are, to a certain degree, involved. Is most frequent in spring, when east winds are prevalent, and when animals are suddenly exposed to extremes of wet and cold after having been accustomed to shelter. It may arise from dampness of the byres in which cattle are kept, or exposure to draughts. Animals debilitated by previous disease are especially prone to this disorder. It is more frequent in young beasts than old, and sometimes is attributable to the "dust and gravel of the road" (Youatt). It may be due to certain specific conditions of the atmosphere, when it assumes an epizootic or enzootic form (see Influenza). Then it is excessively debilitating, and under ordinary conditions it reduces the strength of the patient, and on this account as well as because it is often a forerunner of more serious disorder, it is important, and requires prompt and judicious treatment.

Symptoms.—In some cases simply a discharge from the nostrils, with dulness, but generally slight fever, is present, with the usual signs of ill health. The Schneiderian membrane is reddened and turgid. At first dry, it soon gives a watery discharge, which later becomes of a thick mucous character, and afterwards muco-purulent. Sneezing is generally present, as also is cough, which is especially marked when there is sore throat, as denoted by pain on manipulation, swelling, and difficulty in swallowing.

The conjunctiva is more or less congested, which leads to lachrymation and accumulation of mucus at the inner canthus. A profuse mucous discharge from the eyes may afterwards set in. Generally these symptoms subside in two or three days, but sometimes they become modified to those indicative of laryngitis.

Treatment.—House the animal in a well-ventilated place, and nurse. Counteract all such of the causes as are in operation as much as possible; especially place in fresh air rather than in a close ammoniacal atmosphere. Steam the nostrils either by holding the head over hot washes, or by fixing on a nose-bag containing sawdust or chaff soaked constantly in boiling water, or by Armatage's steam douche, which consists of an india-rubber tube attached to the spout of a tea kettle, the free end being brought towards the animal's nostrils when the vapour begins to escape (see Fig. 9). A febrifuge dose of Epsom salts, together with a diffusible stimulant, may be given, and the animal allowed nitrated water to drink. Altogether the treatment of simple catarrh is more a matter of nursing than of medicine.

Epistaxis—*Bleeding from the nostrils*—is sometimes a symptom of serious blood disorders where ulceration or rupture of blood-vessels of the Schneiderian membrane is present. It is seen as a disease *per se* in working oxen, in which exposure to the heat of the sun, together with laborious exercise, have given rise to congestion of the vessels of the Schneiderian membrane with subsequent rupture of their walls. Sometimes it results from injury, especially when there is fracture of the nasal bones. The hæmorrhage may be somewhat profuse. Under ordinary circumstances it will cease spontaneously, but sometimes cold-water applications, styptic injections, or plugging the nostrils are necessary. These cases require careful examination, for the hæmorrhage may be from some more important membranes than that lining the nostrils. Sometimes it results from *Polypus in the nasal chamber.* Such cases are very rare. Youatt relates one in which, while the pedicle might be traced into the nasal chamber, the main

part of the tumour hung down in the pharynx and acted as an impediment to swallowing. Exploration was made through the mouth, and the tumour (which weighed nearly half a pound), removed by torsion. The écraseur may be used for such cases, or a ligature fixed round the pedicle (see *Pharyngeal Polypus*).

Parasites.—Youatt mentions the occasional entry of leeches from stagnant water. They gain access to the nasal chamber through the anterior nares when the animal is drinking. After they have gorged their fill they will loosen their hold and be expelled by sneezing, except when in the superior part of the nasal chamber. They cause considerable hæmorrhage, and may be removed by injections of salt and water.

Other foreign bodies may become fixed in the nasal chamber, or the nasal sinuses may be diseased, giving rise to *Nasal Gleet*, but this is rare in the ox as compared with the horse, for he is less liable to injuries of the facial bones, and can expel matters returned by vomition through the mouth.

Laryngitis—*Inflammation of the larynx*—is a sequela of catarrh or of bronchitis, but may exist as a primary disease. Besides the general signs of inflammation, the pulse has a peculiarly hard character, the throat is swollen, and the muzzle protruded; considerable pain is evinced on pressure, and a dry, hard, paroxysmal cough may be originated in this way, or occur spontaneously. Also there is profuse discharge of saliva from the mouth, and difficulty and pain in swallowing (sometimes complete inability). There is discharge from the nostrils, and the thickening of the laryngeal mucous membrane gives rise to extreme difficulty in breathing, and an early prostration of strength, such as results from defective oxygen supply. This disease may be attributed to the action of those causes which, under other circumstances, give rise to catarrh. Death may occur either through effusion around the rima glottidis, spasm of the larynx, or extension of inflammation. A permanent thickening of the lining mucous membrane of the larynx is likely to result.

Treatment.—Where the breathing is excessively difficult, tracheotomy should be at once resorted to, as this is a most valuable means of placing the larynx in a state of rest. The throat should be freely fomented, and the head steamed by either of the methods previously mentioned. Nutrient enemas may be administered, and a free supply of nitrated water allowed. Administration of drenches is not advisable, for the pharynx is involved in inflammation, and the difficulty in swallowing may lead to entry of some fluid through the glottis, with its resulting ill-consequences. When the disease tends to assume a subacute character a stimulating application may be applied to the throat. The compound liniment of cantharides is

FIG. 60.—Tracheotomy Tube. (Armatage.)

about the best. These cases are generally of an acute and urgent character.

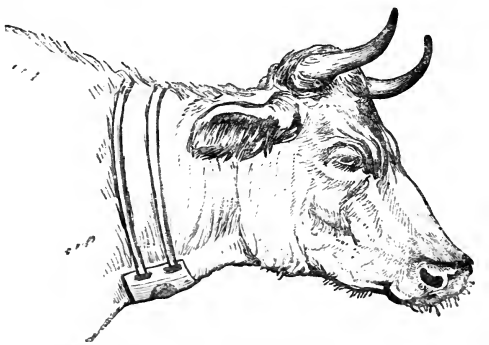


FIG. 61.—Animal wearing Tracheotomy Tube. (Armatage.)

To *perform the operation of tracheotomy.*—The head being extended, the operator feels along the front of the neck for the most superficial position of the trachea. This having been found at about the centre of the neck, a longitudinal incision, about two inches in

length, is made through the skin and muscle on to the trachea, and the edges of the wound being held apart by hooks, portions of two consecutive cartilaginous rings are removed with a scalpel, so that a circular orifice extends into the trachea large enough to admit the tracheotomy tube (see Fig. 60); the latter is then inserted and retained by a band passing round the neck and attached on each side of its plate (see Fig. 61). It must be cleaned daily until, when a hand is kept over the orifice, no impediment to breathing occurs. It must then be permanently removed and the wound daily dressed with carbolic glycerine until it closes. The opening in the trachea becomes filled with fibrous substance or ossification of the rings involved results. Care must be taken lest the excised portions of cartilage fall into the trachea. The operation may be performed on the animal whether standing or lying. Sometimes it is supplanted by *Laryngotomy,* which presents no special advantages in the ox. It consists in perforation of the crico-thyroid membrane, but the inferior position of the body of the

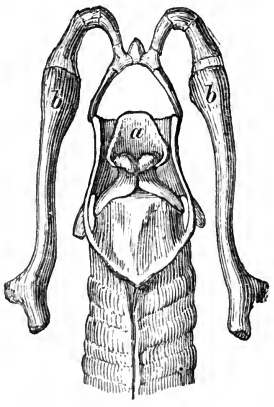


FIG. 62.—Larynx and Os hyoides of the ox. *a*. Epiglottis. *b*. Inferior extremity of long cornua. (Simonds.)

thyroid in the ox is rather an impediment. Besides this, the larynx in bovines is remarkable for its simplicity, the absence of ventricles and the high attachment of the wide epiglottis, which has a rounded apex. The connec-

tion with the hyoid bone is less direct than in the horse.

Pharyngotomy.—After giving an account of an "epidemic affection of the upper air-passages," which is evidently the disease we have mentioned as diphtheria, Youatt says: "When there is no great external enlargement and yet much difficulty of breathing exists and suffocation is threatened, there is reason to apprehend that the pharynx, or some factitious pouch which nature has suddenly formed for the fluid, or (yet very rarely, for they are small in the ox) the guttural pouches (?), or the commencement of the communication between the mouth and ear, are filled with pus." In such cases he recommends the performance of an operation similar to that known as hyovertebrotomy in the horse. In the present day we would operate through the mouth for this condition.

Tumours of the Larynx due to serous accumulations beneath the glottal mucous membrane, cancerous growths, &c., are not frequent in the ox. They prove serious impediments to respiration.

Fractures of the Laryngeal Cartilage may take place from injury; union ensues, the earthy deposit uniting the fractured edges sometimes forms a tumour projecting beneath the laryngeal mucous membrane. Tumours of neighbouring parts or impactions in the œsophagus may impede respiration by pressure on the air-passages.

The *trachea* has more numerous rings and differs from that of the horse, in that the ends of the cartilages meet to form an acute angle posteriorly. There is a small special bronchus given off from the right side of the tube some distance before its termination. Though the dorsal vertebræ and ribs of the ox are much less numerous than those of the horse they are larger, and the posterior ribs are longer, and therefore the differences between the size of the thorax in the two animals is not so great as might be expected. The most essential reduction depends on the way the diaphragm bulges in the ox, so that it extends to opposite the sixth and seventh ribs. The flat sternum of the ruminant allows him to comfortably

repose on the inferior surface of the trunk while chewing the cud; for, thanks to the synovial union between the sternal and vertebral ribs, supero-inferior compression leads to lateral expansion of the chest. Synovial union of the first bone of the sternum with the second facilitates this. To this point of conformation also is attributed the fact that the ox in the emergencies of pulmonary disease often remains in the recumbent position, a marked contrast to the persistent standing of

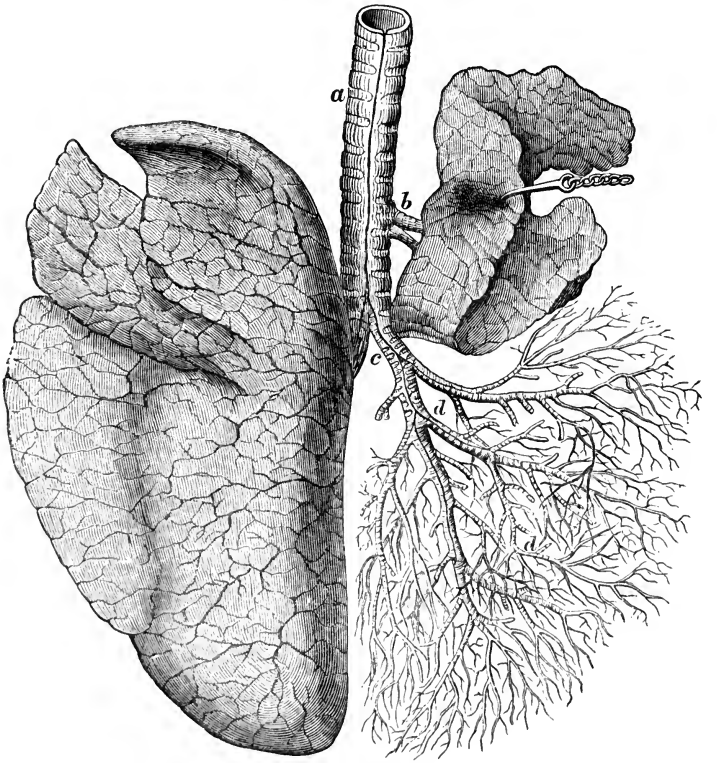


FIG. 63.—Healthy lungs of the ox, seen from above. Showing the extra lobe of the right lung with its bronchus (*b*). *a*. Trachea. *c*. Right bronchus. *d*. Right bronchial tubes. (Simonds.)

the horse under similar circumstances. A study of the arrangement of the respiratory muscles in ruminants

serves to give much information as to their respiratory uses.

Bronchitis—*Inflammation of the Lining Membrane of the Trachea and Bronchial Tubes*—is of comparatively frequent occurrence in the ox, depending either on the ordinary cause of respiratory disorders, exposure, or on extension of inflammation from the larynx and Schneiderian membrane. Also it may be due to mechanical causes, the entry of solid or liquid particles into the air-passages during temporary laxity of the glottis, and the development and residence of parasites in the lungs.

Symptoms.—Besides the ordinary signs of inflammation the pulse is remarkably hard, and the respirations are increased out of all ordinary relation to the beats of the pulse, the inspirations being difficult, and each effort short and imperfect. The animal does not look at the side, nor flinch at pressure on it. The cough is paroxysmal, frequent, and very distressing. The visible mucous membranes are purple through defective oxidation, and there is a considerable amount of debility present, due to the same cause. Auscultation in the early stages gives various results according as the larger or smaller air-tubes are involved ; later, both are affected, as well as the lung-tissue in general. Rhonchus or sibilus, according to the region auscultated, in the early stages, and the mucous râle later in the attack, may be present; sometimes, also, we find intermittent loss of sound in some parts of the lung, due to mucous accumulations plugging the bronchial tubes. In some cases this latter condition may occur permanently, and loss of small portions of the lung result. This is much less important than the similar state in the horse. The functionless parts atrophy and often burst, and the neighbouring air-vesicles enlarge somewhat. Percussion gives healthy results from every part of the chest. The dry stage of the bronchi is succeeded by profuse discharge from the nostrils, which passes through the usual phases, from watery to muco-purulent. This relieves the inflammation, and recovery may now com-

mence. Sometimes the disease afterwards assumes a chronic character. Death may result from suffocation as when the effused fluid blocks up the air-passages and fills the pulmonary cells, or from imperfect blood oxidation, or from extension of the disease to the lungs, pleura, or larynx.

Post-mortem examination shows the air-passages blocked up with frothy fluid, and their lining mucous membrane discolored. The lungs have a sodden appearance, and are also congested.

Treatment must be directed to support of the strength of the patient, the promotion of resolution, and the avoidance of lapse into the chronic stage. The animal must be most carefully nursed, allowed a free supply of pure air, a liberal supply of tempting food, and unlimited nitrated water. The air-passages must be steamed and stimulating applications applied to the sides and along the course of the trachea; these must not prove excessively irritating nor vesicant. When the bowels are torpid enemas may be administered, but not cathartics, for though, in the ox, the alimentary mucous membrane does not so readily become involved, together with that of the respiratory passages, as in the horse, want of judgment in this respect may cause diarrhœa, and fatally tax the strength of the already debilitated patient. Aconite or belladonna may be used to control febrile excitement. When the patient commences to rally, diffusible stimulants with vegetable tonics will prove most beneficial.

Chronic Bronchitis is frequent in the ox; it sometimes is a sequela of the acute form, but more frequently by far results from scrofulous disorder. The lungs, in these cases, non-specific as well as specific, undergo various changes. The most remarkable of these are asthma, emphysema, consolidation. The symptoms common to the two are a persistent hacking cough, general unthriftiness, and tendency to slight asthenic febrile attacks. Emaciation becomes very marked, and the respirations are wanting in depth. The animal is unequal to the slightest exertion.

Asthma consists in inflammation of the muscular coat of the bronchial tubes, which atrophies, whereby either dilatation of the tubes occurs, or, since due supply of air to each air-cell is not regulated, these become dilated, and eventually ruptured, so that air escapes into the interlobular areolar tissue. The latter condition is known as *interlobular emphysema;* the former is *vesicular emphysema.* Dilatation of an air-cell leads to impervious condition of the beautiful capillary network on its walls, and so atrophy of the affected part of the lung is produced. The conditions observed in addition to these in scrofulous bronchitis have been already denoted. We can do nothing to cure these states, and but little to palliate them. Stimulant tonics, easily digestible food, and quiescence, will keep the animal alive for some time, but the owner will generally prefer destruction of the patient.

Parasitical Bronchitis, "husk," "hoose," or *"hoast;" phthisis pulmonalis verminalis.*—This disease is of frequent occurrence among calves under a year old; it certainly is seen in older animals when they are in a debilitated condition, but seldom proves fatal in such cases, though it sometimes causes considerable mortality among calves, for in them there is not sufficient constitutional stamina to enable them to resist the debilitating effects of the parasites. In the older animal the parasites may be found in numbers in the lungs, even when no special indications of their presence have been given; but it must be clearly understood that their ill effects are directly proportional to the strength of constitution of the patient and the number of the parasites. These worms are known as *Strongylus micrurus,* the same parasite as is found so frequently in the lungs of the ass. They are armed nematodes, and are also found sometimes in the alimentary canal, and Williams notes their presence in the heart and blood-vessels in some cases. Hence it is inferred that they arrive at the lungs by entry of the alimentary canal with the food, boring a passage into the blood-vessels, passing with the current of blood through the blood-

vessels, and from the latter into the bronchial tubes. The arguments which have been brought to support this, the most probable, view are that this is undoubtedly the method of distribution of many forms of parasites, and the disease is most frequent and the worm in the lungs are most numerous in young animals in which the tissues are most readily permeable. Other views are those of direct migration from the alimentary canal and entry through the larynx. There is no evidence to support the former view; the latter is based upon the idea that it is possible for entry to occur even in spite of the coughing, which would result from the passage of the worms through the glottis; this is rather doubtful. Again, they might, when immature and small, be carried in with the inrush of air during inspiration. This view does not account for the boring armature of the animal, and it has not been found *en voyage*. As is usual with parasitic affections, this disease is prevalent in wet seasons, on low lands which are liable to flooding. It is seen particularly in calves kept out late in the autumn, and as a result of feeding over land which has been previously pastured by affected animals. It attacks a number of animals at once, and the weakest are the first to give way. The special nature of the irritant determines certain special features in the symptoms. Thus, acute febrile signs are absent, except when the debility causes that form of fever known as hectic. This only is observable in the later stages. The cough is remarkably forcible, distressing, and of a special hacking and paroxysmal character. It leads to the expulsion of stringy mucus, in which parasites may be detected or their ova observed under a low power of the microscope. The attack has a subacute character, and proves very exhausting. Thus, emaciation rapidly increases, and diarrhœa sets in as a complication. The parasites, embedded in stringy mucus, lie intertwined in groups, or stretched against the bronchial mucous membrane. When in balls they block up the air-passages; they also cause spasm of the bronchial tubes. Thus, they seriously impede respiration, which is

always remarkably laboured in this disease. It will be observed, however, on *autopsy,* that little exudation into the air-passages has taken place, and that, though the mucous membrane is purple, it has not undergone such an amount of change as *à priori* might have been anticipated. This is attributable to the fact that the irritant is a living one, capable of altering its position, and simply occupying its natural habitat. When the lungs of an animal which has been affected with this disorder, but has recovered, are examined, it will be found that the worms have become encysted, and have undergone calcareous degeneration, forming nodular calcareous deposits in the lungs. The average duration of an attack is two or three weeks.

Treatment.—Though we are not assured of all the phases in the life history of *Strongylus micrurus,* we know that when ova are expelled from the lungs on to pastures they undergo changes which are dependent upon warmth and moisture in some way or other, and result in the assumption by the immature parasite of the state in which it is fit to gain entry into the alimentary canal with food or water. It remains for some little time in the primæ viæ, and then becomes comparatively inaccessible.

Prevention, therefore, consists in housing all severely affected animals, and destruction of bedding materials and other matters on which the discharges from the patients fall; removal of all the slightly diseased to high and dry pastures, giving them a judicious supply of water not liable to be contaminated, and rock salt; feeding them liberally with strengthening diet and administering doses of iron tonics which are anthelmintic. With regard to the housed animals they must be treated with stimulant tonics and carefully nursed. Williams has seen excellent results from administration of prussic acid, which allays bronchial irritation and destroys the worms, but most authorities seem to prefer more energetic treatment with a view to actual expulsion of the parasites. Thus, turpentine is much lauded, since it is excreted to a certain extent through the bronchial mucous membrane, and is supposed to render their habitat uncomfortable to the para-

sites. Fumigations with chlorine, carbolic acid (coal-tar smoke), and sulphurous anhydride, are supposed to kill the entozoa. They certainly cause such an amount of coughing as leads to expulsion of a very considerable number, but it is highly probable that parasites can stand a more severe dose of these agents than the calves can. Therefore, though these means should be tried they must not supplant the stimulant tonic treatment above suggested. The *usual method of fumigation* is to collect the patients into a loose box with closed doors and windows. In this the gas is generated as long as the operator is able to bear it, then the apparatus is removed, and the patients left exposed to the gas for about a quarter of an hour according to their state and the judgment of the veterinary surgeon. The liberation of chlorine is brought about by the action of sulphuric acid, either on a mixture of chloride of sodium and black oxide of manganese, or on bleaching powder. Sulphurous anhydride may be procured by burning sulphur. Finally, we must insist on the avoidance of pastures notorious for generating hoose; especially must caution farmers against keeping animals on them in the later summer months, when the disease is acquired and manifests itself towards the latter part of autumn. As has been so frequently urged by Dr. COBBOLD, parasitic disorders of this kind are of national importance, and, therefore, should be taken cognizance of by the government with a view to prevention. Failing this, energetic well directed action on the part of our agricultural societies could materially reduce the prevalence of these formidable diseases. Agents used in the treatment of husk are sometimes administered through the nostrils. Of course, this has no advantage over the method of oral adminstration. It is possible that beneficial effects may result from diffusion of such an agent as turpentine over the nasal mucous membrane, whereby it can impregnate thoroughly the inspired air. It also will give rise to violent efforts at expulsion by sneezing.

PULMONARY CONGESTION occasionally occurs in the ox under an *acute form*, as a result of over-driving and over-

work, when it is manifested by extreme dyspnœa, profuse cold perspirations, coldness of the extremities, and extreme rapidity of the pulse, which is scarcely perceptible, also frequent respirations, and, sometimes, a mucous discharge from the nostrils intermingled with blood. The patient occupies the recumbent position, coughs frequently, and has a wild haggard look.

On *post-mortem examination* the lungs are found to be enlarged, of a dark red colour, and increased specific gravity. The cavities of the heart are gorged with black blood, which also flows from a section of the lung substance. The bronchial tubes are filled with frothy, often sanguineous mucus. This state is liable to be complicated by rupture of the vessels and extravasation of blood. This is termed Pulmonary Apoplexy, and very seriously increases the complexity of the case, for the blood thus thrown out does not readily become absorbed, and permanently interferes with the function of a part of the lung varying according to the amount extravasated.

Subacute pulmonary congestion may be seen in the later stages of blood diseases and anæmic conditions, being one of the metastatic congestions due to deficient nerve force most liable to bring about the death of the patient. Thus, it is not infrequent, and is denoted by the above-mentioned symptoms manifested less urgently and appearing slowly. In all such cases stimulants are required; they act in two principal ways, by rousing the weakened heart to increased vigour of contraction and by stimulating the nervous structure of the lungs, whereby the tone of the vessels is resumed and the congestion overcome. Measures must be taken to diffuse the blood which is abnormally heaped up in the lungs by such means as hand-rubbing, hay bandaging or stimulating the extremities. Stimulants, too, may be applied to the sides, and the patient clothed and nursed with care. Tonic agents may subsequently be called for.

Hæmoptysis is *Bleeding from the Lungs.* The flow of blood may be somewhat profuse, and vary in colour. It is intermingled with mucus, and takes place from the nose

and mouth. It results from acute pulmonary congestion, from laceration of the lung substance, or from specific disorders, such as give rise to ulceration in the lungs (as phthisis) or as cause subacute congestion of those organs. The amount of blood which thus escapes is not often considerable and the flow will cease spontaneously, but sometimes cold applications to the sides and administration of hæmostatics are indicated.

Pneumonitis—*Inflammatory Pneumonia* (*Inflammation of the Lungs*)—varies in its nature at the commencement of an attack according to the parts primarily involved. Thus we find three forms described:

I. *Crupous or lobar,* due to blood disease, is preceded by acute congestion, which is followed by accumulations, mainly in the air-cells, of lymphy deposit intermingled with leucocytes, proliferating epithelial cells, and extravasated red corpuscles. Thus, the lung over a considerable part of its extent is rendered firm, and is found granular and somewhat mottled on section. This condition is *red hepatization.* It is succeeded by more marked proliferation of the epithelial cells and increased escape of leucocytes, and thus the air-cells becomes blocked up with young cells, which subsequently undergo fatty degeneration; this is *grey hepatization.* Softening of the deposits may occur as a secondary process. The interlobular areolar tissue is the seat of lymphy deposit, and constitutes yellowish bands extending across the cut surface of the lung.

II. *Broncho-pneumonia—Lobular or Catarrhal Inflammation of the Lungs*—results from extension of bronchitis into the pulmonary vesicles. Sometimes it depends upon reflux of inflammatory products; in other cases it is determined by the perversion of function which is brought about by diminished supply of air. The air-cells become blocked up with the inflammatory products of mucous membrane; the inflamed parts of the lung therefore undergo one form of grey consolidation. It leads to congestion, collapse, and emphysema. As a result of the inflammation, a serous effusion takes place

into the interlobular tissue, so that in an acute case the lungs have a sodden appearance.

III. *Interstitial pneumonia* or *lung induration* is a chronic form consisting in hyperplasia of the interlobular areolar tissue, due to persistence of disease in this structure after the more acute attack in the other lung elements has subsided. It results in diminution in size of the air-vesicles which undergo atrophy, in great firmness of lung tissue, and extensive emphysema. Sometimes it is an effect of broncho-pneumonia, in other cases of pleuritis.

There can be no doubt that each of these forms of pneumonia occurs in the ox. The *croupous or exudative form* in pleuro-pneumonia zymotica, in which its exudative and lobar characters are well marked and the mottled state of the section is very evident. The *catarrhal form* results from exposure, alternations of temperature, and other like causes to those which originate bronchitis. Sometimes it depends on the entry of acrid medicines and solid particles into the lungs, as seen when the protective influence of laryngeal sensibility is interfered with, as in parturient apoplexy, or when the pneumogastrics have been injured. Besides the ordinary signs of fever we find that there is a suppressed cough, and the animal generally lies, but sometimes stands with the muzzle protruded. The extremities are of variable temperature until the latter stages, when they are persistently cold. The pulse is frequent, and afterwards becomes rapid, small, and weak. The breathing is accompanied by a grunt, and is even, short, and quick. Ausculation shows at first crepitus, but the vesicular murmur is soon lost; percussion gives a dull sound. As the disease progresses suppuration or gangrene may supervene. The former result is rare, except when due to specific disorder, as the impactment of emboli in the blood-vessels. It is indicated by rapidly increasing debility, a peculiar resonance of the cough, and the cavernous râle. Also a purulent discharge passes up from the lungs and sometimes this contains the *débris* of the disorganised tissue. When gangrene takes place, there is a rapid sinking of the patient, sudden fall of temperature, coldness of the extremities, and

a very fœtid condition of the breath, as also of the nasal discharge, and the pulse runs down. In cases of lung disease we generally find that pressure of the enlarged organs on the posterior vena cava causes congestion of the liver, as denoted by yellowness of the visible mucous membranes. It is also been noted that in the dry stage of inflammation respiration is interfered with, but that when exudation takes place, the patient experiences sudden relief.

Treatment.—The prospects of cure depend very considerably on the extent of the disease, for if the two lungs be involved the blood will remain unoxygenated, and also be overloaded with impurities. Bleeding is admissible under these circumstances. It is most likely to produce a prompt cessation of the inflammatory process, and also to a certain extent removes impurities from the system. It is only to be adopted in the earliest stage of the disease. Later, and in conjunction with this, we must administer aconite and other sedatives, while we endeavour to excite the kidneys and skin to increased action by saline febrifuges and ether. The bowels should be relaxed by enemas. Externally stimulants must be freely applied to the sides and along the course of the trachea, the limbs must be hand-rubbed, bandaged, and stimulated. Pure air must be freely allowed, but the animal kept warmly clothed. When active febrile symptoms have subsided and secondary lung changes are taking place, our main reliance must be upon diffusible stimulants and sometimes vegetable tonics. This is especially necessary when there is a tendency to suppuration and grangrene. We are not prepared to reject the plan of active stimulation of the body surface in pneumonitis; though some practitioners carry it to excess, its beneficial effects in some cases of this nature will have been evident to all experienced cattle pathologists. We are inclined to attribute the benefit rather to reflex than to direct action.

The animal after recovery is liable to permanent changes of the lungs, which will not interfere with its adaptation for various uses. These changes are not so prejudicial to fitness for duties as they would be in the horse.

Interstitial pneumonia has been described by some authors under the heading emphysema. The latter state is one of its results. Besides the causes already mentioned it may be due to the constant presence of effete matter in the blood. The large amount of areolar tissue of the lungs of the ox must be considered a predisposing cause. The symptoms manifested by an animal suffering from this form of pneumonia are obscure. The patient is manifestly unwell, and there is increasing anæmia. The skin is yellow and scurfy, and the bowels are irritable. Auscultation shows absence or diminution of the vesicular murmur in the diseased and increase in the healthy parts, but percussion does not give definite results. Finally, the anæmia proves fatal, and after death the lungs are found firm, pale, and markedly emphysematous. The right side of the heart is hypertrophied. Cases of this kind are chronic and unsatisfactory. Stimulant tonics and good feeding with careful nursing are about the only means at our disposal. The absorbent action of iodide of potassium may be tried.

The effects of entry of non-respirable gases into the lungs or of the passage of fluid matters in considerable quantity down the trachea are, primarily, asphyxia, but if the animal be able to rally from this the catarrhal form of pneumonia supervenes ('Veterinarian,' vol. xiv, p. 257).

Sometimes *Echinococcus cysts* are found in the lungs. They may be present in considerable number without our attention having been drawn to any sign of ill health in the host. The cysts are formed by the areolar tissue, condensed and altered by the presence of the parasite and enclosing it on every side. They may be deeply embedded in the substance of the organ or projecting on the surface, and sometimes are in the stage of calcareous degeneration. *Wounds of the Lungs* are not so frequent, for these organs are very elastic. An interesting case of a "Cyst in the lung," due probably to the passage of a foreign body from the stomach, is given by Mr. Gerrard, of Romford ('Veterinary Journal,' vol. iv, p. 163). A laceration of this organ leads to hæmoptysis, but repair somewhat

readily takes place. The most frequent cause of laceration is fracture of a rib with the extremities forced inwards. "*Tic*" under this name has been described "wind sucking" of the ox. It has been observed in France, and is due to indigestion.

The pleura of the ox differs from that of the horse, mainly in the fact that the lower part of the posterior mediastinum is as stout as any other part of the median septum of the chest. Hence an accumulation of fluid may take place in one pleural sac only, a state of affairs not often seen in the horse.

Pleuritis, Pleurisy. — *Inflammation of the pleura* results from exposure, especially when east winds are prevalent; it then assumes an enzootic, or even epizootic character. It also occurs as a complication of pneumonia, and a result of fractures of the ribs and other injuries. It has been seen in a case of passage of a sharp agent from the stomach, which gained exit from the body through the thoracic walls. It is in some cases of a rheumatic character. It may be circumscribed or diffused, unilateral or double.

Symptoms.—Besides the general signs of fever, the pulse is small, quick, frequent, and hard. The respirations are peculiar, being principally abdominal; the inspiratory efforts being cautious, and the expirations prolonged. The patient usually stands with an anxious expression. A sharp, suppressed, painful cough is present. Pain is manifested on pressure between the intercostal spaces by the animal flinching and giving a grunt. Auscultation detects the friction sound in addition to the ordinary respiratory murmurs. A sudden subsidence of the acuteness of the symptoms denotes when effusion into the pleural sac has taken place (Hydrothorax). Then the pulse becomes soft, but is still frequent and small. The breathing is laboured, with prolonged expiration, the thorax is enlarged, for the ribs are separated from each other to the greatest degree possible. Less pain is manifested on pressure of the sides, and the animal feeds freely. There have been noted a peculiar flapping of the notrils, protrusion of the muzzle, and an anxious expression. Dropsical swellings

appear, and the patient becomes very weak, and death from asthenia results. Accumulation of fluid in the chest rarely occurs except as a result of previous inflammatory action. The most valuable indications of its presence are afforded by auscultation and percussion. The latter test gives a dull sound as high as the fluid has risen in the chest; the former an absence of all sound below the same line.

Results.—Resolution frequently follows proper treatment, and the deposits become reabsorbed. If the disease has existed for some time some of the deposits will have become organised uniting the pulmonary with the costal pleura. Often we find that the pleura of a healthy animal is opaque in patches, or has slight stringy lymph bands connected with it, as a result of a previous attack of pleurisy. Death may take place in the earliest stage from fever, or in the later stage after prolonged disease from collapse of the lungs, in consequence of pressure from effusion, or it may be the culmination of progressive debility.

Autopsy.—At first a congested condition of the pleura, causing reddening and dryness, either diffused, localised, or in patches; later, opacity and lymph deposits, in various stages of organisation, investing the pleural surface, uniting the parietal and visceral layers of the membrane, hanging as shreds in the effused lymph, or separated as flocculi, which float in the effused serum, which varies in quantity (sometimes amounting to several gallons), colour (straw coloured or red), and turbidity, Occasionally pus is found in the pleural sac, when the condition is known as Empyema (but this, when it does occur, is generally due to a ruptured abscess of the lungs, for instance). The pleura may, in very acute cases, be gangrenous, its lymphy deposit dark and wanting in consistency, and of an offensive odour. In hydrothorax the lung or lungs are small, firm, and somewhat congested.

Treatment.—That suggested for broncho-pneumonia may be adopted, with the following modifications:—Bleeding is not called for; laxative agents may be freely

administered, for there is no such tendency to diarrhœa, as is sometimes seen in pneumonia. External stimulation must be resorted to under the form of mustard applications to the sides, or prolonged fomentation with hot water. In the hydrothoracic stage nitre must be freely given in the drinking-water. Digitalis is specially indicated as a sedative agent, which materially promotes absorption. Iodide of potassium and other resolvents are useful. The deposition of false membranes, however, prevents absorption, and the constantly increasing accumulation of fluid threatens lung collapse. Under these circumstances *Paracentesis thoracis or Thoracentesis*—"tapping of the

FIG. 64.—Thoracentesis *v.* paracentesis thoracis. (Armatage.)

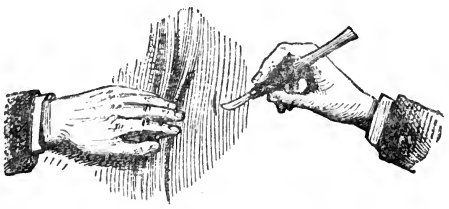


FIG. 65.—Thoracentesis. Primary incision, with the skin drawn to one side. (Armatage.)

chest"—must be resorted to. This is performed as in the horse; the sixth or seventh intercostal space, just behind the point of the elbow, is chosen. A small trocar and canula are used. The skin is drawn forwards (Fig. 65), so that the external wound may not correspond with the

puncture into the chest. It is pierced by means of a scalpel. The trocar is then inserted through the thoracic wall at about the centre of the lower third, near the anterior margin of the rib. Directly the wall is punctured the canula is pushed farther in, and the trocar withdrawn (Fig. 64). It is not considered advisable to thoroughly empty the chest, and thus suddenly and completely remove from the lung all the pressure exerted by the fluid. Again, a rush inwards of air must not be allowed. If a free flow of fluid does not occur, or suddenly ceases, it may be due to lymph plugging the tube; this must be removed with a probe. In all cases where empyema is diagnosed this operation must be resorted to. It may require to be repeated two or three times, and cases have been known to recover under this treatment. Prognosis, however, is decidedly unfavorable.

Pneumothorax is accumulation of gas in the pleural sac, due either to injury of the lung or a wound communicating with the exterior. If the opening be closed the air will become absorbed.

Pleuro-pneumonia sporadica.—We find that frequently pneumonia and pleurisy are concomitant, the disease originating either in the lungs or the pleura. The symptoms, pathological changes, and methods of treatment which are most beneficial are compounded of those of pleurisy and pneumonitis, and do not here need recapitulation. The case seems most like one of pleurisy in some instances, of pneumonitis in others. The most important question for consideration, with regard to this disorder, is in what respects it is to be distinguished from the epizootic pleuro-pneumonia. This is a matter of much importance, especially to veterinary inspectors. The existence of this sporadic disease has been denied, but most unwarrantably.

Causes.—It cannot be attributed to contagion, but results from exposure to cold, and other influences liable to generate inflammation of the respiratory organs; seldom runs through a herd; several animals, similarly exposed, may become simultaneously affected, but removal of the cause leads to cessation of fresh cases; is most prevalent in

inclement seasons, and is not usually found associated with the introduction of a fresh lot of beasts on to a farm, nor with exposure in fairs and markets.

Symptoms.—Acute febrile signs are present, the attack is sudden, runs its course rapidly, and frequently terminates in resolution. We seldom find one lung more affected than the other, and the phases of the disease in the different parts of the lung are uniform.

Post-mortem appearances show the lung disease as rather of the catarrhal than the croupous form. Both lungs are generally uniformly involved. The section presents a marked appearance, but not the variety of colour seen in the other form—the yellow bands are not so evident. With the exception of the intercostals the muscular system presents no special change.

The diaphragm of the ox is very upright. The muscular fibres gain attachment in a bipenniform manner to a tendon running from above downwards centrally, to just above foramen sinistrum. This arrangement is very special.

Rupture of the Diaphragm is sometimes seen in the ox; it is generally complicated with hernia. In some cases it seems to be rather congenital deficiency than true rupture.

CHAPTER VI.—DISEASES OF THE URINE AND URINARY APPARATUS.

