SECTION OF DISEASED LUNG; recent case of Lung Plague. Thin end showed black hepatization; the centre, red hepatization; the thick end, interlobular infiltration. Several blocked vessels are shown.

THE FARMER'S VETERINARY ADVISER

A GUIDE TO THE

PREVENTION AND TREATMENT OF DISEASE

IN DOMESTIC ANIMALS

By JAMES LAW

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WITH NUMEROUS ILLUSTRATIONS

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PREFACE TO THE EIGHTH EDITION.

The "Farmer's Veterinary Adviser" has been so favorably received in America, Canada, and England that I feel called upon to issue a revised edition, to cover the ground over which Veterinary Medicine has advanced in the past eleven years, since it was first published, and thereby to continue to deserve the confidence hitherto accorded it. The advances of the past decade have been marvelous indeed, but most largely in the field of contagious diseases and their prevention, and to meet this progress, I have in the present edition added two complete chapters devoted to this subject. The third chapter has also been considerably enlarged by the introduction of additional plagues, which either exist on the North American Continent or are specially liable to be introduced through the ordinary channels of trade. The changes in the remaining part of the book are less extensive, but they will be found to add materially to the fullness and clearness of the work as a whole.

Some of the changes made may not be fully appreciated at first sight by the average farmer, yet they were considered essential for two reasons, first, the adaptation of the work to the purpose to which it has been largely put as a veterinary text-book in agricultural colleges; and second, for

the education of the agricultural community in the need of effective methods for *stamping out* animal plagues, a subject which has been so ignorantly and ineffectively dealt with in our legislative halls.

The author feels warranted in bespeaking for the revised edition a continuance of those favors that have been so freely accorded to its predecessors.

JAMES LAW,
Cornell University.

ITHACA, *March*, 1887.

PREFACE.

This work is especially designed to supply the need of the busy American farmer who can rarely avail himself of the advice of a scientific veterinarian. The author is deeply sensible of the low estimate placed upon Veterinary Medicine and Surgery in the United States, and the necessity of educating the public up to a better appreciation of its value. We have a property in live stock estimated at $1,500,000,000, and rapidly increasing in value, consisting of at least six different genera of mammals, besides birds, and therefore affording an almost unlimited field for the practical exercise of humanity, political economy, and scientific research in the pursuit of Veterinary Medicine. In the Old World millions are saved yearly to each of the Western European Nations in the exclusion and extinction of animal plagues, and many instances can be adduced of an intelligent veterinary supervision saving at the rate of $30,000 per annum on a stud of 400 horses. But in the Western Hemisphere, apart from the larger cities, the great pecuniary interest in live stock is largely at the mercy of ignorant pretenders, whose barbarous surgery is only equaled by their reckless and destructive drugging. The constantly recurring instances of absolute and painful poi-

soning, and cruel and injurious vivisections practiced under the name of remedial measures are almost sickening to contemplate. To give the stock-owner such information as will enable him to dispense with the unprofitable and perilous services of such pretenders, and to apply rational means of cure when he happens to be beyond the reach of the accomplished veterinarian, is the aim of this book. and this, it is confidently hoped, it will accomplish for all who will intelligently study its pages.

To secure this object, and yet to place the book within the reach of all, it was necessary to sacrifice all extended discussion of diseased processes, and questions in pathology, and therefore the reader who may discover deviations from current opinions is requested to suspend his decision until he has consulted the Author's larger work, in which the reasons for these positions will be given.

With this view of still further condensing the work, the doses of medicines for the different animals are rarely given in the text, but one or more agents are named as applicable to every distinct stage or phase of the disease and species of patient, and the reader must turn to the list of drugs given at the end to find the amount required for each animal. In doing this he must note particularly for what purpose the agent is given and select the dose accordingly, as the effect of large doses is usually essentially different from that of small ones. Thus common salt given in large doses to cattle is purgative and reducing, while in small ones it is alterative and tonic. Sulphur in large doses is laxative, but in small ones alterative, expectorant, and diaphoretic. Oil

of turpentine in large doses is purgative and vermifuge, in small ones diuretic, stimulant, and antispasmodic. Attention must also be given to the age and size of the patient, as more fully set forth in the Appendix.

Illustrations have been freely introduced to render the text more lucid, and, being selected from those prepared for the Author's larger work, may be implicitly relied on.

In the list of contagious diseases are included not only those that are habitually developed on American soil and those already introduced from abroad, but also such as prevail in Europe, and are liable at any time to be brought into our midst by importation. It is no less imperative that the American farmer should be forewarned of pestilences that threaten him from abroad, than of those that beset him at home. For all such affections the principles that should guide us in preventing and extinguishing the disease are concisely but clearly set forth.

All the important parasites are introduced, and their conditions of life and individual metamorphoses in and out of the bodies of domestic animals referred to, as well as their migrations from man to animals and from animals to man wherever such exists. The vast importance of animal parasites is only beginning to be realized in connection with their frightful ravages in countries (England, Australia, Buenos Ayres, Egypt, Abyssinia, Iceland, India, etc.) into which they have been introduced, or where they have been allowed to increase unchecked, and a concise statement of their forms, habits, and results is therefore imperatively necessary for the protection of the stock-owner.

This subject has accordingly been brought up to the date of present observations, and though short enough for the perusal of the busiest, it will furnish a sound basis for the limitation and destruction of each of these noxious pests.

JAMES LAW,
Cornell University.

ITHACA, *May*, 1876.

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FARMER'S VETERINARY ADVISER.

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INFLAMMATION.

Inflammation forms the essential part of so many diseases, and a concomitant of so many more, that a brief statement of its features and phenomena appears desirable, even in a

condensed manual like the present. From the days of Hippocrates inflammation has been recognized by *redness, heat, pain, and swelling*, followed by *resolution* or *induration, suppuration*, or *gangrene.* Such a definition is, however, sadly insufficient in view of modern discoveries as to the different phases of the inflammatory process. Redness occurs in the transient blush, heat in the feverish system, pain from simple passing nervous disorder, swelling from dropsy, induration from the formation of tumors, and gangrene from the blocking of blood-vessels or other exclusion of blood and the means of nutrition from a part, and in no one of these cases need there be an element of true inflammation. Perhaps no definition can be given which will cover all the phenomena of inflammation.

INFLAMMATION IN VASCULAR TISSUES.

These phenomena, as seen in a transparent membrane like the web of the frog's foot or the mesentery may be stated as follows: 1st. *Disturbed circulation* evinced by contraction, quickly followed by dilatation with elongation of the capillary blood-vessels, and a rapid, followed by a slow, and even oscillating or backward movement of the blood within them, branching redness. 2d. *The blood-globules become sticky and adhere together* and to the walls of the capillaries so as to block them in points. 3d. *The fibrin of the blood coagulates around these masses of globules*, forming points of complete obstruction, and constituting those minute spots of deep redness which cannot be effaced, even for an instant, by the pressure of the finger on inflamed skin. 4th. *The liquid parts of the blood ooze out in excess through the capillary walls* into the tissues, causing the swelling. 5th. *Blood-globules and granules escape through the walls of the vessels* and degenerate into pus-cells or become the centres for the growth of new tissue in the exudate. 6th. *The nuclei* (*cells*) *presiding over the nutrition, etc., have*

their functions impaired or lost; the inflamed skin in the frog has its pigment-cells unchanged while all the body beside has changed color, the inflamed retina no longer sees, the inflamed nose no longer smells, the inflamed mamma no longer yields milk, the inflamed finger has no more the proper sense of touch, and the inflamed cells that control nutrition no longer build up the tissues amid which they lie, but tend rather to a simple multiplication of their own cell forms, as do the cells of the early growing embryo. 7th. In an extensive inflammation *the large arteries proceeding to the diseased part have their coats abnormally rigid*, giving a harder beat to the pulse and determining a more abundant flow of blood than in the corresponding vessels of the healthy part. This doubtless results from the disorder of the vaso-motor (sympathetic) nerves, and this disorder is involved in the causation of the derangement of the capillary circulation as well, since the cutting across of a branch of these nerves going to a part promptly induces inflammatory changes in such part. This tendency to the production of inflammation through nervous influence is further shown in the extension to the other of a violent inflammation of one eye caused by a mechanical injury. Yet the essential changes may be induced in the tissues by irritants, though the nerves proceeding to the part have been cut or the blood-vessels tied.

It is worthy of notice that in extensive inflammations in otherwise healthy systems the circulating blood acquires a great increase of fibrinogen (often doubled), and the blood-globules become abnormally adhesive, so that before the drawn blood has time to coagulate the globules adhere together in masses and precipitate toward the bottom, leaving the upper layers of the clot of a dull yellow hue (buffy coat). This is shown in the blood of the healthy soliped, but in other animals it implies inflammation, apart from the conditions of plethora, anæmia, pregnancy, or over-driving. In

the horse suffering from inflammation the normal buffy coat is increased. The blood of inflammation also coagulates more firmly and contracting most toward the centre assumes a cupped appearance on the surface.

These changes in the blood and nervous system are associated with an increase of body temperature and other manifestations of fever proportionate to the extent and violence of the inflammation. Again, in both inflammation and fever, the disease process may be of a strong type (sthenic), or of a low type (asthenic, adynamic).

INFLAMMATION IN NON-VASCULAR TISSUES.

Inflammation in tissues unprovided with blood-vessels may be observed in the irritated transparent cornea of the eye, or the cartilage covering the ends of bones in joints. Each when inflamed has its nutritive function impaired and loses its clear, translucent aspect, so much so that in the case of the eye one can no longer see into its interior. There may be as yet no real thickening, and no film of exudation formed on its surface. It is the pre-existing structures that have become opaque by change in the process of their nutrition. If a thin slice of this inflamed cartilage is treated with picric acid and placed under the microscope it is found that the nuclei within the cartilage-cells have become individually larger, that the cells embedded in the cartilaginous matrix are more numerous than is normal, and that, when the inflammation is most active, even cell-walls are no longer formed, but that a mass of rapidly multiplying nuclei is taking the place of the solid transparent matrix. As in the vascular tissue, so in the non-vascular, the power to build up the sound tissue (cartilage, corneal tissue) has been temporarily lost, while there is a mere growth of a cellular or embryonic tissue at the expense of the pre-existing structure. It remains to be added that in the inflamed cartilage or cornea there is an abundant infiltration of wandering

white blood-cells, which have escaped from the vessels in the adjacent vascular tissue and made their way into the inflamed and softened cornea.

Thus in both types of inflammation, in the vascular and non-vascular tissues alike, there is this abundant concentration of plastic cells (white blood-cells and tissue nuclei), which assume for the time the functions of the cells of the early embryo from which all the varied tissues of the future animal are to be developed. Hence these cells, which grow so abundantly in inflamed parts with the size, form, and functions of embryonic cells, are not inaptly called embryonic cells, and the tissue, which they first form, embryonic tissue. These cells may be looked upon as the guardians of the system, charged with the duty of removing from the part all noxious, useless, or extraneous matter, and building up new tissue to repair the breach resulting from the injury. No sooner is the injury sustained than there is established an increased flow of blood through the vessels of the injured part (or through the nearest blood-vessels in case the injured structure has no vessels), the white globules are delayed in the capillary vessels and passed through their walls, and at the same time the tissue nuclei increase in size and numbers, abandon their habitual work of building up tissue, and together with the wandering blood-cells devote every power to the removal of the irritant and the repair of the breach. A similar work is effected in an entirely natural way in the tail of the tadpole when developing into a frog. Embryonic or lymphoid cells increase enormously in the tail, feeding upon the tissues of the now superfluous organ, and gradually absorbing and removing the whole mass. So it is, too, in the case of offensive living organisms introduced into a tissue. When bacteria have been thus inoculated inflammation is at once set up, and the accumulating cells, if numerous enough relatively to the micro-organism, take the bacteria into their substance and gradually

dissolve and digest them, thereby rendering the inoculation harmless. If, however, the bacteria are too numerous or too poisonous (in themselves or their products) to be thus easily devoured, the opposite result ensues, the cells of the blood and tissues sent to dispute their invasion are themselves destroyed, and there takes place the death and removal of a circumscribed portion of tissue, an extensive suppuration and abscess, a spreading gangrene or ulcer, or a fatal general infection. A small dose of such bacteria is devoured, removed, and rendered harmless by the defensive work of these exudation-cells; a larger dose may establish a temporary stronghold in the tissues, which is finally circumscribed, loosened, and thrown off as a slough by the active agency of the investing animal cells around it, while a still larger dose conquers the defending army, and extends its sway over the entire body with grave or fatal effect.

INFLAMMATORY EXUDATIONS AND EFFUSIONS.

These vary much in different cases according to the grade and stage of the inflammation, the part affected, and the subject of the disease.

1st. *Serous Exudations.* These consist of the liquid elements of the blood, with only a limited amount of the fibrine-forming element (fibrinogen), and consequently little tendency to clot firmly. The effused fluid is distinguished from the liquid of mechanical dropsy by the presence in it of the fibrinogen, of albumen, of cells, and of nuclei. The dropsical fluid does not coagulate unless heated, and contains less common salt and phosphates than the inflammatory effusion. Serous exudations are characteristic of the early stages of inflammation, and of inflammations of serous membranes (pleura, peritoneum, joints) in strong, vigorous subjects. They are especially dangerous by reason of interference with the functions of organs by pressure, as with

the dilatation of the lungs, the movements of the heart, the movement of joints, or the integrity of the brain or spinal cord. When the disease that caused them has subsided they are usually speedily reabsorbed, though not invariably so.

2d. *Mucous exudations* are formed wherever mucus is produced in health, as in catarrhs of nose, eyes, throat, and other mucous membranes. They contain filaments of precipitated mucin insoluble in acetic acid or alcohol, and globular cells in all stages of change from the mucous to the pus-corpuscle, the latter recognized by its bipartite or tripartite nucleus, manifested by contact with acetic acid.

3d. *Fibrinous Exudations. Inflammatory lymph.* This oozes out through the vessels in a liquid state and afterward coagulates by reason of its contained fibrinogen or plasmin, which exists ready formed, but in solution, in the blood. It is the excess of plasmin which distinguishes this from the serous exudation. The coagulation of plasmin may result from the ferment globulin escaped from the blood-globules, and it always coagulates promptly on contact with inflamed tissues, probably from the presence of the same or an allied ferment. If, on the other hand, the exudation escapes into a healthy cavity, and comes in contact with healthy tissues only, it may, like blood in similar circumstances, remain liquid for months. It is specially injurious by enveloping organs (lungs, heart, bowels, iris) and hampering their movements, or by binding them to adjacent structures by false membranes. In coagulating it becomes first fibrillar, then granular, and finally undergoes molecular disintegration (Cornil and Ranvier) or development into new tissue (Paget). When organized it usually takes the form of the adjacent tissue; in granulating wounds and between serous membranes it is fibrous, and between the broken ends of bones it is bony.

Fibrinous exudations are especially seen in a high grade

of inflammation, in connection with fibrous tissues and in strong vigorous subjects.

4th. *Blood Exudations.* As already stated, blood-globules escape through the walls of the vessels in all inflammations, though seldom in such quantity as even to stain the tissues. Minute ruptures of the capillary vessels are not uncommon with punctiform clots in the tissues, but extensive escapes of blood are usually indicative of a specially unhealthy type of inflammation, usually associated with a specific and deadly poison, as in anthrax, rinderpest, swine-plague, purpura hæmorrhagica. They are further most common from newly formed vessels, which are yet soft and possessed of little power of resistance.

5th. *Croupous Exudations.* These are deposited on diseased surfaces in the form of false membranes, composed mainly of cell-elements, epithelium, and pus-corpuscles in a thin network of fibrine, mucin, or both. To these belong the membranous products of croup and diphtheria, and the false membranes that appear independently of these poisons on violently inflamed mucous membranes (croupous enteritis, etc.)

RESULTS OF INFLAMMATION.

Resolution. This is the condition in which a slight inflammation, which has not advanced beyond the stage of liquid effusion, has the exudate reabsorbed, and the blood-vessels and tissues restored to their healthy condition. If this occurs with extraordinary rapidity the term *delitescence* is applied to it, and there is danger of its reappearance elsewhere by reason of clots from the capillaries being suddenly loosened and washed onward to block other capillaries in the lungs or other distant organs. This occurrence of a secondary disease at a distance, when a first has suddenly subsided, has been named *metastasis*, and is usually due to the blocking of the capillaries by blood-clots.

Inflammatory New Formations. Of the growths in lymph there are two principal kinds: first, *the plastic, fibrinous, granular*, or *molecular;* and second, *the aplastic, croupous*, or *corpuscular*. The first form tends to develop into new structure, the second to disintegrate and decay. The tendency to one or other form depends largely on the strength or weakness of the system's health, on the deficiency or excess of corpuscles in the exuded fluid, and on the distance of the latter from living tissues and blood-supply. Much also depends on the predisposition of the genus, the tendency to suppuration in lymph being in a descending series from horse, ass, and mule, through ox and sheep, to dog, pig, and, finally, the bird, in which latter suppuration is quite exceptional.

Suppuration. In inflammations of a high type, in those occurring on the skin or mucous membranes in which there is an extraordinary increase of nuclei and embryonal cells, and in lymph thrown out in excess at one point, so that its central parts are far from vascular tissue, the cell elements undergo a rapid increase and degradation into pus-corpuscles, and its solidified intercellular lymph undergoes granular decay and liquefaction into the liquid of pus.

While the above conditions are favorable to the formation of pus, the process of suppuration must now be recognized as an infective process due to the propagation of bacteria (mainly chain forms—*Streptococcus pyogenes*—and cluster-groups—*Staphylococcus pyogenes*). These or other bacteria are found in the pus of acute abscesses, and when absent in chronic abscesses are to be considered as having perished since the abscess was recent and active. Inoculation of a rabbit with an excess of the pus of an acute abscess produces general purulent infection (pyæmia) and early death; from a medium dose an abscess is produced; while from a small dose there is no effect whatever. In the latter case the bacteria are overcome and devoured by the abun-

dance of vitally potent white blood-globules and tissue-cells. This pus-forming action of these bacteria explains the great difference in results in wounds exposed to the air and those in the interior of the body and far removed from air and its floating bacteria. A broken bone, with no wound in the skin and little injury to parts around the fracture, is readily repaired, without any formation of pus, if merely kept still and immovable; whereas a broken bone, continuous with a wound through the skin, always tends to form pus and is extremely dangerous even to life. The tendency of every open sore is to form pus on its surface, but this may be arrested and prevented by a free use of disinfectants and a covering which shall arrest and filter out the germs. Similarly in an abscess the injection of disinfectants, without the formation of any perceptible permanent opening to the outer air, will put a stop to the pus-formation. The subjection of an inflamed part to the control of these pus-forming bacteria is dependent on the lowered vitality and power of resistance of the inflamed tissues, and of the white cells of their circulating blood. Healthy parts can successfully resist them, though they are constantly present in surrounding air and on objects, but in this, as in all other cases; of bacterial infection, so soon as the tissue is injured, inflamed, and lowered in its power of vital resistance, the pyogenic bacteria assail it successfully. Hence, too, the more abundant exudations of lymph, the centres of which are farthest removed from the healthy tissues, and from the influence of their *vital resistance*, are the most prone to suppuration. That the germs can make their way to such deep-seated exudations in the substance of solid tissues is to be accounted for by their gradual advance through the inflamed and weakened structures from the adjacent skin or mucous membrane, or in some instances by reason of their presence in small numbers in the blood. It is further noteworthy that those animals in which suppuration does not occur readily are such as have

a special power of resistance to some other organic poisons. Thus the hog, which is supposed to be proof against snake-bite, is also, to a large extent, proof against the pus-forming bacteria. For further notice of this subject see article on *Pyæmia.*

Pus. This is a white, or yellowish-white, creamy-looking product, composed of a clear, transparent fluid, rendered opaque by numerous floating pus-corpuscles. These pus-corpuscles have the same size as the white globules of the blood ($\frac{1}{2500}$ to $\frac{1}{3000}$ inch) and are peculiar in that each shows within it three or more nuclei, which become visible on the addition of a drop of water or acetic acid. Each of the common embryonal cells found in the inflamed tissue contains two nuclei, the indication of the active increase by division into two, but when the supply of nutriment is checked the nuclei continue to divide, while the cells remain unchanged, and thus every cell comes to contain several nuclei in addition to fatty granules, and constitute pus-corpuscles.

When pus is formed in a well-maintained system and tissue, the outer layer of the lymph is developed into a fibrous sac inclosing the liquid pus and constituting an *abscess.* In an unhealthy system, or when the inflammation depends on some injurious poison, like that of erysipelas, this sac may not be formed, and the pus, burrowing into and between different organs, destroys the connections and substance—*diffuse suppuration.* When an abscess has formed in soft tissues its investing sac shrinks as it assumes the fibrous character, and the confined pus being incapable of compression, presses the membrane outward on the side in which the surrounding tissues are most loose and least resistant, hence, usually, though not always, in the direction of the skin, the soft tissues become absorbed and removed in the track of the advancing pus; and, finally, the latter reaches a surface and escapes. Thus, an abscess usually bursts

through the skin, but also, at times, through a mucous membrane into the lungs, bowels, etc., or through a serous membrane into chest, abdomen, etc. When an abscess is formed in bone or dense fibrous tissues which press equally on all sides, it may remain imprisoned for months and years after all inflammation has subsided, constituting an *indolent* or *cold abscess.* When the imprisoned pus is inclosed by thick fibrous or resistant tissues at all points but one, it will make its way along the narrow passage of yielding tissue, but as the resulting outlet is constricted, long, and tortuous, the contents cannot readily escape through it nor the walls of the abscess contract so as to expel the confined pus, and the latter goes on forming and discharging through the narrow outlet for months or years. This is a *fistula* or *sinus.*

Healing by Adhesion or First Intention. When a clean-cut wound has the blood staunched and its lips brought together without exposure to the air (or contact with pyogenic germs), they adhere at once and heal without pus or any appreciable formation of new tissue. Here the lymph thrown out on the cut surfaces agglutinates them, and the cells, multiplying, form a thin layer of embryonic tissue which gradually develops into a fibrous structure and repairs the breach without any perceptible scar.

Healing by Second Intention. Granulation. When a wound has caused destruction of tissue, or when a simple incision is left exposed to the air, the breach is filled up by new tissue through the process known as granulation. The superficial layer of lymph thrown out on the raw surface becomes oxidized and degenerates into pus, while the deeper layers become solid, fibrillated, the seat of cell-growth, and are finally transformed into a fibrous structure. New blood-vessels form in loops in the developing lymph and constitute the bright-red granulation-points which cover the raw surface. The fibrous tissue into which the lymph is transformed undergoes gradual contraction in development,

and thus, day by day, the edges of the adjacent healthy skin are drawn in, so as to cover the wound more or less perfectly, and a slight scar only is left when healing has been accomplished.

Granule Corpuscles and Masses. This is another degenerative transformation in lymph and, is seen mainly in inflamed glands and brain- and lung-tissue. The cells found in the exuded lymph are made up of granules $\frac{1}{10000}$ inch in diameter, and besides these, large, irregularly shaped masses of granules are extended along the capillary blood-vessels. After the lymph has coagulated these granular masses soften and liquefy preliminary to re-absorption and removal, and the restoration of the tissue to a healthy condition. When in excess this softens and disintegrates the tissues, leading to permanent loss of substance.

Development of Lymph into Tissue. This is equivalent to what takes place in the formation of the sac of the abscess or of granulation-tissue. The liquid lymph in coagulating, becomes fibrillar, and the exuded cells and nuclei and those of the adjacent tissue, having an abundant supply of blood and nutriment, multiply first as simple, rounded embryonic cells, then deposit around them new tissue, becoming elongated, spindle-shaped, branching, etc., and thus get imbedded in a fibrous material of their own formation. These new formations are usually of a low type of organization, like white fibrous tissue or bone, and hence, although breaches in the higher structures like muscle, nerve, gland, skin, are filled up, it is usually only by the drawing together of the remaining healthy parts by these new formations without the restoration of any of the original tissue which has been destroyed. The cicatrix (scar), alone is made up of new material.

Lymph developing in this way may undergo any degeneration to which normal tissues are subject. Thus it may undergo black pigmentary (*melanotic*) degeneration, it may

become impregnated with lime-salts (*calcified*), it may wither up into a hard *gelatiniform* or *horny* mass, or it may undergo *fatty* degeneration.

Fatty degeneration is the most common form, and consists in the excessive deposit of fatty granules, first in the cells which are in excess or badly nourished, and next in the adjacent tissue, the normal elements of which are replaced by fatty granules.

Softening is an almost constant result of inflammation. The exudate infiltrates and separates the tissue elements, destroying their cohesion; its liquefaction impairs this still further, and the more or less perfect transformation of the tissue into embryonic tissue entails the loss of its rigidity and power of resistance. Thus the inflamed brain-tissue may become a mere pulp, and the inflamed bone may be cut with a knife.

Ulceration is closely allied to softening. On the surface of a sore there is an excessive exudation of lymph, which loosens and disintegrates the layer of lymph that is already in process of development, and also a part of the tissue beneath. The cells in these parts fail to develop naturally and to build up good tissue; they become fatty, die, and together with the tissue in which they lie, break down and pass off as a pulpy débris. Thus the sore constantly deepens and widens, or at least refuses to contract and heal.

Gangrene or *death of a part* is another effect of inflammation. It results usually from the cutting off of the blood-supply through the obstruction of the blood-vessels; by the pressure of excessive exudation in unyielding structures, as in bone, or under the hoof; by implication of the inner coats of the blood-vessels in the inflammation, when the contained blood will clot and obstruct them; or by blocking with the blood-clots that have been formed at a distance and washed on in the blood-current to be arrested when they reach vessels too small to admit them. Like

suppuration, gangrene is associated with a micrococcous growth. The dead mass remains as an irritant, and is slowly separated by the formation around it of embryonal tissue, granulations and pus. A second form is *molecular gangrene*, in which the cells and minute elements of the tissue die, and are cast off, leading to phagedenic (eating, extending) sores, as noted above under Ulceration. When gangrene occurs on an exposed surface, that may be altered from the normal color into shades of yellow, brown, green, red, or black, according to the amount of blood and the stage of decomposition, and may be cut without pain, if the subjacent parts are not pressed upon; it may be soft, may pit on pressure, may crackle under the hand from the evolved gases of decomposition, and may be covered with blisters (*phlyctenæ*) with red, grumous liquid contents (*moist gangrene*); again, it may be white, as after freezing, or it may be dark-colored, dry, and horny, as from ergotism (*dry gangrene*).

FEVER.

Definition. Whether occurring as an accompaniment of inflammation or independently of it, fever is an unnatural elevation of the temperature of the body, the direct result of an excess of destructive chemical change in the blood and tissues, and more remotely of disordered nervous function.

Of all extensive inflammations fever is the constant result and accompaniment, rising as the inflammation rises or extends, and subsiding as the inflammation subsides. It also occurs as a distinct affection, as in all the infectious diseases, as the result of a specific irritating poison in the system, and then is the manifestation of the disease, while a local inflammation may or may not be present as a special secondary feature of the malady or as an accidental complication.

Symptoms of Fever. Fever is marked by certain definite stages, each of which has its own special manifestations. In the cases due to a specific disease-germ, or *contagium*, these are, however, preceded by a period of *latency* or *incubation* in which no symptoms whatever are manifest, but during this time the germ is rapidly multiplying in the system, and it is only when it has gained a certain increase that it disorders the nervous system, wastes the tissues, raises the temperature of the body, and induces the other phenomena of fever. The same may be said to hold in the fever attending on inflammation. The slight and circumscribed inflammation is at first productive of no fever, and it is only when it gains a certain extent that the nerves and nutrition are disordered so as to bring about a feverish condition.

Premonitory Symptoms. These usually last but a few hours and are often entirely absent or unnoticed. There is a lack of the customary vigor and spirit, an indisposition to exertion, a loss of clearness and vivacity of the eye, a manifest dullness, with hanging of the head, and frequent shifting of the limbs as if fatigued. Appetite is less sharp and ruminants chew the cud less heartily or persistently.

Cold Stage. These are soon succeeded by the *chill*, *rigor*, or *shivering fit*, in which the hair, especially that along the back, stands erect (staring coat), the skin is cold and adherent to the structures beneath (hidebound), the extremities (legs, tail, ears, horns, nose) are cold, and the frame is agitated with slight tremors, or even a shivering so violent that a wooden floor or building is made to rattle. The back is arched, the legs brought nearer together (crouching), the mouth is cool and clammy, the breathing hurried, the pulse weak, and it may be rapid, but with a hard beat, the bowels costive, and the urine higher colored than natural. The temperature of the interior of the body, taken by a thermometer in the rectum, is already found above

the normal, the excessive destruction of tissue having begun, and the blood driven from the cooler surface, and accumulating in the hot interior, at once favors tissue-change and maintains the extra heat thereby produced. In cattle the end of the tail is soft and flaccid from this stage onward. The *cold stage* lasts a few minutes or one or two days in different cases.

Hot Stage. The hot stage appears as a reaction from the chill, the contraction in the minute vessels of the skin giving place to dilatation, so that the whole surface, including the extremities, becomes hot and burning, but still dry and parched. The burning is especially noticeable in the more vascular parts, like the roots of the horns and ears, the muzzle or snout, the mouth, the hoofs, the bare parts of the paws in carnivora, and the mammæ (udder) in suckling animals. The mucous membranes lining the nose and mouth become hot and red, the breathing freer, but not less rapid, the pulse softer but accelerated, appetite (and rumination) greatly impaired or lost, thirst great, costiveness increased, urine diminished and of a higher color, the flow of milk greatly impaired or entirely arrested, and the dullness and prostration greatly increased.

The hot stage lasts longer than the cold one, usually persisting until death or convalescence. It may alternate with chills throughout the whole course of the illness, and in the fever of inflammation the interruption of the *hot stage* by a chill usually implies either a considerable extension of the inflammation or the occurrence of suppuration.

Defervescence. The decline of the fever may take place by a sudden reduction of the body temperature to the natural standard, or near it, and a sudden and general improvement in the symptoms (crisis), or by a slow improvement from day to day through a more or less tedious convalescence (lysis).

Natural Temperature. The body temperature of the

domestic animals is best taken by inserting the bulb of a clinical thermometer three inches or more into the gut (rectum) and leaving it there three minutes. After it has been used, the registering column must be shaken down to below the natural temperature of the next animal on which it is to be employed. The natural temperature is for the fowl, 107° F. to 110° F.; swine, 104°; goat and sheep, 102° to 103°; cow, 101° to 102°; dog, 99° to 100°; horse, 99° to 99.6°. Ranging in the fields, at work, or under a summer sun, it may be a degree higher than at other times. Female animals *in heat* are two or three degrees above the natural, and in advanced pregnancy and at parturition they may also be two degrees higher.

Fever Temperature. A temporary rise of one or two degrees is unimportant, but a permanent rise indicates fever. A rise of ten or twelve degrees is usually fatal. A sudden fall to or below the natural, unless with general improvement in the symptoms, indicates *sinking.* A similar fall, with a free secretion (perspiration, urination, relaxed bowels) and general improvement in symptoms, betokens recovery.

Retention of water in the fevered system is as significant as the elevated temperature. The patient drinks greedily, but all the secretions are arrested or diminished, and liquids go on accumulating in the system. The sudden bursting forth of secretions (especially sweating) implies that the fever has, at least temporarily, given way.

The production of waste matters in the system is necessarily proportionate to the amount of tissue destroyed. This appears in the blood mainly as urea, the organic acid of urine (hippuric in herbivora, uric in carnivora), together with phosphates, sulphates, and chlorides. These thrown off by the urine give it its high density. If not thus thrown off, they remain as poisons in the circulation and bring about that prostrate, sunken, debilitated condition which charac-

terizes the advanced stages of all severe and continued fevers—*the typhoid condition.* This is not to be confounded with the specific *typhoid fever*, in which a special fever-germ expends itself, mainly on the bowels, and that runs through a regular course. The *typhoid condition* is that state in which an animal system, already greatly weakened by a severe disease, and perhaps further prostrated by a specific disease-poison, is subjected to a species of poisoning by the retained chemical products of the waste of the tissues.

Types of Fever. These are as characteristic as the types of inflammation, and of the same kind. The *strong* type of fever, which attends on an acute inflammation in an otherwise healthy, vigorous system, is spoken of as a *high* or *inflammatory* fever. The *weak* type, which occurs in a broken-down or debilitated system, or in connection with the action of a specific disease germ, or with the saturation of the system by waste chemical products, is known as *low, typhoid* (better *typhous*), or *adynamic* fever. That form which persists in the utterly debilitated system, where the power of assimilation is practically lost, is known as *hectic.*

TREATMENT OF INFLAMMATION AND FEVER.

Treatment will be guided very largely by the type of the attendant fever. If that is of a high type, with a hard, full, rapid pulse, bright red mucous membranes, a clear eye, and well-sustained strength in a strong, vigorous animal, what is known as antiphlogistic (depleting, depressing) treatment is admissible at the outset. But in many cases with a low type of fever, a weak, rapid pulse, pallid, yellow, or livid mucous membranes, a coated tongue, a dull or sunken eye, much depression and prostration, swaying on the limbs in walking, pendent head, ears, eyelids, and lips, and varying and irregular temperature of the limbs, etc., such measures are forbidden from the first, and tonics and stimulants are

demanded from the outset. Between the two extremes there are many grades, which demand a judiciously adjusted intermediate treatment. The general principles only of each characteristic form of treatment can be here formulated, it being understood that no two cases can be most advantageously treated in precisely the same way; but that according to its special grade each case will demand its own specific management applied according to the skill of the physician.

Regimen. An antiphlogistic diet will consist in a moderate or very sparing amount of non-stimulating food of easy digestion (wheat bran or oil-meal in warm, sloppy mash, carrots, turnips, beets, potatoes, apples, pumpkins; fresh, tender, green grass, or in winter a little scalded hay, may be taken as examples). *Ruminants* should have no food necessitating chewing of the cud; thus the roots, etc., should be pulped or boiled, and hay and even grass must be interdicted until rumination is re-established. When food is absolutely refused for days in succession, well-boiled gruels of oat-meal, barley-meal, linseed-meal, bran, etc., may be given from a bottle or by injection. *Dogs* and *cats* should have only vegetable mush (unbolted flour, barley, or oat-meal) with just enough beef-juice to tempt the animal to eat a little. Milk with an admixture of oxide of magnesia, or even lime-water, is often at once palatable and cooling. *Drink* should be pure water, cool if kept constantly fresh before the animal, but warmed to something less than tepid if supplied only at long intervals, so that the thirsty patient is tempted to drink to excess and chill himself. *Rest* in a clean, well-aired building, free from draughts of cold air and with a southern exposure, is desirable, especially in winter. The best temperature is usually sixty degrees to seventy degrees, especially in inflammations in the chest, and extremes of temperature are to be avoided. *Clothing* will depend on the weather. In warm weather it may be often discarded, while in winter it should always be sufficient to

obviate the access of *chill* and consequent aggravation of the disease. Whenever the atmosphere can only be kept warm at the expense of impurity, it is better to secure the comfort of the patient by the requisite clothing than to subject him to impure air. As the extremities are the first to suffer from cold, loose flannel bandages to the limbs are often imperative.

Remedies. *General bleeding*, a great resort of our forefathers, has been long all but discarded from modern practice. To-day it is rarely resorted to, except to save from an urgent and extreme danger, as in the plethoric cow merging into parturient apoplexy, or the fat and overdriven horse, gasping for breath and life, in general acute congestion of the lungs. There are other cases of extensive acute and dangerous congestions, especially in a strong, vigorous, and plethoric patient, in which general bleeding is beneficial in warding off threatened death; but as much sound, discriminating judgment is necessary to its safe employment, it is better for the amateur stock-owner to resort to less radical measures. When resorted to at all, the blood should be drawn from a large orifice, in a full stream, to secure the desired depressant effect with the smallest loss of blood, and the patient should be kept especially quiet and apart from all excitement which would tend to counteract the sedative action.

Local bleeding is more extensively applicable than *general*, as it usually effects the same purpose without the permanently weakening effect. It acts in two ways, first, by emptying and contracting the vessels in the skin over the inflamed organ it solicits a sympathetic contraction of the capillary vessels in that organ itself, and thus inaugurates a progress toward recovery; and second, by so much as it draws blood to the surface it diminishes the blood-pressure on the deeper inflamed organ, and affords a better opportunity for the restoration of the healthy circulation

and function. Local bleeding may be practiced by simple scarification or leeches, or better, by cupping with or without scarification. To apply leeches, the skin must first be shaved. To cup, it must at least be greased. As a cup, an ordinary large drinking-glass may be used, the air contained in it being driven out by a lighted taper, and then the taper being withdrawn, the mouth of the cup is instantly and accurately applied on the skin and held there, until, as it cools, it draws up the skin within it and clings like a sucker. A number of these may be applied according to the extent of the inflammation, and, if desired, they may be removed, the part scarified, and the cup reapplied. The cupping usually effects more than a mere local attraction of blood; it very commonly causes a free circulation in the whole skin, a generally diffused warmth, and even perspiration. Thus we may secure the derivation of blood from the inflamed part, the cooling of a large mass of blood in the extensive cutaneous circulation, the cooling of the entire system by the return of this blood internally, the elimination of injurious waste matters through the skin, the lowering of the febrile heat and tension, and a better functional activity of all the organs of the body.

Similar good results are obtained from all remedies that induce surface warmth and vascularity and a free secretion from the skin.

Warm baths, for animals to which they can be applied, abstract blood temporarily from the inflamed internal organs, diminish the blood-pressure, and really cool the system, beside securing elimination from the skin and other secreting surfaces. They may be commenced warm (80° F.) and gradually cooled down to 65° F. after the skin has become freely active. In the larger quadrupeds, in which the warm bath is practically impossible, the same revulsion of blood and warmth to the skin may be secured by *rags wrung out of hot* (*almost scalding*) *water*, wrapped tightly round the

body covered, with two or more dry blankets, and kept tightly applied against the surface by elastic circingles. The legs may be rubbed with straw wisps till warm, and then loosely bandaged, or applications of red pepper, ammonia, or mustard, may be made prior to bandaging. In place of hot-water rags, bags loosely filled with bran, chaff, or other light agent, heated to 110° F., may be applied round the body, or, where it is available, a Turkish or steam bath may be resorted to. These hot cutaneous applications, to produce glow and perspiration, are especially valuable in the chill that heralds a violent inflammation, and if that can be suddenly checked by this means the inflammation will often be warded off, or at least rendered slight and easily controllable. After perspiring for half an hour the patient may be gradually uncovered, rubbed dry, and covered with a dry, warm blanket. If the skin is still glowing, a slight sponging with cool or cold water may beneficially precede the rubbing and drying.

Cold Baths. In cases of very high fever a full cold bath (68° F.) may be employed for fifteen minutes, and repeated as often as the temperature rises. In many cases of parturition fever in cows great benefit accrues from sponging the body with cold water and allowing it to to evaporate from the burning skin. In the extreme fever of heat apoplexy (sunstroke), with a temperature of 110° F. and upward, a strong current of cold water from a hose directed on the head and body often gives the best results. In ordinary fevers in large animals the *cold pack* will often serve a good purpose. Wring a blanket out of water (cold or tepid, according to the height of the fever and the strength and power of reaction of the patient), wrap it round the body, cover it with several dry blankets so that no part is exposed, and keep the whole in close contact with the skin by elastic circingles. In fifteen minutes the skin should be glowing and perspiring, and in half an hour the wrappings should

be removed, a little at a time, the parts rubbed dry and covered with a dry woolen blanket. It may be repeated as often as the fever rises.

Diaphoretics. Besides these remedial methods of inducing a revulsion and glow in the skin with perspiration, there may be resorted to the *medicinal diaphoretics.* Among these may be included *copious drinks and injections of warm water, acetate of ammonia, antimony, ipecacuan,* or *pilocarpin,* or one of the sedatives, *aconite, veratrum,* or *opium,* etc. Many a threatened acute inflammation has been to a great extent cut short and nipped in the bud—the stage of chill—by warm clothing, active hand-rubbing, and such an apparently unscientific nauseant as tobacco.

When the preliminary stage has passed and the hot stage of the fever has set in, cooling and eliminating agents are especially called for.

Laxatives. In many cases, and especially in those with marked constipation or bowels loaded with indigestible materials, a laxative is beneficial. For the horse, aloes, or, often better, sulphate of soda, and for cattle or sheep, the latter, or Epsom salts, will at once remove an irritant, cool the general system, draw off much blood and nervous energy to the bowels, and secure a considerable depletion and elimination from the intestines. For swine, dogs, and cats castor-oil or salts may be used, and for fowls castor-oil. If the mucous membranes are yellow, the tongue furred, and fæces scanty, hard, and fœtid, a dose of calomel (horse or ox, one drachm; sheep or pig, one scruple; dog, three grains; chicken, one-half grain) with tartar emetic (horse or ox, two drachms; sheep, twenty grains; swine, one-half grain; dog, one-fourth grain; chicken, one-eighth grain) may be given and followed in ten hours by one of the laxatives named above.

Diuretics. In the absence of any manifest disorder of the digestive organs, the laxative may be omitted and re-

frigerant diuretics resorted to. Acetate of ammonia or potassa, nitre, tartrate of potassa, carbonates of potassa or soda, may be used along with sedatives.

Sedatives. Of the sedatives, aconite, bromide of potassium, veratrum, hyoscyamus, or chloral hydrate may be used according to the special indications. As an example the following may be prescribed for the horse: ℞. Nitrate of potassa, two ounces; bromide of potassium, one ounce. Mix. Divide into eight powders. Give one every six hours.

Alkalies: Resolvents. When the organ inflamed is a serous membrane in which dangerous adhesions or other functional disorders are likely to occur from newly formed false membranes, their formation should be counteracted as far as possible by the free use of alkalies (carbonates of soda, potash, or ammonia, nitre, iodide of potassium, muriate of ammonia, etc.), and in the same conditions excessive effusion should be controlled by free action on the kidneys.

Tonic Refrigerants. Later, when both inflammation and fever have been somewhat reduced, temperature, breathing, and pulse rendered more moderate, eye clearer, and even appetite perhaps slightly improved, the sedatives may give place to refrigerating tonics, such as mineral acids (nitric, muriatic, sulphuric, or phosphoric), in combination with bitters (quassia, cascarilla, calumba, gentian, salicin), without as yet the suspension of refrigerant diuretics. Thus for the horse the following: ℞. Pharmaceutical nitric acid, two drams; infusion of gentian, ten ounces; nitrate of potassa, two ounces. Dissolve. Give one ounce every six hours. Of the newer refrigerants antipyrin is one of the safest and best.

In Convalescence. When convalescence has fairly set in, the fever has subsided, and there remains merely some debility with a remnant of the inflammatory exudation to be removed or organized into tissue, or when an abscess has

developed and burst, the tonics must be even more freely given, the mineral acids may even give place to preparations of iron, and the diet must be made increasingly liberal. But throughout the whole progress of the disease the bowels should be carefully watched. Costiveness may quickly undo all that has been gained, hence any indication of this should be met by laxative food (boiled flaxseed, etc.), or, this failing, by injections or laxatives. Similarly, if a freer action of the kidneys seems to be necessary for elimination of waste matters or to reduce fever, diuretics should be continuously kept up.

Treatment of Adynamic Inflammation and Fever. In treating *low asthenic* or *adynamic inflammation* all depression and depletion is to be carefully avoided. Even *laxatives* must be employed with extreme caution. If absolutely necessary it is best to give them in small (half) doses and supplement their action by liberal injections of hot water. Elimination of waste matter from the blood and system is still to be sought, but it must be by *stimulating diuretics* (sweet spirits of nitre, carbonate, acetate, or muriate of ammonia, digitalis), and direct *stimulants* and *tonics* must be given from the first (ammonia, wine, strong ale, whisky, brandy, ether, gentian, calumba, nux vomica). For the horse the following may serve as an example: ℞. Sweet spirits of nitre, four ounces; sulphuric ether, two ounces; tincture of gentian, ten ounces; digitalis, one dram. Mix. Dose, two ounces in a pint of cool water four times a day. When there is great debility and prostration, ammoniacal and alcoholic stimulants must be given freely, while if the fever heat rises very unduly the cooling diuretics (citrate, tartrate, or acetate of potassa, or nitre, etc.), and even sedatives (bromide of potassium, chloral hydrate, salicin, salicylate of soda), must be resorted to. In weak or prostrate subjects antipyrin may often be used with advantage, as in moderate doses it effectually lowers the tem-

perature without decreasing the force of the circulation or affecting the blood injuriously. If there is any indication of a special depressing poison in the system, or of the absorption of septic or other noxious matter from a wound, antiseptics (hydrochloric acid, or salicylic acid, sulphite of soda, quinia, or chlorate of potassa) may be advantageously added to the prescription.

In these cases of asthenic inflammation, as in the advanced and debilitated stages of sthenic inflammation, the diet should be as good as the patient can digest. Boiled oats, barley, or flaxseed, rich, well-boiled gruels, and beef-tea (even for herbivora) may frequently be resorted to with advantage.

Local Treatment of Inflammation. In all forms of superficial inflammation the local treatment occupies an important place. The persistent application of *cold* (cold water in a stream, ice-bags, freezing mixtures) will sometimes overcome the tendency to inflammation or arrest it. This is especially sought when a violent inflammation (as in a wounded joint) threatens to destroy an important organ. If adopted it must be persisted in, as if it is suspended too soon the reaction is likely to make matters worse than ever. *Cold astringent applications* have a similar tendency. Sugar-of-lead, one-half ounce; laudanum, one ounce; water, one quart, may be kept applied by means of a linen bandage. The water may often be advantageously replaced by extract of wych-hazel. If there is an exposed surface the lotion may be made slightly *antiseptic* (carbolic acid, one dram; or sulphurous acid solution, five ounces; water, one quart). *Hot applications, fomentations, poultices* are nearly always appropriate, and when adopted should, like *cold* ones, be kept up as continuously as possible. These soothe alike the superficial and deeper parts, the latter through sympathy, producing first a relaxation of vessels and tissues, and later a

contraction of the former attended by pallor of the surface. They greatly favor suppuration when that is already inevitable, though in other cases they may obviate it by checking at an early stage the acute inflammatory process on which it depends. Any bland agent that will retain heat and moisture will make an excellent poultice, though flaxseed-meal is the type of a soothing demulcent application. Very slight inflammation may be successfully treated at the outset with a *stimulating embrocation* (alcohol or camphorated spirit), yet in the more violent type of acute inflammation all local excitants tend to aggravate the disease. In these violent forms the activity of the disease should be first abated by local soothing and general sedative measures, and then the part over the inflamed organ may be safely treated with a stimulating liniment or even a blister. In such cases the liniment first acts as a derivative of blood and nervous energy from the inflamed part, and later and still more beneficially by securing in it a sympathetic healing process, like that set up in the skin. In raw sores where inflammation has been set up the granulations may become dropsical or excessive, bulging beyond the adjacent skin as *proud flesh.* This should be repressed by touching it gently with some mild caustic (lunar caustic), so as to produce a thin white film, and the remote cause of the inflammation (often a local irritant) should be sought and removed. In some unhealthy sores tending to excessive granulation, the compound tincture of myrrh and aloes may be applied daily with great benefit.

Blistering. In subacute and chronic inflammations and in those acute forms in which the violence of the inflammatory action has been already subdued by soothing measures, blisters and other counter-irritants may be employed to counteract the remaining inflammatory action. These act primarily by drawing off blood and nervous energy from the inflamed organ to the skin, and secondarily, by estab-

lishing a sympathetic healing process in the diseased part, simultaneously with the work of recovery in the skin, when the blister has spent its action. But if applied above a part which is still violently inflamed, it is apt to seriously aggravate that, through this same sympathy with the part suffering under the rising of the blister. In this way great and irreparable injury is often done through the laudations of particular blisters for the cure of given diseases, without any reference to the stage or grade of such disease. The value of a blister depends far more on the time of its application than on the ingredients of which it may be composed. A simple formula is as follows: Powdered cantharides, 2 drams; morphine, 2 grains; lard, 1 ounce. Mix. Cut the hair close to the skin from the part to be blistered, and rub in for two or three minutes against the direction of the hair. The ointment must be rubbed in more energetically in winter than in summer, when the circulation in the skin is freer and the oleaginous matters remain more liquid and penetrating. For cattle, the addition of one dram of oil of turpentine will usually be necessary. For sheep, a mixture of equal parts of strong aqua ammonia and olive-oil, well shaken together, and rubbed on the skin, will usually suffice. There is no need for removal of the wool.

Firing. This acts in nearly the same manner as a blister, and demands similar caution in its application. It is especially available in subacute and chronic diseases of the joints, bones, and tendons, and may be made more or less severe according to the nature and obstinacy of the disease. It is applied in points or in lines at intervals of one-half to one inch, and penetrating one-third, one-half, or entirely through the skin. The hotter the iron the less the pain, but the greater the danger of destruction of the intervening skin by the excess of radiating heat. Hence the contact of the heated iron with any one part must be judiciously graduated to the heat of the iron and the deli-

cacy of the skin, and should never exceed a fraction of a second. But it is only in the greatest extremity that the stock-owner should himself undertake such an operation, so that any lengthened description is superfluous.

Abscess. The treatment of abscess consists in warm poultices (flax-seed meal, wheat-bran, boiled carrots) or fomentations in the early stages, to hasten and perfect suppuration, and thus to dispose of the superfluous and injurious consolidated lymph, and prevent the threatened destruction of tissue. The poultices should be put on warm (about 100° F.) and replaced by fresh ones when they have become soured or dry. Poulticing should be kept up without intermission till the hard inflamed mass has become soft and fluctuating in the centre, and, indeed, until this liquefaction has extended throughout its whole substance. If the abscess is deeply seated, it may be desirable to continue it until the superincumbent layers of tissue have become absorbed and the pus is felt to be separated from the air only by an attenuated layer of skin. Then it is opened with a lancet or sharp knife inserted in the centre of the thinnest part, where the pressure of the advancing pus has pushed all important structures aside, so that incision is made practically without danger. The opening should be large, so that the finger, previously dipped in a carbolic-acid solution (1 : 50) or carbolated vaseline (1 : 20), may be introduced and its extent ascertained. Usually the opening will be sufficiently low to secure a constant and free drainage of all pus subsequently formed from the walls of the abscess. If, however, sacs exist beneath the level of the opening in which the pus must collect, then the incision must be extended in a downward direction until it will drain such sac or sacs. If this would produce too large a wound, then a counter-opening should be made leading downward and outward from the lowest part of the sac. For this purpose a curved staff is carried to the lowest part of the abscess, and pressed out-

ward so as to project under the skin, and cut down upon from without. In doing this important structures are largely pushed aside, yet they may be left in the way of the incision, so that safety demands a knowledge of the parts to be cut. More than one opening may be required from different dependent sacs, though in other cases such sacs may be made continuous, and be drained from one opening by breaking down the partitions between them. Here again there is danger, as arteries and nerves sometimes pass through the centre of an abscess, and dangerous bleeding or paralysis may follow their division.

If the lower or drainage-opening from an abscess is necessarily small, or so compressed by adjacent structures as to interrupt the free and constant flow of pus, a drainage-tube of perforated caoutchouc, or a bunch of horse-hair or silk, should be inserted to secure a perfect discharge. Such agents should be clean and dipped in a solution of carbolic acid (1 : 50) before insertion. When the sac has become obliterated by contraction of its walls the canal of discharge may be allowed to heal gradually, from within outward, by withdrawing the drainage-tube a little day by day, cutting off the projecting portion, and allowing the canal to close behind it.

When poultices appear insufficient to precipitate suppuration, more stimulating applications may at times be adopted. Blisters at times succeed, but there is a danger (especially great in specific phlegmons like those of strangles) that they may drive back the inflammatory products to form in other organs, perhaps deep-seated and vital ones. The common domestic remedy of sugar and soap is more certain and safe, or it may be replaced by a mixture of salt, soap, and crude Canada balsam.

CHAPTER II.

CONTAGIOUS AND EPIZOOTIC DISEASES.

Their importance and classification. Germs the cause of plagues. Purely contagious diseases preventible. Propagation of disease-germs outside the animal body. General characters of micro-organisms causing disease. Form inconstant in different media. Viability of bacterium and spore. What they eat, breathe, and excrete. Alkaloids and ferments. Antagonism between bacteria and blood-globules and tissue-nuclei. Relative susceptibility of blood, lymph, and solid organ. Effects of acid and alkaline media, of light, electricity, heat, cold. Fecundity of bacteria. List of bacteria producing animal diseases. Rendering animals insusceptible to a plague. Direct cause of acquired immunity. Exhaustion theory. Antidotal theory. Condensation theory. Vital resistance. Immunity by good hygiene; by tonics and anti-ferments; by a first attack; by inducing a mild type of the plague; by inoculation of a closely related disease; by inoculation of a minimum amount of virus; by arrest of the disease while still local—antiseptic; by inoculation in an unimportant organ; by inoculation in the veins; by inoculation with germs weakened by passing through another genus of animal; by inoculation with germs weakened by cultivation in special media; by inoculation with germs grown for long in free contact with air; by inoculation with germs weakened by condensed oxygen; by inoculation with germs weakened by long rest in free air; by inoculation with the sterilized products of germs. Advantages of the use of sterilized virus. Drawbacks. Limitation of protection by sterilized products. Radical extinction of plagues. Measures for extinction of a prevailing plague. To exclude an animal plague from a country. Disinfection.

These are among the most important of the whole range of diseases of animals, being the most destructive to the animals themselves and in many cases to man, and being at the same time, as a rule, preventible by a rigid adherence to sanitary laws. Of their devastations we have the most appalling accounts in the records of antiquity as well as in

recent times. In the time of Moses they ravaged Egypt until, says the record, "all the cattle of Egypt died;" nor was man spared, for "boils and blains" broke out on man and beast.—*Ex. IX.* 3. At the siege of Troy the Grecian army was decimated by a similar infliction, animals and men perishing in a common destruction.—*Iliad.* So it has been down through the ages, the great extension of the plagues being usually determined by general wars and the accumulation of cattle drawn from all sources (infected and sound) into the commissariat parks. In the first half of the eighteenth century it is estimated that 200,000,000 head of cattle perished in Europe in connection with the Austrian wars. These plagues again entered Italy in 1793 with the Austrian troops, and in three years carried off 3,000,000 to 4,000,000 cattle in that peninsula. More recently, rapid railroad and steamboat traffic and extended commerce have taken the place of war in favoring their diffusion. Free trade between England and the Continent since 1842 has cost the former $450,000,000 in thirty years, and as much as $40,000,000 in 1865-66 during the prevalence of the Rinderpest. A similar importation cost Egypt 300,000 head of cattle (nearly the whole stock of the country) in 1842, and others have caused ruinous but unestimated losses in Australia, Cape of Good Hope, and South America. On the other hand, some of the most exposed countries of Europe, Norway, Sweden, Denmark, Schleswig-Holstein, Oldenburg, Mecklenburg, and Switzerland have long kept clear of these plagues by the simple expedient of excluding all infected animals or their products, and promptly stamping out the disease by the slaughter of the sick, followed by thorough disinfection, when they have been accidentally introduced. Exclusively breeding districts, in Spain, Portugal, Normandy, and the Scottish Highlands, into which no strange cattle are ever imported, also keep clear of nearly all of these destructive pestilences.

It is unquestionable that the animal plagues are propagated, in Western Europe and America, only by the disease-germs produced in countless myriads in the body of a diseased animal and conveyed from that to the healthy. It follows that the destruction of the infected subjects and the thorough disinfection of the carcass, manure, buildings, etc., is the most economical treatment of all the more fatal forms of contagious disease in live stock. For the less fatal forms, the most perfect separation and seclusion, and the thorough disinfection of all with which they have come in contact is still imperative.

To the first class of exotic maladies belong: *Small-pox in sheep and birds*, the *lung-plague* or *contagious pleuro-pneumonia of cattle*, the *Rinderpest* or *cattle-plague*, the *malignant disease of the generative organs in solipeds*, and *malignant cholera* in all animals. These demand separation, destruction, and disinfection. To the second or less fatal class of exotic maladies belongs the *Aphthous fever* or *foot and mouth disease.* This demands seclusion and disinfection.

Beside these maladies, that are foreign to our soil and which are not to be feared except as the result of importation from abroad and subsequent transmission by contagion, there is a very important class which, though perhaps not generated in America, are widely disseminated over the continent and spread by contagion. Among these may be named: *Glanders* and *farcy*, *canine madness*, *contagious foot-rot*, *tuberculosis*, *bacillar anthrax*, *vibrionic* (*emphysematous*) *anthrax*, *Texan-fever*, *swine-plague*, *influenza*, *strangles*, *canine distemper*, and perhaps the *variola* or *pox of horse*, *cow*, *goat*, *pig*, *and dog.* All of these down to *swine-plague*, like foreign contagious affections, demand separation and disinfection, with destruction or not of the diseased, according to the severity and diffusibility of the particular malady. The remainder, from influenza onward,

are either too mild to warrant such measures, or too easily spread to be satisfactorily controlled by them.

GERMS THE CAUSE OF PLAGUES.

Since the above was written the demonstration of the essential causes of a number of these plagues in microscopical vegetable ferments (microphytes) has practically opened a new field in pathology, prevention, and treatment. When a plague is found to be due to seed sown in a susceptible animal system, such seed being not a product of the animal body, but derived from a different kingdom (the Vegetable), and introduced from without the economy, it follows that every case of such disease implies that the body of the animal victim has been seeded for that particular crop as a field is for wheat, barley, or rye, and in both cases alike the seed sown has come from a preceding crop and a preceding sowing. The parallel may be put thus: *No seed = no wheat; no germ = no plague.*

PURELY CONTAGIOUS DISEASES PREVENTIBLE WITH CERTAINTY.

The moment we apprehend the fact that a particular plague is essentially dependent for its existence on a specific germ, we are compelled to the conclusion that it is quite possible to prevent the spread of such a disease and to extirpate it from a country in which it has already gained a foothold. If at a given date all English sparrows on the American continent were destroyed, we would be rid of the race until specimens were again imported. So with a plague caused by a vegetable germ; let all plague-stricken animals and all the living disease-germs be destroyed, and the plague would be certainly abolished. Ordinary hygiene makes no such radical extinction of a plague. Clean, airy, wholesome surroundings retard the progress of a plague and favor the production of a milder type of the malady, but they allow the preservation of the germ, ready to resume all its pristine

violence when conditions are favorable. As a field of wheat suffers alike in quantity and quality from poor soil and lack of cultivation, manure, rain, sunshine, and heat, but in spite of all brings to maturity a seed for a future crop, so the plague-germ languishes somewhat when the animal systems and their surroundings do not favor its propagation, yet it does not perish, but from the mild case it advances to the more severe and deadly whenever the circumstances become more favorable. As an instance of the obstinate vitality of the disease-germ, we see that in an uninterrupted open-air life, in a land of perpetual summer, the lung-plague of cattle advanced more rapidly, proved more deadly, and defied human control more successfully on the grassy plains of Australia and South Africa than in any other part of the globe.

No measure less radical than the destruction of every diseased animal and its infecting products will furnish a guarantee of the permanent extinction of plagues spread by living vegetable germs only, but in all such plagues the destruction of the germ gives a perfect assurance of this result, and is the bounden duty of the Government.

PROPAGATION OF DISEASE-GERMS OUTSIDE THE ANIMAL BODY.

The absolute destruction of disease-germs and the extinction of the corresponding plagues is limited by the fact that the germs of certain maladies live and increase out of the animal body. Prominent among these may be named the germs of anthrax, typhoid fever, yellow fever, and cholera, which increase not only in numbers, but often in deadliness as well, in sewers, cesspools, dung-heaps, filth-saturated soils, and undrained impervious ground which is rich in decomposing organic matter. Where a germ of a given plague is permanently domiciled in a soil favorable to its preservation and growth it is manifest that the disposal of sick ani-

mals and the disinfection of their products will not eradicate the disease from the locality. It must be also destroyed in the soil as well, and fortunately this can sometimes be done by thorough drainage, exposure to the air, and prolonged and thorough cultivation.

Most of the disease-germs heretofore discovered have been cultivated in carefully secluded glass vessels, in animal liquids (soups, etc.), or on semi-solid organic bodies (peptonized gelatine, etc.), showing very clearly the possibility of survival outside the animal body. On the other hand, the history of certain animal plagues (Rinderpest, lung-plague, glanders, small-pox) furnishes no instance of the outbreak of the disease without a pre-existing case as a direct cause, but gives numerous examples in which, after the immunity of a given country for a great length of time, a specific plague has been imported from without and has thereafter spread with almost unprecedented severity. In such cases, even where the soil is favorable to the preservation and multiplication of the germ, it is still necessary first to implant the seeds, as it was necessary to go abroad for the seeds of the thistle which now grows so luxuriantly in many of our fields.

It follows that, instead of abandoning all effort for the extinction of plagues, the germs of which can increase in the soil, etc., we should avail of every means of excluding their seeds from our shores, or, if they have already gained a foothold, we should prevent them from spreading and contaminating new soils, and thus multiplying the permanent centers of infection.

GENERAL CHARACTERS OF THE MICROPHYTES CAUSING DISEASE.

The germs that determine specific diseases in animals nearly all belong to the lowest order of vegetable life, known as, *Bacteria*, *Schizophytes*, *Schizomycetes*, or *Microbia*. As

found in the animal fluids these may be distinguished (after Du Bary) as follows:

I. Asporeæ. That don't form Spores.

1. Cocci. Round or ovoid cells.
   - *a.* Micrococcus. Very minute round or ovoid cells; singly, in chains, or in formless gelatinous masses.
   - *b.* Macrococcus or "Monas." Larger round or ovoid cells.
   - *c.* Diplococcus. Cells in pairs.
   - *d.* Staphylococcus. Cells in groups.
   - *e.* Streptococcus. Cells in fine chains.
   - *f.* Sarcinæ. Cells in cubes of four or eight.
   - *g.* Ascococcus. Cells in larger irregular colonies or groups.

II. Arthrosporeæ. Form Spores—by segmentation.

- *a.* Bacterium. Short rods.
- *b.* Leptothrix. Rodlike cells remaining united in very fine filaments.
- *c.* Cladothrix. Filaments with apparent branching.
- *d.* Spirochæte. Long flexible sinuous filaments.

III. Endosporeæ. Form Spores within the mother cell.

- *a.* Bacillus. Filament short, straight, or bent; rigid, with distinct joints.
- *b.* Vibrio. Wavy, very flexible filament.
- *c.* Spirillum. Short spiral rigid filament.

Many microphytes are furnished with delicate mobile filaments by which they move actively in spite of their rigid forms, and whip into active motion small bodies (cells, granules) in their vicinity.

The form and mobility of microphytes are by no means constant. The rigid bacillus may, in different media out of the body, grow out into long waving branches, forming spores, and even into beautiful net-works. Organisms, too,

which at one stage of their existence are perfectly motionless, are at other stages endowed with powers of active movement. The spores, like dried grain as compared with the cereal plant, have a greatly enhanced vitality, can survive indefinitely without change, and in some cases resist even a boiling temperature for a length of time.

All bacteria live upon organic matter, and some use up a large amount of oxygen by way of respiration—the *ærobia* of Pasteur. Others can adapt themselves to a comparative privation of oxygen, and some, it would appear, can live altogether apart from the air, obtaining the oxygen necessary to their existence from the decomposition of the nitrogenous animal or vegetable substances on which they feed: These last are the *anærobia* of Pasteur. A large class of the air-breathing bacteria are mere scavengers (saprophytes) feeding upon decomposing organic matters and resolving their component parts into carbon dioxide and other simple bodies which constitute food for plants. Thus they exercise a most important function in nature, in transforming into plant-food the products of vegetables and animals which would otherwise accumulate in endless quantity. A fermenting manure-heap or a decomposing carcass or plant is a grand exhibition of this beneficent work, and the nitrification in soils is equally the work of these invisible servants of nature.

The products of bacteria growth are very numerous and vary much with the species and the medium in which they grow. The products of those growing in free air are, however, usually simple and comparatively harmless, while those that have only a limited supply of air and that obtain their oxygen by breaking up nitrogenous matters are usually, in part at least, more complex in chemical composition and are more likely to prove poisonous. Thus it is that disease-germs increase in virulence and in their fatal power after they have been grown for several generations in the tissues

of animals with a very limited supply of air; and thus, too, it is that some maintain and even increase their infectiousness when grown in organic matter out of the body, but apart from the action of the atmosphere; for example, in close spaces beneath barn floors, in cesspools, closed drains, in privy-vaults, in graves, in dense or clay soils, in marshy ground, and in soils rich in organic matter and in which the gases resulting from decomposition drive out the air. (See Author's article in New York *Medical Record* for June 18, 1881).

Flügge gives the following list of the chief products of bacteria: "*Gases*, as CO_2, H, CH_4, H_2S, NH_3; *water; sulphur; volatile bodies*, such as trimethylamin, alcohol, formic acid, acetic acid, butyric acid; *fixed acids*, as lactic acid, malic acid, succinic acid, oxalic acid, tartaric acid; *sulpho-acids*, as taurin, amides of the fatty acids, especially leucin, alanin, etc.; *bodies of the aromatic series*, as tyrosin, phenol, cresol; *reduction products*, as indol, hydroparacumaric acid; *complex molecules*, as carbohydrates, pepton, hydrolytic ferments; finally, *coloring matters* and *poisonous alkaloid substances*."

Of these the simplest bodies, at the head of which are the gases, are especially the products of bacterial *growth in free air*, and these, under the circumstances of their production, are usually harmless to the animal organism. The more elaborate and complex bodies, however, represented especially by the *poisonous alkaloids* and the *hydrolytic ferments*, are, *par excellence*, the product of bacteria growth in albuminoid substances, and in comparative absence of air; and these are the products which are especially poisonous to the animal organism. In attacking the animal economy, and above all the living cells of the lymph, blood, and tissues, the alkaloid and other poisons destroy their life, or at least impair their vital powers, so that they can no longer with sufficient force exercise their own protective power of

digesting and assimilating such organic matter as is presented to them, and in this weakened state they are readily acted upon by the hydrolytic ferment of the bacterium and reduced to a soluble product which the bacterium can take into its substance and assimilate. This explains why so many bacteria can grow in the animal tissues that can not grow in the blood. In the solid tissue the cell is fixed and immovable, and must sustain the whole force of the undiluted bacteria product (alkaloid and ferment). If at all susceptible to these, it is therefore liable to succumb. But in the circulating blood, the constantly moving liquid speedily dilutes and weakens the bacteria poisons, so as to frequently render them harmless, and meanwhile the bacteria themselves are constantly assailed by new streams of the digesting product of the blood-globules, and are nearly always weakened or even digested by the blood-globules. Hence, too, the preference shown by the disease-producing bacteria for the lymphatic system over the blood. In the lymphatic system the circulation is slow, especially in the microscopic net-works in which the lymphatics originate in the tissues, and in the glands in which the lymph is delayed and its cells multiplied. Here, accordingly, we have a condition approximating to that of the cells in the solid tissues. The comparatively stagnant lymph-cells in the radical net-works and glands are attacked by the concentrated poisons of the bacteria, no longer diluted and weakened by the active circulation of liquid that takes place in the blood-vessels, and the bacteria, living and multiplying at their expense, invade the surrounding tissue as well, and can perhaps after a time carry their invasion even into the blood with good prospect of success. It should be noted that even in the solid tissues an attempt is made to meet and conquer the invading army of bacteria. As soon as the irritant products begin to act on the tissue, inflammation is set up and large numbers of the white globules of the blood

are passed out of the vessels, into the affected tissue, and meanwhile the original fixed cells of that tissue also undergo a rapid multiplication, so that the inflamed part soon becomes a centre of extraordinarily active cell-growth. In many cases the defence is successful and the invading bacteria are devoured or thrown off in a mass of pus, or in a circumscribed slough. In others, the accumulating cells which constitute the army of defence sink under the lethal power of the bacteria products, and the bacteria invasion is carried into the entire system.

That bacteria attack the vital powers in other ways is undoubted. The production of the poisons above named, by the decomposition of the albuminoid tissues of the body, implies the destruction of these important tissues, the impairment of function and of the strength, and, it may be, death or long-standing debility. In other cases, as in the case of the Bacillus anthracis, they abstract oxygen from the red blood-globules, and reduce the blood to a venous condition in which it can no longer nourish the body nor maintain the vital functions, and hence speedy death is the rule in that infection. In still other cases, illustrated again by the Bacillus anthracis, the bacteria accumulate in the lymph- and blood-vessels in such numbers as to block the vessels and stop circulation in the part affected, and bring about a corresponding train of evil consequences.

Wyssokowitsch found that, in case of a survival of bacteria injected into the blood, they passed in part into the white blood-globules, and were arrested mainly in the liver, spleen, kidney, and marrow of bone; unless, indeed, the particular germ had a predilection for a special organ. In these different organs they had passed into the cells (endothelial) lining the capillary blood-vessels. He even attributes the prolonged latency of certain contagious diseases to the lodgment of the germs in an inactive condition for a length of time in these endothelial cells. This, however, lacks con-

firmation, and is rather improbable, considering the assimilating power of the animal cell.

It remains to be noted that other conditions than the presence and absence of air (oxygen) affect the development and pathogenic power of the bacteria.

Thus, as the animal fluids generally are *alkaline* (the section of the stomach and contents of the large intestine excepted), the bacteria that live in them are those adapted to an alkaline medium, and are at once debilitated or killed by being placed in an acid medium. Hence, most pathogenic bacteria, taken in with the food, are either killed or rendered harmless by passing through the acid stomach, and those only successfully run this gauntlet that are taken in in the condition of spores, or that pass through during an attack of gastric indigestion, when the acid is defective. For the same reason these bacteria require, for their survival out of the body, a medium (soil, fermenting heap) that is naturally alkaline by reason of the presence of lime, or by the artificial production of ammonia, which is so constant a product of fermentative decomposition. The saturation of the fermenting mass, therefore, with a powerful acid, not only checks the alkaline fermentation but also usually disinfects the mass if infectious germs are present.

Light, too, has a marked influence on bacteria growth, the disease-producing forms being especially those that thrive in darkness, while their virulence is more or less impaired by exposure to sunlight. Hence the great value of light as well as of oxygen as a means of purification and disinfection.

Electricity, too, has a potent influence on their development, though it seems to act differently according to the particular kind of germ and the strength of the electric current. Thus everyone knows the effect of a thunder-storm in rapidly souring milk, a process which is directly caused by the *Bacillus lactis;* and the rapid decay of vegetables, and even

of eggs, the result of the action of various bacteria, is equally familiar. Yet Dubois shows that the effect of a strong electric current is fatal to the *Micrococcus prodigiosus.*

Heat is another important agency. Each bacterium has a given range of temperature within which its propagation is most active. All excepting those that have produced spores are destroyed by exposure to a high temperature—from that of boiling water down. Different spores will resist boiling for different periods.

Cold arrests the growth of bacteria, but does not necessarily kill them, many reviving after prolonged freezing. Plague-generating bacteria that are destroyed by cold produce those plagues which, like cholera, Texas cattle fever, and yellow fever, do not survive the winter in northern latitudes.

The possibility of the action of bacteria for evil may be deduced from their power of rapid increase in suitable surroundings. They multiply their numbers by fission—one enlarging and dividing into two, and thus some of them can, under favorable conditions, double their numbers every hour. A single bacterium increasing at this rate would, in twenty-four hours, have produced 16,777,216. These, again, multiplying at the same rate would, at the end of twenty-four hours more, amount to 282,584,976,710,656. A single *Bacterium termo* (of putrefaction), one-thousandth of a millimeter in diameter and a five-hundredth of a millimeter in length, would produce in forty-eight hours a sufficient progeny to nearly fill a half-pint measure. The increase attained in five days at the same rate is so enormous that to state it would only arouse incredulity. The curious can calculate it for himself, doubling the product every hour.

Fortunately for the world the bacteria cannot find such opportunities for unrestricted increase, but they perish in unlimited numbers by starvation, by the action of light, heat, cold, oxygen, electricity, chemical poisons, by the action of other living organisms, and even by preying on each

other, so that their numbers are generally kept within beneficent bounds. In the case, however, of those that can live in animal and vegetable bodies, the limit is manifestly set by the number of such susceptible bodies furnished ready to be attacked. Hence the danger of a plague is always proportionate to the number of live-stock susceptible to it, and with continual intercourse between these there can be no limit to the rapid progress, the extent, and the deadly effects of the infection.

LIST OF DISEASE-PRODUCING BACTERIA.

The following is a partial list of the bacteria found in diseased states in animals:

Micrococcus. Round or Ovoid Bacteria.

Micrococcus Vaccinæ in Cow-pox and Horse-pox.
" Variolæ Ovinæ in Sheep-pox.
" Ureæ in Ammoniacal Urine (Cystitis).
" of Erysipelas.
" " Ulcerative Endocarditis.
" " Croupous Pneumonia in Horse (Pneumococcus).
" " Lung-plague in Cattle.
" " Suppuration.
" " Septic Wounds.
" " Gangrenous Wounds.
" " Fowl Cholera.
" " Diphtheria.
Diplococcus of Swine Plague.
Sarcina Ventriculi of Stomach.
" Urinæ of Bladder.

Bacterium. Short Rods.

Bacterium Syncyanum (Cyanogens) in Blue Milk.
" Synzanthinum (Zanthogens) in Yellow Milk.
" Œruginosum in Red Milk.

Leptothrix. Filaments of Connected very Small Cells.

Leptothrix Buccalis of Mouth and Carious Teeth.
" Vaginæ of Generative Organs in Enzootic Abortion in Cattle.

Bacillus. Straight or Bent Filaments.

Bacillus Anthracis in Anthrax.
" of Malignant Œdema in Horse.
" " Glanders.
" " Tuberculosis.
" " Septicæmia.
" " Swine Plague.
" " Carious Teeth.
" " Leprosy.

Vibrio. Linear, Wavy, Flexible Filament.

Vibrio of Emphysematous Anthrax (Black quarter).
" " Cholera (Comma Bacillus, Koch).

Spirillum. Spiral, Rigid Filament.

Spirillum of Relapsing Fever of Horse ("Surræ").
" " Milk-sickness.
" " Gums and Teeth (Spirochæte Cohni).

RENDERING ANIMALS INSUSCEPTIBLE TO A PLAGUE.

So much has been done of late in the direction of protecting the individual animal against a contagious disease by reducing its susceptibility thereunto, that it seems needful to furnish a short general statement of the various processes adopted to secure this, and their explanation.

Direct Cause of Acquired Immunity. It has long been well known that for a certain class of contagious diseases a first attack protects its victim for many years, or even for a lifetime, against a second. This knowledge was availed of in inoculating exposed animals with virulent matter from a mild case of a dangerous disease (small-pox, sheep-pox),

and thus inducing a disease which, in the great majority of cases, was slight and comparatively harmless. In the same way children have been voluntarily exposed to the infection of measles or scarlet fever when that particular disease was prevailing in an unusually mild form, and by passing through such mild form of the malady have been empowered to resist the infection when at a later date the disease had assumed a malignant and fatal type.

Of late years facts have accumulated which tend to throw light on the real cause of such acquired immunity. To comprehend these it is necessary to state one or two fundamental truths.

1. A contagious disease is maintained and propagated in an animal body, and from one animal to another, by the multiplication and transference of a living organism, having the property possessed by all living bodies of increase by natural generation, of assimilation of food, and of the excretion of waste material. In a certain number of contagious diseases these have been shown to be infinitesimal cellular organisms (bacteria) allied to the ferments which produce alcohol, vinegar, the carbonic acid which raises bread, and the offensive liquids and gases of putrefaction. It is not necessary to claim that all contagious diseases are caused by bacterial ferments; it is enough for our present purpose to assume that every contagious disease is due to the presence of a distinct microscopic living particle which feeds, excretes, and increases by generation as do ferments. The only other alternative, that it is due to a chemical agent which acts injuriously on the tissues of the body, disproves itself; for every chemical agent expends its power in exercising such chemical action, and can by no means recruit its substance nor strength, but will act with greater or less effect according to the amount originally applied, and must be more speedily exhausted in exact ratio with the bulk or the number of the animals attacked; whereas the disease-

germ (contagium) constantly increases in quantity and force with the increasing number of the susceptible victims upon which it is allowed to operate.

2. Each particular kind of disease-germ has but a limited sway over the animal creation, one or more genera proving completely insusceptible to it. Thus measles, scarlatina, and mumps are peculiar to man, lung-plague to the ox, Rinderpest to ruminants, and strangles to solipeds. Other races of animals have by nature a stronger resistance to each particular disease than the susceptible races acquire even by a first attack.

3. This antagonism or power of resistance to a particular disease is especially inherent in the living animal and in different instances solutions or gelatinous compounds made from the bodies of insusceptible animals have been found to support the life and multiplication of disease-germs that were entirely harmless to the living animal.

4. In the life of bacterial ferments (and disease-germs) there are two main considerations bearing on the question of the causation of disease: *a*, The ferment abstracts from the liquid element in which it lives the food elements necessary for its nutrition and growth; and, *b*, the ferment throws out of its system into the liquid in which it lives the waste products of its own bodily life. Thus the beer-yeast consumes the sugar in the malt, and after using it for its own nourishment, throws out into the liquid carbonic acid and alcohol.

So it is with the disease-generating bacteria. They draw upon the animal fluids for their food materials, thus abstracting from the system materials that may be essential to health, and they pour back into the animal fluids products that may be injurious to health.

5. The disease-producing bacteria or other germs are liable to be arrested in the capillary blood-vessels, the lymphatic radical net-works of the different tissues and the lymphatic

glands, to block these passages to a greater or less extent, and to derange healthy processes by obstructing the flow of blood or lymph or by irritating the parts and producing local inflammation.

These may serve as principles in the light of which to consider the various theories of the mode of operation by which a first attack gives immunity from a second. Four hypotheses have been advanced to account for this immunity, which may be considered seriatim.

a. The Exhaustion Theory. This assumes that in the susceptible animal the disease-germ finds its appropriate food, which has been accumulating from birth, that it uses up this and is starved to death when this supply has become exhausted. The theory holds that the presence of the living germ in the system causes the fever, that the fever subsides when the germ dies, and that the disease cannot again recur in the same animal because all the food of the disease-germ which it contained has been used up. This view was naturally adopted by Pasteur, whose chemical experience with beer and wine had accustomed him to gauge the growth of the yeast by the amount of sugar in the malt or grape-juice. It is, however, utterly untenable as applied to the growth of a disease-germ in an animal body. In the animal system the disease-germ lives in a medium which is constantly changing, new food material is taken in several times a day, this new food is being continually built up into living tissues, and from the living tissues so constructed waste materials are being constantly abstracted and carried out of the body. The newborn animal readily contracts a contagious disease, though the whole period of its pre-existence from its inception in the ovum does not exceed one month to one year in the different domestic animals; yet, after a first attack, it may live for many years exposed at frequent intervals to the same contagion, and never again submit to its malign influence.

Is it conceivable that in these many years of active life and nutrition this same animal system has been unable to elaborate even a fraction of that particular food which was so abundantly produced in the first short year or months of its existence? But this is not all. If the muscles or other tissues of this animal, rendered insusceptible by a first attack of a given disease, are boiled and made into a soup, it supports the life of the specific germ of that disease, and even secures its rapid increase. It follows that there is no lack of food in the living body for this germ which finds such a fertile field in the soup made from its elements.

b. The Antidote Theory. This supposes that some chemical substance is produced during the progress of the disease which is laid up in the living tissues of the animal body, and acts as a direct poison to the germ. This, adopted by Klebs and Klein, has, like the first-named hypothesis, a basis in the action of ferments in simple chemical solutions out of the animal body. Bread that has risen once or twice under the action of yeast is raised less effectually on each successive occasion, though more flour is added every time. So with many other ferments; their growth is rendered less active in proportion to the accumulation of their own chemical products in the liquid in which they are. But the germ is not killed by the accumulation of its chemical products; it remains alive and active so long as it finds food in its surroundings. Were it otherwise, it is not conceivable that these chemical products should remain in the tissues for years in a soluble condition, in which alone they would be taken in by the germ, so as to poison it. If entirely insoluble they might remain in the tissues indefinitely, like the particles of charcoal in the tattooed skin, but they could not affect the composition of the animal fluids nor hinder the growth of any germs in these liquids. If, on the contrary, they were soluble in these animal fluids, they would, like other dissolved pro-

ducts, be carried to the kidneys, skin, bowels, etc., and thrown out of the system in a few days or weeks, so that the system would be no longer protected by them against a new attack. But aside from this, as seen under our last heading, a soup made of the tissues of an animal which has been protected by a first attack of a given disease will readily support the life, growth, and reproduction of the germ which is the cause of that disease. This is conclusive; for the infusion of the tissues will contain the chemical products which were the alleged cause of the destruction of the germ.

c. The Condensation and Filtration Theory. Toussaint found that during an attack of anthrax the lymphatic glands were congested and swollen, and that on the subsidence of the disorder the exuded matter which caused the swelling, developing into fibrous tissue, contracted upon the lymphatic ducts in such glands, compressing them and lessening their calibre, so that he supposed they no longer admitted the passage of the germs (bacteria) of the disease. This view was thought to be supported by the absence of bacteria in the fœtus in many instances where the dam had perished from the disease, the filtration having presumably been effected by the placenta. But, as I have shown elsewhere, the fœtus partakes of the nature of carnivorous animals which are insusceptible to many germs producing disease in the herbivora. The filtration theory becomes untenable when we consider that the lymph-corpuscles, which are incomparably larger than any lethal bacteria, continue to find their way through the constricted tubes of the glands, so that there can be no insuperable obstacle to the passage of the germs as well. Again, this condensation of the glands would not prevent the development of a local anthrax sore in the skin in the seat of inoculation, yet a first attack usually prevents the subsequent formation of the local disease as well as of the general infection. The resistance to the

germ is inherent in every tissue of the body, and not merely in those parts that must be reached through an indurated gland. Finally, this condensation of the gland, caused by the infection of one disease, gives no protection against that of a second. If the protection were due to a mere mechanical obstruction, then the immunity acquired by an attack of one disease would extend to all others having germs of equal size; whereas, with rare exceptions (cow-pox and small-pox), no one contagious disease is vicarious of another.

(D) The Vital Resistance Theory. This hypothesis assumes that the living cells and nuclei of the blood and tissues of the body, having once been subjected to the attack of a specific disease-germ, acquire a power of tolerance or resistance of that particular germ or its products which prevents them from readily succumbing a second time to its evil influence.

The habit of tolerating an injurious agency without harm is a matter of common experience. Exposure to the sun after long seclusion in-doors blisters the face and hands, but after continued exposure and tanning, it has no such effect. Rowing, hoeing, or chopping will at first blister the hands, but after some experience it only hardens and strengthens them. The boy's first cigar or pipe of tobacco sickens him, while the practised smoker can consume the poison from morning to night. So with the drinker, the opium-eater, the victim of the chloral-habit, and the arsenic-eater. Each of these comes to take with impunity that which would have proved fatal in his early experience.

So it is with the morbid products of the life of a disease-germ. Coming for the first time in contact with the living cells and nuclei of the body, they prove more or less potent poisons, whereas later these can bear their presence with comparative impunity. But in both cases alike the power of resistance is limited. It is quite possible by an overdose to kill the smoker, the drinker, the opium-eater, the chloral-

guzzler, or the arsenic-eater. Equally possible is it, by an excessive dose of a specific disease-poison, to lay the best protected system under the fatal influence of that disease. There is no such thing as conferring absolute immunity. Hence the occasional occurrence of a second attack of small-pox, or other plague, on occasions when the disease has become unusually virulent, or acts on a specially depressed system.

But this cannot be the whole measure of the antagonism. Were it to rest here the multiplication of the disease-germ might be as great as before, the system might become saturated with these germs, and trouble would inevitably come from the exhaustion of the blood and animal fluids of their oxygen, the blocking of capillaries, etc. The germs and their products would tend to increase till the vital resistance was overcome, and a fatal result might ensue. The important feature of the resistance is that it prevents the survival and increase of the germs introduced into the body. In the protected animal system, therefore, there is not simply a vital insusceptibility of the cells and nuclei to the action of the chemical products of disease, but there is in addition an active antagonism between the living animal cell and the living disease-germ. There is a certain similarity between the bacterial ferment and the plastic animal cell, in that both are engaged in taking in and using up organic matter for their own nourishment, or, in the case of the animal cell, for the building up of tissue. Each finds in the other organic matter by the devouring of which it can support its own life. Each would feed upon the other but for the vital resistance offered by its antagonist. If one is killed, or has its vitality depressed as compared with the other, the latter will destroy and devour it. If, then, the nuclei of the tissues have had their vitality lowered by the action for the first time of the poisonous chemical products of the disease-germ, they meet the attacks of that germ at a disadvantage, for a

time the germ triumphs in the struggle for existence, and a grave or mortal disease is the consequence. When, however, the animal cells and nuclei are inured to the action of this disease-poison by a former attack, they have acquired an insusceptibility to it, and in spite of it retain all their native vitality and vigor, so that the disease-germs which are introduced fall easy victims to the devouring animal cells.

This position is further sustained by the fact that many virulent liquids, introduced in small amount into the blood, quickly perish, whereas if introduced into the tissues they survive, multiply, and generate disease. In the blood, the attacking party of disease-germs is confronted in rapid succession by the endless myriads of actively moving blood-globules, and in the resultant struggle the countless numbers of strong animal cells triumph, and the invading disease-germs are devoured. When the disease-germ is planted in the tissues the case is reversed. Here the animal cells (nuclei) are immovably fixed in the tissues which they serve to build up, so that the whole force of the invading germs is thrown upon a few. The poisonous chemical products (ptomaines) lower their vitality, so that they can no longer successfully resist the morbid germs, and the latter increase rapidly, pour their depressing products onward through the lymphatic vessels into the blood and system at large, and finally debilitate the whole, so that the germ finds no effective resistance at any point, not even in the blood itself. Thus the disease, which is at first local, becomes general, because the animal cells at the point where the virus was implanted, had not the power to resist the depressing influence of the germ products, and the germ was allowed to increase in numbers and force.

Another consideration sustains this theory. The protection conferred upon a system by a first attack of a disease-germ is to be trusted even where the diseased processes

have been strictly local. Thus a vaccination on the arm protects the whole system against a second occurrence of the disease. A single malignant pustule on the hand fortifies the whole body against anthrax. A swelling no larger than a peach, caused by the insertion of lung-plague virus on the tip of the tail, protects the lungs from attack as if the first manifestation of the disease had been in the lungs themselves. This is the more remarkable, that the introduction of lung-plague virus into the blood causes no local disease in the lungs nor elsewhere. The germs introduced into the tail caused disease in the tail, but none in the lungs, and as the germs could only reach the lungs by passing through the blood, and as the blood is destructive to these germs, it follows that the germs could never have reached the lungs, and that the vital resistance conferred upon the lungs by this inoculation in the tail must have been secured by contact with the chemical products of the growth of the germ, which were thrown into the blood and carried to the lungs and the whole body continuously through the whole progress of the disease.

Still another fact favors this view. With some disease-germs (chicken-cholera), dilution of the virus till you can guarantee that no more than one or two germs are introduced into the sore by inoculation secures a local and non-fatal in place of a general and lethal disease. The small number of germs introduced have no advantage in point of force over the living nuclei with which they are brought in contact in the tissues, and in the resulting struggle the tissue elements triumph and the germs are destroyed. Yet here again the general system is protected against a subsequent attack of the disease, the inoculated germs having diffused enough of their chemical products (ptomaines) through the body to secure this before they died.

This hypothesis of acquired vital resistance and antagonism meets the case at every point, and of the four theories

named is the only one that makes full explanation of the phenomena.

We can now proceed to intelligently consider the different modes of seeking immunity from contagious diseases.

I.—IMMUNITY BY GOOD HYGIENE.

We have seen above that the animal system is conquered by any contagious disease in ratio with the debility of the living animal cells and their feeble power of resistance. The system, therefore, in which these cells are weak from living in impure air, damp buildings, darkness, on poor or deficient food, on foul water, from overwork, from old-standing or debilitating disease, from excessive drains on the vitality, as heavy milking, etc., is more ready to succumb to the attack of a disease-germ than is one in the strength of the most vigorous health. So it is with the individual that has descended from weak or debilitated ancestors, or from such as were too young and imperfectly developed, or too old and worn out. Hence it is that all that contributes to robust health favors the resistance to contagious disease. But this resistance is extremely limited in its scope. We constantly see the strongest and healthiest men and animals fall under the blight of a plague, while their weak and debilitated compeers that have already passed through this affection successfully resist. In many cases, too, the unusual vigor of an animal system, while failing to completely throw off the disease-germ, yet modifies the affection so that it passes in a milder form. This may save the individual, but it does not hinder the multiplication of the germs and the propagation of the plague. The robust system, like a barren field, produces a stunted crop of disease-germs, a crop, however, which is amply sufficient to keep the contagion constantly progressing from animal to animal, and from herd to herd.

II.—IMMUNITY BY TONICS AND ANTIFERMENTS.

The use of tonics is based on their tendency to produce a more vigorous health. Like good hygiene, therefore, they will sometimes assist in warding off infection, or in rendering the resulting attack more mild. A long course of sulphate of iron will do much to fortify against lung-plague, and is not without influence even on rinderpest; but a certain number of victims suffer after all, and too often the plague continues to extend.

The free use of sulphites, bisulphites, and hyposulphites was long ago shown by Polli to counteract the dangers of inoculated septicæmia, and has undoubtedly the effect of retarding the growth of certain disease-germs within the animal body, but at best they but mitigate the disease and do not prevent the progress of the infection to other animals.

III.—IMMUNITY BY PASSING THROUGH THE PLAGUE BY EXPOSURE.

In a country where a deadly animal plague is generally prevalent, a measure of security is sometimes secured by passing the young and comparatively valueless through the disease. Those that die are but a trifling loss, while the survivors resist this plague for their whole life-time. This has been especially adopted in lung plague.

IV.—IMMUNITY BY INOCULATION FROM A MILD TYPE OF THE PLAGUE.

Before the days of Jenner this was employed for small-pox, and to the present time it is largely resorted to for sheep-pox. Sheep in good health, inoculated from a mild case of the disease, usually have the pox in a mild form; nearly all recover, and the flock is thereby preserved.

V.—IMMUNITY BY INOCULATION FROM A CLOSELY RELATED DISEASE.

This was inaugurated by Jenner, who observed that the Gloucestershire milkers who contracted cow-pox never suffered from small-pox, and to-day his beneficent method is followed all over the civilized world. No two other diseases have been yet shown to be vicarious of each other.

VI.—IMMUNITY BY INOCULATION WITH A MINIMUM AMOUNT OF VIRUS.

This consists in diluting the virus in water or saline solution of the density of the blood, until the drop or drops inoculated contain but one, or at most two germs (bacteria). Dr. Salmon has employed this extensively in chicken-cholera producing a local slough only, followed by recovery and subsequent immunity from the disease.

VII.—LIMITATION OF LOCAL DISEASE BY ANTISEPTICS AND CAUSTICS.

Jenner recognized that an excessive inflammation in the seat of vaccination could be cut short by the caustic application of the sulphate of zinc or nitrate of silver. In the light of to-day we can recognize in these, antiseptics which destroyed the living germs in the seat of inoculation and prevented their further increase. Similarly, in all those affections that are for a time limited to the seat of superficial infection, the general infection may be prevented by the application of caustics or antiseptics to the affected part. This applies to local anthrax, septic poisoning, inoculated lung plague, and even canine madness, and in proportion to the chemical products thrown off into the system before the local disease was arrested will be the measure of protection from a future attack.

VIII.—IMMUNITY BY INOCULATION IN AN UNIMPORTANT ORGAN.

This has been especially resorted to in lung plague after the mode of Willems, of Hasselt, Belgium. The liquid exudate from the diseased lung, recently attacked and still gorged with an uncoagulated liquid, is inserted into the tail near the tip. In fifteen days, on an average, it becomes inflamed, swollen, and it may even slough, but after recovery the system is fortified against the disease. Inoculated elsewhere in the body where there is an abundant connective tissue beneath the skin it is usually fatal, but in the tail, with its dense texture and deficiency of lymphatic tissue, it rarely extends to dangerous dimensions.

IX.—IMMUNITY BY INOCULATON IN THE VEINS.

In 1879 Burdon-Sanderson inoculated cattle with the lung-plague virus by injecting the same into the veins, without any contact with the adjacent tissues. The inoculated cattle showed no special disorder, but when afterward inoculated in the tissues with fresh virus they proved to be entirely insusceptible of it. Later, Galtier adopted the same measure with the saliva of canine madness, injecting it into the veins of rabbits and sheep with no direct evil result, and the subjects afterward resisted the infection by inoculation in the tissues. Lussano long before, and Pasteur later, made intravenous injections in dogs, but with the result of inducing rabies. The method, then, must have a very limited application, being restricted to such disease-germs as do not survive in the blood. It is utterly inapplicable to diseases in which the blood is habitually infecting, such as syphilis, glanders, tuberculosis, rabies in dogs, anthrax, etc.

X.—IMMUNITY BY INOCULATION WITH GERMS MODIFIED BY ANOTHER GENUS OF ANIMAL.

In 1878 Burdon-Sanderson and Duguid inoculated anthrax on guinea-pigs for several generations of the poison, and from the guinea-pigs inoculated several cattle, all of which passed through a mild form of the disease and without exception recovered in five days. The same cattle, afterward inoculated with very virulent anthrax fluids, again sickened, but in no case with a fatal result. These experiments were repeated and confirmed by Greenfield a year later.

In 1879 I inoculated swine-plague matter on a lamb and a rat and conveyed the infection from these animals back to pigs, the latter taking the disease in a mild form, and showing the characteristic lesions on post-mortem examination after the recovery had been well advanced. As a first attack protects against a second, we assume that these pigs had been rendered insusceptible.

In 1884 Pasteur inoculated the virus of canine madness on monkeys, and inoculated it from the apes back on rabbits and dogs, producing in the latter a non-fatal disease which protected the system against a second attack.

This method is doubtless capable of very great extension in other plagues.

XI.—IMMUNITY BY INOCULATION WITH GERMS GROWN IN DIFFERENT LIQUIDS OR SOLIDS.

It is well established that ferments produce different products and assume varied forms as grown in different liquids. So with disease-germs. In 1878 I found that the virus of swine-plague preserved in wheat-bran was constantly fatal, and in 1880 that similar virus cultivated in previously sterilized milk, egg albumen, and urine, respectively, produced only mild attacks, which protected against the usual infection.

XII.—IMMUNITY BY INOCULATION WITH VIRUS GROWN IN FREE CONTACT WITH AIR.

The same principle operates in this as in the last method, the bacterium or other germ living in free contact with air acquires the habit of using more oxygen than it can secure in the animal tissues, and when transferred to these it grows in a sickly manner and is easily thrown off by the living animal tissues. This is largely operative in slowly disinfecting buildings freely open to the air, infected yards, parks, and other open places, while it determines that virulent matters closely shut up in sewers, manure-heaps, cess-pools, close areas under floors, compact, water-logged, or filth-saturated soils, or indeed wherever the air cannot freely reach it, retain their infecting qualities for a much longer time, and at times, as in cholera, yellow fever, and typhoid, have them materially enhanced in potency. In my experiments with swine-plague and septic matters I invariably found that material the most deadly which had been grown in closed flasks with a very limited supply of air, while that which was grown in thin layers and with free access to air steadily lost in potency, and finally produced a disease so mild that it could be resorted to as a means of preventing losses in herds.

XIII.—IMMUNITY BY INOCULATION WITH VIRUS WHICH HAS BEEN EXPOSED TO COMPRESSED OXYGEN.

This is based on the same principle with the last, only in place of a lengthened exposure to the oxygen in the air there is a temporary exposure to pure oxygen under extra pressure. Chauveau has especially labored in this field, and found that, by carefully graduating the pressure and the period of exposure, he could secure such debility or lessened potency in the germs as would determine a mild and non-

fatal disease, which would prove vicarious of the more severe form.

One drawback to this method is that, if applied to a virus which has been some time removed from the system and has produced spores, the latter still retain their potency.

XIV.—IMMUNITY BY INOCULATION WITH VIRUS WEAKENED BY RESTING INACTIVE (STARVED) IN FREE CONTACT WITH AIR.

This is the far-famed method of the brilliant Pasteur. He began his work on the virus of chicken-cholera, setting aside his cultures of the virus in vessels unfurnished with any more food for their nourishment and freely exposed to the air. After a sufficiently long exposure he found that the virus had lost somewhat of its deadly character, and after a three months' rest it could be inoculated on healthy fowls without a fatal result, and proved protective against another attack of the disease. Later, with anthrax virus cultivated in chicken-soup at 41° C., so that it would not produce the unimpressible spore, he produced by delay a debilitated virus which could be safely inoculated on healthy sheep and cattle, and would protect them from a second attack. Later still the method has been successfully applied to canine madness and other diseases. The one great drawback to the method is the fact that, though the individual is preserved, yet the virus is multiplied in its system and scattered in the surroundings, ready to resume its virulence at any time under favorable circumstances. Pasteur himself has secured this reversion to the deadly type by inoculating the weakened virus of fowl-cholera on the chick, and successively on older and older animals. It is easy to conceive how a diffusion of germs, by a general inoculation with the weakened virus, may become the means of starting many new centres of deadly infection.

Pasteur's system is therefore not one that can be adopted

with any confidence for the extinction of an animal plague; the highest good that can be expected from it is the protection of the system of the particular animal inoculated, against an ordinary attack of the disease. The living germs are, however, propagated in the system of the animal operated on, and unless the animal and all its products are carefully secluded for a time sufficient to allow of the escape of the germs from the system, and unless such escaped germs are suitably disinfected, each protected animal may start a new focus of infection and plague. In connection with this it is not a little suggestive that, since the general adoption of the Pasteurian method for hydrophobia in France, the disease has become unusually prevalent in that and neighboring countries, and though nearly all the subjects inoculated by M. Pasteur have escaped the disease, the number of people dying from hydrophobia in a given time has in no way decreased, even in France (Colin).

The truth is that the Pasteurian inoculation should be surrounded by greater safeguards than even its author has yet appreciated the need of. While the great majority of those bitten by rabid animals may, by its adoption, be protected against rabies, they cannot safely be set at large immediately after, as practised by Pasteur, but should be quarantined until time shall have assured us of the destruction of the potent virus introduced into their system, and should, with all their belongings, be disinfected before final liberation. In the case of herds, too, the same precaution is imperative, and on no account should animals kept on uninfected lands be inoculated with these less potent germs as a preventive against the more potent germs to which they are to be subsequently exposed in an infected pasturage. Such a course would only be the sowing of a previously wholesome soil with a deadly seed which would be preserved and intensified in any portion of that soil favorable to its maintenance and increase. The extensive adoption of Pasteur's method

of protection against anthrax has undoubtedly been the means of planting that deadly disease on many soils hitherto wholesome and safe, and this evil cannot fail to be extended wider and wider, so long as the method is pursued in the present indiscriminate manner.

For animals pastured on fields that are already infected, Pasteur's protective inoculation against that infection may be safely allowed, but for those on fields as yet uninfected, but of a nature favorable to the preservation of that poison when planted, such inoculation must be unequivocally condemned. In such a case the animals should be housed for inoculation, or confined on a porous soil which will not preserve the germs, and should only be set free when all danger, from living germs within their bodies, has passed, and after a perfect disinfection.

XV.—IMMUNITY BY INOCULATION WITH STERILIZED PRODUCTS OF A CONTAGIOUS DISEASE.

As we have already seen, in the development of bacteridia, whether in or out of the animal body, there are two distinct bodies, *living* and *dead*, *the multiplication of the living germ* and *the increase of its chemical products*. Thus the beer-yeast (saccharomyces cerevisiæ), growing in a sweet organic fluid, like malt, multiplies its own numbers enormously, but it also produces an amount of carbon dioxide and alcohol proportionate to the amount of sugar originally present in the liquid. So the disease-germ, operating in the animal body, not only increases its numbers but elaborates a variety of chemical products of which a soluble digestive ferment and a poisonous organic alkaloid (ptomaine) are especially important as attacking the integrity and life of the tissues. Apart from these chemical poisons the living germ probably could not destroy the vitality of the blood-globules and tissue-cells (nuclei). It is their place to rob the living tissues of their vital power of resist-

ance, and to digest and dissolve them in preparation for their consumption by the ravenous bacteridia. In their turn the well-nourished bacteridia produce the ferment and poison in increasing amount, and thus the strength of the invading germs is increased relatively to the waning power of vital resistance in the body until the whole economy is fatally invaded and the victim perishes.

The overwhelming action of these chemical products is seen in the sudden death which ensues when a large dose of virulent fluid is thrown into the body, no time being allowed for the development and increase of the living germs. On the contrary, when a small dose only is introduced, illness is delayed much longer until the germs have had time to multiply and produce their chemical products, and death, if it occurs at all, is at a much later date. Some germs, when thrown at once into the veins, produce no disease at all, but are destroyed by the ferments of the vital fluid and the myriads of living blood-globules with which they are brought rapidly into contact, and over the whole body of which their chemical products can exercise no appreciable effect. Yet the virus of lung-plague or of black-quarter, deadly when introduced into the tissues but harmless when thrown into the blood, have, nevertheless, in the latter case, the effect of conferring upon the entire system the power of subsequent resistance to the same poison, so that if later introduced into the tissues it rests innocuous. Again, in the animal that has passed through a non-recurring contagious disease without dying, a similar exposure to the same poison later is harmless. This cannot be due to a greater vigor of constitution, for the system, permanently weakened by a first attack of a plague, still fails to contract the same disease on exposure to even a more potent virus. It can only be that the system has learned by its previous experience to resist the organic poison which proved so hurtful to it before.

Acting on this suggestion, I, in 1880, inoculated two pigs with swine-plague liquids, after I had sterilized them by heat, and had the satisfaction of seeing developed but a slight and temporary fever only. Later I repeated the inoculation with sterilized liquids, and finally exposed the same animals to contact with pigs sick with swine-plague, and to repeated inoculations with virulent liquids which proved fatal to unprotected pigs, yet they successfully resisted all such exposures.

Since that date I have availed myself of the same method for lung-plague in cattle, having first carried it out on ten experimental cases in 1881, which subsequently successfully resisted all my inoculations with fresh virus that proved fatal to unprotected animals used as test cases, and were finally sent, to the number of six, into infected premises in Brooklyn, N. Y., and Baltimore County, Md., but came through all without showing a sign of illness. Since that time I have successfully inoculated with sterilized lung-plague virus a considerable number of cattle that had been exposed to the contagion, or were to be, with, in the main, thoroughly satisfactory results. In two cases only were the results unsatisfactory, in the first, where the inoculating matter had been taken from a lung which did not show a sufficiently active development of the lung-plague lesions, and in the second, where no thermometer could be had marking over 120° F., so that the sterilization remained incomplete and living germs were inoculated.

Similarly Toussaint inoculated against anthrax in 1880: I tested it on two herds, in July, 1884, and in 1885. In the first herd one heifer was left without inoculation as a test case, and in two days she died of anthrax, while the remainder of the herd, twelve in number, successfully resisted. The second, a large herd, escaped without a loss.

In these cases the virulent liquids were heated to 160° F., and even higher, for an hour, and when time permitted this

was repeated some time later. The inoculations were made at least twice, with intervals of one or several days.

The results in the case of the swine have been criticised mainly, it would appear, because similar attempts on pigeons proved unsatisfactory, unless a greater number of inoculations with the sterilized virus were resorted to. Such criticism is, however, entirely unwarranted. 1st. Results obtained in one genus of animals will not necessarily be secured in another genus. 2d. No acquired immunity is absolute, not even though it may have been secured at the expense of a violent attack of the disease. In every case a large dose of powerfully virulent material will cause the best protected system to succumb. All such protection is only relative, and the fact that my inoculated pigs were unharmed by exposure to infection and by inoculations with fresh virulent liquids that proved fatal to other and unprotected pigs, sufficiently attests that I was working on the right principle, which even my critic and follower in the same line of experiment has found satisfactory in his own hands. He need not begrudge me the mead of priority in the work of establishing this great principle as applicable to swine-plague.

Superiority of Principle of Protection by Sterilized Virus. In comparing the method of protection by sterilized virus with the other inoculation methods, its great superiority becomes at once manifest. With the single exception of Jenner's inoculation of a harmless disease (cow-pox) to protect against a deadly disease (small-pox), all other inoculation methods consist in the introduction into the animal system of the living germs of the disease which it is sought to protect against. They are, one and all, but the production of a mild form of the disease in question. Fundamentally, they are but a return to the pre-Jennerian principle of inoculating from a mild case of small-pox, to protect against a deadly form of the same disease. They all result in the multiplication of these weakened germs by myriads in the animal

system, and too often in their distribution on surrounding objects, where they may be preserved indefinitely to infect other susceptible animals. As in the case of all germs, there is the certainty of reversion to the original deadly type whenever the medium in which they grow is favorable to such transition. Pasteur himself has shown this to be the case, when his weakened anthrax virus is passed through a succession of young guinea-pigs; and what is true of one germ is true of all in this respect. All have the power, within given limits, of adapting themselves to varying conditions of life. That the weakened virus (misnamed *vaccine*) has the power of reversion to the deadly type is assured to us by the fact that already a change of culture has robbed it of its deadly potency without destroying its life; it has merely acquired a new habit of life, and the recurrence to the original habit is just as certain under a reversal of the conditions. Nothing, then, short of the absolute seclusion and disinfection of the inoculated animals, and their habitations and belongings, will render such inoculations reasonably safe. With the use of sterilized virus, on the other hand, all such possibilities of diffusion of the disease-germ are entirely done away with.

1st. No living germ is introduced into the animal system.

2d. No multiplication of germs can occur on nor in the animal.

3d. The inoculated animal can convey no living germs to surrounding objects.

4th. The material inoculated agrees with ordinary chemical poisons in affecting the system only in ratio with the dose. It has no power of self-multiplication, with consequent augmentation of its power for evil.

5th. The dose can be graduated as easily and safely as can a dose of morphia.

6th. By a succession of small doses we can keep up the

effect on the system, without at any time endangering life by any sudden increase of germs, and their deadly products within the body.

7th. The inoculated animal may be kept throughout among the uninoculated, or may be sent at once to any part of the country to mingle with other, stock without a shadow of risk to such stock. It carries no living germ.

8th. Neither the inoculated animal nor its surroundings is in any need of seclusion during the process, as there is no living germ present which visitors may carry away with them.

9th. Neither inoculated animals nor their surroundings are in any need of disinfection before contact with susceptible animals can be allowed.

Drawbacks to the Method of Protection by Sterilized Virus. 1st. The main objection to the method is the necessity of keeping up a constant cultivation of the germs in their virulent form. This must be done either in living animal bodies or by means of culture-fluids and solids out of the body. In either case we must maintain a centre of infection to supply the inoculating material, and there is always the risk that germs escaping from such centres will start new outbreaks of the plague.

2d. Such cultures must be conducted with the greatest care, as, alike in and out of the animal body, there is always the liability that the germ may change its habit somewhat, lose its potency, and produce an ineffective virus only, lacking in either quantity or quality. Even if grown out of the animal body, therefore, a continuous chain of test cases, in inoculated animals, must be kept up to test the efficacy of the cultures. This makes the centres for culture extremely dangerous centres of infection.

3d. Extreme care is requisite in the sterilizing of the virus, as the slightest failure here is fatal to the procedure, and unless the precautions are extreme there is the strongest

probability of the conveyance of germs on instruments or on the person and clothes of the operator or his assistants.

4th. Then, too, as the practice is often called for in herds, among which the plague in question has already appeared, there is always the probability of the presence of germs on the surface of the animal inoculated, and unless the skin is first thoroughly cleansed and disinfected (say with chloride of mercury, 1 to 1,000 water) such germs are liable to be carried in with the instrument and deposited in the tissues.

5th. In all such infected herds, too, a given number of animals will usually have the germs already in their systems, and in such cases the sterilized virus, weakening the vital resistance of the blood and tissues, will too often contribute to intensify the already implanted disease.

6th. With a general application of the principle it would inevitably happen that blunders would be made by the owners and others as to the precise nature of the disease to be prevented, and thus the products of one plague would be inoculated to prevent the irruption of another, and in the consequent failure the whole system would receive unmerited discredit. To avoid this, and in the absence of the requisite skill for diagnosis, the virus should be obtained from one of the victims in the herd, and prepared with all due precaution on the spot. In such case a failure would be unlikely, unless the subject furnishing the virus showed only an imperfectly developed type of the malady, or unless two diverse maladies existed in the same herd at the same time.

7th. Another obvious precaution is to take virus only from typical cases of the disease to be prevented, and not from those which show any defect in development (as the chemical products are then liable to be wanting in strength) nor from advanced nor complicated cases (in which there may be superadded germs of other poisons and other deadly products). Thus in the advanced stages of disease the propagation of septic germs is not at all uncommon.

Limitation of Protection by Sterilized Products. While it is evident that there is a large field as yet uncultivated in which the fruits of this method may be gathered, yet there are obvious limitations to its application, some of which may be shortly stated.

1st. A certain number of animal plagues will recur in the same system at frequent intervals. Thus aphthous fever not unfrequently attacks the same herd twice in the course of a single year, and the same apparently holds with some forms of equine influenza. It would be folly, therefore, to expect any permanent protection from inoculating the chemical products of these diseases.

2d. A certain number of infectious diseases cannot be said to have any limit set to their duration. Thus tuberculosis and glanders may go on for a life-time, the inflamed and embryonic tissue produced under the influence of the poisonous products of the germ furnishing continual accessions of new food for the slowly developing germ, and thus determining a constant extension of the colonies of bacilli. It is absurd, therefore, to expect protection by the use of the chemical products in these cases.

3d. It may turn out that the ptomaines of given diseases are volatile and would be dissipated by heat, so that the final sterilized product will be deficient in the essential element in which its preventive virtue resides. In the inorganic kingdom we have the alkali ammonia volatile at ordinary temperatures, and it would not be surprising if in the organic kingdom a certain number of alkaloids should also prove volatile. In such cases the product sterilized by heat would be useless.

4th. It is not at all improbable that chemical or physical changes may be effected by heat in the ferment or alkaloid produced by a disease-germ, as egg albumen is coagulated. Here again the method would be at fault.

5th. In other methods of sterilization similar difficulties

would at times be met with. Thus the life of the germ may be destroyed by oxygen under a pressure of three atmospheres, but in too many cases it is to be feared such intensified oxygen would oxidize the chemical products, and thus rob them of all their virtue.

In cases where these limitations are found to operate, there may perhaps still be devised, in the future, other methods of sterilization which will not affect the chemical condition nor virulent potency of the disease-products, and thus the grand principle of prevention by sterilized products may receive a much wider application than can be effected by the methods of sterilization by heat or compressed oxygen.

Radical Extinction of Animal Plagues. The public appreciation of preventive medicine is still at a very low ebb. It has been aptly said, people will give "millions for cure, but not a cent for prevention." It is incomprehensible how, year after year, and generation after generation, we can see the human race dying off from preventable diseases, and yet with true fatalism accept it all as the inevitable. It is astounding to contemplate the thousands of tons of quack *remedies*, so called, which mankind yearly swallow, for maladies chargeable only on their own ignorance or neglect of available means of prevention. Still more astounding is it to see the plagues of animals imported into a new country, and by the most criminal negligence allowed to acquire a general prevalence, when the prompt sacrifice of one animal, or one hundred, or one thousand, could at the different stages have put a final end to the contagion. Yet all radical measures for the extirpation of animal plagues are habitually treated with neglect or active opposition; the advocate of such measures is told that "his duty is to cure, not kill," and his reasoning is scouted as the "logic of the pole-axe." And all this not by the common people alone, but by those whose position would entitle us to expect

from them better things. The editors of powerful newspapers, who can surely never have given five minutes' sober and intelligent consideration to the question, join in this cry, and quite recently Mr. Clare Sewell Read, M.P., in an agricultural address, bewails that "veterinary science can only advise them to kill." Now in view of all that is set forth above, our readers must see that all this talk is but the fruit of ignorance and slander, and that for the plagues of animals we are to-day in a better position to offer preventive measures than is the practitioner of human medicine for the pestilences of man.

It is true that we cannot exercise omnipotence and extinguish infection with a word, nor can we mail to any point a much desired, and very generally believed in, panacea, which will cure the victims of all *contagia* from ringworm to rinderpest. But we can in suitable cases procure such conditions of life and such power of resistance in the animal economy as will render the assaults of given plagues harmless.