We find that in the ox the kidneys are lobulated, since they retain the division into parts observable in the fœtus; they are large, and present well-marked papillæ

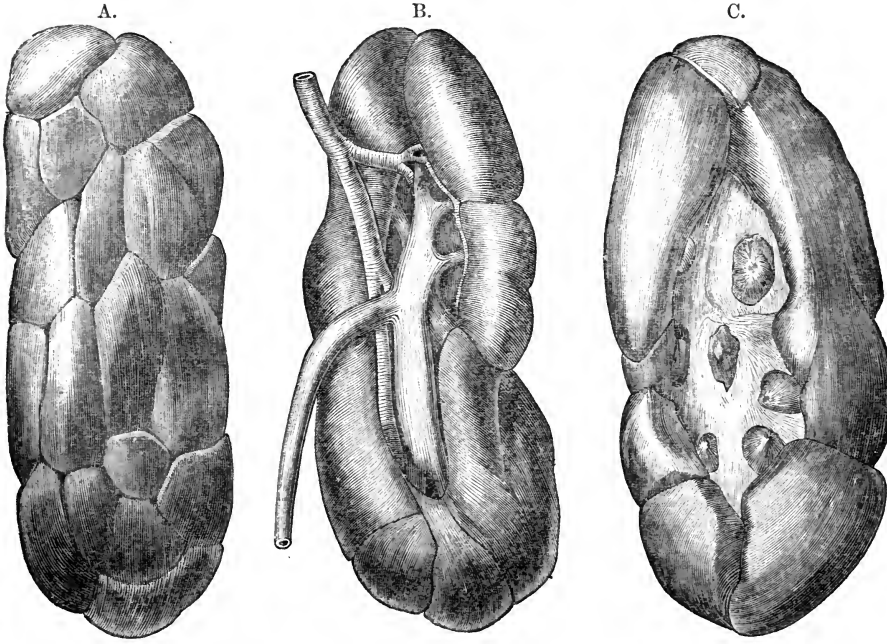


Fig. 66.—Kidney of the ox. A. Right: supero-external surface. B. Left: infero-internal surface. C. Left: showing calyces. (After Chauveau.)

and calycine divisions of the pelvis. The bladder is thoroughly invested by peritoneum, and is of considerable size. The curve in the penis of the male interferes with the passage of the catheter. Also the urethral passage is small and situated deeply in the substance of the penis.

In the female a small mucous pouch, which opens backwards, may be found on the floor of the vulva, just behind the termination of the urethra. In passing the catheter some care must be taken to avoid this cul-de-sac. The urine of the ox is alkaline, of a light yellow colour, having a specific gravity of 1032 to 1040. Boussingault estimates the average amount passed at 7·2 kgrs. in twenty-four hours, and his analyses show that as compared with the urine of the horse that of the ox contains more water, hippurate of potash (16·5—4·7), sulphate of potash and chloride of sodium, and much less urea (18·5—31), and scarcely any carbonate of lime (0·6—10·8). From the prepuce of the male hang downwards long hairs in a tuft of a considerable size. The urine flows in small straight stream while the animal stands still. The cow postures herself for expulsion of urine, and evacuates forcibly and in large stream.

Disorders of the urinary system naturally divide into those of the secretory organ and the product of the secretory process, on the one hand; of the urinary passages and the accumulation and evacuation, on the other.

Section 1.—Abnormalities of the Urine.

The production of fluid may be excessive or the reverse, may be perverted, or matters may be abnormally added.

Diabetes simplex, v. Insipidus.—*Profuse urination* is dependent on excess of water in the blood (hydræmia), or on the presence in that fluid of some diuretic principle. Thus, it is sometimes observed as a crisis of fevers, and is nature's means of removal of impurities from the blood. The total daily product of urine is in excess of the normal, but its specific gravity is decreased, and there is a deficiency of colour. The patient is very thirsty, and some fever may be present. The bowels are torpid, the appetite depraved, and the visible mucous membranes very pale. Anæmia is present, and may increase to even a fatal degree. This can hardly be considered a disease, but rather a symptom of unsatisfactory composition of the blood. It must not be too hastily checked, but the

animal allowed a free supply of food and drinking water, and nursed, care being taken to change the diet. Later, doses of iodide of potassium will be found beneficial. Special care should be taken that the skin be kept healthy, and the bowels may be aroused into activity by a laxative dose. Tonics may be required in the later stage. The adminstration of laxatives is especially called for, since food containing excess of moisture, or impure, or rank, is liable to cause diabetes. Autopsy shows signs of anæmia. This condition is rare.

Non-secretion of Urine seriously affects the blood, giving rise to the condition know as *uræmia*. It is seen experimentally after excision of both kidneys, also to a less degree in inflammation of these organs, especially when both are involved. Then the impurities in the blood prove actually poisonous, though the liver and skin endeavour, to a certain extent, to perform the duties of the kidneys in addition to their own labours. This also is but a symptom of disease, and must be treated with the state upon which it depends. Sometimes there is deficient secretion of urine, as in fever, and that which is passed is of high specific gravity in consequence of the large amount of extractives it contains. A similar state, but of a chronic character, is due to deficient supply of water for drinking purposes when the patient has been fed on dry food. This certainly predisposes to calculous disorders of the urinary passages. It is seen in draught beasts in dry countries, or when animals are turned out on upland pastures in hot, dry weather. *Parkes* estimates the amount of water necessary for a working ox on dry food at 6—8 gallons per diem.

Hæmaturia.—Occurrence of *blood in the urine* depends upon injuries, acute congestion, or ulceration of the kidneys or urinary passages. Sometimes also upon excessive, indiscriminate, administration of diuretics or ingestion of acrid plants. Straining, leaping on each other, and falling into ditches are the most frequent cause of injury. This is an accompaniment of some forms of blood disease, and is often symptomatic of the presence of calculi.

Symptoms.—The urine contains blood in a coagulated condition. There is pain on pressure of the loins, the animal stands "in a heap" with the back arched, moves with difficulty, and with a stiff staggering gait. There is frequent passage of a small amount of urine. The patient stands, and suffers from a variable amount of sympathetic fever. Sometimes this is associated with injuries caused at the same time. In one case clots became fixed in the urethra and interfered with the flow of urine, causing the symptoms of retention of urine. Rectal exploration should be made in all cases of this kind to determine whether any injury of the vertebræ is present, in which case there is likely also to be paralysis. In the female, also, examination should be made per vulvam.

Treatment.—Generally consists in the endeavour to cure the injury upon which this depends, but where the flow is very rapid cold enemas and cold-water applications to the loins, and such hæmostatic agents as sulphuric acid and the acetate of lead may be given. Demulcent drinks are a useful adjunct to more active measures. The diet throughout the attack, and for some time after, should be laxative; small doses of oil will be beneficial.

Albuminuria is treated of at some length by Armatage. He tell us it is due to disordered digestion and excretion of imperfectly elaborated albumen by the kidneys. That it results from irregular feeding and bad management, and from diseases of the nervous and digestive systems.

Symptoms.—A great desire to stretch at full length, constipation, stiffness, and straddling gait. Respiration acclerated, urine thick, mucilaginous, and dark coloured. We are also told that this fluid may not exhibit the ordinary reactions of albumen, "but white precipitates are obtained with nearly all the following:—Tincture of galls, solution of bichloride of mercury, alcohol; solution of subnitrate of mercury, flesh colour; solution of ferrocyanide of potassium, acidulated with acetic acid, gives a white precipitate after being heated." Paralysis and coma result. Armatage considers this the same as Bright's

disease in man, but it has not the chronic character of that disorder, the kidneys are not found in a state of granular degeneration after death, and the urine has not been shown to contain disorganised renal substance and casts of the tubuli uriniferi. The analogy between the two diseases can hardly be considered to be established, but we must consider albuminuria of the ox a symptom of defective assimilation. It must, therefore, be treated by a cathartic dose, liberal administration of readily digestible food, and vegetable tonics. Measures must not be taken to check the activity of the kidneys.

Section 2.—Diseases of the Kidney.

Nephritis—*Inflammation of the Kidney*—is not a frequent disease of cattle. It is seen in working oxen, for these are most liable to exposure when heated and to strains. In the horse this disease may generally be traced to excessive administration of diuretic agents to improve condition, but sometimes to over-weighting and want of harmony between the movements of an awkward rider and those of the horse. These influences do not operate on the ox to such an extent, though the former may be to him an occasional cause of this disease. Injuries of various kinds and extension of inflammation from neighbouring parts sometimes give rise to nephritis.

Symptoms.—Besides the general febrile signs we find that if both kidneys be affected no urine is passed; if only one, a diminished supply of urine of a thick viscid character, containing much albumen, and perhaps blood and pus. This is frequently passed in small quantities, and afterwards the patient continues to make ineffectual attempts to urinate; passing the catheter or manual exploration per rectum or vaginam shows that the bladder is empty. There are generally obvious signs of colicky pain. The patient stands, and moves stiffly, and with a straddling painful gait. The back is arched, and acute pain is manifested on pressure of the loins. In the latter stages uræmic complications set in, denoted by double pulse,

considerably increased fever, urinous sweats, fœtid evacuations of fæces, and paralysis. In some cases the diagnosis of this disorder will be found very difficult.

On *post-mortem examination*, one or both kidneys are found disorganised, enlarged, and reddened. Lymphy deposits occur in parts of the organ, and sometimes suppurative changes which lead to formation of abscesses. Gangrene of these organs is seldom seen. In chronic cases, cystic disease due to accumulation of fluid in the Malpighian corpuscles, with blocking of their tubes and atrophy, are present. Hypertrophy of these corpuscles may often be observed in the undiseased kidney.

Treatment.—Bleeding is indicated as exerting a sedative influence and removing a considerable amount of effete matter from the blood. The bowels and skin should be aroused to activity to relieve the kidneys, Aconite may be required as a febrifuge. Warm water to the loins or the application of a fresh sheep skin to the same part is decidedly beneficial, and warm enemas are useful as fomentations. Digitalis applied as a decoction to the skin is recommended by Williams as a means of exciting the secretion of urine when uræmic intoxication sets in. When pain is excessive, doses of opium must be given. Thoughout the attack cantharides, turpentine, and other stimulants which act on the kidneys, must not be applied to the surface.

Abscess of the Kidney is denoted by passage of a considerable amount of pus with the urine. It most often depends on calculus. Little can be done in such cases except to support the strength of the patient. This condition may be secondary, due to emboli or to specific blood diseases.

Renal Calculus of the ox is not infrequent. Generally there are several of these concretions situated in the calyces of the pelvis. They are irregular in form, are dense and laminated. "And as they increase in size cause absorption of the medullary structure of the kidney, and to a certain extent interfere with the function of the organ." (Morton). They vary considerably in size and in their

effects on the animal. Sometimes they cause no noticeable symptoms; in other cases there are signs of suppurative nephritis, but of a chronic character. The uncertainty of diagnosis and the deeply-seated position of the concretion are impediments to remedial measures. Stimulants freely administered, and opiates when there is much pain, may be tried. The value of the so-called lithontriptics, hydrochloric acid, for example, in such cases is probably *nil*. These calculi must be considered to result from an excess of salines or deficiency of water in the urine; probably a portion of inspissated mucus forms the nucleus. Cases of free incision through the side and removal of calculus from the kidney through the wound have, I believe, been known, but there are many objections to this bold operation. It is better, if possible, to fatten the patient for the butcher.

Parasites have been observed in the kidney of the ox, but are less frequent than in the horse.

Encephaloid Cancer of the kidney. Professor Walley records a case in the 'Veterinary Journal,' vol. ii, 1878, p. 9. It was associated with similar tumours in the omentum, and nothing was known of the history of the case.

Section 3.—Abnormalities of the Urinary Passages.

Sometimes a small calculus passes from the kidney into the ureter and there becomes impacted, either on account of its size or of spasm of the tube. Then severe colicky pains take place, with straining, stamping the feet, lashing the tail, and perhaps looking round at the side, until relaxation supervenes and the concretion passes on into the bladder. Occasionally diagnosis in such cases is possible from exploration *per anum*, when the stone may be removed by incision through the wall of the bowel. This operation is seldom called for. Sometimes the calculus becomes fixed at the opening into the bladder, when *dilatation of the ureter* and of the pelvis of the kidney will result from accumulation of urine behind the obstruction. In these cases full doses of opium are indicated

when pain is excessive; it acts as an anodyne and relaxes spasm of muscular fibres.

The bladder is subject to several serious disorders. Of these the most important are associated with either retention, incontinence, strangury, and dysury—symptoms of disorder mostly dependent on several causes.

Retention of Urine must be distinguished from *Ischury*. In the latter case no urine is secreted, as may be seen in nephritis. Retention is non-passage, attributable either to obstruction or to want of expelling power. We are frequently told by cowmen that the patient has not passed any water for some time; this must be interpreted as "has not been seen to urinate," it generally is a false alarm. The retention may be due to loss of power of the bladder, depending on nervous lesions, as in apoplectic cases; to spasm of the neck of the organ, with or without inflammation; blocking up of the urethral passage by calculi or lymph; the pressure of a hardened mass of fæces in the rectum may have this effect. The secretion of urine continues, the longer, therefore, this state remains the more urgent the symptoms; but in cases due to nervous lesions accumulation may take place to a sufficient extent to rupture the bladder without any appreciable signs of discomfort. Under other circumstances the animal is very uneasy, lashes the tail about, shifts the hind limbs, and sometimes rises and lies down again frequently. He repeatedly endeavours to micturate, and perhaps looks round at the flank. There is always an anxious expression of countenance. Exploration *per rectum et vaginam* discloses the distended state of the bladder, and also ascertains whether any cause exists in either of these parts to account for the obstruction. Sometimes simple pressure on the organ will rouse it to action, a point of great importance in the male, in whom this accident most frequently occurs, for the sigmoid flexure of the penis of this animal complicates the *passing of the catheter*, which is the next measure which suggests itself. The same form of catheter is used for both male and female in cattle practice. It is a metal tube, about 24 inches long, and with a calibre of

about ½ inch, somewhat curved, blind at one rounded extremity, but perforated at its sides just within this, open at the other (see fig. 77, p. 394). The operator, standing on the right ("near") side of the cow, passes the left hand, with the index finger over the rounded end of the tube, into the vulva, and thus introduces this end into the urethral opening on the floor of the canal, avoiding the cul-de-sac placed just behind the orifice. When the instrument enters the bladder a rush of urine takes place. This easy operation must be performed whenever a cow remains recumbent for an unusual length of time. In the male the course of the urethra must be traced to its extreme posterior part, and an incision made into it behind the ischial arch. Through

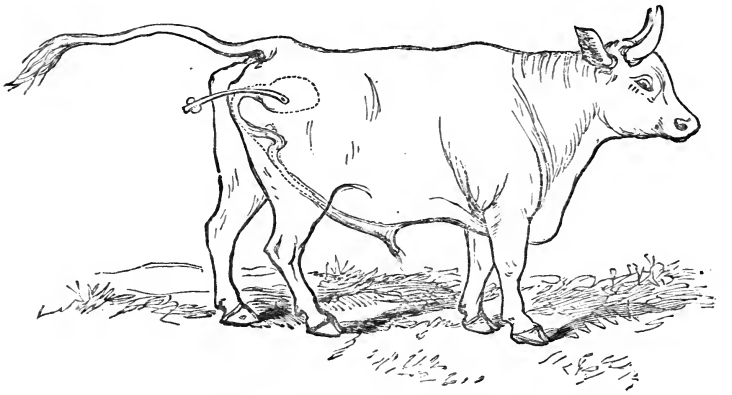


FIG. 67.—Passing the Catheter in the ox. (Armatage.)

this the catheter may be passed. The animal will not require to be cast; indeed, this would not be satisfactory in the highly distended state of the bladder. The wound may be closed with a suture if it does not seem that evacuation will require to be repeated. The method of *prepubic puncture* has been suggested, and might well be performed in the ox if the symptoms be very urgent.

INCONTINENCE OF URINE (*diuresis*).—Constant dribbling of urine may result either from relaxation of the urethral canal at its commencement (the contact of whose walls is now deemed the true physiological means of preventing

the escape of the accumulating urine), or from irritability of the bladder, as in certain disorders of its lining membrane or a cystic calculus; also where the urine is abnormally acrid and laden with irritating material; thus, we have noticed its presence in hæmaturia. Sometimes it may be deemed advisable to inject demulcents into the bladder. A free exhibition of fluids will dilute the urine and render it less acrid. In all cases the cause must be removed.

Dysuria is pain in expulsion of urine, seen in inflammation of the urethral canal, presence of cystic calculus, and some other cases.

Strangury, as seen in spasm or inflammation of the neck of the bladder, is painful passage of urine *guttatim*.

Cystitis, *inflammation of the bladder*, is very rare, though it may arise from several different causes, such as excessive use of certain diuretics, cantharides more especially, injuries, and extension of inflammation from neighbouring parts. It is also said to be attributable to acrimony of the urine. The inflammation may involve part or the whole of the organ. The neck is most frequently the seat of the circumscribed form, probably as a result of spasm. The lining membrane may become involved in catarrhal diseases of the urethra. When the greater part of the organ is affected examination per rectum detects heat and pain on pressure of the bladder. There is retention of urine, which, when evacuated, is found to be bloody, albuminous, and thick, with a considerable quantity of mucus. Colicky pains, looking round at the flank, and uneasiness are present, spasmodic contractions of the cremaster (in the bull), and acute febrile signs.

Results.—Those enumerated are resolution, death from exhaustion, rupture of the bladder, and uræmia. With regard to the latter, it must be a direct result of destruction of the vesical epithelium, for under normal conditions this is a very decided impediment to reabsorption of urine.

Treatment.—When possible, injection of mucilaginous

substances into the bladder, after drawing off its contents with the catheter; also free administration of water and mucilaginous drinks, warm-water applications to the abdomen; warm sedative injections, as infusion of poppies; sedative and febrifuge agents, which are not excreted by the kidneys. Of course, careful nursing is required.

Spasm of the Neck of the Bladder is not frequent in the ox, but some cases have been recorded.

Rupture of the Bladder results from over-distension. It is denoted by sudden cessation of the acute signs of retention, and especially collapse of the organ, as felt *per rectum*, without any passage of the urine externally. Uræmic symptoms occur and bring about death, which may take place from collapse or the bursting of the viscus. When there is retention of urine, throwing the animal for operation may cause this accident. Sometimes it has occurred when the animal fell in dying. The state of the peritoneum ought to inform us whether such has been the case, or the flooding of the abdomen with urine took place earlier. This lesion is, of course, fatal.

Inversion of the Bladder is seen in the female animal, and is due to violent parturient throes. Amatage has seen it follow the administration of irritant medicines. Youatt quotes a case where the wall of the vagina ruptured, and the bladder was herniated through it. The practitioner in attendance punctured this, and the urine escaped. In a true case of inversion (*prolapsus vesicæ*) the organ appears as a red tumour, projecting from the floor of the vulva, and having urine constantly trickling from it. Thus, the urine constantly drops from the urino-generative opening, and excoriates the surrounding parts. In such a case it is advisable to slaughter the patient, for the accident is extremely liable to recur. After straining pains have ceased the organ may be returned. Little difficulty is generally experienced in accomplishing this, because of the large size of the urethral canal in the female. In a case of rupture of the wall of the vulva, with hernia of the bladder, the latter

organ having been returned, the opening may be closed by suture.

A Pervious Condition of the Urachus is sometimes seen in calves. This passage, which in the fœtus extends from the peculiarly elongated bladder at the umbilicus to the allantois, becomes, under normal circumstances, plugged with lymph, which undergoes organisation and degeneration when the bladder recedes from the umbilicus. In scrofulous subjects, especially, this process does not occur properly; the lymph thrown out only becomes imperfectly organised, loosens from its position, and there is a constant dribbling of urine through the umbilicus. We have known a case in which a plug of lymph which had receded into the bladder became fixed, and thus opposed the exit of urine *per urethram*. Straining led to prolapsus recti, and necessitated slaughter. In these cases a ligature around the umbilicus must be resorted to, or sutures may be inserted. The abnormal condition is liable to disappear with development, for this condition is of greatest frequency in animals born prematurely.

Calculus in the Bladder.—Cystic or vesical calculus depends upon excess of salines in the blood or upon retention of urine. It is most frequent in the male, for in him the urethral passage is much smaller than that of the female, and is often attributable to a considerable quality of special salines in the food or water, such as the presence of many phosphates, as in oil-cake and turnips. Sometimes renal calculi travel along the ureter, and entering the bladder form the nuclei of larger concretions, for cystic calculi are almost invariably laminated and concentrically arranged around some nucleus or other. They may attain a considerable size without giving rise to much inconvenience, or may cause special symptoms. *Sabulous matter* is sedimentary deposit from the urine in the bladder; it is largely passed off by the urine, but accumulates in the viscus in considerable quantity, or the deposit may assume a crystalline form known as "*gravel.*" This also is partially expelled with the urine, but frequently becomes embedded in the mucous mem-

brane, and gives rise to irritability of the bladder and incontinence of urine. Fürstenburg gives the following composition as an average analysis of urinary calculi of the ox:—Carbonate of lime, 84·8; carbonate of magnesia, 10·0; carbonate of iron, 0·6; organic matter, 1·6; water and loss, 1·6; silicic acid, inconstant. The presence of calculus in the bladder sometimes gives rise to hæmaturia; generally, however, no alteration is observable in the character of the urine further than a somewhat copious sediment. In all cases there is a straddling movement with the hind limbs and stiffness about the loins. Sometimes the stone becomes fixed in the urethral passage, whereby it interferes with the expulsion of the urine, and the signs of retention are present and urgent. This condition takes place in the male, and the urethra becomes distended with urine to the obstruction. It may result in *rupture of the urethral passage*, a condition which may also arise from injury (see 'Veterinarian,' vol. xxi, p. 204). Exploration per rectum is often useful in cases of cystic calculus. The bladder may be found distended with urine, as in spasm of its neck, but the calculus is perceptible, and sometimes may be removed by pressure, whereupon a rapid flow of urine results. In these cases, too, there is not generally complete retention, but the flow, at first free, suddenly ceases, and the animal lashes its tail, grinds its teeth, moves the hind feet, and makes violent expulsive efforts, which only tend to fix the obstructing agent more firmly in the passage. Surgical methods are resorted to for the relief of this condition. Lithontriptic or "slow dissolving medicinal agents" have been found wanting; stimulants are only palliative. There are three forms of operation.

Lithecstasy—Dilatation of the Urethra—is especially resorted to in the female. It consists in the frequent distension of a bladder introduced into the urethral passage, leading to dilatation to such an extent that the stone may pass. It is seldom resorted to in veterinary practice.

Lithotrity consists in crushing the stone, whereby, being reduced to the state of gravel, it can be expelled through the urethra. The instruments by means of which this is

done are large screw forceps curved and toothed at the end. They are passed through the urethra of the patient (from the perineal incision in the male), and the stone, having been grasped, is broken by a few turns of the screw handle. This operation is said to be facilitated by frequent injection of a weak solution of hydrochloric acid.

Lithotomy—"*Cutting for the stone*"—consists in incisions through the urethral walls, whereby the passage is rendered large enough for extraction of the stone. The presence of calculus having been confirmed by introduction of a sound through the vulva and urethra of the female, or through an incision made down on the urethra at the ischial arch in the male, and so into the bladder, the walls of the passage are incised obliquely upwards and outwards (whereby the artery of the bulb is avoided) by a concealed bistoury and the stone withdrawn with forceps. Subsequently in the male, the wound requires to be closed by means of sutures after the bladder has been thoroughly washed out. This wound will gradually close, but the bowels must be kept in a slightly relaxed state. These operations, however, are seldom performed on the ox; we have not, therefore, given minutely such details as the practitioner will derive from works upon the surgery of the horse. The bladder of the ox is much more thoroughly invested by peritoneum than that of the horse, and extends somewhat further forwards into the abdominal cavity; thus, it might, in cases of emergency, be punctured through the walls of the abdomen in front of the symphysis; again, it has been suggested to evacuate the contents of the organ by incision from the rectum. These formidable operations are seldom required.

Tumours in the Bladder are sometimes found *post mortem* in cases of incontinence of urine. They are very rare, and seem to be of an epitheliomatous nature.[1]

[1] Mr. H. King Shaw exhibited at the meeting of the Central Veterinary Society, November, 1880, a most interesting case of vesicular polypus from a cow. The principal tumour was pedunculated and of considerable size, and two others were just commencing to grow. The specimen, without any history, had been obtained from a slaughter-house.

Calculus of the Urethra is not uncommon in the ox, but is generally a small vesical stone on its way to the exterior. It has been stopped either by spasm of the urethra or by the curvatures of the passage through the penis, and gives rise to retention of urine of an obstinate character. The symptoms are urgent, and must be relieved by incision either longitudinally or obliquely across the direction of the passage. The patient must not be cast for the operation. There will be little difficulty in determining the seat of obstruction, for the urethral canal is distended to the same point.

Stricture of the Urethra may be organic or functional. In the former case there is thickening of the lining membrane of the canal, in the latter spasm of the accelerator urinæ muscle. These give rise to more or less complete impediment to the passage of urine. They are seldom seen in cattle.

Præputial Calculus generally assumes the form of calcareous deposit around the hairs hanging in a tuft from the prepuce. These deposits are mainly phosphatic, and depend upon excess of salts in the food. The slow and unenergetic expulsion of urine predisposes to their formation. They must be removed by excision of the hairs, around which they sometimes accumulate to such a degree as to cause obstruction to the flow of urine. Modification of diet so as to avoid excess of salines, also free supply of water and other solvents, must be looked upon as prophylactics against calculous diseases.

CHAPTER VII.—DISEASES OF THE ORGANS OF SPECIAL SENSE.

Section 1.—Abnormalities of the Skin.

The skin of the ox is remarkable for its thickness, and in some parts it is very loose, as where it forms the "dewlap." In other respects it somewhat closely resembles that of other quadrupeds. Under healthy conditions it is soft, elastic, and pliable, and the coat lies evenly and smoothly. The animal or its fellows apply sharp rasping friction to the surface of the integument by means of the rough tongue with its horny epithelium. Ordinarily the skin is loose and flexible, but when the animal is in a state of ill health it becomes dry, harsh, and tightly bound to the tissues beneath it. This state is known as "*hidebound*," and is not a disease. It is generally accompanied by a "*staring coat*," due to erection of the hairs in consequence of the minute muscular bundle of each hair-follicle contracting in a spasmodic manner, as a result of perversion of nervous energy. This is one of the general signs of ill health to which we have had occasion frequently to allude. It especially accompanies the rigors which are indicative of the invasion of a febrile attack. The disorders of the skin are divisible in the following manner, primarily, into two classes:

Non-parasitic	*Inflammatory*—Eczema, Psoriasis, Impetigo, Erythema, Ecthyma, Herpes, Urticaria, Pemphigus, Furunculus. *Hypertrophic*—Nævus, Warts, Elephantiasis (Scleroderma), Dermo-pilous cysts, Pityriasis, Keratoid. *Atrophic*—Alopecia. *Functional*—Bloody sweat, Emphysema, Œdema, Pruritus.
Parasitic	*Animal*—Phthiriasis, Œstriasis, Acariasis. *Vegetable*—Tinea: var. (1) tonsurans, (2) favosa.

In examining the list of skin diseases affecting the

horse we are enabled to trace the majority of them to improper or neglected grooming and exposure of various kinds, either local or general. These influences seldom affect the ox, and his skin is less delicate than that of the horse; hence it is less liable to disorder. Nevertheless, as may be seen from the above list the diseases of the skin of the ox are numerous, and deserving of careful attention.

Subsection 1.—*Non-parasitic Diseases.*

Inflammatory, Non-parasitic Disorders may be included under the term DERMATITIS. Of these, *Erythema* is the most simple. It consists of a diffused redness of a portion of the superficial layer of the dermis, which gradually blends with the healthy skin. It is characterised by disappearance of colour on pressure, but its hasty recurrence. Other signs of inflammation are little marked. It leads to vesication, effusion, and sometimes ulceration. It depends upon slight irritation long continued, as friction, dirt, mild irritants (as urine in cases of incontinency), and in some cases is attributable to intrinsic causes, such as indigestion and ingestion of acrid matters. Treatment is seldom required for simple, though a laxative dose is beneficial in severe cases; also lead lotion may be applied locally. This disease sometimes tends to a chronic character, as when it consists in ulcerations of a sluggish nature, of which the most important are those the seat of which is the teats. This is described as ERYTHEMA MAMMILLARUM, *sore teats,* or *chronic erythema,* and occurs especially in newly-calved animals, though not infrequent under other circumstances. In some cows the skin is very delicate, and this disorder is particularly liable to develop, and is difficult to cure. They are constantly affected while the calf roughly manipulates the organ, and the ulcers assume a very sluggish character. The calf should be removed and fed by hand, the milk daily drawn off by means of a milk syphon, and refrigerant lotion should be applied to the

affected part; a laxative dose also may be administered. Sometimes the disorder does not lead to ulceration, but in other cases even the gland tissue becomes involved, and when the heat and pain in the parts is considerable, the precautions suggested for acute mammitis must be tried. Farmers usually keep elder ointment about them for cases of this kind, but the ordinary Glycerinum Acidi Carbolici will prove most useful when the calf has been removed, for it will also keep away the flies.

Eczema is the vesicular stage of dermatitis, and, therefore, is generally preceded by erythema. The surface of the skin presents a number of vesicles, while a somewhat acrid fluid exudes upon it, and the hairs fall off. The process is accompanied by a considerable amount of itching, and the friction with which the patient endeavours to relieve this renders the parts raw and bloody. The vesicular eruption is recurrent, and thus the case lasts for some time; it is liable to lead to cracks in the skin or to resolution. In the latter case the secretion dries, and protects the inflamed parts. When this disease becomes chronic it leads to thickening of the skin, due to a horny change of the epidermis and induration of the dermis which is traversed by elongated sluggish ulcers. This Armatage describes as Psoriasis, and he says: "The parts where this disease is located are the legs chiefly, one, two, or all of which may be affected. We have seen cattle of all ages turned upon clay pastures, and those in which lime abounds, suffering repeatedly from the combined irritation of these substances with wet and cold, as well as severe lameness, to the great detriment of condition, health, and even sloughing of hoofs." He suggests prolonged fomentations, followed by poultices, a laxative dose, and clean quarters; also doses of Liquor Arsenicalis in long-standing cases. Simple erythema almost always depends upon improper diet, and is associated with special changes of surrounding influences. In treatment of it the food must be changed, a cathartic dose given, and weak carbolic solutions may be applied locally.

Herpes.—When the vesicles of eczema are arranged in

a gradually increasing circle they are sometimes described as *non-contagious ringworm* or *herpes*. This disease is subacute; several rings may be present, and it is difficult to account for their form. When the vesicles burst their discharge forms a scab. No special methods of treatment are necessary. Herpes is not frequent in cattle.

Impetigo—*Pustular Dermatitis*—results from the powerful irritant action of certain plants, especially upon the delicate skin of calves. It has also been traced to special acrid plants growing in pastures, and has been found to most often affect animals with white legs and muzzles, which parts it usually involves. A crop of pustules forms, and by the bursting and aggregation of these a yellowish scab is formed, which is persistent, and remarkably disfigures the animal when it involves the muffle, as it is apt to do. Change of pasture, and nitrate of zinc or of mercury ointment, applied to the parts, will generally effect a cure. A cathartic dose will remove the irritant if it has been ingested, from the alimentary canal, for undoubtedly some of these cases are due to disorder of the digestive tracts, though others depend upon direct irritation of the affected parts.

Urticaria—*Nettle-rash—Surfeit*—is characterised by the sudden appearance of patches of elastic prominences of the skin, which are in a constant state of itchiness, and disappear almost as rapidly as they came. Several forms have been described, according to the size of the swellings and their heat. The most usual form is *urticaria tuberosa*. This is sometimes very dangerous, since it may affect the structures of the muzzle and interfere with respiration and ingestion of food. It is vulgarly termed "*stinge*," "*blain*," or "*singe*," probably on account of the manifest tingling sensation to which it gives rise, and which renders the animal very uneasy. The causes of this disorder are a high surrounding temperature, a rich pasture (especially after a run on poor land), also certain constituents of food, and errors in dieting. Manifestly a purgative is indicated in these cases, salines being preferable to others, and sedative agents may be applied

to the surface of the skin. Some authorities trace this disorder to defective action of excretory organs, notably the kidneys. In cases of "stinge" tracheotomy may be necessary. Urticaria is essentially a serous effusion.

Ecthyma or Acne is the formation of discrete (or separate) abscesses, of various sizes, in skin substance, a sebaceous gland being generally involved. These burst externally, producing a brownish scab. "They may be frequently seen if carefully sought for upon those parts of cattle covered by thin skin and few hairs, as upon the udder, and about the vulva, inside the thighs, &c." Constitutional symptoms are seldom present; the disorder seems to depend upon local influences. When the pus has become evacuated the pustules heal with facility.

Furunculus is intense localised dermatitis, involving the subcutaneous areolar tissue, and leading to death of a portion of structure, which is expelled as the "core" of the boil. The inflammation runs high, and requires to be determined to suppuration by poultices and fomentations, and, after bursting, the usual treatment of abscess.

Carbuncle differs from boil in the large amount of tissue which dies, and requires to be removed by sloughing. It is generally due to specific influences, as in cases of anthrax. It constitutes a serious drain on the system; hence removal of the dead parts with the knife, antiseptic dressings, and (internally) stimulant tonics are indicated.

Pemphigus.—Mr. Isaac Seaman, of Saffron Walden, gives a good case of this disease, as affecting a three-year-old bullock (see 'Veterinarian,' vol. xxv, p. 262). There was diffused inflammation of the skin, with effusion of serum, "which elevated the cuticle in places, forming bullæ or bladders, varying in size from a small nut to a fowl's egg. In other places a thin transparent fluid was dropping from the hair, and in some places in quite a stream." The mucous membranes also seemed involved, and constitutional symptoms ran very high. The case terminated successfully after about a week, but the hair was apparently lost from several parts of the body. This disease is

sometimes enzootic; often it assumes a chronic character, and in some instances the effused fluid is intermingled with blood or pus. It depends upon irritation of the alimentary canal, and must be treated by evacuation of the contents of the blebs, and subsequent dressings with glycerin or oxide-of-zinc ointment. A cathartic should also be administed.

Hypertrophic Disorders of the Skin are sometimes seen in the ox. Of these, one of the most remarkable is Keratoid change of the Epidermis. Hypertrophy of the cuticle results from continued slight friction or from gradual increase in size of a subcutaneous accumulation of fluid with a tendency to burst. Thus, in every case, it must be considered to be an effort to strengthen the skin, and the better to adapt it to new conditions. A most remarkable case of this disease has just come under our notice. A beast has a tumour, of a globular form, 56 inches in circumference, in front of the knee, this contains pus, and the skin investing it has a flocculent epidermis of stringy horn.

Pityriasis is that scurfy condition of the skin which not infrequently affects cattle without any other indications of disorder than some local irritation. The scurf has a peculiar branny character, whence the name of the disease. It occurs most frequently in young animals, and is associated with mal-nutrition, whether from imperfect supply of food or from deficiency of nutritive materials in it. A change of diet to richer food, and the inunction of the surface with some sedative must be adopted.

Nævus is hypertrophy of the superficial layer of the dermis, constituting a slight swelling composed of blood-vessels, often having an erectile character. It is rare in the lower animals, but a congenital case is given by Mr. L. Barker, in the 'Veterinary Journal,' vol. iv, p. 255. In this, intermittent free hæmorrhage took place, and materially reduced the strength of the animal, but a cure was ultimately effected. These tumours are liable to injury, and may, when small or of moderate size, be removed by the knife or by cauterisation.

Dermopilous Cysts are involutions of the integument. They are occasionally found in various parts of the body, and sometimes so deeply placed in viscera, such as the testis, that the difficulty in attributing them to growth from the skin has compelled pathologists to consider them specimens of "*fœtus in fœtû*." Generally a small fistulous opening from the cyst discharges a fluid consisting of watery matter and epithelial *débris* on to the surface of the body, and a few long hairs may protrude through the opening. The discharge is sometimes offensive; then the cyst may be removed by means of the knife (see 'Edinburgh Veterinary Review,' vol. v, p. 593).

Elephantiasis—hypertrophy of the subcutaneous areolar tissue, with increase in its density—is very rare in the ox. Under this heading has been described a specimen of skin disease of the calf, in the Museum of the Royal Veterinary College. The skin in this animal is in plates like that of the rhinoceros, but on a smaller scale. This seems a case of the disease described in man as *Scleroderma*.

Warts — "*angle berries*" — *verrucæ* — are epidermic growths primarily, but subsequently the true skin becomes involved and hypertrophied, and thus are produced on the surface of the body tumours of various sizes, confluent or distinct. These, when subjected to friction, ulcerate, and thus ugly fungus-like masses, in a raw condition, project from the surface. They are most unsightly, and bleed on the slightest pressure; are principally seen about the genital apertures, eyelids, lips, and teats. We are not assured of the cause of these growths, but in the majority of cases dirt seems to be the exciting influence. Irritation of any kind may give rise to these circumscribed dermal hypertrophies. A most singular case, reported by Youatt, indicates their constitutional origin in some cases: "At uncertain intervals, from six to nine or ten months, a cow suddenly lost flesh, her coat stared, she would scarcely eat, and at length rumination was entirely suspended; then would appear, and nearly all over her, and particularly about the udder and in the mouth and on the evelids, a thick crop of warts, varying from the size of a

millet seed to twice that bulk. In a fortnight they were gone." We have already had occasion to notice warty growths, as they are sometimes found in the œsophagus. When developed on the udder and teats they prove very unsatisfactory, for they make the animal troublesome to milk.

Treatment.—Where these growths prove unsightly or detrimental they must be surgically removed, either with the knife and actual cautery, or by means of ligature. They are generally pedunculated, so that the latter can be applied with facility. Some prefer to destroy by the application of caustic agents, but this is a slow process.

Atrophic Diseases.—Alopecia or Depilation—*baldness* of the skin—sometimes results from disease. Occasionally calves are born in this state (see 'Veterinary Journal,' vol. x, p. 302). It is hopeless to endeavour to cure this in congenital cases, but when it is attributed to disease, mild repeated stimulation, especially with cantharides, may promote renewal of hair. In man it is sometimes due to parasites.

Functional Disorders.—Œdema, *v.* Anasarca, is not a rare affection of cattle, in which there is dropsy of the subcutaneous tissue of the lower parts of the body. It may depend upon inflammation of the skin, but far more frequently is due to constitutional disorder, as anæmia and hydræmia. It accompanies dropsical affections of other serous cavities.

Treatment of this state comprises tonic means and sedative diuretics, such, especially, as digitalis. Careful nursing and local friction by means of hand-rubbing of the affected parts will tend to promote absorption. This disease is not so frequent in the ox as in the horse.

Emphysema is escape of gas into the subcutaneous areolar tissue, dependent upon decomposition of the blood or of structural elements, or some profound changes in the blood of the part due to nervous influence, sometimes also to entry of air either through an external wound or a tear in lung substance. This is most often seen in black-quarter; sometimes the fœtus, on birth, is found to be in an emphysematous condition. In these cases there

is a peculiar crackling beneath the epidermis when pressure is brought to bear upon the part. The gas is at liberty to escape if incisions or punctures are made through the skin; in addition, the surface should be manipulated freely. Sometimes the patient will require a stimulant dose.

Bloody Sweat, as occurring in oxen, has been dealt with by Count Ercolani, the celebrated Italian veterinary professor; his conclusions are given in volume iii of the 'Edinburgh Veterinary Review,' page 567.

Pruritus—*Neurosis* (Law) consists in itchiness of the skin without any appreciable structural change. It is not rare in cattle, and causes a considerable degree of restlessness, so that the animal applies friction to the affected part until it becomes raw. Such cases are generally attributable to excessively high feeding and want of exercise. They must be treated with saline cathartics and sedative applications.

The *effects of colour on diseases of the skin* are sometimes marked. White portions of the skin seem to be more liable to disease than those which contain pigment. In certain forms of vegetable poisoning sloughing of only the white portions of the skin is seen, and in cases of some forms of impetigo it has been stated that the white portions of the skin especially are involved. There is related a peculiar case, illustrating the effects of colour, in the 'Veterinarian,' 1834, p. 97:—A white cow, with some black spots on various parts of the body, suffered from acute fever, with a peculiar hardness of the skin. Shortly, the cuticle, and with it the hairs, separated from the dermis, except where the skin was black; the coloured spots remained quite soft and healthy. The hair gradually grew again, except on the shoulders.

Subsection 2.—*Parasitic Disorders of the Skin.*

Some of these are attributable to Dermatozoa (animal parasites, or Ectozoa), others to Dermatophyta. The former are most important, the latter are acquiring fresh interest as we become more acquainted with the vegetable forms which give rise to disease.

Animal Parasitic Diseases of the Skin of Cattle.

MANGE—ACARIASIS—is a contagious disorder due to the presence and ravages of those Arachnidan or spider-like parasites generally known as the *Acarus bovis,* which comprises two forms (according to Gerlach), *Dermatodectes bovis* and *Symobiotes bovis.* Of these, the former is most frequent, the latter being rare. Mange of the ox is, therefore, due to Dermatodectes, which lives on the surface of the epidermis, but gives rise to much irritation by biting. Its most frequent seat is on the withers and the root of the tail, but this preference is not very marked. From the parts primarily affected the disease extends, and passes through its various stages, during the more acute of which there is intense itching. Circumscribed nodular

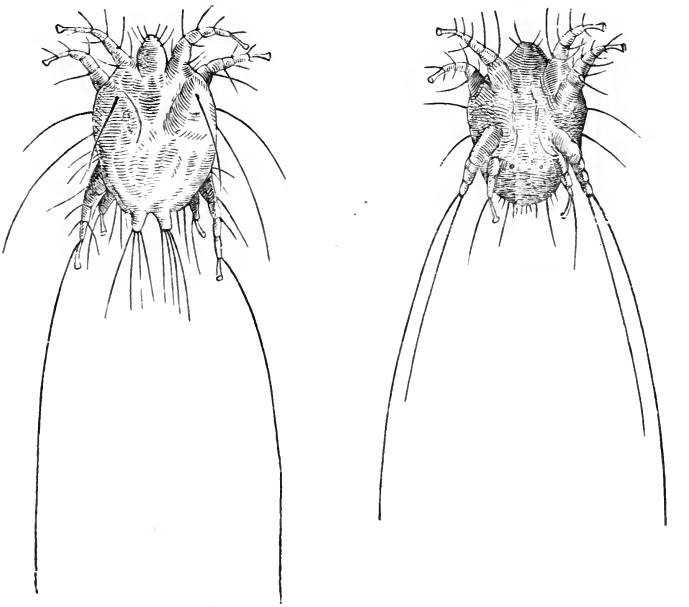


FIG. 68.—Mange insects (*Acarus bovis*). (Dobson.)

projections (papules) first appear; these become vesicles and burst, giving exit to a watery fluid, which soon dries on

the surface, forming crusts, which are liable to be succeeded by ulceration. The hair falls off, or a few hairs persist and project from the crusts. In chronic cases there is but little irritation, but the skin is thickened, devoid of sensibility, dry, harsh, and corrugated. Thus, it will be observed, no special symptoms indicate mange; it passes through several stages—papular, vesicular, &c. Diagnosis must depend, in the first place, upon detection of the parasites; also, secondly, upon accurate tracing to an origin by contagion. The latter must be, for we cannot allow that animals so high in the scale as Acari can appear spontaneously. The spontaneous origination of the disorder was once universally allowed, but this depended upon confusion of mange with some of the simple non-parasitic diseases already described, or non-recognition of the presence of parasites. This disease, in regularity of eruption, phases, persistency, and contagiousness, resembles some of the eruptive disorders of the system. Analogy leads us to anticipate that the latter will, with improved means of investigation, be traced to parasitic forms of some kind or other. This lesson learned from mange is a remarkable one. When the disease is unchecked it exhibits urgency proportioned to the seasons or the surrounding temperature. Thus, it seems to be dormant in the winter, but in warm weather and places is almost intolerable. The disease is not truly transmissible to the attendants and to animals of other species, for the parasites cause inconvenience for a time but do not propagate in their new abode. The Acari can be detected on the hairs and surface of the epidermis, and can be seen with the naked eye as minute white points moving about somewhat rapidly when the patient stands in the full glare of the sun. Gerlach, who is one of the leading authorities on this subject, suggests for detection of Dermatodectes the removal of some of the scales from the surface and placing them on the human arm, with the under part uppermost, for an hour or more. The Acari pass to the arm and there cause eruption, and when the vesicles form they may be punctured with a needle and the parasite obtained. Subsequently the arm should

be rubbed with oil of turpentine or some oatmeal, as a precaution against any increase of the parasites; though this is hardly necessary, it is as well not to reject the precaution. Acariasis is not frequent in the ox, but is most prevalent in badly kept dirty herds, and is generally associated with debility, which is traceable to the irritation by the parasite being a constant source of worry. The Acarus is the sole cause, and we cannot generate it by any combination of ordinary causes. Nevertheless, it may be that the skin of the weak animal forms a more congenial nidus for the acarus than that of an animal in good health, and thus weakness becomes a predisposing cause.

In the *treatment* of mange our efforts must be directed to the destruction of the parasites. Also, it is necessary to remember that after this has been accomplished the ova may remain intact and undergo development in due course. Two conditions lead to obstinacy of this disease (not so marked in the ox as in some other animals)—the concealed state of the parasites and the powers of resistance of the ova. We must break down and remove the scales, and generally must repeat our dressings at intervals, to destroy the young Acari as they appear from the ova. The removal of the epidermic *débris* may be best accomplished by friction with a weak alkaline solution, as ordinary soft soap and water. Subsequently, the solution of liver of sulphur, tar, and turpentine liniment, arsenical wash, solution of bichloride of mercury, or other anti-parasitics, may be applied with care; stavesacre or tobacco infusion are also used for this purpose, and many prefer sulphur ointment, or even simple reagents, which prevent access of air to the Acari and thus suffocate them. When making use of poisonous applications we must remember that they are liable to become absorbed or to be ingested, from animals licking themselves or one another. Another practical inference is to frequently change the dressing in any particular case, for the Acari seem to become tolerant of some of the agents, which do not cause their death, but simply their departure. The desirability of adop-

tion of constitutional treatment is debated, but the value of tonics, especially arsenic, cannot be questioned. In this disease isolation must be enforced, all clothing and appliances from the affected animal either destroyed or thoroughly purified.

Symbiotes bovis infests the region of the tail, is rare, and must be treated like Dermatodectes.

Phthiriasis—"*Lousiness*"—is very common in cattle, especially in marked cases of debility, whether due to disease or to want of food and shelter (as in animals half-starved in a straw yard); the lice abound, and cause pruritus, and materially retard growth and development of the stock. They prove troublesome to the auscultator who has not remarked their presence. Several different forms are described, as *Hæmatopinus vituli* (which specially affects the calf), and *Hæm. eurysternus, ani et vulvæ*, found on the cow, the former on the shoulders, the latter in the positions which its name indicates. Also, there is a form of *Trichodectes* present in some cases. For the removal of these pests dressings with tobacco water and stavesacre infusion are recommended. These require to be several times repeated, well rubbed in, and the animal should be subsequently thoroughly washed. Measures should be taken to prevent their passage to man or other animals.

Œstriasis ("*Warbles*").—*Œstrus bovis*, the gad-fly of the ox, assumes its imago or perfect form at about the end of summer; it then attacks cattle, puncturing their skin by means of an ovipositor, and placing in the subcutaneous tissue a drop of acrid fluid with an ovum. There results an abscess of small size with a larva situated in it. A small opening extends from the surface to the abscess cavity; against this the respiratory orifice of the grub is placed, and he feeds upon the pus of the abscess. At length the abscess bursts (according to Youatt, always between the hours of six and eight in the morning), and the larva falls to the ground and becomes a chrysalis, if it escapes its numerous enemies, notably birds, who consider it a sweet morsel. This occurs in about June or

July; at the end of six weeks, under favorable conditions, the full-blown dipterous insect escapes from its shell, copulates, and the females deposit their eggs and then die. The beast is much afraid of the fly, and rushes towards water in a high state of excitement, with tail erected and quivering. The pain results from the acrid substance inserted with the egg. Mr. D. M. Storrar relates a case in which he attributed paralysis to a number of these warbles in their usual position on the loins on each side of the spine. Sometimes they are very numerous and give rise to fever, but more frequently do no harm, except to the hides. Young animals and those in an exuberant state of good health are generally chosen by the fly, for in them the skin is soft and penetrable. The Œstrus must be removed from the warble, which is nature's method of cure, and may be easily brought about by pressure; the results of its presence will then be gradually obliterated. Care should be taken to destroy the Œstrus ("maggot" or "bot"). Water is a very effectual protective means, and cattle, when attacked, will charge into it with great force.

The *Tsetze fly*, described by Livingstone, is more formidable. It is seen in South and East Africa, and is capable of poisoning cattle by its sting. Its technical name is *Glossina morsitans*. Turpentine ointment is said to be useful when applied for its bites. Maggots of the ordinary fly are sometimes to be seen on neglected wounds of cattle. Some forms of ticks (Ixodides) are sometimes seen on cattle.

Vegetable Parasitic Diseases of the skin of Cattle: Tineæ—"Ringworm."

Tinea favosa is due to the fungus *Achorion Schönleinii*, which originates from a spore which has gained entry into a hair-follicle. It perforates the epidermic structures so that its spores may be found in the hairs as well as in the main portion of the cuticle; from the opening of the hair-follicle the fungus projects and forms a yellowish cup-like crust, with a hair projecting from its

centre. A number of these aggregated produce a honeycomb-like mass, whence the disease is known as "*Honeycomb Ringworm.*" It does not originate in the ox, but is transmissible to this animal with some facility. Mice and rats suffer from it, especially the former, for they become much debilitated and their heads covered with crust, in the form of an immense tumour, which causes absorption of the facial bones by pressure. Pulverising of the crust disseminates the spores, whence the disorder is infectious, but certain conditions of the skin, as seen in young or debilitated animals, seem especially favorable to its growth.

Treatment.—Remove the crusts and destroy them; thus, an ulcer caused by absorption of the superficial layer of the dermis will be exposed. Remove all affected hairs and dress with nitrate-of-mercury ointment, nitrate of silver, vinegar of cantharides, or, preferably, dilute sulphurous acid. Many kinds of animals suffer from this disease, and true favus crusts have been grown from spores on the acid cut surface of an apple.

TINEA TONSURANS is caused by another and more simple fungus—*Tricophyton tonsurans.* Its constituents are smaller than those of Favus, and it does not project as cups on the surface, simply invading the epidermal structures and constituting a fine powder on the epidermis. It affects young animals, especially when exposed to damp, and with dirty skins, and is readily transmissible from ox to ox, or to man and other animals. It attains a greater luxuriance of growth in the ox than in man, and the disease, when first received by man from the ox,

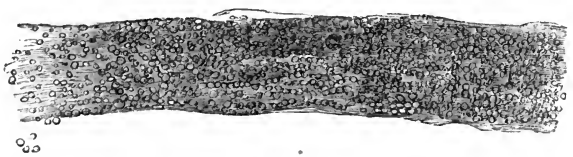


FIG. 69.—Hair, with the spores of *Trichophyton tonsurans.* (After Harley and Brown.)

is so luxuriant that it has been described as specifically distinct.

Symptoms.—Circular patches in various parts of the body, characterised by the absence of the hair, the presence of vesicæ near the outer margin, and a scurfy condition of the central parts; here and there in the ring may be seen a dry looking hair, of a greyish colour, somewhat twisted at the root, or the stump of a hair which has broken off. Mégnin considers the true Tinea of the ox distinct from that of the horse, and terms it *T. decalvans* or *T. depilens.* This he finds to be generally nearly three times the size of *T. tonsurans,* to give rise to more formidable symptoms when communicated to the horse by inoculation, and to induce a different condition of the affected hairs. In calves, the disease affects the eyes, ears, neck, withers, and limbs. These cases must be treated with the same applications as suggested for *T. favosa.*

Section 2.—Diseases of the Foot.

The foot of the ox, in a zoological sense, comprises the structures from the knee and hock (inclusive) downwards in the fore and hind limbs. Custom sanctions the application of the term foot to the inferior part of each extremity from the fetlock-joint downwards. From a pathological point of view it matters little which view we adopt. Suffice it to say that the knee of the ox is remarkable for the peculiar manner in which it is bent inwards in consequence of the obliquity upwards and outwards of the inferior articulatory surface of the radius, whence the proverbial term "Calf-kneed." That the ulna meets the carpal bones, os pisiforme (Trapezium) is less developed than in the horse, that the trapezoid and magnum are fused into a single bone, and no true trapezium is present. The metacarpus consists of a rudimentary splint bone on the outer side, and of two fully developed metacarpals blended together along the central line, separating inferiorly, each division bearing three pastern bones and a navicular, resembling moieties of the corresponding bones in the horse. The two diverg-

ing digits are connected together by certain interdigital ligaments, and each bears a hoof resembling half the hoof of the horse. Finally, behind the fetlocks are two rudimentary claws, each with a contained bone, the os pedis of a rudimentary digit. Thus, to sum up, the foot of the ox consists of two functional digits united together superiorly, which together represent the compound functional digit of the horse, and two very rudimentary digits, of which the outer has a splint bone, a hoof, and a pedal bone, but the inner has no splint bone. In the hind limb the arrangement of the bones is much the same, but there are no distinct splint bones, and the hock consists of a well-developed astragalus, which forms a well-marked hinge-joint below, with a bone compounded of the large cuneiform and the cuboid, and is freely movable on os calcis, which has a long, rather slight process. The cuneiforme medium is only of moderate size, and the cuneiforme parvum is very small. The joint between the upper and lower row of tarsal bones renders the hock capable of a great degree of flexion. Diseases of the foot in the ox are very rare, especially in this country, for—1st, its conformation is such as to render it less liable to injury, as being more simple than that of the horse; 2nd, the ox is seldom used for draught purposes, and never for conveying heavy weights for great distances along hard roads, nor for excessively rapid progression on the racecourse; 3rd, but few cattle are shod.

Foul, Loo, Low.—This term is applied, somewhat indefinitely, to the formation of abscess in the foot and resulting disorganisation of structure. This may be attributed either to common causes or specific influences. The latter are scrofulous and perhaps rheumatic conditions. Scrofulous arthritis not unfrequently affects the bones and joints of the foot, causing such disease of them as of other parts of the skeleton. This disease may be caused by the presence of foreign bodies fixed between the claws, giving rise to inflammation, by overgrowth of the hoof-horn on the inner side, by various kinds of injuries, and, among others, certain sprains of the pastern, pedal joints, &c.

It most frequently affects the hind feet, and is most prevalent on low marshy lands, such as promote overgrowth and excessive malformation of the hoof. It is in many respects similar to the non-contagious form of foot-rot of sheep, and somewhat resembles quittor of the horse. The extreme cases of non-specific foot-rot and foul which we see occasionally are due to neglect, whereby inflammation extends to the joints of the foot and leads to acute arthritic disorder. Thus, the pathological conditions of this disease are, at first, the existence of inflammation in the interdigital substance, which may be partially removed by sloughing, then the presence of pus beneath the hoof-horn, boring and forming simple sinuses; also later, arthritis and ostitis, leading to increased suppuration and the formation of sinuses, which extend outwards and burst on the surface. The patient is very lame, and the digits are separated from one another in a remarkable manner. Considerable sympathetic fever is generally present in such advanced cases, and the animal materially loses condition, succumbing to the pain of the disorder in a very rapid manner. This entails considerable loss upon the owner, and necessitates energetic treatment, which must consist of removal of the patient to a thoroughly clean quiet place, careful washing of the foot, removal of any ragged horn and overgrowth, also of any part of the hoof which is underrun by the pus, poulticing for removal of the pain and to arouse a healthy process, also a cathartic dose. Subsequently, carbolic dressings, or mild astringents may be applied, but such powerful caustic agents as were once used are not required. Neither is the prolonged interdigital friction, which was considered beneficial, and was usually applied by means of a tar rope. The diseased foot will require to be dressed and to be protected by means of a bandage. The mode of elevation of the foot usually adopted has been already mentioned (see page 71).

Bleeding from the coronet, whereby much blood may be removed, is recommended by Youatt and others, but its effects are not likely to produce much benefit in this sub-acute disorder, and it is preferable not to bleed too near

inflamed parts. In long-standing cases, with considerable disorganisation of bones and joints, amputation may be

FIG. 70.—Method of applying dressings between hoofs. (Armatage.)

performed, for the patient will thrive better after removal of the diseased organ, and the case cannot otherwise be cured. Either one digit may be removed at the pastern, or both may be simultaneously amputated at the fetlock, or through the metacarpal region.

The operation is performed by casting the animal and freeing the diseased limb. A tourniquet, consisting of a band passing round the centre of the metacarpal region, with pads on the inner side, tightened by passage of a bar through it and twisting, is used to restrain hæmorrhage. This must be brought into use just before the operation is commenced. Either disarticulation or amputation through the bone is then performed with the following precautions: to leave a good flap or flaps of skin to cover the exposed surface, and to ligature all the larger arteries. Then the wound is closed by approximation of the flaps, and maintained by sutures, the ends of the arterial ligatures being allowed to hang free. The stump must be protected with tow and a bandage. The operation may preferably be performed with antiseptic precautions. The animal will favour the limb thus operated upon, and will be able to make shift with the others, and may be provided with such a wooden leg as described by Mr. Litt, of Shrewsbury, in 'Veterinary Journal,' vol. iv, p. 241. This operation has become thoroughly established in veterinary practice.

With regard to the diagnosis of this disease, it is said to be sometimes confounded with foot-and-mouth disease. The latter, when neglected, degenerates into "foul" of an

aggravated character; it seems probable that at this stage all virulence is lost. The treatment of "foul" in scrofulous animals is, of course, only palliative.

Laminitis, "*Founder.*"—*Inflammation of the sensitive structure of the foot* is not frequent in cattle, but sometimes results, especially in very heavy and highly-fed animals, from over-driving. It is also somewhat often seen in working oxen. The simplicity of the foot of the ox renders this a comparatively unimportant affection. It may cause removal of the hoofs, but they will grow again. The patient is better able to remain recumbent and to remove the weight from an affected digit than is the horse. This disease may be treated by a cathartic dose, rest, cold-water applications, and, if necessary, sedatives.

Loss of a Hoof may arise from other causes than foul and laminitis, as when the foot becomes caught by the landing stage during unshipping, and under certain other emergencies of travel. If time be allowed a fairly perfect new hoof will be produced, until when the animal cleverly utilises the companion claw for purposes of progression.

Sore Feet result from excessive wear of the hoof from travelling along hard roads. These must be dressed with tar or put in a poultice, and the animals rested. On this matter Youatt says: "There is not a farmer that has not had cows in his dairy that have lost for a time full half of their milk on account of the pain which tender and diseased feet have occasioned; the grazier sometimes loses the advantage of three or four months' feeding from the same cause, and in London dairies tender feet are often a most serious ailment, and compel the milkman to part with some of his best cows, and that in a very indifferent condition."

This liability to sore feet necessitates the *shoeing* of working oxen, which consists in affixing thin plates of iron to the soles of the hoofs by three nails to each. These nails are small, and require considerable care in driving, on account of the thinness of the hoofs. The animal is liable to prove restless while being shod, and thus pricks may occur.

Overgrowth of Horn, though not a disease, occasionally requires attention from the veterinarian, since it may give rise to foul and other diseases. It is seen in animals constantly housed, and so deprived of the attrition which naturally maintains the proper length of the hoof, and the remedy consists in regulated application of the rasp and drawing-knife.

Pricks and other Penetrating Wounds of the Foot must be treated in such a manner as to give free exit to all discharges, by removal of horn, so as to form a depending orifice; and carbolic dressings; however, cases of this kind are not so important in the ox as in the horse, for the pus readily bores its way to the coronet, and gains exit in consequence of the comparatively loose union of the laminated surfaces, whereas in the horse there is a tendency to form secondary sinuses. Youatt lays stress on this difference.

Monstrous condition of the Foot.—The development of extra digits in the ox is of very rare occurrence, but we have before us an instance in which the inner rudimentary digit was fully developed, and bore a hoof about three quarters as large as those of the two functional digits. A case was mentioned before the Société Centrale de Médecine Vétérinaire of an ox with a cloven condition of one hind limb, extending up to the tarsus.[1]

Interdigital Fibromata are sometimes seen; as they increase in size they cause lameness, tension of the interdigital ligament, and may ultimately lead to foul. They should be removed with the knife.

Ulceration of the Heel, of a sluggish character, either associated with foul or as a distinct affection, sometimes proves obstinate to treatment. It develops luxuriant papillæ, assuming a fungoid character, or may form an irregular, hard, callous mass. In either case cauterisation is called for. This condition results from long-continued exposure to cold and dirt. Youatt compares it to

[1] We have just received the hind limb of a calf with a well-developed digit, consisting of a metatarsal, the full number of phalanges, and a fairly formed hoof, curling upwards from the inner side of the hock.

grease in the horse, but is not very successful in establishing the comparison.

Section 3.—Diseases of the Ear.

The ear of the ox presents no special anatomical or physiological features of import to us at present, nor is it frequently involved in diseased action. The external ear may be lacerated, and must then be treated on conservative principles. The skin investing it is also liable to be involved in skin diseases; and Youatt mentions the occurrence of fungous granulations springing up within the ear.

Otitis is a formidable affection, not frequently recognised, but liable to be confounded with disease of the brain, because of the violence exerted by the animal, since this is a very painful disease. We have before us a case in which extensive abscess had formed in the bone, but the true nature of the disease was discovered only after death. The principal symptoms, besides those of fever, are carrying the head to one side and heat and redness of the external parts. If this state is diagnosed nothing can be done more than powerful stimulation around the root of the ear, and the administration of febrifuges and cathartics.

Section 4.—Diseases of the Eye and its Appendages.

Sub-section 1.—*Abnormalities of the Ocular Appendages.*

The orbit of the ox has its external opening laterally placed, giving a considerable backward range of sight—a feature observable in all ruminants. This margin is formed only of three bones, the squamous temporal being excluded by the peculiar bifurcation of the posterior portion of the malar. In other respects the orbit essentially resembles that of the horse, and the accessory organs of vision are

very similar, except that the retractor muscle is even more powerful, and the lachrymal and Meibomian glands are very well developed, as also is the Harderian gland, which is situated inside the cartilago-nictitans, and secretes a lubricating fluid. The ductus ad nasum does not extend so far down as the anterior naris. We have already noted the frequent presence of *bony tumours on the margin of the orbit. Fractures* of this part are not rare as a result of various kinds of injuries; either a small portion of bone is chipped off the edge, or the orbital frontal process may be entirely fractured. Loose portions of bone must be removed artificially, or will slough out, and the attachments of the eyelid may be interfered with, or depression of the fragments may exert pressure on the contents of the orbit. A highly vascular encephaloid or medullary sarcomatous growth sometimes commences at the back of the orbit, and grows rapidly, pressing on the optic nerve, and forcing the eyeball to one side. It appears at the surface as a highly vascular mass, and is termed Fungus Hæmatodes. It produces complete loss of sight, and must be treated by extirpation of the contents of the orbit, and subsequent application of the actual cautery, to restrain hæmorrhage and destroy the last vestiges of the cancerous mass. The patient should then be fattened for slaughter. This is perhaps the most frequent cancerous growth in the ox.

Lacerations of the Eyelids must be treated on the principle of not removing any part which can possibly be saved. Youatt tells us that "the eyelids are more subject to disease in the ox than in any other domestic animal," and mentions Spontaneous Emphysema of the organs to be cured by puncture; and also Œdema, which is a sign of general debility, or may be a sign of the existence of some irritant in the eye. Sometimes cases of this kind lead to chronic thickening.

Warty Growths are sometimes seen on the eyelids, and must be snipped off, and their roots touched with caustic. Finally, the largely developed Meibomian glands may become inflamed or their ducts blocked up, and a small abscess results. When this bursts or is opened the parts

regain their normal condition. We are not aware that inversion and eversion of the eyelids have ever been seen in the ox. We have found records of a few cases of *Ptosis*, dropping of the upper eyelid, but have no evidence as to the occurrence of disease in the lachrymal apparatus.

TUMOURS OF THE CARUNCULA LACHRYMALIS AND CARTILAGO-NICTITANS sometimes attain a considerable size. They result from chronic irritation or conjunctivitis, and must be removed by means of the scissors, the animal having been cast and the cartilage fixed. The latter must be as little injured as possible in the operation. Sometimes caustic applications will suffice to destroy these tumours, but generally it is found necessary to operate.

Sub-section 2.—*Diseases of the Eyeball.*

The eyeball is somewhat flatter in the ox than in the horse, the cornea more convex, and the tapetum lucidum has a golden-green colour, bluish near the margin, and a fibrous structure.

CONJUNCTIVITIS—*Simple Ophthalmia*—results from injuries, and especially from the entry of foreign matters into the eye. It is denoted by profuse lachrymation, the tears trickling down the cheek, thickening of the eyelids, intolerance of light, redness of the conjunctiva, and generally some opacity of the cornea through extension of irritation, due to general causes, as exposure to cold, or to acrid vapours; both eyes may be thus affected (but this seems to be very rare). An examination must be made for the detection of foreign bodies, the lids being separated by the finger and thumb, and each everted in turn. The rapid movement of the haw over the eye renders this examination a little more complicated than it otherwise would be. The cause having been removed the irritation may be overcome by fomentations and dressings with solution of the subacetate of lead, and the eye or eyes should be protected from the light. This disease is generally complicated with *keratitis* or *corneitis*, in which the cells which are collected

together to form the cornea proliferate freely and cause opacity.

Opacity of the Cornea also depends upon nutritive conditions, and sometimes upon pressure, due to swelling of the contents of the eyeball. Under these circumstances it is temporary, and disappears with its cause, but when it results from blows or other injuries, and sometimes after ophthalmia, it may be permanent. When a slight bluish imperfect opacity it is termed *nebula*, if more circumscribed, perfect, and with well-defined outlines, it is termed *albugo*. These conditions are incurable; they may become less marked with time, and the process of diminution in size may be accelerated by the application of caustic agents, such as nitrate of silver. Cartwright describes it in some cases, as due to plethora and the pendent position of the head ('Edinburgh Veterinary Review,' vol. v, p. 22); but it probably is more frequently dependent on defective nutrition.

Staphyloma is either a tumour on the cornea or protrusion of the lining membrane of the aqueous chamber with its contents through an ulceration of the cornea. Such ulcerations result from debility, especially that due

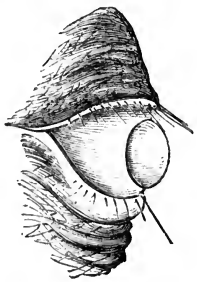


Fig. 71.—Staphyloma. (Armatage.)

to defective assimilation of tissue formers, or occasionally, perhaps, from ophthalmic corneitis. The projection is opaque and generally irregular on the surface, and in the ulcerative form there is a tendency to evacuation of the contents of the aqueous chamber. Ulcerations of the cornea and tumours on it may be touched with nitrate of

silver. Special attention must be directed to improvement of the condition of the animal. Repair may be established, even after the aqueous humour has escaped.

Congenital hairy tumours have been seen on the sclerotic. The most recent case on record is that in the 'Veterinary Journal,' vol. iv, p. 169. Development shows us that the conjunctiva is but a modified portion of the external investment of the body; this is a teratological proof of the same fact.

Worm in the Eye is sometimes seen in the ox (see 'Veterinarian,' vol. i, p. 77). The parasite is a Nematode (either *Filaria lachrymalis, F. papillosa,* or *Strongylus armatus*), and occupies the anterior chamber, where it excites irritation, and thus produces corneitis and some degree of conjunctivitis. We have no instance of this occurring in this country, but perhaps it might be seen more often in India. Incision at the supero-external part of the cornea, with pressure on the eyeball, causing the aqueous humour to squirt out, carrying the worm with it, should be tried, as in similar cases in the horse.

Lymphy deposits in the Aqueous Chambers result from inflammation of the eye, especially the rheumatic form, and they may cause adhesion of the iris to the lens capsule. They are generally only temporary, and soon disappear. When small and attached to the anterior part of the lens capsule they may be mistaken for cataract, unless care be exercised. In the 'Veterinarian,' vol. xxv, p. 3, Mr. Cartwright relates a case of lymphy deposit, which he attributed to inflammation of the iris. No treatment is required—simply time for absorption.

Specific or Periodic Ophthalmia, also described as *Retinitis,* is not so frequent in the ox as in the horse.[1] It is probably rheumatic, since it is periodical, and undergoes metastatic passage from one eye to the other. It especially effects the deeper structures, causing disorganisation of the retina, a breaking up of the hyaloid membrane, opacity of the lens, an orange colour of the iris, and

[1] Many cattle pathologists deny that this disorder occurs in the ox. The balance of opinion seems to favour the view advanced in the text.

its attachment to the capsule of the lens (both conditions due to lymph extravasation), a jagged condition of its free margin, and paralysis of its muscular structure, deposits of lymph in the aqueous chamber, opacity of the cornea of a temporary character, and constitutional irritability. The *symptoms* are those of common ophthalmia of a severe character, but on examination, the deeper structures of the eye will be found to be the parts principally involved, and those which are visible will be found altered more or less, as above described. The attack is generally sudden, and only one eye affected at a time. This disease leads to cataract, atrophy, and thorough disorganisation of the eyeball.

Treatment.—The same as for simple ophthalmia, and in addition constitutional remedies, such as colchicum and iodide of potassium. Is seldom amenable to treatment. Animals thus affected, should be prepared for the butcher, and should not be used for breeding purposes, for the disease is certainly hereditary.

Cataract.—Opacity of the lens, or of its capsule, or of both these structures, may be circumscribed or diffused, in the latter case it causes complete blindness. It is caused by rheumatic ophthalmia, and sometimes by blows. In the latter case it is a fracture of the lens, and is generally a stellate opacity.

Treatment in the lower animals is not likely to prove beneficial.

Amaurosis—*Paralysis of the Retina*—is denoted by permanent dilatation of the pupil (except when the iris is influenced by sympathy with the other eye) and by a greenish and transparent condition of the posterior part of the eye. The primary lesion may be in the cranium as when a tumour presses on the optic nerve, along the extracranial portion of the nerve as injury or compression, or in the retina as in cases of depositions of lymph in it as a result of inflammation. It also sometimes depends upon debility and excessive loss of blood. It is not frequent in the ox. When due to compression or structural change, nothing can be done which will be likely to effect a cure. That form due to debility is

only temporary. When the eye cannot be any longer used as an organ of vision the retina atrophies. This is to be seen in cases of cataract. ('Veterinarian,' vol. iii, p. 141.)

Section 5.—Diseases of the Organ of Taste.

We have already dealt with the abnormalities of the tongue (Chap. IV, Section 1). *Perversion of Gustation* is generally present in cases of depraved appetite.

CHAPTER VIII.—DISEASES OF THE NERVOUS SYSTEM.

The nervous system of the ox is not very highly developed as a whole, though, perhaps, the sympathetic portion somewhat exceeds the average. The brain is more rounded and tilted upwards anteriorly than that of the horse; it has not such a numerous and complex state of the convolutions. The spinal cord, and cerebral, spinal, and sympathetic nerves present no special differences in the two animals.

Section 1.—The Cerebro-spinal System.

The brain seems to be especially affected by inflammation, apoplexy, and those ill-ascertained conditions known as epilepsy.

Phrentis—*Inflammation of the Brain*—preferably may be called Encephalitis, since we cannot diagnose inflammation of the brain or Cerebritis, in which simply the cerebrum is involved, from that diseased action of an inflammatory nature which involves both brain and membranes. Aitkin, as quoted by Williams, gives the following features of distinction between cerebral and meningeal disease. The former is characterised by loss of some proper nerve function from the first, not at all by high exaggeration of function nor vascular excitement, and paralysis, anæsthesia, loss of volition, are its distinctives. In the latter, loss of nerve force takes place only some time after the attack commenced; it is generally preceded by exaggeration of function and much vascular excitement and local disturbance. Also spasms, pain,

and delirium, are present. Sometimes abscess in the brain occurs.

The disease usually described as phrenitis is primarily congestive, subsequently inflammatory. It is vulgarly known as "Phrensy," and is highly acute. The exaggeration of cerebral functions and of vascular excitement are very marked. Perhaps the shortness of the neck of the ox proves a predisposing cause to this and apoplectic conditions against which even the complex Rete Mirabile at the base of the brain is not always an efficient preventive. Encephalitis is not of rare occurrence, and is especially prevalent in hot countries and hot seasons, and more particularly affects working oxen, those exposed in pastures, and plethoric males.

It is found that the disease also is less prevalent now than formerly, perhaps due to less frequent over-driving and greater care of animals. Fortunately, too, bull-baiting, which would tend in this direction, is under the ban of public opinion. Sometimes injury is the cause.

The congestive stage is denoted by a highly injected condition of the conjunctival membrane, together with a condition of stupor, during which the pulse is slow, respirations infrequent, there is a tendency to somnolence, and the patient is "foolish." Soon general febrile symptoms and the true phrenitic signs are developed. A wild and staring condition of the eyes, bellowing, and charging at all available objects. This is the stage of delirium. When the disease is more advanced, convulsions are present, and there is a gradual tendency to loss of power as denoted by frequent falling. The patient is throughout the delirious stage all but unapproachable; the pulse is full and bounding, the respirations are not usually accelerated, but sometimes slower than usual. There is a want of method in the fury of a phrenitic ox not discernible in that of a rabid one. Later, paralysis sets in, and is succeeded by death.

Treatment.—The beast having been secured and confined by the horns, blood may be abstracted to consider-

able amount, which will materially tend to relieve the cerebral and meningeal congestion; also, cold water may be constantly applied to the head, and, when possible, a cathartic dose administered. Sometimes croton can be given where more bulky remedial agents are rejected, and the subcutaneous injection of sedative (not narcotic) agents, such as hydrocyanic acid, may be tried, and the tincture of aconite may be administered if possible.

Diagnosis.—This disease may be confounded with certain abdominal disorders, especially impaction of the omasum. It may be distinguished by its greater acuteness of the symptoms, the presence of acute febrile conditions, and the history of the case.

Prognosis, on account of the difficulty in managing the patient, is unfavorable, since we are not even able to adopt proper measures of nursing.

Post-mortem examination shows a highly congested condition of the membranes and of the brain substance, as denoted by unusual distinctness of the puncta vasculosa; also, sometimes the brain is softened, and there is fluid in considerable quantity in the arachnoid and subarachnoid spaces. Should the animal recover, there is a liability to recurrence, so that altogether, when this affection is present, the best treatment is to destroy the patient and utilise the carcase.

Epilepsy—*Megrims* or *Staggers*—is only a symptom of disorder, as shown by the varied appearances seen post mortem. Sometimes it is seen in diseases of an ordinary character, as anæmia, and certain other forms of blood disease. Thus, it is mostly prevalent among young and debilitated animals. Sometimes on *autopsy* a spiculum of bone is found penetrating the brain, in other cases there are scrofulous or other deposits, and, again, there may be induration of the white matter, with a marbled or rosy colour of the grey, and adhesions of the membranes to the surface (Watson). How far these apply to the conditions in the ox we are not in a position to state, but certainly we find epilepsy associated with irregular blood supply. "We have in this malady another illustration of the fact that,

when the controlling influence of the cerebrum is suspended, the peculiar functions of the spinal marrow are exercised, not only in a disorderly, but also in an unusually energetic manner" (Watson). Thus, the symptoms of an epileptic fit are, after a premonitory dulness, a sudden loss of brain power, as denoted by the animal staggering and falling, and remaining for a shorter or longer time in a state of unconsciousness. Convulsive movements of the limbs, which are outstretched and shivering, of the respiratory and ocular muscles, and of those of mastication, are very marked. There is frothing at the mouth and involuntary passage of fæces and urine. Finally, the convulsions cease and the animal rises, and shortly seems again in a healthy state.

Treatment must be palliative, and directed to the production of blood in greater quantity and of a better quality, and also to ensuring its regular supply to the head. In young stock this diseased condition is most frequently seen. Since, in the majority of cases, there is a deficient supply of blood to the head, bleeding must not be performed. A cathartic will prove useful in removing any irritant from the alimentary canal. As soon as possible animals which have once suffered in this way should be sent to the butcher. Cases of epilepsy in the ox are rare.

Apoplexy is the reverse condition, in so far as blood supply goes, to that which is observed in most cases of epilepsy, being attributable to an over-distension of the encephalic vessels with blood, and a giving way of their walls, thus undue pressure is exerted upon the brain by extravasated blood. Similar symptoms also may be seen when sudden pressure results from bursting of an accumulation, and other influences similar in their nature. Plethora is the most fruitful predisposing cause. The conditions of life of the ox especially tend to render him plethoric, and when he is over-driven or excited during hot weather apoplexy is apt to occur.