As veterinarians, however, and as citizens, it is not for us to advocate especially those measures which would protect the individual animal or the individual herd at the cost of danger to the herds around them, when more radical, and, in the end, cheaper measures can be availed of to obviate all necessity for these partial and dangerous methods of protection. Veterinarians have been freely slandered for an alleged desire to feed luxuriantly from the public treasury. The wonder is rather that more of the profession have not pandered to the public prejudice, and advocated and engineered public culture establishments from which the variously modified virus could have been sent out everywhere at a handsome profit. Have our detractors ever thought of how many millions it would cost yearly to inoculate the hogs of the United States as a protection against swine-plague? And of how many millions more it would cost to

inoculate against each of the other animal plagues now existing in the land? The radical and thorough extinction of these plagues, which, to their credit be it said, the better class of our veterinarians have consistently advocated, has for its purpose the speedy removal from the land of all need for preventive measures apart from those aimed at the prevention of renewed importation of infection, and such extinction is therefore the only method that looks toward the lessened remuneration of veterinarians as a body. In the face of these facts does not their consistent advocacy of extinction of contagion savor more of public-spiritedness than of the selfishness so slanderously attributed?

For the instructed and high-minded veterinarian the question is mainly one of political economy. It is simply a question of how we can, at the cheapest rate and in the shortest period, rid ourselves for ever of our pestilential enemy, and at once abolish all future loss and worry coming from this source. There is only one answer: *By the prompt and remorseless extinction of every germ of contagion.* We need make no account here of the *sacredness of life.* The killing of an infected and infecting animal is not murder. We entertain no such feelings concerning the tens of thousands of animals that die daily under the knife of the butcher, and the lives of which might have been prolonged with safety to others. Why should we hesitate to sacrifice the few, whose systems are multiplying by inconceivable myriads the germs that are so deadly to others of their race, and which in the case of several plagues are now costing the country more every year than it would take to exterminate them once for all? The question is essentially one of dollars and cents. The only moral elements that enter into it are the questions of the remuneration of the stockowner for the animals expropriated for the public good, and the protection of the public at large from the consumption of diseased and often dangerous meat and milk. The last ques-

tion is more effectually met by thorough extinction of pestilence than by any other method, and the indemnity of the owner in no niggardly spirit is a simple matter of justice on the part of the nation toward the citizen.

Measures for Extinction of a Prevailing Plague. It is not within the province of this book to treat fully on the entire subject of veterinary sanitary administration, yet it seems desirable that the public at large should be made acquainted with the leading principles that must guide such administration. The measures will necessarily vary with each animal plague, and to some extent according to the nature of the local animal industry, yet some general principles must dominate in all cases, and these may be stated under separate headings.

Setting aside the preliminary discovery of the plague in a State or district toward which investigations must often be made on the merest suspicion, in a country where movement is so free as with us, and in which the plague in question already exists, we may note those fundamental measures that look especially toward extinction.

1st. The infected district must be proclaimed.

2d. All movement of animals susceptible to the plague in question must be temporarily stopped in the infected district.

3d. All mingling or contact of separate herds of susceptible animals within said district must be put a stop to.

4th. All exposure of susceptible animals on public high ways or on unfenced pasturages must be vigorously interdicted.

5th. Insusceptible animals mingling with suspected herds must be prohibited from passing into other herds of susceptible animals.

6th. Attendants on suspected herds must be rigidly kept from all other susceptible animals. Visitors except such as attend officially must be excluded from all suspected herds.

7th. Markets or fairs in infected localities must not be held.

8th. The expiration of the period of incubation will lead to the development of cases of disease, and wherever these appear the herd must be even more rigidly segregated.

9th. In the case of deadly *contagia* the whole herd should be at once condemned, appraised at not less than two-thirds their sound value, and promptly slaughtered. The carcases of animals that show no disease after death may be sold as human food, in the case of certain diseases, but not in all. To making such into canned food there is no objection. Hides should only be removed after a prolonged steeping in solution of chloride of lime. The carcases of the diseased are best destroyed by fire, or disinfected by boiling, but they may, when necessary, be deeply buried in a dry, porous soil, where the free circulation of air will secure an early disinfection.

10th. The building, utensils, yards, etc., with which the infected herd has come in contact must be subjected to a thorough disinfection. (See below, Disinfection.)

11th. The infected buildings must be left empty until all danger has passed. This may entail thorough aeration for several months after disinfecting applications have been made.

12th. Hay, fodder, feed, litter, etc., in infected buildings should be destroyed.

13th. Manure from infected places must be burned or disinfected with chloride of lime.

To exclude an Animal Plague from a Country. 1st. Prohibit all importation of animals susceptible to the plague in question, and of their products.

2d. Disinfect the surface of all imported animals of a genus insusceptible to the plague, but that may have cohabited with those that are susceptible.

3d. Disinfect all blankets, or other clothing and utensils

imported with such animals, the clothing of their attendants, and the clothing of all emigrants who have had to do with susceptible animals.

4th. In place of *absolute prohibition*, as called for in No. 1, susceptible animals must be imported under careful restrictions, including a quarantine after arrival for a period equal to the longest known *incubation* of the plague which it is desired to exclude.

5th. Prohibit the importation of baled hay, straw, or other farm product, in the preparation or removal of which the domestic animals are usually employed, or which is usually stored in buildings beside the dwellings of such animals.

These headings are only given as illustrative of the general principles which must be carried out in such cases. In putting them in practice they must be elaborated materially in various directions. But in thus elaborating and administering them no laxity and no exceptions must be admitted. In many of the concerns of life a blunder or neglect results in an immediate loss, the extent of which can be at once seen and the after-effects of which are *nil*. But in dealing with the invisible but unspeakably prolific bacteria of animal plagues, a blunder is quite likely to prove fatal, and anything like laxity is almost of necessity the road to failure and ruin. It is in this respect that the man of business usually fails. The dealer demands that live stock shall be examined at a particular point and a certificate of health shall be given if no disease is discovered. The magistrate *carries out the law in* (what he calls) *its spirit* (?), ignoring its letter, and undoes everything which it was designed to effect. The legislator insists that his constituent and supporter has selected his stock with extreme care, and that there can be no danger in making the quarantine merely nominal in his particular case. The city magnate finding that his animals from an infected locality cannot be admitted to a public sale, makes a fictitious sale to some one outside in order that his stock may

ostensibly come from another district and thus gain admittance. The agents of great live stock interests are sent into Congress and to foreign lands to deny point-blank the existence of animal plagues that are simply notorious in their prevalence. The patriotic citizen demands the appointment of two or three microscopists to examine and certify to the soundness of our meat-products in a centre where many thousands are butchered daily and where a whole army of microscopists could not satisfactorily carry out such work. In no other field of human activity is a most thorough knowledge of the subject and a most unbending and impartial administration demanded than in this.

DISINFECTION.

Disinfection cannot be treated fully in the short space that can here be given to it, yet the general principles and some of the more potent of the agents employed may be noticed.

The first and main object in disinfection is to secure perfect cleanliness. From the buildings, cars, loading banks, ships, quays, yards, manure-pits, drains, cesspools, harness, clothing, utensils, etc., all decaying organic matter should be removed, by scraping, washing, emptying, etc., as such decomposing organic matter is the food which sustains and preserves the disease-germs out of the body. Even the water and air must be carefully seen to, since in close places they are usually charged with invisible particles of organic matters in a state of decay, the most suitable field for the growth of contagious principles. These, too, tend to purify themselves in a free circulation of air, and ventilation may be largely relied upon for this purpose, unless the deleterious supplies are too abundant from some adjacent putrid accumulation, as dung-heaps, cesspools, leaky drains, or soil saturated with filth. Purity of the surroundings kills many contagious elements on the principle of starvation.

Some disinfectants operate by destructive oxidation of the infecting material. Simple aeration often acts thus, and much more when the aërial oxygen is combined in the form of ozone, so abundant after thunder-storms, and developed to a lesser extent by camphor and some of the essential oils. Ozone is, however, rapidly used up in filthy stables, in cities, and in connection with decomposing organic matters generally.

A much more prompt, thorough, and reliable oxidizing disinfectant is FIRE. BURNING is the best of all disinfectants. Rotten and filth-saturated wood-work, infected manure, fodder, litter, and even the infected carcases of animals may be safely disposed of in this way. It may be used in a plumber's charcoal stove placed in all parts of a stable in succession, or over the opening of a drain, or as a lamp in the ventilating outlet of an infected building.

Certain oxygen-bearing agents, like running, rippling, or falling water, and inert powders (charcoal, plaster-of-Paris) which condense oxygen on their surface, and bring it into closer contact with the adjoining germs and their products; also chemical agents which liberate oxygen (chlorine gas, chloride of lime, permanganate of potassa, peroxide of hydrogen, iodine, bromine, hyponitric acid, bichromate of potass a, etc.), are more or less effective in the same way. Other agents act on the germs in different ways, such as by abstracting the oxygen requisite to the life of the germ, by coagulating its albuminous substance and otherwise. To this class belong the fumes of burning sulphur, the salts of zinc, iron, manganese, copper, and mercury, also carbolic and cresylic acids, creosote, thymol, menthol, and allied agents.

Among these none holds a higher place than chloride of mercury, but its highly poisonous nature forbids its general use. In its place *chloride of lime* may be confidently and safely used in the proportion of four ounces to every gallon of a lime whitewash. Such a preparation has the advan-

tage of showing clearly the extent of its application, insuring that no part shall be missed, and thus it becomes even a more certain disinfectant than the more potent salt of mercury. As a powder it may be sprinkled on floors, yards, manure-heaps, and in drains, cess-pools, etc.

For dairies, in which the smell of the chloride of lime will injure the milk, *chloride of zinc* may be substituted.

Chlorine gas, set free by pouring sulphuric acid on common salt, with a slight admixture of black oxide of manganese, is one of the most effective purifiers of the air of buildings. Doors and windows should be closed, though light is beneficial to its action. The salt and black manganese should be placed in a bowl in the centre of the floor, and the operator, taking a full breath, should pour in the sulphuric acid and retreat outside the door before taking another breath. The gas is a violent and suffocating irritant, and if inhaled is promptly fatal.

Sulphurous acid gas, obtained by burning sulphur in a metal pot, may be fairly started, then left in the centre of the room and all outlets closed for from five to ten hours. The same precautions are necessary as with chlorine, for though it is somewhat less irritating it is equally suffocating. Both gases will act on solids as well as on the air, and to make sure of their action the air and surfaces should be charged with moisture. Perfectly dry germs will often survive, whereas moist ones are quickly destroyed. Hence, a current of steam may be sent into the building, or all exposed surfaces may be watered before the gas is set free.

Some disinfectants act by merely changing the physical condition of organic matter, and thereby destroying the vitality of the living germ, without any chemical abstraction from, or addition to, its constituents. Thus heating to the boiling-point (212° F.) coagulates albuminous matters and destroys infectious principles generally. But it must be prolonged for a variable time, according to the size of the

object, to allow of the heat penetrating to all parts alike. In the case of germs which have formed resting spores, it may be further needful to repeat the boiling on several successive days, time being allowed in the interval for the development of the spore into the more destructible bacterium. Clothing may be heated in an oven to 300° F., or, safer, boiled, and even the prolonged application of hot transparent steam, directed from a hose upon wood-work, etc., previously well cleaned, is found effectual.

Some poisons, like those of Texas fever, cholera, and yellow fever, are destroyed by freezing, while the majority are merely imprisoned in the ice, but resume their evil work as soon as they are thawed out.

Carbolic acid may also be used in occupied buildings, being allowed to evaporate from shallow basins, alone or mixed with ether or alcohol, from saturated rugs hung up at intervals, or from cloth-lined ventilating inlets, kept saturated with the acid, or, finally, it may be diffused through the air of a building by an atomizer. It is, however, rather an antiseptic than a germicide, preventing the propagation and increase of germs, while it really fails to kill them. *Carbolic* and *cresylic acids* may also be used for disinfecting solids and liquids, being poured into drains or sprinkled on the floors, walls, and other parts of the building. For the latter purpose the strong acid may be diluted with one hundred times its weight of water. The cheap impure acid is usually preferred for dung-heaps, yards, and other outside purposes but is disagreeable indoors. *Coal-tar* and *wood-tar*, from their contained carbolic acid and allied products are also good for out-door uses.

The following are especially applicable to solids and liquids:

Chloride of lime sprinkled on floors, yards, dung-heaps, etc., or applied to walls, wood-work, etc., or poured into drains, as a solution of ½lb. to a gallon of water.

Chloride of zinc is equally efficient but more expensive, and *chloride of aluminium* (*choralum*) is somewhat less potent.

Sulphate of iron (*copperas*) is one of the most efficient and cheapest disinfectants for drains, manure, floors, yards, etc., and may be applied either in fine powder or in solution.

The *sulphate of copper and zinc* and *perchloride of iron* are efficient, but much more expensive.

Saturated solutions of caustic potassa and soda are satisfactory for wood-work, harness, and utensils, but they are useless if diluted. *Lime* is useful in graves by absorbing the water and uniting with the organic débris, but is very unsatisfactory as a general disinfectant.

Permanganate of potassa promptly changes putrefying organic matter, rendering it sweet and wholesome, but it is questionable how far it can destroy living organic germs, of which many of the contagious principles are composed. The same remarks apply to *charcoal*, animal and vegetable, and to *earth*, especially that containing a considerable proportion of clay or marl.

CHAPTER III.

SPECIFIC CONTAGIOUS DISEASES.

Variola in animals. Horse-pox. Cow-pox. Sheep-pox. Goat-pox. Swine-pox. Dog-pox. Bird-pox. Aphthous fever, foot-and-mouth disease. Rinderpest. Lung-plague. Contagious pleuro-pneumonia. Strangles. Influenza. Typhoid or bilious fever. Canine distemper. Asiatic cholera. Swine-plague. Hog-cholera. Texas fever. Canine madness, rabies. Bacillar anthrax. Vibrionic anthrax. Pyæmia. Septicæmia. Bird-cholera. Chicken-cholera. Actino-mycosis. Milk sickness. "The trembles." Glanders and farcy. Venereal disease of solipeds. Tuberculosis. Quebra-bunda. Beri-beri.

VARIOLA IN ANIMALS.

HORSE-POX.

This is identical with cow-pox, being indistinguishable when inoculated on men and cattle. It most frequently attacks the limbs, but may affect the face or other part of the body. There is usually some little fever, which, however, passes unnoticed by the owner. Then swelling, heat, and tenderness supervene, commonly in a heel, and firm nodules form, increasing to one-third or one-half inch in diameter, the hair bristles up, and the skin reddens unless previously colored. On the ninth to the twelfth day a limpid fluid oozes from the surface and agglutinates the hairs in yellowish scabs, on the removal of which a red, raw depression is seen with the scab fixed in its centre. In three or four days the secretion ceases, the scabs dry up, and the parts heal spontaneously. It is easily transmitted from horse to horse, to man, or to cow. No treatment is required beyond weak astringent lotions (carbolic acid 1 dr., water 1 quart) or bland ointments.

COW-POX.

This is the same disease appearing in the cow. There is a preliminary slight fever, usually overlooked, succeeded by some diminution and increased coagulability of the milk and the appearance of the pox on the udder and teats. The udder is hot and tender for a day or two, then little pale-red nodules, about as big as peas appear, growing to three-fourths to one inch in breadth by the eighth or tenth day, acquiring liquid contents, and often a central depression on the summit. The liquid in each pock is contained in several distinct sacs and cannot be all extracted without a succession of punctures on different parts. It contains a micrococcus. The liquid, at first clear, changes to yellowish white (pus) and soon dries up, the whole forming a hard crust which is gradually detached. On the teats the blisters are early ruptured and raw sores form, often proving very obstinate, and even leading to inflammation of the udder, abortion, or death.

Treatment is scarcely ever demanded further than to obviate sores on the teats. A mild laxative of Epsom salts is, however, usually desirable. The teats may be smeared with an ointment formed of an ounce each of spermaceti and almond oil, and half a drachm of myrrh. Milking-tubes may be necessary to avoid injury by drawing the teats.

In many localities the disease appears in all newly calved heifers on particular farms, in which case it would be well to purify the barns by a thorough disinfection.

SHEEP-POX.

Though unknown in America there is no improbability of this disease reaching us through importations of sheep, hides, or wool. Like *small-pox* of man, it is only known as a contagious disease. The *incubation* or *latent period* of

the poison, after it enters the system, is from three to six days in summer, and from ten to twelve in winter. Then there is loss of appetite, dullness, dropping behind the flock, and stiffness of the hind parts. This is followed by trembling, increased temperature, very manifest on the bare and delicate parts of the skin on which the eruption usually takes place, loss of appetite and rumination, costiveness, red, weeping eyes, a discharge from the nose, and the appearance of red patches inside the limbs and along the abdomen. Soon minute red points appear and increase to papules, with a firm base extending into the deeper parts of the skin. These are flat on the summit (rarely pointed or indented), and become pale or clear in the centre, from the effusion of liquid beneath the scurf-skin, with a red margin. With the appearance of the eruption the fever moderates, but increases again in three or four days with the development and irritability of the vesicles. These may remain individually distinct (*discrete*), in which case the attack is mild, or they may run together into extensive patches (*confluent*), when the result is likely to be serious. The pocks will even appear on the visual, digestive, or respiratory mucous membrane. The eruption passes through the same course of exudation, suppuration, drying, and dropping off as in cow-pox. The duration of the disease is three weeks or a month. The mortality in the milder forms may not exceed seven per one hundred, in the more severe it may destroy almost the whole flock. But the losses of lambs by abortion, of wool, sight, hearing, hoofs, digits, flesh, and general vigor often render recoveries anything but unmixed blessings. The germ is a micrococcus.

Treatment. Keep in cool, dry, well-aired and littered sheds, shelter from rain, and feed roots, or, if very weak, oat- and bean-meal gruels, with a drachm of saltpetre to each sheep. Common salt may be supplied to be licked, and the drinking-water may be slightly acidulated with

vinegar. The bowels should be opened by injections of milk-warm soapsuds, or 3 oz. sulphate of soda if necessary. Avoid heating agents. In the advanced stages support by quinia, gentian, nitric acid, and nutritious gruels, even animal broths. The pustules may be treated with the ointment advised for cow-pox, or, if unhealthy, with weak solutions of chloride of zinc.

Prevention. Nothing short of general infection will justify the treatment of this disease. It should be excluded from our country by the most stringent supervision over the importation of sheep and their products, and when it does appear should be promptly stamped out by the destruction and disinfection of the sick and the purification of all with which they have come in contact. *Inoculation* as a measure of prevention is unwarrantable except in the case of wide-spread infection, a contingency which ought never to arise in this country.

GOAT-POX.

This is a rare and mild affection, with an eruption on the udder and teats closely resembling that of *Cow-pox*. It has been thought to be spontaneous in the goat, but is known to be derived from sheep suffering from *Sheep-pox*. It follows a mild course and requires the same care as *Cow-pox*. Seclusion or destruction and disinfection are, however, imperative when danger is likely to arise for sheep.

SWINE-POX.

This is more frequent than *Goat-pox*. It is communicable to man and goat. Young pigs are thought to be most liable. The eruption appears inside the forearm and thighs, and is usually preceded by considerable fever. It is *discrete* or *confluent* like *Sheep-pox*, and the severity corresponds.

The duration of the mild forms is twelve to fifteen days. *Treatment* is similar to that of *Sheep-pox* and the same precautions should be taken to prevent its dissemination.

DOG-POX.

These animals sometimes contract *Small-pox* or *Sheep-pox*, and have been supposed to have their own specific form besides. The young suffer most frequently and severely. There is the usual preliminary fever, with an eruption on the sides and belly passing from pimples to vesicles and pustules, and finally drying up into crusts which drop off. The eruption may be *discrete* or *confluent*, the latter being very fatal. Similar *preventive* measures are demanded, as in the other forms of *pox*.

BIRD-POX.

Birds seem susceptible to different forms of variola, having contracted the disease from man in some cases, and in others conveyed it to the sheep. Chickens failed to contract *Cow-pox* in the experiments of Röll and myself. It has proved very fatal in chickens, but very slightly so in pigeons, turkeys, and geese. The eruption appears mainly on the head, under the wing, on the tongue, or in the pharynx. In fatal cases death ensued in four or five days. *Treatment* would rarely be desirable, the great point being to stamp out the malady by destroying the diseased and disinfecting the place.

APHTHOUS FEVER. FOOT-AND-MOUTH DISEASE.

A contagious eruptive fever, attacking cloven-footed animals and communicable to other warm-blooded animals, including even man. Its special feature is the eruption of blisters in the mouth, on the udder and teats, and on the

feet. It is only known as communicated by contagion, whether in Western Europe, in Great Britain and Ireland, where it was introduced in 1839–42, or in North and South America, which it reached in 1870 by imported stock. Like the other animal plagues it follows in the track of great armies and in the channels of commerce. The contagion does not readily spread on the air, a river or common road being often sufficient to limit it, but no poison is more certainly transmitted by contact, direct or through the medium of human beings, tame or wild animals, fodder, litter, manure, clothing, drinking-troughs, etc., etc. Milk is one of the most frequent sources of contagion to pigs, dogs, and even to infants, producing the most dangerous intestinal irritation and diarrhœa.

Symptoms. The poison may remain latent in the system for one or two days, or, in exceptional cases, perhaps as many as six. Then there is roughness of the coat or shivering, increased temperature, dry muzzle, hot red mouth, teats, and interdigital spaces, lameness, inclination to lie, and shrinking from the hand in milking. The second or third day blisters arise on any part of the whole interior of the mouth, one-half to one inch in breadth, or on the teats and between the digits about one-half inch across. Saliva drivels from the mouth, collecting in froth around the lips, and a loud smacking is made with the lips and tongue. Swine champ the jaws. Sheep and swine suffer more especially in the feet, often losing the hoofs or even the digital bones, a contingency not unknown in neglected cattle.

Among the consequences may be named the loss of milk, inflamed udders, blind teats, a habit of vicious kicking, abortions, permanent lameness, and a lengthened incapacity for the dairy, for feeding, or work. If well cared for the disease passes in fifteen days, leaving no ill consequence, excepting the poison hidden away in the building. The average loss in flesh is $5 to $10; in dairy cows it is much more.

Treatment. A laxative (Epsom salts); astringent mouth-wash (borax and tincture of myrrh 1 oz. each, water 1 qt.; or carbolic acid 1 dr., honey 2 oz., vinegar 1 pt., water 1 pt.); a lotion for the teats (carbolic acid ½ dr., glycerine 10 oz.); and a dressing for the feet (oil of vitriol 1 oz., water 4 oz., to be applied with a feather after cleaning the space between the hoofs by drawing a cloth through it). After dressing, tie up the feet in a tar bandage. The hind feet are easily dressed if two men raise each separately with a long, stout fork-handle passed in front of the hock. In dressing the feet all detached horn should be removed and a poultice applied if inflammation runs high. Soft cold mashes or thinly sliced or pulped roots are the best food throughout.

Prevention. Importation of diseased animals should be sufficiently guarded against. Diseased stock should be rigidly secluded from all but the necessary attendants, who ought to be disinfected on leaving the enclosure. Wild animals, even birds, should be excluded. Every place where the diseased have been should be closed for a winter or disinfected, the milk should be buried in a safe place, or boiled and given to pigs; manure, infected litter, etc., may be burned, or disinfected, removed, and ploughed under by horses. No diseased animal should be moved until fifteen days after full recovery, and it should first be sponged over with a carbolic-acid wash.

RUSSIAN CATTLE-PLAGUE. RINDERPEST.

A contagious fever of cattle communicable to other ruminants and characterized by a general congestion of the mucous membranes, but, above all, those of the stomach and intestines, and an excessive growth and shedding of the superficial layers of cells on the skin and mucous membranes. It is only propagated by contagion, at least, out of the Kirghiz steppes and Kherson district in Southern Russia, but spreads farther on the air than *Aphthous Fever*.

Symptoms. Incubation lasts about two days until the temperature of the body is elevated, or four days until the appearance of outward signs of illness. By this time the mouth, inside the lips, on the dental pad of the upper jaw, or around the gums of the lower front teeth, shows minute white elevations, like the aphtha of the mouths of children, calves, and lambs suffering from thrush (muguet). This may be exceedingly slight and transient, but is most characteristic. The other mucous membranes, (eye, vulva, rectum, nose) show a more or less dark flush, and concretions may appear around these and on other parts of the skin, especially the teats. These are solid aggregations of epithelial cells, not vesicles nor pustules. In twenty-four hours they undergo fatty softening and are easily detached, leaving small pink erosions, and by the sixth day a great part of the mouth and muzzle may have become raw, and the surrounding mucous membrane of a deep red. About the fourth day the skin feels greasy, and dullness and impaired appetite and rumination appear. In cows the milk is diminished, is richer in cream, and even slightly coagulable. Urine becomes scanty and of a high color and density. These signs increase until the sixth day, when the mouth is often raw, saliva drivels, appetite and rumination gone, bowels relaxed, the dung passed with much straining and pain, the everted gut appearing of a deep red or port-wine hue, the ears are drawn back, head pendent, eyes half-closed and watery, back arched and often insensible to pinching, abdominal muscles tense and resistant, and there is a peculiar check in the act of expiration, the breath being suddenly arrested with a flapping sound and concussion of the entire body, to be exhaled a second or two later with a grunting noise. Sighing and whistling sounds are heard in the chest and it becomes unnaturally drum-like to percussion. A sudden lowering of temperature is usually the precursor of death, which happens on the seventh or eighth day.

Nervous symptoms appear in some outbreaks, with delirium, butting, shivering, and tenderness of the loins, while in the milder cases the peculiar eruption may be almost altogether confined to the skin.

The symptoms in other ruminants are essentially the same as in the ox, and in the peccary there is sufficient resemblance for recognition.

The mortality out of its native habitat usually amounts to forty per cent. and upward.

Treatment. The treatment of this plague should be legally prohibited under all circumstances. All the attempts of the different schools of medicine and of empiricism have only increased its ravages, while nations and even countries and districts that have vigorously stamped it out and excluded it have saved their property.

Prevention. The advent of this plague should be prevented by a sufficient supervision of our ports and frontiers and a quarantine of stock. If admitted, the victims should be ruthlessly destroyed, deeply buried, and all places and things with which they have come in contact disinfected in the most perfect manner.

THE LUNG-PLAGUE OF CATTLE, CONTAGIOUS PLEURO-PNEUMONIA.

A specific contagious fever of cattle, with extensive exudation into the chest and lungs containing a micrococcus.

Like the other plagues already noticed this is only known in Europe and America as a contagious disease. Its importation into the different countries of Europe has always been traceable to the introduction of diseased beasts or their products. The assertion of the immortal Haller, more than a century ago, that it is propagated by contagion, has received the amplest confirmation in recent times. It invaded Ireland in 1839–40 by Dutch cattle, England in 1842 by Irish and Dutch cattle, Sweden and Denmark in 1847 by

English stock, and later again by English and Dutch, Norway in 1860 by infected Ayrshires, Oldenburg in 1858, and Schleswig in 1859, in each case by Ayrshires, the Cape of Good Hope in 1854, Australia in 1858 by an English cow, Brooklyn, L. I., in 1848 by a Dutch cow, and again in 1850 by an English one, New Jersey in 1847 by English stock, and Boston, Mass., by Dutch cattle in 1859. In Sweden, Norway, Denmark, Oldenburg, Schleswig, Massachusetts, and New Jersey it was stamped out, in the last case by the importer, Mr. Richardson, sacrificing his whole herd and voluntarily assuming the loss, but in the other places named it was left to itself and spread disastrously.

Symptoms. The period of latency of the poison in the system is from four to six weeks, and in exceptional cases perhaps three or four months, or as short as ten days. Increased temperature of the body usually appears a week or two before other symptoms. Then there is a slight cough, erection of hair along the back, sometimes shivering and always tenderness of the back to pinching, the animal crouching and groaning. Soon breathing and pulse become accelerated, bowels costive, urine scanty and high-colored, milk diminished, appetite impaired, rumination irregular, nose alternately moist and dry, and legs and horns cold and hot. If in the field, the sick leave the herd. The cough increases in harshness, depth, and painfulness, and all the symptoms are aggravated until the animal stands in one posture, with head extended on the neck, mouth open, and every breath accompanied by a loud moan. From the earliest stages the ear applied to the sides of the chest detects an absence of murmur over particular parts of the lung, or lungs, with a line of crepitation (fine crackling) around it, and occasionally rubbing, wheezing, and other unnatural sounds. On percussion over the silent parts the natural resonance is found to have given place to dullness, and the animal winces and groans. Other peculiar sounds

may follow later, into which we cannot enter here, and exhausting liquid discharges from the bowels and kidneys, tympanies and abortions are frequent results. Death may take place early, from suffocation, when both lungs are involved, or may be delayed six weeks or more. Slight attacks, common in the Northern States in winter, may only cause a few days of fever, but usually leave encysted masses of dead, diseased tissue in the lungs, that render the apparently recovered animal dangerous to others for long after.

The percentage of deaths and permanent destruction to health is fifty or sixty, or when all the more susceptible animals have perished it may be reduced much lower.

Treatment. This disease is much more amenable to treatment than rinderpest, but to preserve the sick is no less reprehensible, as the poison is more subtle, more diffusible through the atmosphere, is hidden unsuspected for a greater length of time in the body of its victim, and when manifested is far more liable to be mistaken for other diseases (pneumonia, pleurisy, bronchitis). No treatment should ever be allowed, except in perfectly secluded buildings, far from roads, where no strange men or animals can get access, and in a constantly disinfected atmosphere.

In the early stages, refrigerant and diuretic salts (liquor of the acetate of ammonia, nitre, bisulphite of soda) with aconite may be given; injections of warm water or mild laxatives (Epsom salt), used to regulate the bowels, and blisters applied to the sides of the chest (mustard and oil of turpentine). Later, when prostration sets in, stimulants (sweet spirits of nitre, wine, aromatic ammonia, etc.) and tonics (gentian, cinchona, cascarilla, boneset, sulphate of iron or copper, mineral acids, etc.) are called for. Antiseptics are useful, especially such as can be inhaled in the air (sulphur fumes, carbolic acid vapor or spray) and thus reach the seat of disease.

The hydropathic treatment, by a rug wrung out of water applied next the skin and covered by several dry ones kept closely applied by elastic surcingles for an hour and followed by a cold douche and active rubbing till dry, has proved very successful, but demands intelligence, enthusiasm, and activity on the part of the attendants. The pack is repeated as often as the temperature rises.

Prevention. Importation should only be allowed from countries free from the plague, in ships that have carried no suspected stock for at least three months, and after inspection and, if thought necessary, quarantine at the port of entry. But the disease already exists in New York (Connecticut), New Jersey, Delaware, Pennsylvania, Maryland, Virginia, Illinois, and District of Columbia. This ought to be rooted out by measures executed by the central government and defrayed out of the public treasury. Little good must be looked for from isolated action by States, counties, townships, or individual owners; the danger threatens the entire country, and for the general safety all must pay. It is absurd to expect the unfortunate possessor of sick animals to beggar himself for the public good. There should be destruction of the sick, partial remuneration of the owners, thorough disinfection under professional supervision, and the most perfect control and constant inspection of all suspected herds and places until the malady has been eradicated from the land. This is the most insidious of all our animal plagues, the one which now most urgently presses for active interference, and which, if neglected, will bring a terrible retribution in the future.

Inoculation, as a preventive, like medical treatment, is suicidal unless where a country is very generally infected, and in this case even sterilized virus should be used. (See Lung Plague in Appendix.)

STRANGLES. DISTEMPER IN YOUNG HORSES.

A specific fever of young solipeds, usually attended with swellings and formations of matter between the bones of the lower jaw, or elsewhere in groups of lymphatic glands.

Causes. Early age, change from field to stable, from grass to dry feeding, from idleness to exciting work, the irritation of teething, and, above all, change of locality and climate. Repeated attacks will occur in the same horse under the influence of the last-named cause. Exposure to cold and wet, impure air, sudden thaws, etc., contribute to hasten its development. Lastly, contagion is a common cause, and, in some cases, the malady may even be conveyed to man.

Symptoms. The disease is often preceded by a period of unthriftiness, staring coat, loss of condition, dullness, and languor. Then there appear cough, redness of the nasal membrane, and watery flow from the nose and eyes, slavering, accelerated breathing and pulse, costiveness, scanty high-colored urine, and increased thirst. Soon a swelling rises between the bones of the lower jaw, hot, tender, and uniformly rounded and smooth, at first hard with soft, doughy margins, later soft and fluctuating in the centre from the formation of matter. Water is often returned from the nose in drinking and food dropped after chewing. The throat may even be closed so as to make breathing laborious, difficult, and noisy, or quite impossible. With rupture of the abscess and escape of the matter, relief is obtained and a steady recovery may usually be counted on.

Irregular Forms. The swelling may harden in place of softening, and maintain the disease for an indefinite time, or it may disappear and be followed by the formation of matter in other and more vital organs. Thus matter may form in the groups of lymphatic glands about the shoulder,

groin, the roots of the lungs, the mesentery, the brain, etc. Sometimes no swelling nor suppuration takes place beyond the discharge from the nose, while at others a pustular eruption on the skin is the manifestation of the disease.

The disease may be over in ten days, or, in cases of indolent action in the swelling, it may be protracted for months. If properly treated, the *regular form* generally does well, but the *irregular* is fatal in proportion to the vitality of the organ affected. In protracted cases and in those subjected to impure air and weakening treatment, dropsical and sanguineous swellings in the dependent parts of the body (*purpura hæmorrhagica*) is a frequent result.

Treatment. Sustain the strength of the patient by abundance of soft, nourishing mashes and pure air, and promote the formation of matter between the jaws by fomentations, poultices, and steaming of the nostrils. A poultice may be applied by a square of calico with holes for the ears and eyes, tied down the middle of the face and sewed up a little at the chin to prevent any from dropping out. Bran or oil meal may be used along with hot water. Steaming may be done by feeding hot bran mashes from a nose-bag hung on the head. When matter points it should be freely evacuated with the lancet, and the poultices continued to complete the softening. If suffocation is threatened, the windpipe must be opened in the middle of the neck and a tube inserted to breathe through.

Medicine is rarely required. Yet costiveness may be counteracted by warm water injections, and weakness by stimulants (muriate and carbonate of ammonia) and tonics (gentian, calumba, willow-bark). Complications must be treated according to their nature.

INFLUENZA.

A specific epizootic fever of a low type associated with inflammation of the respiratory mucous membrane, or less

frequently of other organs. It has prevailed at intervals over different parts of the world in man, horses, dogs, and even cats.

Causes. Nothing can be definitely stated as to the primary cause of its development, as all peculiar conditions of soil, volcanic action, atmospheric electricity, aerial moisture or dryness, density or levity, season, temperature, winds, calms, ozone, and antozone fail to account for its appearance. The great American epizootic of 1872 was preceded and accompanied in Michigan by an excess of ozone, but the excess did not determine its appearance in other States, which it invaded by a gradual progress and with a rapidity proportional to the celerity, of communication. Again, insular and sequestrated places escaped, as Prince Edward's Island, (frozen out), Vancouver's Island (quarantined), Key West, Hayti, St. Domingo, Jamaica, La Paz, by the non-importation of horses (Cuba suffered through imported American horses). It stopped at Panama, where there is no horse traffic, owing to the state of the country. (See the author's report to Government, and report of New York Board of Health.)

Symptoms. The disease comes on suddenly with extreme weakness and stupor. There is often pendant head, half-closed, lustreless eyes, great disinclination to move, with swaying gait, and cracking joints. Appetite is lost, mouth hot, clammy, bowels costive, urine scanty and high-colored, pulse accelerated and weak (sometimes hard), a cough, deep, painful, and racking comes on, crepitation or harsh blowing sounds are heard in the chest, and the membrane of the nose assumes a bright pink or dull leaden hue. The ears and limbs are alternately cold and hot, the hair rough, the skin tender and frequently trembling.

Soon the nose discharges a white, yellowish, or greenish matter, and the animal may recover, or an increasingly heavy breathing, depth and painfulness of cough, and changed or

absent respiratory sounds in the chest, with dullness on percussion show that the lungs are seriously involved. Thus there may be the symptoms of pneumonia, pleurisy, bronchitis, hydrothorax, pericarditis, hydropericardium, etc. Clots sometimes form in the heart, modifying the heart-sounds and proving rapidly fatal.

In other cases the abdominal organs suffer, and with great torpor, stupor, tension and tenderness of the abdominal walls there are colicky pains, ardent thirst, coated tongue, yellowness of the membranes of nose and eyes, yellow or reddish urine, costive bowels and dung in pellets thickly coated with mucus.

Sometimes rheumatic swelling and tenderness take place in the muscles and joints of the limbs, and may even last for months. At others, paralysis or delirium will ensue, or, finally, severe inflammation of the eyes.

Treatment. Overcome costiveness by injections of warm water, or by one-third the usual doses of linseed oil or aloes. Give mild febrifuge diuretics (liquor of acetate of ammonia, spirit of nitrous ether), with anodynes (extract of belladonna), and when fever subsides or great prostration comes on, stimulants (nitrous ether, aromatic ammonia, carbonate of ammonia) and even tonics (gentian, calumba, quassia).

Counter-irritants (ammonia and oil, equal parts, mustard, etc.) may be used from the first to the throat, sides, or abdomen, according to the seat of the inflammation.

Soft mashes, roots, or green food, pure air, without draughts, and warm clothing are essentials of treatment throughout.

If the *abdominal organs* are the main seat of disease, supplement the medicines above named by demulcents (slippery elm, mallow, boiled linseed) and anodynes (opium, hydrocyanic acid) with, in some cases, a gentle laxative (olive oil). *Nervous symptoms* may demand wet cloths to the head, blisters to the sides of the neck, purgatives, unless

contra-indicated, and bromide of potassium. The *rheumatic* complication must be treated like ordinary rheumatism, with colchicum, salicin, salicylate of soda, propylamine, acetate of potassa, turpentine, warmth, counter-irritants, etc.

TYPHOID, GASTRIC, OR BILIOUS FEVER.

This strongly resembles the abdominal form of influenza and sometimes occurs in the same place at the same time. It also appears independently in horses weakened by shedding their coats in spring and autumn, in those kept in a hot, close, impure, and unwholesome atmosphere, fed insufficiently or on badly-preserved, musty, or otherwise injured aliment, supplied with water containing an excess of decomposing organic matter, fed irregularly, subjected to overwork, etc. Finally it proves contagious in confined, insalubrious buildings, and to a less extent, in those that are wholesome and well aired. Some unknown, generally acting influence makes it more virulent at one season than at another.

Symptoms. There are a few days of dullness and lassitude followed by the general signs of fever: Staring coat, shivering, alternate heat and coldness of the surface, restlessness, hot, dry mouth, and elevation of the internal temperature of the body. There is a yellowish tinge of the mucous membranes, costiveness, colicky pains, full, tense, tender belly, passage of a few dark, hard pellets of dung covered with a mucous film, urine scanty, reddish, and depositing a sediment, pulse rapid and weak, and there may or may not be sore throat, excited breathing, and discharge from the nose. In the more favorable cases, signs of improvement are noticeable in eight or nine days, and a perfect recovery is made. In the unfavorable, the pulse becomes small, weak and rapid (eighty to ninety per minute), the mouth hotter, more clammy, and covered by yellow-

ish, brownish, or greenish blotches, the abdominal walls more tender, the bowels more irritable, sometimes with a fœtid diarrhœa, and the strength is rapidly exhausted. The head is constantly pendant, the eye sunken, the expression of the countenance stupid and haggard, and the stupor or insensibility may become so great that pinching or even pricking of the skin may pass unnoticed by the animal. Death usually takes place from the tenth to the twentieth day.

Treatment. English veterinarians rely much on calomel, and with a firm, full pulse, not too rapid, a general warmth of surface and extremities, a bright eye, cheerful countenance, whitish, fœtid dung, and much yellowness of the eye, nose, or mouth, a few doses of calomel (10 grs.) and opium (30 grs.), repeated twice daily, may be useful in stimulating the liver and throwing off injurious agents from the blood. But it is to be avoided when there is a weak, rapid pulse and great prostration and debility, and in no case should it be given over two or three days, or until the system is saturated with the drug. Severe costiveness may be obviated by 2 or 3 drs. of aloes and a drachm of calomel, or by a daily dose of 2 or 3 ozs. of Glauber's salt until relaxation occurs. Soft feeding and copious injections of warm water must be continued to maintain the bowels in a healthy state. A drachm each of chlorate or nitrate of potassa and muriate of ammonia may be given three or four times daily with the water drunk, or in case of great dullness and debility an ounce of oil of turpentine, sulphuric ether, sweet spirits of nitre, or carbonate of ammonia may be given as well. Great tenderness of the belly may be met by persistent hot fomentations and mustard poultices, and if necessary by half-drachm doses of opium. Tympany is treated by hand rubbing and by aromatic ammonia or oil of peppermint. During recovery 3 or 4 ozs. of tincture of gentian or cinchona may be given twice daily with muriate of iron and stimulants. Feed throughout on soft

bran mashes, sliced roots, boiled oats or barley, green grass, oil-cake, etc., giving from the hand if necessary. Secure pure air and water, cleanliness, warm clothing, and general comfort until restored to health.

CANINE DISTEMPER.

A specific fever of the young domestic carnivora, affecting the respiratory organs, and it may be the abdominal viscera, the brain, the muscular system and joints, or the skin. One attack usually protects from a second.

Causes. Connected, like strangles, with domestication, it is most severe on pet dogs kept in hot, close rooms, on spiced food, or confined in kennels. Change of climate, teething, and contagion are other causes.

Symptoms. Dullness, peevishness, loss of appetite, dry nose, watery eyes, elevated temperature, increased pulse (110 to 120), sensitiveness to cold, shivering, cough and glairy or yellowish discharge from the nose. The cough becomes paroxysmal and is often followed by vomiting, the matter not being licked up again, the breathing is disturbed, and the chest-sounds on auscultation and percussion imply disease there. The animal is weak, debilitated and emaciated, and diarrhœa, ulceration of the mouth, and nervous symptoms usually precede death.

The complications are marked by symptoms of bronchitis, pneumonia, enteritis, hepatitis, conjunctivitis, phrenitis and skin-disease. Diseases of the brain (cramps, convulsions, chorea, paralysis) and skin-eruption are exceedingly common in the advanced stages. The eruption is peculiar, consisting of small blisters, containing often a reddish or purple fluid.

Treatment. A warm, comfortable bed, pure air, and a milk, or bread and milk diet are important. The diet should not be so exclusive in dogs having had animal food only.

A mild emetic (antimonial wine) or a slight laxative (castor oil) may be followed by tonics (gentian, quinia), febrifuges (saltpetre), and expectorants (ipecacuanha), with perhaps an anodyne (belladonna). As fever subsides, tonics must be given freely (wine, quinia, sulphate of iron, Fowler's solution). In all the various complications treat as for the different diseases, but avoid weakening remedies, and keep up tonics, stimulants, and a nutritious diet.

MALIGNANT CHOLERA. ASIATIC CHOLERA.

This attacks the domestic quadrupeds and birds simultaneously with man, and has been produced experimentally by feeding the dried bowel discharges. These were found to increase in virulence for several days then to decrease (Sanderson). The germ is a curved (comma) bacillus.

Symptoms. Muscular cramps, great prostration, partial loss of motor power and excitability, great lowering of the body temperature (80° F.), deathly cold, bloodless extremities, viscid tardily-flowing blood, and lastly, violent abdominal pains and fluid bowel dejections, often having the specific *rice-water* appearance.

Treatment. The disease is mainly important as propagating a poison so fatal to the human being, hence the most perfect disinfection of all bowel dejections is imperative, together with the seclusion and burial of the sick and dead. As an example of current treatment may be named, aromatics (oil of anise, oil of cajeput, oil of juniper, tincture of cinnamon), stimulants (ether), and acids (sulphuric acid), mixed and given every quarter of an hour. In the early stages add opium to check diarrhœa. To overcome surface coldness and collapse, use hot fomentations, rubbing, inhalation of nitrite of amyl; to sheath the intestines, demulcent drinks (linseed tea, mallow, slippery elm), and to meet other states according to in-

dications. Every separate case would demand special treatment.

SWINE-PLAGUE. HOG-CHOLERA.

A specific contagious fever of swine, attended by congestion, exudation, blood extravasation, and ulceration of the membrane of the stomach and bowels, by liquid fœtid diarrhœa, by general heat and redness of the surface and by the appearance on the skin and mucous membranes of spots and patches of a scarlet, purple, or black color. It is fatal in from one to six days, or ends in a tedious, uncertain recovery. The germ is in some epizootics a diplococcus, and in others a bacillus, implying two distinct diseases.

Symptoms. Incubation ranges from a week or fortnight in cold weather to three days in warm. It is followed by shivering, dullness, prostration, hiding under the litter, unwillingness to rise, hot, dry snout, sunken eyes, unsteady gait behind, impaired or lost appetite, ardent thirst, increased temperature (103.2° to 105° F.) and pulse. With the occurrence of heat and soreness of the skin, it is suffused with red patches and black spots, the former disappearing on pressure, the latter not. The tongue is thickly furred, the pulse small, weak, and rapid, the breathing accelerated and a hard dry cough is frequent. Sickness and vomiting may be present, the animal grunts or screams if the belly is handled, the bowels may be costive throughout, but more commonly they become relaxed about the third day and an exhausting fœtid diarrhœa ensues. Lymph and blood may pass with the dung. Before death the patient loses control of the hind limbs and is often sunk in complete stupor, with muscular trembling, jerking, and involuntary motions of the bowels. The lymphatic glands swell in all cases.

Causes. It is propagated by contagion, though faults in diet and management may prove accessory. The poison

will blow half a mile or more on the wind, and is with difficulty destroyed in hog-pens, fodder, etc.

Treatment ought not to be permissible, unless in a constantly disinfected atmosphere. Feed well-boiled gruel of barley or rye, or, in case these raise the fever, corn-starch made with boiling water; give to drink fresh cool water, slightly acidulated with sulphuric acid. For the early constipation give a mild laxative (castor oil, rhubarb) and injections of warm water, following up with fever medicine (nitrate of potassa and bisulphite of soda). If the patient survives the first few days and shows signs of ulceration of the bowels (bloody dung, tender belly), give oil of turpentine, fifteen to twenty drops night and morning. Follow up with tonics, and careful soft feeding.

Prevention. Kill and bury the diseased; thoroughly disinfect all they have come in contact with; watch the survivors for the first sign of illness, test all suspicious subjects with the thermometer in the rectum, and separate from the herd if it shows more than 103° F., destroying as soon as distinct signs of the disease are shown. Feed vegetable or animal charcoal, bisulphite of soda, carbolic acid, or sulphate of iron to the healthy, and avoid all suspected food, places, or even water which has run near a diseased herd. All newly purchased pigs should be placed at a safe distance, in quarantine under separate attendants, until their health has been proved.

TEXAS FEVER.

A specific fever, rising in the low, malarious grounds of the States bordering on the Gulf of Mexico, and communicable to the cattle of the elevated lands of the same and other States in a more fatal form. It is characterized by enlarged spleen, profound changes in the blood, escape of the blood-elements into the substance of the various tissues

and with the urine causing bloody discharges from the kidneys, yellowness of the mucous membranes and fat, great prostration and debility.

Symptoms. There seems to be an incubation of four or five weeks, ending in elevated temperature (103° to 107°) and followed in five to seven days by dullness, languor, drooping head till the nose reaches the ground, arched back, hind legs advanced under the belly and bent at the fetlocks, cough more or less frequent, muscular trembling about the flanks, jerking of the neck muscles, heat of horns, ears, and general surface (limbs cold, in exceptional cases) and impaired appetite and rumination. Soon weakness compels lying down, by choice in water, eyes are glassy and fixed, secretions lessened, dung hard and coated with mucus, or with clots of blood, and the urine changes to a deep red or black and coagulates on boiling. The mucous membranes are of a deep yellow or brown, that of the rectum, seen in passing dung, is of a dark red, as in Rinderpest.

All these symptoms become aggravated, weakness becomes extreme, and the patient dies in a state of stupor, or sometimes in convulsions.

The disease usually passes unnoticed in the Texan cattle, but is exceedingly fatal in Northern beasts.

Contagion takes place through the bowel discharges, and roads, pastures, water-courses, etc., become efficient bearers of the virus. It is destroyed at once by frost, and has never been satisfactorily demonstrated to be conveyed from one Northern animal to another. Sucking calves rarely suffer. One attack does not protect against another. There is a strongly refrangent micrococcus in the bile and blood. Detmers has also found a bacillus.

Prevention. It should be enforced by United States law that no Gulf-coast cattle should be moved north excepting after the first frosts of autumn, or before the last frosts of spring. Then would the traffic be safe for all the North.

The time would vary for the different States, but the earlier or later traffic for the extreme North should be by direct route without intermediate unloading. A general restriction of this sort, with the expense levied on all the States, would be more economical and satisfactory than a supervision by each State of its own frontier.

Treatment should never be called for. It may, however, be resorted to with less danger than in the case of a true plague. In some cases emollient drinks and enemas, soft food, and stimulating fever medicines have been followed by recovery. Chlorate of potassa, nitre, iodide of potassium, and carbolic acid have evidently been of advantage. Wet-sheet packing, as for Lung-fever, should be beneficial, and refrigerant or stimulating diuretics (digitalis, nitre, or nitrous ether), according to the indications of the particular case. Peculiarities in different cases would demand a variation of treatment. The diet throughout should be of soft mashes, and a return to ordinary fibrous aliment made slowly and carefully, patients being liable to be cut off by gastro-enteritis.

CANINE MADNESS. RABIES (HYDROPHOBIA).

A specific bacteridian disease of the genus canis (dog, wolf, fox) and the cat, and transmissible by inoculation to all the domestic animals and to man. It is marked by disorders of intellectual, emotional, and nervous functions, altered habits, irritable temper, optical delusions, spasms of the muscles of the eyeballs and throat, paralysis, and more or less fever.

Causes. Inoculation by bite is the usual (almost invariable) cause, yet cases arise also from other channels of contagion. Season, climate, abuse, privation of water, improper food, muzzling, etc., have no effect further than they serve to produce a febrile state and hasten the development of

the disease when the seeds are already implanted in the system. A constantly increasing mass of testimony points to the conclusion that the restraint of an ungovernable sexual desire is one cause of the development of the malady, and it is even supposed that the maternal instinct has had a similar effect after the puppies have been removed. Males chiefly suffer, partly, no doubt, from their special liability to common accessory causes, but mainly because the rabid dog is far more likely to bite a male than a female. Dowdeswell finds a micrococcus in the brain and spinal cord.

The poison is resident in the saliva and blood, but not always in the milk. The saliva of rabid herbivora, omnivora, and men is equally virulent with that of carnivora, though in all animals it varies in intensity according to the stage of the disease. Of animals bitten by a violently rabid dog nearly all contract the disease, whereas among men the proportion is five to fifty-five per cent. This apparent immunity is largely due to the cleaning of the teeth on the dress before they reach the skin.

Incubation varies in dogs from five to eighty days, the majority showing symptoms thirty to forty days after the bite; in the horse fifteen to ninety days (usually thirty); in cattle twenty to thirty days; sheep twenty to seventy-four days; swine twenty to forty-nine days. In man it ranges about the same, exceptional cases extending over years being manifestly instances of disease resulting from fear, a common occurrence in the human being.

Symptoms. In the Dog. Any sudden change of habits, or instincts—dullness, restlessness, watchfulness, tendency to pick up and swallow straws and other small objects, constant desire to smell or lick the anus or generative organs of themselves or others, to lick a stone or other smooth, cold object, to rub the throat or chops with the fore paws, silent endurance of pain, rubbing or licking of a scar, the seat of the bite, liability to sudden passion and attempts

to bite at sight of another dog or cat, may be looked on as very suspicious, if rabies exists in the country. Soon the characteristic howl is omitted. The voice is hoarse, low, and muffled, and there is one loud howl, followed by three or four more, successively diminishing in force and uttered without closing the mouth. Some dogs appear unusually fond of their owners and fatally inoculate them by licking their hands and face. Others turn the head and eyes as if following imaginary objects and snap as if at flies. Barking without object, a constant searching, or tearing of wood, etc., to pieces, a seeking of darkness and seclusion and a disposition to resent disturbance, or a pilgrimage of several days' absence from home are among the most common precursors of the disease.

Furious Rabies. Following some of the above symptoms there is a redness and fixed glare in the eyes, squinting, rolling of the eyes after fancied objects, more frequent howling, and increasing irritability with a tendency to worry all animals that come in their way, the respect for, and immunity of former friends being lost in the violence of a paroxysm. The victim can no longer rest, but undertakes long journeys at a slouching trot, ready to fly at all that cross his path, especially if they make any noise or outcry. He may die during one of these journeys, or return dirty, careworn, and sullen, with the rabid glare in his eye and ready to resent any interference. Each paroxysm of violence or wandering is followed by a period of depression and torpor proportionate to the preceding excitement, during which dark and seclusion are preferred, though any disturbance will arouse to violence. From the fourth to the eighth day paralysis sets in, first in the hind limbs, then in the jaw and the whole body, the certain precursor of approaching death.

Paralytic Rabies. In this case paralysis with dropping of the lower jaw is shown at the outset, and gradually ex-

tends to the whole body. The animal cannot bite, eat, nor drink, rarely barks, and dies early.

Lethargic (*Tranquil*) *Rabies.* Palsy of the jaw is less marked, but there is complete apathy, the patient remaining curled up in one position, and is not to be roused by any effort. He becomes daily more emaciated and dies in ten to fifteen days.

In addition to these typical forms there are others holding an intermediate place. The furious form is especially common in bulldogs, hounds, and the less domesticated varieties, the paralytic and tranquil in the house and pet dogs.

Popular Fallacies. I name these because of the evil results of entertaining them. 1. Mad dogs have no *fear of water* (*hydrophobia*). On the contrary, they swim rivers, plunge their noses in water or lap their urine without hesitation. 2. *Appetite is not lost*, only depraved, and the stomach after death is found to contain an endless variety of improper objects. 3. There is rarely *froth at the mouth*, though saliva may run from it when the jaw is paralyzed. 4. The *tail is not carried between the legs* but is rather held erect during a paroxysm.

Foxes and *wolves* have symptoms like those of the dog, the animals losing their natural shyness or fear, and attacking man and beast indiscriminately. *Cats* attack with claws and teeth, flying at the face and hands, and utter hoarse loud cries, as in heat. The *horse* bites, kicks, neighs, draws his yard, rolls his eyes, jerks his muscles, and dies paralyzed. The mischievous propensity distinguishes from delirium. The *ox* is restless, excitable, everts the upper lip, grinds his teeth, bellows loudly and as if in terror, scrapes with his fore feet, and butts and kicks all who approach. There is jerking of the muscles and finally paralysis. *Sheep* are similarly excited, show sexual appetite, stamp, butt, and bleat hoarsely. They die paralytic. *Swine* are

excitable, restless, grunt hoarsely, champ the jaws, bite intruders, tear objects to pieces, gape, yawn, become weak and die paralytic.

Recoveries are extremely rare.

Treatment. This can only be warranted in the lower animals in hope of discovering a curative method for man, and then with extreme precautions and in iron cages. Theoretically, vapor baths, with sulphites and antispasmodics (datura, atropia, chloral-hydrate, etc.), would promise the best results. The boasted curative agents have all broken down when tried on well-marked cases in the lower animals, in which diseases of the imagination are not to be looked for.

Prevention. When bitten, at once check the flow of blood from the part, in the limb by a handkerchief or cord with a piece of wood through it twisted tightly around the member a little higher than the wound,—in other parts by sucking, or by cutting open the wound to its depth and squeezing or wringing as if milking to keep up a free flow of blood, soaking it meanwhile in warm water if available. Drinking liquids to excess will also retard absorption. But as soon as caustics can be had apply them thoroughly to all parts of the wound, making sure that its deepest recesses are reached. The compression by handkerchief or fingers should not be relaxed until this operation is completed. A hot skewer, nail, or poker serves admirably, and if at a white heat is less painful. But oil of vitriol, spirit of salt, nitric acid, caustic potassa or soda, butter of antimony, chloride of zinc, nitrate of silver, blue stone, copperas, indeed any caustic at hand should be at once employed. The wound should be thoroughly cauterized, though some time has elapsed since the bite, as absorption does not always take place at once.

All dogs should be registered, taxed, and furnished with a collar bearing their own and their owner's names and

that of their residence. During the existence of rabies in a country all dogs found at large unmuzzled should be destroyed. Suspected dogs should be shut up under supervision for three months unless rabies is developed earlier. Dogs that have bitten human beings should be similarly shut up for a week to test the existence of the disease or otherwise.