Symptoms.—Some slight dulness may at first be present, but generally the animal is noticed to fall suddenly, with complete loss of sensibility, consciousness, and power of

voluntary movement; the eyes in an amaurotic condition; the breathing slow, stertorous, laboured; the surface of the body covered with cold sweat. Often the convulsive movements, rolling of the eyes, and sudden falling may lead to diagnosis of epilepsy, but this will soon be withdrawn, as the case remains in the same condition, or lapses into the quiescent form, or rapidly terminates in death. This results from extension of the pressure to the medulla oblongata, and interference with its functions. It will be observed that the symptoms vary somewhat, according to the seat of the extravasated blood. This condition is sometimes seen in association with fracture of the cranium and with rupture of the blood-vessels such as may also arise from other forms of external injury.

Treatment consists in free bleeding and administration of a laxative, but is seldom effectual, and the disease is apt to recur.

Dropsy of the Brain: Hydrocephalus—is the accumulation of serous fluid in the cranium, either between or below the membranes of the brain, or else dropsy of the ventricles. The latter condition is said to sometimes occur in adults, but it certainly is very rare. Youatt tells us the symptoms mostly resemble those of apoplexy, but are gradually developed. The former state occurs in the fœtus, and causes enormous enlargement of the head and impediment to parturition. The practitioner, when called in, finds the head partly in the generative passage, either the muzzle or forehead projecting with the fore limbs. The enormous cranium is yielding, but must be diminished in bulk by tapping with a trocar and long canula, or by opening with the knife. To give room the fore feet should be secured with ropes and returned into the uterine cavity. When the cranium collapses the calf will readily be expelled, of course dead. The loss is not to be lamented, as it would have done no good, the animal remaining weakly and unthrifty for a short time, and then dying. Youatt gives an interesting case, in which puncture was tried, but tetanus supervened and the animal died. He also mentions that the disease may appear in weakly ani-

mals *after* birth. In these cases we shall find the cranial bones thin and widespread, and large numbers of stellate Wormian bones placed between them, in the endeavour to

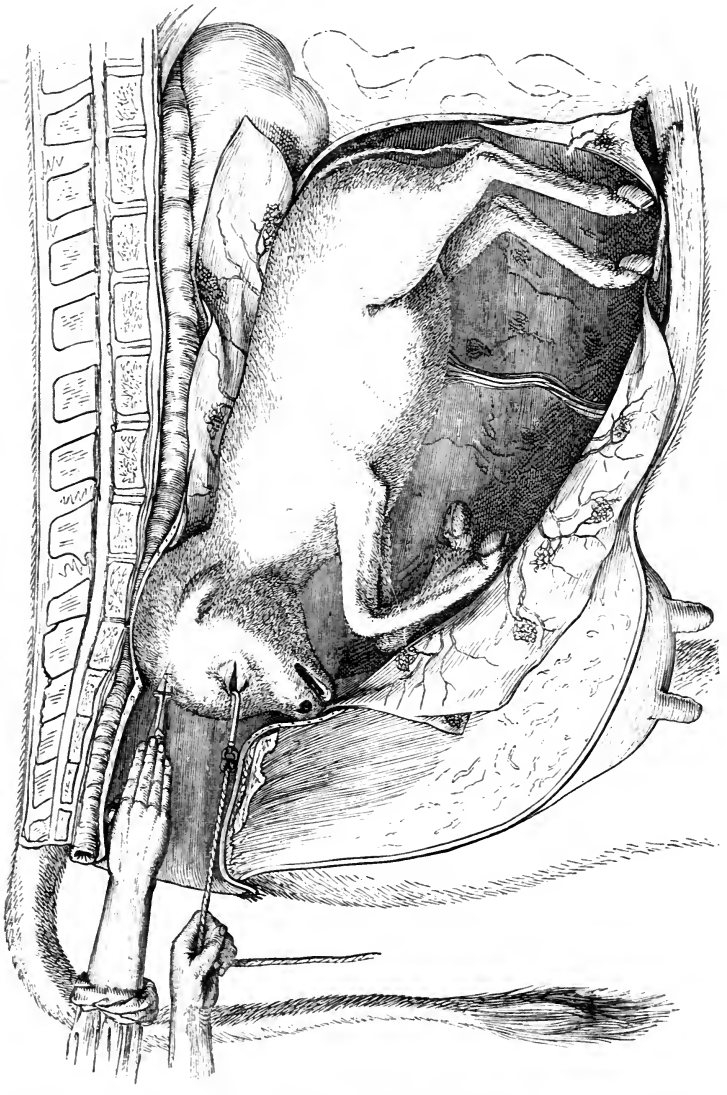


FIG. 72.—Congenital hydrocephalus, causing difficult parturition. (Simonds).

close up the large cavity, but not sufficient to replace a great part of the membranous walls. The brain is imperfectly developed. Sometimes we find only the floor of the cranium present, its bony walls being entirely absent, and the margins of the imperfect walls regularly rounded off.

PARASITES occasionally grow in the brain. These are the same hydatids as are seen in the brain of sheep, giving rise to "turnsick." They are known as *Cœnuri cerebrales,* are the larval form of the *Tænia cœnurus,* seen in its and adult state in the dog. They affect various parts of the

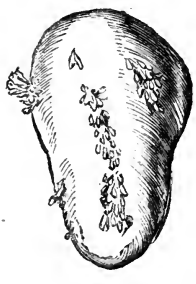


FIG. 73.—*Cœnurus cerebralis.* (After Cobbold).

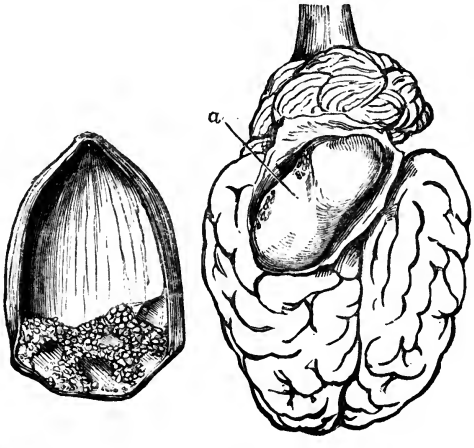


FIG. 74.—*Cœnurus cerebralis.* (*a*) *In situ.* (After Cobbold).

brain, generally the cerebral hemispheres. The embryo which has escaped from the ovum of the tapeworm bores its way through the tissues and enters a blood-vessel. It is carried in the round of the circulation to the brain, and there locates itself. It increases in size, and generally is large before it causes any appreciable symptoms, which are those due to circumscribed deficiency of a portion of the brain, or some forms of pressure on the surface, viz. constantly moving round and round in the same direction, and generally towards the side on which pressure is made. The disease is most prevalent in young animals, and in

some seasons than others; it is also somewhat rare in this country.

Post-mortem examination having proved the presence of the parasite, this must not be thrown away carelessly, but destroyed or preserved as a specimen, for it is of interest. Trephining may be experimentally tried, for in calves the sinuses are very small, and so sometimes a yielding of the bone over the hydatid may be perceived. With regard to the direction of turning and other interesting physiological deductions from this disease, as seen in the sheep, the 'Journal of Anatomy and Physiology,' 1879-80, may be consulted with benefit.

The occurrence of bony tumours in the cranium is noticed under the heading "Exostoses." It will be remembered that the cases of "ossified brain" recorded are of this nature.

We know but little of the derangements of the brain of a less striking nature than those hitherto described which, perhaps, occur in the ox. But we must remember that the conditions of life of this animal are not such as to call for any high exercise of cerebral functions, nor are cattle, as a rule, subjected to such close scrutiny as suffices to detect slight indications of brain disorder. This organ is very liable to disease in association with deranged conditions of the digestive apparatus, and a disease of this kind has been described as *Stomach staggers*, but really is a case of functional brain disease due to congestion. We are familiar with the drowsy sensation which results from a fulness of the stomach; the same is sometimes exaggerated in cattle, giving rise to *Coma*, which is denoted by dulness and a torpid condition, with sleepiness and a tendency to fall down, especially when the head is elevated. The respirations are deep and slow, the pulse full and slow, and the pupil dilated. This is the state also induced by narcotic poisons; it is then termed *Narcosis*. It must be treated by bleeding, stimulants, and a full cathartic dose.

Delirium is a condition of perverted cerebral functions seen in some diseases, such as encephalitis and some forms

of blood disorder, and it also results from the action of certain poisons. There is a wild look of the eye, excitement and sometimes fury, with violent struggling and discharge of frothy saliva from the mouth.

Diseases of the Spinal Cord have not been diagnosed with thorough accuracy, though Cruzel gives a long account of *myelitis*, which, he says, is very rare in the ox. Associated with this important nervous centre are two remarkable conditions which, having been described as distinct diseases, must be rather looked upon much in the same light as coma and delirium, they being symptoms which may be dependent upon any of several pathological states. Thus, Tetanus or Locked Jaw may be caused by electric stimulation of a motor nerve or the spinal cord, or by the introduction of strychnia into the system, or by certain conditions of nerves associated with a wound, or, we believe, as a result of the action of cold and other influences. It is simply an excitation of the spinal cord, causing it to throw so many impressions into the motor nerves so closely following one another that tonic spasm results. It may be diffused or circumscribed. In the latter case simply the source of motor-nerve force to the muscles of the head may be affected then the jaws are fixed and the retractor muscle draws the eyeball back into the orbit and so causes persistent protrusion of cartilago-nictitans. This is known as *trismus*. Again, we may find only the muscles of one side of the body affected (*pleurosthotonos*), or those above the spine (*opisthotonos*), or those below (*emprosthotonos*). In other cases we find a combination of these conditions. In disease is described as *Traumatic* when due to wounds, and *Idiopathic* when no wound can be found to which it may be attributed. It must not be supposed that it is only the motor portion of the cord which is affected, for there are indications that hyperæsthesia is present often to a marked degree, thus, excitation of the patient is apt to give rise to exaggeration of the spasm, and quietude is by far the most important feature of treatment.

Symptoms.—A gradually increasing difficulty is evi-

dently found in separating the jaws, and in performance of the voluntary movements in general. The disinclination to feed is the first matter which directs attention to the case, but there is no concomitant fever. There is a straddling gait, due to inflexibility of the hind limbs. Attention is directed to the mouth to determine the cause of refusal of food, and it is found that by this time the jaws are locked. Usually there is a flow of saliva of a fœtid character from the mouth when the lips are separated. Soon the appearance of the patient becomes characteristic; there is a marked condition of the muscles, due to rigidity, the tail is slightly straightened, the haw protruded, and the animal moves "all of one piece." If the haw be not protruded it will do so when the head is raised. The muzzle is extended forwards, and there is obstinate constipation. The animal sometimes tries to feed, and succeeds in sucking up a small quantity of fluid; he sometimes falls and continues in the recumbent position, but as often stands persistently. Respiration is materially interfered with by the contraction of the inspiratory muscles, but the diaphragm for a long time retains its activity. That the sympathetic system is involved is inferred from the state of the bowels; in some cases this may be primary, and the disease of the cord secondary. As a general rule, the reverse is the case. Sometimes the disease proves rapidly fatal, and causes death on the second or third day; if the patient lives to the sixth day some hopes of cure may be held out, but the prognosis is never very favorable, for we are working very much in the dark in treating tetanus. In some cases it is directly traceable to a wound either in the suppurative or cicatrising stage, when it is supposed that some nerve-fibre is entangled in the scar or otherwise disordered. Of these wounds the most frequent are surface-grazes, those produced in castration, and pricks in shoeing. Owing to the frequency of the latter, it is said to be most prevalent in working oxen. The idiopathic forms are attributable to exposure to cold and sudden changes of temperature, especially when the skin is heated. Thus, it is some-

times seen in newly-born animals as Trismus nascentium. It is also attributed to over-driving (when it may depend on soreness of the feet) and the presence of irritants in the alimentary canal. The latter, besides (probably) causing the disease, increase its intensity, as is proved by the beneficial effects of catharsis. To induce this extremely large doses of powerful drastics are given, and it is wonderful with what impunity. Once trismus has set in administration of medicines in the ordinary way is difficult, but croton oil may be placed on the tongue. Other agents may be given per rectum, but the best method is subcutaneous injection. Thus, morphia may be administered, or prussic acid, or a trial may be made of the nitrite of amyl. Chloroform inhaled is found to relax spasm temporarily, and the same effect follows its administration per rectum; it exerts no permanent influence. In these cases *quiet* must be substituted even for ordinary nursing measures. The patient must be placed in a dark and hushed place, and left there with a free supply of gruel available and a good bed. The wound to which the attack is attributed may be treated by sedative applications and poulticed. Möller has shown (see 'Veterinarian,' 1880) that tetanus cannot be produced by transfusion of blood from a tetanic to a healthy animal; it, therefore, is not specific, as some suppose. No definite post-mortem lesions have been observed, but in many cases there are congestion of the spinal cord and its membranes, softening of the cord, and accumulation of fluid between the membranes.

An interesting feature of this disease is the height to which the internal temperature may rise. Some of the highest readings on record in the human being were taken from acute cases of this disorder.

Paralysis—*Palsy*—is also a symptomatic condition referable to many different causes, and varying much in its characters. It is loss of voluntary motor power in a few or many of the muscles of the body, and generally is accompanied by a similar condition, anæsthesia, loss of sensory power. This union of the two conditions is the result of the proximity of the sensory and motorial

tracts, both in the majority of nerves and in the spinal cord. The degree of palsy may vary from that of a single muscle to total paralysis. When the whole of one side of the body is affected, it is termed *hemiplegia*, when both hind limbs, *paraplegia*. In the other cases, simply "paralysis." It may result from pressure on, or disease of the medulla oblongata, pressure on the spinal cord on the same side as the loss of power between the origin of the roots of the nerves and the brain, or on the nerves of supply to the affected part. Section of these structures or diseased action has the same effect. The loss of power does not generally occur suddenly, though it may do so, but where the limbs are affected there is a staggering gait, and a tendency to cross the hind legs. The most prevalent form in the ox is paraplegia. It is most frequent in old animals, especially those turned out on damp low pastures and during severe weather. All hardships tend to the occurrence of cases of this kind in the herd. Sometimes we find that the pressure on the nerves or cord is due to fracture; in this case the paraplegia occurs suddenly after a fall or some other form of injury, and the animal retains sensibility and motor power in all parts anterior to the fracture, and loses them posteriorly, but it must be remembered that reflex movements may occur, though they are not frequent. In the horse, intermittent paralysis of the hind limbs has been found to be due to plugging of the iliac arteries with lymph; such cases have not been noticed in the ox, but cases of paraplegia in pregnant animals are sometimes seen, in which the paralysis disappears after parturition; in them there may be pressure on the posterior aorta, or the iliacs more particularly, interfering with blood supply. Tumours of various kinds may be observed post-mortem, or even during life, in such positions as to press upon the nerves of the affected part. Sometimes paralysis is due to the action of poisonous agents; of these cases, lead palsy is the most remarkable.

Treatment.—All attention must be paid to the comfort

of the animal, which must have a good bed and be frequently turned to avoid bed-sores, which are very liable to occur under an aggravated form in these patients. When the case is attributable to debility, we may expect success in restoring the patient, but, as a rule, these are protracted and doubtful cases. When fracture of the spine exists, or we surmise that tumours compress the nerves and cannot be removed, we must anticipate a prolonged course of treatment, loss of condition, and want of success. It is better, therefore, to at once have the patient destroyed. When the pressure is due to inflammatory deposits, we may expect these to become absorbed in time, and the process of removal will perhaps be accelerated by the use of such agents as the iodide of iron, which is at once deobstruent and tonic; also by the external application of biniodide-of-mercury ointment. The food should always be as nutritious as the digestive apparatus is able to bear, and also of a laxative nature. The urine may require to be removed frequently by means of the catheter. Lastly, treatment of chronic cases by strychnia in two-grain doses, gradually increasing and continued for some time, may lead to return of nerve force to a portion of the spinal cord, which has had its powers reduced by some influence. Hand-rubbing of the affected parts, and mild stimulation and clothing, are useful adjuncts. The muscles of the paralysed part decrease in size, and sometimes degenerate into masses of fibrous tissue; this is an advanced stage. The muscles less affected are found in the stage of fatty degeneration. This is well seen in cases of *progressive lipomatous paralysis*, such as is noticed in the 'Veterinarian' for 1880. We have often observed this in our dissection of monstrosities, in which the nerve centres have been destroyed after due development of the muscles, or in which muscles and nerves have developed independently of nerve centres. It seems that as long as they are involuntary the skeletal muscles develop without the aid of nerve centres, but when they become striated, unless used they degenerate, and they

can scarcely come into use except under the influence of the cerebro-spinal nerve centres.

ADYNAMIA NERVOSA GENERALIS (Armatage) is that nervous debility which affects some cows during the later stages of pregnancy, which has been confounded with parturient apoplexy, but which is only indicated by a want of ability to rise, a tendency to coldness of the

FIG. 75.—The natural position of rest as retained in adynamia. (Armatage.)

surface, and a weakness of the pulse, with some torpidity of the bowels, otherwise the animal remains apparently in good health. It has been attributed to pressure of the uterus containing the fœtus on the posterior aorta, preventing the proper supply of blood to the hind extremities, and in some instances this seems to be the case, but it often persists after parturition, therefore it must be due also to other causes. Of these, the demands of the fœtus on the nutritive material of the blood is considered to be one of the principal. Sometimes it is treated successfully by suddenly frightening the animal, but it is better to keep the bowels open by means of enemas and the surface of the body warm, and support the strength of the animal until it has entirely recovered from the effects of utero-gestation. Small doses of strychnia have been

recommended, and stimulant applications along the length of the back are of decided benefit.

Chorea—*Stringhalt.*—Cases of this nature characterised by clonic muscular spasms have been described, as in the 'Veterinarian,' vol. xv, p. 71, and 'Edinburgh Veterinary Review,' vol. iv, p. 237. In the latter instance a number of animals were affected, and this was attributed to the practice of giving them burnt ale with their food.

Parturient Apoplexy—"*milk fever,*" "*dropping after calving*"—is a disease peculiar to the cow, generally occurring after calving, and within three days of that event, most frequent after easy accomplishment of birth, in good milkers, and in old animals seldom before the third calf, perhaps most often seen after the fifth; very liable to recurrence in animals which have once suffered from it when the time for parturition again comes round. It is noticed most frequently in warm weather, and in animals which are in a plethoric state at the time of parturition. The disease is mentioned as also taking place in some cases before birth, and some say even several weeks after that event; but this is very doubtful, and, at any rate, quite exceptional.

Symptoms.—The cow, some time after parturition, generally about four hours, becomes restless, raises the hind feet alternately, breathes rather quickly, is unwilling to move, and staggers during progression. There is cessation of appetite and rumination, a staring condition of the eye and—a sign of great significance—the supply of milk suddenly fails. Shortly, in about twenty-four hours after parturition, the animal falls, the hind limbs giving way, and remains on the ground, generally after several ineffectual attempts to rise. Then, it is found that the eyes are protruding and bloodshot, and insensible to the touch; in fact, there is a general loss of sensation and power of voluntary motion. The pulse is now full, soft, and frequently slow, but subsequently it becomes faster, smaller, and finally imperceptible. The respiratory efforts are slow and infrequent, and, after a little time,

stertorous. The visible mucous membranes are purple in colour, and the head and horns are hot. The animal is delirious, and dashes the head about with extreme violence,

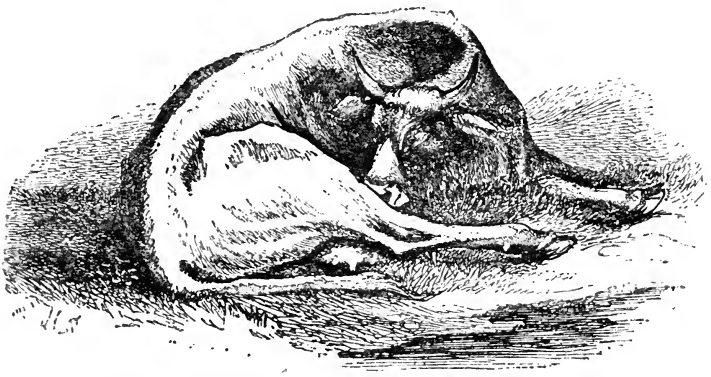


FIG. 76.—Puerperal (Parturient) apoplexy in the Cow. (From Fleming's 'Veterinary Obstetrics.')

or becomes comatose, and lies with the head flexed round on the shoulder[1]. Amaurosis sets in, and there are twitchings of the muscles of the eyelids. The udder remains soft and flaccid, or sometimes becomes hard and small. All power of swallowing is lost, the bowels do not act, and the urine is retained. Tympany also is present. Usually the coma becomes more profound and the signs of vitality less marked, until the patient dies; but in other cases the functions of the internal organs commence to be more satisfactorily performed; the bowels act, the pulse becomes perceptible, and the respirations more frequent, and gradually the patient recovers. Even after the animal is far advanced towards convalescence relapse may take place, and we have seen cases in which the slow recovery was seriously interfered with, the sloughing of large patches of skin—bed-sores, in fact—resulting from a want of attention to frequent turning and protection from the acridity of urine while the animal was recumbent. To these lesions an animal recovering from this disease seems par-

[1] This is by some considered due to special tonic spasm of the cervical muscles.

ticularly liable, probably in consequence of interference with the nervous supply of the superficial parts.

Post-mortem examination.—The blood dark in colour and distending the veins; petechiæ of various serous membranes; congestion of the brain and spinal cord, with apoplectic clots on various parts.

Pathology.—Gamgee and other authorities on this subject consider that there is present in the blood a specific element. The congested condition of the veins in general and the dark colour of the blood, together with the ecchymosis of the serous membranes observed post-mortem, seem to support this view until we consider that the blood must contain many impurities, as a result of defective action of all the excretory organs. Probably those cases in which the disease has been communicated were septic peritonitis, a disease frequently mistaken for that in question. Another argument advanced is, that the disease sometimes assumes an enzootic form, but this is probably attributable to uniformity of surroundings and mismanagement of a number of pregnant cows. The "anatomical theory" is that this disease is due to the arrangement of the arteries at the base of the brain, as a rete mirabile, rendering the cow liable to apoplexy, especially when the supply of blood to the pregnant uterus is cut off, and there is no compensatory determination to the mammary gland. That the arrangement of the arteries has little to with the matter is shown by the fact of the spinal cord, as well as the brain, being the seat of extravasations. Some attribute the disease to accumulation of milk-producing elements in the blood, giving rise to fever and, practically, blood poisoning; to sudden overloading of the system with blood, causing nervous disorder; to encephalic anæmia (eclampsia). After a very careful consideration of the various theories on the subject, Fleming ('Veterinary Obstetrics,' p. 668) adopts the latter view, as suggested by Franck, and he considers the view of Professor Barlow, one of the ablest of British cattle pathologists, as "most far-fetched." He hardly treats this view, which is supported by Pro-

fessor Williams, with proper respect. These professors considered the disease a disorder of the sympathetic nervous system. Many considerations tend to render this view most probable. In the ox, and especially the milch cow, this system is most highly developed. Alimentation, lactation, and utero-gestation, are under its direct control, and its influence is especially appreciable in the various secretory processes. At parturition, when the act is rapidly accomplished, undoubtedly a large excess of blood is thrown upon the system; the effects are the same as when a flux of long standing is suddenly stopped—either some excretory organ exerts its powers of vicarious action, or there is sudden increase in blood pressure, and congestions and apoplectic lesions take place. Normally, the mammary gland becomes very active, and removes the excess of nutritive blood constituents, while watery matters and salines are also removed by the other excretory organs. If any influences lead to imperfection of this safety-valve action congestions and apoplexy take place. That the functions presided over by the sympathetic gangliated cord are not duly performed is evident in parturient apoplexy. The sudden loss of milk, retention of urine, torpidity of the bowels, and loss of power of deglutition, are proofs of this. But the next question is as to what has brought about this disorder? We must answer this by saying that the violent throes which were necessary for the rapid expulsion of the fœtus depended on excessively violent nervous efforts, which so exhausted the sympathetic system as not to admit of its recovery until apoplectic mischief has been done by the method above described. With the present state of physiological knowledge of the sympathetic nervous system we are not in a position to reason the matter out more closely, but it is evident that this view is worthy of attention, and some pathologists will find it hard to believe that apoplexy is due to anæmic conditions of a part which is found congested after death. The occurrence of coma, delirium, and convulsions is thoroughly explicable, as due to congestion of the brain and spinal cord. The disten-

sion of the blood-vessels seen post mortem and the purple colour of the visible mucous membranes throughout the attack show that extreme fulness of vessels is present in these cases, and also a loss of tone of their muscular structure. Several other theories as to the nature of the disease might be given, but it is not necessary. Williams' idea, "that the particular congestion of the brain and its meninges is determined by the state of mental excitement which is always present at this period, an argument borne out by the fact that the removal of the offspring from the mother is a fruitful cause of the so-called milk fever," is feasible, but such an exciting cause is not absolutely essential, and the brain is not the only part of the body which is congested and presents blood extravasations.

Treatment.—Prophylactic consists in ensuring a healthy state of the constitution towards the time of parturition by allowing a little exercise and adopting other means to avoid plethora. Some authorities even suggest cathartic doses and bleeding with this object.

Curative.—In the earliest stages the abstraction of blood is decidedly beneficial, and a large cathartic dose must be administered. This latter measure should always be adopted whatever the stage of the disorder, for one of the most important indications is to get the bowels to act, and it is really wonderful what large doses of purgatives may remain in the alimentary canal without producing any effect, for the great distension of the blood-vessels prevents their absorption. Usually a combination of salines with aloes is recommended. In no disease is more careful and assiduous nursing required. The animal must be supported by bundles of straw, and covered with cloths, the udder stripped regularly, and friction applied all over the surface of the body. Cold water or ice may be applied to the forehead, which may tend to rouse the tonicity of the cranial arteries, which may thereby overcome the passive congestion, but a more important means is the frequent administration of small doses of diffusible stimulants, which, we believe, tend to rouse the sympathetic system into activity, and to diffuse some of that

nerve force now heaped up in the cerebro-spinal centres, as manifested by delirium and convulsive efforts. It is usual to apply a stimulant or a sheep-skin along the course of the spine. Enemas should be frequently given, and the urine drawn off with the catheter. All agents

FIG. 77.—Catheter.

administered internally should be given by means of the stomach-pump, as deglutition is impaired and fluids are apt to fall down the trachea, and to cause the death by mechanical bronchitis of an animal which otherwise might have recovered. Also introduction of the tube into the stomach will tend to relieve tympany. A very good plan is to insert the trochar and canula, and to administer the stimulant doses through the opening. Any change for the better must not cause relaxation in our efforts, but the animal must not be allowed to feed on anything but easily digestible laxative food, or strictly for some time kept on a gruel diet.

Results.—We have already alluded to the liability of this disorder to recur. Resolution takes place more frequently in some parts of the country than in others, and thus the fatality has been variously estimated. Paraplegia is one of the most unsatisfactory results, dependent upon pressure on or disorganisation of the cord. Such cases are occasionally treated successfully by means of tonics, strychnia, and absorbent agents, and blisters over the course of the spine. Sometimes, as the deposit is gradually removed, they undergo spontaneous cure. Where there are no signs of amendment after a short treatment, the animal should be slaughtered, and, if in a fit state, used as food. Whether the carcase of an animal which has been destroyed while suffering from milk fever is fit for food is much debated. It has nothing specific about it, but the blood is so laden with impurities that we must condemn such meat as bad,

though we cannot say that it will cause disease in animals which consume it.

Cases of *Parturient Fever*, ordinary fever observed after parturition, which present no special features of treatment, must not be confused with parturient apoplexy; and the latter disease must be carefully distinguished from septic peritonitis, adynamia, and simple metritis.

Mania puerperalis is a disease which is occasionally seen a few days after parturition, characterised by extreme excitement, constant champing of the jaws, with gnawing of the surrounding objects, especially the animal's own fore legs. These symptoms are somewhat similar to those of rabies, but contagion cannot be traced, there is the special relation to parturition, and the attack generally lasts only a short time and yields to the action of opiates. It is attributed to dyspepsia, exposure, and to removal of the calf from the cow. Cases are recorded in the 'Veterinary Journal,' vol. ii, p. 17, and vol. ix, p. 13. Mr. Storrar, of Chester, prefers to consider this disease as a form of epilepsy.

With regard to the *Nerves*, we can only state that Neurotomy has been performed in the ox as in the horse, the anterior plantar nerves being divided as well as the lateral. The operation is so seldom performed that we need merely allude to it here as having been resorted to successfully.

In the third volume of the 'Edinburgh Veterinary Review,' p. 503, is a case of suppose *division of the pneumogastric nerve* in bleeding. Vomition, cough, and atrophy of the left lung resulted.

Section 2.

Diseases of the *Sympathetic nervous system* in the ox do not seem to have been recognised, except in so far as has been already mentioned. (See Parturient Apoplexy.)

CHAPTER IX.—DISEASES OF THE SKELETON.

The Skeleton of the ox is heavy and comparatively simple. The skull is large, for the face has to accommodate the huge grinding teeth. It also is peculiarly bent upon the cranium. The frontals especially are well developed, occupying the whole of the upper part of the cranium, prolonged on each side as a horn core and permeated throughout by sinuses, which contain heated air, and lessen the weight of the head. The cervical vertebræ are short and stout, and ligamentum nuchæ is well developed, but special in its character, having a layer of it on each side lying externally to complexus major. The lumbar region is composed of stout bones with long non-articulatory transverse processes. The shoulder-girdle consists of a scapula, with the coracoid appended to it as a process. The clavicle is only represented by a white fibrous band. The humerus has a single groove at its supero-anterior part, and the ulna is prolonged to the knee. The pelvic girdle is principally remarkable for the large size of the ischium, which (with its symphysis) inclines peculiarly upwards posteriorly. Consequently the sacro-sciatic ligament is small. The most important feature of the hip-joint is the absence of the pubio-femoral ligament; the femur, therefore, has freer movement than that of the horse, its trochanter major is not so much divided, and there is no third trochanter. The fibula, in all but very old animals, is ligamentous throughout, except where it is situated below the outer side of the tibia, and assists in the formation of the tarsus by articulating with os calcis. Other peculiarities have been already mentioned (as at

pp. 309 and 316, &c.). Diseases of the skeleton in the ox are not so frequent as in the horse, but yet are not uncommon.

Section 1.—Abnormalities of the Osseous System.

Ostitis.—*Inflammation of Bone*—results from injury or from specific influences, especially the scrofulous

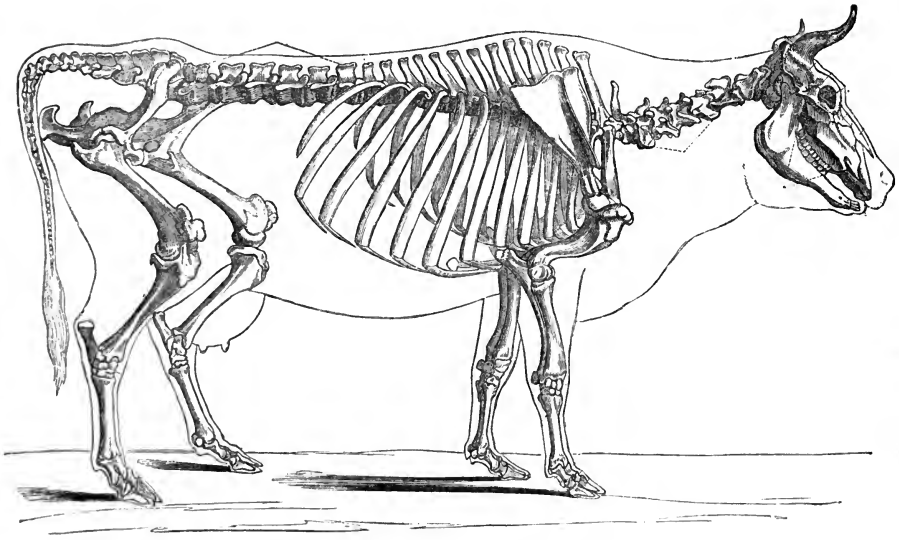


Fig. 78.—Skeleton of the ox. (Dobson.)

diathesis. Abscess is the most frequent result. Also, since the inflammation causes condensation of bone tissue, the supply of nutriment to the articular surfaces is cut off, and caries with arthritis ensues. Pain is very marked in these cases, and swelling is but slight and very gradual. The death of bone is termed *necrosis*, and the portion removed is a *sequestrum*. When a bone is diseased at the bottom of a wound, or when an abscess from a bone has burst externally, the most important indication is to remove all dead parts, otherwise an ichorous discharge persists, sinuses extend in various directions, and the

affected part undergoes extensive disorganisation. When a number of fragments of bone are separated in a comminuted fracture these act as foreign bodies, and necrose through defective blood supply. When this is the case the larger portions may be surgically removed, and whenever a small amount of necrosis is present hydrochloric acid dressings will prove useful by breaking up the bony structure. One of the most frequent seats of necrosis is the pastern bones in cases of foul. In cases of ostitis poultices should be applied, and the parts freely fomented and as thoroughly rested as possible. Besides a laxative dose no constitutional treatment is generally required.

Periositis and Inflammation of the Outer Lamina of a Bone result from injury and, occasionally, from rheumatism. The membrane becomes thickened, and sometimes much congested, and an exudation of lymph beneath it occurs, which becomes converted into bone. The process is painful, and sometimes requires to be relieved by *periosteotomy*. This operation does not seem to have been used in cattle practice. A case of diffused metatarsal periostitis, by Professor Walley, may be read in the 'Veterinary Journal,' 1880, vol. i, 126. It was a complication of arthritis of the hock and fetlock, and led to encasement of the upper three fourths of the metatarsus by a bony layer. Chronic cases of ostitis and periostitis are sometimes benefited by a blister.

Exostosis—*Bony Growth from Bone*—results in most cases from periostitis. In the first place it is simply lymphy material thrown out, but later earthy matter is deposited in it, and this in process of time becomes converted into true bone. Callus thrown out round a fracture has much the same nature, but is specially arranged in relation to the injured bone. The most remarkable growths of this nature seen in the ox are those dense outgrowths from the petrous temporal bone which extend into the cranial cavity and cause absorption of the brain; they attain an immense size and weight, and become closely moulded against the cranial walls in such a way that often they present a lobulated appearance, and have ramifying grooves

upon their surface for blood-vessels. Hence, they have been mistakenly described as "ossified brains." Strange to say, such cases are seen in animals in good condition brought for slaughter, no special signs of disorder having been noticed in connection with them. Bony growths are not infrequent, too, around the margin of the orbit, dependent on periostitis, the result of injury. They sometimes attain such a size as to require to be removed with a saw. Sometimes they bend inwards and exert pressure on the eyeball, and they are always rather liable to injury, which causes ulceration. Small or large bony tumours are sometimes found on the ribs, extending into the thorax. Once exostoses have assumed the true bony character they will remain as part of the body whatever treatment may be adopted. The application of blisters will promote absorption of any surrounding deposit. Cases of this kind seldom require treatment.

Osteophytes, or bony growths, result from ossification of exudates or of fibrous tissue. They are distinguished from exostoses by not being attached to bone.

Fragilitas ossium is a condition in which, through excess of earthy matter, produced either by too great removal of animal constituents (as seen in old age, and as a result of inflammation), or, less frequently, by excessive earthy deposit, the bones readily break. Under this heading must be recorded the disease known as *Cachexia ossifraga malacia*, which was especially noticed in the 'Edinburgh Veterinary Review,' vol. iii, pp. 16, 75, and 223, and also treated of in the 'American Veterinary Journal,' May, 1852. It is vulgarly known as "Cripple" or "Stiffness," and is enzootic in certain situations, and affects especially milch cows. It is attributed to the non-assimilation of phosphatic material, or its excessive removal from the system in milk. A deficiency of phosphates in the soil is considered the main cause, and over-stocking land is likely to give rise to it.

Symptoms.—Indigestion, with progressive debility, stiffness of gait and staggering. Later, inability to rise, swelling of the bones, especially at the joints, and paralysis.

These cases are long and tedious, and require to be treated by change to full and highly nutritious diet, a mild laxative to empty the alimentary canal, and subsequently mineral tonics.

Post-mortem examination shows ligaments torn away from their attachments, bones enlarged, friable, and presenting outgrowths. Fractures also are generally present. This disease is similar in many of its characters to "*Osteoporosis*" as seen in the horse, but differs in the presence of friable tumours and in the considerable alteration in shape which the bones undergo. Whether these are the same disease is a matter of importance, for *Osteoporosis* has been described as affecting the ox by Professor Williams, who says, "Cattle reared on bad, ill-drained land, poorly kept in the winter, grazed on sterile upland pastures during dry summers, or otherwise ill-used, are liable to be affected with it." This matter must be settled by microscopical examination of the bones.

Rachitis—*Rickets*—is an imperfection of bones seen in young animals, and essentially dependent on the non-deposition of sufficient earthy matter in the ossifying tissue, which therefore yields to the superincumbent weight. This depends on imperfect nutritive supply or mal-assimilation, and is not infrequently associated with the scrofulous diathesis. As seen in calves it is characterised by enlargement of the joints, a bent condition of the limbs, especially below the knee and the hock. Also, it is almost invariably accompanied by indigestion and diarrhœa. It is first manifested when the animal is a few weeks old, and can be sometimes traced to imperfect supply of milk; in other cases it may be associated with lesions of the nervous system.

Treatment.—Careful nursing, nutritious and digestible diet, cod-liver oil and lime water, mineral and vegetable tonics. The medicinal agents should be given in milk. The bent portions of the limb may be supported by properly applied splints on the convex surfaces. As the animal grows older the bones will become hardened, but will remain deformed.

A degeneration of the gastrocnemii tendons has been seen in young cattle.