Pasteur's method of rendering the system insusceptible is by preserving the spinal cord of a rabid animal in a sterilized bottle, with free access of air, but protected against all germs by a filter of sterilized cotton-wool, until inoculation with its substance is no longer fatal. Beginning with this, say twelve days old, he inoculates his patient and the following day he operates again using virus which has been kept one day less, and so on daily, using the progressively stronger virus until he has inoculated with that of the full strength. A number of recent failures have led him to adopt his intensive method, by which this series of inoculations is practically repeated several times. That the process is generally protective must be acknowledged, as otherwise all his subjects must have died of the last and strongest virulent injection, whereas less than one per cent. have actually perished. On the other hand, to laud such protection as constant and absolute is to contradict all that we know of acquired vital resistance to specific disease-poisons, and is to contradict the results of Pasteur's own inoculations. Add to this that a constant succession of cases must be kept up to obtain the requisite amount of virus of the different required potencies, and that after the inoculations the subjects carry away in their bodies the most virulent virus that Pasteur has been able to produce, to the danger of any other susceptible animals with which they may come in contact, and the method must be held to be pregnant with danger. It is a notorious fact that since Pasteur began inoculating rabies has become extraordinarily prevalent in

France and England where his *protected* animals have mostly gone.

Galtier found that in rabbits and sheep protection without visible disease was secured by injecting the rabid saliva into the veins without contact with the tissues.

Fernandez shows, from extensive statistics and numerous experiments that dogs bitten by vipers are proof against rabies.

I have had the following results with rabid brain matter, sterilized and diffused in water: English terrier had three injections of twenty drops each on successive days, then inoculated with virulent matter on the brain; proved fatal, but death delayed till the twenty-fifth day instead of the sixteenth. Two rabbits had three hypodermic injections of one drachm each on successive days; afterward inoculated with virulent brain matter, but resisted for nine months. One rabbit after four injections of one drachm each of sterilized rabid brain matter, inoculated with fresh rabid brain matter, but survived nine months. Three control rabbits inoculated with fresh rabid brain matter, one on the brain, and two hypodermatically, all died of paralytic rabies, the first on the sixteenth day, the second on the seventy-second, and the third on the one hundred and eightieth day. Inoculation of any kind, however, which demands the propagation of the germ is not to be commended.

BACILLAR ANTHRAX.

A contagious disorder, prevailing in rich, damp localities, in herbivora and swine, and communicable by inoculation to other animals and to man. It shows itself in many different forms, all characterized by extreme changes in the chemical and vital properties of the blood, breaking down of the blood-globules, extravasations of blood or albuminous fluids in different parts of the body, with a tendency to

gangrene, yellow or brown mucous membranes, enlargement or even rupture of the spleen (milt), and a very high mortality. The germ is a bacillus viable out of the body in damp soils, etc.

Causes. It is propagated by *contagion* but tends to die out when produced in this way only. It is transmitted by contact with the blood, liquid exudations, portions of the diseased carcase, fat, skins, hair, wool, bristles, feathers, and bowel evacuations, and rarely or not at all through the atmosphere. Simple contact of these matters with the healthy skin of a susceptible subject is at times enough to produce the disease. The virus is most potent when received from an animal still living or only recently dead, and yet may be preserved for months in all conditions of climate, temperature, and humidity.

Eating of the flesh of animals killed while suffering in this way has often conveyed the disease despite the cooking to which it was subjected. Fifteen thousand of the inhabitants of St. Domingo once perished in six weeks from this cause, and a whole family was poisoned a few years ago in Aberdeenshire, Scotland. The Tartars perish in great numbers from eating their anthrax horses. Mosquitoes and other insects with perforating apparatus to the mouth help to communicate it, as nearly all cases in man occur on exposed parts of the body, and inoculation of the insects' stomachs has caused the disease.

Its preservation in a locality is determined: 1. By the rich surface soil abounding in organic matter, and the impervious subsoil preventing natural drainage. 2. The frequent inundations of banks of rivers flowing through level countries and the drying up of ponds and lakes leaving much organic deposit in their basins. 3. A continuation of warm, dry weather, which favors organic emanations from such places as the above. 4. A condition of the system of the animal predisposing to the reception and growth of the poison.

and consisting in the loading of the blood with plastic or waste organic matter, as in overfed plethoric animals, in those making flesh most rapidly, in the young and rapidly growing, in those rendered unhealthy by overwork, impure air, unsuitable food or water. 5. Sudden chills when the poison is already present; hence, extreme variations in the temperature of night and day. 6. A close, still atmosphere.

General Characters. In the typical cases the blood is black, tarry, and incoagulable, and in all it shows broken-up globules, and microscopic rod-like bodies, bacillus anthracis, 3.5 μ ($\frac{1}{7000}$ inch) long, and one-fourth as broad. The spleen, lymphatic glands, and liver are enlarged, the mucous membranes of the stomach and intestines are usually reddened, thickened, and softened, and any other part of the body may be the seat of bloody or albuminous effusion with a tendency to death, decomposition, the extrication of gases in the tissues and a crackling sound when handled. When it commences in one point on the surface (malignant pustule) there is first an unhealthy eruption of minute blisters, which burst, dry up, and become gangrenous, while new blisters appear around as the unhealthy action spreads.

Divisions. The bacillar anthrax may be manifested by external disease, or swelling, or without such appearances. To the first class belong the carbuncular erysipelas of sheep and swine, malignant sore throat of hogs, gloss-anthrax or black-tongue, one form of black-quarter or bloody murrain, the boil-plague of Siberia, and the malignant pustule of man. To the second belong all those forms of the disease in which there are the specific changes in the blood, with engorgement of the spleen, blood-staining, and exudations into internal organs, only.

ANTHRAX WITH EXTERNAL LESIONS.

(A) In Horses.—(1) *Siberian Boil-plague.* This is unquestionably an anthrax disease, and though named from

Siberia is not unknown in other lands. A slight shivering and fever are followed by a swelling on the udder, sheath, breast, throat, or elsewhere, which rapidly increases, sometimes to the size of an infant's head. At first soft, it hardens, assuming a yellow, bacon-like appearance, with red streaks and spots. The animals die in twelve or twenty-four hours, rarely surviving three days. The blood is in the state so characteristic of anthrax, with bacteria, enlarged spleen, and sanguineous effusions. In *cattle* similar tumors appear, mainly on the throat, neck, or dewlap, in *sheep* and *goats* on the bare surfaces and in *pigs* around the throat. In all cases the disease, when conveyed to man, produces the *blue-pox* (malignant pustule). At the outset all cases prove fatal; later, recoveries occur under the local use of cold water, or the hot iron or other caustics pushed to the depth of the tumor, and mineral acids internally.

(2) *Anthrax with Diffused Local Swellings; Typhus.* This is usually confounded with the *purpura hæmorrhagica*, which occurs in weak conditions of the body, as a sequel of debilitating diseases (influenza, bronchitis, pneumonia, etc.). Our limits forbid extended treatment, hence the general symptoms will be named, and the observer left to distinguish the two diseases according to their origin, communicability, and prevalence.

Symptoms. Shivering, lassitude, stupor, impaired appetite, whitish discharge from the nose, accelerated pulse and breathing, costiveness with slimy dung or scouring, high-colored, odorous, or bloody urine, swellings the size of a walnut or closed fist on different parts of the body, or a continuous swelling beneath the chest and belly, or extreme engorgement of the limbs or head. These are at first hot and tender, and easily indented with the finger, but soon become hard, the skin gets rigid and exudes drops of a yellow serum or pure blood. They may render the patient unable to walk, see, feed, drink, urinate, or breathe, according to

situation. The mucous membranes become swelled, puffy, dusky or yellow, with red spots and streaks, and a viscid, bloody, and finally fœtid discharge flows from the nose. Breathing may become labored and quick in connection with exudations into the chest, or violent colics may supervene from effusions in the abdomen. With internal effusions death ensues in forty-eight hours, with external only, the effects may last for weeks or months before ending in recovery or death. In the latter case the swellings may suddenly disappear to reappear elsewhere, they may subside permanently in connection with free action of the bowels or kidneys, or they may slough, leaving extensive and sluggish sores and scars.

(B) In the Ox.—(1) *Black Tongue; also in the Horse.* This is manifested by the eruption of blisters, red, purple, or black, on the tongue, palate, and cheeks, increasing individually often to the size of a hen's egg, bursting, discharging an ichorous, irritating fluid, and forming unhealthy sores with more or less tumefaction. There is a bloody discharge from the mouth, active fever sets in, and death ensues in twenty-four to forty-eight hours.

(2) *Black-quarter; Bloody Murrain.* This is sometimes anthrax, with extensive engorgement of a shoulder, quarter, neck, breast, or side. It is most frequent in young and rapidly thriving stock, attacking first the finest of the herd or those thriving most rapidly, and runs its course so quickly that its victims are usually found dead in the field as the first indication of anything amiss. If seen during life there are the general symptoms of plethora, fever, with halting on one limb, stiffness, and excessive tenderness of some parts of the skin, to be promptly followed by swelling of such parts, with yellow or bloody oozing from the surface. These swellings become firm, tense, insensible, and even cold, and if the subject survives may finally slough open and leave large, unsightly, and inactive sores. Recoveries are the exception and too often slow and tedious.

(C) In Sheep.—*Carbuncular Erysipelas.* This strongly resembles black-quarter of cattle. Like that it attacks the finest of the flock and the bodies of its victims are found dead in the field. There is first halting on a limb, then a red or violet swelling, beginning inside the leg and rapidly extending over the body. The feeling, appearance and course of the swelling agree with those of *black-quarter* and death occurs in a few hours, or in exceptional cases in two days.

(D) In Swine.—These suffer from *Anthrax of the Mouth*, comparable to *black-tongue*, *carbuncular erysipelas*, like that of the sheep, *pharyngeal anthrax*, and *tumors about the throat*, which sometimes, at least, have the anthrax characters.

(1) The *Carbuncular Erysipelas* has been constantly confounded in systematic veterinary works with swine-plague, but is a distinct disease, being derivable from other anthrax patients and communicable to other genera of animals and to man, whereas *hog-cholera* is mainly confined to swine.

(2) *Malignant Sore-throat; Pharyngeal Anthrax.* This is perhaps the most frequent form of the disease in swine, often appearing to arise from eating the carcasses or excretions of other anthrax animals. There is active fever with redness and swelling of the throat, neck, breast, and even the fore limbs. This is at first hard, elastic, warm, and tender, but becomes purple, cool, insensible, and pits on pressure. There is loss of appetite, retching, vomiting, purple patches and black spots on the eyes, snout, and skin, difficult breathing through the mouth, livid tongue, decreasing temperature, great weakness, and death in one or two days.

(3) In the *guttural tumors* the swelling is circumscribed to the size of a kidney-bean or egg, on one or both sides of the throat, extending to involve the throat generally, causing vomiting, difficult breathing and swallowing, the

general symptoms of anthrax, and death from suffocation often under twenty-four hours. It attacks pigs of five or six months.

(E) In Dogs and Cats.—These suffer when they have eaten the carcasses of anthrax victims. The disease usually localizes itself in the mouth, throat, and digestive organs, giving rise to bloody vomiting and purging, with high fever and often death.

(F) Birds suffer from the primary disease and more frequently from eating the debris of anthrax victims. The susceptibility of birds is slight, but may be easily developed by a chill or other cause of low vitality and lessened power of resistance. In addition to the fever, characteristic swellings appear mainly on the comb, beak, and feet.

(G) In Man.—*Malignant Pustule.* There is itchiness of the affected part, with a minute red spot, increasing in twelve or fifteen hours to the size of a millet-seed, bursting and drying with a livid appearance in thirty-six hours. Next day a new crop of vesicles surround the seat of the first and pass through the same course, to be succeeded by another and still wider ring. The whole is surrounded by a puffy, shining swelling, the central dry part passes through the shades of red, blue, brown, and black, becomes gangrenous and insensible and in case of recovery is sloughed off. At first the disease is quite local, but as it advances a violent fever sets in, which too often proves fatal.

Bacillar Anthrax without External Swellings.

Apoplectic Form. In all animals there is a form in which the victim is cut off after a few minutes' illness, with or without discharge of blood from the natural openings of the body and before time has been allowed for any of those changes in the blood and internal organs which characterize the disease. These are often to be distinguished from apoplectic seizures and sunstroke only by their occur-

rence simultaneously with other forms of *anthrax* and in the same places.

Anthrax Fever in Horses. Vigorous health is replaced by dullness, muscular weakness, stupor, hanging on the halter, leaning on the side of the stall, if at work unsteady movement, colicky pains, lying down and rising, turning the head toward the flank. The hair is dry and erect, the hide tense, and may even crepitate on handling; the skin trembles or sweats about the ears, elbows, or thighs. The eyes and nose assume a yellow or reddish or brownish-yellow tinge, with oftentimes dark red or black spots. The pulse is weak, the heart's impulse behind the left elbow strong, breathing labored or quick and catching. A frothy, bloody fluid may appear at the nose. The bowels are costive, the dung covered with mucus, or loose with streaks of blood. The rectum, everted, is of a dark red and puffy. Great weakness comes on and the patient dies in convulsions or during the subsequent calm. Death usually occurs in twelve to twenty-four hours.

Anthrax Fever in Oxen; Splenic Apoplexy. The patient ceases feeding and ruminating or does so irregularly, trembles, has partial sweats, staring coat, varying heat of the body, arched back, quarters rested on the stall or fence, or lies with the head turned to the flank. A high temperature (105° to 107°) precedes the outward symptoms by hours or days. The eye is sunken, dull, watery, with the shades of brown and yellow, and dark spots, remarked in the horse; breathing hurried, heart's action violent, pulse weak, loins and back tender or even crepitating, urine bloody, bloody liquids escape from nose, anus, or eyes, and the dung is streaked with blood. As the disease advances the temperature of the body decreases and the patient dies in convulsions or quietude, or makes a rapid recovery. The fatal result usually takes place in from twelve to twenty-four hours.

Anthrax Fever in Sheep; Blood-striking; Braxy. Is very promptly fatal, the dead and already fœtid carcasses being usually found in the morning though the flock was apparently well at night. The black, tarry blood brightening very slowly on exposure, the enlarged spleen and mesenteric glands, the red, puffy, softened membrane of the bowels, and the bloody and gelatinous exudations show the true nature of the disease. When seen during life there are signs of plethora, fever, red eyes, costiveness, bloody, mucous dung, bloody urine, colicky pains, unsteady gait, breathlessness when driven, flattened fleece, deep-sunken eyes, stupor, convulsions, and speedy death. Many cases of so-called braxy are not communicable to other animals, hence not genuine anthrax.

Anthrax Fever in Swine. There are dullness, thirst, inappetence, a tardy, unsteady gait, hot, pendent ears, drooping tail, deep, dull brownish-red eyes, hurried breathing, small pulse, violent heart's action, and tense, tender abdomen. Nervous tremors, twitching, or cramps come on, the body cools, bloody urine is passed and sometimes bloody dung. Dark or black spots appear on the skin and mucous membranes, as in *hog-cholera*, and if the animal survives, these are sloughed off, often leaving sores. If swelling appears externally it is often a herald of improvement.

Anthrax Fever in Birds. There is inappetence, ruffling of plumage, sinking of the head in the shoulders, fœtid diarrhœa, drooping, trailing wings, tenderness to the touch, muscular weakness, unsteady walk, inability to perch, livid or black comb and wattles. Sometimes the feathers drop off and swellings appear about the head, throat, or feet.

Treatment of Bacillar Anthrax.

This is unsatisfactory, owing to the rapidly fatal action of the poison. The first cases usually die, the later ones may often be treated with fair success.

General Treatment. In very plethoric subjects bleeding may prove beneficial at the outset, but in advanced stages, in poor and weak subjects, and in those with feeble constitutions, like sheep, it is to be strongly condemned. Act on the bowels, kidneys, and skin to eliminate the poison (sulphates of soda, or magnesia, acetate, nitrate, or tartrate of potassa, common salt, oil of turpentine). Sponge with cold water and rub actively till dry. Rub with camphorated spirit or oil of turpentine. Give tonics (quinia, salicin, etc.), antiseptics (mineral acids, nitro-muriatic acid, tincture of the muriate of iron, chlorate of potassa, carbolic acid, bisulphite of soda, tincture of iodine, iodide of potassium, biniodide of mercury, salicylate of soda, bichromate of potassa). In the Genesee outbreak of 1875 I had admirable results from the use of nitro-muriatic acid sixty drops, bichromate of potassa three grs., and chlorate of potassa two drachms, twice daily by the mouth, and two or three drachms of a saturated solution of sulphate of quinia, iodide of potassium and bisulphate of soda injected at equal intervals beneath the skin. Of fifty very sick oxen only four died.

In the advanced and weak conditions stimulants (alcohol, turpentine, ether, valerian, angelica, camphor, etc.), are useful.

Local Treatment. This is very successful with inoculated forms of the disease (malignant pustule, boil-plague, gloss-anthrax, malignant sore throat) if employed before the poison has passed into the system and produced fever. For these, free cauterization, and especially with the antiseptic caustics (crystallized carbolic acid, the mineral acids, chloride of zinc, chloride of iron, sulphate of iron or copper, tincture of iodine), is successful. But the whole diseased tissue must be reached, and in the case of the tongue the blisters must be first laid open and the agent applied in small quantity with a brush, or more freely in a di-

luted condition. In some external cases the hot iron is used with advantage. Such treatment may still be applied to circumscribed tumors accompanied by the fever, being followed by poultices to encourage suppuration.

For extensive engorgements use astringents (cold water, vinegar, etc.), weak antiseptic lotions, and, above all, injections with a hypodermic syringe of antiseptics (diluted tincture of iodine, diluted carbolic acid—1–100, etc.). The hypodermic treatment is equally applicable to the circumscribed tumors, but we must saturate their whole substance, otherwise absorption of the poison will lead to general disorder.

Prevention. 1. Drain the soil thoroughly. 2. When a soil cannot be drained, soil the stock in-doors or on other pastures rather than graze them. 3. Remove the stock from pastures known to be dangerous as soon as summer heat and dryness of the soil favor malarious emanations (late summer and autumn). 4. Shelter the stock at night and secure the shade of trees or sheds during the day, when, after a hot, dry season, there comes an extreme difference between the day and night temperature. 5. Secure abundance of pure water, avoiding such as is stagnant or putrid. 6. Keep always in good thriving condition, and avoid sudden accessions of plethora. Artificial feeding in dry times is often necessary to secure this, or, in case of an over-luxuriant pasture, seclusion in a barnyard for four or five hours a day. Sheep may be shut up on moonlight nights, to prevent feeding, in dangerous localities. 7. Overwork, exhaustion, close-aired buildings, ill-health, or whatever tends to load the blood with waste matter should be avoided. 8. Exposed animals may have a little nitro-muriatic, sulphuric, or carbolic acid daily in the water or food. 9. Diseased animals must be separated from the healthy. 10. Carcasses, secretions, dung, litter, etc., of diseased animals should be burned or otherwise per-

fectly destroyed. Buildings, yards, sheds, etc., occupied by the diseased should be thoroughly disinfected. Pastures should be abandoned for that season, and graves fenced safely from trespass for two years. 11. None but the attendants should approach the diseased. 12. Before handling, cauterize all raw sores on hands or face with lunar caustic and wash the hands in a weak solution of carbolic acid both before and after. 13. Shut up all dogs, cats, and pigeons. 14. Never allow the flesh or milk to pass into consumption.

By way of prevention I have had excellent results from two hypodermic injections, at intervals of a week, of a drachm of the diseased blood or exudate, after it had been exposed for an hour to a temperature of 150° F. Pasteur's method of injecting the weakened virus is only permissible on soils already charged with the poison. Elsewhere it endangers the permanent implanting of the germ in new soil.

Vibrionic Anthrax. Emphysematous Anthrax. Bloody Murrain. Milzbrand-Emphysem. Charbon Symptomatique.

From the time of Chabert till recently this has been classed with bacillar anthrax, but is now shown to depend on a *vibrio* or motile rod, shorter and broader than that of anthrax, rounded at its ends and furnished with a clear refrangent nucleus near one end (rarely in the middle, though there may be two, one at each end of a long vibrio). The nucleus is easily mistaken for a micrococcus, as the filament has the same index of refraction with the surrounding liquid. In its active movements too it often presents but one end, and thus appears spherical.

The germ is fatal to guinea-pigs, and in large doses to cattle, sheep, and goats, but can be inoculated with difficulty only on rabbits, horses, and asses, while dogs, cats, swine, and chickens successfully resist it.

It is further distinguished from bacillar anthrax, in that animals insusceptible to that by reason of a previous attack or inoculation are not thereby rendered exempt from vibrionic anthrax.

The blood is not usually infecting, as it rarely contains the germ save in the advanced stages. The vibrio is found above all, in the liver, but also in the lymphatic glands, spleen, kidney, lung, and intermuscular connective tissue when the seat of the exudate.

The disease is ushered in by high fever and much depression, followed in a few hours by a swelling on some part of the body, at first soft and doughy, but soon crackling under pressure from the formation of gases under the skin. The ear laid on the swelling detects a fine crepitating sound caused by the bursting of fine bubbles of gas. The surface may be the seat of blisters with reddish contents, or it may discharge drops of a bloody or straw-colored serum which concretes on the surface, and the swelling, at first hot, may finally become cold and the skin dry and leathery should the animal survive. The skin may, further, crack open or slough off, together with part of the tissue beneath, forming an indolent, unhealthy sore. More commonly the fever advances rapidly, with rapidly increasing weakness and debility, and death ensues in a period varying from six hours to two days.

It is only in the mildest cases that *treatment* can be of any avail, and then it need not differ materially from that advised for bacillar anthrax. The early appearance of the general fever would suggest the prompt use of internal antiseptics (salicylate of soda, iodide of potassium, quinia, bichloride of mercury, biniodide of mercury, bichromate of potash). For the local swelling, too, the free use of acid astringents (acetic, or hydrochloric acid) largely diluted, and antiseptics superficially and by hypodermic injection is to be recommended. Internally tincture of muriate of iron,

four drachms, every four hours, and locally equal parts of tincture of iodine, aqua ammonia, and oil of turpentine (Dr. Phares) is very successful.

By way of *prevention* specific care should be given to the young and plethoric as the most susceptible. Keeping always in good condition and avoiding sudden accessions of plethora proves very beneficial. No less useful is the maintenance of free action of bowels and kidneys, by a moderate ration of flaxseed or other laxative. The avoidance of night frosts alternating with hot noons, of unwholesome or insufficient food, of impure water, or, indeed, of any cause of debility is desirable. On infected soils the avoidance of damp grass, by seclusion in houses at night, or even by soiling the cattle altogether, may be resorted to. Antiseptics (copperas, carbolic acid, sulphites of soda or lime, and iodide of potassium) may be useful.

It is a common practice on infected lands to insert a seton through the dewlap of each of the young cattle, with the view of preventing undue plethora. The beneficial result is probably rather due to the fact that the germ is planted in the wound, where, in connection with active suppuration, it produces a mild infection only, the germs remaining confined to the sore, and the animal recovering enjoys a subsequent immunity. A similar protection may be secured by inoculation with a weakened specimen of the virus, or still better, by the virus that has been sterilized by heat.

PYÆMIA. PURULENT INFECTION (BLOOD-POISONING ?).

It has long been known that in connection with wounds which have become unhealthy or suddenly dried up, a severe general fever often sets in, accompanied by the development of abscesses in different parts of the body and early death. It is now known that suppuration is usually or always associated with the presence in the seat of its formation of bacteria, and that, when secondary abscesses appear

in different parts of the body, these micro-organisms are constantly found in such parts. Why all suppurations do not produce this general infection is not well understood, but there is doubtless a varying power of resistance in different subjects, and a varying potency of the alkaloids and other poisons produced by the bacteria under slightly different conditions of life. The frequent formation of abscesses filled with these micro-organisms in the deepest and most solid tissues of the body, is evidence enough that they may exist in an apparently healthy system and only operate for serious evil under certain conditions of local or general debility. The poison acquires greater potency when grown in the body apart from air, as in the generative passages after parturition, etc.

There are various micro-organisms in the different forms of suppuration, all of a spherical form, though one is arranged in form of a chain.

Kranzfeld, who has experimented largely on the subject, describes, first, those found in groups—Staphylococcus Pyogenes (aureus, albus, and citreus), and second, the chain form, Streptococcus Pyogenes. The swelling and suppuration caused by the *first*-named type tend to appear in the seat of injury, while those due to the *second* tend to affect the nearest communicating lymphatic glands. Both may cause general infection, the abscesses from the *first* appearing by preference in the internal organs, and those from the *second* in the joints, marrow of bones (Osteo-myelitis) and serous membranes.

Symptoms. If following on an external wound, the access of fever is usually coincident with a drying of the wound and a dark-red, glistening, unhealthy appearance of its surface. A chill is constant, and following this the body temperature is high and variable, the breath strong or mawkish in odor; the tongue red, furred; the teeth covered with incrustations; the eye sunken, hopeless; there may be diar-

rhœa or bleeding from the nose, and soon there are indications of the formation of the secondary abscesses in the lymphatic glands, joints, bones, or internal organs. Pyæmia does not at once follow a surface wound, but usually appears a week or two later, after suppuration has been freely established.

Treatment, Prevention. The treatment of pyæmia is so generally unsatisfactory that attention should rather be given to prevention. At the same time antiseptics (sulphate or muriate of quinia, salicylate of soda, hyposulphite of soda, benzoate of soda, etc.) may be given, together with eliminating diuretics, and stimulants. Secondary abscesses should be opened, and dressed with antiseptics. Its *prevention* is to be sought mainly in avoidance of injuries, and in the maintenance of a pure antiseptic atmosphere, for surgical patients especially. Filthy stables, with close, polluted cavities under the floor, rotten woodwork and soft brick charged with all manner of septic products, is but an invitation to this class of diseases (pyæmia, septicæmia, erysipelas, septic puerperal fever, etc.), while perfect cleanliness, pure air, and antiseptic dressings for wounds are the best antidotes. A dressing of carbolic acid (1 part to 50 parts of water or 1 to 15 of vaseline), or of bichloride of mercury (1 part to 5,000 water), covered by a thick layer of absorbent cotton also charged with the same dressing, and dried, may fail to exclude germs from the wound, but will rarely fail to retard their growth and keep them from attaining a dangerous development.

SEPTICÆMIA. SEPTIC INFECTION (BLOOD-POISONING).

This is the exact counterpart of pyæmia, the tissue or the system at large being poisoned by the entrance of septic bacteria or their poisonous products. Like pyæmia, also, it is not dependent on one invariable micro-organism, but in different cases depends on distinct germs, giving rise to more

or less variable symptoms. It is, therefore, in its causation not one disease, but rather a group of allied diseases, and this is one reason why one attack will not necessarily protect against a second.

Among the micro-organisms may be named a micrococcus of septicæmia in rabbits, fowls, rats, and guinea-pigs; a micrococcus from the mouths of certain men, fatal to rabbits; two bacilli of septicæmia in the mouse, 1.6 μ ($\frac{1}{15000}$ inch) and 1 μ ($\frac{1}{25000}$ inch) in length. It is clear that different germs are present in different cases and in different animals, and that a germ proving fatal to one genus of animal is often comparatively harmless to another genus. As in the case of pyæmia, ill-health, an impure condition of the blood and animal fluids, foul, close atmosphere, overcrowding of patients, and a special potency of the poison, from previous growth in given media, and above all in the animal body, strongly conduce to an attack.

Septicæmia may appear at any time, from the moment of the infliction of a poisoned wound to any stage of its progress, whereas pyæmia occurs only after the onset of suppuration. Again it may remain exclusively local or it may produce at once general fever with little local inflammation and destroy the patient in two to four days. The difference depends largely on the varying strength of the poison and on the difference in the power of resistance in different individuals. The local form affects, especially, the lymphatic vessels, giving rise to local, boggy, dark-red swelling, and in white, delicate skins to a branching redness, leading along the lines of the lymphatics and veins. It appears to be generally through these lymphatics that the poison enters the blood to produce the constitutional disease, whereas in micrococcus pyæmia the distribution appears to take place mainly through the veins, and in the substance of minute floating blood-clots.

Septicæmia usually sets in without a chill, but sequent to

a putrid state of the wound. The body temperature runs very high, lowering, sometimes even to the natural, especially in the morning, but only to rise again, and it becomes abnormally low only in the last stages. The wound becomes of a dark red with dirty grayish spots and black edges. The breath is mawkish or fetid, the mouth dry, thirst ardent, skin moist but without free perspirations, mucous membranes dusky yellow; expression of countenance dull, listless, stupid, heartless, and there is much muscular weakness or lethargy. A very offensive, watery diarrhœa is a marked symptom; and vomiting may occur in pigs and carnivora.

There is no tendency to secondary abscesses, and after death there may be little change, save enlarged, engorged spleen, softened liver, and an incoagulable condition of the blood. The blood of pyæmia coagulates firmly.

Though occurring separately pyæmia and septicæmia often co-exist, when the symptoms of both diseases are combined.

Treatment is not satisfactory in the general disorder, though it consists in support by antiseptic tonics (quinia, salicin) and alcoholic stimulants. The mineral acids (muriatic, nitro-muriatic) are also febrifuge, and general anti-ferments (salicylate of soda, hyposulphite of soda, etc.) may be resorted to. Nourishing feeding, and pure air are, above all, important.

For the wound, lotions of antiseptics—hyposulphite of soda, permanganate of potash, carbolic acid, chloride of zinc, chlorinated soda, boro-glycerine, etc.—may be freely used in the form of lotion on sterilized cotton.

Prevention is essentially the same as for pyæmia, which see. In no case should an operation be performed on a subject in a low state of health, as the system is then much more open to attack, and no surgical patient should be kept in an impure atmosphere.

(For Erysipelas see Skin Diseases.)

BIRD CHOLERA. CHICKEN CHOLERA.

This is one of the most destructive of our indigenous animal plagues, and causes greater losses in the United States than can be well conceived of, considering the relatively low value of the individual animal. The susceptibility is not confined to chickens, though, as usually seen, it proves especially destructive to these. By inoculation Renault conveyed it in fatal form to pigeons, ducks, geese, and parrots, and during its prevalence in a district we frequently see dead thrushes and other wild birds manifest victims of the same infection. Renault and Toussaint have conveyed it in fatal form to rabbits; and the latter, supported by recent German observers, considers it identical with *rabbit septicæmia*, so that rats and mice must be added to the susceptible list. Renault inoculated both dog and horse, with fatal result, but Toussaint found that in horse, ass, dog, and sheep inoculations produced local swelling and abscess with much constitutional disturbance, but the blood did not become virulent and recovery ensued.

The germ is a slightly ovoid micrococcus found in the discharges and in the blood. It is evident that infection may be conveyed by birds, wild and tame, by rabbits, rats, and mice. In the summer season it is also propagated by insects.

Symptoms; Course. Inoculation is variable, averaging five to eight days, and proving shortest in winter.

The bird becomes dull, listless, trails its wings, drags its limbs, sits a great deal, head sunken between the wings, and feathers ruffled. It seeks sunshine, and if several suffer they huddle together for heat. Temperature rises to 109°. Appetite is lost, but thirst continues, and abundant yellowish or yellowish-green discharges are passed, with in some cases a whitish flow from the bill and nostrils. The comb and wattles become flaccid, and of a dark livid or blue color, at first in spots and later throughout, weakness and prostra-

tion advance rapidly and death ensues after two or three days of illness. In the later stages of an epizootic, the deaths are delayed by several days and a considerable proportion recover.

Treatment is not satisfactory, though the use of antiseptics (sulphuric, benzoic, or salicylic acid, chloride of lime, carbolic acid) in the water may be resorted to.

Prevention has not been secured through inoculation with sterilized virus, but can be attained by using virus so diluted that but one or two bacteria are inserted under the skin (Salmon), or by the use of virus that has rested inactive in free air for three to five months (Pasteur). In either case a small slough forms in the skin and muscles around the puncture.

The simplest and cheapest preventive is sulphuric acid of a strength of not less than 60 drops to the pound of water (1–150) freely sprinkled on the buildings, yards, and feeding-grounds. When the range is too extensive to sprinkle thus, restrict it till it can be, and on the subsidence of the outbreak keep up the restriction, or remove the fowls to new land.

ACTINOMYCOSIS.

This is a parasitic disease of animals and man, caused by the growth in the bones or soft tissues of a fungus which grows in tufts, consisting of cells converging to a central stem, like the seeds of a composite plant (daisy), and appearing on section to radiate, and hence the name—Actinomyces —star fungus.

The individual tufts may reach the size of a small pin's head, and reflect a yellowish color in the midst of a pinkish or dirty white soft exudate. The tufts are further extremely hard, so that they cannot be cut in slices for the microscope until they have been softened in a weak acid.

The fungus usually invades the interior of the jaw-bone, upper or lower, or the soft parts adjacent (tongue, cheeks,

face, throat) but is also found in the lungs and other internal organs. About the head it seems to start from slight sores of the gums or mucous membrane or cavities by the side of decaying teeth and to extend slowly into the solid tissues. The affected jaw-bone swells out into a large rounded mass, and the outer dense bone becoming absorbed before the advancing soft growth within, the diseased mass finally reaches the surface and gives rise to running sores. This was formerly known as "lump-jaw" or "osteo-sarcoma" but the presence of the gritty yellow granules in the open sores betrays the true nature of the malady. When the tongue is attacked the growth takes place as a rounded hard swelling which has given rise to the name of *wooden tongue.* As it advances it approaches the surface and forms a raw ulcerating sore in which the yellow tufts may be found. At times the whole face may be involved, the lips and nostrils becoming thick, firm, rigid, and comparatively immovable, and the mucous membrane as well as the skin is swollen so that breathing is snuffling and difficult. Around the throat it forms similar hard resistant swellings, more or less round as it invades especially the glands. In the lungs the deposit causes modification or loss of the respiratory murmur over circumscribed areas, with cough and expectoration, but unless the yellow tufts can be found in the expectoration the exact nature of the disease may escape recognition.

Prevention.—As the fungus appears in grass and grain fed animals in omnivora and carnivora, no precautions as to diet can be suggested, except the avoidance of very coarse fibrous food likely to wound the mouth or throat, and of hard flinty corn and other seeds likely to cause injury to the teeth. Vegetation grown on pastures where the disease prevails should especially be avoided. I have known the affection recur in three generations of cattle on the same soil. Diseased teeth and ulcerated gums which might form a seed-bed for the germ should be extracted, filled, or healed. Fi-

nally the badly diseased should be promptly destroyed and burned or boiled, as they are necessarily important propagators of the poison. The burning of mangers, racks, and other woodwork that may harbor the germ is an obvious necessity, and the saturation of floors with carbolic acid or chloride of lime may be resorted to.

Treatment.—This is only advisable where the disease is local and superficial. In the parts about the mouth, and even in the jaw-bone, the diseased masses may be scooped out with a knife and the cavities stuffed with iodized carbolic acid. This we have known to succeed even where the enormous jaw-bone was hollowed out in many great cavities opening alike externally and into the mouth.

MILK SICKNESS. "THE TREMBLES."

A specific infectious disease peculiar to some unimproved agricultural districts in Ohio, North Carolina, and other States, usually occurring in cattle, and communicable through meat, milk, and cheese to warm-blooded animals generally. A spirillum existing in the blood has been described as the specific germ.

Symptoms. In cows in full milk the disease is said to be productive of scarcely any constitutional disorder, the poison being eliminated by the milk and proving very fatal to the consumers. In cattle that do not yield milk, and in other animals, the symptoms are torpid bowels, trembling, great muscular weakness, swaying in the walk, inappetence, drooping head and eyelids, utter listlessness and stupidity, some fever, and rapidly advancing debility and marasmus. In man the moral sense is practically abolished as a manifestation of the general hebetude, and after death the large intestines are found blocked with dry concretions not unlike sawdust.

The malady has been attributed to rhus and other vegetable poisons, and to nickel among the mineral products,

but the conveyance of the affection through a quantity of milk so small as that used in a coffee-cup, and the transmission of the disease through successive subjects, argues the multiplication of a living organism in the system.

The malady usually disappears with the clearing of the forest and cultivation of the soil, and is chiefly important in that the meat, milk, butter, or cheese furnished by the infected animals may be sold and shipped to distant parts of the country to find human victims in the large cities unless due care is taken to prevent it.

GLANDERS AND FARCY.

A specific bacteridian disorder originating in solipeds, and transmissible by contagion or inoculation to dogs, cats, goats, sheep, swine, rabbits, and men. *Glanders* is characterized by a peculiar deposit with ulceration on the membrane of the nose, and in the lungs, etc., and *farcy* by deposits of the same material and ulcerations of the lymphatics of the skin. Each has its *acute* and *chronic* form. The acute form usually results from inoculation, or in weak and worn-out systems. Besides the common cause—contagion—overwork, exhausting diseases, and impure air are especially injurious. The specific germ is a bacillus.

Symptoms of Acute Glanders. Languor, dry, staring coat, red, weeping eyes, impaired appetite, accelerated pulse and breathing, yellowish-red or purple streaks or patches in the nose, watery nasal discharge, with sometimes painful dropsical swellings of the limbs or joints. Soon the nasal flow becomes yellow and sticky, causing the hairs and skin of the nostrils to adhere together, and upon the mucous membrane appear yellow elevations with red spots, passing on into erosions and deep ulcers of irregular form and varied color, and with little or no tendency to heal. The lymphatic glands inside the lower jaw, where the pulse is felt, become enlarged, hard and nodular, like a mass of peas

or beans, and are occasionally firmly adherent to the skin, the tongue, or the jaw-bone. The lymphatics on the face often rise as firm cords. An occasional cough is heard and auscultation detects crepitation or wheezing in the chest. The ulcers increase in number and depth, often invading the gristle or even the bone, the glands also enlarge but remain hard and nodular, the discharge becomes bloody, fetid, and so abundant and tenacious as to threaten or accomplish suffocation, and the animal perishes in the greatest distress.

Symptoms of Chronic Glanders. This is characterized by the same unhealthy deposits and ulcers in the nose, varying extremely in size and number, often, indeed, situated too high to be seen; by the same viscid discharge, but usually much less tenacious than in the acute form; by the same hard, comparatively insensible nodular glands on the inner side of the jaw-bone; and a cough, which, however, is much more rare. Excepting at the very outset, the animal usually appears to be in the best of health, with the apparently insignificant drawback of the nasal discharge, and hence he is often kept and used till he contaminates a number of horses or even men. The case is easily recognized unless where the ulcers are invisible or the enlarged glands removed. It is sometimes needful to inoculate a useless animal to decide as to the nature of the malady. It usually proves fatal to the inoculated animal in about ten days.

Symptoms of Acute Farcy. The premonitory symptoms resemble those of acute glanders, of which it is but another manifestation. The local symptoms consist in thickening of the lymphatic vessels, which feel like stout cords, painful to pressure; and the formation of rounded inflammatory swellings (farcy-buds) along the course of these corded lymphatics. There follow ulceration of these buds, raw sores, discharging a glairy, unhealthy pus, and dropsical engorgement of the limb or other part affected. It is usually seen to follow the line of the veins on the inner side of

the hind or fore limb, but may appear on any part. The cording usually extends from the feet toward the body, and is most likely to be confounded with *lymphangitis*, in which the swelling begins high up in the groin. It usually proves fatal, becoming complicated with glanders before death.

Symptoms of Chronic Farcy. This may follow the acute form or come on insidiously. First there is some swelling of a fetlock, usually a hind one, and a round, hard, nut-like mass may be felt, which gradually softens, bursts, and discharges the characteristic serous or glairy matter. The lymphatics leading up from it meanwhile become corded, and farcy-buds appear along their course. Or the round, pea-like buds appear first on the inner side of the hock, or on some other part of the body, soften, burst and discharge before any cording of the lymphatics can be felt.

By-and-by, dropsical swellings appear in the limbs and elsewhere, at first soft and removable by exercise, later, hard and permanent. Sometimes the farcy-buds fail to soften, but remain hard and indolent for months.

Glanders in the dog is a comparatively mild affection, but as deadly if it is conveyed back to the horse or to man. *Glanders in man* presents the same general symptoms as in the horse, and need not be further described.

Treatment of Glanders. The acute disease is fatal. The chronic form occasionally appears to recover, though more commonly the symptoms are covered up to reappear whenever the animal is put to hard work. The treatment of glanders in all its forms and of acute farcy with open sores should be legally prohibited, because of the danger to man as well as animals.

For glanders the most successful agents have been arseniate of strychnia (5 grs.), bisulphite of soda (2 drs.), biniodide of copper (1 dr.), cantharides (5 grs.), with vegetable tonics, sulphate of copper (6 drs. in mucilage), sulphate of iron (4 drs.), chloride of barium, copaiva, cubebs,

etc. Pure air and rich food are perhaps even more important. To the nose may be applied sulphur fumes, fumes of burning tar, carbolic acid solution in spray, etc. The enlarged glands may be treated with astringent solutions, and later with iodine injections, or may even be excised with the knife.

Treatment of Chronic Farcy. Active local inflammation may demand a purgative (aloes), diuretics (iodide of potassium), with warm fomentations or astringent lotions, exercise, and a soft, non-stimulating diet. In the absence of such indication use the tonics advised for glanders, choosing in the order named. The corded lymphatics and unbroken farcy-buds may be blistered or rubbed with iodine or mercurial ointment. The raw sores should be treated with caustics (carbolic acid, nitrate of silver, corrosive sublimate, chloride of zinc, or even the hot iron). Use iodine, diuretics, exercise, rubbing, etc., to reduce the swelling, and feed liberally.

Prevention. 1. Destroy all glandered horses, and all with acute farcy and open sores, and bury deeply. 2. There should be a high penalty attached to the exposing of glandered horses in public places. 3. Suspected animals should be secluded under veterinary supervision until they can be pronounced sound, or destroyed. 4. The stable, manure, litter, harness, clothing, utensils, etc., with which the diseased has come in contact should be thoroughly disinfected. 5. Neither strange animals nor men should be admitted, and attendants should disinfect before leaving. 6. Horses should be protected as far as possible from exhausting work, chronic wearing-out affections and above all impure and rebreathed air.

VENEREAL DISEASE OF SOLIPEDS.

This is a curious disease of unknown origin, existing in Arabia, North Africa, and Continental Europe, bearing a strong resemblance in many points to Syphilis, and prop-

agated by copulation. I name it here because of the probability of its importation with European or Arabian horses. (It is already reported in Percherons, in Illinois and Montana.)

Symptoms. From one to ten days after copulation, or in the stallion sometimes after some weeks, there is irritation, swelling, and a livid redness of the external organs of generation (in stallions the penis may shrink), followed by unhealthy ulcers which appear in successive crops, often with considerable interval. In mares these are near the clitoris, which is frequently erected, with switching and rubbing of the tail; in horses on the penis and sheath. In the milder forms there is little constitutional disturbance and the patients recover in a time varying from a fortnight to two months. In the severe forms the local swelling increases by intermittent steps. The vulva is the seat of a deep violet congestion and extensive ulceration, pustules appear on the perineum, tail, and between the thighs, the lips of the vulva are parted, exposing the irregular, nodular, puckered, ulcerated, and lardaceous-looking mucous membrane, abortion ensues, with emaciation, lameness, paralysis, and death after a wretched existence of five months to two years. In horses swelling of the sheath may be the only symptom for a year, then there may follow dark spots of extravasated blood, or swellings of the penis, the testicles may swell, a dropsical engorgement extends forward beneath the abdomen and chest, the lymphatic glands in different parts of the body may swell, pustules and ulcers appear on the skin, the eyes and nose run, a weak and vacillating movement of the hind limbs gradually increases to paralysis, and in a period varying from three months to three years death puts an end to the suffering.

It is needless to speak of treatment. This disease ought to be stamped out at once, as its insidious nature enables it to spread to the great destruction of stock.

TUBERCULOSIS. CONSUMPTION. PINING.

This is a specific bacteridian affection, due to a bacillus, and characterized by a specific deposit of cells, large and small, in a special network, but without blood-vessels. It is situated by preference in the groups of lymphatic glands, or in the microscopic gland-like tissue of the different organs, and may be seen in all stages, from the simple redness and congestion in which the deposit is only commencing, through the solid grayish tubercle to the soft yellowish, cheese-like mass resulting from the softening of the latter. There are also the open cavities (*vomicæ*) resulting from their rupture and discharge of the tuberculous matter, and chalky masses from the deposit of earthy salts within them. They may be no larger individually than a millet-seed (miliary tuberculosis), or in the chest of cattle one may measure a foot long and five or six inches in thickness. They are most common in cattle, especially heavy milkers, with long legs, narrow chest, attenuated neck and ears, and horns set near together. Fowls and swine with a corresponding conformation are next in order of liability, while horses, dogs, and sheep are comparatively exempt. Oft-repeated experiment has shown that tubercle is communicable to healthy animals by inoculation, or by eating the raw, diseased product, and that it is superinduced in any predisposed individual by setting up a local inflammation. It has also been transmitted by the warm, fresh milk, but probably only when the disease has invaded the mammary glands; in many experiments, including those conducted by the author, the milk has proved harmless. Close, badly-aired buildings (as town cow-sheds) are among the most prolific causes of the disease, as are also changes to a colder climate, to a cold, exposed locality, or from a dry to a low, damp, undrained region. Finally, any cause which tends to wear out the general health tends to tuberculosis in a predisposed subject.

Tubercles may be developed in any part of the body, as the lungs, their serous covering, the membrane supporting the bowels, the coats of the intestines, the throat, the spleen, the liver, the pancreas, the ovaries, the kidneys, the bones, especially the ends of long bones, and in rare cases, the muscles and connective tissue.

Symptoms vary according to the seat of the deposit, yet there is a constitutional condition common to all, and the lungs are almost always involved in the later stages, giving rise to a great similarity of symptoms. The disease may be acute but is usually chronic. The onset is insidious and easily overlooked, tubercles being often found in animals killed in prime condition, and I have seen them in *parturition fever*, which is always attributed to plethora. There is some dulness, loss of vivacity, tenderness of the withers, back, and loins, and of the walls of the chest, occasional dryness of the nose, heat of the horns and ears, want of pliancy in the skin, slightly increased temperature (102°), weak, accelerated pulse, mawkish breath, stiffness of the limbs, wandering perhaps from one to another, slight, infrequent, dry cough, and blue, watery milk, often abundant but with cheesy matter, fat, and sugar decreased and soda and potassa in excess. The lymphatic glands about the throat are often manifestly enlarged. Swellings of the joints may appear, or a murmur harsher than natural may be heard over the lower end of the windpipe or in the chest. With deposits in the abdomen and especially in or near the ovaries of cows the desire for the male is often constant (*bullers*), though conception and the completion of gestation are usually impossible. Working oxen are easily overdone and become visibly emaciated from day to day. As the disease advances the eyes sink in their sockets and lose all animation, the skin is hidebound, harsh, dry, and scurfy, the hair dull, dry and erect, the membranes of the eyes, nose, and mouth of a pale, yellow, bloodless aspect, though often streaked with

pink vessels, a whitish discharge often takes place from the nose, and with it an increased repulsiveness and often distinct fœtor of the breath; if the bowels are involved scouring is common, and if the bones, swelling and lameness increase. Exhaustion with profuse perspiration and labored breathing occur on the slightest exertion, the appetite fails, tympany follows each meal, and the milk is at once poorer and lessened in quantity. The cough increases, becomes rattling, the discharge profuse, fetid, mixed with cheesy-like or chalky particles, crepitating, wheezing, gurgling and other abnormal noises are heard in the chest, and percussion shows dulness in particular parts with wincing. All of the symptoms become steadily aggravated, and the animal usually perishes from the difficulty of respiration or the profuse fetid diarrhœa. In cases affecting the bones, the patient may be unable to stand, and the bony prominences may make their way through the skin or even crumble under the pressure thrown upon them. If the tubercle is deposited in liver, pancreas, or kidneys, there are symptoms of disease of these respective organs.

Recoveries sometimes ensue in connection with healing of vomicæ or calcification of the tubercles in strong subjects, but more frequently the disease progresses to a fatal issue.

Treatment. This is unsatisfactory as being rarely successful, and even then in preserving an animal which is dangerous as a breeder for producing a progeny predisposed to this disease, and for slaughter and dairy purposes as possibly conveying the malady to man.

The most promising course is to secure dry, pure air, sunshine, a genial temperature, rich and easily digestible food, containing abundance of fat (linseed, corn, beans, peas, potatoes), a course of tonics (linseed or cod-liver oil in small doses, sulphate of iron, hypophosphite of iron, quinia, gentian, etc.), and antiseptics (fumes of burning sulphur, bisulphite of soda, sulpho-carbolate of iron, etc.).

Prevention. This would include drainage, shelter of pastures by trees, avoidance of changes to cold or damp localities, a warm, sunny location for farm buildings, suitable feeding and watering, the prevention and cure of all debilitating, and especially chronic diseases, protection against overwork, or excessive secretion of milk on a stimulating but insufficiently nutritious diet, securing young, undeveloped animals against breeding and milking at the same time, rejection of tuberculous subjects from breeding, the prompt removal of all such animals from pastures or buildings used for the healthy, and the thorough disinfection of all places where they have been kept.

The flesh and milk of tuberculous animals are always to be viewed with suspicion, but this poison, like others, can be destroyed by the most thorough cooking.

QUEBRA BUNDA. BERIBERI.

This affection of horses is said to have been developed in the island of Marajo, in the mouth of the Amazon, as the result of the slaughter of the immense herds of predatory wild horses, and the decomposition of the carcasses under the tropical sun. It has extended to the adjacent mainland, and might easily be imported in the bodies of cheap Brazilian horses. It has even been thought to be identical with the Beriberi of man, in which case its introduction, and domestication in our Gulf States would appear to be a still more imminent contingency. The main symptoms of the malady are a progressive paralysis of the hind limbs, which renders the animal absolutely and permanently worthless. The Portuguese name, given above, means literally *broken buttock.* Our principal danger consists in the possibility of the germ being implanted and perpetuated in the rich alluvial soils of our semitropical Gulf States, and the consequent destruction of the equine races there, as they now are cut off in Brazil.

CHAPTER IV.

LARGER PARASITES.

Parasites—their numbers. Tapeworms. Tænia Cœnurus. Cœnurus Cerebralis and their effects, Staggers, Turnsick, Gid, Sturdy, Water-brain in calves and lambs. Tænia Echinococcus, Echinococcus Veterinorum (Hominis), Echinococcus disease. Tænia Solium. Cysticercus Cellulosa, Parasitic measles in swine. Tænia Mediocanellata, Cysticercus Mediocanellata, Parasitic Measles in cattle. Tænia Expansa, tapeworm in sheep and cattle. Lard Worm, Kidney Worm of hogs. Eustrongylus Gigas, Kidney Worm. Trichina Spiralis, Trichinosis.

PARASITES.

The domestic animals harbor no less than two hundred species of parasites which will be found treated in the author's larger work, but the limits of the present book will restrict us to a few of the more injurious. For convenience of reference most of these are noticed in connection with the organs (skin, bowels, liver, air-passages,) which they infest, and here we will only name such as having a more general diffusion through the body cannot well be referred to any one organ.

TAPE-WORMS.

These are flat-bodied worms made up of small segments joined end to end, and when full grown varying in length from one inch to one hundred feet. The narrow end terminates in a small globular head furnished with circular sucking discs, and a proboscis usually encircled by one or more rows of hooklets. From the other end the ripe segments are continually detached and expelled from the body, and may be recognized as little, white, flattened,

oblong objects progressing over soil and vegetables by a worm-like movement, and depositing an endless number of microscopic eggs with which they are literally filled. Some tape-worms are estimated to lay as many as 25,000,000 eggs. Taken with the food or water into the body of a suitable host these eggs open and set free an ovoid six-hooked embryo, which bores its way through the tissues until it reaches that organ or tissue which is the natural habitat of its species in the young or larval state and there encysts itself. It may survive indefinitely or even die in this situation or if its host is eaten by a carnivorous animal it may develop in its bowels into a mature tape-worm and reproduce its species as before. Fortunately nearly all the eggs perish from failing to be taken into the body of a suitable animal in which they can develop into the cystic form, or this peril escaped, because the first animal host is not devoured by the right species of animal in which the young cystic worm can grow into its mature tape-worm form. But from the enormous fecundity of these tape-worms in eggs it is manifest that there may be scarcely any limit to their increase when the different animals which form their hosts in the cystic and mature condition abound together in the same locality.

STAGGERS. TURN-SICK. GID. STURDY. WATER-BRAIN IN LAMBS AND CALVES.

The *Tænia Cœnurus* of the bowels of the dog, a tape-worm of one to three feet long, has its *cystic form—Cœnurus Cerebralis*—in the brain and spinal cord of sheep and cattle, giving rise to nervous disease, varying much in character according to the exact site of the cyst.

Symptoms. Great nervousness and fear without apparent cause, or dullness, stupor and aberration of the senses, and disorderly muscular movements. The sheep is found apart from the flock with red eyes, dilated pupils, blindness and unsteady gait, but with a tendency to move restlessly in one direction. Left to itself, it neglects to

eat or drink and wastes daily. But, if well-fed and excitement avoided, it may even gain flesh. If the cyst is situated on one side of the brain, the lamb turns to that side, moving in a circle and making a beaten track. The limbs on the opposite side of the body act in a disorderly manner, being partially paralyzed. If there is one on each side of the brain, the sheep will turn to one side or the other, according to the relative activity of the parasites at any given moment. When the cyst is directly in the median line, the sheep elevates its nose and advances in a straight line until stopped by some obstruction. When located in the back part of the brain, (cerebellum),

Fig. 1.

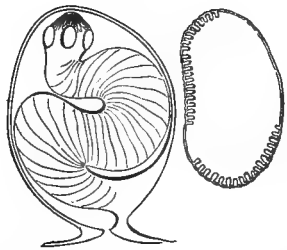

Fig. 1—Cœnurus Cerebralis. Showing the sac with its many heads (reduced). Also a single head magnified.

the host lifts its limbs in a jerking, uncertain manner, sets them down in a hesitating way, stumbles perpetually, falls and struggles for some time ineffectually in its efforts to rise. If situated in the spinal cord, difficult breathing and paralysis are marked symptoms. The disorders are often extreme at first, and afterwards undergo a temporary improvement, the remissions and aggravations being probably due to the varying activity of the parasite at different periods. Simple tumors, maintaining a steadily increasing pressure rarely give rise to such intermittent symptoms.

The cœnurus mostly affects sheep under two years old

and those that are out of condition. Yet the finest animals, kept for show, will sometimes suffer. So it is in cattle, the young, weak and ill-thriven are the most exposed, but all may suffer. For the same reason, poor, damp and exposed localities suffer more than the rich, dry and sheltered.

Prevention. Destroy the dogs, or, if they must be kept, deny them sheep's heads until cooked. Examine them at frequent intervals and expel all tape-worms by vermifuges, (oil of turpentine, male-fern, kousso, areca nut, etc.) Keep the young sheep at all times in good, thriving condition. Drain all wet pastures, shelter exposed ones.

Treatment. In rare cases, spontaneous recovery may follow rupture of the cyst in connection with a blow on the head or a fall. Hogg passed a long knitting wire through the nose into the brain, and Youatt advises a small trocar for the same purpose. But the cyst is more easily punctured and extracted through the upper part of the skull. In advanced cases, the internal pressure of the cyst has sometimes caused absorption of the bones and the formation of a soft spot on the upper part of the skull. This should be laid open with a sharp lancet or penknife, just enough to introduce a trocar and cannula one-eighth inch in diameter, through which the liquid may escape slowly. The animal may be turned on its back to complete the evacuation, but held firmly so that no struggling can take place. As the cyst is emptied, a membrane will be found projecting through it, and should be slowly drawn out. This is the parasitic cyst, and from its inner surface will be found projecting one hundred to two hundred little elevations like pin-heads, each representing the head of a tape-worm and being capable of development into the mature parasite if swallowed by a dog. The wound should be covered with a pitch plaster and a leather hood, and the patient placed in a dark, quiet, secluded box, on soft, laxative diet for a week.

If the bones are not softened the point to be perforated must be ascertained from the symptoms. If the sheep turns to one side, open a little in front of the corresponding ear and about half an inch from the median line of the skull. If the head is elevated and the walk straight forward without much terror or disorderly movement, open at the same level but in the median line. If there is awkward, hesitating movement, much terror, flurry and stumbling, open in the median line further back. A flap of skin is to be dissected up from the bone, large enough to admit a trephine one-eighth inch in diameter (in an emergency a gimlet will do) with which the bone is to be perforated. After this the cannula and trochar is used as above advised.