FRACTURES—solutions of continuity of the hard structures of the body—are simple, compound, or comminuted. A fracture is simple when there is a breaking into two parts; when several fragments are formed it is comminuted; and it is compound when there is a communication with the surface through a wound and sometimes protrusion of a portion of bone. When one of the long bones of the extremity is the seat (they are the most frequent) the fracture may be longitudinal, transverse, or oblique. The latter are the easiest to set, but the most difficult to retain in position, and their sharp ends are apt to pierce the skin and to convert a simple fracture into a compound one, which is not at all satisfactory, since exposure to the air excites suppuration, and materially delays repair. Transverse fractures are difficult to set, but easy to retain in position; longitudinal are least liable to displacement. When the bone is in a comminuted condition, it requires to throw off all portions of which the nutritive supply is cut off, and to unite together the remaining fragments. Reunion of a fractured bone results from the calcification and subsequent ossification of lymph, which is thrown out around the fracture and forms the *interior* callus, a plug inside the bone; the *intervening* situated between the fractured surfaces, and the *ensheathing* around the parts, binding them together. The callus after a time almost disappears, and but little trace of the fracture of the bone is visible. Rest is essential to the proper performance of these processes, otherwise simply a lymphy bond of union between the fragments may be formed, constituting the condition known as "false joint." Certain minor details of the process of repair have not been touched upon, such as the rounding off of sharp projections and the establishment of cancellated and compact tissues continuous with one another.

Symptoms of Fracture.—The principal symptoms are deformities and pain of the part, interference with its function, crepitation when on manipulation the extremities

are rubbed together. Soon swelling sets in and renders diagnosis obscure.

Treatment comprises restoration of the fragments to their natural position, and maintaining them there in a state of rest until union has been completed. This takes over a month, so that such cases are rather serious ones to take in hand. "Setting the bone," can best be effected by extension and counter-extension, but the details must vary with the part affected. Retention may be accomplished by bandages, compresses, or splints; the latter are made of leather, gutta percha (warmed in hot water), or some other soft yielding substance, and must not be bound on too closely, but allowance made for the swelling which will ensue. These are retained in position by a starch bandage, which gives even pressure; depressions below the splints must be padded in such a way as to secure this. A pitch-plaster is useful in some cases where splints and bandages cannot be applied. To secure as much rest as possible the patient should be housed and allowed a good bed and regular laxative diet. Of particular fractures we may specify—

Fracture of the Horns.—It is often seen, especially in young animals which have been fighting. The horn core may be fractured transversely without injury of the horn; the latter then will act as splints. When both core and horn have been broken off, hæmorrhage will be profuse, and must be restrained by pressure, or, if necessary, by the actual cautery. The opening extending into the frontal sinuses must then be covered with a tarred cloth, which must not be bound on too closely, or it may give rise to exostotic growth from the exposed bone as in a case before us, where the tumour measures about two feet ten inches in longitudinal circumference, and weighs about five pounds. Anything of this kind must be removed with a saw. An imperfect horny covering will, in due time, invest the exposed extremity.

Fracture of the Metacarpal or Metatarsal Bone, when compound or comminuted, may be treated by amputation, performed as recommended for foul.

Fracture of the Os Innominatum may be through the acetabulum, when, if the animal is at all in condition, it should he killed for the butcher. The same rule applies to fractures of the more serious kind involving joints, or penetrating cavities in any part of the body. Animals rushing through doors, over landing stages, or through gates which shut on them, are liable to fracture of the antero-inferior spinous process of the ilium; this never unites, but a false joint forms, and the animal remains permanently deformed, "ragged" or "hipped," as it is termed.

Fractures of the Ribs may lead to passage of the fragments inwards and laceration of the lung or to pleurisy.

Fractures of the Cranium are seldom seen in cattle, and not likely to compress the brain, for the plates of bone of the cranium are separated almost everywhere by the frontal sinuses, so that the outer gives way without the inner.

Fractures of young animals unite more readily than those of the adult; in them we occasionally see cases of partial fracture, fracture with *bending*, or *greenstick fracture*, and apparent fracture may be due simply to *separation of epiphyses*, especially those of the olecranon and of the summit of the process of os calcis. In such cases there is flexure of the limb at the hock or the elbow, generally a hard tumour above the joints of these parts, and a thickened condition of the muscles higher up. In such cases the limbs must be forcibly kept straightened for a considerable time, and an attempt must be made to bring the separated parts in apposition, and maintain them there. Such cases are troublesome.

As in other lower animals, the difficulty in treatment of fractures in the ox consists in our inability to keep the patient quite quiet and at rest. Again, we cannot satisfactorily use slings for him as we would for the horse for they too much compress the abdominal viscera and interfere with digestion. Still, we do not require such accurate and perfect union in the ox as in the

horse. Altogether treatment of the majority of cases is indicated.

Section 2.—Injuries and Diseases of Ligaments and Muscles.

Sprain is rupture of some of the fibres of a ligament or tendon. When all give way simultaneously we have to do with *complete rupture of a white fibrous band,* thus, these conditions so often described separately are simply one and the same, but the latter is an exaggeration of the former. Reparative inflammation is set up and thus the parts become hard, swollen, hot and painful, and there is a want of free movement of the tendon. Over-tension of some kind is the cause of this state, as when an animal progressing rapidly steps in a deep hole, catches its foot in any place, or bears its weight improperly on the limb. Of course the tendons of the limbs are most frequently the seat of this lesion. Generally some amount of thickening remains after recovery.

Treatment comprises thorough rest, not only by keeping the patient quiet, but sometimes by placing the limb in a favorable posture. In the early stages warm water may be used to relax the parts and lessen pain, but when possible, cold water may be continuously applied, whereby tendency to excessive deposit will be prevented; and also there will be a certain amount of local anæsthesia produced; unless the application be continuous, it may as well be left alone. When all heat has subsided in the part it will be advisable to complete the repair by the stimulating action of a blister or even of the actual cautery.

Sprain of the Fetlock Joint is perhaps the most frequent lesion of this nature. It depends upon excessive divergence of the digits, and here mainly falls the stress of all the weight thrown upon the limb. This form of injury is most frequent in working oxen, and presents nothing special in its course and treatment except that it is liable

to be accompanied by arthritis and to result in false anchylosis of the joint. The sheaths of the tendons about this part always undergo thickening in such cases. Sometimes the inflammation runs so high as to give rise to considerable systemic disorder, so that a cathartic and febrifuge agents must be administered. Overgrowth of the hoofs, by giving rise to abnormal direction of tension, predisposes to this injury.

Sprain of Ligamentum Teres of the Hip is seen in the ox, for he has no pubio-femoral ligament to strengthen the union of the head of the femur with the acetabulum. Armatage gives the following symptoms :—Flexion of the affected limb during rest and drooping of the haunch of that side. Inability to raise the thigh and advance the leg, so that the hoof is dragged along the ground. Great pain on movement of the limb, absence of external indications, and in chronic cases, wasting of the quarter, with a clicking noise during progression. The most frequent cause of this is beasts "mounting" on one another, but blows may also give rise to it. Abscess in the hip-joint may result. These cases are not rare, and prove severe and protracted, and seriously interfere with condition. The ordinary treatment for sprain must be tried; in chronic cases a seton may prove useful. Above all things thorough rest must be secured; this ligament has been found ruptured.

A case of *Ruptured Suspensory Ligament* may be read in the 'Veterinarian,' vol. xvi, p. 254. This ligament divides inferiorly into four in the ox and assists the perforatus to form its sheaths for perforans.

The muscular system of the ox is less liable to injury and disorder than that of the horse, since the tendons are seldom subject to excessive strain, and the animal is not compelled to undergo excessive muscular exertion. Yet, as a result of over-feeding, the muscles degenerate, undergoing fatty change, and are liable to give way under the influence of a comparatively slight degree of force. Of this nature is the *Rupture of serratus magnus,*

which gives rise to excessive and sudden lameness when heavy fat cattle are made to travel any distance.

Displacement of the Abductor femoris has been described by some authors. It gives rise to hip lameness, with a dragging of the limb and imperfect flexion. Incision through the investing fascia is necessary to free the muscle. It is seen in working cattle and in mountainous districts.

In muscles certain parasites take up their abode. Of these the most important are the Trichina and Cysticerci. These have, in this country, only been found in the ox as a result of experimental investigation. It seems probable that the *Cysticercus bovis* frequently occurs in the flesh of cattle in India and other warm climates. Certain psorosperms, very low organisms belonging to the Gregarinidæ, have been found in the flesh of oxen. These have been described as cattle-plague bodies — "Miescher's" or "Rainey's" bodies—are detectable under high powers, and have no clinical importance. They are found in healthy as well as diseased animals.

Sometimes wounds lay OPEN SYNOVIAL TENDINOUS SHEATHS. The lining membrane exposed to the air becomes thickened and discharges largely, manifesting all the signs of acute inflammation. The continuous application of cold water seems to be the best means which can be adopted.

SECTION 3.—ABNORMALITIES OF THE JOINTS.

The various affections of the joints are not so frequent in the ox as in the horse. We may enumerate the following:

ARTHRITIS—*Inflammation of a Joint*—generally depends upon rheumatism or scrofula, or arsenical-fume poisoning, but sometimes is simple and due to ostitis, or punctured wounds or bruises. The specific affections have been already noticed and compared. Traumatic arthritis causes ulceration of the extremities of the bones, which produces ulceration of the articular surfaces, with sometimes loose

portions of bone; also a distended condition of the joint cavity, with the ordinary local signs of inflammation, the swelling being particularly hard. Fever is apt to run high, and when the diseased joint is in one of the limbs lameness is intense. The discharge through the puncture is at first profuse; subsequently it becomes flocculent, and sometimes sanguineous.

Results.—Of these anchylosis is the most frequent untoward condition; to it all these cases tend. It is nature's method of cure of the disorganised joint by establishing bony connection between its constituent portions, and thus entirely obliterating its cavity.

The best treatment in such cases is to secure as much rest of the parts as possible, and to endeavour to close the wound before inflammation is excited in the joint. This may sometimes be done by adhesives or sutures. When admissible, of course the wound must be thoroughly cleansed. Later cold water must be applied continuously, which will allow only enough inflammatory action for reparative purposes. More recently the application of a smart blister around the joint has been found to be very successful, since it serves to limit motion and close up the wound by the swelling it causes. Severe constitutional irritation may occur in these cases. Even where anchylosis has resulted the patient will probably be able to get sufficient food to fatten himself; thus, we may deem a cure of this nature fairly satisfactory in the ox, whereas it would prove useless in the horse. Remarkable cases of arthritis are those seen in "copper-smoke disease."

The Stifle-joint is very liable to injury from blows, bruises, and other traumatic influences. The affected limb is raised from the ground, and there are fluctuating swellings, due to accumulations of synovia in the joints. Weight on the limb causes extreme pain, and the animal will not lie down, or when recumbent can scarcely rise. Sometimes these cases last a very long time.

Hydrops Articulorum—*Dropsy of Joints*—results either from inflammation, or as a result of constitutional or local debility. It is seen most frequently in young animals when

it is due to the latter causes. It is not frequent in cattle.

Treatment.—Subdue any inflammation present, then paint with tincture of iodine, or apply friction and give tonics.

Synovitis—*Inflammation of a Synovial Membrane*—occurs whenever it is exposed to the air, as in open joint, bursa, or sheath, and is a complication of tendinous inflammations. It leads to the throwing out of lymph and adhesions, which impede free movements of tendons in the case of sheaths and bursæ. The membrane undergoes the various stages of congestion, with dryness, thickening from interstitial effusion, and lymphy exudation; and there is considerable pain, and fever runs high.

Treatment comprises active antiphlogistic means. The most important point is to prevent extension of inflammation to the neighbouring cartilages.

Other diseased conditions of the structure of the skeleton are of minor importance, and will present no difficulties to the scientific practitioner.

Relaxation of the Pelvic Symphysis has been seen in cows after parturition.

Dislocations or Luxations are misplacements of joint surfaces, to allow of which some of the retaining ligaments have given way. This leads to deformity, interference with function, and subsequently to changes of the articular surfaces in the direction of an adaptation of the parts to their new situations. Thus, cartilage is removed, prominences are levelled, and new depressions are formed, and condensed bony tissue to a certain extent replaces the articular cartilage (eburnation), and receives a polish. These displacements depend upon some irregular action of muscles or force applied to the surface; they are most frequent in young animals with delicate ligaments and only partially developed articular surfaces.

Treatment comprises reduction of the dislocation, retention of the parts in their natural position, and artificial strengthening of parts. Hip-joint and patella dislocation are the forms of this lesion most frequently seen in cattle

practice. The former lesion is seldom unaccompanied by fracture of the acetabulum.

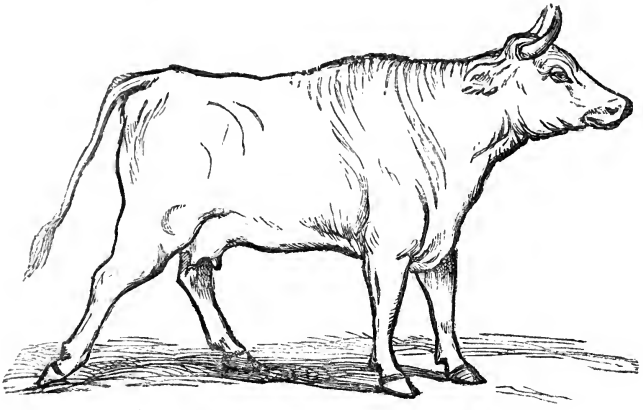


FIG. 79.—Dislocation of the patella. (Armatage.)

Dislocation of the Patella is the most frequent luxation in cattle, and is almost always outwards, so that the bone

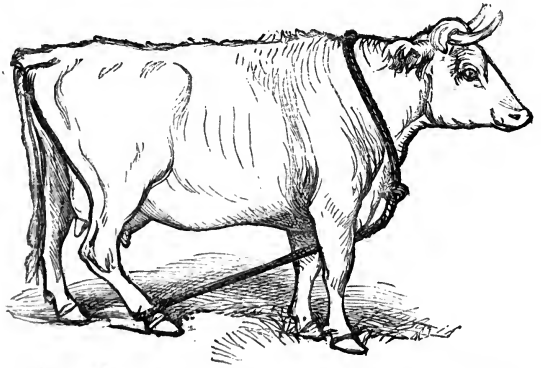


FIG. 80.—Means for preventing recurrence of dislocation of the patella. (Armatage.)

may sometimes be distinguished as a hard tumour outside of its normal position. The limb is drawn and maintained forcibly backwards in a manner which cannot be mistaken. Reduction must be attempted by drawing the limb forwards by a hobble round the fetlock, with a rope attached

to it, and connected with a band passed round the neck, at the same time pressure inwards is brought to bear on the displaced bone, which will probably easily slip back into its position. The limb should be kept forwards by tying the hobble rope to the neck band, and a blister may be applied over the stifle to excite effusion as a means of retention, for sometimes this dislocation is recurrent, and the patella, constantly passing out of and into position, causes absorption of the outer ridge of the femur, and still further aggravates the case, and renders it incurable. The immediate causes are slipping of the limb backwards, as into a ditch, and want of tone of the surrounding muscles. It is said to be most frequent in mountainous districts.

CHAPTER X.—WOUNDS AND OTHER SURGICAL CONDITIONS.

Section 1.

Wounds are solutions of the continuity of the superficial soft parts of the animal body, extending more or less deeply into other structures. They generally result from violence or other form of injury applied from without, and vary with the nature of the cause. Thus:

Incised Wounds are cleanly cut with straight edges, a tendency to bleed profusely, and to heal readily. They are simple separations of parts of a tissue from one another, and hence can be sometimes repaired by simply bringing the parts again into apposition.

Punctured Wounds result from forcible contact with some penetrating instrument, which may break and leave a portion of its substance in the depths of the wound. The body, in the course of its entry, either cleanly cuts its way or lacerates the tissues through which it passes; in the latter case healing is least readily brought about, but this is not of much importance, for such wounds must heal at the bottom first, and if union prematurely occur near the surface accumulation of liquid products may give rise to inconvenience and retard the healing process. It is principally in wounds of this kind that we find serous cavities and joints penetrated; serious complications being not of rare occurrence.

Lacerated Wounds result from bluntness of the injuring body and moderate force, whereby the tissues are torn, their elasticity exceeded, and destruction of material along the course of the instrument brought about. There is seldom much hæmorrhage in these cases, but the ragged ends of the tissue require to be removed by sloughing, and

the retraction of the parts generally leaves a large exposed surface.

Contused Wounds are those in which, besides a cut, considerable bruising of surrounding parts results from injury with a blunt instrument, or contact with a hard, irregular surface. The bruise renders the case much more complex than it otherwise would be, for, besides simple repair of the cut, much tissue must be removed or restored. A similar condition without the cut is termed a *contusion*, and is less serious, as reparative changes take place most readily without access of the air. The blood thrown out in this latter case forms a *hæmatoma* or blood tumour. The clot which is formed does not undergo organisation, at any rate as a rule, but becomes slowly absorbed.

Poisoned Wounds show a tendency to gangrenous results, and heal very badly; they are not frequent in cattle.

Gunshot Wounds require no detailed notice from us. The methods by which repair is brought about are as follows:—*Repair by growth*, where no reparative processes are set up, but the injury has not been sufficient to disarrange the relations between the cells, so in process of time the space left is filled up; *primary union*, where the parts, being brought together at once after the wound, become united without any mark of injury being left; the two surfaces are so grafted together that the necessary influences of neighbouring tissues may be exerted between them; *primary adhesion* occurs when two exposed surfaces are brought together some little time after the injury, and maintained in apposition, union being the result of the adhesive influence of lymphy material on each surface; *repair by granulation* is the most frequent method; in this the exposed surface, after hæmorrhage has ceased, seems to be covered with a glaze, which is the adhesive material, simply thrown-out by the blood-vessels; this becomes covered with little, highly vascular, minute projections, resembling papillæ in their figure; also pus is formed at about this time. The wound is gradually closed by the

growth and aggregation of successive crops of these processes, which are termed *granulations;* they consist of granulation tissue, which is at first composed solely of leucocytes, either united by soft fibrinous intercellular substance, or aggregated longitudinally around certain capillary loops, which are shooting into the new tissue from the blood-vessels of the nearest uninjured part. As a fresh outpouring of leucocytes occurs those nearest the surface escape as pus, and those deeply situated become new tissue. The skin surrounding the wound is stretched over it to the utmost extent of its yielding, and the part of the surface still uncovered is closed in by a growth of epithelial cells, which takes place from the nearest cutis, or sometimes from some generating centres in the granulation tissue on the surface of the wound. This process of completing repair is termed **cicatrisation.** Union by granulation is slow, taxes the strength, and its newly-formed tissue is liable to become the seat of degenerations. Sometimes *healing under a scab* takes place; it is granulation without access of the air, whereby all the leucocytic material can be utilised for granulation, and none is lost as pus. The scab is formed by the discharges of the wound, which have dried and entangled other matters with them to form a hard layer.

Adhesion of Granulations may be brought about by binding together of two granulating surfaces, whereby organic continuity is induced.

In the treatment of wounds the first indication is to *check hæmorrhage,* if present. This may be arterial or venous. When not very profuse it will not require special measures, but sometimes it persists long enough to debilitate the patient, and even produce syncope. Arterial hæmorrhage depends upon the nature of the incision or wound of the artery. When an artery is completely divided it retracts into its sheath, and also contracts, and thus impediment to hæmorrhage is brought about, except when the vessel is a large one. Partial division may be longitudinal or transverse; in the latter case the hæmorrhage will be greater, for the wound gapes. Persistent

hæmorrhage results from oblique imperfect division of the arterial coats. Arterial hæmorrhage differs from venous, in that the blood is pumped out in jerks and of a bright scarlet colour, and the flow is promptly lessened by pressure on the course of the artery of supply to the injured part. Venous hæmorrhage depends upon wounds of various kinds, but these are less important in their effects than those of arteries, on account of the smaller pressure in the veins, whence hæmorrhage is less difficult to control, and also the blood which escapes being impure, its loss is less felt by the system.

When an artery has been partially divided complete division generally suffices to check hæmorrhage. In other cases *pressure* will prove useful. This is applied along the course of the artery between the heart and the seat of injury; *torsion* also is a very useful means, as it places the coats of the vessel on the stretch in a spiral manner, until they give way, and the jagged edges thus produced recoil, and plug up the orifice of the vessel (see figs. 35, 36, p. 222). *Ligatures* must sometimes be tried, and tied with sufficient force to rupture the middle and inner coats of the artery, for these retracting will lessen the liability to secondary hæmorrhage when the ligature separates. *Application of the Actual Cautery* to a bleeding wound is a rough but effectual method, and in our patients, less under supervision than human beings, is specially called for when it is necessary to leave the patient to himself after the operation. Hæmostatic agents administered internally (such as tannic and gallic acids) are seldom required. Styptics, as the chloride of iron and various caustics, are sometimes very useful. Cold water is, perhaps, the best of these agents. Venous hæmorrhage may be generally restrained by pressure over the wound, or by compression of the veins of supply. Usually it ceases spontaneously.

Bleeding having been checked *all foreign bodies must be removed.* This is a matter of difficulty in some cases of punctured wound, and it must be remembered that not only bodies actually foreign, but pieces of dead tissue

and loose bone must be removed, or they will retard healing. Any extravasated blood should also be extracted. All this must be done by gentle fomentation of the part, with slight manipulation, lest hæmorrhage recur. Next, nature's processes must be assisted as much as possible, and in the first place it must be our aim as often as we can to promote primary union; even if this be brought about only to a slight extent the duration of healing may be materially lessened.

The edges of the wound must be brought together by means of SUTURES. Of these there are several kinds.

Figure-of-eight Suture.—Formed by passing a pin through the two edges of the wound, and winding thread round each end in turn.

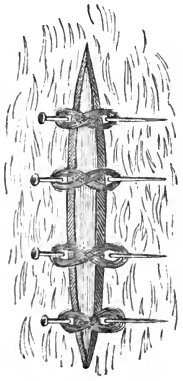


FIG. 81.—Pin, or figure-of-eight suture. (Dobson.)

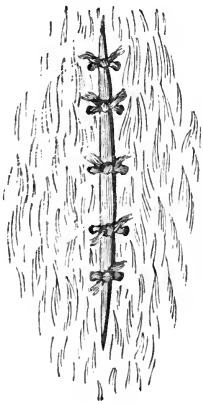


FIG. 82.—Interrupted suture. (Dobson.)

Interrupted.—Stitches passed at intervals through the edges of the wound, and each tied separately.

Uninterrupted.—Suture material passed successively and continuously several times through the edges of the wound alternately.

Quilled are semi-cylindrical pieces of wood, resting by their flat surfaces against the edges of the wound, which they keep level and prevent from tearing. They are retained by the thread sutures.

Catgut, metal, or thread are used for these sutures; of them the first is best in almost every respect, as it causes but little, if any, irritation, and will, in course of time, become absorbed. It is also very strong, but may sometimes require to be replaced by the metal when great strain is put on the sutures. In large wounds the many-tailed bandage is a useful means of retaining the parts in apposition with one another.

Of the methods adopted to promote healing of wounds, and to ward off ill consequences, the most remarkable is the **system of antiseptic surgery,** sometimes called "*Listerism.*" This consists in somewhat elaborate methods for avoidance of contamination of wounds by atmospheric germs, which prove irritants, and, as such, promote suppuration. They also are the cause of gangrene. Wound dressing on this system is accomplished under a spray of carbolic acid and water, which is also diffused through the atmosphere while the operations are being performed. Drainage tubes of decalcified bone or of carbolised lint are so arranged as to allow "the drainage of decomposable fluids from the wound without admitting the entrance to it of unfiltered air." Certainly this method has materially reduced mortality in human surgery, but the refinements of method and constant supervision necessary render it seldom admissible in cattle practice. We, therefore, have to resort to the simpler means of antiseptic lotions and stimulants, especially those of carbolic acid, which keep off flies, allay pain and suppuration, and promote granulation.

All our measures of treatment must tend to assist nature, and especially to keep the affected parts in a state of rest. Unless we can accomplish the latter object the granulations will become irritable, and the discharge from them of an ichorous character.

Sir William Fergusson, in the treatment of simple wounds, preferred cold-water dressings, and their value has been often noted in veterinary practice. Reparation is brought about by salutary inflammation, and unless this be interfered with no treatment will be required. When,

however, motion between the surfaces occurs there is a tendency to excessive irritation, which must be restrained. Again, we must observe that, in some cases, stimulating treatment will be required, either in consequence of general or local debility. Thus, judgment must be exercised in the treatment of every wound. A punctured wound running obliquely to the surface may, by a bold slit, be converted into an incised wound much more formidable in appearance, but which will heal in half the time. In a contused wound blood will often require to be freed from the tissue spaces into which it had escaped. Few matters in surgery require more judgment than the treatment of wounds.

In the ox suppuration does not so readily occur as in the horse, and the pus, when formed, is of a special odour, and not of uniform consistence. Incised wounds are not frequent in this animal, but punctures from the horns of companions are both frequent and formidable. Lacerated wounds, too, are often seen, but the thick skin of the ox acts as a preventive against these.

Of the *results of wounds* we may say that gangrene, pyæmia, and tetanus are rare, and sympathetic fever seldom runs high. Punctured wounds of the abdomen may lead to rupture or to injury of the bowels, as already described. A wound of the same nature extending into the chest leads to the easily repaired laceration of the lung and to pleuritis, with considerable embarrassment of respiration, but seldom proves fatal.

Chronic wounds, fistulæ, and the various kinds of ulcer, have been already described at length.

Section 2.—Tumours.

Swellings of a circumscribed character due to abnormal accumulation of tissue materials are described under this name. They may be situated on the surface of the body, or more deeply, and are primarily divisible into malignant and non-malignant.

Sub-section 1.—*Malignant Tumours.*

The former essentially depend upon constitutional conditions and exhibit a tendency to infective distribution. They are specific in their character, and are commonly known as **Cancers or Carcinomata.** We have had occasion already to notice the cachexia which results from constitutional impregnation with cancerous matter, and have shown how cancer may be generated by a process of grafting, so that local developments may be either the cause or result of constitutional conditions. This local manifestation either assumes the character of an infiltration or more frequently of a tumour. The latter is less dangerous to the system than the former; its virulent cells are confined and are less liable to invade important organs; also the case may be palliated by removal of the masses of specific cells. The cachexia remains in a scarcely manifest state throughout the stage of generation of the tumours, and according as the latter have a soft or a hard character is the rapidity of systemic complication; when the swelling begins to soften the infective processes are in their greatest activity. Carcinomata are of several kinds:

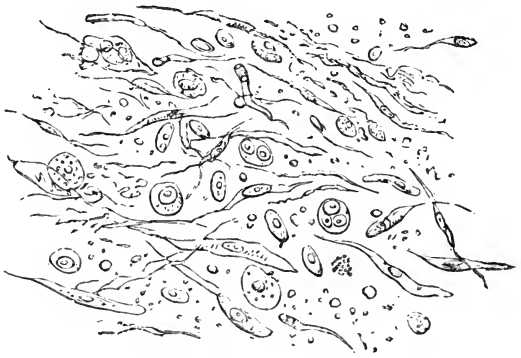


FIG. 83.—Scirrhous growth from mammary gland. × 200. (After Harley and Brown.)

SCIRRHUS, dense, hard, generally lobulated, consisting

of groups of cancer-cells embedded in a fibrous stroma, which is very plentiful. These are of slow development.

Colloid, gelatinous, adhesive, generally amber yellow and soft, consisting usually of but little stroma and a great number of cells. The cells separate somewhat freely, leaving the areolar network behind.

Medullary Sarcoma or Encephaloid, a lobulated mass of brain-like substance, the skin investing which presents very much enlarged veins, consisting of a more or less plentiful stroma with cells in its loculi.

It will be seen that each of these forms of cancer consists of cells in stroma. The cells are of a special character. They vary very much in form and in their degree of nucleation, but are all endowed with a high degree of vital activity, which seems specially exaggerated in the direction of reproduction. Thus, new cells are rapidly produced within the older ones, and another sign of activity is the tendency to migrate; softening of the cancer masses leads to ulceration, for the superficial layers of the body become invaded and softened, and thus a large ulcer may be present, the distinctive characteristic of which is the fact that its surface is largely composed of cancer-cells. The discharge is of an ichorous or special character and consists of specific cells; the danger of cancer lies in this, that it consists of special highly vital tissue, which grows more rapidly than other tissues, and constantly increases in size, involving neighbouring parts; thus, it extends to the surface and produces an ulcer, which does not tend to heal, and it involves all tissues. Finally, its constituents are conveyed by the lymphatics through the lymph glands, where a similar diseased process results, and thus the blood constantly receives supplies of the specific cells. We must not be understood to imply that there is any special appearance of cancer-cells by which they may be at once determined; their specificity consists in their origin and effects; they are frequently quite similar to normal tissue elements. The cancerous nature of a tumour may generally be determined by examination of a section of it, or of some

"cancer juice" scraped from its surface. The manner of extension and any infective indications will confirm the diagnosis. These tumours exhibit all variations in size and form as well as in consistence.

Causes.—These growths are due to hereditary influence and have been originated by inoculation. The latter process is attended with much difficulty and cannot be a frequent occurrence in nature; we must, therefore, consider hereditary tendency to be the predisposition, and we find that mechanical and other injuries prove excitants. Under these circumstances we cannot be surprised that malignant tumours are less frequent in the lower animals than in man. Besides the above enumerated forms of cancer two other kinds are to be included under this heading; they are less malignant than the others, and sometimes seem to be simply local.

Epithelioma consists of freely proliferating epithelial cells embedded in a fibrous stroma. The cells present must not be considered truly of an epithelial nature, but rather mimic the cells of the tissue in which the tumour grows, either the skin or mucous membrane.

Melanosis, sometimes called "*black cancer,*" is somewhat similar, but its cells resemble those of the Malpighian layer of the skin which contain pigment in the granular form. They differ from them, however, in their high reproductive activity and in their tendency to infiltrate other tissues. Thus, melanotic infiltrations of various organs sometimes are seen, but they are very rare in the ox, in which animal, however, tumours of this black cancerous material occur, and often are of very considerable size. They differ from those of the horse in having a less marked tendency to spread, and also in not having a preference for the anal and coccygeal parts of the body.

Treatment of cancerous tumours is not satisfactory. The constitutional tendency remains except in a local case taken very early; also there is a great liability to recurrence. Excision is the only means of relief, and all the morbid material must be removed. Cases of this disease are not frequent in the ox but some are on record.

The question may arise as to the propriety of use of the flesh of a cancerous animal for food; if the patient presents marked constitutional changes the carcase ought to be at once condemned. But we have no proof of cancer of the lower animals being communicable to man, and it is highly improbable that a disease which can scarcely be communicated by inoculation to another animal of the same species would be produced by ingestion of the flesh as food. Thus, the use of such flesh must be sanctioned, but we must remember that this *may* possibly be a source of human disease, and should make this a matter for testing by observations and experiments. Next in importance to the true cancers must be placed the SARCOMATA—tumours composed of embryonic tissue. They are generally described as cancer, but are dis tinguishable from it by the nature of their elements. These vary considerably in their characters, but in all cases they present the distinctive features of new and imperfectly formed tissue. This generalised nature often makes them seem malignant, for they may grow in tissues of different kinds, and are frequently seated in the lymphatic system. They tend to recur, for since they are similar in nature to the parts in which they are found, the generating tissue cannot be completely removed. They are not frequent in the ox unless the disease known as OSTEOSARCOMA or SPINA VENTOSA is to be considered under this heading, as it probably ought to be. It appears as a swelling of the face, which is hot and painful, opposite the molar teeth either of the upper or lower jaw. This increases in size but does not materially prevent the animal from feeding. The patient is generally young, and the disease seems to be more prevalent in some parts of the country than in others. As it progresses the molar teeth become loose, and softening of the swelling occurs in spots, which ultimately burst, and there is then a profuse discharge of a gelatinous or purulent character.

Post-mortem examination shows disorganization of the bone apparently of a colloid nature. The swollen bony structure is arranged in bands and layers, the spaces

between them being filled with a gelatinous reddish or somewhat white and creamy substance. The true nature of the disease is doubtful. Gamgee terms it "*Fibro-plastic degeneration of the bone.*" Williams thinks it is tubercular. By others it is considered either truly cancerous or sarcomatous. Lastly, it is thought to be simply a form of osteomyelitis. Until more careful examination of its nature has been made, we shall be hardly in a position to decide this matter. Generally some injury is the exciting cause.

Treatment in the early stages must consist of cutting down on the diseased parts and removing them, which must be done with a saw or bone forceps. All the growth must be removed to avoid recurrence. The edges of the wound must be closed by sutures, and the ordinary treatment of such lesions adopted. In advanced cases the animal may be fattened with care for the butcher.

Sub-section 2.—*Non-malignant or Innocent Tumours.*

Ordinary Simple Tumours are hypertrophies of the tissues of the body, and hence are of several kinds solid or cystic.

Solid: *Epidermic or Epithelial Tumours,* such as ordinary warts (for which see p. 354) on the skin and in the œsophagus. These are hypertrophies of the skin or of mucous membrane, the whole thickness of tissue being involved.

Fibromata consist of the ordinary elements of areolar tissue; sometimes they are highly vascular. Of these, the principal are the subcutaneous fibromata, polypi (as of the pharynx, nasal chamber, or vagina), and fibrous tumours on the knees, which often attain a very considerable size as a result of pressure.

Lipomata—fatty tumours—may result from hypertrophy of adipose tissue in almost any part of the body; the most important are those in the appendices epiploicæ, which may have such long peduncles as to enable them to become twisted round the bowel, producing strangulation.

Enchondromata—cartilaginous tumours—are not often seen in the ox, they generally grow from pre-existing cartilage.

Exostoses and Osseous Tumours, in general, are the result of ossification of an inflammatory deposit, whether in connection with or separate from a bone. Osteophytes are bony tumours, generally of loose texture. Exostoses are treated more in detail elsewhere (see p. 399).

Calcareous Tumours are inflammatory exudates, in which earthy matter has been deposited, or, not infrequently, the result of calcareous degeneration of hydatids.

Lymphomata have been already alluded to (see p. 225).

There are other forms of solid tumours, but they are of little importance to us at present.

Cystic Tumours are not simple hypertrophies, but result from the formation of cavities filled with fluid, their walls being more or less dense. They comprise :—

Hæmatomata—blood-containing cysts—generally the result of injury, and sometimes having a false aneurismal character.

Serous Abscesses, due to injury, which has caused the formation of a space by rupture of areolar fibres and condensation of the surrounding connective tissue to form the wall of a cavity containing serum. These are most frequently seen in front of the knee. They are most prevalent in bulls.

Fig. 84.—Suction Trocar, used in exploring fluctuating tumours. The blunt end of the instrument consists of a compressible india-rubber ball. (From Erichsen's 'Surgery.')

Bursal enlargements.—Dropsies of bursæ may be due to excessive accumulation of synovia, or to sprain of the tendon belonging to the bursa, or simply the manifestation of a general tendency to effusion in consequence of debility.

Hydatids.—These are larval tapeworms, sometimes enclosed in a fibrous investment formed by condensation of the areolar tissue of the part in which they are situated.

Dermopilous cysts have been described among skin diseases (p. 354).

We find no record of cyst-bearing and dentigerous cysts having been observed in cattle practice.

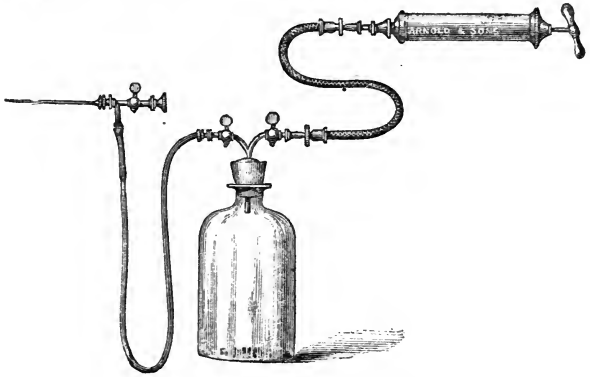


FIG 85.—Pneumatic Aspirator, used for the removal of the contents of fluctuating tumours without admission of air.

Clinically, tumours are of minor importance in comparative pathology. Their diagnosis comprises determination of their nature. It must be first decided whether the swelling is solid or contains liquid. Certain of the cancers, especially of the medullary form, may seem to contain fluid. Generally the grooved exploring needle or the suction trocar (fig. 84) may be used, and the material brought out with it will often give us a clue to the nature of the case. Signs of malignancy must be sought for, especially the diseased condition of lymphatic glands. There seems to be in some animals a tendency to hypertrophy of certain tissues, hence, not infrequently, a number of fibrous or osseous tumours appear, simultaneously however, which contrasts with the consecutive growth in cases of malignance; also the growths all occupy one kind of tissue. Some swellings depend on inflammations, and must be considered exudates in a more or less altered condition. Our guide in determining the nature of these, and distinguishing them from hypertrophies, must be their origination with an inflammatory attack, also their course to a standstill or decrease when inflammation ceases. The position of the growth and its physical characters will generally

enable the practitioner to determine with considerable accuracy its composition and importance; sometimes growths prove troublesome by their tendency to block up passages either by pressure or by plugging; again, they may interfere with nutritive supply by pressure on vessels (though generally they grow so as to avoid this); often they cause ulceration of the investing skin by pressure, and are thus transformed into obstinate ulcers or irregular bloody projecting masses of a highly irritable character, and with a tendency to bleed profusely; sometimes, by their size, form, and position, they are serious eyesores. In growth, they may become pedunculated or wide at the base.

Treatment consists in their removal with the knife or hot iron, or by some other cauterising agent, or their destruction through defective nutritive supply from pressure of a ligature round the base. In cases of cystic tumour other measures must be tried before recourse is had to surgical removal. Generally evacuation of the contents is indicated, the exceptions being hæmatomata, synovial cysts, and recent serous abscesses. In them inflammation must be set up to lead to consolidation, or absorbent agents, as the biniodide of mercury, must be freely applied; pressure also is highly valuable as a means of promoting absorption. *Surgical removal of a tumour* of any considerable size necessitates casting the animal. The skin must be boldly divided, and all the mass removed, the process of dissection being more or less careful according to the proximity or otherwise of important organs. Carbolic spray may be used during the operation, and, if deemed advisable, the part may be placed in a state of anæsthesia or the patient put under chloroform. All arteries should be tied with catgut thread, and bleeding may be reduced as much as possible by a free supply of cold water, sponging, and sometimes pressure along the course of the artery of supply. Finally, sutures may be inserted, and the animal allowed to rise. Bony tumours must be removed with a saw or bone forceps. After-treatment is that required

for ordinary wounds of some size. In these operations no skin must be removed unless it is diseased, however loose it may seem; after removal of the tumour it will soon adapt itself to the parts beneath.

Caustics, when used for the destruction of tumours, generally require to be several times repeated. The best for this purpose are those which penetrate deeply and cause considerable destruction of tissue, such as the mineral acids. Occasionally destruction is brought about by placing masses of caustic in the centre of the tumour, which lead to destructive changes of the surrounding mass. The red-hot iron is one of the most effectual caustics; with it a projecting mass of tumour may be amputated without danger from hæmorrhage. Acetic acid has been recommended in cancers, as having a special influence in causing swelling and destruction of the cells. (The galvanic cautery is used in human practice.) The écraseur is a useful instrument for removal of tumours. Ligatures around the pedicles of tumours may be of thread or horsehair; they must not be too large, and must be sufficiently tight to exert firm pressure; an elastic ring may be used instead, and is very effectual.

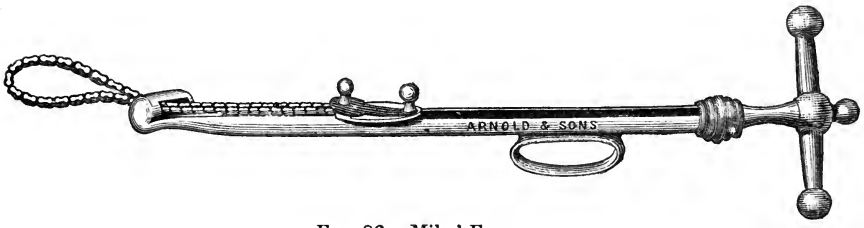


Fig. 86.—Miles' Ecraseur.

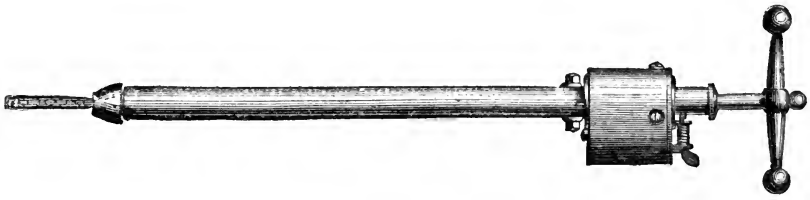


Fig. 87.—Beach's Ecraseur.

CHAPTER XI.—THE GENERATIVE ORGANS.

Section 1.—Diseases of the Male Organs of Generation.

The testes of the bull are well developed, and elongated from above downwards. The vesiculæ seminales are glandular, and Cowper's glands are absent, but the most remarkable structure as compared with that of the horse is the penis, which is very long and narrow, having a firm external investment surrounding it, and a well-developed band in the centre of the corpus cavernosum. Just behind the scrotum the organ presents an S-shaped flexure, to the posterior convexity of which are attached the retractor muscles. The glans penis is fine and tapering; to the sheath, at about opposite the umbilicus, run the retractor muscles from behind, and circular fibres from in front extend through the prepuce and are known as the protractors. A tuft of hair hangs down from the opening of the prepuce. As in the case of the horse, early castration prevents many of the generative disorders to which the ox would otherwise be liable, while it also checks pugnacity and so lessens the frequency of injury. The castrated male is more docile, forms better beef, and often a larger body than the uncastrated; the change induced by the operation is, therefore, in every respect, beneficial. The operation of Castration is performed by removal of the generative glands, and various methods of performance of this have been suggested. In India "*mulling*" is the popular method. It is described by Mr. Richard Poyser in the 'Veterinary Journal' (1875) as *orchithlasis*, and depends upon breaking down the structures of the sper-

matic cord by a special manipulative process. In this country a simple method termed "*lashing*" used to be very

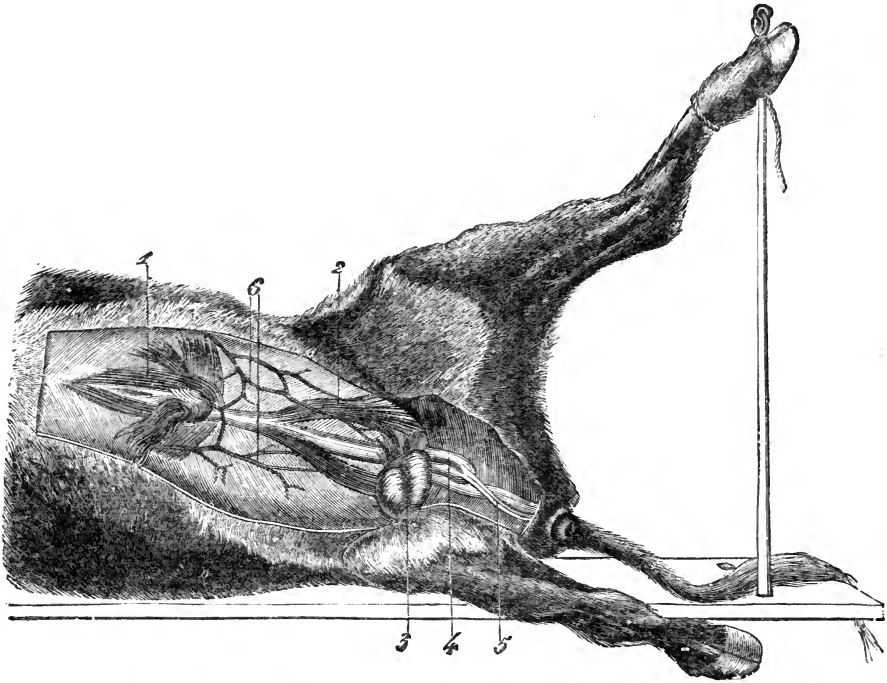


FIG. 88.—External generative organs of a bull dissected. 1 and 2. Muscles of prepuce. 3. Scrotum, dartos muscle; above it the spermatic cord. 4. Anterior curvature of penis. 5. Retractor muscles of penis. 6. Superficial abdominal veins. (Chauveau.)

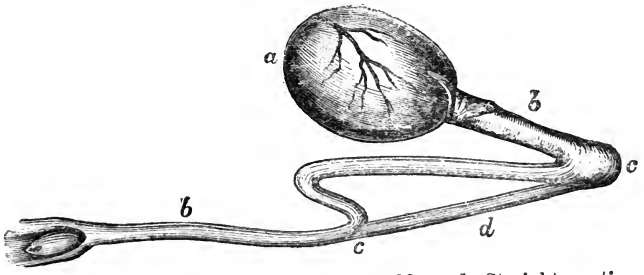


FIG. 89.—Urethral canal of the ox *a*. Bladder. *b*. Straight portions of canal. *c*. Curvatures. *d*. Retractor muscles. (Armatage.)

prevalent; it consisted of tying a piece of cord so tightly

round the root of the scrotum that this organ with its contents underwent mortification, and in due course of time sloughed off, or was removed with the knife. Quite recently a modification of this process has been suggested and tried in France with some success; this is the compression of the root of the scrotum by means of an *elastic band,* considerably too small. This method has the advantage of the pressure being even, and constantly varying with the diminution in size of the root. Generally the process of *removal with the hot iron* is adopted. The patient is thrown, the skin rendered tense over one testicle with the hand, and an incision made boldly in as far as the tunica vaginalis testis; the sperm gland is then drawn out, and the operation completed by division of the cord by means of a red-hot iron. Sometimes the scrotum is opened with the hot iron, it being urged that this entirely checks any tendency to union of the external wound by first intention, whereby the pus from the seared end of the cord is apt to become pent up. Subsequently the parts should be examined occasionally, to see that this closure does not take place too early, and also to break down any adhesion between the spermatic cord and the external wound. After the testis has been freed the cord may be *scraped through* with a knife having a jagged edge, or the posterior part having been freely divided, the anterior may be scraped through. This method has the advantage of being quick, surgical, and not liable to be followed by hæmorrhage or other complications; also not infrequently the parts heal, even without suppuration.

The *method of ligature* consists in tying either the whole cord or only the spermatic artery in the anterior part, and then removing the testis. It is said that tetanus is rather apt to follow this form of the operation, also there is a liability to secondary hæmorrhage when the ligature separates.

Torsion, either of the whole cord, or simply of the spermatic artery, until it gives way, is not liable to be followed by hæmorrhage, and is preferred by some practitioners; it certainly is very effectual. In France

torsion without incision into the scrotum is performed in a special manner, and leads to atrophy of the testes. The barbarous operation of *tearing out* the testicle used to be followed, but is not much resorted to now. It is said especially to predispose to pelvic hernia, and the cord is apt to tear off too short, and thus give rise to inconvenience and disorder. The removal of the testis, after it has been exposed, by means of the *écraseur*, is easy, quick, and effectual, and the use of this instrument is regarded with considerable favour in the present day.

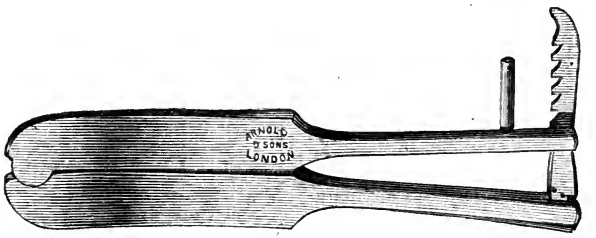


FIG. 90.—Castrating Clamps.

Removal with the Clamps, and by the Covered Operation are seldom resorted to now, the latter, as already noticed, being required in cases of inguinal and scrotal herniæ, such as require the operation for radical cure (see p. 281). Animals are chosen to undergo castration when they are two or three months old, before the glands have manifested their generative activity. If it be performed later there is greater liability to untoward complications, and it is said the meat is not so good. Indeed, it is not at all advisable to delay the operation, for the extra development is not an advantage, as in the horse. Sometimes, but rarely, we require to operate upon an older animal, then the scraping method is still very good, but castration with the hot iron is generally preferred. Greater liability to complications is seen in old animals than in young. Of these the principal are hernia, hæmorrhage, tetanus, and peritonitis, and adhesions of the testis to the scrotum. In the primary incision care must be taken lest a small portion of bowel in the scrotum be divided. All animals

should be carefully examined, to ensure the absence of hernia, before castration is commenced. Hæmorrhage may be treated by cold-water applications, or by taking up the artery and applying a ligature. Adhesions must be broken down, and not allowed to interfere with the operation. Finally, if flies be troublesome, the parts may be dressed with carbolic solution, but animals should be castrated as much as possible when no flies are about. The slight movements of the animals in pasture, and green food will do them good. Sometimes it is deemed advisable to perform the operation with the patient standing. He is then secured by fastening the hind limbs together, or by means of the side-line.

Emasculation of the ox is less frequently performed by the veterinary practitioner than of the horse. It is generally placed in the hands of empirical operators, who sometimes, by practice, attain considerable dexterity, but are not competent to meet the emergencies which may arise, and require prompt action. It is thus not infrequent to find the operation omitted from works on diseases and treatment of cattle, but we have thought it advisable to give the above *résumé* of methods.

Orchitis—inflammation of the testicle—may result from injury or excessive copulation. The former is the most frequent cause. There is considerable pain and heat in the diseased part, the dense investment of which does not freely admit of swelling, and fever may run high. Atrophy and suppuration have been noted as consequences; in either case there is apt to be loss of generative power, or the animal will become an irregular stock getter. Measures adapted to control local inflammation, together with febrifuges, will generally restore the animal to health. Sometimes the inflammation is of a scrofulous character, leading to deposits of a specific nature in the testis; this is the state known as Tubercular Sarcocele. The animal should not then be again utilised for breeding purposes, but early castration may check the progress of the disease.

Sarcocele is enlargement of the testis; it may be can-

cerous, or non-specific, but a scrofulous form is most frequent. The spermatic cord is liable to certain morbid conditions of its various components. Aneurisms and varicose veins are sometimes present, giving rise to swelling, not necessarily of a painful character. These conditions are generally associated under the name *varicocele*.

In a specimen before us, STERILITY was attributable to *fatty deposits around the structures of the cord*. It may be due also to morbid changes in the seminiferous passages blocking them up; and in other cases is attributable to nervous disorder, due to over-excitement of the sexual apparatus. In such cases high feeding, regular exercise, and tonics should be tried, and the animal prevented from the exercise of the generative functions for some time. This derangement is especially liable to occur in young bulls allowed too early to exercise their procreative powers.

Sometimes on incision into the scrotum in castration a considerable amount of fluid escapes. This dropsy of the vaginal cavity is HYDROCELE; it is not frequent in the ox, and seldom of much importance.

The penis is liable to *injury sub coitû*, which interferes with its protraction or retraction. The rapid performance of the act in cattle rather predisposes to this. Generally the parts are restored to their healthy state after a short period of inability; but deposits may give rise to permanent deformity.

Such injuries predispose to *Cancer* of the organ, which is occasionally seen in cattle. Cases of this kind are given in the 'Veterinarian,' vol. xii, p. 51, and the 'Veterinary Record,' vol. iii, p. 232. They may necessitate *amputation of the glans* or of a still larger portion of the organ. This is performed by casting the animal, drawing out the penis, passing a sound along the urethral passage, and retaining it in position by a ligature tightly compressing the organ posteriorly to the seat of amputation. A circular incision must then be made on to the sound all round, and the ligature be left on for a day or two, the sound also remaining in position to keep open the urethral passage.

Phymosis is inability to protrude the penis, due generally to contraction of the anterior part of the prepuce or to disease of the glans. It may also result from excessive accumulation of smegma. It is associated with certain chronic inflammations of the sheath which result from irritating discharges, in some of which there is extensive ulceration of the surrounding parts. Usually there is an impediment to the passage of urine, which trickles on to the surrounding parts, and increases the extent of the disease, which at first has an erythematous character. Phymosis is less apt to occur in the ox than the horse, because of the mobility of the prepuce in the former animal, the pointed condition of the glans, and the great freedom of movement of the penis. It requires to be treated by fomentations to cleanse the parts, and manipulative protrusion of the penis, which can generally be accomplished after prolonged fomentation. Failing this, an incision may be made into the sheath. If any morbid growths are on the glans, they must be removed with the knife. The surrounding parts will require to be protected with glycerine, vaseline, or lard.

Calculus of the Urethral Passage depends upon the entry of a small stone from the bladder, its impactment, and an impediment to the free flow of urine. Sometimes the obstruction is complete, in other cases only partial. In the latter, strangury is the most prominent sign, and the symptoms are less urgent. In the former there is no passage of urine, the urethral canal is distended to the seat of calculus, and the over-distended bladder tends to burst, this occurs and causes death in some cases. In one the membranous portion of the urethra gave way, and infiltration of urine into the surrounding tissues took place and resulted in uræmia. The stone generally becomes fixed against the flexure of the penis, and the presence of this, as well as the smallness of the canal, is the cause of the greater frequence of this disorder in the ox than the horse; also it is attributable to the fact that the food of the former contains often an excessive amount of phosphates, which are liable to form deposits, especially around

the prepuce and the hairs hanging down from it, on which the excess of phosphates in the urine forms stalagmitic threads. The slow expulsion of the urine is one cause of this. Accumulations of inspissated secretion around the urethral orifice also sometimes impede the escape of urine. Hairs thus covered may be cut off, and the accumulated calcareous matter and sebaceous material must be removed from around the glans. In cases of urethral calculus, relief must be afforded by incision on to the stone and its removal, when a great rush of urine will take place through the wound. This incision must be made longitudinally and sufficiently long to allow of the free exit of the stone. The animal may be kept standing, but the hind legs fastened together. In the distended state of the bladder it is not always advisable to cast him. The escape of urine will be followed by cessation of violent signs of over-distension of the bladder. The wound should be closed with sutures. Urethral calculi are not often seen in the female.[1]

Gonorrhœa, vulgarly termed "*Bull Burnt,*" is a disease of the glans penis and sheath of the bull, associated with a certain amount of disorder of the lining membrane of the urethra. When the latter is much affected, there is a profuse discharge of thick mucus, and evident pain on passage of urine is observable in every case, but is sometimes very extreme. The patient stamps, moans, lashes the tail, and evacuates the urine in jets rather than in full stream. A certain amount of fever is present. The prepuce may be primarily or secondarily affected; it is swollen, hot, and tender, and becomes ulcerated internally, and abscesses may form in it, and sinuses extend into the substance of the penis. The inflammation of the urethra is attributable to excessive venery, and is most frequently seen in highly fed animals. When neglected the disease terminates in fungous growths, which may necessitate amputation of the penis. It is certain that if bulls thus affected be allowed to copulate

[1] I have a record of but one such case; it is by Mr. Matthew Hedley, of the Irish Veterinary Department.

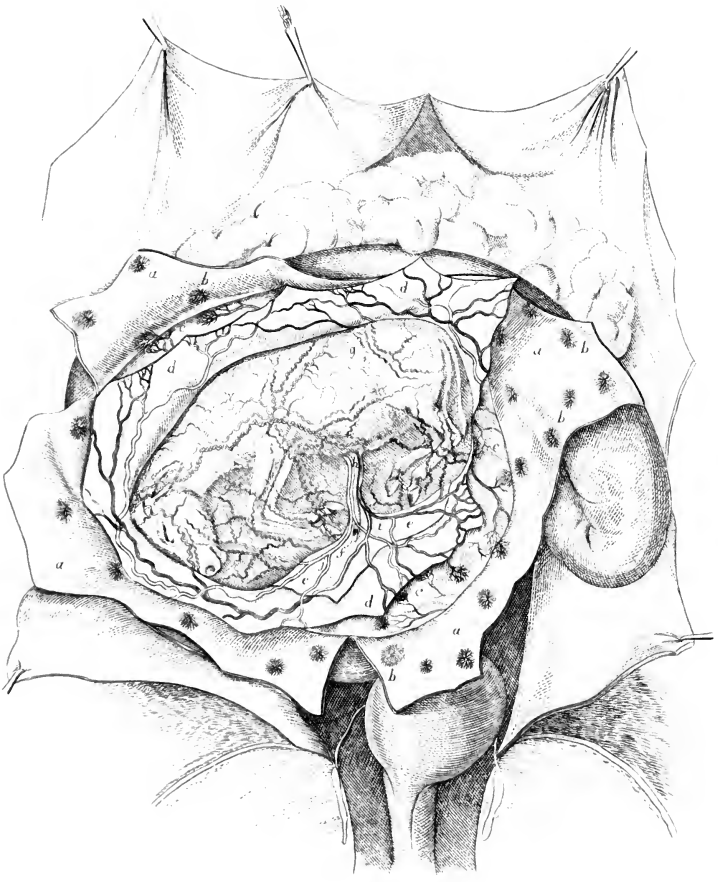
they give rise to a similar disease of the lining membrane of the vagina and the vulva. Thus, it has been supposed that this discharge has a specific character resembling that of the syphilitic gonorrhœa of man. There is grave doubt with regard to the nature of some cases of gonorrhœa, but certainly that form seen in this country is not specific. The ulceration of the vulvo-vaginal membrane is due to acridity of the discharges (see Leucorrhœa). Though considerable sexual excitement is manifested by both male and female animals affected by this disorder they must not be indulged, since this only aggravates the case.

Treatment comprises thorough cleansing of the affected parts, for which purpose the bull generally requires to be cast, opening of abscesses, and slitting up of sinuses; touching long-standing ulcers with nitrate of silver and the reduction of fungous growths with more powerful caustics, such as the butter of antimony; a dressing of Glycerinum Acidi Carbolici to be applied all over the diseased surface to allay irritability and promote healing. The parts must be dressed every second or third day, according to the state of the case, but the animal need not be cast each time. Cases of this kind will thus not prove so protracted as they are generally considered to be.

Urethritis—simple inflammation of the urethra—uncomplicated by the above disorder is very rare. When a case occurs, it must be treated with anodyne fomentations and injections. The most distressing symptoms arise from spasm of the accelerator muscle during passage of the urine.

Section 2.—Diseases of the Female Generative Organs.

The uterus of the cow differs from that of the mare in the fact that its horns, situated at the free margins of the broad ligaments, are twisted upwards, so that their concavity is inferiorly placed. Also, in the pregnant animal, the increased vascularity of the mucous membrane is confined to certain spots, the uterine cotyledons, for rumi-



FOETUS IN UTERO,

surrounded by its membranes.

nants have the placenta formed by a number of cotyledons; the walls of the vagina contain rudimentary tubes, canals of Gaertner; the labia are thick, and from the inferior commissure hangs a tuft of hair. The pelvis of the cow is so arranged that the expulsion of the fœtus is more tardy than in the mare. The ischium is very large and expanded, and forms a very considerable part of the pelvic wall, the sacro-sciatic ligament being correspondingly shortened. The posterior part of the ischial junction forms, with the remainder of the symphysis, an oblique angle superiorly, and thus the pelvic outlet is diminished in size, and placed above the general level of the floor of the cavity. The pelvic passage of the cow is long.

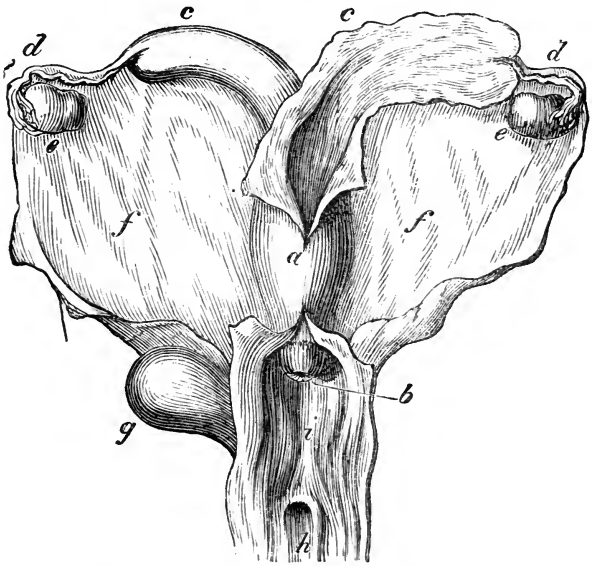


FIG. 91. Female generative organs. *a*. Body of uterus. *b*. Its external os. *c*. Its horns. *d*. Fallopian tubes. *e*. Ovaries. *f*. Broad ligaments. *g*. Bladder. *h*. Meatus urinarius externus. *i*. Cavity of vagina. (After Simonds.)

The ovaries of the cow are smaller than those of the mare; they are liable to only two forms of disorder.

DROPSY OF THE OVARIES is seen in old animals, and especially in those which have not been impregnated. It

is due to the continued and unrelieved distension of the Graafian vesicles, which enlarge so slowly that the fibrous coat of the ovary is still able to protect them from bursting. This condition is denoted by constant œstrum, which does not seem to be relieved by copulation. It can only be treated by removal of the organs.

Atrophy of the Ovaries is associated with hermaphroditic malformations of the generative apparatus, and with malignant disease, either of the organs themselves or the generative passages. It is not described as a distinct disease. This condition can hardly be diagnosed. Only one ovary may be in this state, then the animal will be in a condition to breed.

Ovariotomy—Removal of the Ovaries—Spaying—Castration of Cows—is an operation of which the value, from an economical point of view, has been much debated. The following arguments have been advanced in its favour:

1. The milk is produced continuously, and in increased quantity, and of better quality after the operation. This is not, however, by any means generally admitted.

2. The animals are not subject to the periodical inconvenience of œstrum.

3. They are not so liable to disease, especially the numerous and complex disorders of the generative apparatus.

4. They fatten more readily and attain a greater weight than other cows.

5. By spaying beasts of doubtful value for breeding purposes the race will be gradually improved.

Nevertheless the operation has not been generally adopted, for some of the above-mentioned arguments are of a doubtful character. The animals operated upon are not so generally useful, tend too much, in some cases, to the laying on of fat, and altogether are not so profitable as the uncastrated females.

Spaying sometimes requires to be performed as a curative means. An incision is made in the flank in the usual manner. The hand is introduced and feels for the ovaries, which are drawn out through the wound and

excised by means of the jagged-edged knife, or removed with the écraseur. Only one incision is generally necessary, for both ovaries can be reached through it. This may preferably be made on the left side. After the operation has been completed, the wound being closed in the usual way, the patient must be kept quiet and fed on nourishing food, and the bowels kept open. Untoward results seldom follow this operation. Removal of the ovaries through the vaginal wall has been tried with success.

Menstruation of the cow is associated with the escape of the ova from the ovaries, being accompanied by that con-

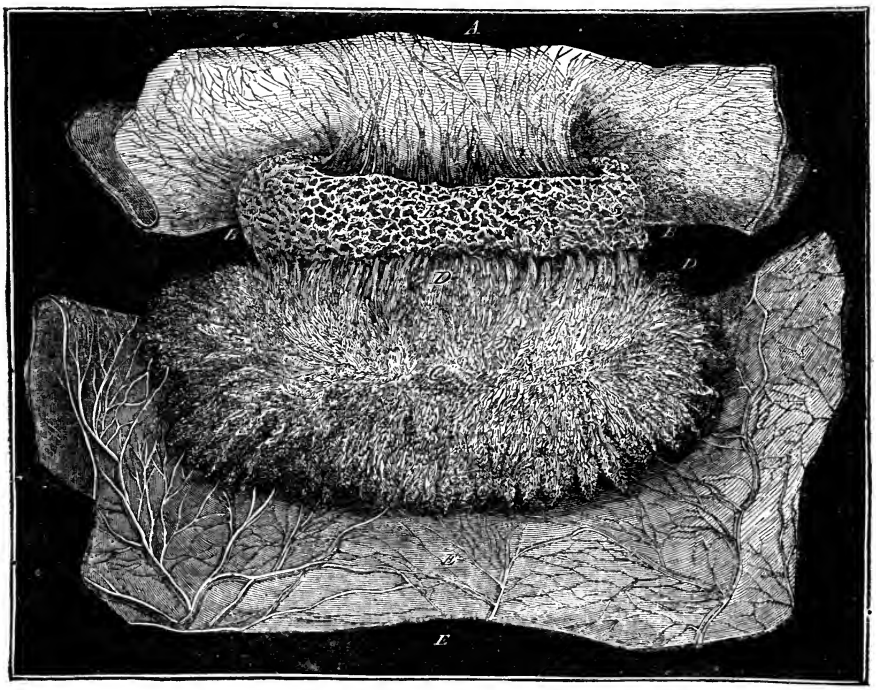


Fig. 92.—Maternal and fœtal cotyledons of the cow. A. Pedicle of the maternal cotyledon. B. Maternal cotyledon. C. Fœtal cotyledon D. Placental villi. E. Chorion. (From Fleming's 'Veterinary Obstetrics.')

dition of excitation known as *Œstrum*, or *Heat*. "Kahleis, Fuchs, Spinola, Numan, and others, have observed evident

sanguine emissions in the cow, and have also noted that the discharge occurs regularly at intervals of nineteen or twenty days, when the animal is not giving milk or in calf. The hæmorrhagic flow appears two or three days after the commencement of the 'rutting,' and when this is most intense" (Fleming). Thus, we have the opinions of the leading observers on the subject summarised by the author of the excellent work on 'Veterinary Obstetrics.' It generally commences when the animal is about twelve months old, and occurs with fair regularity every month or three weeks during the "rutting" season, the duration of each period being but short. Whether or not impregnation takes place, a proliferation of the uterine epithelium occurs. When this is thrown off it is intermingled with a small amount of blood. Sometimes the discharge has not a sanguineous character. The *œstral products* may be retained, as in cases of impervious neck of the uterus or imperforate hymen. They then accumulate, and give rise to symptoms resembling those of dropsy of the uterus. Again, they may be very *profuse*, and contain much blood, as in a case related by Mr. Macgillivray, of Banff ('Veterinary Journal,' vol. iv, p. 186). In others they are suppressed, and then the ordinary signs of œstrum are usually, but not always, absent. Such cases of *suppression* must be distinguished from those of *retention*, the latter being by far the more serious condition. Suppression is due to debilitating constitutional disorders, and must be looked upon as a symptom of disease. With retention it is generally included under the heading AMENORRHŒA.

STERILITY is not at all infrequent in heifers, especially well-bred animals. It is generally associated with frequent œstrum, but sometimes there is an absence of sexual desire. It may depend upon imperviousness of any of the generative passages, such as results from inflammation of them, scrofulous disease, or morbid growths; it is, therefore, one of the symptoms of scirrhous os uteri, impervious hymen, and congenital malformation of the generative organs, as seen in hermaphrodites. Again, the excessively fattened condition may cause sterility.

Free Martins are born twins with bull calves, and have the external form of the female, but are reputed to be sterile. John Hunter, whose great mind neglected no source of information, made this popular opinion a matter of inquiry. He found that the apparently female calf is often hermaphroditic, but all free martins are not to be considered sterile, as many prove fertile.

The progress of **utero-gestation** is associated with a higher development of the structures of the uterine wall, whereby they are adapted for the supply of oxygen and nutritive materials to the fœtus. These changes, being in the direction of higher development, increase the liability to disease. Sometimes False Labour-pains occur before the usual period, tending to produce abortion, and due to such influences as disturb the relations between the mother and the fœtus. Thus, falls and injuries separate some of the cotyledons, and stimulate the muscular walls of the uterus to contract. Any colicky pains dependent upon the pregnant condition of the uterus, but not succeeded by expulsion of the fœtus, must be classed under this heading. Some authorities also include those which produce untimely expulsion. The difference is one of degree, not of kind: therefore these uterine spasms, whenever they take place prematurely, should be carefully watched, and, if they seem likely to produce ill effects, must be controlled by opium or some other antispasmodic. At the same time all irritant food-stuffs which may have been the cause by reflex action, must in future be avoided.

The Signs of Pregnancy are, sometimes a cessation of œstrum and a considerable improvement in condition together with a want of inclination for the bull. The abdomen enlarges and becomes pendulous, and the mammæ increase in size, as also does the mucous membrane of the vulva and vagina and its secretion is increased. About the fifth month the *fœtus may be detected by manipulation* of the right side; the wall of the abdomen in front of the stifle being suddenly raised with the hand, the fœtus *in uterô* will fall back again

and be felt. About this time, too, careful examination will detect fœtal movements, and later these can be perceived without manipulation. Exploration per rectum or per vaginam is sometimes resorted to as a means of confirming the diagnosis, and it is said that the beats of the fœtal heart may be detected by auscultation in front of the symphysis pubis.

Abortion occurs very frequently, due to the nature of the food and other influences. It must be distinguished artifically from premature birth in which the fœtus is able to live for a longer or shorter time after expulsion. Fleming estimates all cases as abortions which take place thirty-five days before the normal period of from nine to ten months. He quotes the valuable observations of Earl Spencer, 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. This accident is termed *slinking* or *slipping the calf*, and is sometimes sporadic, often epizootic or enzootic. It varies in importance with the stage of pregnancy in which it occurs. Thus, in early stages it may cause no apparent inconvenience, later it is accompanied by some fever, a yellowish-red discharge from the vagina, and a considerable amount of uneasiness, and still later, there are all the ordinary signs of parturition. It is liable to be brought on by too frequently taking the bull, by various kinds of injuries, by bad feeding, or the presence of fungi, such as ergot or ustilago (rust) on the food, and by excessive exposure to cold. It often results from debility. It generally takes place in pregnant animals affected with blood disease, is common in cases of hernia, and may be due to nervous influence. Owing to the latter condition, if one cow abort, many others in the same shed will do so too. By some, however, these enzootics of abortion are attributed to the influence of certain prevalent bacterian organisms which are developed in the fœtal membranes and on the vaginal mucous surface, and ordinarily cause a breaking down of the fœtal coverings. Consequently, if some of the latter be left about it may prove most prejudicial, and

rigid separation of animals which have aborted from those which are pregnant should be attended to in all cases. It is remarked that enzootics of abortion occur most frequently in seasons favorable to the development of fungi. Sometimes abortion leads to flooding, but the most important ill effect is the loss to the owner, for not only is the calf dead but also the regular secretion of milk may be seriously interfered with.

Treatment.—After an abortion, an animal should be nursed and carefully watched. Sometimes stimulant tonics are requisite. As a rule, the fœtal membranes are passed investing the fœtus, but if not, they should be removed as soon as possible. Special care must be taken to isolate all affected animals, and since the irregularity is very liable to recur when pregnancy again advances to the stage when the accident happened, it is often better to fatten the cow for sale. We may conclude that any cause seriously altering the constitutional conditions of a pregnant animal may bring about abortion; some of these influences also directly cause death of the fœtus, others do not do so. In the former case it is not to be regretted that abortion takes place. The occurrence of the false labour pains must be met by antispasmodics.

Premature Birth depends upon influences similar to those which give rise to abortion. We note it here as necessitating special care in the rearing of the calf. The small animal thus prematurely brought into the world is deficient in heat-producing power, and also in strength, but in due time may progress as well as if the full period of gestation had been completed. In many cases the *utero-gestation is remarkably prolonged;* in one recorded it amounted to fifty-two weeks, this was most remarkable; it is not usually found that the calf is exceptionally large in these cases. The *number of animals born at one time* from the same cow is sometimes very extraordinary. The most extreme case was one in which fifteen embryos were found in the uterus. Cases have been known of animals producing five calves at a birth and all of them living.

Superfœtation is the impregnation of a second ovum after the embryo from another has undergone a certain degree of development and is still in the uterus. It sometimes is observed in the cow.

Extra-uterine Conception—development of the fœtus in situations other than the cavity of the womb—is an extraordinary phenomenon of which some cases in the cow are recorded. It is rare, and seems in this animal only to assume the abdominal form. Exploration per vaginam vel rectum discloses no fœtus, though the abdomen has become enlarged and the other signs of utero-gestation have appeared in due course, and even there are indications of approaching parturition. The fœtus is found in the peritoneal sac, embedded in fibrinous material, and often in a very advanced stage of development, the neighbouring parts of the mother taking upon themselves the nutritive functions of the uterine walls.

The *Cæsarean Operation* may be tried in these cases, as being the only chance of relief, for if the fœtus be retained, it may give rise to septic disease of the mother. Occasionally it undergoes calcification. It must be noted that in these cases the position of the fœtus may be determined, and it may even be removed without incision into the peritoneal sac. Nature sometimes adopts this method, and throws off the decomposed fœtus in the pus of an abscess. The animal having been cast on the left side and the right leg loosened and drawn backwards, an incision is then to be made with the usual precautions, as in ruminotomy but about one foot in length. The intestines having been drawn to one side, an incision must be made through the uterine walls or into the tumour in which the fœtus is embedded, and the latter is taken out and the umbilical cord ligatured and divided. The membranes are then to be removed, and the uterine walls to be closed with catgut sutures, the outer wall being closed in the usual way. This operation is very formidable, but may succeed if properly performed with due antiseptic precautions. It must be had recourse to,

when necessary, before the patient's strength begins to flag, and may even be the means of saving both calf and mother. It is also indicated when some deformity of the cow or calf absolutely prevents expulsion in the usual way.

The ordinary *signs of* **parturition** are swelling and occurrence of milk in the mammary gland, discharge of thick mucus from the vulval opening with swelling of the labia and relaxation of the pelvic ligaments. Then the animal separates from the herd and manifests signs of discomfort. The os uteri enlarges and gradually there flows a watery fluid, liquor allantoides. The animal may assume the recumbent position or remain standing. For some time labour-pains will have been observed; they gradually increase in severity and frequency. The amnion is next seen protruding as a bladder containing fluid ("water bladder") from the opening. Soon the fore feet of the young animal appear, and then the head resting on the fore legs; finally, it is entirely expelled and falls slowly to the ground, the umbilical cord being often ruptured in the fall. The process of parturition generally occupies upwards of an hour; its duration varies with the constitution of the cow. When more than one calf is present, the second may be retained some time after the expulsion of the first, and the third after the second. The chorion may not be expelled for several hours, or even days, as its cotyledonary union with the uterine mucous membrane is complex. The process of removal is termed "*Cleansing*," and the product the "After-birth." In case of Retention of the Fœtal Membranes it is advisable to remove them, for sometimes they decompose in the cavity of the uterus and give rise to septic disorder of the system. It seems probable that their retention is due to entanglement as a result of uterine contractions, but it also is attributable to want of the necessary efforts in consequence of debility. In natural cases a slight recurrence of pains brings about their expulsion through the os uteri, which is still unrelaxed, and when these do not seem to be very effectual traction may be applied on the protruding portion of the cord, the efforts coinciding to the pains. A more

effectual grasp of the protruding parts will be obtained by rolling them round a piece of stick. Regularly applied traction will often succeed in removing them, but sometimes it is necessary to introduce the greased hand into the uterus and separate each cotyledon from its attachment by a special peeling process. This measure should not be resorted to until all chance of natural expulsion has passed. Too forcible separation may give rise to hæmorrhage. Sometimes retention is seen after abortion, then, if left alone, the membranes will pass off in due time. When the fœtal appendages commence to undergo decomposition there is a fœtid discharge from the vulva, and typhoid symptoms may be manifested.

After-pains sometimes are present in cases of retention of the fœtal membranes, of injury to the womb, and even of the presence of an irritant in the intestines. When birth has been completed the uterus tends to contract, is checked in this to a certain extent during passage of the membranes, but subsequently succeeds in its efforts, and thereby tends to prevent hæmorrhage, and to return to something like its state before pregnancy. Sometimes after-pains indicate incipient uterine inflammation, but they generally yield to an antispasmodic dose. We have on record one case of Placenta prævia, in which a cotyledon was situated over os uteri.

Hæmorrhage per vulvam is of two kinds, *uterine* and *vaginal* or *vulval*. In either case it may depend upon injury either from the fœtus or from the instruments used in extracting it. It is indicated by a constant trickling of either arterial or venous blood from the external opening, together with restlessness and increasing debility of the patient. When the womb is affected the flow is profuse, the passage painful, and the blood, when expelled, is clotted. The usual symptoms of hæmorrhage are present. The practitioner will generally find that the application of cold water continuously to the loins, or cold intra-uterine injections will excite contraction and check hæmorrhage, but sometimes it is necessary to make use of the ordinary hæmostatic measures. In the later

stages stimulants are required. Uterine hæmorrhage is generally termed "*bloody flux.*" There may be slight hæmorrhage before parturition, *Ante-partum Bleeding*, due to the sudden separation of the fœtus from the maternal membranes or to injury; it often is not of importance, but sometimes it indicates that the fœtus is dead. After birth bleeding may take place from the cut end of the cord; it does not last long and is unimportant. The peculiar depravity of appetite of cows in-calf leads them to devour all sorts of extraordinary things; the fœtal membranes will often thus be transferred to the rumen.