If more than one cyst should be present the operation may require repetition, and with care recoveries often ensue. A bag of ice on the head may remove symptoms but does not kill the worm.

ECHINOCOCCUS DISEASE.

The *Tænia Echinococcus*, a tapeworm of the dog, not ex-

Fig. 2.

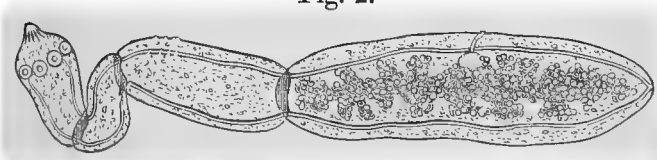

Fig. 2—Tænia Echinococcus magnified (Cobbold).

Fig. 3.

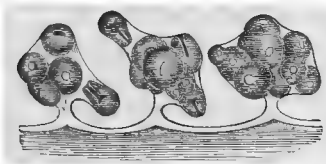

Fig. 3—Portion of cyst and heads of Echinococcus.

ceeding one inch in length, lives in its cystic form as

Echinococcus (E. Hominis, E. Veterinorum), in the most varied internal organs of men and animals. As the cystic form of this parasite has the power of increasing its numbers almost indefinitely, and growing into enormous multilocular cysts, it becomes extremely injurious and even deadly to its brute, and, above all, to its human victims. One-sixth of the human mortality in Iceland has been attributed to this parasite, and a fatal case in a child has recently come under my notice in Tompkins Co., N. Y. Many of the cysts of water found in the liver and other internal organs of the domestic animals are specimens of *echinococcus*, and that they are not more frequently fatal may be attributed largely to the shortness of the lives of animals raised for slaughter. They may inhabit almost any organ (liver, lungs, spleen, abdominal walls, kidneys, brain, eye, etc.,) and the symptoms will vary accordingly.

Treatment. Spontaneous recovery may take place from death or rupture of the sac. Otherwise the true nature of these fluctuating tumors can rarely be recognized, but if they should, they may be punctured with a very fine needle-shaped nozzle, the liquid evacuated with a syringe, and compound tincture of iodine injected into the sac.

Prevention. Destroy all superfluous dogs. Keep others from slaughter-houses and deny raw flesh and especially offal. Examine frequently and if segments of tape-worm are passed, clear them away with vermifuges (see *gid*). Burn the dung of all dogs suffering from tape-worms, the contents of evacuated hydatids and all offal containing cysts.

MEASLES IN SWINE.

Fig. 4.

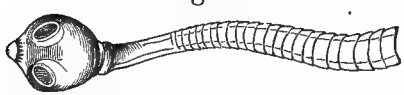

Fig. 4—Head of Tænia Solium, magnified. Cobbold.

The bladder-worm of pork, (*Cysticercus Cellulosa*, Fig

5), is the immature form of a tape-worm of man, (*Tœnia solium*), and is only caused by pigs having access to hu-

Fig. 5.

Fig. 5—Cysticercus Cellulosa, magnified.

man excrement, or to places near privies, etc., from which the segments of the human tape-worm may travel. The cysts, respectively about the size of a grain of barley, are found in the muscles, in the loose connective tissue between them and under the skin, in the serous membranes, in the eye, under the tongue, in the brain, etc., of swine. They are also found in this undeveloped form in the muscles, brain, etc., of man, causing disease and death. To man the parasite is usually conveyed by eating underdone pork, or in the cystic form he receives it as the egg in his food (salads, etc.,) and water.

Symptoms. In pigs the cysts can usually be seen under the tongue or in the eye. In man there are the general symptoms of intestinal worms and the passage of the ripe segments. Other symptoms may attend the presence of the cysts according to the organ which they invade. Thus when passing into the muscles there are pains and stiffness resembling rheumatism, when into the brain, coma, stupor, imbecility, delirium, but when they have once become encysted they may continue thus indefinitely without further injury.

Treatment. The cysts scattered through the body are beyond the reach of medicine.

Prevention. Human beings harboring tape-worms should be compelled to take measures to expel them. Their stools should be burned or treated with strong mineral acids. Swine should be kept far apart from all deposits of human excrement; no such manure should be used as a top-dress-

ing on pastures open to swine, or on land (market gardens, orchards, etc.,) devoted to the raising of vegetables to be eaten raw. Avoid raw meat, especially pork, even if salted and smoked, and underdone meat and sausages, also well-water from gravelly soils in the vicinity of habitations.

MEASLES IN CATTLE.

This consists in the presence in the muscles of cattle, especially young ones, of a cystic parasite two to four lines in length, *(Cysticercus Mediocanellata)* which as a mature tape-worm *(Tœnia Mediocanellata)* inhabits the human

Fig. 6.

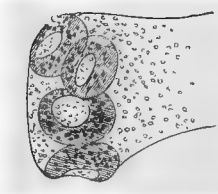

Fig. 6—Head of Tænia Mediocanellata, magnified.

bowels. When the eggs were given experimentally to calves they caused stiffness, wasting and death in three weeks. Or improvement began at the end of a fortnight and terminated in apparent recovery, the live cysts of course remaining in the muscles and ready to develop into their adult form when eaten by man.

Under *prevention* and *treatment* might be repeated what is stated under *measles of swine,* merely substituting the word cattle for pigs. The current practice of eating raw beef ham is especially reprehensible.

TAPE-WORM OF SHEEP AND CATTLE.

Tœnia Expansa is the name of this worm, which causes great loss in some localities in America, as well as in Australia, Germany, etc. Its cystic form is unknown, therefore we can only check its increase by watching what

sheep pass the ripe, detached segments, shutting them up, expelling the worm by vermifuges (oil of turpentine in milk, male-fern, etc.,) and burning both it and the sheep's droppings.

LARD-WORM OF THE HOG.

This worm *(Stephanurus Dentatus)* is from one to one and

Fig. 7.

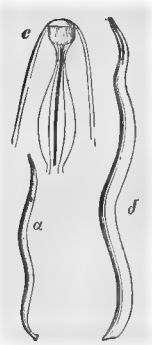

Fig. 7—Stephanurus Dentatus; *a*, male; *d*, female; *c*, head, magnified. Ver rill.

three-fourths inches long by one-thirteenth inch broad, and is found in almost all parts of the body of swine. It

Fig. 8.

Fig. 8—Eustrongylus Gigas. Cuvier.

is frequent in the liver, kidney and the fat about the spare-

rib, but has been found in the air-passages, the heart, the veins, the mesentery and elsewhere. In many cases no impairment of the health is observed. But irritation of important organs like the kidney or liver may lead to weakness of the hind parts, diarrhœa, or even blood-poisoning and sudden death. It seems not improbable that the attacks of this worm in the liver may produce a disorder which is confounded with *Hog Cholera.* Its presence in the kidney may sometimes be recognized by the existence of microscopic eggs in the urine. The same results from another worm—*Eustrongylus Gigas.* But without the observation of such eggs weakness of the hind parts cannot be ascribed to the *kidney-worm.*

Treatment is unsatisfactory. Small doses of salt and oil of turpentine may be given with no great hope of success. The favorite dose of arsenic only escapes killing the hog because he rejects it all by vomiting. If beneficial at all it must be in small doses, one-eighth to one-sixth grain, so that it may be taken up into the system.

Prevention is to be sought by keeping the healthy and diseased apart, and especially by raising young pigs apart from the ground occupied by the old.

TRICHINA SPIRALIS.

This worm, which is capable of being reared in all the domestic animals, is especially common in man, the hog

Fig. 9.

Fig. 9—Adult Intestinal Trichina Spiralis, magnified.

and the rat. Trichinæ are almost microscopic, vary-

ing from one-eighteenth to one-sixth inch in length, yet they are among the most deadly worms known. The mature and fertile worm lives in the intestines of animals, the immature in minute cysts in the muscle. The latter can only

Fig. 10.

Fig. 10—Muscle Trichina encysted, magnified.

reach maturity and reproduce their kind when the animal which they infest is devoured by another and they are set free by the digestion of their cysts. When thus introduced into the bowels they grow and propagate their kind, giving rise to much irritation for the first fortnight, *diarrhœa*, *enteritis* or *peritonitis*. The symptoms caused by their boring through the bowels and into the muscles last from the eighth to the fiftieth day. There are violent muscular pains like rheumatism but not affecting the joints, a stiff, semiflexed condition of the limbs and sometimes swellings on the skin. In man the affection is often mistaken for rheumatism or typhoid fever, in the lower animals the symptoms are usually less marked but are the same in kind. There are loss of appetite, indisposition to move, pain when handled and stiffness behind. If the patient survives six weeks recovery may be expected because the worms no longer irritate after becoming encysted in the muscle.

Treatment. In the first six weeks, but especially for the first fortnight, use laxatives and vermifuges. Glycerine, benzine, Düppel's animal oil, chloroform, alcohol and picric acid are fatal to them in about the order named.

Prevention. Never eat underdone meat. Trichina sur-

vive 140° F. Hams thoroughly smoked or salted for three months are safe. Slightly smoked hams and those steeped in creosote or carbolic acid are most dangerous. Pigs should not be kept near slaughter-houses, and especially should the waste of these places be forbidden them. Such hog-pens, indeed all piggeries, should be kept scrupulously clean and clear of rats and mice. The carcasses of swine fed near slaughter-houses or where rats abound should be subjected to a thorough microscopic examination before passing into consumption. Whenever a case of trichinosis occurs in a human subject the pork should be traced to its source if possible, and the pigs reared in the same place killed and subjected to prolonged boiling. The rats and mice should be eradicated and the hog-pens and manure burned.

CHAPTER V.

DIETETIC AND CONSTITUTIONAL DISEASES.

Ergotism. Goitre. Rheumatism. Acute Anasarca. Purpura Hæmorrhagica. Anæmia.

ERGOTISM.

From time immemorial animals and men have suffered from eating the cereal grains which have been attacked with ergot. This was especially the case when agriculture was in its infancy, for then a damp, cloudy season would cause this affection to spread after the manner of a plague. The same holds still to a less extent, and in the New World as well as the Old. Not only the *ergot* but even the *smut* of maize will bring about untoward effects. These results may be divided into three categories according as the poison acts on the *brain* producing *convulsions*, *paralysis* or *profound lethargy ;* on the *womb* tending to *abortion ;* or on the extremities causing *dry gangrene.*

Symptoms of the Nervous Form. Unsteady gait, a great tendency to lie down and to remain in a torpid state little conscious of what is passing around, loss of lustre of hair or feathers, coldness of skin, dilatation of the pupils of the eyes, and dullness of the special senses mark the early stages. This may go on to paralysis or deep lethargy without any active nervous excitement. Or paroxysms supervene, during which the special senses become more acute, the animal very excitable, and twitching of the muscles or spasms like those of lockjaw or epilepsy convulse the patient. Then there is a relapse into the former stupor and drowsiness, with palsy of the hind limbs or knuckling

forward at the fetlocks. Death may ensue in a few hours or days, or the affection may become chronic, the patient remaining with variable appetite, but getting no good of his food, with spasms of the pharynx, vomiting or diarrhœa. He usually passes off in a convulsion.

Symptoms of the Abortion Form do not differ from those of abortion from other causes. (See *Abortion*).

Symptoms of the Gangrenous Form. Nervous symptoms may or may not usher in the disease. Then follow swelling, heat and tenderness of the extremities, usually the hind feet but sometimes the fore, or the tail, ears or roots of the horns. Lameness usually first draws attention to this condition. Soon the extremity becomes cold, insensible, of a deep brownish-red appearance and dry, hard or almost horny. The swelling, heat and tenderness persist higher up, but the lower part is dead including even the bone up to a given point. At this level a red, circular crack appears in the skin separating the dead from the living, and if the patient should survive long enough the whole gangrenous part drops off.

It usually occurs in winter from the dry hay fodder but is distinguished from frost-bite by implicating the deep as well as the superficial parts and attacking the feet in preference to the more exposed tail and ears.

Treatment is only successful in the mildest cases, and the earliest stages. Change to wholesome diet, including plenty of roots or potatoes. Clear offensive matter from the bowels by laxatives, and give tonics (cinchona, gentian,) stimulants (ammonia, valerian, angelica, musk,) and antispasmodics (opium, chloral-hydrate, chloroform, or nitrite of amyle). Use soft, warm poultices containing camphor.

Prevention. Ergoted hay, known by the black, spur-like growths out of the husks, should be withheld, or fed only in limited quantity in conjunction with roots and potatoes. Be careful in selecting seed clear of ergot. Seed may be protected to a large extent by sprinkling with a strong

solution of blue-stone or bisulphite of soda before sowing, and drying with quicklime. Contaminated soil should be used for other crops. Drainage, and open sunshine are conducive to healthy growth. Hay from affected pastures must be cut early, before it has run to seed.

GOITRE.

This is a diseased enlargement of the *thyroid body*, situated beneath the throat, and is common in animals and in man wherever the water is charged with the products of magnesian-limestone. Hence, its frequency on the limestone formations of New York and Pennsylvania. Weakness, from any disease, poor feeding, abuse, overwork, etc., aggravates the affection. In solipeds there are two distinct swellings, one on each side, but in other animals and, above all, in swine, the swelling is single and in the median line. At first it is soft and even doughy, but afterwards it is firm, tense and resistant, and if cut into may even be gritty. In lambs it may form a great engorgement from the jaw to the breast-bone, and the whole produce of the year may be still-born or die soon after birth.

Treatment. Give rain-water and use iodine freely, both internally, on an empty stomach, and over the swelling. Persist in this for months. Weak solutions of iodine may be thrown into the tumor by a hypodermic syringe, or the nutrient blood-vessels may be tied.

The destruction of lambs by goitre may be obviated by giving the ewes rain-water, good feeding and plenty of exercise in the open air during the winter.

RHEUMATISM.

This is a peculiar form of inflammation attacking the fibrous structures of the body (muscles, tendons, joints, bursæ, etc.,) and dependent on a constitutional predisposition transmitted from parent to offspring. It often shifts from place to place, rarely results in suppuration,

and shows a great tendency to implicate fatally the valves and other fibrous structures of the heart. Besides the constitutional predisposition, it owes its development to accessory causes, such as cold and wet, cold draughts, and disorders, especially those of the digestive or respiratory organs which load the blood with abnormal and probably acid elements.

Symptoms. Acute Form. Dullness, languor or indisposition to move is followed by extreme lameness in one or more limbs, and heat, swelling and tenderness of a joint, tendon or group of muscles. If this tenderness moves from joint to joint or muscle to muscle it is very characteristic. The swelling is at first soft and afterward hard and resistant; it may fluctuate from excess of synovia in a joint, but rarely from the formation of matter. With the onset of the inflammation comes active fever, with full, hard pulse, increased temperature, hot, clammy mouth, dry muzzle, hurried breathing, costiveness, and scanty, high-colored urine, sometimes with a neutral or even acid reaction. Cattle often remain down and refuse to rise. If the disease extends to the heart, the pulse has a sharp, often intermittent or irregular beat, and one or other of the heart sounds may be accompanied by a hissing or sighing murmur. *(See diseases of the heart.)*

Chronic Form. This resembles the acute, excepting that it is less severe, usually unattended by fever, and may even appear only on exposure, and disappear in the warm sunshine. It is liable to induce fibrous and even bony enlargements, and in cattle suppuration, especially about the joints, and in such cases the disease is more stable and less inclined to shift from place to place.

Treatment. Give a laxative (horse, aloes; ox or sheep, Epsom salts; pig or dog, castor oil,) with anodynes (opium) if pain is extreme, and follow up with alkalies (bicarbonate of potassa or soda; acetate of potassa or ammonia; cream of tartar,) and diuretics (colchicum, muriate of ammonia, nitrate of potassa). Sudorifics (hot

room; warm clothing; rugs wrung out of boiling water closely applied to the skin and covered with dry; bags of dry grain, bran or sand; rubbing with hot smoothing-irons over a thin covering; hot air or steam baths; aconite; acetate of ammonia; guarana, etc.,) are in the highest degree beneficial. Some agents, like propylamine and muriate of iron, have been very serviceable in certain hands. Local treatment consists in the application of warmth, etc., as above indicated, and also blisters (strong aqua ammonia and olive oil) which may be applied several times a day and the inflammation followed up as it recedes from structure to structure.

ACUTE ANASARCA. PURPURA HÆMORRHAGICA.

The affection to be described here is altogether different in its nature from the dropsies which result from obstruction of veins, in phlebitis, or because of pressure by a diseased structure, as also from those dependent on suppression of the secretion of urine, on heart-disease or a watery state of the blood with deficiency of blood globules. It is not at all inflammatory nor of the nature of malignant anthrax as is generally assumed. It is exceedingly common after influenza and other affections of the respiratory organs, in ill-ventilated stables where animals are compelled to use rebreathed air, and in very open, cold barns where they are liable to be chilled after being heated at work. Sudden excessive lowering of temperature or exposure to cold rain or wind storms, especially when hot and perspiring, are efficient causes by reason of the sudden check to the secretions of the skin. The disease is much more frequent under the extreme vicissitudes of temperature of the Northern States than in the more equable climate of the British Isles.

Symptoms. The disease is manifested abruptly by appearance of tense, painful, rounded or diffuse swellings on the nose, lips, face, neck, inner sides of the limbs, belly or indeed anywhere over the body. These tend to enlarge,

to run together and to gravitate downwards into the limbs and the lower parts of the trunk, where they form extended, tolerably smooth swellings, pitting on pressure and subsiding abruptly into the sound skin at their upper margins. The membrane lining the nose usually shows dark blood spots and patches, ineffaceable by pressure, even at this early stage, sometimes indeed before any swelling of the skin, but always as the disease advances. Similar spots may be seen on the skins of white animals. The urine is usually dense, thick, ammoniacal and often brownish-red. Shivering often marks the period of effusion but there is at first little change of pulse, temperature, breathing or appetite. As the swellings increase, the animal becomes unable to see, to eat, or even to move, almost, and breathing may be carried on only with the greatest difficulty, through the swollen and closed nostrils. Transverse cracks and yellowish liquid oozing, appear in the bends of the joints; little blisters with yellowish or bloody contents rise, especially in the hollow of the heel behind the pastern, and, bursting, continue to discharge. Yellowish serum or dark blood may ooze from the general surface of the swelling; patches of skin die, drop off and leave unhealthy, weak sores with a serous discharge; the exudations may even soften the muscles, and loosen and detach the tendons from the bones leading to turning up of the toe or other distortions. Sometimes the superficial swellings suddenly subside, and unless a critical diarrhœa or diuresis occurs, serous infiltration of some internal organ like the lungs or bowels is apt to ensue, cutting off the patient suddenly, with great oppression of breathing or violent and persistent colicky pains, and, at times, a bloody fœtid diarrhœa.

The symptoms and dangers vary with the seat of the effusion. The result is most favorable when this is under the skin, the main danger then being from suffocation, extensive death and sloughing of skin, and softening and detachment of tendons and ligaments. Unless improvement

is shown by the third or fourth day the disease will usually last over twelve or fourteen days, and the resulting sores even for months.

Prevention. Keep in strong, vigorous health, and avoid the various causes (exposure, etc.,) known to precipitate the malady. Drainage of damp localities is not without its influence. Lastly, avoid weakening treatment in diseases of the respiratory organs, especially such as are attended with a low type of fever like influenza, and, above all, avoid exercising such animals to fatigue, or exposing to inclement weather.

Treatment. Give a mild laxative (olive oil, linseed oil, aloes,) and follow up by diuretics (sweet spirits of nitre, oil of turpentine, buchu, nitrate of potassa,) carefully graduated in amount to the strength of the patient, and use freely agents calculated to increase the viscidity of the blood (tincture of muriate of iron 1 dr., chlorate of potassa 2 to 4 dr., bichromate of potassa $\frac{1}{8}$ grain,) with bitter tonics (quinia, cascarilla, camomile,) and, if necessary to moderate suffering, anodynes (belladonna) or in very prostrate conditions stimulants (alcoholic liquors, oil of turpentine). Locally, the swellings should be often bathed with tepid lotions of tincture of muriate of iron, carbolic acid, or chloride of zinc diluted so as to be non-irritating. Astringent solutions should be assiduously employed about the head, and, if suffocation is threatened, tubes of gutta-percha may be inserted in the nostrils to keep them open. Tracheotomy is to be avoided if possible, together with scarifying of the swellings, because of the risk of unhealthy sores resulting.

Modified Forms. The mild forms of this affection have been described as scarlatina, the distinction being based on the punctiform nature of the blood-staining, the severity of the sore-throat and the more moderate exudation. But there is no contagion nor, indeed, anything that seems to warrant the distinction claimed. This form may be especially benefited by poultices and counter-irritants to the

throat, by the inhalation of warm water vapor, and by astringent electuaries (chlorate of potassa, 2 oz.; vinegar, 2 oz.; linseed meal, 5 oz.; syrup, sufficient to form a pasty mass. Smear one-eighth of the mass on the back teeth twice a day). Otherwise, the treatment is the same as for purpura.

ANÆMIA.

This term is used to imply a deficiency of red globules in the blood, a result which may be determined by a variety of causes described in other parts of this work. Among these may be named: worms, profuse bleeding, excessive secretions from the udder, kidneys, bowels, etc., chronic diseases of digestion, or of the mesenteric glands, feeding on aliment deficient in some essential element, on what has been grown on poor, sandy soils, restriction for a length of time to one kind of food, starvation, diseases of the jaws or teeth, damp, dark, badly-aired buildings, seclusion from sunlight, etc. Some cases, however, are not traceable to any definite cause, and it appears that they set in and progress, in spite of good hygienic arrangements, and in the absence of any obvious disease of structure.

Symptoms. Great and increasing paleness of the mucous membranes, and in white animals of the skin (paper skin); lack of fullness or roundness of the veins; slow, weak pulse; heart's beat slow and heard with difficulty, but excited to palpitation when the patient is subjected to violent exertion; there is great lack of life and energy, and hurried breathing, perspiration and fatigue are easily induced. As the blood becomes poorer all these symptoms are aggravated, movement becomes unsteady, the hair or wool is easily detached, appetite fails, the dung is passed in small quantities and very hard, and a very clear urine of a low density is secreted in excess. In the advanced stages the pale, dull, sunken eye, the puffy appearance of the membrane of the eyelids, the dropsical swellings beneath the jaws or body or in the limbs, the inability

or disinclination to rise, the staggering gait, the hurried breathing becoming quick and wheezing on the least exertion, and the palpitations are highly characteristic. Towards the end the urine may pass involuntarily or diarrhœa may supervene. Death sometimes occurs early, before there is much emaciation, and horses will even die in harness.

Prevention. Avoid everything calculated to reduce the system unduly. Severe depletive treatment of disease (bleeding, purging, diuretics,) should only be resorted to under necessity. Hard work, excessive yield of milk, etc., can only be warranted under a rich, abundant food, and in an animal of great powers of digestion and assimilation. Regularity in feeding, watering and work are essential.

The effect of a spare diet, even in idleness, must be carefully watched, as well as a long-continued feeding on one variety of plant. If evil effects are shown there should be a prompt change to natural hay or grass, consisting of a variety of plants grown on a dry soil, and a liberal supply of grain.

In cases due to parasites or other removable cause, attention to these is manifestly the first step to prevention.

Treatment. After removal of the causes, support by nourishing, easily-digested food in small bulk to avoid exhausting the powers of the stomach. Ground oats, barley, oil-cake, and a little natural hay may be especially mentioned, though, for weak subjects, thick, well-boiled gruels and beef tea (even for herbivora) may be resorted to. Tonics are all-important (iron, gentian, quassia, cascarilla, cinchona, common salt, pepsin,) but should be given in small doses to the weaker subjects. Iron and gentian, given as tinctures, are especially useful. In extreme cases, health may be speedily revived by the transfusion of blood from a healthy animal. In all cases, the patient should be allowed rest in a dry, warm, well-aired place, and should have light, sunshine, and grooming.

CHAPTER VI.

DISEASES OF THE RESPIRATORY ORGANS.

General causes of diseases of the breathing organs. Physical examination of these organs:—Auscultation, percussion. Bleeding from the nose. Nasal Catarrh. Cold in the head. Collection of matter in the nasal sinuses. Abscess of the false nostril. Abscess in the guttural pouches. Tumors in the nose. Malignant catarrh of cattle. Sore-throat. Croup. Roup. Diphtheria. Chronic roaring. Bronchitis. Chronic bronchitis. Glander heaves. Acute congestion of the lungs. Pneumonia. Inflammation of the lungs. Pleurisy. Inflammation of the membrane lining the chest. Pleuro-pneumonia. Broncho-pneumonia. Broncho-pleuro-pneumonia. Hydro-thorax. Water in the chest. Pneumo-thorax. Air or gas in the chest. Abscess of the intercostal spaces. Dropsy of the lung. Apoplexy of the lung. Pleuro-dynia. Rheumatism of the walls of the chest. Asthma in dogs. Heaves. Broken-wind. Bleeding from the lungs. Hæmoptysis. Parasites in the upper air-passages. Grub in the head. Larva of Œstrus Ovis. Pentastoma Tænioides. Parasites in the lower air-passages. Lung-worms of sheep, etc. Lung-worms of horses and cattle. Gape-worm of fowls. Verminous bronchitis in calves, sheep, swine and birds.

DISEASES OF THE RESPIRATORY ORGANS.

These are of the first importance in domestic animals alike as regards their frequency and the mortality and other serious consequences they entail. In young horses especially they are far more common and more destructive than any other class of diseases. Among the general causes of diseases of this class of organs the following may be stated in brief: 1. The great extent of the respiratory surface in the lungs = 200 to 500 square feet. 2. The extreme tenuity and delicacy of the membrane covering this surface, protective cells (epithelium) being almost wanting in the air cells, contrary to what exists on every other mucous surface in the body. 3. The extraordinary work to

which the lungs are subjected in the rapid paces and severe efforts made by the horse. 4. The close, impure air of the stable in contrast to the clear bracing air of the fields to which the colt has been accustomed. 5. The effect of the hot relaxing air of the stable is not only on the lungs directly but on the skin with which the lungs and all internal organs so closely sympathize. 6. The heats and chills, and violent nervous excitement to which young horses are subjected in passing into training and work. 7. The changes of locality, feeding and management to which young horses are subjected on leaving the breeder. 8. The variable weather and sudden, extreme changes of spring and autumn. 9. The susceptibility which results from the want of habitude of bearing extreme heat and cold, and which tells especially at the above seasons. 10. The draughts of cold air to which animals are often subjected, and particularly when warm and perspiring. 11. The frequent exposure to cold drenching rains, night dews and the like, after the excitement and relaxation consequent on a hard day's work. 12. The arrest of circulation through the lungs owing to imperfect æration of the blood when an animal out of condition is driven at a pace beyond his power of endurance.

Modes of Physical Exploration of the Respiratory Organs. *Auscultation* and *percussion* are the most essential. The first is the application of the ear alone or with a stethoscope to the surface over some part of the respiratory organs (nose, throat, windpipe, chest,) to listen to the natural sounds of breathing and to detect any unnatural change or absence of these sounds. The natural sounds must be studied on the healthy animal, and then the different modifications followed on the diseased. In general terms there is a blowing sound to be heard in health over the nose, throat, windpipe, and between the upper and middle thirds of the chest. In the rest of the chest is a soft, rustling murmur which has been compared to the gentlest zephyr stirring dry leaves. Just behind the left elbow in

horses this murmur is absent and replaced by the sounds of the heart. Between the upper and middle thirds of the chest it mingles with the blowing sound anteriorly, but is unaccompanied by that over the few last ribs. *Percussion* consists in drawing out the resonance of any part by striking it gentle taps with a hard object, the blows falling perpendicularly to its surface, and of a force proportioned to the depth of the organ it is meant to sound. Thus, for the surface, the gentlest taps with the tip of the finger are wanted, while for the centre of the chest in large animals, the closed fist may be advantageously used. For intermediate depths the four fingers and thumb may be brought together, in a straight line at their tips, and the surface tapped with this. When a cavity, enclosed by a hard bony surface, such as the nose, is being sounded, it is well enough to tap this direct, but if the surface is soft, as in the chest of fat and fleshy animals, a hard, solid body should be pressed firmly upon it and the taps delivered upon this. As the different parts of the right hand may be used for delivering the taps, so may the two middle fingers of the left hand be employed to compress the soft parts and receive them. The front of the fingers should be applied against the surface and the hard bony backs turned out to receive the taps. If *percussion* is made over a hollow space, like the nose or windpipe, the sound is drum-like; if over an open, spongy tissue, like the lung, it is much less so but still full and clear, but if over a solid body, like the thigh, it is dull, dead, or quite wanting in resonance. Behind the left elbow such dull sound is met with in the horse and, to a less extent, in cattle; and on the last ribs on the right side in cattle, sheep and pigs a similar dullness is found in accordance with the position of the liver. Any increase, diminution or loss of resonance over particular parts thus becomes of great value as indicating the healthy or unnatural state of the parts. But the observer must learn this matter by experience on the healthy and diseased. These hints are merely thrown out to make what will follow intelligible.

BLEEDING FROM THE NOSE.

Bleeding from the nose is rather rare in animals, and usually results from disease or injury to the mucous membrane or to violent exertions in coughing, sneezing, drawing heavy loads uphill, or with a tight collar, and especially in animals with a plethoric habit.

Symptoms. Bleeding in drops (rarely in a stream) from one nostril only, accompanied by sneezing, and without frothing or sour odor. Bleeding from the lungs comes from both nostrils, is bright-red, frothy and accompanied by a cough. Bleeding from the stomach also comes from both nostrils, and is black, clotted, sour, and attended by retching.

Treatment. Tie the head short up to a high rack or beam, cover head and neck with bags of ice or rugs wrung out of cold water, and blow matico powder or strong alum water in spray into the nose during inspiration. In obstinate cases, the nose may be plugged with pledgets of tow, tied with a soft cord by which they may be withdrawn when the bleeding subsides. Both nostrils must not be plugged in horses unless *tracheotomy* has first been performed. Internally, may be given gallic acid, acetate of lead, perchloride of iron or ergot of rye.

NASAL CATARRH. COLD IN THE HEAD.

This results from the *general causes* above mentioned and from irritant gases, vapors, etc.

Symptoms. Sneezing, redness and watering of the eyes, and redness of the membrane of the nose which is at first dry, afterwards discharges a clear watery fluid and finally a yellowish-white muco-purulent matter. In mild cases there is little or no fever, in the more severe fever may run high.

Treatment. In mild cases rest in a clear, airy, warm building with suitable clothing and warm bran mashes is all that is necessary. In the more severe steam the nose as for strangles, and slightly charge the air with the fumes

of burning sulphur, give warm water injections or even a mild laxative, (horse, ox or sheep, Glauber salts; dog or pig, castor oil), followed by refrigerant diuretics (nitre, acetate of potassa, etc.). If debility ensues feed well and

Fig. 11.

Fig. 11—Syphon for injecting the nose.

give tonics (gentian, etc.,) and stimulants (spirits of nitrous ether). Chronic discharges may usually be promptly checked by injecting the nose with a weak astringent solution (sulphate of zinc ½ dr., glycerine 1 oz., tepid water 1 qt.) This is thrown in with a syphon having one arm sixteen inches long and the other leaving that at an angle of 45°, three and a half inches long and narrowing to half an inch at the point. The short limb is inserted into the nostril, having first been passed through a hole in the centre of a piece of sole leather intended to prevent the return of the fluid from the nose. The adaptation is perfected by pledgets of tow, and the head being brought into a vertical position the liquid is poured into the long end of the syphon until it rises in that nasal chamber and escapes by the opposite nostril. One or two such injections are usually sufficient.

COLLECTION OF MATTER IN THE NASAL SINUSES.

This is common after severe colds in the horse; and as the result of blows on the forehead or horns in oxen, of injuries from the yoke, etc.; in sheep from grub in the head (larva of *Œstrus Ovis*); in dogs and horses from the *pentastomata*, and in all animals from diseases of the upper back teeth.

Symptoms. A more or less constant discharge from

the nose, fœtid if long retained, and above all if from a diseased tooth, a dullness on percussion on that side of the face between the eyes or just beneath the eyes, and occasionally heat, tenderness and even swelling of these parts, especially below the eye.

Treatment. Trephine the bone to one side of the median line of the forehead, in the interval between the eyes, and again, an inch above the end of the bony ridge which extends down beneath the eye, and wash out daily, at first with tepid water and finally with the injection recommended for the nose. In the case of parasites these must be rinsed out. Sometimes a slight collection of this kind will recover under injections for the nose and the persistent use of sulphate of iron or copper, or other tonic. If there is a diseased tooth it will be recognized by the dropping of food half-chewed, by the swelling and tenderness around the fang of the tooth and by the intolerable fœtor which clings to the fingers when a balling iron has been placed in the mouth and the tooth examined with the hand. Such a tooth must be extracted with large forceps, if already loosened, or if not, an opening should be made upon its fang with a trephine and the offending tooth driven out with a punch and mallet. But there is much danger of injuring important vessels and nerves unless the operator is thoroughly conversant with anatomy.

ABSCESS OF THE FALSE NOSTRIL.

This is common in young horses and appears as a slowly increasing, inactive, tense, round swelling in the outer part of the nostril. It is so firm as to feel solid but collapses at once when opened. It should be laid open from within the nose along its whole length and plugged with tow till the raw edges have skinned over.

ABSCESS IN THE GUTTURAL POUCHES.

These are two cavities situated above the throat and pe-

culiar to solipeds. Each has a small opening at its anterior part through which any liquid within them can escape only when the head is depressed. Hence a collection of matter in these sacs, consequent on a sore throat, escapes and is discharged through the nose intermittently when the head is down drinking, or still more in grazing or nibbling roots. The discharge comes from both nostrils and there may or may not be swelling beneath the ear. Many such cases will recover if sent to grass or fed from the ground and treated with some of the tonics recommended for chronic catarrh or glanders. But should these fail the sac must be laid open, setoned and washed out daily with a weak astringent lotion. This operation requires the most accurate knowledge of the parts to avoid the many important structures in the region. (See the author's larger work.)

TUMORS IN THE NOSE.

Tumors of almost every kind grow in the nose and must be removed by surgical means.

MALIGNANT CATARRH OF CATTLE.

This appears mainly in cold, damp, marshy situations where the vitality is impaired, or in unusual seasons. In the cold early summer of 1875 I met with it in cows in several marshy places. Low, damp river-bottoms are most subject to it and probably it is due to deleterious agents taken in with the food and water as well as to chills and exposure.

Symptoms. A slight diarrhœa may be followed by costiveness, the dung being black, firm and scanty. The hair is rough and erect, shivering ensues, the head is depressed, the roots of the horns and forehead hot, eyes sunken, red, watery, with turbidity in the interior and intolerance of light, muzzle dry and hot, mouth hot with much saliva, the membranes of mouth, nose and vagina bluish-red, pulse rapid, impulse of heart weak, breathing

hurried, cough, urine scanty and high-colored and surface of the body alternately hot and cold. In twenty-four hours all the symptoms are aggravated, the nose discharges a slimy fluid, the forehead is warmer, and duller on percussion, the mouth covered with dark-red blotches from which the cuticle soon peels off leaving raw sores, appetite is completely lost, dung and urine passed with much pain and straining and there is general stiffness and indisposition to move. From the fourth to the sixth day ulcers appear on the nose and muzzle, swellings take place beneath the jaws, chest and abdomen, and on the legs, the skin may even slough off in patches, a fœtid saliva drivels from the mouth and a stinking diarrhœa succeeds the costiveness. Death usually ensues from the eighth to the tenth day, preceded perhaps by convulsions or signs of suffocation. The disease strongly resembles the *Russian Cattle Plague* but is rarely contagious.

Treatment. Clear out the bowels by a laxative (olive oil and laudanum), following this up by slightly stimulating diuretics (sweet spirits of nitre, liquor of acetate of ammonia,) with antiseptics (chlorate of potassa, bichromate of potassa, hydrochloric acid). Wet cloths may be kept on the head, the mouth and nose sponged with very weak solutions of carbolic acid, and only soft mashes and sliced or pulped roots allowed.

SORE-THROAT.

This may be confined to the larynx or upper end of the windpipe *(laryngitis)*, or the *pharynx* or membranous pouch through which air and food both pass at the back of the mouth *(pharyngitis)*, or the whole may be involved *(laryngo-pharyngitis)*. There are, besides, the sore throats connected with specific diseases (croup, diphtheria, influenza, strangles, distemper and purpura).

The CAUSES of simple sore-throat are the same as those of *nasal catarrh*. Bots in the throat may cause it in horses.

Symptoms. The nose is raised and protruded, the head being carried stiffly and more in a line with the neck than usual, and there is swelling of the throat or beneath the roots of the ears. There is cough, hard in laryngitis, and dry and husky in pharyngitis, and, later, loose and gurgling in both diseases. With laryngitis there is much tenderness to touch, and, in the early stages, a loud, harsh blowing sound which may become loose and rattling as the disease advances. With pharyngitis there is a little tenderness, but difficulty in swallowing, chewed morsels being often dropped again and water rejected through the nose. The discharge from the nose is more glairy than in nasal catarrh or bronchitis, and on its appearance the active fever usually subsides in great part. If there is much redness of the membrane of the nose, and high fever, the case is likely to be severe, and the same is true of cases with a painful, paroxysmal cough.

In *Chronic Sore-throat* there may appear to be general good health, but a cough comes on in paroxysms when the patient comes into the cold air, drinks cold water, eats dry oats or dusty hay or undergoes active exertion. There are also more or less tenderness and wheezing or rattling in the throat, and sometimes slight swelling.

Treatment. Rest in a clean, dry, airy stable or box. Clothe warmly and flannel bandage the legs if cold or tending to shiver. Tie a rug or sheep-skin with wool in around the neck. Steam the nose as for *strangles.* Unless the fever and pulse are low or the affection of an *influenza* type, a laxative is usually beneficial (horse, aloes; ox and sheep, Glauber salts; dog and pig, castor oil;) following up with nitre or acetate of potassa in the water, and anodynes as electuaries. Solid extract of belladonna 4 drs.; tannic acid 1 dr.; bisulphite of soda 4 drs.; honey or syrup 5 oz.; mix. Dose—horse and ox a piece as large as a hickory nut; sheep one-fourth, dog one-tenth of this bulk, thrice daily. To be smeared on the back teeth and swallowed at leisure.

In most cases, a thin pulp, made with mustard and water, should be well rubbed in around the throat as soon as the bowels respond, and covered up for two hours, but, in the most severe, this may be preceded for a day or two by a linseed poultice. The diet throughout must be green, soft mashes or roots.

CROUP.

Especially seen in young animals (calves, lambs, foals,) in cold and damp or high exposed localities. The symptoms are those of severe sore-throat *(laryngitis)* coming on very suddenly with hard croupy cough and dry wheezing breathing, worse at one time than another or heard only at particular times of the day (morning, night,) when spasms of the larynx come on. But the most characteristic symptom is the formation of albuminoid false membranes as white films or pellicles in the throat, and which are discharged in shreds on the second or third day. Fever runs very high, pulse ninety to one hundred, temperature 107°, and even higher.

Treatment. Give a warm, well-aired building, with water-vapor set free in the atmosphere, if possible; warm clothing, a laxative (sulphate of soda) with antispasmodic (laudanum, aconite, chloral-hydrate, lobelia); follow up with small doses of sulphate of soda, chlorate of potassa and antispasmodics, giving each dose in well-boiled linseed tea, slippery elm or marsh-mallow. Blister the neck actively (mustard, with or without oil of turpentine,) and, if necessary, swab out the throat with a solution of nitrate of silver ten grs., water one oz., applied by a small sponge immovably tied on a piece of whalebone. In the worst cases suffocation must be obviated by opening the windpipe in the middle of the neck and inserting a tube to breathe through. In horses a ring must not be completely cut across, but a semicircular piece cut out of each of two adjacent ones. Sometimes stimulants (wine whey, carbonate of ammonia,) and tonics (gentian, cinchona,) must be used to sustain the failing strength.

CROUP OR ROUP IN FOWLS.

Causes. Probably similar to those acting on quadrupeds. Exciting diet (wheat, buckwheat, oats,) seems at times injurious. Newly-arrived fowls are most liable to contract it, yet it does not always seem contagious in the ordinary sense, but rather inherent in soil, locality or conditions of life.

Symptoms. Dullness, sleepiness, neglect of food, ruffled feathers, unsteady walk, quickened breathing, with a hoarse wheeze, and an occasional loud crowing noise. On the tongue, at the angle of union of the beak, or in the throat appear yellowish white films (*false membranes*) firmly adherent to a reddened surface, and raw sores where these have been detached. The nostrils may be completely plugged with swelling and discharge so that breath can only be drawn through the open bill. The inflammation may extend along the windpipe to the aerial cavities and lungs, or along the gullet to the intestines. In the first case, death may take place from suffocation, and in the second, from diarrhœa, and as early as in twenty-four hours. Toward the end of an outbreak, the malady may last twenty days and still prove fatal. False membranes may form on other distant parts of the body, but especially the comb, wattles, eye, or on accidental sores.

Treatment. Disuse raw grain, and feed on vegetables, and puddings made of well-boiled oat, barley or Indian meal. Dissolve carbonate or sulphate of soda, or chlorate of potassa freely in the water drunk, remove the false membranes with a feather or forceps and apply to the surface with a feather the nitrate of silver lotion advised for croup in quadrupeds. If diarrhœa supervenes, give a teaspoonful of quinia wine thrice a day. It is all-important to change the run of the chickens for a time at least.

DIPHTHERIA.

This is seen in calves, pigs, horses, rabbits, mice, rats, kittens, guinea-pigs, hens and ducks. It is undoubtedly contagious, yet one attack does not protect against a second. In the false membranes, blood, and internal organs (spleen, liver, kidney, etc.) are found spherical and rod bacteria (strepto-

coccus and bacillus), which convey the disease to susceptible animals after a number of artificial cultures (Loeffler). Though not always inoculable from one genus to another, there are many cases of such interchange, accidental and experimental, and in these man has reciprocated freely with the lower animals. The special potency of the poison, the receptivity of the subject, and the unwholesome condition of the surroundings have much to do with the result. Close, filthy pens, and want of care, strongly predispose. The poison is easily carried in milk.

Symptoms. Sudden illness, with sore-throat and extreme weakness and stiffness of back and loins. The pig moves slowly and crouchingly with raised head, open dry mouth, hoarse nasal grunt, livid tongue, and red swollen throat with grayish-white patches of false membranes. The eyes are dull and sunken, and the appetite gone. In a few hours all the structures of throat and nose are involved, there is much swelling and threatened suffocation and shreds of *false membrane* are coughed up. The patient remains down, sits on his haunches, or leans on the fence and usually perishes in a fit of coughing. In other genera there is violent sore-throat (at first often without fever), swelling of throat and glands, difficult swallowing and breathing, and later coughing up of false membranes. The false membranes also appear on superficial sores, while in some cases the poison acts especially on the internal organs. Muscular pains, weakness and paralysis often follow.

Treatment. Must be early to succeed, hence, examine the throat for false membranes in all cases of sore-throat in pigs, holding the animal with a noose around the upper jaw. If white patches are seen, apply at once and freely the nitrate of silver lotion advised for croup, and repeat as often as may seem necessary to keep the diseased growths in check. Tincture of muriate of iron, with as much chlorate of potash as it will dissolve, may be diluted in water to a strong astringent wash and given every hour. The bowels may be freely opened by a purgative, and tincture of the muriate of iron and nitre given thrice a day in a tablespoonful of cold water.

Great attention must be given to the comfort and to secure pure air, and soft, easily-digestible food for some time.

CHRONIC ROARING IN HORSES.

This is a wheezing, whistling, or hoarse rasping sound made in the upper part of the windpipe (larynx) in breathing and especially when excited. It is usually due to paralysis and wasting of the muscles on the left side of the larynx and which open the channel for the air, and in such cases the noise is only made in drawing air in. But any obstruction in the large air-tubes will give rise to roaring, heard most commonly in both inspiration and expiration. Thus palsy of the nostrils, fracture and depression of the bones of the nose, tumors in the nose, throat, windpipe or bronchi, false membranes extending across the air-passages, dropsical swelling about the throat, and in stallions undue accumulations of fat, may give rise to it. In the typical form with palsy of the laryngeal muscles the animal grunts (groans) when led up to a wall and a feint is made to strike him on the ribs. If galloped up a steep hill or over a newly-plowed field, or even for some distance on level ground, the *roaring* is strikingly brought out. The same holds good if made to draw a heavy load or one with the wheels dragged.

Treatment. In incipient cases with simple thickening of the mucous membrane, benefit may arise from swabbing out the larynx with nitrate of silver solution, as recommended for *croup*, or firing the skin over the throat with a red-hot iron. But if the muscles are wasted and fatty these means will be fruitless, and we must look to mechanical or surgical measures for help. Pads attached to the nose-band of the bridle, and so arranged that they will lie on the false nostrils and check somewhat the ingress of air, will enable many roarers to do moderate work with comparative comfort. In the worst cases, in which the animal is rendered useless, *tracheotomy* may be performed and the animal made to breathe through a tube inserted in the middle of the neck. Or finally, the larynx may be laid open with the knife, and

the flap of gristle (arytenoid), which is drawn in, valve-like, over the opening by the current of air, cut off.

Some cases of roaring due to feeding on vetches (*Lathyrus Sativa* or *Cicera*) may be cured by changing the feed, and giving some doses of nux vomica. Others due to dropsical effusions appear intermittently and may be benefited by tonics and iodide of potassium, with hard, dry feeding and exercise. Tumors and other mechanical obstructions must be removed with the knife.

Finally, roaring is often hereditary in horses with a narrow space between the jaws and thick, short neck, with badly set on head, and such should be rejected for breeding purposes.

BRONCHITIS.

Inflammation of the large air-tubes within the lungs. It may be looked upon as an extension downward of nasal catarrh or sore-throat and frequently supervenes on one or the other of these. Otherwise it owns the same general causes with these affections. It may also attend on influenza, strangles, contagious pleuro-pneumonia, distemper in dogs, tuberculosis, and parasitic diseases of the lungs.

Symptoms. In *mild cases* there are dullness, impaired appetite, hot dry mouth, red membrane of nose, accelerated pulse and breathing, and a cough at first hard but becoming soft and rattling as discharge is established from the nose. Such may recover in a few days without treatment.

In *severe cases* there is dullness, inappetence, hot dry mouth, increased temperature, rapid pulse, labored breathing with loud blowing sounds over the lower end of the windpipe and behind the middle of the shoulder-blade. The cough is dry, hard, sonorous, and painful (barking), often occurring in fits and seeming to come from the depth of the chest. *Percussion* detects no change of resonance at any part of the chest, as in *pneumonia.* The membrane of the nose has a dark red or violet hue, varying in proportion to the general implication of the bronchial tubes and especially the smaller ones, and there is drowsiness and drooping of the head in the same ratio.

From the second to the fourth day a whitish discharge sets in from the nose, the cough becomes soft and rattling, the noise over the windpipe and behind the shoulder-blade less harsh and blowing, but with a slight rattle from bursting bubbles, and the symptoms of fever abate. From this time improvement dates, and recovery may be complete in two or three weeks.

Solipeds stand obstinately throughout the disease, other animals may lie. There is no tenderness on punching the ribs, as in *pleurisy.*

Treatment. Rest in a warm, dry, airy building, clothe warmly, bandage the limbs in cold weather and give warm sloppy mashes of wheat bran. A laxative is often useful but if there is weakness, small pulse, prostration or any yellowish tinge of the mucous membranes, is to be rejected and warm water injections used in place to move the bowels. Give frequent diuretics (nitre, sweet spirits of nitre), anodynes (belladonna, lobelia, aconite), and expectorants (liquor ammonia acetatis, oxymel of squill, guaiacum, ipecacuanha, antimony, muriate of ammonia). The nose should be frequently steamed, as if for *strangles*, and inhalations of sulphur fumes mixed with the air, and not too strong, may be added. Mustard or other blisters should be applied to the sides of the chest, and repeated if any renewed access of disease seems to demand it. When fever has nearly subsided and there is left only a white discharge from the nose tonics should be used. (See those recommended for *glanders.*)

When there is much prostration and weakness, stimulants (aromatic ammonia, carbonate of ammonia, wine, etc.,) may be required, even in the early stages.

GLANDER HEAVES. CHRONIC BRONCHITIS IN HORSES.

This arises from the same causes as the acute disease and often follows it. It is characterized by a frequent weak wheezing, husky, almost inaudible cough, often occurring in fits; a white discharge from the nose, with white flocculi, like buttermilk; great shortness of breath in exertion; and a mucous rattle in the lungs. *Percussion* shows increased

resonance over the lower and posterior borders of the lungs. The right side of the heart may be enlarged and easily felt beating behind the right elbow.

Treatment is not very satisfactory in cases of old standing. Feeding should be mainly of soft mashes, roots and other laxative agents, but never bulky. Linseed, oat, barley or corn meal may be given wet and hay replaced by corn-stalks or good fresh grass. Finally give tonics, mainly arsenite of strychnia, or sulphate of iron or copper and tannic acid. Muriate, carbonate or benzoate of ammonia is often valuable.

ACUTE CONGESTION OF THE LUNGS IN HORSES.

This is always the first stage of *Pneumonia* but may occur in a sudden and fatal form from overexertion in fat or otherwise ill-conditioned horses. An animal that has stood idle in the stable or has been rapidly fattened for sale, when taken out and driven or ridden at the top of his speed soon hangs heavily on the bit, slackens his speed, and if not stopped, staggers and falls; or the exertion is passed through but the animal is seized when returned to the stable. He then stands with dilated nostrils, quick, labored, convulsive, wheezy breathing, extended head, staring bloodshot eyes, agonized expression, deep red or blue nasal membrane, and rapid, weak pulse often almost imperceptible at the jaw. *Auscultation* detects a loud respiratory murmur and the finest possible crepitating sound. The heart is felt behind the left elbow beating tumultuously and the limbs are cold, though perspiration may break out at different parts of the body. If blood is drawn it flows in a dark, tarry-looking stream and the lungs after death might be compared to a dark-red jelly.

Treatment. Remove girths, saddles, and whatever may hamper breathing, turn the head to the wind, give an active stimulant (alcohol or alcoholic liquors, ammonia or any of its compounds, oil of turpentine, ether, sweet spirits of nitre, ginger, pepper), the first that comes to hand, in a full dose, following up with warm water injections and active hand-rubbing. In extreme cases prompt relief may often be obtained by bleeding from the jugular, but this should not re-

place the measures already advised but should be added to them. An excellent resort when available is to wrap from head to tail in rugs wrung out of hot water and cover thickly with dry ones, the limbs being meanwhile actively hand-rubbed to bring the blood to this part of the skin which the rug cannot reach.

If the patient survives and does not at once entirely recover the case becomes one of *pneumonia.*

PNEUMONIA. INFLAMMATION OF THE LUNGS.

Causes. The same as in other acute diseases of the chest. Also the result of overexertion and acute congestion, or of parasites in the lung. Lobular pneumonia has a micrococcus.

Symptoms. If not following an acute congestion as above described there is shivering, more or less severe according to the gravity of the attack, and usually a dry cough. This is followed by hot skin, with increased temperature, quick but deep labored breathing and a full but oppressed rolling pulse, redness of the membranes of the eye, nose and mouth; the cough is deep as if from the depth of the chest but not so hard nor so painful as in bronchitis. The horse always, and the ox, in bad cases, obstinately stands with legs apart, elbows turned out, nose extended and usually approached to a door or window. In cattle expiration is generally accompanied by a moan. With the fever there is costiveness, high-colored, scanty urine, in cattle, heat of horns and ears and dryness of muzzle, and hide-bound. Auscultation detects a very fine crackling (crepitation) over the affected part of the lung or there may be an area of no sound encircled by a line of crepitation and beyond that by the normal murmur slightly increased. Or over the dull spot the blowing sounds from the larger tubes or the beating of the heart may be detected. Percussion causes flinching or even groaning when the affected part is reached; the space where sound was wanting in auscultation sounds dull and solid and the remainder of the chest retains its healthy resonance. There is no tenderness on merely pinching the spaces between the ribs. By auscultation and percussion the increase

or decrease of solidification (*hepatization*) of the lung may be followed from day to day excepting in the parts covered by the thick, muscular shoulder. In this way aggravation and improvement can be noticed. A yellowish or whitish discharge from the nose comes on as the disease advances.

Treatment. Give a pure, dry, airy box with windows or doors turned to the sun or away from the direction of prevailing winds, clothe warmly, and flannel-bandage the limbs, or even rub them with ammonia and oil. The hot rugs advised for congested lungs may be applied, and when removed let it be done a little at a time, and the part rubbed dry and covered by a dry blanket. Or a mustard poultice may be applied to the sides of the chest. Large injections of warm water and drinks of warm gruel may also be given. A laxative is often beneficial in the more active forms of the disease, but should be given cautiously as in bronchitis, and rejected when there is low fever, and much depression. Neutral salts (nitre, acetate of potassa, bicarbonate of soda,) should be given with sedatives (belladonna, henbane, tincture of aconite, digitalis or white hellebore; in pigs and dogs, tartar emetic), or if there is much prostration, or when the fever has in the main subsided, stimulant diuretics (sweet spirits of nitre, liquor of acetate of ammonia,) repeated three or four times a day. The sides should be blistered with a pulp of the best ground mustard in water, or Spanish flies, or in cattle and swine, mustard and turpentine, and the blister may be repeated with advantage in protracted cases. When in severe cases the blister refuses to rise, the skin may be first warmed with rugs wrung out of boiling water and then the application of the blister made. Or a hot shovel held near the blistered surface may determine an active flow of blood to the skin and the rising of the blister. When well risen the surface must be kept soft by sweet oil or fresh lard to favor healing. In chickens it is advised to open the bowels by a teaspoonful of castor-oil, and shake one-twelfth grain of tartar emetic on the tongue twice a day. If very weak or prostrate give a teaspoonful of sherry thrice a day.

PLEURISY. INFLAMMATION OF THE MEMBRANE LINING THE CHEST AND COVERING THE LUNGS.

This is common in all domestic animals and particularly in cold, exposed localities, which suffer at the same time from rheumatism. Otherwise it owns the general causes of chest disease.

Symptoms. Shivering, followed by heat of the skin and even of the limbs, and partial sweats of the surface, uneasy movements, pawing and sometimes looking at the flanks, lying down and rising. If one side of the chest only is involved that fore limb is often advanced in front of the other. The pulse is rapid, hard and incompressible, and the breathing highly characteristic. It is hurried, carried on chiefly by the abdominal muscles, and has the inspiration short and suddenly checked, while the expiration is slow and prolonged. This character of the breathing may be well observed with the ear placed on the false nostril, on the windpipe or on the side of the chest. There is a prominent ridge on the abdomen from the outer angle of the hip bone to the lower ends of the last ribs. By handling the spaces between the ribs a point is reached which is exceedingly tender, the patient flinching and even groaning when it is touched. The ear applied to the same spot detects a soft, rubbing sound during the movements of inspiration and expiration. There is at first no other change in auscultation or percussion. The animal often changes his posture or place as if seeking an easier position, and emits a short, hacking, painful cough. There is much less redness of the nose than in pneumonia or bronchitis, less heat of the expired air and no nasal discharge.

In twenty-four to thirty-six hours effusion ensues in the cavity of the chest, the rubbing sound ceases, the catching breathing and ridge on the belly disappear, the pulse becomes soft, the anxiety of countenance passes away, and the patient may begin to feed as if well. But soon the pulse loses its fullness, and gains in rapidity,

breathing becomes labored and attended with a lifting of the flank and loins, the nostrils are widely dilated, the nose protruded, the elbows turned out, the skin sweats, and there may be signs of imminent suffocation. Auscultation detects no sound over the lower part of the chest up to a given horizontal line, and up to the same level there is dullness on percussion. This shows the extent of watery effusion. The pulse becomes weak, with a peculiar thrill at each beat, the limbs and lower aspect of the chest swell, the patient moves unsteadily and falls suddenly to die.

In other cases the effusion is re-absorbed and a good recovery is made. In others it ceases to increase but fails to be taken up and remains as a cause of short wind; it may even give off gases, in which case a gurgling sound may be heard in the chest, or a sound as of drops falling into a half-empty barrel, after the patient rises from the recumbent position. In other cases still there remain false membranes attaching the lung to the inner sides of the ribs, or enveloping the lung in whole or in part, and in either case impairing respiration.