When called in to a case of calving, the practitioner will find that he has to do with a case of normal PRESENTATION or abnormal. In the *normal* form the owner has generally adopted such measures as his experience suggests. Sometimes his anxiety has led him into apprehension when the birth is simply *prolonged.* In this the fœtus is in its proper position, but in consequence of imperfection of the throes is not expelled. In such cases a stimulant may lead to the desired effect, or, in more extreme instances, the careful administration of ergot of rye may be tried. The latter agent should never be given unless there is no impediment in the passages and the os uteri is relaxed. Often *mechanical assistance* is required. The passages of the generative organs, and the os uteri especially, having been found, lubricated, and relaxed, the hand is passed into the uterine cavity. It is thus enabled to determine with a certain degree of accuracy the nature of the contents and their position. The parts of the fœtus are very slippery, the fluids are passed in considerably quantities, and the room for working is confined, hence the extraction of the fœtus is not so easy as it seems. Looped cords, forceps, hooks, crutches, and other instruments, are required to assist in parturitions, and the number of appliances now used is very considerable. In all these cases the main aim must be to support the strength of the patient and to restore or keep the calf in its natural position and then to overcome every impediment. It is important never to lose control over any part which

has once presented itself. A cord round the lower jaw and one round each fore foot will be very useful for this purpose.

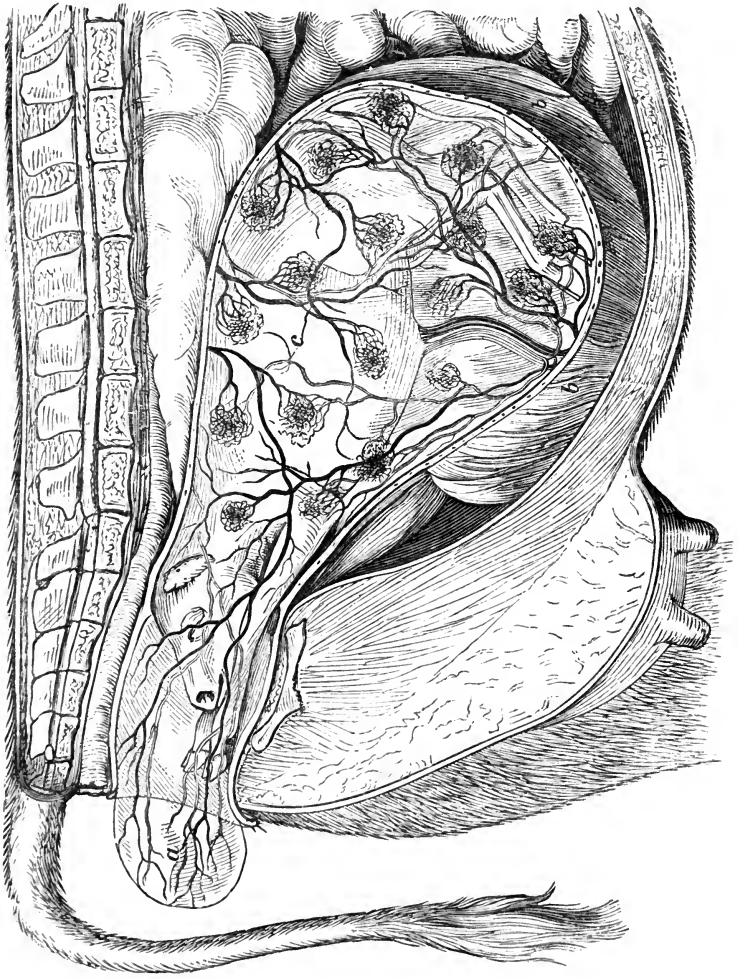


FIG. 93.—Normal presentation. Fœtus enclosed in membranes. (After Simonds).

FALSE OR ABNORMAL PRESENTATIONS may be:

a. Head presented and one foot.—Secure the foot and head; introduce the hand with the slipping noose of

a rope and feel the flexed other fore limb; trace it downwards to the fetlock and slip the noose on to the foot,

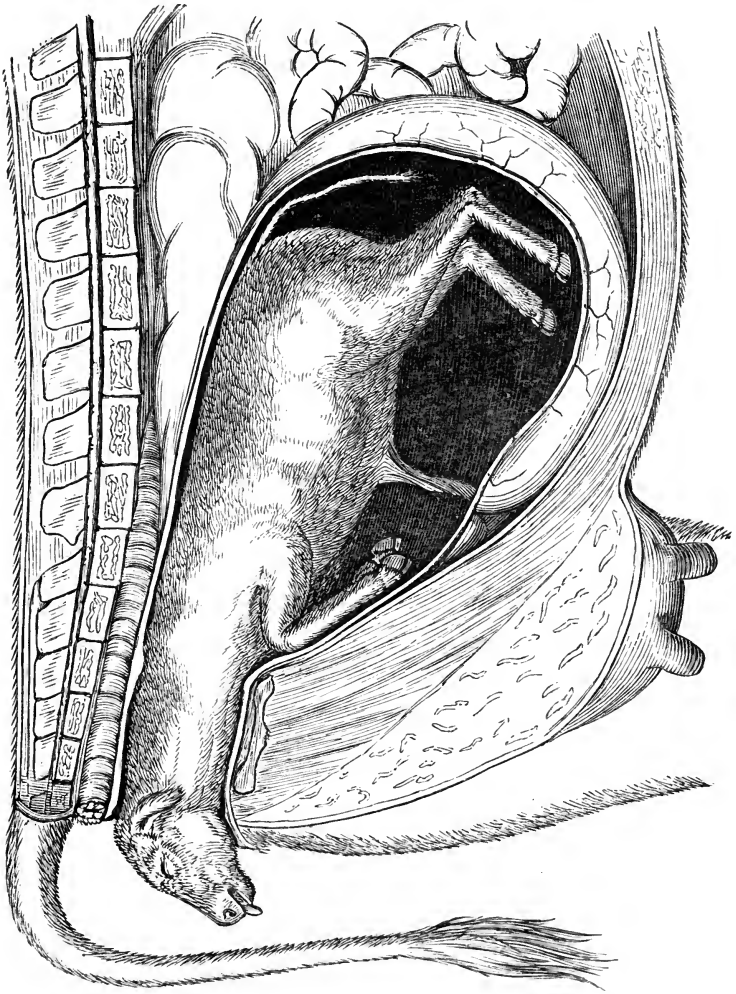


FIG. 94.—Abnormal presentation (*b*).
(After Simonds.)

then push the fœtus forwards while traction is brought to bear through the rope on the flexed limb

b. Head presented without the feet. — Secure the

lower jaw, then press the head back into the uterus, find the fore legs, and secure and draw them upwards.

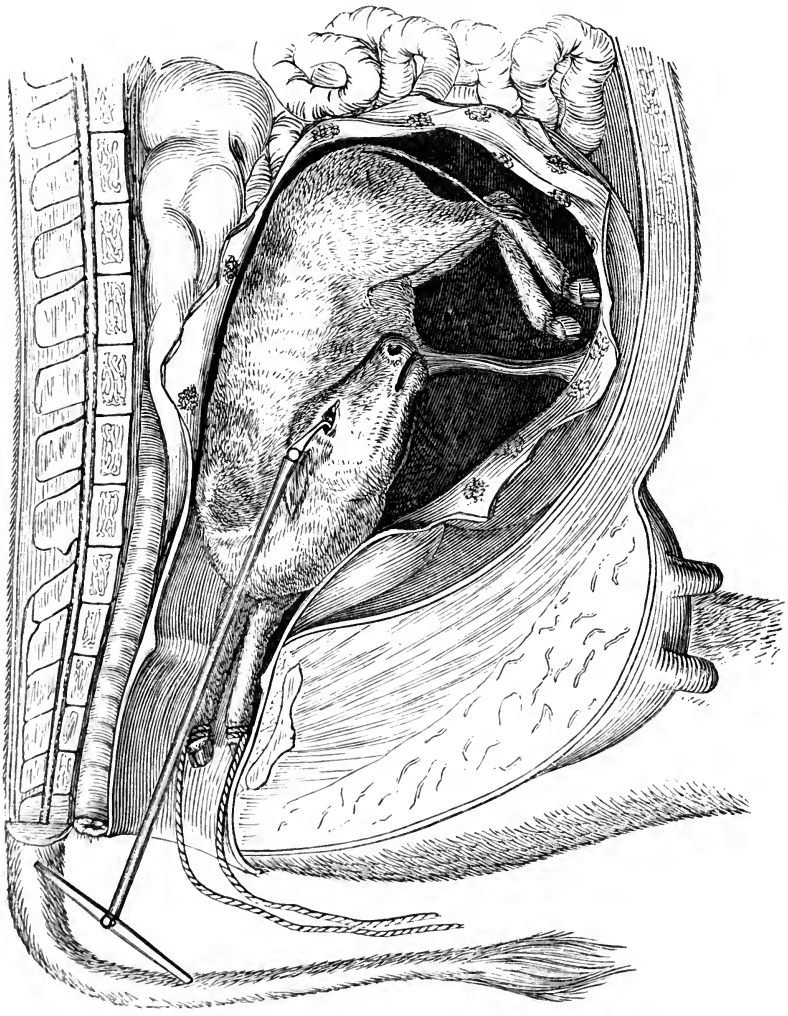


FIG. 95.—Abnormal presentation (*c*).
(After Simonds.)

c. Head turned backwards, feet presented.—Feel for the head, and, if possible, fix a rope on the lower jaw and also one round each of the feet, or a hook may be fixed

in the eye. Then if pressure be applied to the chest, forcing the fœtus deeper into the womb, by traction

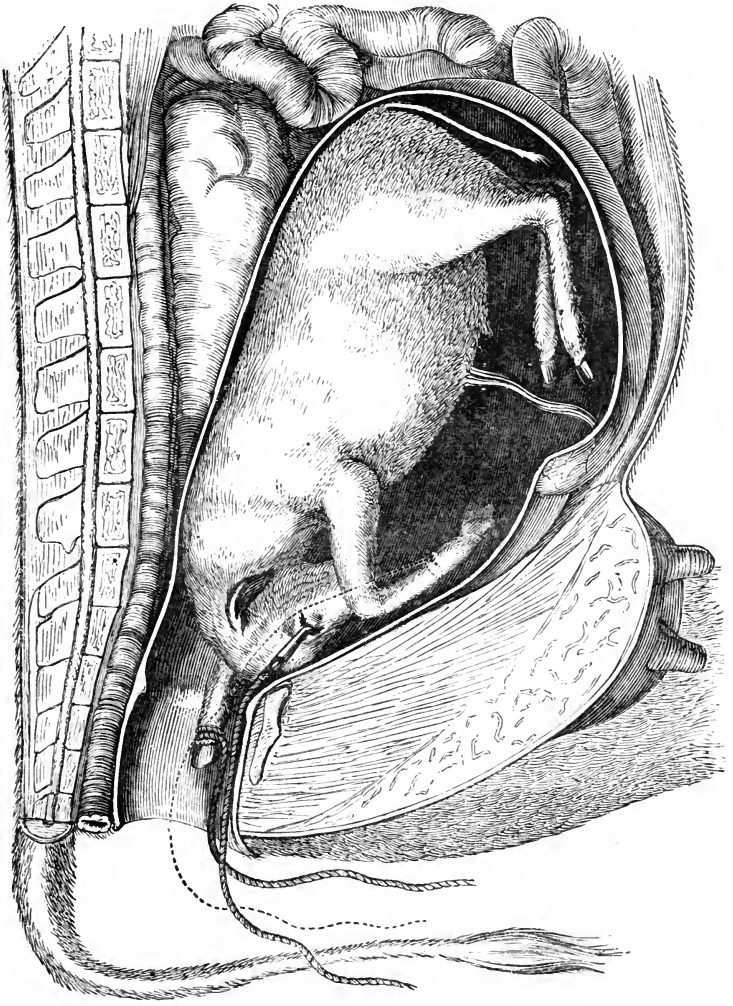


FIG. 96.—Abnormal presentation (*e*).
(After Simonds.)

of its cords the head may be brought into position. When the head is out of reach embryotomy must be performed.

d. Head turned backwards, and only side of neck presented.—Proceed as much as possible as in *c*.

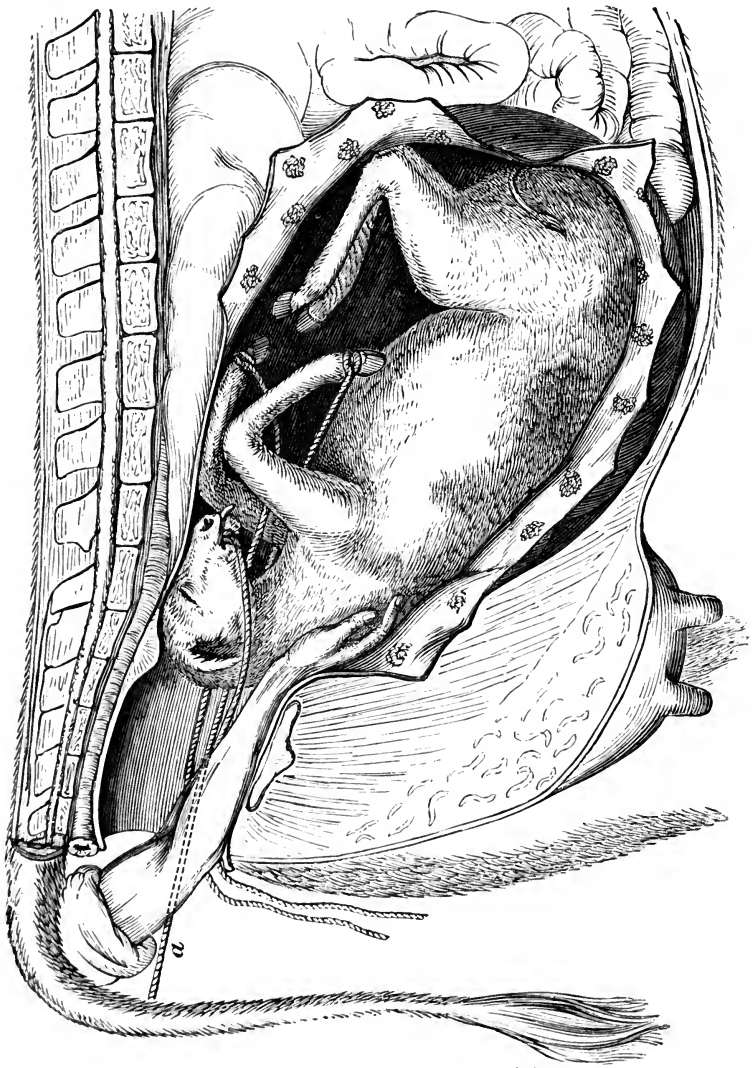


FIG. 97.—Abnormal presentation (*f*).
(After Simonds.)

e. Nape of neck against os uteri and one fore leg projecting.—Secure the other foot and continue as in *c*.

f. Fœtus on its back, nape of neck presented.—Pass a rope round the jaw and one around each fetlock,

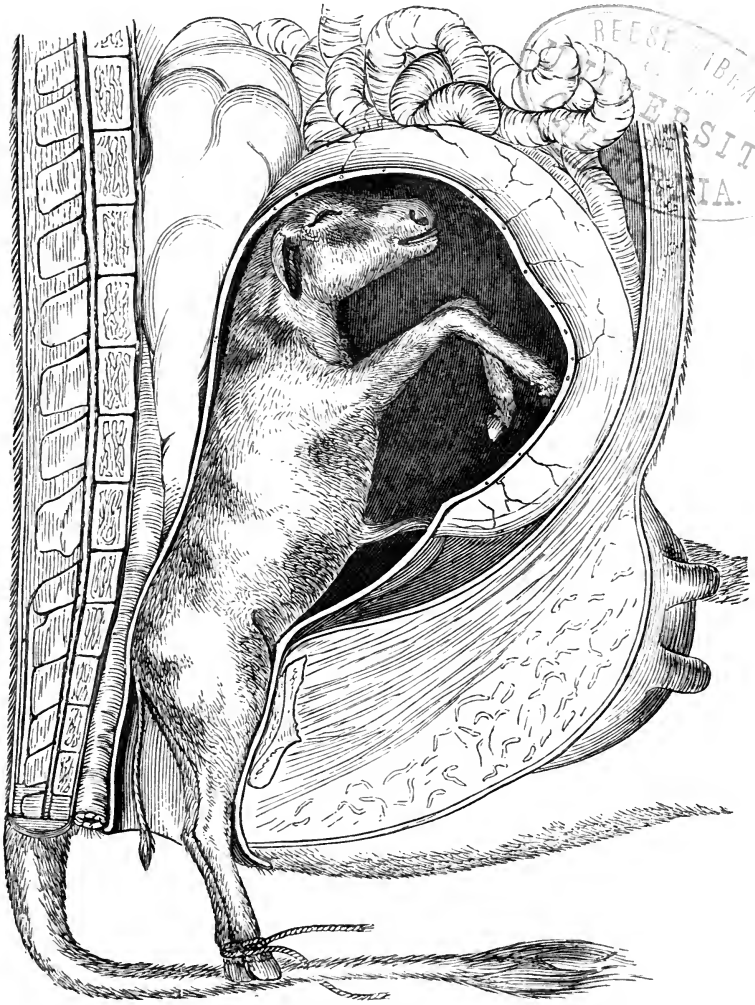


FIG. 98.—Abnormal presentation (*i*).
(After Simonds.)

bring the two latter round to the same side of the head; support the withers with the hand. Then apply pressure

in a rotatory manner from below, while an assistant pulls the ropes on the limbs. A gradual change to the ordinary

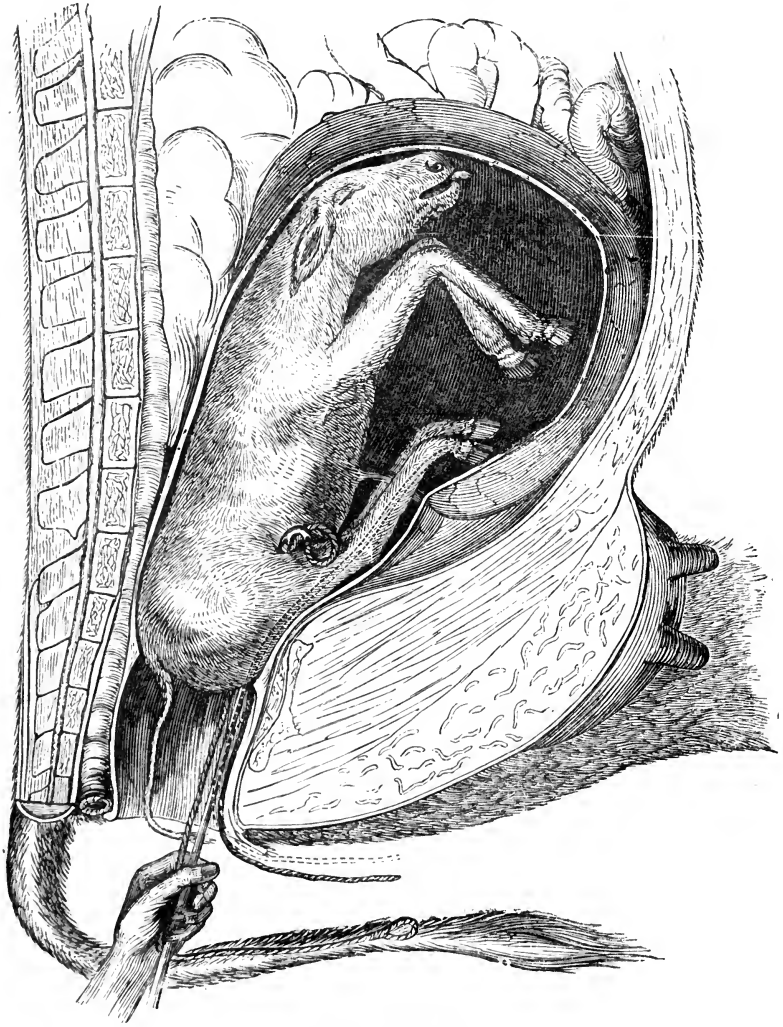


FIG. 99.—Abnormal presentation (*j*).
(After Simonds.)

position may take place, otherwise forward pressure must be applied, and an attempt made to deliver the calf as it is.

g. Fœtus on its back, hind feet presented.—Extract in position.

h. Fœtus on its back, hind feet inclined forwards.—Endeavour to press the calf downwards and forwards, and then flex the hocks and obtain position (*g*). If this be not sucessful, amputate at the hip.

i. Hind feet protruded.—Remove in this position.

j. Breech presentation; hind feet projecting downwards and forwards.—A case of great difficulty, there being no room for operations. By means of a special instrument a cord is passed round each thigh, the body of the fœtus is then pushed forwards by means of the crutch, and the loop passed down to the fetlocks; then, the pressure being still made, the feet are drawn by flexure of the hocks and other joints into the passage and removal is effected.

Certain other presentations have been noted, but the above are the principal. Besides these may be mentioned some of a special character, due to **diseases and irregularities of the calf.**

HYDROCEPHALUS CONGENITALIS has been already noted (see p. 379), as also ASCITES of the fœtus at time of parturition. Each must be treated by the process of tapping. In the latter case, the simplest method will be found to be direct puncture by means of a concealed knife carried in the hand into the uterus. In the former, the operation is performed by means of a perforator, the head being held in position by a hook fixed in the eye, but this is not always necessary. Occasionally the fœtus is enormously enlarged by disease, either general emphysema, or the condition known as polysarca or œdema congenitalis. *Emphysema* generally results from decomposition of a dead fœtus, from which the gas must be removed by incisions. *Polysarca* is an enlarged fatty condition of the fœtus not often seen; *œdema or anasarca* causes premature birth.

Irregularities of the fœtus comprise the various forms of MONSTROSITIES, of which the principal seen in the cow are as follows:

1. *Anidians.*—Rounded masses of living matter, con-

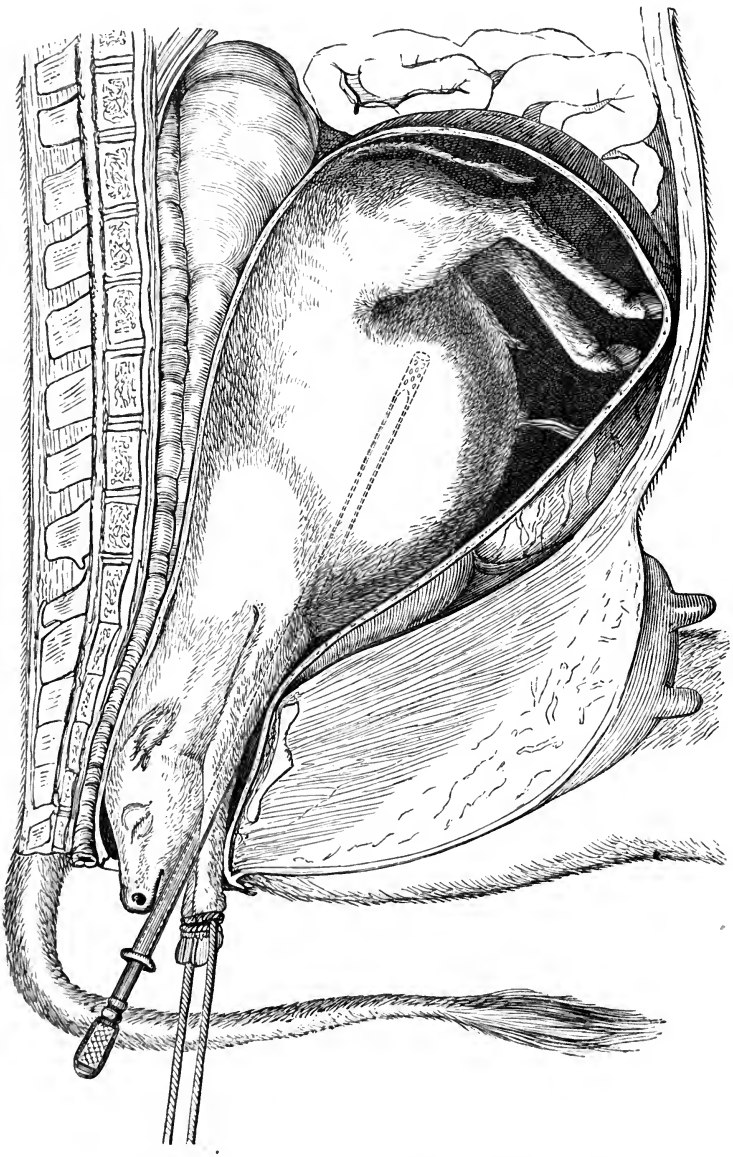


FIG. 100.—Congenital ascites, causing difficult parturition.
(After Simonds.)

sisting of bones, muscles, vessels, &c., sustained by an umbilical cord.

2. *Celosomians.*—Abdominal walls deficient, bowels loose in amniotic cavity.

FIG. 101.—A special form of hydrocephalus of the calf. (From Fleming's 'Veterinary Obstetrics.')

FIG. 102.—Harelip. Schistocephalus fissilabrus. (From Fleming's 'Veterinary Obstetrics.')

3. *Ectopia cordis* (see Heart).

4. *Harelip* or cleft-palate forms; the separation usually extends through the whole face.

5. *Campylorrhachides.*—Twisted condition of the spine, so that often all four feet project forwards.

6. *Dicephalians,* or double-headed animals. The division may simply comprise the faces or there may be two distinct skulls.

7. *Hermaphrodites* with a confused mixture of male and female organs, or external generative organs of the male and internal of the female, or *vice versâ.*

8. *Megalomelus perissodactylus.*—Before us is a specimen in which the rudimentary metatarsal bears a distinct digit, as is sometimes the case in the horse.

9. *Schistomelus.*—In a case recorded, the hind limb was cleft up to the hock.

10. *Twin calves,* united more or less intimately.

11. *Polymelians,* many-limbed forms.

We have mentioned some of the above forms more on account of their curious characters than of their practical importance in parturition. These peculiar creatures used to be termed *Lusus Naturæ,* but recently the study of them, Teratology, has been remarkably advanced by the experimental method, and it has been shown that they are not "freaks," but produced according to definite laws. Thus they may depend upon pressure as preventing the development of any part, upon amputation performed by a twist of the umbilical cord, upon budding of the ovum, or upon exaggerated or arrested development. The various kinds which occur in domesticated animals are treated of at length by Fleming in his 'Obstetrics,' where he fills a great blank which long existed in English veterinary literature. Monstrosities are of very frequent occurrence in the cow, and cases of double or even triple calf, twisted spine, dicephalus, and polymelianism may give rise to difficult parturition and necessitate adjustment, and often embryotomy. Some monsters are unable to live independently of the parent, others are unable to stand the pressure exerted upon them in expulsion, as those with ectopia cordis. Many live and are much appreciated by itinerant showmen. Sometimes it is most astonishing what peculiar bodies can be expelled without much trouble.

Whenever the fœtus cannot be removed by ordinary traction, *embryotomy* must be tried. It consists in the reduction of the size of the fœtus by removal of parts, which are separated with a special concealed knife (Fig. 103), or by means of a curved pointed blade which has a ring for its handle (Fig. 105), and thus may be fixed on the middle finger and carried in the hollow of the hand into the uterus. Operations with these knives are limited by the small space in the pregnant uterus, and by the cramped state of the arms of the operator from the pressure exerted upon them, particularly during the uterine throes. Sometimes the chain saw (Fig. 106), will be found useful. The fore

limbs are the parts most frequently removed in this way. An incision is made through the skin from as high up as possible longitudinally downwards as far as the fetlock,

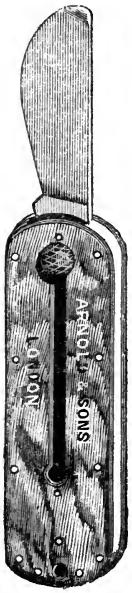


FIG. 103.—Common Embryotomy Knife.

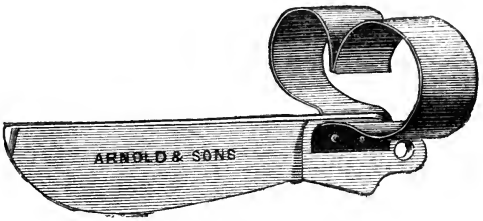


FIG. 104.—Gowan's Knife.

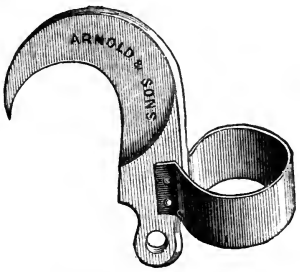


FIG. 105—Finger Hook.

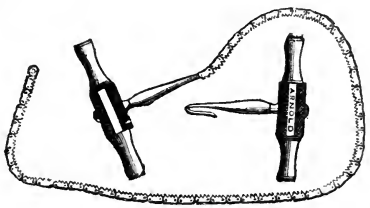


FIG. 106.—Chain Saw, with removable handles, for embryotomy.

where a circular division of the skin is made. The subcutaneous areolar tissue is then divided as much as possible, first with the knife, then with the fingers. The limb is then removed by a forcible steady pull, its muscular attachments to the trunk giving way. The skin can subsequently be used for traction, a rope being fixed to it, and also, in some cases of embryotomy, serves to protect sharp

bony edges. Care must be taken with the embryotomy knife, as with other instruments, lest injury of the uterine walls result from a false stroke or a slip. This operation is generally performed when the cow is in the recumbent position, and she may be supported by occasional doses of stimulants. It must be resorted to only when other means fail, the fœtus being too large for the passage or inaccessible otherwise. It is generally best to sacrifice the life of the fœtus to save that of the mother. In all obstetric operations great care must be exercised to avoid injury of the uterine walls; the feet when moved, must be taken into the hand and then gently drawn round. Again, it is always necessary to carefully examine the contents of the uterus. The two legs projecting with the head, may be not such as are most convenient for easy removal, as seen in cases of curved spine and many-limbed animals. Again, the projecting feet may belong to distinct animals.

Twins.—The presence of two calves in the uterus being so frequent, we should always after removal of one look for a second. They generally lie in reverse positions; one being presented in the ordinary way, the other with its hind legs first. Twins are usually small, and therefore do not cause much difficulty in expulsion. They are apt to become fixed together in the genital passages. In such cases, the state of affairs having been clearly ascertained, the fore legs of the normally presented calf are to be secured with ropes, and, these being kept tight, the other calf is forced back into the uterus. The first can then be removed in the usual way, and the second will generally follow.

Diseases of the fœtal membranes are not very frequent, but some few are on record.

Cases of Dropsy of the Amnion—Hydramnios—are some-what often seen in the cow, they give rise to undue distension, which may lead to abortion, or to over-distension of the uterine walls with corresponding inertia. The accumulated fluid is described as sometimes resembling Vitreous Humour in its characters. The causes of this condition are ill-ascertained, and its diagnosis from

Hydrops Uteri is not frequently possible. Thus, as in that disorder, the accumulated fluid must be evacuated through the os uteri. In the 'Veterinary Journal,' vol. iii, October, is recorded a case of firm union of the fœtus, membranes, and uterine walls, probably resulting from endometritis.

HAIR BALLS—ÆGAGROPILES—are occasionally seen in the liquor amnii. This fluid consists largely of the products of excretory action of the skin; the aggregation of the hairs results from the regular movements of the membrane which are known to take place in the living animal.

The *cause of difficult parturition* often resides in the cow. The passages in a normal state may be too small for the calf, as when a small cow has been put to a very large bull, or the parts may not have sufficiently relaxed. In the latter case enough time may not have been allowed for relaxation of the os to take place, then the practitioner must wait and mark the progress of the case. Often there is some actual impediment present. Thus, there may have been *fracture of the os innominatum*, with a considerable deposition of callus, or some *exostosis or other tumour pressing upon the genital passages*. Such cases are most formidable and generally necessitate operative interference.

There may be TUMOURS IN THE GENITAL PASSAGES; such growths in the vagina are of a fibromatous, lipomatous, or serous cystic character. They must be incised if cystic, and removed by ligament or the écraseur otherwise. They are often appreciable only on manual exploration. Of course the progress of parturition is gravely affected both by the position and size of such growths. Another cause preventing expulsion of the fœtus is IMPERFORATE VAGINA, due either to congenital malformation or to inflammation of that passage. This may be complete or partial. In the former case there is retention of the products of œstrum, and sooner or later severe straining sets in. The state of the parts can be detected on exploration, and the animal generally has not been known to take the bull.

In the latter, impregnation may occur, and the excessive diminution in size of the vaginal passage not be detected until the time of parturition, when it may be necessary even to perform the Cæsarian section. In the 'Edinburgh Veterinary Journal,' vol. ii, p. 283, is given a case in which *a band extended across the os uteri,* probably the result of inflammation of the parts. It required to be divided before parturition could be effected. The os uteri may be affected with *spasm,* but this is not very frequent; rigid occlusion of the orifice is more frequently due to STRICTURE, in which the muscular walls undergo various changes, as the fibrous, and especially the cartilaginous. Then labour pains occur in due course, but do not result in expulsion of the fœtus, and on exploration the hard and firmly constricted condition of the os is determined. This state seems sometimes to be hereditary, it may also result from injury. The fingers and thumb of the hand in the vagina having been approximated, an attempt is to be made to insert the hand as a wedge through the opening; this will seldom be accomplished. The instrument suggested for lithecstasy might be tried, or incisions made through the cervix in various directions by means of the concealed bistoury. In cases which resist these means the Cæsarian operation must be tried or the patient slaughtered. Sometimes the os is unyielding and incapable of relaxation in consequence of disease of a cancerous or scrofulous nature. These "SOFT STRICTURES" of Macgillivray require to be treated by incision, an operation known as *vaginal hysterotomy.* This may give rise to much hæmorrhage, but will not usually do so. When the narrowing of the os is due to spasm, there are generally powerful uterine contractions, and the parts are regular, tender, and somewhat yielding. Antispasmodics may be had recourse to or even the abstraction of blood, manual dilatation, or the lithecstasy apparatus may be tried. Usually the spasm will relax in time. Warm-water vaginal injections are indicated.

An IMPERVIOUS STATE OF OS UTERI has been observed, probably it is due to the throwing out of false membranes

as a result of inflammation. In the virgin animal it gives rise to uterine dropsy from retention of fluid; in the pregnant cow there is generally a small opening through which impregnation has taken place. This must be treated by incision and dilatation.

Persistent Hymen is sometimes a cause of impeded parturition in the cow. It is found to be a fibrous band extending across the vulvo-vaginal passage, just above the meatus urinarius. This must be divided, and then no further difficulty in expulsion will be experienced.

Torsion of the Neck of the Womb, or of the anterior part of the vagina, is rather common in the cow, probably on account of the special position of the cornua, which tend to "heel over" where the extra weight of a fœtus is in one of them. This constitutes the predisposing cause, but blows, falls, and injuries of other kinds, are the most frequent exciting influences. The twisting may be complete, incomplete, or double.

Symptoms.—Labour-pains in due course, but not leading to protrusion of the amnion; violent abdominal spasms; extreme indications of abdominal pain. The hand introduced into the vagina meets an impediment, and recognises the twist in the spiral arrangement of the walls at the anterior part. If these conditions be not relieved remission of the labour-pains occurs, and death ultimately results from asthenia. The direction of torsion may be determined by the way in which the back of the hand introduced into the twist inclines; when to the left, it is a case of left torsion and *vice versâ*.

Prognosis in such cases is unfavorable, but not absolutely hopeless. They generally necessitate some severe operation. Rolling the cow in a direction opposite to that of the twist, the uterus with the fœtus in it being as much as possible retained in position by means of the hand introduced through the os has been tried. Sometimes the strain on the hand is found to increase, then the body must be turned in the opposite direction. When relief has taken place, there is generally an escape of liquor amnii. Failing this means the Cæsarian operation must be per-

formed. Sometimes a slight torsion may be counteracted by manipulative means per vaginam, any protruding portion of the fœtus being grasped and rotated. In other cases abdominal section with manual restoration of the uterus to its position has been tried with success, but the operation is difficult.

Dilatation of Os Uteri.—Post-partum the os in due time contracts, but sometimes this is not so. This is generally associated with imperfect contraction of the main portion of the uterus. It indicates a want of tone, and may be generally overcome by cold-water applications.

The Imperfect Post-partum Contraction of the Uterus may be associated with hæmorrhage, for diminution in the volume of the organ normally suffices to prevent bleeding from the slightly lacerated cotyledons. In such a case it may be treated by cold-water injections either into the uterus or the rectum. But when unassociated with such a complication, it may be overcome by administration of stimulants, or even small doses of ergot of rye.

When Inertia of the Uterine Walls takes place in the pregnant animal, it is apt to lead to a want of response to the ordinary indications for expulsion of the fœtus, and therefore to prolonged retention. Then the young animal may continue to grow, and thus become large enough to cause some difficulty in expulsion, or it may die, and either decompose and cause septic disorder of the cow, or, if the os uteri prevent access of air, it is apt to undergo dry gangrene and mummify.

Sometimes the decomposed fœtal remains are expelled gradually as a discharge *per vulvam*; in one case alluded to by Youatt, expulsion took place *per anum*, the cæcum and uterus having contracted adhesions and become connected by a fistula. The tincture of the ergot of rye is a most valuable excitant of the walls of the uterus to contraction. In cases of prolonged parturition, the uterus may lose its power and remain in a relaxed state with the fœtus still in its cavity and labour-pains

ceased. In such a case as this, when the passages are clear, the use of ergot is indicated.

Furor uterinus.—Sometimes cows remain as it were in a constant state of œstrum, always ready to receive attentions from the bull, in a highly excitable condition, and often with a slight discharge trickling constantly from the lower part of the urino-generative aperture. The vaginal mucous membrane is congested. These animals are termed "*bullers*," and the furor is not always to be associated with uterine disorders. Thus, it is a sign of dropsy of the ovaries, of inflammation of the vulvo-vaginal membranes, and often of the presence of tumours in the generative passages. It is most frequently attributable to scrofulous disease of the uterine walls, or some other chronic inflammatory action in the uterus.

Hydrops uteri.—Though many cases of retention of œstral products have undoubtedly been mistaken for true dropsy, some instances of the latter state are recorded. These occur in animals supposed to be pregnant; but when distension of the uterus has taken place, the os opens and there is a spontaneous evacuation of a watery, or more frequently a semi-purulent or sanguineous, fluid. This gives relief, and is succeeded by a gradual reaccumulation and a recurrence of the false pregnancy. Trying for the fœtus in theusual manner is ineffectual in these cases, and there are several signs of this not being true pregnancy. The pent-up fluid should be evacuated as soon as the disease has been diagnosed. Then the uterus should be washed out frequently by syringing it with a weak solution of carbolic acid or chloride of lime. In the meanwhile the patient should be well fed and nursed, for the disease results from debility, injuries, and slight inflammation. Tonic agents (especially mineral) will prove beneficial.

Inflammation of the Uterus may be of three kinds, according as the external, middle, or internal coat is the main seat of disease.

Endometritis.—Inflammation of the mucous membrane of the uterus results from injuries during parturition,

and occasionally perhaps from abortion, or exposure when the animal is heated. It is not very frequent nor urgent, but during its course there may be false pains, and usually the products of inflammatory action accumulate in the cavity and so cause distension. Thus this disorder leads to dropsy of the uterus, but sometimes the products pass off as a continuous discharge. In some cases the lining membrane is much disorganised by ulceration, there is then frequent straining and rapid loss of flesh. In cases of protracted labour the discharges from the generative passages become acrid and may cause endometritis by retention. This acridity is proved by the *ecthymatous disease which so frequently affects the arms of veterinary obstetrists,* and which is fully described by Professor Gamgee in the 'Edinburgh Veterinary Review," vol. i, p. 23, where a beautiful illustration of the affected arm of the professor is also given. Endometritis must be treated by antiseptic injections and careful nursing. When it occurs during pregnancy, separation of the fœtal membranes from the lining of the uterus will cause death of the fœtus in some cases. Inflammation of the muscular coat of the uterus without the other layers being affected is seldom or never seen.

Metro-Peritonitis or Puerperal Peritonitis (Barlow).—We have already alluded to septicæmia in general, and noted that it especially occurs in connection with parturition and its accidents. The substance of the womb being inflamed, the peritoneum generally is involved, and the diseased action spreads remarkably rapidly, and involves a considerable extent of surface. Cases of this kind used to be confounded with true parturient apoplexy, but are now diagnosed with certainty since the symptoms differ in many important particulars. Thus together with the general signs of disorder succeeded by those of fever, there is found a peculiarly hard quick pulse, which also is frequent. The respirations as the disease progresses becomes quickened, frequent, and often thoracic. There is straining and the passage of a chocolate-coloured fluid through the vulval opening, and the lining membrane of

this part is of a dark-purple colour, the labia being small, contracted, and œdematous. The cessation of secretion of milk is generally sudden and the udder becomes soft and flaccid. In the later stages the pulse becomes very rapid and imperceptible, the rumen distended with gas, the patient comatose. There are usually signs of abdominal pain of rather an acute character. The prostration of strength is rapid and the animal dies from asthenia.

On *post-mortem examination,* the cavity of the uterus is found to be small and to contain chocolate-coloured fluid. The diminution in size results from the thickening of the walls of the organ as a result of deposits. Blood extravasations are to be seen beneath the peritoneum which exhibits the various marks of inflammation. The veins of the uterus contain dark blood in a coagulated state and ecchymoses are visible on many of the serous membranes, and sometimes on the inner surface of the labia. Ecchymoses have been noted in the cranial membranes.

Causes.—Such cases supervene on retention of the after-birth or of the fœtus. Wounds received during assistance in parturition, especially in protracted cases, prolapsus, inversion of the uterus, also exposure during or after parturition, or over-driving also cause them, plethoric animals being predisposed. It usually manifests its first symptoms from a half to three days after parturition.

Results.—Most frequently runs a rapid course and ends in death from blood poisoning. Occasionally very rapid resolution occurs, and sometimes the attack degenerates into a chronic endometritis tending to flooding, leucorrhœa, and dropsical accumulations in the womb.

Treatment.—The system of the patient must be sustained by stimulant tonics, especially the tinctures of the vegetable bitters, and nourishing soft diet must be supplied to her for sometimes the appetite remains after the commencement of the attack. All debilitating influences must be avoided, and it is questionable whether administration of cathartics is beneficial. However, we deem this advisable, for it is an advantage to keep those

important excretory organs, the bowels, in free action; the influence of the cathartic is derivative, and the peritonitis is not so diffused as in idiopathic cases of that disorder. Local treatment comprises the administration of belladonna or other anodyne enemas and of carbolic intrauterine injections. All endeavours must be made to remove decomposing membranes or the remains of a fœtus, but the practitioner must be most careful not to injure his arms or hands with fœtal bones, nor to work in such cases with an exposed wound on the parts brought into contact with the decomposing material. The hands may be advantageously lubricated with carbolised soft soap. Neglect of these precautions has proved fatal to some country practitioners.

Lacerations of the Uterine Walls result from excessively powerful throes in different cases of parturition, from wounds either by the foot of the fœtus or by instruments during delivery, and sometimes as a direct result of other forms of injury. These lacerations may be partial or complete. In some cases of metritis abscesses form in the thickness of the coats, and in time burst into the cavity of the uterus, leaving behind them spaces, which become fistulous in consequence of the constant entry of the acrid uterine discharges. Thus Uterine Fistula is established. The symptoms are those indicative of endometritis, and are usually slight. Sometimes we have a true fistulous communication, between the uterus and the intestines for instance. We can only treat such cases as suggested for endometritis. Perfect or complete laceration is Rupture of the Uterus, which may occur either before parturition, during labour, or after delivery. When it takes place before or during parturition it generally results in the falling of the fœtus into the abdominal cavity. A remarkable form of this lesion is noticed by Fleming, after Count Ercolani of Bologna, in which transverse rupture of the uterus (either the body or one cornu) results in the hanging of the anterior separated part of the organ as a fœtus-containing cyst, supported by the broad ligament below the lumbar region. The development of the fœtus

continues; probably the rupture is gradual. It has not been observed in this country. Rupture is often seen in the everted uterus, but the organ may be returned and the case recover. It is generally considered unnecessary to insert sutures in such cases. The reparative powers of the uterus seem very extraordinary, for the organ contracts after evacuation of its contents, and thus the edges of any wound are kept close together and in a condition favorable to rapid healing. Protrusion of the small intestines through the rupture (which generally is at one side of the anterior part of the organ) is sometimes seen. The symptoms of rupture of the womb are those indicative of collapse; sometimes there is a flow of blood or sanguineous fluid through the vulva, but this symptom may be absent. When the fœtus has fallen in the abdominal cavity there will be sudden alteration in the shape of the abdomen and in the position of the fœtus. In such cases all that can be done is to perform the Cæsarian operation as early as possible; in others all our efforts must be directed to supporting the strength of the patient and counteracting untoward results.

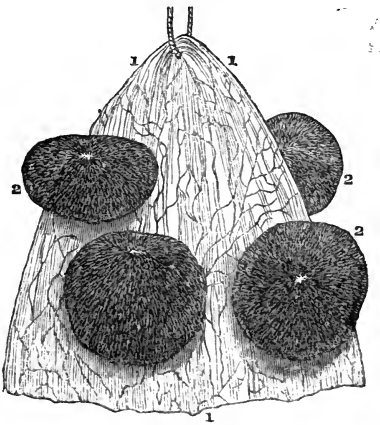


FIG. 107.—Portion of chorion with placentulæ. Cow. 1. Chorion. 2. Placentulæ. (From Fleming's 'Veterinary Obstetrics.')

PROLAPSUS VEL INVERSIO UTERI—"Falling of the read or calf-bed"—the turning inside-out of the uterus—may

be complete or incomplete. In the latter case the cornua are generally not involved, but even they may be par-

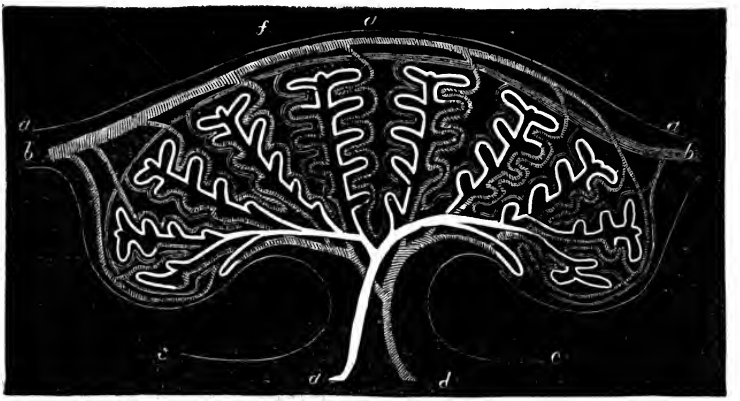


FIG. 108.—Cotyledon of a cow's uterus. *a a.* Surface of fœtal chorion. *b b.* Blood-vessels of fœtal chorion. *c c.* Surface of uterine mucous membranes. *d d.* Blood-vessels of the same. *f.* Secretion from utricular glands. (From Fleming's 'Veterinary Obstetrics.')

tially inverted. The uterus with its mucous surface and maternal cotyledons protrudes through the vulval opening and hangs downwards for a distance varying with the severity of the case. It generally becomes strangulated by the action of the sphincter vulvæ or the narrowness of the passage, and thus tends to increase largely in size in consequence of infiltration of serum into its substance and accumulation of blood in its vessels. It generally is somewhat lacerated as a result of exposure to external injury, and even tearing up by the patient; sometimes rupture of its walls has taken place. To allow the inversion, the broad ligaments have generally become lacerated and the vagina may be involved with the uterus. The patient strains constantly, and thus tends to aggravate the case. This accident occurs at or shortly after parturition and may result from excessive spasmodic contraction of the uterine walls, non-contraction of os uteri post-partum, adhesion of the fœtal membranes to the walls of the uterus, and it is especially frequent in animals in a state of debility.

Treatment comprises restoration of the organ, its retention, and the counteraction of the ill consequences of the accident. Restoration may be effected either from the neck or from the fundus, or by both these methods combined. As a preliminary measure the surface of the womb must be cleansed from all foreign bodies, especially also from adhering portions of the fœtal membranes. The animal must be placed with the hind part of the body raised and kept in that position, which is important not only as a means of facilitating return of the part but also of retention. The protruding organ must be supported by a towel held on each side during the process of cleansing and return. In the latter effort the fist must be closed and applied to the fundus of the organ which must be pressed inwards at the intervals between the throes and prevented from return during their efforts, which must be prevented as much as possible by distraction of the patient's attention and pressure on the loins. While the pressure is brought to bear on the fundus an endeavour must be made to gradually return the neck, for a combination of the two methods is decidedly the most satisfactory. When the protruded uterus is very much swollen, it may be reduced in size by cold-water applications and by pressure evenly applied from the fundus towards the neck. This may be best accomplished by an Esmarch's bandage, which also assists in the return of the organ, but it may be effected by fixing a carbolised cloth around the protruding organ and manipulating in a manner which may be learned rather from observation than description. The fist with the fundus must be passed in so far as not to cause great increase in the expulsive efforts, and must be kept in position for some time. Of retentive means the most important are distension of the uterus with some bland mucilaginous fluid, with an antispasmodic dissolved in it; the use of a special retentive appliance termed a pessary. These are of various kinds, but the most readily available and simple of all is an ordinary glass bottle. The concavity on the floor of this fits well against the os uteri, and its neck

may be fixed at the vulval aperture to the truss or sutures. The narrowness of the neck allows urine to pass freely, and its rounded edges and smooth surface render it very unlikely to cause irritation (see 'Veterinarian,' 1880, p. 296). In cases where it is found impossible otherwise to return the organ, it has been suggested to place the animal on its back and elevate the hind quarters by means of pulleys. When the spasms are excessive large doses of opium are beneficial to allay this undue straining. On return of the womb it has been suggested to place metallic sutures through the os uteri, but these may prove a source of irritation, therefore the application of a truss (such as Gowing's, shown in the accompanying figure 109) is suggested. Trusses for this purpose are of various kinds, and some are valuable as being composed of a simple rope specially arranged (see Fig. 110). For a description of these we must consult Fleming's 'Obstetrics.' Sometimes it is deemed advisable to apply a truss in every case after parturition; this preventive means should certainly be taken with all debilitated animals and those which have previously suffered from prolapsus. Standing on a floor slanting

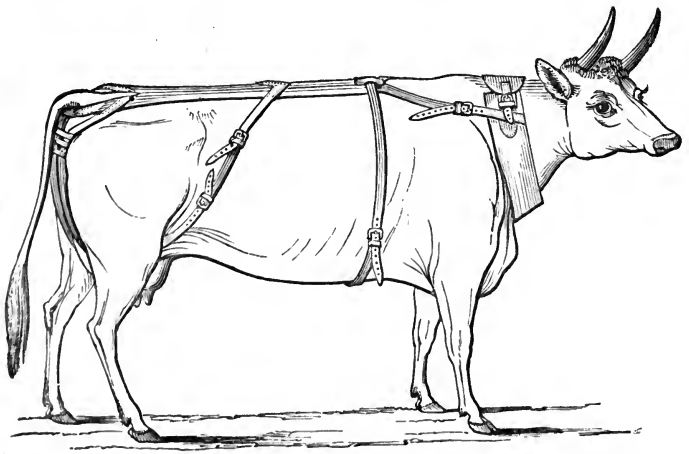


Fig. 109.—Gowing's Truss for prolapsus uteri. (After Simonds.)

forwards is always a useful precaution after parturition. Some practitioners insert sutures through the labia instead

of using the truss; the quilled suture is the best, and the ligatures must be stout, so as not to readily tear

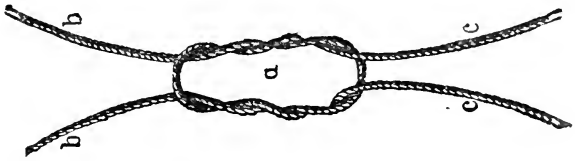


Fig. 110.—The loop of Delwart's Truss. (From Fleming's 'Veterinary Obstetrics.')

away; a good hold also must be taken. All measures failing to effect the return of the protruding organ, it may be amputated. This operation, *Amputation of the Uterus*, has often been successfully performed The neck being constricted by an ordinary ligature, the greater part of the organ may be removed with the knife or with the heated iron, or the method of caustic clamp or elastic ligature may be tried, and the use of the écraseur has been suggested for this purpose. The patient will require to be cast in the usual way and the operation be performed under chloroform.

Prognosis in cases of prolapsus uteri must be considered favorable. In many cases the recovery is so perfect as to make the animal useful for breeding purposes afterwards, but such animals should always be carefully watched during parturition and the truss applied directly the fœtus has passed. Death may take place through shock on amputation, or from mortification of the protruded organ. An animal which has once been thus affected, can be returned to the vendor, according to the law of some countries.

Inversion of the Vagina is a frequent accompaniment of prolapsus uteri, and cannot be said to render the case more complicated. Sometimes it is seen as a distinct lesion; then there is a red tumour hanging from the vulval opening which presents no cotyledons, has an opening at its fundus, and at its lower part may be seen the orifice of the urethra. It is not difficult to return this after cleansing, but the accident is very liable to recur, there-

fore the truss or sutures through the labia must be used. This lesion is sometimes chronic; the lining membrane of the organ becomes indurated. In such cases, since returning is only effectual for a short time, amputation has been tried with success, the operation being performed with the hot iron or with the knife, the edges of the wounds being united by sutures; this measure is seldom necessary. The prolapsus results from prolonged retention of the fœtus in the vulvo-vaginal canal and dryness of the passages. It is apt to give rise to dysuria from pressure on the urethral orifice.

Inversion of the Bladder has been already mentioned (see p. 343). We allude to it here to prevent the everted organ being mistaken for a polypus. Its position is diagnostic, as also its form.

Hernia uteri or Hysterocele is rare in the cow on account of the large size of the organ. We have already alluded (p. 281) to the cases in which it is seen in front of the pubis. Such seldom interfere with parturition.

Tumours in the Uterus.—Fibromata either highly vascular or lowly organised, hence either soft or hard, and generally pedunculated, have been found in the uterus of the cow, attached to almost every part of it in the various cases. When near the os, these may prevent parturition by becoming fixed in the cervix, and the same may be said of those from any part of the cavity, provided the peduncle be sufficiently long. In such cases the tumour must be returned into the uterine cavity so that extraction of the fœtus may be possible. Afterwards an attempt must be made to remove the growth by means of the écraseur or ligature, the latter being most generally available. We have no record of malignant tumours in the uterus, but in some cases the external os uteri is affected by disease apparently of the nature of true cancer.

Malformations of the Uterus are seen in hermaphrodite heifers, which are generally sterile.

Rupture of the Vagina or Vulva is somewhat frequent in parturition. It also is sometimes due to introduction of sticks and other rough instruments by boys and

labourers, who seem to consider this an excellent joke. Some hæmorrhage will take place through the external opening, and later, a discharge of a muco-purulent character will appear. Manual exploration of the parts will disclose the lesion. Cases of this kind do not seem to be attributable to the penis of the bull. During birth a foot of the fœtus may be forced into the rectum and protrude through the anus, or pass into the areolar tissue around the vulva. The throes being powerful, more or less laceration occurs, and thus in some cases the perinæum may be entirely lacerated and the anus and vulval opening become continuous with one another. This lesion is seldom seen in the cow. When the foot protrudes through the anus it must be returned as soon as possible, and the calf removed through its normal passage. There is after this great liability to Recto-vaginal Fistula, which must be avoided as much as possible by keeping the contents of the rectum soft, whereby they can pass easily, and by adopting dressings calculated to promote speedy healing of the orifice.

Vesico-Vaginal Fistula is not frequent. It causes incontinence of urine, and the fistula can hardly be got to heal because of the constant passage of the urine. A rupture of the vagina may be far enough forwards to admit of protrusion of the intestines and to be complicated with peritonitis. Injuries, and especially bruises during parturition, are rather liable to cause blood tumours, *Hæmatomata,* in the erectile tissue of the bulb of the vagina.

Leucorrhœa — "*The Whites.*" — Vaginitis sometimes results from injury, but generally subsides rapidly, and is represented by a chronic form of inflammation of the lining membrane of the vulva and vagina, which in some cases is ulcerated, in others simply thickened, and sometimes is the seat of scrofulous deposit. It may be more or less extremely diseased. The discharge varies in amount and in consistence also in constancy of flow. It may be quite white and profuse, or purulent or sanguineous. Also the constitution is variably affected; there

may be considerable fever or scarcely any. Generally the patient exhibits constant sexual desire, but seldom becomes pregnant, and if it does is liable to abort. There usually the general signs of unthriftiness.

Causes.—Gonorrhœa of the bull, debility, and the scrofulous diathesis are the principal.

Treatment.—Tonics, nutritious diet, avoidance of sexual intercourse, and stimulant astringent applications after thorough cleansing. In cases of ulceration, the application of nitrate of silver. These cases sometimes prove very obstinate. A crupous form of vagnitis has been described.

Addendum 1.—The Lactiferous Apparatus.

The mammary gland of the cow is largely developed, having been much increased in size by artificial selection. It consists of four distinct quarters, each with a teat, and sometimes two rudimentary teats, imperforated, are

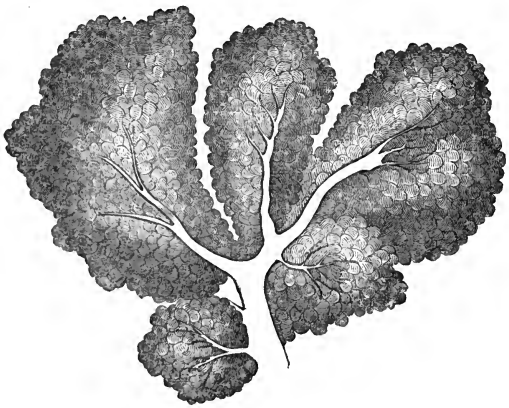


Fig. 111.—Some of the smallest lobules of the lacteal gland of a puerperal woman. × 70. (After Langer.)

situated behind those which are more fully developed. The most frequent malformation is the Absence or Imperforated state of the Teats, and in animals thus formed,

after impregnation the gland enlarges, and in proper time produces milk, but this cannot gain exit; it remains in the milk channels, and gives rise to mammitis. Sometimes an incision at the extremity of the teat will open the partially developed duct, when the milk must be drawn off regularly with a syphon. Usually an abscess forms, and the curdled and decomposed milk is thrown off in the pus. Such animals should not be bred from, as there is some risk, and this, like other vices of conformation, may be transmitted to the progeny.

Mammitis—"*Garget*"—"*Downfall of the Udder*"—inflammation of the mammary gland—is frequent in the cow, as might have been expected from the facts that this animal is used as a milk-producing machine, and has its lactiferous apparatus very largely developed. This disease is of the highest importance as affecting the yield of milk rather than the life of the animal. It may be partial or complete, for the quarters of the gland are separated from each other by dense fibrous septa, so that, practically, there are four glands, and inflammation may rage in one or more quarters without the rest being affected. It may be acute or chronic, and most frequently is seen in young cattle, especially primiparæ (those with the first calf), kept in a plethoric state. Sometimes it commences directly after calving, but in other cases only comes on some time after. Exposure to cold when heated, injuries of various kinds, obstructions to the flow of milk, eczema epizootica, and other specific disorders, may be enumerated as causes; in some cases it seems traceable to metastasis from the lungs, since its appearance is associated with sudden disappearance of pneumonitis. It has been observed to be most frequent in hot summers. Among the most frequent causes must be included imperfect removal of the milk ("Hefting"), and allowing the animal to remain too long without milking, to ensure a full and tempting bag at the time of sale.

Symptoms.—Fever runs high and the affected gland is swollen, hot, painful, and hard to the touch. The skin investing it is reddened, and there is generally lame-

ness of one hind limb. The milk is markedly decreased and is curdled, and often intermingled with blood, or simply a thin serous fluid is removed when efforts are made to milk the animal. The inflammatory action may originate in the substance of the gland, or extend from the openings of the teats into the ducts. As the disease progresses resolution may be gradually brought about with subsidence of acute symptoms. *Suppuration* is of frequent occurrence, and is denoted by softness of some part of the gland, which pits on pressure. The abscesses sometimes involve a very considerable part of the gland substance, forming sinuses and fistulæ extending from the milk sinuses to the surface. In more acute cases *gangrene* takes place, and the mortified portions of gland become cold, pasty to the feel, and are removed by sloughing; at the same time the constitutional symptoms have a markedly asthenic character. When the inflammation is less acute *induration* is apt to occur, constituting the so-called "*scirrhous*" condition of one or more quarters of the udder. In either of these cases, suppuration, gangrene, or induration, the quarter is lost.

In the purchase of a cow the state of the udder, the perfection of all its quarters, must be specially looked to. We have already alluded (p. 174) to a form of septic mammitis, which has been described, and admitted that it is just possible that there is a diphtheritic form of the disorder, in which the milk may prove the vehicle of contagion, but we have no positive evidence on this point.

Treatment of this disorder comprises constitutional and local antiphlogistic means. A cathartic dose should be administered, and the animal allowed nitre in the drinking water. Aconite will counteract the systemic excitement, and in some cases it is thought advisable to bleed. This measure will prove beneficial when the inflammation runs very high, threatening gangrene, otherwise it may be omitted. The superficial abdominal or milk vein used to be preferred for this operation; it is remarkably developed in the cow, and takes a course from behind forwards to the internal thoracic veins. This local abstraction

can have no more beneficial effect than general bleeding. The vessels the milk vein receives from the udder are very small, for the greater part of the blood from this

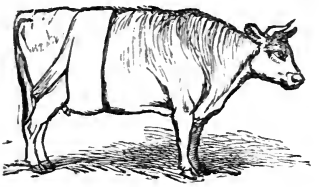


FIG. 112.—Means of supporting the udder in mammitis. (Armatage.)

FIG. 113.—Injection of fluids into the mammary gland. (Armatage.)

gland passes into the femoral veins indirectly through the subpubic. Local treatment comprises removal of all the milk at regular intervals, either by milking, by use of the teat syphon, or by allowing the calf free access. Sometimes the cow will not allow the calf to suck at the diseased quarters. Next foment freely, and afterwards apply a poultice containing belladonna to the whole gland, supporting it and the weight of the organ by a wide bandage passed over the loins. As soon as suppuration has taken place, and the abscess is perceptible, it must be opened with a lancet, or an irregular wound will result from its bursting, and the pus will burrow extensively and cause disorganisation. By early puncture a part of the quarter may be preserved. Subsequently the abscess cavity should be dressed with tincture of myrrh or carbolic ointment. In cases of gangrene the strength of the patient must be supported by means of stimulant tonics, and the mortified parts excised, or if they have sloughed away, the wounds must be dressed with solution of chloride of lime or of carbolic acid. In those cases where the disease

assumes a chronic character, and there is a tendency to induration, we must endeavour to break down the masses of curdled milk in the gland by alkaline injections through the teats, and constant attention to milking; and we must endeavour to promote the removal of exuded fibrinous matter in early cases by stimulating applications, as soon as all active inflammation has subsided; later, by iodine ointments and iodide of potassium administered internally. Throughout cases of mammitis the use of food materials containing large quantities of milk-forming elements should be avoided. In the early stages the calf may be allowed the milk, but when this becomes mingled with inflammatory products, and especially when gangrene sets in, this fluid must be thrown away. During œstrum and the first production of milk a *congested condition of the mammary gland* has been observed. This is the early stage of true mammitis, but the supervention of inflammation may often be prevented by the timely withdrawal of milk and fomentation. Mammitis is very seldom seen in "dried cows" ("drapes").

Sore Teats — Erythema Mammillarum — has been already mentioned (see "Diseases of the Skin," p. 349).

Tumours on the Teats.—Warty growths are sometimes seen on the teats; they interfere with milking, and are liable to injury, but can be easily removed with the knife, or by means of ligatures.

Obstructions in the Teats are not rare; in milking the animal they can be felt as nodules along the course of the duct, and the flow will be more or less impeded. These are either masses of curdled milk, small tumours attached by pedicles to the mucous membrane, or Lacteal Calculi. These impediments to free flow tend to produce mammitis, and must, therefore, be removed. This is not always an easy matter, but, when not extracted, they may be returnable to the galactophorous sinuses, where they will often remain without causing inconvenience.

Inflammation of the Lining Membrane of the Duct, occurring as a complication of mammitis, sometimes results in stricture of the passage. This may be relieved by

frequent passage of probes or syphons of gradually increasing size.

Relaxation is seen as a result of the practice of allowing over-accumulation of milk. It gives rise to LACTORRHŒA. The mechanism by which the milk is retained in the galactophores is variously described as an elastic ring or a sphincter of muscular fibre. The fact that the cow can retain the milk if an attempt be made to remove it by a stranger seems to support the latter opinion. When this muscular substance is disordered a free flow takes place. To palliate this the sphincter has been artificially replaced by an elastic band which compresses the teat enough to close its passage but not to strangulate it. This is removed at milking time, and seems to answer in many cases. Lactorrhœa sometimes results from inattention and want of milking after removal of a calf ('Edinburgh Veterinary Review,' vol. iii, p. 190).

ADDENDUM 2.—MILK AND ITS DISORDERS.

The milk of the cow has a specific gravity, averaging 1030, and contains less fatty matter, albumen, and sugar than that of the human female, but considerably more casein and salines. It varies very much in quality and quantity with the nature of the diet. Is tested by means of a special form of the hydrometer, termed the lactometer, and also by microscopical examination. We need not enter into details of this, but simply remark that though under healthy conditions the variations in quality and quantity of this fluid are rather extensive, they are more so as a result of disease.

Agalactia is the non-production of milk in consequence either of atrophy of the mammary gland, which results from inflammation, or of debility of the system in general. In the former case it is incurable, in the latter, by judicious feeding with highly nutritious diet, the flow of milk may be restored. The value of galactagogues is not quite a matter of certainty. It is said by some that

agalactia takes place in two or three years after spaying has been performed, but others assert that this is only a

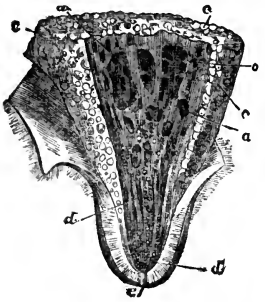


FIG. 114.—Section of the cow's teat. *a a*. Principal lactiferous ducts. *b*. Lactiferous sinus. *c c*. Acini. *d d*. Dartoid tissue of the teat. *e*. Orifice of the teat. (From Colin, "Physiologie des animaux domestiques.")

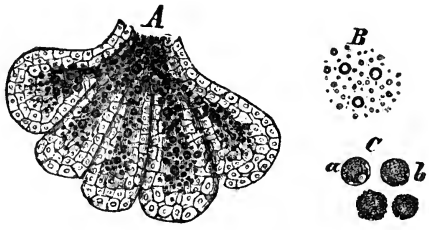


FIG. 115.—*A*. Lobule of mamma filled with milk. *B*. Milk globules. *C*. Colostrum. *a*. Cell with visible nucleus. *b*. Cells from which the nucleus has disappeared. (From Colin, 'Physiologie des animaux domestiques.')

very exceptional condition, the secretion of milk being constant and lasting for a long time. Aged cows dry up, and a loss of milk is the first symptom in many important diseases.

Hypergalactia, or prolonged lactation, is not so frequent and is often seen in very good milkers. It is hardly a diseased state, but it constitutes a great strain on the system.

CHANGES IN THE QUALITY OF THE MILK are—(1) due to *excess or deficiency of natural components*. Thus, some milk gives scarcely any cream, while in other cases the secretion is scanty, but very rich. Bluish watery milk is given sometimes in normal quantity by debilitated animals. These and other similar conditions are dependent on feeding, and other points of management. The nature of the food very frequently affects the flavour of the butter. Sometimes it is found that the milk gives little butter, and at other times is not valuable for cheese. (2) *Admixture of foreign matters*, as blood, pus, specific discharges, bacteria, &c. These result from specific or

ordinary inflammation; in the former case the milk may prove the vehicle of contagion to man and other animals. In foot-and-mouth disease, and other specific disorders, the calf if left with the dam may become affected with a virulent form of the disease. Medicinal agents administered to the cow pass off in the milk and may seriously affect the calf or children fed on this fluid. It has been proposed to thus prepare medicines in a palatable and bland form for human use at the expense of the cow, but this method has not been generally adopted.

Fig. 116.—Milk or Teat Syphon.

Addendum 3.—Diseases of very Young Animals.

The young animal on birth is sometimes found asphyxiated. No respiratory efforts are made; the "necessity for breathing" does not produce the usual effect. Artificial respiration may be tried or douching with cold water.

Umbilical Hæmorrhage may result from breaking off of the cord too close to the abdomen. The usual styptic measures may be tried, and if possible, a ligature put on.

Perviousness of the Urachus, Gastro-enteritis, and *Herniæ* of young animals have been already described. Also we have alluded to the *accumulations of meconium,* which give rise to constipation and general abdominal disorder, and result either from excessive accumulation, or from the young animal being deprived of the colostrum, its natural cathartic.

Inflammation of the Umbilical Cord—Omphalitis—is especially seen in the progeny of scrofulous animals, and may result from any ordinary irritating influence; the tendency calves have to suck the remains of the umbilical cord especially gives rise to this. The scrofulous cases are very obstinate, but ordinary ones soon suppurate, and there is a

tendency of the pus to pass up the cord and cause sinuses. These must be opened, the young animal removed from among other calves, and the inflamed part fomented and protected from injury, after opening it must be dressed with the glycerine or oil of carbolic acid. No special measure is necessary in the treatment, but a long and severe case of this disorder may considerably retard the development of the calf. It also may give rise to a disorder which has been described by M. Lenglen, of Arras, in a paper which has been translated for the 'Veterinarian,' December, 1880. It is termed GANGRENOUS STOMATITIS, being similar to a disease of the same name which affects children who are badly nourished. The buccal membrane sloughs in patches of considerable size against the molar tooth, and there is a tendency to the formation of an abscess in the cheek or lips. Fœtid diarrhœa is present, and often carries off the patient. Though most frequently seen in very young animals this disease may be found in calves several months old, and should be treated by nourishing diet, vegetable tonics, and, according to M. Lenglen, coffee. The lesions should be touched with caustic after the sloughing patches have been removed. All the hygenic conditions should be carefully regulated.

ŒDEMA OF THE UMBILICUS also results from calves sucking one another. It must not be mistaken for umbilical hernia. A bandage may be put on to protect the part.

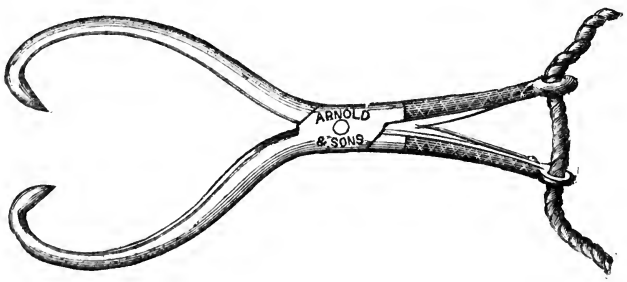


FIG. 117. –Parturition forceps.

NOTES ON THE BIBLIOGRAPHY OF CATTLE PATHOLOGY IN THE ENGLISH LANGUAGE.

For a long time after some scientific knowledge had been brought to bear on the subject of the diseases of the horse, the treatment of other domesticated animals remained in the hands of the most ignorant of empirics, who, under the name of "Cow leeches," were called in to attend such cases as proved beyond the experience of the owner. The vilest and most complicated of nostrums were administered by these worthies, and it seems that it was generally considered to be safer for the farmer to trust to his simple knowledge of disease and the prescriptions handed down to him by his ancestors, than to expend money on medicinal treatment with little prospect of receiving its value, and considerable likelihood of detriment to his stock. Hence, we find that accounts of the diseases of the ox are, with those of other animals, treated of in works on Husbandry, such as Markham's *Way to Wealth* and *Country Farmer*, and we need scarcely say that the language used and the notions expressed in these works were markedly different from those sanctioned by science. Before 1825, some books were produced specially touching upon the management and diseases of cattle, of these we may mention:

Mascall on "Cattle" (1680).
Mills on "Cattle" (1776).
Downing on "Cattle" (1797).
Feron's "Farriery" (1803).
Rowlin's "Cow Doctor" (1804).
Boothby on "Cattle" (1809).
Causer on "Domestic Animals" (1822).

Also the works of Lawrence, Tindall, Rydings, Peck, and Rydge, and those of Clater and White, which, under much modified forms, have remained to the present day; the latest edition of Clater's *Cattle Doctor* by Armatage being one of no little value, to which we are indebted for many useful hints and illustrations. White was an author of much repute and merit, and his *Veterinary Dictionary* and *Cattle Medicine* are still worth examination, especially the 1842 edition of the latter, which was brought out by Mr. W. C. Spooner, an eminent veterinary surgeon and accomplished writer. Topham produced a book specially on the *Diseases of Cattle*, and this period of the evolution of the literature of cattle pathology led to such monographs on special subjects, as Parkinson on *Parturient Animals*, Skellet on the *Breeding Cow*, and Blurton on *Milking*.

In 1798 was published Jenner's remarkable work on *Variola Vaccina*.

During the rise of veterinary science appeared books useful both

for the owners of cattle and to the members of the young profession; of these the one which most largely has influenced the progress of cattle pathology is that excellent work, YOUATT *On Cattle*, which appeared in 1834, and may still be consulted with benefit in spite of the vast strides of all branches of pathology since then. More recently members of the veterinary profession have contributed largely to the advancement of this branch of science, and our leading authors have treated of the diseases of cattle generally with those of our other patients, as in the works of BLAINE, DICK, GAMGEE, and WILLIAMS, the *Veterinary Surgery* and *Veterinary Medicine* of the last of these authors, and the work of GAMGEE on *Our Domestic Animals in Health and Disease*, are those which we suggest as most valuable to the student of cattle pathology in the present day. For information on special subjects he cannot do better than consult such works as those of FLEMING on *Animal Plagues, Rabies and Hydrophobia, Veterinary Sanitary Science and Police*, and (especially) *Veterinary Obstetrics*, the publication of which has rendered it less necessary for us to enter into prolonged treatment of this section of bovine practice than has seemed right to our predecessors in this branch of professional literature. Also WALLEY'S *Four Bovine Scourges* is of special value and interest; it is a marked gain to veterinary science. We must here also allude to the small but useful papers by MORTON and SIMONDS, the former on *Calculous Concretions* and *Toxicology*, the latter on *Pleuropneumonia, Parturient Apoplexy*, and so on. Also to that formidable but interesting volume, GAMGEE on *Cattle Plague*. For our information on the action of medicinal agents we are indebted to the works of MORTON, TUSON, and FINLAY DUN; and we have derived much valuable matter from DR. COBBOLD'S *Parasites*, and *The Parasites of our Domesticated Animals*, as well as from notes on his course of lectures at the Royal Veterinary College, which we, as a student, had the privilege of taking. A few works on cattle have been recently produced in America, of these we need only allude to PROFESSOR JAMES LAW'S *Farmer's Veterinary Adviser*, as in many points original and always worth reading. DOBSON *On the Ox*, through which we have been fortunate enough to obtain many of our illustrations, is addressed to the farmer as well as the practitioner, and is therefore hardly sufficient for the requirements of the profession in the present day. It has proved of considerable use to students and practitioners, and we can conscientiously allude to it as a simple, interesting, and *practical* work. With those of Youatt, Armatage, and Spooner, already alluded to, it has recently represented that portion of veterinary literature most directly dealing with diseases of the ox. Not the least valuable portion of the literature of my subject must be sought for in the columns of such periodical publications as the *Veterinarian, Veterinary Journal, Edinburgh* and *American Veterinary Reviews, Veterinary Record, Abstract of Proceedings of the Veterinary Medical Association*, and also the journals of the various agricultural societies.

INDEX.

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16

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