Treatment. Give the same general care as in bronchitis and pneumonia. In the early stages of chill treat as for congested lungs. Later give a laxative (horse, aloes; ox and sheep, Glauber salts; swine and dogs, castor-oil,) following it up with neutral salts (nitre, acetate of potassa, liquor of the acetate of ammonia,) in full doses, and anodynes (digitalis, aconite). These may be used in the fullest doses after effusion has taken place, and in weak subjects stimulants (sweet spirits of nitre, ether, alcoholic liquids, tincture of gentian,) should be added. Iodide of potassium may also be given internally and tincture of iodine rubbed on the chest. If from exposure use salicylate of ammonia.

In very severe cases, a large linseed poultice may be applied over the chest, or it may be shaven and subjected to dry cupping, or an active blister may be applied as for pneumonia.

If there is extreme effusion threatening suffocation the liquid must be drawn off by a small cannula and trocar (see Tympany) inserted at the anterior border and near the lower end of the ninth rib, the skin having first been drawn aside to form a valvular wound, and great care being taken to prevent the entrance of air. The liquid should be drawn off only in part at first to avoid shock, and the operation repeated in a day or two. It should be followed by tonics (sulphate of iron, tincture of gentian,) stimulants (sweet spirits of nitre) and diuretics (iodide of potassium).

PLEURO-PNEUMONIA, BRONCHO-PNEUMONIA, AND BRONCHO-PLEURO-PNEUMONIA

Are common complications of the three diseases, *bronchitis*, *pneumonia* and *pleurisy* and their respective symptoms and treatment may be inferred from the description of the uncomplicated affections.

HYDROTHORAX. WATER IN THE CHEST.

Beside the effusion of liquid into the cavity of the chest in pleurisy, dropsical effusions may take place into it in connection with weak, bloodless conditions, as in *flukes in the liver*, disease of the heart, enlarged bronchial lymphatic glands and other morbid states. The symptoms resemble those of *hydrothorax* following pleurisy, only there is no fever, and there are the indications of those other diseases on which it is dependent. The treatment is essentially the same after the morbid condition which has caused the effusion has been removed. If that is incurable neither can this be remedied.

PNEUMOTHORAX. AIR OR GAS IN THE CHEST.

This often attends on hydrothorax when the contained liquid has undergone some decomposition. More frequently it is the result of a wound penetrating the walls of the chest with its edges pressed inward so that they ad-

mit the air from without while the chest is dilating, but close like a valve when it is contracting. A little thus entering with each breath and none escaping, the lung is soon compressed into a small solid mass against the lower end of the windpipe. The same may happen from a broken rib having torn the surface of the lung even without any external wound. A little air escaping from the lung with each respiration the cavity soon becomes filled and the lung compressed and collapsed.

Treatment is limited to the prevention of the introduction of air through an external wound, should such exist; the relief of pain by opium and other anodynes; the management of the resulting pleurisy on ordinary principles; and the drawing off of the accumulated air by a needle-like tube and aspirator, or even by a small cannula and trocar. Spontaneous recovery often takes place, the wound being closed by inflammatory exudation and the air absorbed. In cases dependent on decomposition of the products, both gas and liquid should be drawn off and a weak solution of carbolic acid (one part to two or three hundred water) thrown in, in small quantity.

ABSCESS OF THE INTERCOSTAL SPACES.

This occurs especially in the horse as a result of pleurisy, a diffuse swelling appearing at some part of the walls of the chest, tender and pitting on pressure, and, finally, softening in the centre, bursting and discharging a yellowish or whitish matter. The patient should be well fed, and poultices or warm fomentations continuously applied to the part until there is softening in the centre, when it may be freely laid open. Continue to support the patient by nourishing food, stimulants and tonics.

DROPSY OF THE LUNG.

This is mainly a result of valvular and other diseases of the heart. To percussion and auscultation it gives nearly the same symptoms with pneumonia, but there is an entire

absence of fever. The coexisting heart-disease also serves to reveal its true nature. Its cause being usually incurable, it terminates fatally in the majority of cases. Treatment must be altogether directed to the disease of the heart.

APOPLEXY OF THE LUNG.

In the lower animals extravasation of blood into the substance of the lung is usually the result of profound alterations in that liquid as in *Malignant Anthrax, Purpura Hæmorrhagica, Typhoid Fever* or *Intestinal Fever.* A portion of the lung tissue gives way and the blood escaping raises the membrane covering it (pleura) from a half to three inches above the natural level. The extravasation has the appearance of a fine jelly and often preserves the shape of the pulmonary lobules—a cone with the apex turned in. Being usually a complication of another disease, treatment must be directed to that rather than the local lesion.

PLEURODYNIA.

This is a term applied to rheumatism of the muscles between the ribs, which bears a strong resemblance to pleurisy. It may be distinguished by the coexistence of rheumatism in other parts and by the comparative absence of fever, cough, rubbing sounds and effusion. Treat it like other forms of rheumatism.

ASTHMA IN DOGS.

A spasmodical affection of the circular muscular fibres of the bronchial tubes, occurring in paroxysms with irregular intervals and associated with corpulence and disordered digestion, distended or ruptured air-cells, mucous discharges from the air-passages and dilatation of the right side of the heart.

Causes. Usually in pet dogs pampered with highly seasoned articles of food, in excessive quantity, and deprived

of exercise. A change of food or temperature, a smart walk or run or indeed any exercise will bring it on.

Symptoms. Corpulence is a constant condition at the outset though the subject may be emaciated and worn out in the advanced stages. A slight cough becomes frequent, hard and sonorous, with habitually labored breathing aggravated at intervals so as to threaten suffocation. Then the patient stands with open mouth, pendent tongue and staring eyeballs panting for breath and having his condition rendered still more threatening by every change of position or cause of excitement. The frequency and severity of the attacks serve as a means of estimating the danger of the patient. In the intervals between these paroxysms may be noticed signs of indigestion, in a variable appetite, perhaps vomiting, a tumid tympanitic (bloated) abdomen, constipation and piles. The skin is dry, harsh and bald in patches, the teeth covered with tartar and the breath fœtid.

Treatment. 1. *During a paroxysm.* Cause to inhale ether, chloroform, the fumes of burning stramonium or of burning paper which has been steeped in a strong solution of nitre; or one or two teaspoonfuls of laudanum with 2 oz. castor-oil may be thrown into the gut as an injection. Or if there is reason to suspect overloading of the stomach shake a grain of tartar emetic on the tongue.

2. *In the intervals between the paroxysms.* Check any existing bronchitis or pneumonia as advised in the earlier pages of the book, and restrict to a very moderate diet of oat meal or corn meal mush, with skim-milk or buttermilk. Exercise well but in no case for three hours after feeding. Give a laxative of castor-oil twice a week. Wash frequently with soap, drying afterward by rubbing, and brush daily. A daily sedative (stramonium, tartar emetic,) is beneficial, but in advanced stages and weak conditions, vegetable tonics (quinia, gentian,) will be demanded.

HEAVES. BROKEN WIND.

This is closely allied to asthma, but is more continuous in its symptoms, and less paroxysmal.

Causes. Overfeeding on clover hay, sainfoin, lucern and allied plants: on chaff, cut straw and other bulky and innutritious food. In Arabia, in Spain, and in California where there is no long winter feeding on hay, and in our Territories where clover is not used, heaves is virtually unknown; it has advanced westward just in proportion as clover hay has been introduced as the general fodder for horses, and it has disappeared in England and New England in proportion as the soil has become clover sick and as other aliment had to be supplied. The worst conditions are when a horse is left in the stable for days and weeks eating clover hay, or even imperfectly cured, dusty hay of other kinds, to the extent of thirty pounds and upwards daily, and is suddenly taken out and driven at a rapid pace. Violent exertions of any kind, and diseases of the lungs are also potent causes. It is mainly a disease of old horses but may attack the colt of two years old. Finally, horses with small chests are most liable and thus the disease proves hereditary.

Symptoms. There is a double lift of the flank with each expiratory act, there being first a falling in of the abdominal walls and then, after a perceptible interval, a rising of the posterior part of the belly to complete the emptying of the chest; also a short, dry, weak, almost inaudible cough, followed by a wheeze in the throat, and occurring in paroxysms when violently exercised, when brought from the stable into the cold air, or after a drink of cold water. The breathing is accompanied by a wheezing noise above all evident when the patient is excited by work, or when the ear is applied on the side of the chest. Indigestion is also a prominent symptom and manifested by a ravenous appetite, even for filthy litter, by the frequent passage of wind from the bowels, and often by swelling and drum-like resonance of the abdomen. When

starting on a journey the subjects pass dung very frequently at first and after traveling some distance may go much better. Their muscular systems are soft and flabby and they run down rapidly in active work. Frequent aggravations of the symptoms may be seen in connection with overloaded stomach, costiveness, a hot close stable, a thick muggy atmosphere, or a very severe day's work.

The symptoms may be temporarily masked or hidden by restriction in diet, abstinence from water and the use of sedatives, but there remains an unnatural action of the nostrils, and a full drink of water, and above all a free supply of water and hay will bring back the symptoms in all their intensity.

Treatment. Turning out on natural pastures or feeding cornstalks or other laxative food will relieve, and even cure mild and recent cases. Feeding on dry grain with carrots, turnips, beets, or potatoes and a very limited supply of water will enable many broken-winded horses to do a fair amount of work in comfort. Hay should never be allowed except at night and then only a handful clean and sweet. The bowels must be kept easy by laxatives (sulphate of soda 2 or 3 oz.), the stable well aired, and sedatives (digitalis, opium, belladonna, hyoscyamus, stramonium, lobelia,) used to relieve the oppression. If a white discharge from the nose coexists tonics should be given as for chronic bronchitis, to which wild-cherry bark may be added. Tar water as the exclusive drink is often useful and a course of carminatives (ginger, caraway, cardamoms, fennel, fœnugrec,) may be added with advantage. But nerve tonics and above all arsenic in 5 grain doses daily, and continued for a month or two, are especially valuable.

No broken-winded horse should have food or water for from one to two hours before going to work.

BLEEDING FROM THE LUNGS.

May occur in any of our domestic animals as a result of

excessive plethora, overexertion, disease of the heart or tuberculosis. If in limited quantity, the blood comes from the nostrils and mouth of a light red and frothy and with coughing. If in greater amount it may fill the bronchial tubes and cause death suddenly by suffocation without much escape by the nose.

Treatment. When brought on by severe exertion perfect rest and quiet will check. Keeping the head elevated, cold applied to the head and neck, iced drinks acidulated with vinegar or mineral acids, are useful. Opium benefits by checking the cough, and in obstinate cases acetate of lead, ergot of rye, matico, tincture of muriate of iron, or oil of turpentine may be given internally three times a day. Remove costiveness with Glauber salts and keep in a cool airy place at rest for at least a fortnight.

PARASITES IN THE UPPER AIR PASSAGES.

The GRUB IN THE HEAD of Sheep is the larva of a small gadfly (Œstrus Ovis) which deposits the live embryo on the

Fig. 12. Fig. 13.

Fig. 12—Œstrus ovis, Clark. Fig. 13—Larva of ditto.

margin of the nostril, whence it creeps up into the nasal sinuses. It stays there during the winter and spring, often proving harmless but sometimes causing much irritation, redness of the nostrils, and a white, muco-purulent discharge, with dullness and stupor from sympathetic disease of the brain. To *prevent* the attacks of the fly the sheep should be fed salt from two-inch augur holes bored in a log, the surface of which is smeared with tar, so that they get a dressing every time they partake. A less satis-

factory method is to turn up a furrow in the pasture so that the sheep may push their noses into the ground when attacked.

Treatment. Place in a warm building to tempt the larvæ from the sinuses and introduce snuff, solutions of salt, vinegar or tobacco, weak solutions of turpentine, etc., into the nose to kill them or cause their expulsion by sneezing. For such as remain in the sinuses the only successful treatment is to trephine the bones of the face between the front of the eye and the median line of the face, or just in front of the root of the horn should that be present. The sinus is then to be syringed out freely with tepid water until the parasites are washed out.

The PENTASTOMA TÆNIOIDES is a species of acarus which

Fig. 14.

Fig. 14—Pentastoma Tænioides.

lives in the nasal sinuses of horses and dogs, and in the mesenteric glands of sheep and other herbivora. If productive of much irritation in the nose it must be expelled by a current of water after trephining the sinus.

PARASITES IN THE LOWER AIR PASSAGES.

The most common are the different forms of round worms which in certain animals (lambs, calves, pigs, birds,) may assume the dimensions of a plague and cause enormous yearly losses to a country.

The *sheep*, *goat*, *dromedary* and *camel* harbor two round worms in their air passages and lungs: the small *Strongylus Filaria*, a thread-like worm of one to three and one-

half inches long, and *S. Rufescens* of considerably greater length. The *calf*, *horse*, *ass* and *mule* have the *Strongylus Micrurus* of from one and one-half to three inches long. The *pig*, the *Strongylus Elongatus* of eight lines to one and one-half inches long. Finally the bird *(hen, turkey, pheasant, black stork, magpie, hooded crow, green woodpecker, starling, swift, etc.,)* have the *Syngamus Trachealis*, male one-eighth inch, and female one-half to five-eighths inch in length, always found united together, so that the male appears like a process from the neck of the female.

Fig. 15.

Fig. 15—Strongylus Filaria, male, enlarged. When adult, should be at least ten times the length for this thickness.

The *Strongyli* in their mature condition inhabit the air passages within the lungs but they may be reproduced either in or out of the body. In the first mode the female worm creeps into an air cell and there encysts herself and produces eggs or young worms already hatched, or she dies and the myriad eggs, hatching out amid the debris, the young worms finally migrate into the adjacent air passages, grow to maturity and reproduce their kind. In the second mode the impregnated female worm is expelled by coughing, and perishes in water or in moist earth or on vegetables, and the eggs, escaping from her decomposing remains, may lie unhatched for months or even a year, or, in genial weather, may rapidly open and allow the escape of the almost microscopic embryo worms. These, in their turn, may live an indefinite length of time in the water, or moist soil, or on vegetables, and only begin to grow to their mature condition when taken in by a suitable host with food or water. This is true of those of the sheep, goat and camel, of that of the ox, horse and ass, and of that of the pig. Only those of

the sheep, once introduced into the system, will maintain their place in the lungs for the whole lifetime of the host, though no more young worms should be taken in. That of the ox, etc., on the other hand, is more likely to be expelled, and, therefore, often infests its host but for a limited period.

The *Syngamus* of the bird has probably the same history out of the body, but this has not been so carefully studied.

Within the chest the *Strongyli* live in the small terminal air passages in their young or embryo state, in the larger air tubes when mature, and in cysts in the lung substance when laying their eggs or when about to die that the eggs may be set free and hatched. In the air passages they give rise to bronchitis, in the lungs to pneumonia and deposits resembling tubercles but distinguishable under the microscope by the presence of the elliptical eggs and the embryo worms.

The *Syngamus* of birds inhabits the air passages and gives rise to bronchitis.

In all cases the parasites are most fatal to the young. Although old animals continue to harbor them they prove much less destructive and are often unsuspected.

SYMPTOMS IN CALVES AND FOALS. VERMINOUS BRONCHITIS. HOOSE. HUSK.

These are essentially those of bronchitis, with the difference that the whole herd is affected and mucus coughed up, containing worms either singly or rolled up in bundles. There is at first only a slight rather husky cough repeated at irregular intervals. There follows dry staring coat, embarrassed breathing and advancing emaciation. Soon the cough becomes frequent, paroxysmal and suffocating, with expectoration of mucus and worms. Or the cough is soft, loose and wheezing, and the patient is weak, hide-bound, with sunken eyes and pale, thin or puffy membranes, dropsical swellings beneath the jaws, chest or belly, and no appetite; the sufferer may be found

apart from its fellows in a corner or under a tree, covered with flies and sinking rapidly into extreme debility and death. Intestinal worms (in cattle, *Strongylus Radiatus, Sclerostomum Hypostomum, Ascaris Lumbricoides, Tœnie Expansa*, etc., in foals, *Sclerostomum Equinum, S. Tetracanthum, Ascaris Megalocephala, Oxyuris Curvula*, etc.,) usually coexist to a most injurious extent, causing diarrhœa and other irregularities of the bowels.

In the worst cases death may result ten or fifteen days after the onset, though more commonly it is delayed two or three months and recovery may take place.

Prevention. In localities and countries to which the disease is new the parasites should be killed out by the continuous medical treatment of the diseased animals, or if necessary their destruction, and the separation of all horses, asses, mules and cattle, from the infested pasture or its vicinity and from any stream of water running through or close to it; as well as from all fodder, roots, grain, etc., grown on such land, for several years after. In infested localities calves and foals should never be pastured on land recently occupied by older stock of the same kind or allowed access to water used by such stock. Sheep, goats or pigs may be safely fed on such land. Avoid overstocking. Drain the land to clear off pools or wet spots. Keep the young stock from infested or suspected pastures while wet with dew and rain, and from clover and allied plants which by their moisture are liable to harbor the worm. Suspected beasts should be kept apart from the healthy and from healthy pastures until subjected to thorough and continuous treatment. The carcasses of the dead should be very deeply buried, or better, the lungs and windpipe removed and burned to ashes. All exposed animals should be well fed on a diet including dry grain, and should be allowed salt to lick at will, this being destructive to the young worms.

Treatment. Feed liberally on linseed cake, rape cake, cotton cake, roots, maize, oats, beans or other sound nu-

tritious diet to which may be added a mixture in equal parts of sulphate of iron, gentian and ginger, in proportion of four ounces to every ten calves of three months. To destroy the intestinal worms, give every morning, fasting, a tablespoonful of table salt or an equal amount of oil of turpentine shaken up with milk. For the lung parasites, place the affected animals in a close building and burn pinch after pinch of flowers of sulphur on a piece of paper laid on an iron shovel, until the air is as much charged with the fumes as they can bear without coughing violently. The administrator must stay with them in the building to avoid accidents and keep up the application for half an hour at a time. It should be repeated several days in succession, and at intervals of a week for several weeks, so as to kill the young worms as they are hatched out in successive broods, and not until all cough and excitement of breathing have passed should the animal be considered as safe to mix with others or to go on a healthy pasture.

SYMPTOMS IN SHEEP, GOAT AND CAMEL. VERMINOUS BRONCHITIS.

These are the exact counterpart of those in the calf. There is a short, dry, sonorous cough, with a frothy discharge from the nose containing worms or their eggs, loss of appetite, rapid wasting, diarrhœa, shedding or drying and flattening of the wool, excessive thirst and irregular or depraved appetite, there being a disposition to eat earth. In the advanced stages the cough becomes very harassing and death may ensue from suffocation. Intestinal parasites *(Strongylus Contortus, S. Radiatus, S. Filicolis, Sclerostomum Hypostomum, Tœnia Expansa,* and perhaps *Sclerostomum Duodenale,)* are even more numerous and injurious than in calves.

Prevention. All the measures advised for the disease in calves will apply equally well here, with this proviso, that the parasites only affect sheep, goat, dromedary and camel, so that they only must be kept apart, while infested past-

ures may be safely grazed by cattle, horses, asses or mules. Nathusius obviated the attacks by keeping the early lambs in sheds and boxes until May, and the late ones until autumn, and by feeding in the same places on roots and hay in wet weather. Abundant dry feeding and a free access to salt are especially desirable.

Treatment. This is precisely the same as for calves. The tonic mixture (iron, ginger and gentian,) may be given to the extent of two ounces to every ten three months lambs daily. For the intestinal parasites, a teaspoonful each of salt and oil of turpentine may be given in milk every second day, before eating if possible. Fumigate precisely as for the calf.

SYMPTOMS OF VERMINOUS BRONCHITIS IN PIGS.

Rayer and Bellingham supposed these parasites to be harmless to pigs, but my experience agrees with that of Deguileme, that they will accumulate in such numbers as to cause bronchitis and death. The symptoms are essentially the same as in other animals—the coughing up of worms and eggs being the only reliable evidence of the disease.

Prevention and *treatment* are essentially the same as for lambs and calves.

SYMPTOMS IN BIRDS. GAPES.

Young turkeys or chickens a few days old frequently open the mouth wide and gasp for breath, sneeze and make efforts at swallowing. These movements become more constant and severe, breathing is oppressed and wheezing, and the little patients grow languid and dispirited, droop and die. It is especially prevalent on old-established farms with large flocks of fowls.

Treatment. The worms may be partly removed by a feather stripped of all its plumes except at the tip, or still better by a horse-hair twisted up so as to have a very fine loop. The mouth being opened the feather or hair is

passed into the opening seen in the middle of the tongue, pushed to the lower end of the windpipe, turned round several times and withdrawn, when a few worms will be found attached. It may be repeated at intervals and is still more effectual if the instrument is first dipped in oil, salt water, or a weak solution of carbolic acid, tobacco or sulphurous acid. The treatment is only partially successful as it fails to remove worms lodged in the bronchial tubes or air sacs. Cobbold made an incision in the windpipe and extracted the worms with forceps, while Bartlett succeeds with turpentine (or, better, camphorated spirit)

Fig. 16.

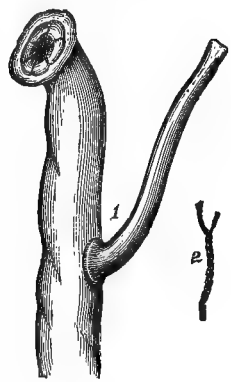

Fig. 16—Syngamus Trachealis. Gape-worm, nat. size, and enlarged.

smeared on the neck and which is of course inhaled. A removal from the contaminated ground, the supply of pure water (boiled if necessary) and an abundance of nourishing diet are essential elements of treatment.

Prevention. Burn all the worms extracted from the air passages. Keep fowls from ground and houses which are known to be infested, until they have been soaked in a strong solution of salt or with crude carbolic acid or petroleum. Suspected water must be withheld or boiled. Avoid all green food from an infested locality. The carcasses of the dead must be burned. Young fowls may be raised safely indoors on the worst infested farms.

CHAPTER VII.

DISEASES OF THE HEART.

Frequency in different animals. General symptoms. Palpitation, **thumps.** Displacement of the heart. Cyanosis. Enlargement, hypertrophy. Wasting, atrophy. Dilatation. Pericarditis, inflammation of the heart-sac. Endocarditis, inflammation of the lining membrane of the heart. Carditis, inflammation of the structure of the heart. Chronic disease of the valves. Fatty degeneration of the heart. Tumors and parasites of the heart. Rupture of the heart.

These are much more common in domestic animals than is generally supposed. Though protected in animals from the strain consequent on the upright position of man and excessive mental efforts, the heart suffers from the severe physical exertions of dogs and horses and in all animals from its contiguity to diseased lungs and pleuræ, from the increased force necessary to propel the blood through the lungs or general circulation when disease offers mechanical obstructions, and above all from the settling of rheumatism on its valves and other fibrous textures. Dairy cows suffer greatly from pins, needles and other sharp-pointed bodies swallowed with the food and afterward directed toward the heart by its movements. High-bred oxen, sheep, pigs and even pampered horses are very subject to fatty degeneration of the muscular substance of the heart and consequent dilatation of its cavities.

GENERAL SYMPTOMS OF HEART-DISEASE.

1. *The pulse* in full grown animals at rest may be set down as follows per minute :—horse 36 to 46 ; ox 38 to 42. In a hot building or with full paunch, 70 ; sheep, goat

and pig 70 to 80; dog 80 to 100; cat 120 to 140; goose 110; pigeon 136; chicken 140. In old age it may be five less in large quadrupeds and twenty or thirty in small ones. Youth and small size imply a greater rapidity: The new-born foal has a pulse three times as frequent as the horse, the six-months colt double and the two-year old one and a quarter. It is increased by hot, close buildings, exertion, fear, a nervous temperament and pregnancy. In large quadrupeds there is a monthly increase of four to five beats per minute after the sixth month. Independently of such conditions a rapid pulse implies fever, inflammation or debility.[1] The *force* of the pulse varies in the different species in health, thus it is full and moderately tense in the horse; smaller and harder in the ass and mule; full, soft and rolling in the ox; small and quick in sheep; firm and hard in swine; and firm and with a sharp (quick) beat in dogs and cats. *In disease* it may become more *frequent*, *slow*, *quick* (with sharp impulse), *tardy* (with slow, rolling movement), *full*, *strong*, *weak*, *small* (when thread-like but quite distinct), *hard* (when with jarring sensation), *soft* (when the opposite), *oppressed* (when the artery is full and tense but the impulse jerking and difficult as if the flow were obstructed), *jerking and receding* (when with empty, flaccid vessel it seems to leap forward at each beat), *intermittent* (when a beat is missed at regular intervals), *unequal* (when some beats are strong and others weak), *irregular* (when without any distinct intermission for a period equal to an entire beat the intervals between successive beats vary in length). Beside these a peculiar *thrill* is usually felt with each beat in very weak, bloodless states.

[1] The pulse may be felt wherever a considerable artery passes over a superficial bone: thus on the cord felt running across the border of the lower jaw just in front of its curved portion: beneath the bony ridge which extends upward from the eye: in horses inside the elbow: in cattle over the middle of the first rib or beneath the tail: in dogs in a groove running down the inne side of the thigh.

Of these the jerking, intermittent, unequal and irregular pulses are especially indicative of heart-disease. The *jerking* pulse is associated with disease of the valves at the commencement of the great aorta which carries blood from the left side of the heart, and is accompanied by a hissing or sighing noise with the second heart sound. The *intermittent* pulse implies functional derangement of the heart but not necessarily disease of structure. The *unequal* and *irregular* pulse is met in cases of fatty degeneration, disease of the valves on the left side, cardiac dilatation, etc. A *retarded* pulse in which the beat of heart and pulse follow each other with a perceptible interval implies imperfect closure of the valves at the commencement of the aorta, or an aneurism on the aorta. A *venous* pulse seen in the jugular veins in the furrow near the lower border of the neck attends imperfect valves between the auricle and ventricle on the right side of the heart, or congested lungs but may exist in health.

Palpation. The application of the hand over the chest behind the left elbow will detect any violent and tumultuous beating, irregularity in the force of successive beats, etc.

Auscultation. The ear applied to the same part will detect a slight rubbing sound with each heart-beat in the early stages of pericarditis. It will also detect any modification of the heart sounds. In health each beat of the heart is characterized by two distinct successive sounds, the first somewhat dull and prolonged, the second short, sharp and abrupt. The first sound is simultaneous with the contraction and emptying of the ventricles, the closure of the valves between the ventricles and auricles and the flow of blood into the arteries. The second corresponds to the completion of these acts, the recoil of blood in the arteries and the closure of the valves between them and the heart. The following table will show the significance of the various superadded sounds (blowing, sighing, purring or hissing murmurs,) to any one who will acquaint himself with the course of blood through the heart:

BLOWING. HEART SOUNDS.

Blowing murmur before the first sound.		Narrowing of the auriculo-ventricular orifice. Clots or growths on the valves.
Blowing murmur with the first sound.	Strongest toward the base of the heart. Heard along the large arteries.	Narrowing of the opening of the aorta.
	Strongest toward the left of the heart. Not heard over the great arteries.	Narrowing of the pulmonary artery, or imperfect action of the auriculo-ventricular valves.
Blowing murmur with the second sound.	Double rushing sound heard over the great arteries at each heart beat.	Imperfect action of the valves at the opening of the aorta.
Blowing murmur after the second sound.	Double rushing sound in the arteries with each beat of the heart.	Aneurism (dilatation) of the aorta.

Besides these the second sound may be doubled in hypertrophy of one ventricle of the heart.

The sounds are like whispered *who*, *awe*, *ss*, or *r*, very low but exceedingly characteristic.

Other Symptoms. Besides the fever attendant on inflammatory affections there are characteristic phenomena present in the chronic form of heart-disease. These are shown at rest or only developed under exercise. There are habitually cold extremities, dropsies in the limbs, and beneath and within the chest and abdomen, difficult breathing especially during exertion, unsteady gait when hurried, vertigo, partial paralysis or cramps of the limbs. In most cases there is sluggishness, dullness and a tendency to lay on fat. Patients may be lively when at rest, but flag at work and are liable to sudden fainting or death.

PALPITATION. THUMPS.

This is sudden violent convulsive beating of the heart not connected with structural disease. Palpitations also accompany most acute diseases of the heart. The functional disorder comes on very abruptly, usually under

some excitement, has perfect intermissions, is manifested by abrupt knocking and visible jerking of the abdomen with the heart-beats, by regularity in force and intervals of successive beats, and by the absence of redness of the mucous membranes, abnormal sounds of the heart and dropsy of the limbs. If connected with structural heart disease it comes on more slowly, is constant though aggravated at intervals, with a heavy, prolonged or irregular and unequal impulse of the heart, with red mucous membranes and dropsy of the limbs. The first form is benefited by gentle exercise, stimulants and tonics, the latter aggravated by them. Some excitable horses and dogs suffer under any cause of fear, and pigs as a result of many acute diseases, (inflammations, intestinal worms, etc.)

Treatment. Quiet, avoidance of all excitement, and sedatives (digitalis) thrice a day will usually arrest. Then the weak excitable condition should be overcome by exercise, tonics and substantial feeding. In structural diseases these must be attended to as well.

DISPLACEMENTS OF THE HEART.

These are not very infrequent in the newly-born, the heart being sometimes lodged altogether out of the chest. There is no remedy.

COMMUNICATION BETWEEN THE TWO AURICLES. CYANOSIS.

This is the natural condition before birth, but sometimes the directing of the blood through the lungs fails to secure its closure, or some obstruction to the circulation in these organs (tuberculosis, congestion, etc.,) leads to its reopening and the arterial and venous blood mix. The blood being equally unfit for nutrition and the maintenance of animal heat, there is surface coldness, staring coat, puny growth, blue mucous membranes, and oppressed breathing and irregular heart's action when subjected to exertion. A murmur usually precedes the first heart sound. The subjects die young or prove worthless

when mature. Nothing can be done to remedy unless the disease is due to some remediable affection of the lungs.

ENLARGEMENT (HYPERTROPHY) OF THE HEART.

This is a simple increase of the muscular substance and may be confined to one side of the heart or to one ventricle. It is usually caused by some obstruction to the circulation through the arteries, or in horses or dogs by habitual violent work.

Symptoms. The heart's beats are more forcible and prolonged and the interval of silence shortened; the pulse is full and rolling; the first sound is low, muffled and prolonged, the second sound unnaturally loud, and sometimes repeated if one ventricle only is affected; the heart sounds may be heard over an unusually large area, the lungs being sound, and the dullness on percussion is equally extended. The pulse is usually regular and if excited to irregularity or intermission soon returns to its normal standard if the patient is left at rest.

Pure hypertrophy rarely implies imminent danger and many hard-worked horses survive to an old age with greatly enlarged hearts. But if associated with dilatation, impaired strength, livid mucous membranes, blowing murmurs with the first heart sound, and paroxysms of difficult breathing it may prove fatal at any time.

Treatment. If possible remove the obstacle to the circulation. Then adopt a restricted, gently laxative diet, perfect rest in fattening animals or only light work in horses, and the daily use of digitalis or aconite, unless there is extreme dilatation. Arsenic is also given with benefit, but in advanced cases, or those due to irremediable obstruction, no treatment is of any avail.

WASTING (ATROPHY) OF THE HEART.

This is much less frequent than hypertrophy. It may be due to compression of the heart and its nutrient vessels by effusion into the pericardium, or the formation of false

membranes, or it may coexist with a general wasting and imperfect nutrition of the body.

The *Symptoms* are the opposite of those of hypertrophy. There are the general signs of chronic heart-disease, but percussion which gives satisfactory results only over the breast-bone and in carnivora gives almost the sole reliable symptom—a decreased area of dullness. Little can be done to relieve, and that little directed to the removal of its causes. By keeping fattening animals quiet they may be preserved for slaughter.

DILATATION OF THE HEART.

This like hypertrophy usually results from some obstruction to the circulation, but especially from a sudden extreme obstruction, whereas hypertrophy results from a slowly increasing obstacle. It is also exceedingly common in cases of fatty degeneration in overfed stock (cattle, sheep, pigs).

Symptoms. Loss of appetite, spirit and endurance, faintness and difficulty of breathing on the slightest exertion, habitual coldness of the limbs, dropsy, unsteady gait, venous pulse, palpitations, weak tremulous heart impulse, murmur with the first sound, small weak irregular and often intermittent pulse, and lividity of the membrane of the nose.

Treatment. Unless the causes can be put a stop to in the early stages no treatment will be satisfactory. Arsenic is sometimes useful in horses. Fattening animals should be kept very quiet and their progress hastened if possible.

PERICARDITIS.

This is inflammation of the fibrous covering of the heart and its reflection on the pleuræ, and is due to similar *causes* with diseases of the lungs. It is also induced by influenza, pleuro-pneumonia, rheumatism, and wounds with sharp-pointed bodies (pins, needles, nails, broken ribs, etc.)

Symptoms. General fever, staring coat, hot dry mouth (muzzle, snout,) dilated nostrils, excited, difficult breathing, double lifting of the flank with each expiration, the formation of a ridge on the abdomen as in pleurisy, tenderness when pinched or percussed behind the left elbow (in ruminants and small quadrupeds over the breast-bone), a rubbing sound with each beat of the heart and the impulse of the heart strong. Soon, effusion takes place, the rubbing sound is lost, the impulse of the heart and its sounds are weakened and the area of dullness in percussion is increased. This dullness does not maintain a horizontal line along the chest as in hydrothorax, but is like an inverted cone and changes its position with a change of posture which is easily effected in small animals. Difficulty and oppression of breathing, protruded nose, staring eyeballs, pinched, haggard countenance, venous pulse and obstinate standing mark the advanced stages. Dropsies of the limbs and other dependent parts are also frequent. A painful cough is sometimes though not constantly present throughout the disease. Death may ensue in five days to three weeks, or the disease may become chronic or end in recovery.

The *chronic form* is seen in the ox without any preceding acute attack. There is slight fever, oppressed breathing aggravated by exertion, weak, irregular, intermittent pulse, distant heart sounds, absence of respiratory murmur, dullness on percussion over an increased, cone-like area behind the left elbow, venous pulse and general dropsy.

Treatment. In the preliminary shivering, treat as for congested lungs. Later, bleeding may sometimes be beneficial in strong subjects by relieving extreme difficulty of breathing and high nervous excitement. Usually it would be injurious. Give a purgative (horse, aloes; ox and sheep, Glauber salts; dog and pig, castor-oil) foment the walls of the chest and envelop in a large mustard poultice until the skin is well thickened, moderate the heart's ac-

tion by digitalis four times a day and follow the action of the purgative by diuretics (nitre, acetate of potassa, etc.) Ointment or tincture of iodine may be applied to the walls of the chest. In cases of extreme danger from effusion the liquid should be drawn off with cannula and trocar or needle-like tube, as in hydrothorax, the puncture in the horse or ox being made between the cartilages of the fifth and sixth ribs.

In case of rheumatic complication use alkalies, colchicum, acetate of potassa and other agents advised for rheumatism.

ENDOCARDITIS.

Inflammation of the serous membrane lining the chambers and covering the valves of the heart.

Causes. Inflammation of the valves in connection with undue strain in severe exertions or obstructions to the flow of blood, the rheumatic constitution or certain other unhealthy states of the blood.

Symptoms. The general symptoms resemble those of pericarditis. There are besides, violent but unequal impulse of the heart against the left side, accompanied by a metallic tinkling, a blowing murmur with the first, or even the second sound, as soon as the contraction of the valves, or the clots formed on them, render them insufficient to close the orifices, and, if the disease exists on the right side of the heart, venous pulse, general venous congestion and dropsical swellings. The pulse, at first strong and sharp, becomes weak with the imperfection of the valves, in marked contrast with the continued strong impulse of the heart. The patient may perish from obstruction to the heart's action by clots on the valves, or from such clots carried on with the circulation and blocking arteries at a distance; or diseases of other organs may supervene from the latter cause, or a recovery may take place with or without permanent alterations which render the valves unable to close their respective orifices.

Treatment is in the main the same as for pericarditis, rest, laxatives, sedatives and blisters being mainly relied upon. As there is less danger from effusion diuretics need not be pushed to the same extent. In rheumatic cases, adopt antirheumatic treatment, and in case of clots on the valves use iodide of potassium and alkalies.

CARDITIS.

Inflammation of the muscular substance of the heart can only take place to a limited extent in connection with endocarditis and pericarditis, or with punctures from sharp bodies and the like. Were the entire organ involved death would be prompt. The *symptoms* are those of acute heart-disease generally, modified by the exact seat of the injury, and treatment need not differ materially from that adapted to the two diseases just described.

CHRONIC VALVULAR DISEASE.

With the general symptoms of chronic heart-disease, there are blowing murmurs as described in the table under *auscultation of the heart.* This is a very common result of endocarditis and is irremediable. Yet affected cattle, sheep and pigs may often be prepared for the butcher by liberal feeding and perfect quiet.

FATTY DEGENERATION OF THE HEART.

This is most frequent in high-bred stock (Shorthorns, Berkshire and Essex pigs, Leicester and Southdown sheep,) but may exist in any pampered animal. Sometimes it is complicated by degeneration of the entire muscular system, especially in pigs. There are the general phenomena of chronic heart-disease and dilatation, and the condition is irremediable, though it rarely kills animals kept in perfect quiet.

RUPTURE OF THE HEART.

If from severe exertion this usually takes place through

the fibrous structure at the base of the ventricles connecting them with the large arteries. If from a fall or violent concussion the muscular walls usually give way, when found in a relaxed condition, or the laceration happens at the point of connection with the veins (vena azygos). Perforation from ulceration is seen in cows in connection with sharp-pointed bodies that have been taken into the stomach. Death is sudden in all such cases.

OTHER HEART-DISEASES.

The heart is further subject to a great variety of diseased growths and deposits and to parasites—*Echinococcus*, *Cysticercus Tenuicollis* (sheep and calf), *Cysticercus Cellulosa* and *Trichina Spiralis* (pig), *Rainey s Cysts* (cattle), and *Filaria Immitis* (dog).

CHAPTER VIII.

DISEASES OF BLOOD-VESSELS AND LYMPHATICS.

Wounds of arteries—punctured, cut, torn. Arteritis, inflammation of arteries. Embolism, plugging. Aneurism, dilatation. Wounds of veins. Phlebitis, inflammation of veins—circumscribed, diffuse. Varicose—dilated veins. Lymphangitis, inflammation of lymphatics. Weed. Poisoned and irritated wounds.

DISEASES OF ARTERIES.

WOUNDS OF ARTERIES.

Punctured wounds are rarely dangerous, as the walls quickly close and the few drops of blood which escape help to plug the orifice; but there is danger of inflammation and plugging of the vessel, and cold or warm fomentations with rest are desirable.

Cut wounds, if only implicating the outer coats, soon heal and are rarely followed by dilatations as in man. If all the thickness of the wall is incised the result will be according to the direction. If in a line with the course of the vessel there is little risk and slight pressure will usually check bleeding. If transverse or oblique the elasticity of the walls of the vessel holds the orifice open and bleeding is severe, the blood flowing in jets and of a bright red color. If cut completely across, the arterial coats retract and curl within themselves and in small vessels will often close the opening.

To *check bleeding* the end of the vessel may be sought and tied, or a piece of silver wire may be passed through to the soft parts beneath it by the aid of a curved needle,

and tied over a cork placed on the surface of the skin. It may be untwisted and drawn out in twenty-four hours. Or a pad of tow may be made with a sharp firm point and gradually increasing to a considerable bulk (graduated compress) and tied over the wound with the narrow point pressing on the vessel. Or the orifice may be seared with an iron at a dull red heat.

Tearing, stretching, twisting, and *scraping* through arteries usually lead to retraction of their coats and complete closure and these measures are sometimes adopted to check hæmorrhage.

ARTERITIS.

Inflammation of an artery may be *external* or *internal* according as it affects the fibrous sheath or the inner lining membrane. In the *external inflammation* there may be little danger, even if matter is formed, as the vessel will continue to transmit the blood so long as its inner coat is sound. But in *internal inflammation* the blood coagulates, layer after layer, on its inner surface until the channel becomes impervious. This may cut off the blood entirely from the part to which the artery was distributed, leading to loss of power and substance, and in the case of the limbs to a lameness, which comes on whenever the animal is exercised, and increases with the exertion, but disappears with a short rest of ten or twenty minutes. Or small clots may be loosened from the mass and passing on block smaller trunks, causing circumscribed inflammation at distant parts.

Causes. Over-stretching of arteries. Plugging by clots from the heart in endocarditis, or from inflamed veins. Wounds, parasites, etc.

Symptoms. Loss of muscular power and coldness of the parts beyond the seat of plugging, extreme tenderness over the line of the vessel at the inflamed point, and sometimes general fever.

Treatment. Perfect rest, warm fomentations, laxatives,

(horse, ox and sheep, linseed oil or Glauber salts; pig and dog, castor oil,) and afterward diuretics and sedatives.

The persistence of the plugging and lameness must be met by patience, the animal being turned into a small yard or paddock where he can take gentle exercise and live well, until the collateral vessels have had time to enlarge and carry on the circulation. Three or four months will sometimes secure a tolerable recovery.

DILATATIONS OF THE ARTERIES. ANEURISMS.

These are mostly seen in the horse among domestic animals, and even in him much more rarely than in man. The *causes* are generally severe strains in the vicinity of an artery, or over-stretching of the vessel itself. They are also common in the mesenteric arteries of horses from the presence of immature worms *(Sclerostomum Equinum)* in the circulating blood. Injuries to the walls of the vessels are much less liable to be followed by aneurism than in man, because of the greater plasticity of the blood, and the speedy formation of a covering of coagulable lymph. They are soft, fluctuating, pulsating tumors, effaceable by pressure, but reappearing at once. Being usually situated internally, treatment can rarely be adopted. But when superficial, compression has been most successful alike in the horse and dog. It is needless to recount the many other modes of treatment for such an unusual affection.

DISEASES OF VEINS.

WOUNDS OF VEINS.

These give rise to the escape of a dark red blood in a steady stream. This is commonly to be arrested by pinning up the lips of the wound evenly, taking hold of each by one-eighth inch and tying them together by a little tow, twisted round the two ends of the pin in the form of the figure 8. Or several pins may be placed near each other and the tow twisted round them and from pin to pin in the same manner. Veins may be tied but this risks the

occurrence of dropsy unless you know that there is a free circulation by other collateral trunks. They may be compressed for a time until the wound is closed with lymph, a simple pad and compress being used, or the silver wire and cork as advised for arteries.

PHLEBITIS. INFLAMMATION OF VEINS.

This usually results from opening a vein with a rusty fleam or lancet, making the incision at the dilated part, just above a valve, pulling out the skin in inserting the pin so as to cause a flow of blood into the tissues beneath, leaving hairs or other irritants in the wound, or pinning the lips awry.

Symptoms. Swelling of the wound, gaping and redness of the lips, and the formation of a hard painful cord along the line of the vein in an upward direction where the blood is necessarily stagnant and in contact with the clot already formed. The exudation may be fibrinous with a tendency to contraction and obliteration of the vein, or suppuration may occur, in which case the matter must escape externally. Clots may be detached and washed on to plug the arteries in the lungs, and rouse pneumonia. or perfect recovery may take place with loss of the vein, and a tendency to swelling of the part from which it comes, when that is in a dependent position.

Treatment. If from an inflamed wound after bleeding, take out the pin, remove hair, pus, clotted blood or other irritant, and foment with warm water. Then rub in, at an inch distant from the wound and along the course of the hardened vein, an active blister (Spanish flies 2 drs., lard 1 oz.,) and tie the animal to the two sides of the stall, so that he cannot rub the part. If a vein is lost in the neck, never again turn out to grass.

DIFFUSE PHLEBITIS

Resulting from an irritated or poisoned external wound, or in the womb after parturition, is usually fatal, the clots

forming on the inflamed lining membrane being washed on in greater or less amount, to set up inflammation in the lungs and elsewhere.

DILATED (VARICOSE) VEINS.

These are common over the distended hock joint in bog spavin and I have seen them in the posterior tibial and other veins but they are rarely or never injurious.

ENTRANCE OF AIR INTO VEINS.

If veins are opened in the lower part of the neck or elsewhere in the vicinity of the chest the suction-power may draw in air in such quantity as to work the blood in the heart into a frothy mass, and block the minute vessels in the lungs, causing sudden death. There is heard a gurgling sound as it enters the vein and afterward tumultuous heart's action and a fine squeaking sound in the lungs, while the animal falls in a faint. The danger is not so great as is usually supposed, as it takes several quarts suddenly introduced to kill a horse. Care is requisite, however, to close promptly all large veins opened in the vicinity of the chest.

DISEASES OF THE LYMPHATICS.

LYMPHANGITIS. INFLAMMATION OF THE LYMPHATICS.

This occurs in two forms, one a constitutional disease and the other a simple local affection due to irritation of a wound or the absorption of poisonous matter.

CONSTITUTIONAL FORM. WEED. SHOT OF GREASE.

This is seen mainly in heavy lymphatic fleshy-legged horses, kept at hard work on heavy feeding, and in the midst of this left in the stall for two or three days without any exercise or change of feed. Thus it is common on Monday morning or after one or two stormy days that have kept the horses indoors. It is the result of a sudden access of plethora, but it may occur in similar

circumstances in over-worked and rather reduced horses. In either case it is due to an accumulation in the blood of deleterious products that should have been worked off by exercise.

Symptoms. There is shivering to a variable extent, but very severe in the worst cases, greatly accelerated breathing, rapid hard pulse, general fever and stiffness in one or both limbs. Examination high up in the groin, by the side of the sheath or udder, detects enlargement and great tenderness of the inguinal glands, the patient usually raising and drawing out his limb till he seems ready to fall over on the other side. Soon the shivering gives place to the hot stage, the surface burns and sweats, and the limb swells, the swelling extending cord-like down the course of the vessels on its inner side, and its lower part becoming the seat of an excessive exudation, which may fill it up to the body, and of two, three, or four times its natural size. If allowed to go on, abscess, sloughing and unhealthy sores may result, the patient may perish, or the fever may subside leaving the limb permanently thickened to almost any extent, and correspondingly liable to future attacks.

Treatment. Mild cases may be entirely restored by giving the animal a fair amount of exercise. In those that are somewhat more severe, a smart purgative (aloes 6 to 8 drs.) must be given, warm fomentations applied continuously to the limb, and walking exercise enforced as soon as the patient can be made to move. The purgation should be followed up by active diuretics (nitre, iodide of potassium,) and when the inflammation has somewhat subsided tincture of iodine may be applied over the swollen glands. In the worst cases in vigorous plethoric subjects a prompt effect should be secured by a free bleeding from the jugular, until the pulse is softened, and the same treatment followed out as in other cases. Diet should be light and laxative (bran-mashes, roots, scalded hay, etc.,) and the water given with the chill off.

For the chronic thickening of the leg, regular feeding

and exercise, a bandage smoothly applied from the foot up when in the stable, the application of tincture of iodine every four days to the limb, and the internal use of tonics (iron, Peruvian bark, columba, gentian, nux vomica, etc.,) and diuretics (iodide of potassium, liquor of acetate of ammonia,) will be beneficial. Some use veratrum.

LOCAL FORM.

This results mainly from wounds, bruises (saddle or shoulder scalds), from injuries of unyielding parts (pricked foot, tendon or fascia,) and above all from the absorption of putrefying animal matter or other poison by these vessels. The same occurs from the specific poisons of glanders, farcy, etc. There are slightly swollen cords (red in white skins) extending along the course of the lymphatics and veins from the point of irritation or poisoning; nodular, painful enlargement of the lymphatic glands along their course, and more or less surrounding pasty swelling, or even erysipelas. It may go on to abscess or diffuse suppuration, it may leave induration of the glands, or even the vessels and surrounding parts, or a perfect recovery may be made.

Treatment. Rest, a purgative, and astringent lotions (acetate of lead 1 dr., opium ½ dr., carbolic acid 1 dr., water 1 qt.) If the inflammation runs very high it may be expedient to use warm poultices to hasten suppuration. In case it arises from a poisoned wound, cauterize the sore thoroughly with lunar caustic or crystallized carbolic acid, and keep the affected parts wrapped in cloths constantly wet with a saturated solution of bisulphite or hyposulphite of soda, and enough carbolic acid to give a sweetish taste. The bisulphite may also be taken internally. In case of suppuration, open early and freely with the lancet. If the affection becomes chronic and threatens permanent induration use iodine ointment or tincture, well applied bandages, giving an equable pressure, and even blisters. Iodide of potassium, or in weak subjects, iodide of iron may be given internally.

CHAPTER IX.

DISEASES OF THE DIGESTIVE ORGANS.

Their frequency and gravity in different animals. Stomatitis. Inflammation of the mouth,—of the palate,—of the gums,—of the tongue. Thrush, Aphthous Stomatitis. Mercurialism. Warts on the lips. Laceration of the tongue. Cysts under the tongue. Tumors of the mouth. Cancroid of the lips. Cancer of the tongue. Supernumerary teeth. Wolf-teeth. Parrot-mouth. Crib-biting, wind-sucking. Displaced teeth. Overgrown and uneven teeth. Carious teeth. Disease of the membranes of the teeth. Tartar on teeth. Dentition-fever. Salivation, slobbers. Salivary calculi. Salivary fistula. Inflammation of the parotid gland. Choking. Stricture and dilatation of the gullet. Impaction of the crop. Tympany in cattle. Hoove. Bloating. Overloaded paunch. Impaction of the third stomach. Gastritis in cattle. Indigestion in oxen. Indigestion in calves, lambs and foals. White scour. Acute gastric indigestion in the horse. Acute intestinal indigestion in the horse. Windy colic. Impaction of the large intestines in horses. Chronic indigestion—catarrh of the stomach and bowels in horses. Vomiting. Depraved appetite. Foreign bodies in the stomach and intestines. Spasmodic colic. Acute hæmorrhagic enteritis. Acute muco-enteritis. Croupous enteritis. Inflammation of the rectum. Diarrhœa, scouring. Dysentery. Obstruction of the bowels,—impaction, invagination, volvulus, etc. Hernia,—diaphragmatic, mesenteric, umbilical, inguinal, femoral, ventral, vaginal. Eversion of the rectum. Piles. Fistula in anus. Imperforate anus. Peritonitis. Ascites. Gastric and intestinal parasites.

DISEASES OF THE DIGESTIVE ORGANS.

The importance of these diseases in the domestic animals follows an ascending series from the carnivora, through the omnivora and solipeds to the ruminants. The small capacity of the digestive organs in carnivora (dog and cat), the completion of the greater part of the digestive process in the stomach, and the facility with which vomiting is accomplished sufficiently account for their comparative immunity. Pigs stand next in these re-

spects and last come the herbivora with their enormously long and capacious digestive organs, the slow digestion as the food passes through the bowels and the difficulty or impossibility of getting quit of irritating agents by vomiting. In the ox and sheep there is the further complication of the four stomachs, the first three of which are little more than macerating and triturating cavities, and in which an enormous bulk of food is continually stowed away. From their rapid collection and swallowing of food poisonous, irritating and unnatural objects appear more liable to be taken in by oxen, while horses suffer more from hurried feeding and from hard work immediately after feeding. Horses, too, suffer much from faults in watering, as excess of cold water when hot and fatigued, causing stomachic and intestinal congestions, an excess after feeding grain, washing that on undigested to ferment in the bowels, etc. Again, all of the herbivora are especially subject to digestive disorders from food that is unnaturally grown, or spoiled in harvesting, so that in unfavorable seasons affections of the stomach and bowels may spread like an epizootic.

INFLAMMATION OF THE MOUTH.

Causes. Mechanical and chemical irritants. There may be wounds, bruises, injuries with bit or twitch, irritant vegetables, scalding food, snake and leech bites, stings of insects, injuries from ropes tied round the lower jaw and tongue, from giving "weak lye" and other irritants, especially to the horse, which can resist swallowing liquids as long as he chooses, from pricks with thorns, needles and other sharp-pointed bodies, from cutting, decay, overgrowth or irregularity of the teeth,* from rough dragging upon the tongue, from the use of mercury and other salivating drugs, from parasitic growths, and from some specific fevers (aphthous fever, Rinderpest, etc.)

Symptoms of General Inflammatior of the Mouth. Difficulty in taking in food and water; swollen, rigid tender

lips and cheeks; red membrane of the mouth; slavering; saliva often fœtid; swelling between the bones of the lower jaw; the formation of blisters or sores inside the mouth; and sometimes swelling of the glands beneath the ears. Abscess or even gangrene may result.

Treatment. Remove the cause whether irritants in food, drugs, sharp bodies lodged in the tissues, injuries by the bit, twitch or otherwise. If injured by lye, wash with weak vinegar; if by acids, with calcined magnesia, lime water or bicarbonate of soda; if by caustic salts, white of egg, boiled linseed, slippery elm or the gluten of wheat flour. Give the same agents as a draught. If from the bite or sting of venomous animals apply ammonia to the part and give it internally. In all the severer animal poisons the wound should be cauterized (see *canine madness*). In simple inflammations open the bowels by injections of warm water with soap or other laxatives, or, if it can be done, give a mild laxative (olive oil). Wash the mouth frequently with cool astringent lotions (vinegar and water; vinegar and honey; borax, alum or tannic acid, honey and water; water slightly sweetened with carbolic acid, etc.) Have fresh cool water constantly present to drink at will, and feed with boiled gruels, or soft mashes cold, or pulped or thinly sliced roots. Poultices beneath the throat and lower jaw are often very useful. If erosions and ulcers appear touch them repeatedly with a feather dipped in a solution of 10 grains lunar caustic to 1 oz. distilled water. If fluctuation shows the presence of matter lance at once. If sloughing takes place wash with a solution of permanganate of potassa 1 dr., water 1 pint. If there is much swelling keep the head tied up.

CONGESTED PALATE. LAMPAS.

A red swollen state of the soft parts behind the upper front teeth, attendant in young animals on shedding of the teeth, or in older ones on digestive disorder. The taking

in of food may be painful and awkward from the tender palate projecting beyond the teeth.

Treatment. Feeding hard unshelled Indian corn has often a good effect. Scarify slightly with knife or lancet, for half an inch back from the teeth. Follow with astringent lotions if necessary. If with costiveness or disorder of the stomach give a dose of physic.

INFLAMMATION OF THE GUMS.

If connected with the shedding and cutting of teeth, remove those that hang partly detached and scarify the gums. For the other causes—diseased teeth and mercurial poisoning—see below.

INFLAMMATION OF THE TONGUE.

There are the signs of general inflammation of the mouth, with great difficulty in taking in food, chewing and drinking, and a swollen red tender state of the tongue which often hangs out of the mouth.

Treatment. Search carefully for any sharp irritant body that may have penetrated the organ and remove it. Support the tongue within the mouth in a bag with tapes tied behind the ears. Otherwise treat as for general inflammation of the mouth.

THRUSH OF THE MOUTH. APHTHOUS STOMATITIS. MUGUET

Is mostly seen in sucking animals. In addition to the signs of ordinary inflammation, there appear on the lips, cheeks and tongue, firm white patches, which on microscopic examination show the presence of a vegetable growth (oidium albicans). Wash the mouth frequently with a solution of bisulphite of soda or even of borax.

MERCURIALISM.

Inflammation of the mouth, ulceration of the gums, loosening of the teeth and free salivation were formerly common results of the abuse of mercurials but are now

fortunately rare. There is likely to be disorder of stomach and bowels, loss of appetite, bloating, rumbling in the belly, badly digested, fœtid stools and great languor and depression. Use washes containing tincture of iodine or chlorate of potassa, and iodide of potassium internally.

WARTS ON THE LIPS

Are very common in dogs. Remove with scissors and cauterize the roots thoroughly with a pointed stick of lunar caustic.

LACERATION OF THE TONGUE.

Causes. Especially common in horses from hard bits, nooses of ropes, or rough dragging with the hand. The lacerated tongue may hang from the mouth. Sew up the wound with catgut previously softened in water; feed thick gruels only, and wash out the mouth frequently with a lotion of permanganate of potassa. Any dead portion must be removed with the knife, but it must not encroach on the living. The whole organ may often be saved when almost entirely torn off.

CYSTS UNDER THE TONGUE.

These are tense elastic rounded swellings and are easily remedied by a free incision with the knife.

TUMORS IN THE MOUTH.

These mostly grow from the gums and tongue, and may attain the size of the closed fist in the horse. Small ones may be removed with scissors, the larger with the *ecraseur*.

CANCROID OF THE LIPS. CANCER OF THE TONGUE.

The former of these attacks the angle of the mouth in horses and cats as an eroded unhealthy sore with hard thickened margins; the latter appears in horses and cattle as an increasing hard swelling with unhealthy open sore and giant cells. It should be excised when very limited. Later it is incurable.

SUPERNUMERARY TEETH.

In the case of nippers or grinding teeth these should be extracted or pinched out as they are liable to injure the gums, palate, cheek or tongue.

Wolf-teeth cannot be looked on as superfluous, being natural and harmless. They are insignificant teeth situated directly in front of the upper, and less frequently of the lower grinders. Being present during the shedding and cutting of the teeth, when recurring inflammation of the eyes is most frequent, they are in very bad odor with people who cannot see the distinction between the mere coincidence and the cause and effect. They are useless, however, and may be extracted without injury, though if broken they may irritate the gums.

PARROT MOUTH.

Abnormal length of the upper jaw may lead to inordinate length of the upper front teeth which project over the lower like a parrot's bill. If this interferes with grazing the extra length should be removed with a saw or with *tooth-shears*. But parrot-mouthed horses usually do well fed in-doors.

CRIB-BITING.

This is a distortion rather than a disease of the teeth, these being worn away on their anterior edge so as to show more or less of the yellow dentine in place of the clear pearly enamel. It is associated with the serious vice of *wind-sucking* (swallowing), and eructation, which leads to tympany, digestive disorder, and rapid loss of condition. The horse seizes the manger or other solid object with his teeth, arches and shortens the neck and makes a grunting noise. The *wind-sucking* may, however, exist without *crib-biting*. It may be learned by standing idle near a *crib-biter*, and alway goes on to disease and loss of condition.

Treatment. Smear the front of the manger with aloes

or other bitters. Cover all exposed woodwork with sheet-iron. Place a small revolving roller above the front of the manger so that the teeth may at once slide off. Apply the muzzle shown in the adjoining cut. In pure *wind-*

Fig. 17.

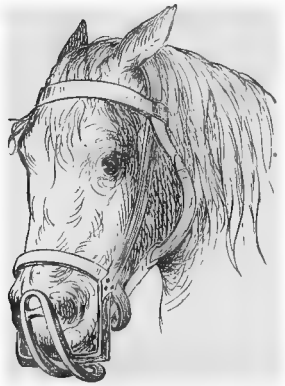

Fig. 17—Muzzle for crib-biter.

suckers a strap may be tied tightly round the upper part of the neck, though at the risk of inducing roaring.

DISPLACED TEETH.

Though loosened and partially displaced, teeth will often grow firm if at once replaced in their sockets and the animal fed for some time on soft mashes. If they cannot be returned to their natural situation they should be at once extracted, as any faulty direction will be a source of after trouble.

OVERGROWN AND UNEVEN TEETH.

The teeth of herbivora are liable to become overgrown into sharp hurtful processes along the outer margin of the upper grinders or the inner border of the lower, because the lower jaw is always narrower than the upper. In old animals and those having broken teeth, extensive over-

growth will ensue from the absence of wear. In other cases a tooth is displaced and failing to meet with a tooth in the other jaw gets overgrown, cuts the soft parts and sets up disease of these or of the jaw-bone. There ensue the usual symptoms of disease of the teeth, with swelling of cheek or tongue, tumefaction of the jaw or even a running sore, or a fœtid discharge from the nose. The overgrown teeth must be reduced with the tooth-rasp, cut with

Fig. 18.

Fig. 18—Tooth-rasp.

tooth-shears, or with a guarded tooth-chisel.

CARIOUS TEETH.

Caries is quite common in the grinding teeth but rare in the incisors.

Symptoms. Slow, careful mastication, and dropping from the mouth of half-chewed food (hay, green fodder,) which, impelled by hunger, the animal takes in but fails to swallow. Greedy swallowing of soft food, indigestions and colics from imperfectly chewed aliment irritating the stomach and bowels. The presence in the dung of undigested grain which has been swallowed whole. Unthrifty, staring coat, *hide-bound*, pale mucous membranes, weak pulse, weakness, emaciation, and liability to sweating, and swelling of the legs are marked features. The more specific symptoms are: swelling of the jaw-bone over the diseased fang or even a running sore if in the lower jaw, the accumulation of partially chewed food around the tooth, and especially between it and the cheek, tenderness of the tooth when touched or gently tapped with the finger, the presence of a black spot on some part of its surface, or of an excavated channel, leading from the wearing surface down to the fang, or between the

tooth and the jaw-bone, this cavity being filled with putrid elements and giving out a most offensive and persistent odor. In some cases the tooth is broken in pieces. In examining the mouth draw out the tongue and turn it up between the jaws, or better keep the jaws apart with a balling iron. If the diseased tooth belongs to the upper jaw and is behind the first grinder there may be a very fœtid discharge from the nose, which with its attendant nodular enlargement of the glands beneath the jaw have led to the destruction of many such horses as glandered.

Treatment. When there is much inflammation of the gums clear out the cavity of the tooth with the aid of a bent flattened wire and a syringe with bent nozzle, feed soft bran mashes only, and give a dose of laxative medicine (horse, aloes; ox or sheep, sulphate of magnesia; dog and pig, jalap;) lance the gums and protect from cold for a few days. When inflammation is less severe, scrape from the diseased cavity all black, softened or diseased tooth, and plug it with gutta-percha softened by heat, moulded into the cavity and hardened by a stream of cool water. If there is a tender spot from exposure of the nerve this should first be deadened by caustic (crystallized carbolic acid and powdered opium). Where the destruction is too great to allow of success by stuffing, the tooth must be extracted, and the cavity syringed out after each meal, until it heals up, and then filled with gutta-percha to prevent the adjacent teeth deviating from their proper direction. If very loose, the grinding teeth of large quadrupeds may be extracted with large tooth forceps, but if at all firm an opening must be made over the fang and the tooth driven into the mouth with a mallet and punch. This operation requires accurate anatomical knowledge, especially in young animals. In small animals the teeth may be removed by ordinary dentist's forceps. After the removal of a tooth in herbivora the opposing teeth on the other jaw must be occasionally cut or rasped down to prevent injury from overgrowth.

DISEASE OF THE MEMBRANES OF THE TEETH.

The membrane surrounding the fang or that lining the pulp cavity may become the seat of disease. There may be loosening, suppuration or shedding of the tooth, deviation from its true direction so that the outer edge of the upper grinder or the inner edge of the lower may get overgrown and injurious, or a hard deposit may fill up the pulp cavity, or surround the fang wedging it into its socket and setting up disease and swelling of the adjacent jawbone. These conditions may often be relieved in the early stages by soft feeding, protection from cold, lancing the gums, a dose of physic, and daily sponging of the gums with tincture of myrrh.

DENTINAL TUMORS.

These occur from the action of any irritant applied to the tooth ivory. Some years ago I removed a large mass of this kind attached to the second upper temporary grinder of the horse. It is usually necessary to remove the teeth from which they grow.

TARTAR ON TEETH.

This is common in dogs and may be removed by a wooden probe with a small pledget of tow dipped in water rendered slightly acid with spirit of salt.

DENTITION FEVER.

Considerable irritation and fever often attend on the cutting of the teeth in animals. Horses are most liable to suffer in the third year when they cut four front teeth and eight back ones, and in the fourth year when they cut four front, eight back, and four tushes. Cattle suffer less and mainly from the second to the third year. One of the first grinders which come up at this period is sometimes entangled with the crown of its predecessor, causing much loss of appetite and condition and fœtid breath. Pigs usually cut thirty-six teeth from the sixth to the

twelfth month and are most liable to suffer at this age. Puppies and kittens suffer even to convulsions, between the third and the sixth months. The temporary tushes should always be extracted if not shed before the permanent ones come up.

The redness, swelling and tenderness of the gums in such cases may extend to the throat, causing fits of coughing, and retained temporary teeth are to be sought for and removed. Otherwise treatment consists in a slight lancing of the gums, washing with tincture of myrrh, using soft food, keeping the bowels open, and avoiding hard work in horses and dogs.

SALIVATION. SLOBBERS.

This is often a symptom of some other affection (aphthous fever, dumb rabies, epilepsy, stomatitis, pharyngitis, dentition, caries and other diseases of the teeth, wounds and ulcers of the mouth, gastric catarrh, etc.,) or caused by irritant food and drugs (rank aqueous rapidly-grown grass, musty mow-burnt fodder, lobelia, wild mustard, colchium, pepper, garlic, ginger, irritants, caustic alkalies, acids and salts, and the compounds of mercury used internally and externally). Mercurials are especially hurtful to cattle. Paralysis of the lips will cause a free flow of saliva, as will also irritation with the bit, and especially from chemical agents attached in bags to the bit.

Symptoms. Free discharge of saliva in stringy filaments or frothy masses, frequent deglutition, increased thirst and disordered digestion. For mercurial salivation see *stomatitis.*

Treatment. Discover and remove the cause, use astringent washes as advised for stomatitis, and give access to cold water. In obstinate cases give a course of tartar emetic, opium, chlorate of potassa, or iodide of potassium. Rub the glands beneath the ears and between the jaws with iodine ointment

SALIVARY CALCULI.

These are small concretions of earthy and organic matter usually around some foreign body (a grain of oats or barley, or a particle of sand) which has accidentally entered the canal. They obstruct the ducts and give rise to the feeling as of a tense elastic cord extending round the border of the lower jaw and upwards on the side of the cheek, or forward along the inner side of the jaw-bone. The pea-like concretion may be felt at the anterior end of the cord, and if there is more than one they may be made to rattle on each other. Sometimes matter forms and bursts and the concretion may be felt in the depth of the wound. Difficulty in chewing and swallowing, and indigestions arise from the lack of saliva.

Treatment. Pass the calculus onward to the mouth by manipulation with the fingers, or this failing lay open the duct and extract it from within the mouth if possible. If it must be opened through the skin, first shave the part, make a small incision with a sharp knife, extract the mass and cover the wound with layer after layer of collodion, allowing as little exposure to the air as possible. Allow no food whatever for twelve hours and then only soft mashes and gruels until healing is completed.

SALIVARY FISTULA.

This is found wherever a wound penetrates a duct of any of the salivary glands. It is especially liable to occur from opening abscesses in strangles and from wounds about the lower jaw.

Symptoms. A free discharge from the wound during feeding, of a clear, slightly glairy liquid, especially abundant where the food is dry and fibrous. Chewing is slow, difficult, and carried on on the opposite side of the mouth only. Digestion and general health are gradually impaired.

Treatment. If recent, shave the edges of the wound, bring accurately together and cover with collodion, layer

after layer, until strong enough to prevent it from bursting open. If of older standing, a smart blister over and around the wound will often close it. Should this fail, the edges must be made raw by paring and the wound firmly closed by carbolated catgut or twisted suture. If the channel between the wound and the mouth has become impervious, a new one must be made and kept open by a thread passed through it and retained by being fixed to a flat button outside and in, until the walls are no longer raw and likely to adhere. Then the thread is to be withdrawn and the external wound closed by stitching, blister or collodion.

In all such cases the patient must be tied to both sides of the stall, high up, so that he cannot possibly rub the wound, and diet must be restricted absolutely to soft mashes and gruels.

In obstinate cases a forcible injection into the duct of the gland of a solution of 2 grs. lunar caustic in 1 oz. of alcohol, will usually destroy its secreting power.

INFLAMMATION OF THE PAROTID GLAND.

This gland, situated behind the ear, is liable to inflammation from mechanical injury and obstruction of its duct, as well as in strangles and other specific diseases.

Symptoms. A hard but painful tumefaction beneath the ear, with more or less soft doughy feeling at its margins, stiff carriage of the head, slow difficult chewing, and more or less general fever.

Treatment. First remove any obstruction in the duct or mechanical cause of irritation, then purge (Glauber salts), wash the mouth with weak solutions of vinegar or chlorate of potassa, and cover the affected gland with a soft poultice, with a little sugar of lead added. Feed soft cool mashes and sliced or pulped roots only, and when the bowels have settled give cooling diuretics (nitrate of potassa). If matter forms let it approach the surface and point before opening, to avoid cutting any of the ducts

and establishing a fistula. If it gets hard and insensible use iodine externally and internally.

CHOKING.

This is especially common in cattle feeding on roots, potatoes, apples, pears and the like, because of the habit of jerking up the head to get the object back between the grinders. Pieces of leather, bone, etc., chewed wantonly often slip back in the same way. Horses suffer mainly from badly shaped balls or sharp-pointed bodies, dogs from bones. Ravenous feeders will choke on dry chaff, cut hay, etc., being imperfectly mixed with saliva, and the same will happen in cases of diseased teeth or salivary fistula or calculus.

Symptoms of pharyngeal and cervical choking. When the object is arrested in the throat or neck there is great distress, staring eyes, slavering, violent coughing with expulsion of dung or urine, continuous efforts at swallowing, and in cattle tympany of the first stomach, which may suffocate the animal in fifteen or twenty minutes. I have seen an animal die in five minutes when the object was lodged directly over the opening of the windpipe. In horses there is in addition an occasional shriek, and water returns by the nose when drinking is attempted. In omnivora and carnivora retching and vomiting are prominent symptoms. A careful examination along the furrow on the left side of the neck will usually detect the offending object.

Symptoms of thoracic choking. If the object is lodged in that part of the gullet which lies within the chest, cough, slavering and gulping may be absent, but there are efforts at regurgitation and the discharge of liquids by the mouth (in horses the nose). This, with the inability to swallow solid food, is very characteristic. Tympany is usually slight, and there may be tremors at intervals.

Symptoms of choking with finely divided dry food. These are the same as for solid masses, according to the situa-

tion, but in addition there is in the groove on the left side of the neck, a diffuse soft yielding swelling, provided the obstruction is situated above the chest.

Treatment. Sharp-pointed bodies lodged in the throat must be carefully sought for and extracted. Solid objects in this region can usually be withdrawn with the hand. Have the animal held with the head elevated into a line with the neck and the mouth held open with a balling iron; then the tongue being drawn out with the left hand, the right is passed through the mouth into the throat and the middle finger hooked over the offending body so as to withdraw it. If lodged still lower it may often be worked up into the throat by pressure beneath it with one hand in each furrow along the lower border of the neck. A vigorous jerk at the last seconded by the action of the pharynx will often lodge it in the mouth, but if not it is easily extracted as above advised.

Should this fail and tympany prove threatening lose no time in gagging the animal. A smooth roller of wood two inches in diameter is tied into the mouth by cords carried from its ends around the top of the head—behind the horns in cattle. Swelling never increases dangerously with this applied, and in a few hours the obstruction usually passes on.

More prompt relief may be obtained by using a probang of leather or other material with a spiral spring wire internally, the whole two-thirds of an inch in diameter, six feet long, and with one end enlarged to one and a half inches in diameter and cup-shaped. This is oiled and the head having been brought into a line with the neck, the balling iron introduced and the tongue drawn out, the cup-shaped end is introduced and pushed on until the obstruction is reached. Steady pressure must be kept up on this for a few seconds, when it will yield and should be passed into the stomach by introducing the probang to its whole length. If it resists leave the animal for an hour or two gagged, and try again. In the horse the probang

cannot be safely passed without casting, and it should never be passed on until by examination in the furrow on the side of the neck, the operator has ascertained that it has entered the gullet and is clear of, and above the windpipe. For the small animals the probang must be made correspondingly small.

The use of whips and such like objects is very reprehensible as being liable to tear the gullet. An effective probang may be constructed out of a piece of stiff new rope, a few of the bundles of the end of which have been opened out and tied back so as to form a cup-shaped extremity. After being used this may be hung up straight on several nails driven into the wall and will be ready for the next occasion.

In choking with finely divided food the probang only packs it firmer, and gagging and time will rarely dislodge it. Pour water or well-boiled gruel down, and seek by manipulation to break up the mass and allow it to pass on little by little. Instruments have also been devised for extracting the obstructing mass. Failing otherwise, the gullet must be laid open, the offending matter extracted, the wounds sewed up, and the animal fed for a time on liquids only.

Horses are sometimes choked by eggs given by foolish grooms. These may be punctured with a needle and then crushed between two solid bodies on different sides of the neck.

Prevention. Besides the more obvious resort of withholding dangerous articles, the mere tying down of the head will prevent choking in cattle feeding on turnips, apples, etc. A loop of rope fixed to the ground is to be hung over the horn when such food is supplied. Solid food should be to a large extent withheld for a week after the relief of choking, until the slight irritation or inflammation has subsided.

STRICTURE AND DILATATION OF THE GULLET.

These usually coexist, the first giving rise to the second, because of habitual accumulation of food above the narrow part. The narrowing results from mechanical injury in choking, etc., or from the presence of a worm (spiroptera) which lives in galleries on the mucous membrane.

The *symptoms* are the formation of an extended diffuse soft swelling along the furrow on the left side of the neck, when the animal feeds or drinks, and the subsidence of this swelling during abstinence. The only permanent treatment is by bougies or probangs passed daily, beginning with those that will just pass the stricture, and using them larger as the former ones begin to pass easily. The food must be restricted to soft mashes and gruels.

Cattle are usually slaughtered when attacked in good condition.

IMPACTION OF THE CROP IN BIRDS.

Symptoms. Want of appetite, dullness, sinking of the head between the wings, ruffled plumage, and enormous and firm distension of the crop, easily recognized when the bird is handled.

Treatment consists in pouring down tepid water and moulding the crop so as to force its contents a little at a time back into the mouth. This failing, cut the crop open, empty it, sew up the wound, and feed gruels or soft mush for a few days.

TYMPANY OF THE FIRST STOMACH IN RUMINANTS. HOOVE. BLOATING.

Causes. It is especially common in weak, ailing, or underfed stock when put on rich luxuriant food, especially green food, in spring. Some food is dangerous, such as clover (white and red); green food covered with dew or hoar frost, soaked by inundations or drying after a shower; diseased or frosted potatoes or turnips (roots or tops); partially ripened but uncured grain and crowfoots and other acrid

plants. It may be caused by overloading the stomach with sound fodder, by the presence of hair-balls and other foreign bodies in the stomach, by fever, choking, stricture or parasites in the gullet, tuberculosis, etc.

Fig. 19.

Fig. 19.—Trocar and cannula.

Symptoms. Swelling of the whole left side of the belly, often rising above the level of the hips and backbone, tense and elastic recoiling at once when pressed in, and drum-like on percussion. There is great difficulty of breathing, distended nostrils, bloodshot eyes, open mouth, driveling of saliva, occasional belching of gas with loud noise, and frequent passage of dung and urine. The patient stands to the last and falls to die with ruptured diaphragm, or stomach, congested lungs and profound nervous shock.

Treatment. Gagging is alleged to succeed as in choking, but I have not tried it. Dashing a bucket of cold water on the body may give temporary relief by condensing the gas and favoring eructation. The hollow probang passed into the stomach as for choking will allow the escape of the gas. In urgent cases the paunch must be punctured with the first instrument that comes to hand, and the openings in the stomach and the skin kept in apposition until the gas flows out. The most suitable instrument is a cannula and trocar at least six inches long which may be plunged without fear into the left side in a downward and inward direction, from a point equidistant from the hip bone, the last rib and the lateral processes of the backbone. The trocar being withdrawn the cannula may be tied in and left for hours or days. In the absence

of these a pocket-knife may be used, and should be kept in the wound until a large quill can be obtained and held in its place. A smaller trocar like that used for hydrothorax in horses is suitable for sheep and goats.

When urgent cases have been relieved in this way, and in milder cases without any such surgical resort, antiferments and antacids must be given; aromatic spirit of ammonia, (ox 3 oz., sheep 1 oz.,) crystalline sesquicarbonate of ammonia (ox 1 oz., sheep 3 drs.,) oil of turpentine, (ox 2 oz., sheep ½ oz. in oil, milk or eggs well mixed,) whisky, brandy or gin, (ox 1 to 2 pts., sheep ¼ pt.,) ether, pepper, ginger, oil of peppermint, etc., in full doses, wood tar (ox 2 oz., sheep ½ oz.,) carbolic acid or creosote, (ox 2 drs., sheep ½ dr. in a pint of water,) sulphite, hyposulphite or bisulphite of soda, (ox 1 oz., sheep 2 drs.,) chloride of lime or chlorate of potassa. Antacids (potassa, soda, ammonia, and their carbonates; soapsuds and lime-water,) check the fermentation by neutralizing the acidity. Care should be taken to see (by tasting) that they are not used in too strong and irritating solutions.

A dose of physic is usually necessary to clear off the offensive food, and should be accompanied by a stimulant (sulphate of soda and ginger).

Chronic tympany due simply to indigestion may be remedied by careful dieting and a course of tonics, (fœnugrec, oxide of iron, carbonate of soda and common salt in equal parts, nux vomica 2 drachms to every pound of the mixture. Dose: ox 1 oz., sheep 2 drs., daily in food).

For *chronic tympany* due to foreign bodies in the paunch see below.

OVERLOADED PAUNCH.

This differs from the last in that the paunch is overloaded, overstretched and paralyzed by excess of solid food, rather than gas. Rich, tempting and unusual food (luscious grass, clover, lucern, vetches, tares, beans, peas, grain,) is especially dangerous, as is food which ferments

with the formation of a fine frothy mass, (potatoes, especially diseased or frosted ones,) food containing a narcotic or paralyzing principle, (green Indian corn, partially ripened wheat, barley, oats, beans, peas, tares and grasses,) bulky, dry, fibrous, innutritious aliments, (aftermath mixed with old withered stems of a former growth, hay that has ripened before being cut, dried sedges and rushes, stalks of ripened beans, peas, etc.,) and finally musty, rusty or otherwise injured hay. Salivary fistula or obstruction and worn or diseased teeth may contribute to it.

Symptoms. Develop more slowly than in tympany. There is dullness, sluggishness, raised back, hurried breathing, and frequent moaning. The abdomen swells, especially the left side, but it hangs downward, has no absolute drum-like resonance on tapping, and pressure leaves a temporary indentation. As the disease advances there is the same difficult breathing as in tympany, frequent passage of dung and urine, stupor and finally suffocation or death from nervous shock. If due to green food, diarrhœa usually precedes death, and a spontaneous cure may be effected by this or by vomiting, but only in rare cases.

Treatment. In the first stages give stimulants and antiferments, as for tympany, with active but not irritating purgatives to unload the stomach. A pound each of Epsom and Glauber salts, 2 oz. oil of turpentine, and ½ drachm of nux vomica will be a suitable dose for an ox, to be followed up by stimulants, and in seven hours, if no relief, by a second dose of the same strength. If drum-like resonance at the upper part of the left side shows the pressure of free gas, draw it off by puncturing, and dash cold water over the body to encourage contraction of the paunch. Give active stimulants every two or three hours.

If there is no sign of improvement but rather stupor and sinking, the only hope is in opening the stomach in the left side where it is punctured in *tympany*, enlarging the opening until the hand can be introduced, having two assistants hold the edges of the wound in the stomach

against those in the skin, taking out at least two-thirds of the contents of the paunch, sewing up the wound in the stomach with the edges turned in, and that in the skin, and keeping on a little gruel and soft mashes for a week. This operation can be performed standing, the right side of the animal applied against a stone wall, and the nose held by bull-dog pincers or even by the fingers. It usually succeeds if resorted to early enough.

IMPACTION OF THE THIRD STOMACH. DRY MURRAIN. GRASS STAGGERS.

A dry baked state of the contents of the manifolds is found in all feverish conditions, in torpid or inactive states of the paunch, with impaired or suspended rumination, in case of feeding on dry, fibrous, indigestible elements (bleached withered hay or that which has been over-ripened, or a mixture of fresh and dry grass in autumn,) on a sudden change to the over-stimulating fresh grass of spring, on smutty maize, cornstalks or wheat, on a deficiency of water, or a sudden change from soft to hard water, or on taking lead into the system in a metallic condition or otherwise. The most rapidly fatal cases result from green food, over-ripe but uncured grain, vetches, or rye-grass, and from lead poisoning. Breeding ewes when fed grain become impacted, stupid, delirious.

Symptoms. Slight cases may be marked by failure to chew the cud regularly when recovering from a fever, a poor appetite, dry muzzle, dull eyes, spiritlessness, quickened breathing with a moan at intervals roused at any time by forcibly punching the closed fist beneath the short ribs on the right side. If it has lasted several days the fist pressed into the left side may detect the contents of the paunch collected in hard masses, and tympany is likely to be present. The dung is usually scanty and hard, but in cases occurring from fibrous or irritating food, this costiveness is preceded by more or less diarrhœa. The beast leaves its fellows, reclines on its left side, with the head in the right flank, and tends by-and-by to show palsy of the hind limbs drowsiness and stupor, or delirium and convulsions.

In the more acute cases, death may ensue in six hours. The animal is found apart, lying with his head in his right flank, with red fixed eyes, eyelids half closed, and much drowsiness and stupor though he may still feed when raised, pulse and breathing accelerated, bowels loose or torpid, hardness and tenderness under the right short ribs, and muscular tremors. Later the eyes glare, the patient seeks relief in motion, in a straight line or to one side regardless of obstacles, and pushing against obstructing walls or fences till teeth or horns are broken, bellowing loudly and in a terrific manner all the time.

Treatment. For the simpler forms give strong purgatives, (sulphate of soda, ox 1 lb., sheep 6 oz. with common salt, molasses and croton,) stimulants (ginger, carbonate of ammonia,) and abundance of water or watery fluids. The stimulants may be repeated at intervals of three hours, and accompanied by injections of warm water. If no relief is obtained in twelve hours, repeat the purgative and if any tenderness of the right side exists, blister it with mustard and turpentine (for sheep use ammonia and oil). If the kidneys act profusely, change the purgative, giving castor or linseed-oil. Even after free action of the bowels it is usually necessary to feed green food, roots or soft mashes, to give all the water that will be taken, and even to add slight laxatives to insure the perfect breaking up of all the impaction.

In the acute forms of the disease with irritation of the stomach the blandest purgatives only (linseed, olive, or castor-oil,) must be used with nux vomica, injections and a blister on the right side over the short ribs, and cold water or ice-bags to the head. Should the victims become delirious, fasten to a strong post round which they can move, or to a ring fixed in the ground. When recovery ensues, follow up with a course of bitter tonics, (gentian, willow bark nux vomica, boneset, etc.)

GASTRITIS IN OXEN.

The acute impactions of the manifolds are usually complicated with congestion, and the chronic impactions lead to it. Inflammation also results from over-stimulating food, (spring grass, clover, tares, green corn, etc.,) from dry heating aliment, (excess of corn meal, linseed cake, rape cake, cotton cake,) from wild mustard and other irritants, from poor, hard, fibrous food, from suspension of rumination during prolonged hard work, and from mineral and vegetable irritants.

Symptoms. In mild cases, from heating or poor food, there are dullness, moaning, trembling, straining and frequent passage of dung in small quantities, hot, clammy, slightly reddened mouth, dry muzzle, sharp accelerated pulse, fullness and tenderness of the belly, and the presence of solid masses of food in the paunch as felt on the left side when pressed with the fist.

The more active forms, resulting from green food or irritants, are manifested by the same symptoms as acute impaction of the third stomach, with the addition of a tense abdomen, not dependent on the paunch, increasing tenderness, and increased temperature of the body. There may be diarrhœa or costiveness or one after the other, and it may end in stupor or convulsions.

Treatment. In the milder forms give a quart of linseed or olive-oil and 2 drs. Dover's powder. Even Epsom or Glauber salts may be used with drachm doses of hyoscyamus or belladonna as often as may be requisite to keep down violent suffering. Give all the water the patient will drink, adding a little decoction of linseed, slippery elm or mallow; also frequent injections of warm water, and warm fomentations to the abdomen followed by a blister. Brain symptoms must be treated as advised under impaction of the third stomach. Follow up with a course of tonics after relief is obtained.

INDIGESTION IN WORKING OXEN FROM DRINKING COLD WATER.

This occurs in hard-working oxen, coming from a dusty road in a hot day and drinking to excess. There are violent colicky pains, uneasy shifting of the hind limbs, lying down and rising, looking at the flanks, and a fullness and gurgling on the right side of the abdomen. It may pass in half an hour to an hour with a free watery diarrhœa. *Treatment* consists in exercise, walking or trotting, and a stimulating draught—pepper, ginger, fennel, caraway, peppermint, ammonia, alcohol and the like.

INDIGESTION IN CALVES, LAMBS AND FOALS. WHITE SCOUR.

This may result from a great variety of causes, such as withholding the first (laxative) milk after parturition, feeding new-born calves on the milk of old calved cows, bringing up foals or lambs on cow's milk, working, overdriving or otherwise exciting the dams, feeding unwholesome food to the dams, allowing too long intervals between the meals of the young, bringing up on hand on cold or soured milk or farinaceous food, keeping in damp unwholesome pens, or the accumulation of pellets of hair in the stomach.

Symptoms. Irregular (impaired or even ravenous) appetite, swollen, tender, drum-like abdomen, sour eructations, profuse fœtid white watery diarrhœa, white or grayish fur on the tongue, dry, scurfy, unthrifty skin, and rapid emaciation.

Treatment. Give a dose of 1 to 2 ozs. castor-oil ($\frac{1}{3}$ for lambs) with a teaspoonful of laudanum. Then with each meal give a tablespoonful from a bottle of sherry in which $\frac{1}{8}$ of the fresh fourth stomach of a calf has been steeped. Or with this give a carminative (1 oz. tincture of cinnamon) with an antacid (prepared chalk or magnesia 1 dr.) and soothing or anodyne agents (gum Arabic, bismuth,) with, it may be, an astringent (tincture of kino or catechu 1 dr.) If there is much tenderness of the abdomen apply a pulp of mustard and water. If yellowness of the

mucous membranes and white, very fœtid dung, give 2 grs. calomel and 5 grs. chalk twice daily. In all cases give fresh, warm, wholesome milk thrice a day, with several spoonfuls of lime-water added to each meal. In some instances the tone of the stomach may be greatly restored by a tablespoonful of tincture of gentian twice a day.

Prevention should be sought in breeding only vigorous families, sheltering properly, and feeding the milk of the dam or of a healthy nurse unaltered by faulty feeding or excitement, or by standing. When a foal must be brought up on cow's milk, dilute with one-third its bulk of warm water, sweeten with sugar and add lime-water. For the carnivora use only the upper third of cow's milk.

ACUTE GASTRIC INDIGESTION IN THE HORSE. TYMPANY.

This results from sudden filling of the stomach to excess, from suspended digestion in connection with hard work immediately after a meal, from the washing on of undigested food, from a full drink after a feed of grain, from certain indigestible and easily fermented aliments, such as cause tympany in the ox, from irritant plants, and from hurried swallowing of hot cooked food.

Symptoms. These appear just after feeding and are at first those of simple colic, (see Spasmodic Colic) soon followed by fullness and tension of the belly, a drum-like sound when it is percussed, quickened, deep, oppressed breathing, dullness and increasing stupor. The pain is continuous though of varying intensity, there is no disposition to eat or drink, draughts administered tend to aggravate the symptoms, the sufferer yawns, places his fore feet apart, arches the neck drawing in the nose toward the breast, and in exceptional cases, may obtain relief by belching gas, or even by vomiting, the food escaping mainly through the nose. More commonly the occurrence of vomiting implies rupture of the stomach and presages death. The pulse then becomes rapid, weak and soon

imperceptible, and the countenance very haggard and dejected. In the advanced stages the animal is usually sunk in stupor, and rests his head on the manger or pushes it against the wall, while in some instances nervous movements of the lips and limbs occur.

Treatment. Give early, full doses of aromatics, stimulants and tonics, (tincture of pimento or ginger, oil of peppermint, aqua ammonia, ether, alcohol, chloral, peppers, nux vomica, etc.,) rub the belly, and if relieved, follow up with a dose of physic. Alkalies are sometimes useful, as in the ox. Warm water injections and walking exercise should also be given. The stomach of the horse cannot be safely punctured, hence the affection is too often fatal. When relieved give easily digested food frequently in small quantity, until the stomach has regained its tone. When horses bolt their food give a little hay to appease hunger before allowing grain.

ACUTE INTESTINAL INDIGESTION IN THE HORSE. TYMPANITIC COLIC.

Due to the same causes as *gastric tympany*, this often complicates that, and is complicated by it, the disease being named according to the predominance of the gaseous evolution in stomach or bowels. When the bowels are mainly implicated, there is greater hope, as medicines may be passed through the stomach and taken up from the gut so as to affect the system, and the gas may even be drawn off with a small cannula and trocar from the large intestines which occupy the lower part of the abdomen. The puncture should be made where the resonance is clearest and most drum-like. The symptoms closely resemble those of tympanitic stomach, only there is more passage of dung and flatus, and the treatment only differs in the greater freedom with which liquids may be poured into the stomach and the possibility of drawing off the gas through a cannula.

IMPACTION OF THE LARGE INTESTINES IN HORSES.

This results from overfeeding, especially on grain, (Indian corn, wheat,) from hard, fibrous, indigestible food taken in excess to make up for the deficiency of quality; from imperfect preparation of the food in diseases of the teeth, jaws or salivary glands; from insufficiency of water, and eminently from want of exercise.

Symptoms. Considerable impaction may last for a time without any sign, and the disease finally shows itself suddenly as a violent colic. More commonly transient colics come on after meals for several days in succession. There are pawing with the fore feet, uneasy movements, or kicking of the belly with the hind, lying down and rising at short intervals, turning of the nose toward the flank, and the frequent passage of wind and of dung, the latter a few small pellets at a time. There is special fullness and tension of the right side of the belly, dullness on percussion, solid resistance when pressed, and if the soaped hand is introduced through the last gut the solidly impacted bowels are usually to be felt. The pressure of these on the bladder often causes frequent discharges of urine. A favorite position is one with the fore limbs stretched forward and the hind backward.

Treatment. In mild cases and in the early stages give a laxative diet (roots, soft bran mashes, oil meal, cornstalks,) and two or three ounces of Glauber salts daily in the food. In the more severe, give aloes, physostigma, gentian and nux vomica, and in case of tympany, carbonate of ammonia or peppermint; relieve pain by hyoscyamus or belladonna, and follow up with frequent injections of warm water, and frictions and fomentations of the abdomen. The aloes should not be repeated under twenty-four hours, but if there is evidence of their having passed off by the kidneys they may be replaced by linseed or olive-oil. The action of the bowels may be deferred three or four days without a fatal result whereas too much medicine will often cause rupture of the gut in front of the impaction.

Prevention should be sought by a more laxative diet, by a liberal supply of water, by exercise, or even by daily doses of 1 or 2 oz. of sulphate of soda in the food. The addition of 2 drachms of powdered gentian and 10 grs. of nux vomica will often restore lost tone to the bowels.

CATARRH OF THE STOMACH AND BOWELS IN HORSES.

This is a form of chronic indigestion resulting from faults in diet, as regards quality, quantity and regularity· from a habit of bolting food; from starvation and hard work; from a sudden access of rich food; from the irritation of worms; from congested or torpid liver; from impaction of the bowels or from any irritant in the food.

Symptoms. Unthrifty appearance, rough coat, hidebound, irregular or capricious appetite, dullness at work, emaciation, tucked up belly, clammy, furred tongue, irregularity of the bowels, diarrhœa alternating with constipation, hard balls of imperfectly digested dung covered with a film of mucus, fœtid sour odor of stools, and an inclination to lick the white walls or fresh earth.

Treatment. A carefully regulated and easily digested diet, (green food, sound hay, ground oats, roots,) moderate regular exercise, a clean, warm, comfortable stable, rock salt to lick at will, and a course of tonics, (gentian with nux vomica, white bismuth, and sulphate of soda,) morning and evening. Change from one tonic to another as they seem to lose their effect. Slippery elm, boiled linseed, mallow, etc., are often useful in checking irritation.

VOMITING.

This is common in carnivora and pigs but exceedingly rare in cattle, and still more so in horses, asses and mules. It may be due to a great variety of causes, as direct irritation of the stomach by food, poison, congestion or inflammation, disease of the brain, or of some other organ, which profoundly affects the system, or which like the throat or gullet has intimate nervous relations with the

stomach. It is therefore mostly a symptom of other diseases, and in many cases of gastric irritation is a means of relief. When due to direct irritation of the stomach favor it by giving tepid water freely. When emptied, the stomach may be soothed by ice, iced water, prussic acid, creosote, carbolic acid, bismuth, nux vomica, lemon-juice, camphor, etc. Gum and albumen may often be given to sheath the irritated organ, and a blister may be placed on the pit of the stomach.

DEPRAVED APPETITE.

Seen in dyspeptic horses, eating earth, lime, etc., in rabid dogs swallowing all sorts of things, and in cows eating chalk, earth, sand, gravel, wood, leather, iron bolts, and articles of clothing, hair, bones, lead, etc. In many cases what is begun as a habit is continued as a disease, the foreign bodies in the stomach deranging the digestion and keeping up a morbid craving. Pregnancy, tuberculosis, and a deficiency of phosphates in the soil and food are occasional causes in cows. The habit should be checked by keeping tempting objects out of reach, dealing with tuberculosis and chronic gastric catarrh as advised under those heads, with a deficiency of phosphates, by an abundant artificial feeding on sound grains and a course of tonics, and with indigestible bodies in the stomach, by a careful feeding to prepare the beast for slaughter, or that failing by opening the paunch on the left side and removing the offending agent (see *impacted paunch*).

FOREIGN BODIES IN STOMACH AND INTESTINES.

These may be taken in by accident with the food or may be deposited from it in the form of calculi or concretions.

Cattle suffer much from sharp-pointed bodies like needles, pins, nails, etc., taken with the food, and afterward making their way to the heart which they penetrate, causing sudden death, or in more favorable cases making their way

through the walls of the abdomen and escaping. Blunt objects remain in the paunch and honeycomb-bag, causing much or little irritation according to size or number. The most varied objects are often found in cattle slaughtered for beef and in good health, nails, coin, shot, solder, buttons, and hair-balls, are among the most common. I have known fifteen hair-balls from three to six inches in diameter in the paunch of a healthy fat heifer. In sucking calves, in which they form in the true stomach, they cause dyspepsia, diarrhœa, and emaciation.

Sheep suffer from wool-balls, from the fine hairs of clover and other aliments, and from collections of sand and gravel when fed turnips from damp soil.

Swine have balls of bristles in the stomach and large intestines.

Horses have concretions of phosphate of lime, with smooth stony surface; of ammonia-magnesian phosphate with rough crystalline structure; of the fine hairs from the surface of the oat with a fine velvety surface; and of two or more of those mixed in one calculus. These are formed equally in the stomach and large intestines.

Dogs have hair-balls mainly in the large intestines, as well as marbles and other objects picked up in play.

These foreign bodies may exist without any manifest result, or they may cause tympany in cattle and sheep after every meal, vomiting in dogs and pigs, acute indigestion in the horse, and in all animals in which they are lodged in the intestines, obstruction of their passage, and violent colics which recur frequently, and usually cut the animal off sooner or later.

In *ruminants* the offending bodies may be removed from the stomach by a surgical operation, but in others little can be done beyond giving anodynes (opium, belladonna, stramonium, etc.,) to relieve pain and spasm and await the result. A dose of physic would carry off the smaller calculi but would be dangerous in the large. But these cases can rarely be recognized until after death, and are

necessarily classed with a number of others, (invagination, constriction, etc., of the bowels,) in which there is irremediable obstruction, and which end sooner or later in death.

SPASMODIC COLIC. BELLY-ACHE.

This term is loosely used to designate all conditions in which there is pain in the belly, whether from disease of liver, pancreas, urinary organs, generative apparatus, stomach or bowels, and whether caused by nervous irritation, inflammation, improper position, strangulation or compression by adjacent organs, obstruction by foreign bodies, etc., etc. The present remarks will be confined to that which is more purely nervous and which results from spasmodic contraction (cramps) of the bowels.

In certain susceptible states of the system a slight indigestion, without impaction or tympany, the taking of indigestible matters that would have been harmless at another time, a drink of ice-cold water when perspiring and exhausted, a chill rain or dew will cause spasms and the most excruciating agony.

Symptoms. The attack is sudden, the horse paws, moves uneasily, kicks at the belly, looks at the flanks with anxious countenance, dilated nostrils and glaring eye, crouches with semi-bent limbs for a few seconds and then throws himself down with a prolonged groan. He rolls, lies on his back, sits on his haunches and may get up, shake himself, take to feeding and appear quite well. Another fit comes on in ten, fifteen, twenty or thirty minutes, and after each there is a period of freedom from pain, with natural pulse and breathing. This with the reckless manner in which he lies down, and the entire absence of tenderness of the abdomen, or of elevated temperature, serve to distinguish from other bowel diseases, especially inflammation. Each succeeding attack may be less severe until they cease, or they may increase in severity and the disease merge into acute tympanitic indigestion or enteritis.

In *cattle* there are similar symptoms with uneasy shift-

ing of the hind limbs, kicking with the upper one when down, twisting of the tail and moaning. It rarely lasts over an hour or two.

Dogs curl themselves up to rest, but move uneasily or moan, and with the more violent pains start up with a sudden yelp, move around for some time and lie down until the next spasm comes on. The eye is bright, the nose cool and moist, the pulse natural, and the appetite retained.

Treatment. In all animals alike, a laxative (aloes, horse; linseed-oil, cattle and sheep; castor-oil, pigs and dogs,) is the safest treatment as it soon relieves the spasm and carries off any irritant that may have contributed to maintain it. It is usually desirable to add an anodyne (belladonna, hyoscyamus, opium, aconite, chloral-hydrate,) to relieve the pain until the laxative is absorbed, and a stimulant anti-spasmodic (carbonate of ammonia, sweet spirits of nitre, ether,) to quiet the nervous excitement. Copious injections of warm water with or without anodynes and anti-spasmodics are not to be neglected, neither is quiet walking exercise. If the affection appears purely spasmodic the laxative may be withheld until two doses of anodynes and anti-spasmodics have been given at intervals of half an hour, but should these fail, give the opening medicine at once, and then only enough of the other agents to moderate excessive pain until it has had time to be absorbed. Complete relief may be looked for in three or four hours.

ACUTE HEMORRHAGIC ENTERITIS.

This is very common in hard-working horses in some localities and is also seen in cattle, sheep, swine and dogs. It may follow unrelieved obstruction of the bowels, especially if these have been treated by powerful opiates and stimulants or dangerously irritant purgatives. To these must be added excessive fatigue, heavy, hurried feeding, and drinking iced water, exposure to a cold draught, chill

rain, or cold sponge when exhausted, a sudden change to dry grain feeding, to new oats or hay, to rank, rapidly-grown clover or grasses, or to musty food.

Symptoms. When not supervening on indigestion or obstruction of the bowels its onset is sudden. The patient stamps, paws, looks at his flank, moves from place to place, walks crouchingly, lies down, rolls, acts in short as in spasmodic colic, but there is a more careful lying down, there is no intermission to the pain, the face continues pinched and anxious even if the beast stands quiet for a few seconds, the eye remains fixed and glazed, the pupils dilated, the breathing hurried and catching, the pulse rapid, and becoming smaller and weaker, the temperature unnaturally high, the surface covered with sweat and often cold, and the limbs and ears deathly cold. The abdomen is usually tender. As the disease advances the animal may become still but all the other signs are worse. Others become reckless and dash about peeling and injuring themselves and imperiling those about them. The bowels are confined and in the advanced stages the pellets passed may be stained with blood. Death may ensue in from three to twenty-four hours after the onset.

Treatment. If seen at the outset give a mild laxative (olive-oil) with an anodyne (hyoscyamus). Bleeding from the jugular vein may give prompt relief if the pulse is still full and strong. But neither of these can be ventured upon except at the very outset, and therefore in the great majority of cases are to be avoided. Apply hot fomentations to the belly by a blanket wrung out of water nearly boiling, rub the limbs with ammonia, mustard or turpentine, and give injections of warm water containing anodynes (belladonna, hyoscyamus, opium, aconite, tobacco, etc.).

If the soft, weak, rapid pulse bespeaks already existing effusion, avoid bleeding and laxatives, give one or two drachms of opium by mouth, or better one or two grains sulphate of morphia injected under the skin, repeating as often as may be requisite to moderate suffering and keep

the bowels inactive, accompanying this by hot fomentations and counter-irritants.

In case of improvement feed linseed or oatmeal gruels, boiled linseed, or very sloppy bran mashes only, and in small amount, for several days. If the bowels continue confined give four or five ozs. olive-oil, or three or four ozs. Glauber salts once or twice a day.

But *prevention* is especially to be sought in such a rapidly fatal disease. Regularity and sufficient frequency of feeding, in moderate quantities at a time and of good quality, and a gradual instead of a sudden change of diet, are important. When new hay or grain, or heating agents like maize or wheat are fed, one feed daily should be replaced by a sloppy bran mash, or one or two ounces of common or Glauber salts added. Avoid full draughts of cold or iced water when sweating and exhausted, and of any water after a meal of grain.

ACUTE MUCO-ENTERITIS.

All the domestic animals are subject to this form of inflammation, chiefly of the mucous membrane of the bowels. The causes are mainly the same as those of hæmorrhagic enteritis acting on a less susceptible subject, or with lessened force. These may be named exposure, sudden extreme changes of weather, coarse, dry, fibrous, musty or otherwise irritant indigestible food, abrupt changes of diet, impure, stagnant or putrid water, too much water after feeding, or iced water when fatigued and perspiring, drastic or oft-repeated purgatives, suppressed perspiration, sand in the food, parasites and the various mechanical obstructions (calculi, impactions, invaginations, hernia). Cattle, sheep and swine especially suffer during the vicissitudes and extremes of spring, summer and autumn, and the latter from want of water to drink and wallow in. Ewes in lamb in New York perish in great numbers when fed grain. Best confine to clover hay. Succulent roots or fruits may be given judiciously. Among dogs the young suffer most and those kept on animal food, or that bathe in rivers when

heated with the chase. Chickens contract it from faults in feeding and watering, but especially from exclusive feeding on grain and deficiency or impurity of the water.

Symptoms. In the mildest forms are fever, increased temperature, thirst, scanty, high-colored urine, costive bowels, the small masses of dung covered with a film of mucus, tender belly, small, quick, hard pulse, yellowish-red eyes, hot clammy mouth, furred tongue with redness along the edges, tip and lower surface, impaired appetite, dull sluggish habit, loss of flesh, unthrifty skin, and slight colics after meals.

In the more severe forms all these symptoms are increased in severity, appetite gone, dullness and depression extreme, head carried low, gait unsteady, breathing excited, a ridge on the tender abdomen as in pleurisy, and more frequent colic, with pawing, uneasy shifting of the limbs, kicking at the abdomen, looking at the flanks and lying down and rising. Diarrhœa may set in and herald recovery, or it may become profuse, bloody and fatal.

In addition to these general symptoms *cattle* and *sheep* have impairment or loss of rumination, frequent belching of gas, fœtid breath and tenderness mainly of the right side of the abdomen. When due to acrid and irritant plants, the back is arched, abdomen tense and tucked up, constipation obstinate, tongue often purple, and the urine high-colored or even bloody. It may prove fatal after a fortnight's sickness. In *swine* the affection is usually mistaken for *Intestinal Fever* which indeed it strongly resembles, but without the ineffaceable black spots on the skin and mucous membranes, and without a contagious principle. In *dogs* much dullness, drowsiness, restlessness, with tucked up, tense, very tender abdomen, violent constipation and very painful and difficult passage of dung are added to the general symptoms. Vomiting is common in dogs and pigs. *Chickens* lose appetite and vivacity, droop the head, raise the feathers, move slug-

gishly, scour, strain violently, and show much tenderness of the abdomen when handled.

Treatment. At the outset give a laxative (horse, aloes ox or sheep, Glauber salts; or for all animals olive-oil;) with anodynes (belladonna, hyoscyamus, Indian hemp,) in a mucilage of slippery elm or gum Arabic, and repeat these mucilages and anodynes as may be needful to quiet the suffering. Mild cases may be successfully treated by small daily doses of sulphate of soda with abundance of mucilage, and tonic doses of gentian and nux vomica. Give injections of hot water, with anodynes, and apply fomentations, or in small animals poultices, followed by mustard or other counter-irritants to the belly as in hæmorrhagic enteritis. When profuse diarrhœa sets in give freely of mucilaginous and starchy drinks, with quinia, gentian, nux vomica or other bitter and opium. The diet must be restricted to well-boiled mucilaginous gruels, and in the case of herbivora, sloppy warm bran mashes.

The treatment of diseased chickens is not always satisfactory, but the whole flock should have mush, vegetables and boiled potatoes, with clear pure drinking water to which may be added cream of tartar or Glauber salts, 1 oz. to every quart.

CROUPOUS ENTERITIS.

This occurs in cattle, horses, sheep and dogs, and may be considered as a modification of the other forms of enteritis and produced by similar causes. The symptoms may approach those of either of the two forms of the disease already described, the suffering being extreme and lasting, or violent but short, and followed by dullness, depression, fever, and tenderness of the belly. If the animal survives long enough the false membranes are passed in great, white, friable masses or shreds. In its earliest stages a laxative will often alter the condition of the membrane and contribute to a prompt recovery. Later treat as in enteritis. Saline laxatives (sulphate of soda or mag-

nesia) and bitters (nux vomica, gentian, quassia, quinia,) are especially indicated when the membranes are separating. If resulting from mercurial poisoning, give chlorate of potassa and iodide of potassium.

INFLAMMATION OF THE RECTUM.

The last or straight gut often suffers exclusively in horses and dogs in connection with the impaction of hardened dung, or calculi, and in oxen with a certain conformation from the introduction of air. Dung is passed in long cylindroid masses with great straining and pain, or cannot be passed at all. In the dog it is covered with mucus, pus or even blood. The everted gut is of a deep red color, thickened, infiltrated and hot. Rupture may ensue if it is not relieved. *Treat* by emptying the gut with the oiled hand or finger, give a spare laxative diet (bran mashes, roots, gruels,) frequent injections of warm water containing some mucilage and olive-oil, and an occasional purgative (olive or linseed-oil).

In high-rumped oxen, cut the muscles on the upper surface of the tail and tie it down until healed.

DIARRHŒA. SCOURING.

This is a frequent discharge of semi-liquid or liquid dung from the bowels without griping or violent straining. It is a symptom of disease rather than an independent malady, as it may arise from almost any irritant in the bowels. Among its common causes may be named a full drink followed by active exertion; feeding soft, aqueous, rapidly-grown green food; cooked food for hard-working horses; many irritant and acrid plants; spoiled potatoes, turnips, apples, etc.; stagnant, putrid water; undigested matters in the bowels from imperfect mastication or digestion; impaction of some part of the bowels; worms, etc. It may occur from irritants secreted from the blood, as in the case of purgative agents accidentally taken in with food or water, and the morbid elements of certain

fevers (Rinderpest, Texan-fever, hog-cholera, lung-fever.) Lastly, a reflex irritation from the skin as in exposure to chilling rains, night-dews, or damp stalls, or to hot damp buildings, seasons or localities. Horses are especially liable to superpurgation if worked or supplied with ice-cold water during the operation of a dose of physic.

Symptoms. These may be slight as in the frequent pulpy evacuations of animals fed exclusively on roots, or severe, as in the excessive and almost constant discharge of a dark-colored liquid mixed with mucus. Slight diarrhœa does not affect the appetite, nor interfere with improvement in condition, but in the severer forms there is loud rumbling in the abdomen, loss of appetite and condition, rapid, small, weak pulse, hurried breathing, pallid mucous membranes and weakness even to unsteady gait. Distension of the belly, with pawing and other signs of abdominal pain may appear in bad cases. In horses it is often followed by inflammation of the feet.

Treatment. Unload the bowels by linseed, olive, or castor-oil according to the patient, adding laudanum, and follow up by mucilaginous (linseed, gum Arabic, slippery elm,) or starchy draughts or even injections with or without laudanum as may seem required. In prolonged and obstinate cases astringents (kino, catechu, oak bark, tannic acid, nitrate of silver,) with tonics (gentian, cinchona, salicine, nux vomica,) and carminatives (camphorated spirit, ginger, peppers, caraway, fennel, etc.,) may have to be employed. But in no case should astringents or opiates be used until the irritant has been carried off by a laxative, and usually a change of diet is needful to prevent a second attack. In acute or obstinate cases dry rubbing or a blister to the belly may be useful, and perfect rest must be enjoined.

DYSENTERY. BLOODY-FLUX.

This is a morbid process approaching inflammation of the mucous membranes of the large intestines, and leading

to the formation of ulcers. It occurs in cattle, horses, swine and dogs, may be enzootic on certain rich impervious soils, or even epizootic.

Causes. Those of diarrhœa acting with greater energy; the emanations from marshy inundated soils, or from carcasses; putrid, stagnant or iced water; musty, putrid or otherwise altered food; overexertion in excessive heats; or even a *contagium.*

Symptoms. The acute form comes on suddenly with symptoms of *acute intestinal catarrh.* The dung is passed frequently with straining and is semi-liquid and fœtid. Later it is quite liquid with mucus, blood and shreds of false membranes or sloughs, intolerably offensive, and passed with still more pain and straining. Later still, the same painful straining fails to bring away anything, though the red, infiltrated and excoriated rectum may protrude. At length the discharge again reappears more repulsive than ever and passes involuntarily. Appetite is gradually lost, but thirst increases. Fever exists at first with staring coat and even shivering, hot fevered mouth and accelerated pulse, but this is less marked as the disease becomes chronic. Then there is extreme emaciation, cold limbs, dry, cracked muzzle, hide-bound, scurfy, unhealthy, lousy skin, often covered with flies, deeply-sunken pallid eyes, and involuntary liquid putrid discharges. Death may occur in three or four days or the disease may be protracted for months.

Treatment. Rub the belly actively and apply mustard, or in small animals give a warm bath. Give a mild laxative (olive-oil, Glauber salts,) with calmative (Dover's powder, laudanum). After the laxative has operated give daily Dover's powder with ipecacuanha, or sal ammoniac, or should these fail to improve the discharge, astringents (kino, catechu, gall-nuts, oak bark, black currant bark, walnut leaves, tormentilla, rhatany, etc.,) with tonics (quinia, nux vomica, salicine, cascarilla, carbonate or sulphate of iron, sulphate of copper, nitrate of silver). Small doses

of oil of turpentine, copaiva, creosote or carbolic acid often act beneficially on the diseased mucous membrane. The same agents may be given as injections in mucilaginous fluids. Diet must be bland, easily digested, and fed little at a time. Mashes of wheat bran, or flour from the whole grain of wheat, barley or oats, and fresh pulped or cooked roots may be given to the herbivora; and farinas made into puddings, with just enough juice of meat to insure their being eaten, to the carnivora. Fresh raw meat without fat, beaten to a pulp in a mortar will often agree when nothing else will. The drink should be mixed with a little boiled linseed, gum, slippery elm or barley water.

OBSTRUCTION OF THE BOWELS.

Under this head may be considered all cases of complete obstruction of the bowels excepting those of the nature of hernia or rupture. It will include blocking of the gut by hardened dung, calculi, and foreign bodies swallowed; invagination or the slipping of a portion of gut into what is adjacent, like the drawing of a finger of a glove into itself; volvulus, or the rolling on itself of a portion of intestine with its connecting membrane until nothing can pass through it; strangulation of an intestine by another rolled round it, by a tumor hanging by a long pedicle, or by a band of false membrane formed in some pre-existing inflammation and gradually contracting; tumors formed within a gut; and in steers the strangulation of a loop of intestine in a pouch in the right flank formed by contraction on the spermatic cord in castration.

The *symptoms* of complete obstruction are those of severe *spasmodic colic*, but without the intervals of complete freedom from pain. It differs also from enteritis in that there is no rise of temperature at first. The dung may be abundant at the outset but as the disease advances is more or less completely suppressed, the portion of intestine behind the obstruction having been emptied. The *horse* often seems to obtain a partial temporary relief by

sitting on his haunches or lying on his back, and will retch, though vomiting is rare, unless the stomach is ruptured. If the obstruction is in the pelvic flexure of the large bowels it may be felt by the hand introduced through the rectum.

In *ruminants* the preliminary colics may be followed by quietude, but there remain extreme lassitude, depression, sunken eye and dry hot muzzle, and even stupor or coma. In cattle the hand introduced into the rectum will detect the mass of the overdistended bowel above the obstruction. It may also ascertain the existence of a pouch imprisoning the gut in the right flank and may even pull it out and relieve.

In *dogs* violent colic may be absent, but there is much depression, inappetence, vomiting of bile or fæces, arching of the back, tucking up of the belly, the passage with much pain and straining of mucus-covered fæces, and later, straining without any passage, while the overloaded gut may easily be felt through the walls of the belly.

Treatment. In most cases of absolute obstruction nothing can be done except to relieve the pain by anodynes (opium, belladonna, stramonium, Indian hemp, etc.,) and give nutrient injections. The obstruction may often be kneaded through the rectum. Liquid above the obstruction may be drawn off through a fine tube. *Invagination*, *volvulus* or *gut-tie*, when their presence is ascertained in ruminants, pigs or dogs, would warrant an incision through the walls of the abdomen and an attempt to rectify with the hand. In cattle the opening must always be made in the right flank, the left being occupied by the paunch. The wound must be afterward carefully sewed up and the animal prevented from rubbing it. *Gut-tie* may often be remedied by manipulation with the hand in the rectum, or even by the simpler expedient of jumping from a bank about two feet high, though if due to adhesion of the cord to an intestine the abdomen must be opened and the band cut.

HERNIA. RUPTURE. BURST.

Hernia is understood to mean the displacement of some

internal organ through a natural or unnatural opening. Of abdominal organs the bowels and omentum are those that most commonly protrude, though the womb often escapes in bitches. According to the structure through which the organ passes the hernia is named:—into the chest, *diaphragmatic* or *phrenic;* through the omentum or mesentery, *omental, mesenteric;* through the navel, *umbilical;* into the scrotum, *inguinal* or *scrotal;* through the *femoral* arch to the inner side of the thigh, *femoral;* through an artificial opening in the walls of the abdomen, *ventral,* through the relaxed walls of the vagina, *vaginal.*

Diaphragmatic Hernia may occur from violent muscular efforts, from the violent shock of a heavy abdominal organ on the midriff in leaping or from laceration with a broken rib or other offending body. The worst cases are suddenly fatal from suffocation. In others there is a sudden access of difficult breathing with gurgling sounds on auscultating the chest. In still others, with a smaller rupture, the rumbling in the chest may be absent but there is violent, continuous colic and rapid prostration as in *obstruction.* In the slightest forms there is only an extra lifting of the flanks as in *heaves. Treatment* is useless, though rest and anodynes will allow a slight case to merge into the chronic form.

Mesenteric and Omental Hernia give rise to complete obstruction of the bowels and can rarely be recognized nor remedied.

Umbilical Hernia is common in horses, dogs and very young ruminants. It is usually congenital but may result from violent straining, running or jumping. The swelling is very manifest and when handled its contents are found to move on each other, to gurgle and to pass back in a mass when pressed.

Treatment is often needless, the sac becoming effaced with growth. If not, make a soft pad for the navel and attach it to elastic bands passing round the body and fixed in their turn to others extending back from a collar round

the neck. Or in slight cases blister the sac severely and repeatedly; or apply wooden clamps over the skin close up to the belly, having first perfectly returned the protrusion, and let them be worn until they drop off.

Inguinal Hernia occurs in the male quadruped of any age, as the sac containing the testicle remains continuous with the abdomen throughout life. It is rare but by no means unknown in the castrated animal. It may exist without any other *symptom* than an unnatural swelling of the scrotum, the contents movable on themselves, the thickening extending up to the abdomen, and the whole disappearing suddenly and in a mass when pressed. Or these signs may be associated with the violent and continuous colicky pains of obstruction. In all cases of colic in entire males the possibility of hernia should be borne in mind and an examination made.

Treatment is very varied, in difficult cases requiring anatomical knowlege and attention to many minutiæ which cannot be given here. Yet in many cases the hernia may be returned by simple pressure with the hand, with or without the other hand inserted into the last gut and carried down to the internal inguinal ring. If the patient is thrown on his back with his hind parts well raised the return will be greatly facilitated. In pigs and dogs castration should be resorted to, the gut being first returned and held back by pressing upon the canal in front of the testicle, and finally the wound in the skin sewed up. Or the testicle covered by its sac may be stripped to pass the bowel back into the abdomen and then tied tightly with a carbolated cord. For particulars of treatment of the various forms of inguinal hernia see the author's larger work.

Femoral Hernia in bitches rarely demands or receives treatment.

Ventral Hernia is easily distinguished from other swellings of the abdominal walls by the movable gurgling contents entirely returnable into the abdomen by pressure. Though often masked by surrounding inflammation these characters can usually be recognized. *Treatment* is most successful just after the injury is sustained, as after the

margins of the wound have become insensible they will not contract and heal. Return the protrusion, throwing the animal on its back and quieting with opium, ether or chloral if necessary. Then cover the opening with pads and cover with a strong sheet wound round the abdomen and laced tightly along the back. Keep the sheet in position by bands carried from its anterior border to a collar round the neck. Adjust and pad it carefully day by day until all swelling and tenderness subside.

Vaginal Hernia must be treated like *eversion of the vagina.*

EVERSION OF THE RECTUM.

The rectum protrudes naturally in passing dung but returns immediately. If it remains and swells it demands interference. Poorly-kept animals (dogs, pigs,) are liable and it may be caused in all from violent straining in work, parturition, constipation, diarrhœa or dysentery. The protrusion may be confined to a mucous fold at one side of the anus or the entire gut may protrude to the length of several feet. If recent it is little altered, but if old, is red, thick, softened or even ulcerated. The protrusion must be emptied, cleaned and returned, the oiled finger or arm (according to size) being introduced into the gut and through the constriction of the anus and the other hand used to strip it off from this. The head of the patient should be turned downhill and straining prevented by pinching the back. In small animals with old protrusions the part may have to be cut off close to the anus and a few stitches passed through the edges to keep them in apposition. When returned a truss should be applied as for *everted uterus* or *vagina* and a spare, laxative diet allowed nourishing or not according to the needs of the patient.

PILES.

These are dilatation of the veins on the inner and outer sides of the anus, with exudation and fibrous thickening

of the surrounding connective tissue to form rounded swellings. They are reported in all domestic animals but are especially common in dogs. Melanotic tumors in horses are often confounded with them. They are generally connected with torpid, inactive liver and an aggravated costiveness, straining and the presence of irritants in the large intestines. Dogs draw the anus along the ground as in intestinal worms, pass hardened, blood-streaked dung, with much straining, pain and sharp cries, and present around the anus bluish tumors which bleed freely if wounded and are connected with the terminal end of the gut that hangs out through the opening. The general health rarely suffers much. In other animals there is itching, switching and rubbing of the tail with the characteristic tumors and much straining and difficulty in passing dung. *Treat* by mild laxatives (sulphate of soda and common salt, 3 ozs. daily for the large and 20 to 30 grains for the small quadrupeds; or podophyllin in one-fifth the usual doses, daily). Give moderately of laxative, easily-digested food and maintain tone by bitters (nux vomica). Locally bathe with tepid solutions of opium, stramonium and astringents (sugar of lead, alum, tannin, sulphurous acid, benzoated oxide of zinc ointment). Check bleeding by solutions of sulphate of iron or matico. It is sometimes necessary to remove with the ligature, or clamp and hot iron.

FISTULA IN ANUS.

This is a communication between a suppurating sore and the terminal part of the rectum. There are usually two openings, one into the gut and the other close beside the anus. The rational treatment is to remove any foreign body or other cause of irritation and then passing an india rubber cord through the canal, to bring the end from the internal wound out through the anus and, stretching the rubber, to tie both together after which by its elasticity it slowly cuts its way through, while the wound steadily heals behind.

IMPERFORATE ANUS.

This is not uncommon in young animals and may be relieved by a free incision as soon as the accumulation of dung in the end of the rectum furnishes a firm pad on which to cut. The incision must be made in the centre of the firm muscular ring that should have encircled the opening, and which may be easily felt. In mares spontaneous relief is often obtained by a rupture into the vagina. If the gut as well as the opening is wanting, there is no remedy.

PERITONITIS. INFLAMMATION OF THE LINING MEMBRANE OF THE ABDOMEN.

This occurs in all domestic animals and may be limited to a particular part or may be general. It is mostly caused by mechanical injuries, as wounds of the abdominal walls—surgical or otherwise, or by rupture of an abscess, of the stomach, intestine, bladder or womb. It may also result from sudden changes of weather, chills from exposure to excessive cold, to frigid showers or dews or to a wet bed after perspiration and fatigue. This is of course most frequent in horses and oxen. Similar exposure to cold is a common cause of peritonitis after wounds of the abdomen, as in castration.

Symptoms. If very circumscribed there may be simply slight colic, worse at one time than another, with acute pain when the affected part is pressed. When more general there is shivering followed by a hot stage, colic, stiffness of the hind limbs, especially in the smaller animals, swelling, tension and great tenderness of the abdomen, constipation, or in rare cases, watery or even bloody diarrhœa, complete loss of appetite, vomiting in animals capable of this act, quick, catching breathing and rapid hard pulse, becoming softer, weaker and smaller when serous effusion takes place. Effusion is further attended by a relief from the colics and tenderness, a more sunken eye, pallid mucous membranes, deeper breathing, and a more

pendent belly with a sense of fluctuation when it is handled. In ruminants the right side is especially tender and the animal stands crouching with its four feet near together. The wound of the abdomen usually completes the list of symptoms.

Treatment. The abdomen may sometimes be cupped or leeched with advantage, though warm fomentations or poultices, (or even warm baths for small animals) followed by mustard poultices, are more generally applicable. Then the preparations of opium may be given in full and frequent doses to allay pain and keep the bowels inactive. Well-boiled gruels may be given frequently as injections, as what is thrown on the stomach is usually vomited or lies unabsorbed. During recovery great care must be exercised in feeding. Decoctions of linseed, or well-boiled gruels of oat, barley or rye-meal should gradually give place to soft warm bran mashes and finally to hay and ordinary food. The carnivora may have beef tea. Anodynes (opium, prussic acid,) may be given to relieve pain and diuretics (nitre, digitalis, sweet spirits of nitre, etc.,) employed to remove the effusion. Tonics (oxide of iron, gentian, cinchona, etc.,) may be demanded and occasionally mustard poultices to remove tenderness.

ASCITES. DROPSY OF THE ABDOMEN.

This may be a result of peritonitis, of obstruction to the flow of blood through the intestinal (portal) veins as in diseased liver, spleen, pancreas, mesenteric glands, valves of the heart, etc., or finally it may depend on an unduly watery state of the blood as in certain parasitic and other disorders.

Symptoms. Distended (pot) belly, loose and pendulous, with hollow flanks, or if the liquid is more abundant, rounded and tense. Fluctuation is easily felt if pressure is made at two different points, and percussion elicits a dull dead sound in place of the normal drum-like resonance of the bowels. The urine is scanty, appetite and

digestion impaired, breathing deep and excited, condition poor and getting worse, hair dry, rough, erect and often shedding, and swellings appear along the lower part of the body into the limbs and chest.

Treatment. Find out and remove if possible the true primary cause. When that has ceased to act employ purgatives, but especially diuretics (digitalis, oil of turpentine, iodide of potassium, squills, colchicum, nitre, etc.,) in as full doses as the strength will permit, with tonics (sulphate of iron, gentian, nux vomica,) and apply tincture of iodine over the abdomen. The liquid may be drawn off with a fine cannula and trocar, one-half only being extracted at a time, and the flaccid walls at once supported by a tight bandage encircling the body.

GASTRIC AND INTESTINAL PARASITES.

LARVA OF INSECTS.—*Bots.* These are the larva of four different species of *gadfly* that pester horses in summer

Fig. 20.

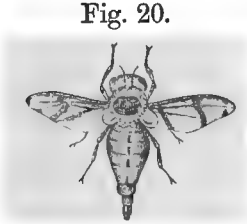

Fig. 20—Bot-fly. Œstrus Equi.

Fig. 21.

Fig. 21—Bot. Larva of Œstrus.

Fig. 22.

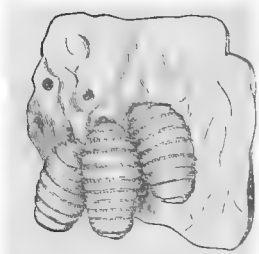

Fig 22—Bots hooked on the mucous membrane of the stomach.

and autumn, gluing their little white ovoid eggs on the long hairs beneath the jaws, on the breast, shoulders and fore limbs on which the empty shells may be carried through the winter. When the horse licks himself the live embryo is extracted from the egg and swallowed or in the

case of those beneath the jaws they fall into the food and are devoured with it. By the aid of the hooks around their heads they attach themselves to the mucous membrane mainly of the left half of the stomach but often also of other parts such as the right side of the stomach, the duodenum or small gut leading from the stomach, and the throat. There they steadily grow in the winter and in spring pass out with the dung, burrow in the soil and are transformed into the gadfly. The disturbance they cause depends on their numbers and the portions of the canal on which they attach themselves. In the throat they produce a chronic sore-throat and discharge from the nose which continues until the following spring, unless they are previously extracted with the hand. In the left half of the stomach which is covered with a thick insensible cuticle they do little harm when in small numbers, hence Bracy Clark supposed them to be rather beneficial in stimulating the secretion of gastric juice. When very numerous and above all when attached to the highly sensitive right half of the stomach or the duodenum they seriously interfere with digestion, causing the animals to thrive badly, to be weak and easily sweated or fatigued, and even determining sudden and fatal indigestions. This last result is especially liable to occur in spring or early summer, when the bots are passing out in great numbers and hooking themselves at intervals to the coats of the sensitive bowels in their course. They will sometimes accumulate in such numbers as actually to block the passage. They even attach themselves to the skin outside the anus causing the animal to go awkwardly, to switch his tail and give other signs of extreme discomfort until the tail is raised and the offender discovered and removed. Alleged perforations of the stomach by bots are usually ruptures, the result of indigestion.

The irritation caused by their presence is not easily distinguished from other forms of indigestion and colic. It may be tympanitic or not, accompanied or not with

diarrhœa, and of the most variable intensity. If occurring after a period of abstinence when the worms are presumably hungry, or if in spring or early summer, if the bots are found passing with the dung, if the horse turns up his lip as if nauseated, and if the margins of the tongue are red and fiery there will be so much more corroborative evidence.

Treatment. In cases of irritation following abstinence give potato juice, gruels, etc., to feed and quiet the bots, adding some anodyne (opium, hyocyamus,) or mucilaginous agents (gum Arabic, boiled linseed, mallow, slippery elm,) if it appears necessary.

We cannot certainly kill the bots in the stomach, as they will resist the strongest acids and alkalies, the most irrespirable and poisonous gases, the most potent narcotics and mineral poisons, empyreumatic oils, etc. Oil of turpentine, carbolic acid, bryony, ether and benzine have been relied on by different practitioners but none of them are quite satisfactory. It seems probable that these like other vermifuges will act best in autumn or early winter before the larva has acquired his hard, horny coat of mail, and at this time accordingly they may be given with more confidence. The azedarach (pride of China) grown around stables in the South to protect from bots, probably acts in this way, if at all, being cropped and swallowed by the animals while the bots are still white, soft and permeable to liquids.

The colics are to be treated by anti-spasmodics (tobacco, stramonium, laudanum, etc.,) and mild laxatives, and the animal must be well fed to support him under the drain and to keep the parasite gorged, lazy and non-irritating. In summer when the bots are coming away their exit may be precipitated by a good dose of physic.

Prevention. Trim off the long hairs of the jaws, breast, shoulder and fore limbs and apply a little oil daily to prevent the eggs from adhering. Or brush off the eggs with soap-suds daily before they have had time to hatch in the

sun. A piece of cloth extended across beneath the jaws is often employed to protect this part.

RAT-TAILED MAGGOTS the larvæ of *helophilus* are also found in horses' intestines but are not known to be injurious.

Fig. 23.

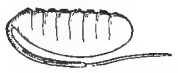

Fig. 23—Helophilus.

INTESTINAL WORMS.

These are arranged in four classes: 1. The *tape-worms*, consisting of flat bodies made up of a succession of segments or links, with a narrow neck and small head, and divided into tape-worms proper, which are round-headed, and bothriocephali, which are flat-headed with lateral openings; 2. the *flukes*, soft-bodied, flattened, leaf-like or ovoid worms, with digestive organs and a variable number of sucking discs; 3. the *thorn-headed worms*, with long rounded bodies and retractile snouts furnished with hooks by which they attach themselves to the mucous membrane, but neither mouth nor digestive canal; 4. lastly, the *round worms* which differ from the last in the absence of a protractile, hooked snout and the possession of mouth and digestive canal. The horse harbors in his intestinal canal at least three tape-worms and seven round worms; the ox, two tape-worms, two flukes and five round worms; the sheep, one tape-worm, one fluke and seven round worms; the pig, one thorn-headed worm and five round worms; the dog, thirteen tape-worms, one fluke and five round worms; the cat, five tape-worms, three flukes and three round worms; the rabbit, one tape-worm and three round worms; the goose and duck, nine tape-worms, seven flukes, one thorn-headed worm and seven round worms; the chicken, four tape-worms, two flukes and seven round worms; and the turkey and pigeon, at least two round worms each. Of these

eighty-eight worms of the digestive organs it is useless to attempt any description in a work of the present limits, so that our attention must be mainly confined to their symptoms and treatment. For further information the reader is referred to the author's larger work or to those of Leuckhart, Diesing, Dujardin, Baillet, Cobbold and other helminthologists.

The transformations of tape-worms have been already referred to under *parasites*, and those of flukes under *dis*

Fig. 24.

Fig. 24—Sclerostomum Equinum. Mature and young forms, nat. size.

Fig. 25.

Fig. 25—Oxyuris Curvula. 1 Female; 2 male, nat. size.

eases of the liver. The *thorn-headed worms* lay their eggs within the body of their host, and these being passed with the dung are swallowed by crustaceans in which they encyst themselves and develop the characters of the adult worm in miniature, but remain very minute and fail to attain their full size till their host is swallowed by another animal. Among domestic animals ducks and pigs harbor these, probably because of their carnivorous appetite. The *round worms* mostly live in their young and immature condition, out of the body, in water or moist earth or on veg-

etables (see *lung-worms, verminous bronchitis,*) but some are exceptions, like the common pin-worm of the horse (Sclerostomum Equinum) which lives in pill-like masses of dung, in little pouches and closed cysts of the mucous

Fig. 26.

Fig. 26—Ascaris Megalacephala.

Fig. 27.

Fig. 27—Trichocephalus Affinis, nat. size.

Fig. 28.

Fig. 28—Head of Tænia Expansa

membrane of the large intestine and in dilatations of the blood-vessels, especially the arteries of the bowels. This, with two other common pin-worms of the horse (Sclerostomum Tetracanthum, Oxyuris Curvula,) are each about

an inch in length and all inhabit the large intestine in their adult condition, sometimes becoming so numerous in a district as to cause an epizootic. Another round worm (Ascaris Megalacephala) about six inches long is very common in the horse's small intestine.

Cattle suffer less from intestinal worms, but the following are not infrequently injurious, especially to calves. The long tape-worm (Tænia Expansa), Ascaris Bovis (like a common earth-worm), the hair-headed worm (Tricocephalus Affinis), the Sclerostomum Hypostomum and Strongylus Radiatus.

Fig. 29.

Ffg. 29—Head of Echinorynchus Gigas.

Fig. 30.

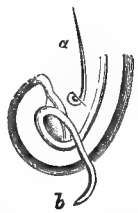

Fig. 30—Spiroptera Strongylina; *a*, nat. size; *b*, tail enlarged.

Fig. 31.

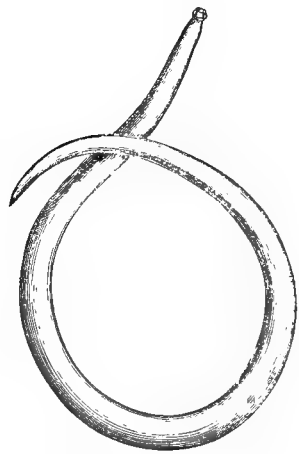

Fig. 31—Ascaris Suilla.

Sheep suffer severely, especially from the long tape-worm, Sclerostomum Hypostomum, Strongylus Fillicollis, S. Contortus, Dochmius Cernuus and Tricocephalus Affinis. The thick portion of the body of the last is about an inch long, the other round worms are mostly under an inch and a half. The tape-worm is usually three feet or under, but is alleged to gain a length of twenty, thirty and even one hundred feet.

Swine suffer severely from a thorn-headed worm (Echinorynchus Gigas) from three to eighteen inches long; a hair-headed worm (Tricocephalus Crenatus) a little smaller than the ruminant's; an ascaris (A. Suilla) like that of ruminants; the Sclerostomum Dentatum, three to five lines in length, and the Trichina Spiralis, one-eighteenth to one-sixth inch long.

Fig. 32.

Fig. 33.

Fig. 34.

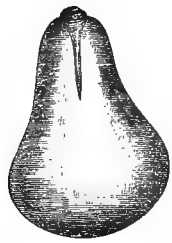

Fig. 35

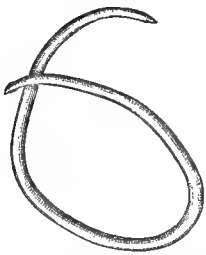

Fig. 36.

Fig. 32—Head of Dog's Tape-worm (T. Cucumerina). Larval form in the dog-louse (Trichodectes Cani). Fig. 33—Head of Dog's Tape-worm (T. Marginata). Fig. 34—Cyst of same (Cysticercus Tenuicollis) infests ruminants, omnivora, etc. Fig. 35—Ascaris Marginata, nat. size. Fig. 36—Ascaris Mystax, nat. size.

In addition to the tape-worms mentioned in the general articles on parasites, the *dog* suffers much from others, as from the following round worms: Ascaris Marginata, two to four inches long; Spiroptera Sanguinolenta, one and one-half to three inches long; Strongylus Trigonocepha-

lus and Dochmius Trigonocephalus, each under one-half inch; and Tricocephalus Depressiusculus, the thick part of which is about one-half inch. One worm of the cat, Ascaris Mystax, one to three inches long, deserves mention because of its being harbored also in the human intestine.

General Symptoms of Intestinal Worms. These are shown when worms are present in large numbers, when they attach themselves to the mucous membranes or when they bore through these to reach other parts. There are general signs of ill-health, poor condition, pot-belly, hide-bound, a scurfy, dry state of the skin, often with itching, irregular and usually voracious appetite, fœtid breath, diarrhœa alternating with costiveness, the passage of mucus with the dung, slight, colicky pains with tympany, especially in the morning before feeding, a puffy swelling and itchiness of the anus, which is often surrounded with a fur of dried mucus, and *above all, the passage of the worms or their eggs.*

In the horse there is often a tendency to elevate the upper lip and to rub it against wall or manger, to lick earth or lime, or to shake the tail or rub out the hair about its root. There may, though rarely, be severe flatulent or spasmodic colic, enteritis or peritonitis.

In *cattle* there are advancing emaciation, depraved or variable appetite, impaired rumination, colics, tympanies and fœtid breath.

Sheep lose appetite, scour, suffer from thirst, wasting, bloodless eyes, clapped, unhealthy or shedding wool, a desire to eat earth, itching anus shown by frequent shaking of the tail, and finally dropsical effusions in the chest and belly and beneath the lower part of the body. They become dull, hopeless-looking and leave the flock.

Swine beside the general symptoms have unusual voracity, and yet lose flesh, cough, scour, start from rest or sleep with a sharp cry, scream excessively just before feeding, have colicky pains, tender abdomen and vomiting,

and many even suffer from palpitations (thumps), vertigo or convulsions.

Dogs suffer from inordinate appetite, wasting, itchy skin, staring coat or loss of hair, indigestions, colics, occasional scouring or vomiting, fœtid breath, and itching anus shown by their frequently licking it or drawing it along the ground. Like swine they may show irritable temper, starting without cause, palpitations, vertigo or convulsions.

Treatment. This may be divided into the administration of agents to kill the worms, of purgatives to carry off them and their eggs, and of tonics to overcome the weakness and the accumulations of mucus in which they live and thrive.

The *diet* for *herbivora* should be grain in summer, or in winter sound natural hay salted, with carrots, turnips or beets, and, in the horse at least, some of the more nutritive grains (oats, barley, beans, corn, linseed cake, etc.,) ground or unground. *Pigs* may also have green food, roots, a liberal supply of grain, and if available, buttermilk. Dogs may have salt meat with soups and milk.

Before giving a vermifuge let the bowels be cleared out by a purgative (horse, aloes; ox or sheep, Glauber salts; swine, dog or chicken, castor-oil). It should also be given fasting before the morning's feed and, if the worms exist in the large intestines, by injection as well as by the mouth.

A great list of *vermifuges* may be mentioned, some destructive to intestinal worms in general; others particularly adapted to specific parasites; while some that are safe and efficacious for one class of patients would prove poisonous to another.

One class destroys worms by the mechanical irritation of their skin and perhaps their intestinal canal. It includes iron filings, granulated tin or tin filings, very finely powdered glass, and cowhage. These are given in doses of ½ oz. to the large quadrupeds, 1 dr. to sheep and swine, or 1 scr. to dogs, made into a ball with linseeed meal

and syrup. They may be repeated daily for a week and followed by a smart purge.

Bitters (quassia, cinchona, gentian, wormwood,) are often beneficial though mainly acting as tonics. For worms in the last gut a concentrated solution as an injection acts well.

Among the more direct vermifuges are: Common salt allowed to be licked at will (must not be mixed in large amount in the food of swine or chickens); oil of turpentine; calomel; tartar emetic with sulphate of iron, for six mornings running, and followed by a purge; empyreumatic oils, and especially those coming off at a slightly lower temperature than creosote and carbolic acid; azedarach; Spigelia marilandica (pinkroot); santonine; sulphuric ether; asafœtida; tansy; savin, etc. These are general vermifuges and may be used especially for the round worms.

For *tape-worms* use areca nut; kousso; root of male shield-fern; pomegranate root bark; kameela; pumpkin seeds; ailanthus glandulosa; or oil of turpentine. In every case the agent should be given fasting, it may even be repeated at the end of four hours and should be followed by a smart purge. For weak animals areca nut is especially suitable.

A course of tonics (sulphate of iron, gentian, columba,) should follow with sound nourishing diet and pure water.

In the case of the Sclerostomum Equinum, it will usually be needful to repeat the treatment at short intervals to kill the young worms which have escaped because of their being buried in the mucous membrane.

Prevention is to be sought by measures advised under lung-worms, especial attention being given to sound nourishing food and pure water.

CHAPTER X.

DISEASES OF THE LIVER.

Effects of deranged functions of the liver. General symptoms and causes. Saccharine urine, Diabetes Mellitus. Blood-poisoning from imperfect oxidation of albuminoids, Azotæmia, Azoturia, Enzootic Hæmaturia, Spinal Meningitis. Red-water in cattle, sheep and pigs. Wood Evil. Jaundice, Icterus, the Yellows. Congestion of the liver. Rupture of the liver. Inflammation of the liver, Hepatitis. Chronic inflammation of the liver. Results of hepatitis. Gall-Stones, Biliary Calculi. Fatty degeneration. Tubercle. Cancer. Hypertrophy. Atrophy. Parasitic diseases of the liver. Liver-rot, Fluke-disease. Fasciola Hepatica. Distomum Lanceolatum.

Only now, when the functions of the liver are being more fully discovered, do we begin to apprehend the full importance of its various disorders. Formerly this organ was supposed to have exhausted its functions in the secretion of bile, and the various modifications and impaired discharge of this product together with inflammation, morbid growths and degenerations circumscribed the list of hepatic diseases. But the recognition of the formation of glycogen and cholesterine in the liver, together with urea and other less perfectly oxidized nitrogenous bodies which pass into the blood in place of being discharged with the bile, points to the liver as the chief local seat of various disorders such as diabetes, cholesterine plugging of vessels, blood-poisoning from imperfectly oxidized albuminoids, and urinary calculi.

General Symptoms. These may be stated shortly as follows: obesity, sluggishness, irregular bowels, the dung being abundant, liquid and deep yellow or orange from

excess of bile in active congestions of the liver, or on the contrary there may be costiveness, with light-colored, fœtid, imperfectly digested stools in cases in which bile is not secreted or is debarred from entering the bowels by some mechanical obstruction; lameness in the right fore limb, or even in one or more of the remaining members, without any observable local cause; cramps and even paralysis in the severer cases with poisonous products thrown into the blood; a tardy pulse sometimes not more than half its natural number; yellow or orange color of the eyes and other visible mucous membranes, and of the urine in cases of obstructed bile-ducts or intestines with reabsorption of bile, or in destruction of blood-cells by taurocholic acid and other products abnormally present in the blood; tenderness or groaning when the last ribs are pinched or struck with the closed fist; a yellow or orange fur may sometimes be seen universally diffused or in circumscribed spots on the upper surface of the tongue; the presence in the urine of deep brown or reddish granular deposits replacing urea is another sign of liver disorder. Obstructed circulation in the liver causes congestion of the portal vein, engorged spleen, intestinal catarrh, effusion of blood on the bowels, piles, dropsy of the abdomen, and swelling of the hind limbs. These may therefore be attendant symptoms.

The conditions in which animals live may further assist our decision in suggesting an efficient *cause*. The fat, idle, overfed and pampered stock are especially subject to liver disease, and more particularly if kept in close, hot, damp buildings or climates, or supplied with putrid water or unwholesome food. Thus the pampered family horse, the idle farm horse during our long winters, the high-bred ox, sheep, and pig in which everything has been sacrificed to secure excellence as meat producers, the pet dog, and the Brahmas, Cochins and other plump hens of Asiatic extraction, present frequent examples of liver disease. The stabled animal is more subject to it than those running at

pasture, and the subject liberally fed on dry fodder than that nourished on succulent green food. Then the denizen of the warm latitude and damp miasmatic soil is more liable than others.

SACCHARINE URINE, DIABETES MELLITUS.

Very rare in the lower animals but has been seen in carnivora (dogs), omnivora (monkeys), cattle and even in the horse. Temporary sweetness of the urine is not disease, but if permanent it may be referred to excessive production of glycogen in the liver which is probably always enlarged (Bernard); or less frequently to the failure of the liver to transform the sugar of the food into glycogen; or it may be from disease of the medulla oblongata (apoplexy) or of some part which exerts an irritant reflex action on the base of the brain. It has been produced experimentally by giving alcohol, ether, chloroform, quinia, ammonia, arsenic, phosphoric acid, and *woorali*.

Symptoms. Rapid loss of condition, scurfy, unthrifty skin, costive bowels, indigestion, ardent thirst, and excessive secretion of urine of a high specific gravity—horse and ox, 1060; pig, goat and sheep, 1030 and upward. The tests for sugar are: 1. taste; 2. fermentation when yeast is added and the whole allowed to stand in a warm temperature; 3. the addition to a little of the urine in a test-tube of a few drops of solution of blue vitriol, and a considerable excess of potassa, and boiling the liquid for a moment when if sugar is present there is a deposit of the yellowish-brown suboxide of copper.

Treatment. Rarely successful. The best results are to be expected in cases in which an active cause, such as disease of the liver, lungs or brain, can be recognized and kept in check or cured. Thus with liver disease, laxatives, alkalies, pure air and water, green or otherwise laxative food, and cupping, mild blistering or even leeching over the spare-ribs, may be beneficial. In lung disease the treatment must correspond to its nature, whether inflam-

matory, tuberculous or otherwise. Tonics and stomachics are almost always demanded. All the bitters, tincture of iron, the mineral acids and carbonate of soda have been used with profit. Opium, which checks the excretion of sugar, is injurious by impairing digestion. Lactic acid has repeatedly succeeded at the expense of a severe attack of rheumatism. Free secretion from the skin is beneficial and should be encouraged by warm clothing, baths and climate. Diet should be mainly albuminous, such as bran mashes and gruels, peas, beans, vetches, flesh deprived of fat, etc.

BLOOD-POISONING FROM IMPERFECT OXIDATION OF ALBUMINOIDS. AZOTŒMIA. AZOTURIA. HÆMOGLOBINURIA.

Variously described in the books as disease of the kidneys and spinal cord, this is really due to disease of the liver which fails to effect the transformation of albuminoids into urea, and entails an accumulation in the gland and in the circulating fluid of partially oxidized products, such as leucin and tyrosin, which pass off in variable amount by the kidneys. It attacks almost exclusively horses which have stood idle in the stable for a few days, on good diet, and are then taken out and subjected to active exertion.

Symptoms, etc. These are very variable. In the *mildest forms* there is only some lameness and muscular trembling in a particular limb, without apparent cause, brought on by sudden exertion and attended by a dusky-brown color of the membranes of the eye and nose and some signs of tenderness when the short ribs are struck. This may be entirely cured by a course of gentle laxatives (podophyllin, 1 scr.) and diuretics (colchicum, muriate of ammonia, taraxacum, nitre,) and a gradual inuring to work, beginning with the slightest exertion and increasing day by day as the condition improves. The *worst forms* come on during or after driving, it may be not more than one

hundred yards, the fire and life suddenly giving place to anxiety and despondency, the subject seems to be in violent pain, the flanks heave, the nostrils are dilated, the face is pinched, the surface is drenched in perspiration, the body trembling violently, the limbs weak, so that they sway and bend, while the animal walks crouchingly behind and soon goes down unable to support himself. If urine is passed it is high-colored, dark brown, red or black, and is usually thought bloody, but it contains neither clots nor blood-corpuscles, its color being due to the imperfectly oxidized albuminoids mixed with an excess of urea. When the patient is down the limbs and whole body are still convulsed at intervals, but are beyond the control of the animal, showing the poisonous effect on the nervous system. The pulse is variable but high and the temperature of the body normal at first, though it rises slightly if the animal survives. Death may ensue in a few hours or days, or improvement manifested at any period may go on to complete recovery. The blood is dark, diffluent, clots loosely if at all, and smells strongly. In some cases of recovery a partial paralysis of the hind limbs or wasting of the crural nerve and muscles above the stifle will sometimes persist for a time, showing structural nervous disease.

Prevention is to be sought by regular daily exercise. In the case of horses which have had a period of absolute repose, submit to walking exercise only, at first, and increase this day by day until they have attained good, hard condition.

Treatment. Clear out the bowels and unload the portal vein and liver by active purgatives. Podophyllin ½ drachm, aloes 4 drachms, may be given by the mouth, and copious injections of soap-suds with oil or salts by the anus until the bowels respond, in which case a favorable termination may be hoped for. Drachm doses of bromide of potassium may be given frequently to calm nervous disorder, and when the bowels have responded half drachm doses of colchicum and drachm doses of muriate of

ammonia three times a day. Warm fomentations to the body, but especially to the loins, are beneficial, alike in soothing irritation in the liver, spinal marrow and kidneys, and in securing a free perspiration and the elimination of morbid matters by the skin. They may be replaced by a newly removed sheep-skin applied with the fleshy side in, and followed by a mustard poultice. When the appetite returns the diet must be of sloppy mashes and moderate in quantity.

In case the paralysis persists after the acute symptoms have subsided, treat as for functional paralysis.

WOOD EVIL. RED WATER OF CATTLE, SHEEP AND PIGS.

Under this name we designate a malady generally described as bloody urine *(hœmaturia)*, but as the liquid does not usually contain blood globules or clots, and as the liver is almost invariably enlarged and softened and the blood elements are largely destroyed, it must be conceded that the affection is more intimately associated with disorder of the hepatic functions than of any other. The cause, which may be stated as feeding on irritant and unwholesome food, is such as is calculated to disorder the digestive organs and liver. The blood seems to suffer secondarily, though it is by no means disproved that other blood-forming functions beside those of the liver are involved. The blood itself is usually thin, watery and comparatively incoagulable, with a deficiency of fibrine, albumen and red globules—the last named elements being smaller than natural and irregularly notched around their margins. The urine varies in color from a simple reddish tinge through the various shades of red and brown to black. It contains albumen and various albuminoid agents, excess of urea, cholesterine and phosphates, implying hepatic disturbance and destructive changes taking place in the blood.

This is essentially a disease of unimproved localities and attacks animals fed too exclusively on products of such land, which are naturally stimulating to the digest-

ive organs and liver. Turnips and other saccharine roots, though perfectly safe from ordinary soils, are dangerous from these, and in the natural meadows and woods the young shoots of resinous trees (coniferæ) and the acrid plants of the *ranunculus, colchicum* and *asclepias* families, etc., are held to produce it. Its prevalence in woods and uncultivated meadows has procured for it in almost all European countries some name equivalent to *wood disease.* An important element in the causation is the existence of soil rich in organic matter and soured by the stagnation of water owing to a clay or otherwise impervious subsoil. Cows are very susceptible just after calving and often perish.

Symptoms. Dullness, languor, weakness, especially of the hind limbs, trembling, surface coldness, staring coat, dry muzzle, hot mouth and horns and diminution of the milk which is white and frothy and may throw down a reddish sediment. Appetite is lost, thirst ardent, pulse small and weak, beats of the heart tumultuous, amounting to palpitation in the parturient cases, bowels at first relaxed afterward costive, abdomen tender, urine passed frequently in small quantity and often with suffering. Colicky pains are often a marked symptom when the irritation of the bowels is extreme. Delirium even will set in in bad cases and death usually supervenes on a state of extreme prostration.

Prevention may be sought in thorough drainage; in restricting the allowance of objectionable food and supplementing it with sound dry grain and fodder; in the avoidance of damp, woody and natural meadows in spring until there is a good growth of grass, and in the rejection of hay from faulty pastures containing an excess of acrid plants.

Treatment. At the onset of the disease nothing succeeds better than a free evacuation of the bowels and depletion of the portal vein and liver by an active purgative. When there is no abdominal pain or other sign of inflammation of the bowels, salts or any other active purgative will suf-

fice, but with colic and tenderness of the abdomen, we must restrict our choice to olive-oil, and other bland materials. In advanced and weak conditions, decoctions of linseed should be resorted to. The animal is to be supported by diffusible stimulants and iron tonics, with chlorate of potassa, and the bowels sheathed and protected by infusions of slippery elm, or mallow, decoctions of linseed, eggs, milk or mucilage; diet should consist of linseed decoctions, well-boiled gruels, bran mashes, and other nutritive and easily digested food.

JAUNDICE. ICTERUS. THE YELLOWS.

This name is given to that condition in which the visible mucous membranes, the skin—if white—the urine and the tissues are stained yellow, orange or brown by bile coloring matter. It is only a symptom of various disorders, but is so specific in its characters that the name bids fair to be retained for the state. It is not caused as once supposed by the non-secretion of bile from the blood, but by the re-absorption of bile already secreted.

This absorption may be determined by various cases. 1. Obstruction of the bile duct, by gall-stones, parasites, foreign bodies entering from the gut, fibrous or spasmodic stricture of the duct, inflammation or ulceration and swelling of the mucous membrane of the canal, or the intestine near the opening, tumors or overloaded intestines. 2. Obstruction of the bowels which hinders the discharge of the bile. 3. Diminished fullness of the capillary vessels of the liver from partial mechanical obstruction of hepatic artery or aorta. 4. Excessive secretion of bile in congested states of the liver.

Jaundice may also result from imperfect metamorphosis of the re-absorbed bile, as in certain fevers (anthrax, Texan-fever, hog-cholera, purpura hæmorrhagica,) in blood-poisoning, (septic matter, snake venom, phosphorus, mercury, copper, antimony, chloroform, ether, carbonic acid). It may farther result from the breaking down

of red blood-globules and liberation of their coloring matter to stain the blood and textures. This may be caused by excess in the blood of water, bile acids (taurocholates) alkalies, nitrites, ether or chloroform. It may result from freezing, burning, (140° F.) and frictional and induction currents of electricity. It is noticeable that the coloring matter in the blood of solipeds is very easily dissolved and that of carnivora only with difficulty. Hence the frequency of a dusky or jaundiced appearance of the membranes in horses and its comparative harmlessness, as contrasted with similar conditions in the dog. It is further probable that the re-absorbed bile acids are transformed into bile pigment in certain states of the blood.

Symptoms. General coloration of all the tissues, but especially the mucous membranes of a yellow, or over large veins of a greenish hue, and also of the urine. When there is obstruction of the bile duct, the dung is devoid of bile, fœtid and often clayey in appearance, but if from other causes it may retain its natural color and odor.

Other symptoms may appear dependent on the nature of the attendant disease, or the poisonous action of the bile acids, and of various diseased products on the blood, while the coloration itself seems to be comparatively harmless.

Treatment. This will depend on the nature of the cause. As a general rule what favors the action of the bowels, the free elimination of the bile, and depletion of the portal vein and liver will counteract the jaundice. Small daily doses of podophyllin, (horse and ox 1 scr.) with one or more ounces each of Glauber, Epsom, and common salt, as may be needful, will often act very efficiently. Or aloes, jalap or calomel, may replace the podophyllin. Taraxacum may be given either in diuretic or purgative doses, or a herbivorous patient may be turned out on a pasturage of dandelion; succulent spring grass indeed is sometimes all that is needed. Diuretics are useful in effecting elimination of the pigment, the carbonates and acetates of po-

tassa, soda and ammonia being especially good. Bitter and other tonics are often valuable in conteracting that impairment of tone which favors congestion and swelling of the stomach, intestine and liver, otherwise the treatment must correspond to the nature of the cause when that can be ascertained.

CONGESTION OF THE LIVER.

This is common in horses in warm climates, where luxuriant grasses (plethora) and hot seasons strongly predispose. Hence, in the Southern States, and especially in localities which are moist as well, and where malarious emanations exist, it may be looked for, but it is also seen in pampered idle animals kept in hot close stables anywhere. Rich food and the comparative absence of waste by exercise and breathing throw too much labor on the liver, which is rendered liable to clogging and congestion. Among the immediate exciting causes may be named sudden changes of temperature, emigration from a cold to a warm damp region, chills in cold dewy nights after hot days, sudden exertion when unfitted for it by long rest and bad condition, exertion under intense heat of the sun, and blows on the region of the liver, particularly on the young. Venous congestion from imperfect action of the heart valves is a cause of hepatic congestion, at once predisposing and exciting.

Symptoms. These strongly resemble the severe forms of poisoning, by imperfectly elaborated liver products, the two conditions being often coexistent and mutually dependent on each other. There are the sudden prostration, dull sunken eyes, pinched anxious face, excited breathing and pulse, trembling, swaying limbs, perspiration, sighing, and violent colicky pains with frequent looking at the flank, lying down and rising. Striking the last ribs with the fist causes flinching, groaning, or even attempts to kick or bite, and some jaundice and furring of the tongue are often seen. When fainting ensues, this with the pallid mucous

membranes and quick, weak pulse, imply rupture of the liver and extensive loss of blood. In the slighter attacks the symptoms are correspondingly mitigated.

The attack may subside and end in complete recovery, or blood effused into the substance of the liver may be slowly absorbed, or organized into fibrous material, or may determine extensive and fatal softening of the liver, or finally the patient may perish in a fainting fit from rupture of the liver and loss of blood.

Treatment. At the outset a free bleeding will often obviate effusion of blood and rupture and check the disease. It must never be resorted to, however, when faintness, a weak, small pulse or a small stream from the orifice implies already existing effusion. Quiet, mustard poultices or other derivatives applied to the limbs and saline purgatives (1 lb. sulphate of soda) by the mouth, and as injections will prove valuable in directly depleting the portal system and liver. Cold water or ice to the last ribs will often serve to check effusion already begun. The sulphate of soda may be kept up in small doses (1 to 4 ozs. daily) and a mustard or other blister may be applied over the region of the liver. During treatment the animal must have the purest air and, as food, soft bran mashes and roots. After recovery feed moderately on sound, easily digested food, keep in pasture or airy stable and never neglect moderate exercise even for a day.

INFLAMMATION OF THE LIVER. HEPATITIS.

Due to the same causes as congestion but much less frequent. In dogs, beside the general causes we must acknowledge the influence of sharp-pointed bodies swallowed in wantonness, and splinters of bones which perforate the stomach and liver.

Symptoms. At first those of slow congestion already referred to. As active inflammation sets in there is less violent pain and excitement and more fever. The pulse is accelerated, the breathing quickened, especially in in-

flammation of the liver capsule, the region of the last ribs is very tender to a blow (on the right side only in ruminants), the mouth hot and clammy, tongue furred, mucous membranes more or less dusky or yellow and the heat of the body raised by 2° or upwards. The bowels may be at first loose, yellow and bilious but soon are confined, the small pellets of dung being covered with a yellowish mucus and this state may again give place to a mucous diarrhœa. Appetite is usually completely lost, emaciation advances rapidly, blood spots and patches appear on the visible mucous membranes, and the legs, especially the hind ones, swell or stock. Great nervous atony, convulsions or even delirium may appear toward the last.

In *dogs* there is great dullness and muscular weakness, inclination to lie constantly, unsteady gait, dusky or yellow membranes, furred tongue, prominence of the last ribs on the right side and tenderness along them and their cartilages. When the disease is fully developed the tumid edge of the liver may be felt behind the last rib and the costal cartilages. A brownish, mucous diarrhœa succeeds to the preliminary constipation. Great nervous prostration and stupor usually precede death. The disease is very fatal in dogs but may merge into the chronic form with ascites or end in a perfect recovery.

Fowls, especially the less lively birds, suffer much from hepatitis when well fed and kept in a small poultry-yard. They may die suddenly of effusion of blood on the liver without any previous signs of illness, or they may droop for some days or even weeks prior to death. Any change in the habits of closely confined, plethoric fowls should lead to suspicion of liver disease. Ruffled feathers, sinking of the head between the wings, sluggishness in running or feeding, drooping in a corner alone, with a withered brownish appearance of the comb and jaundice of the skin are especially to be noted.

Treatment. Bleeding is rarely beneficial and we must rely mainly on depletion from the portal system and liver

by purgatives, or counter-irritants and change of habits. A pound of sulphate of soda may be given at once to the larger animals, or an ounce to a shepherd's dog and an equivalent amount by injection. Podophyllin, aloes, etc., may be used instead. Friction, with loose bandaging of the limbs, with or without excitation with mustard or ammonia and cupping, or in small animals leeching over the region of the liver or mustard poultices are demanded. After the bowels have been freely opened smaller doses of Glauber salts or cream of tartar may be given daily to keep up a free action of the bowels, and throughout the diet must be soft (mashes, roots, green food,) and restricted in quantity. Taraxacum with bitter tonics (Peruvian bark, gentian, columba, gelsemium, etc.,) will be useful during convalescence, and when the herbivorous patient is well enough to be pastured in a field well stocked with dandelion this may be resorted to. In carnivora and swine ipecacuanha and guaiacum are useful in favoring free elimination by the bowels and skin.

Fowls attacked usually die, but the morbid state in which the disease takes its origin may be counteracted in the remaining fowls by a free range, by cabbage, cooked potatoes, turnips and other vegetable food in place of grain, and a small quantity of salt and Glauber salts in the food or water. Excess of common salt is poisonous.

CHRONIC INFLAMMATION OF THE LIVER.

This is seen especially in horses and dogs, the liver often attaining an enormous size or undergoing fibrous degeneration (cirrhosis). It is attended by the same symptoms as the acute form, but these are less urgent and dropsy of the belly and legs is a common result.

It is to be treated in the same manner as the acute form but less energetically, mild laxatives with bitters daily and above all a free range in the open air; for herbivora, sound, juicy pastures and in case of malarious soil or impure water, a change even for a few miles to a higher locality.

RESULTS OF INFLAMMATION OF THE LIVER.

Beside recovery there may be effusion of blood with softening, granular softening, abscess and fibrous induration. These if not promptly fatal give rise to wasting diseases with general symptoms of liver disorder, but into these our space will not permit us to enter. (See the author's large work.)

GALL-STONES. BILIARY CALCULI.

These are especially common in oxen when subject to the dry feeding of winter but are found in all domestic animals, often in great numbers. They occur as round masses, angular masses when they have lain in contact, or as incrustations on the walls of the ducts of which they form distinct casts. They often fail to cause manifest disorder, but if they obstruct the ducts there is acute spasmodic pain in the abdomen, with all the signs of colic, tenderness over the last ribs, and more or less jaundice. The attacks are liable to recur as new calculi are displaced, and the general health suffers. Carnivora vomit, and in all diarrhœa may set in if relief is not obtained. Sheep generally have incrustations when affected with flukes (liver rot).

The formation of these calculi may usually be *prevented* in herbivora by allowing a fair amount of exercise and succulent food, and they nearly always disappear in cattle turned out on the rich grasses of spring. Beside these measures their removal may be sought by the daily use of carbonate and sulphate of soda and common salt, with abundance of good water and exercise. During the attacks give antispasmodics, lobelia, belladonna, hyoscyamus, chloral-hydrate, etc., and keep up hot fomentations perseveringly to the loins and abdomen. Chloral-hydrate and chloroform dissolve cholesterine calculi.

OTHER AFFECTIONS OF THE LIVER, *fatty degeneration*, *tubercle*, *cancer*, *hypertrophy*, *atrophy*, are manifested by the general symptoms of hepatic disorders, but space forbids further notice of them here.

PARASITIC DISEASES OF THE LIVER.

LIVER-ROT. FLUKE DISEASE.

This affection is most destructive to sheep, of which it has destroyed as many as from one to two million head in England alone in certain years. It is immediately determined by the presence in the gall ducts of two flat leaf-like parasites—the Fasciola Hepatica and the Distomum Lanceolatum—the first ¾ to 1 inch in length, the

Fig. 37.

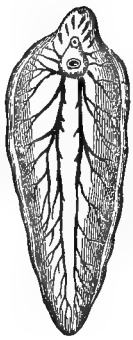

Fig. 38.

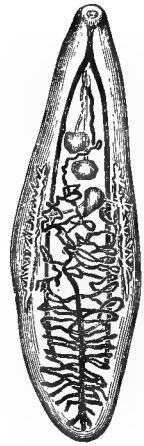

Fig. 37—Fasciola Hepatica. Fig. 38—Distomum Lanceolatum.

second 4 lines. These inhabit the gall ducts of all the domestic animals, of many wild animals and even of man, but in most of these they do little harm. The eggs of these parasites laid in the gall ducts cannot be developed there, but pass out with the bile and dung, hatch in pools of fresh water in which the embryo floats until it finds a mollusk, in which it encysts itself and becomes a brood capsule developing many new embryos within it; these embryos may form new brood capsules and thus increase their numbers materially, or if swallowed by a mammal along with its food or water they develop into the mature

flukes, inhabiting the bile ducts and reproducing themselves only by eggs. The necessity for these intermediate generations, and the fact that they can only take place in fresh water and in fresh water mollusks, points to thorough drainage as the most efficient means of limiting the ravages of the parasites.

In small numbers they do little harm and as they cannot multiply within the body their presence may be of no consequence, but when present in large numbers they become most destructive. In certain damp lands stocked with these parasites sheep cannot live, no matter how well fed, and cattle often perish as well. A single infested sheep brought on such damp lands will speedily stock them, as infested German rams did the colony of Victoria in 1855.

Symptoms. Sheep may thrive unusually for a month or two, but soon they begin to lose flesh and waste with a rapidity that is surprising. The skin and the membranes of the nose and eyes become soft and puffy, the naturally bright pink vessels of the eye become yellowish, dark, or even quite imperceptible, the whole eye assumes a yellow tinge, the skin is pale, bloodless, deficient in yolk or oil, dry and scurfy. The wool loses its brilliancy and comes out easily when pulled. The muscles waste, the animal is *razor-backed*, the hip-bones project, and the flank becomes sunken, the belly pendent and the back drooped from dropsical effusion. Similar effusions take place in the chest beneath the abdomen and breast-bone and under the lower jaw. The head is no longer carried erect, the expression of the face is haggard and hopeless, the appetite capricious, thirst ardent, and there is occasional diarrhœa. Examination of the dung detects myriads of microscopic eggs $\frac{1}{180}$ inch in diameter.

Treatment. Almost all the tonics of the pharmacopœia have been employed with more or less effect, but all usually fail when many parasites have gained access to the

system. The following is a good example of a tonic mixture:

Linseed, rape, pea, oat, barley, or unbolted wheat flour,	40 lbs.
Powdered gentian or anise seed,	4 "
Common salt,	4 "
Sulphate or oxide of iron,	1 "

Give half a pint daily to each sheep.

In all treatment it is essential to remove from the infested meadow to a perfectly dry pasture or salt marsh on either of which the eggs of the fluke will perish. To turn on a wet fresh pasture is merely to stock that with the parasites.

Prevention. Keep sheep on high dry pastures or salt marshes where the fluke cannot live out of the body Feed salt daily if flukes exist to however limited an extent; this is fatal to the young flukes and will destroy most of them as they are taken in. Thorough drainage of infested pastures will make them wholesome. This may fail when land is subject to inundations, and in this case such land should be devoted to raising hay or other crops. Keeping the sheep off the infested fields at nights and until the dews leave the grass in the morning will go a long way towards protecting them. In some instances of the introduction of this parasite into a new country the contaminated sheep should be destroyed and the infested pasture with a wide area around it proscribed from being grazed.

For other parasites of the liver, see general article on "PARASITES."

CHAPTER XI.

DISEASES OF THE PANCREAS AND SPLEEN.

Diseases of the pancreas: inflammation, degeneration, calculi, etc. Diseases of the spleen: tuberculous, cancerous, glanderous, inflammatory, congestive, apoplectic. Hypertrophy, Atrophy, Lymphadenoma, Leukæmia.

DISEASES OF THE PANCREAS.

Though subject to a variety of diseases as shown by the existence of abscess, tuberculosis, sarcoma, melanosis, cancer, calculi and worms (Sclerostomum Equinum) after death, this organ is so deeply seated and the result of its disorder so little manifest, that its pathological states usually pass without recognition during life. One symptom only is characteristic—the passage of much undigested fat with the dung. The fatty aliment is mainly emulsionized by the pancreatic juice, and its presence in the stools unchanged may be held to imply suppression of that secretion. If this condition coincides with general fever, colicky pains, and tenderness behind the last rib on the right side, *inflammation* of the gland may be suspected; if with sharper colic but without fever, *obstruction of the pancreatic duct by calculi* will be suggested.

Inflammation should be treated on general principles by laxatives, blisters to the right side of the abdomen and spare diet; *Calculi* by antispasmodics and fomentations as for gall-stones; and simple *suppressed secretion* by *sulphuric ether.*

DISEASES OF THE SPLEEN (MILT).

These are if possible even more occult than those of the

pancreas. And yet this organ is involved in nearly all diseases of the liver, in specific fevers due to a poison in the blood, and in disorders of the lymphatic vessels. Obstructed circulation through the liver sends the blood back on this organ and over-distends it almost to rupture.

Advanced tuberculosis and cancer rarely fail to show secondary deposits here. Glanders sometimes shows the same tendency. Anthrax and anthracoid affections and, to a less extent, other specific fevers, lead to enlargement and even rupture of the spleen, in connection with the long retention of the blood and disease poisons in its venous cavities. Of particular diseases the spleen suffers from *wasting* in starved animals, from extraordinary *increase* in the highly fed, and from changes of structure such as *glandular degeneration and enlargement (lymphadenoma).* Several of these diseases, and notably the latter, are associated with an excess of white globules in the blood, *(leukæmia)* which condition revealed by the microscope may assist in diagnosis.

We can do little for these affections besides giving attention to the general health, by tonics and a sound hygiene.

CHAPTER XII.

DISEASES OF THE URINARY ORGANS.

General causes and symptoms. Examination of the urine. Diuresis, Diabetis Insipidus, Polyuria. Bloody urine, Hæmaturia. Simple inflammation of the kidneys, Nephritis. Bright's disease, Desquamative Nephritis Albuminuria, Albuminous urine. Spasm of the neck of the bladder. Paralysis of the bladder. Inflammation of the bladder, Cystitis. Inflammation of the Urethra, Gonorrhœa, Gleet. Stricture of the Urethra. Eversion of the bladder. Urinary Calculi, and gravel, Stone in the kidney, ureter, bladder, urethra and prepuce,—in horses, cattle, sheep, pigs and dogs.

Diseases of the urinary organs are not infrequent in the domestic animals, though less prevalent than in man. They prevail above all in certain localities, as: on the magnesian limestones, in company with goitre, on lands abounding in diuretic or resinous plants or water, in damp regions where fodder is secured in a wet, musty condition, where it is fed covered with hoar-frost, or where frequent cold rains and winds repress the perspiration and throw undue work on the kidneys. Feeding to excess on aliments rich in phosphates of lime and magnesia—bran, beans, peas, vetches, etc.,—the habitual privation of water, injudicious dosing with diuretics, diseased heart and lungs which throws the blood back on the veins and determines passive congestion of the kidneys, diseases of the liver which interfering with the oxidation of albuminoids predispose to urinary deposit, and finally mechanical injuries to the loins or pelvis all tend to induce various urinary diseases.

General Symptoms. With most acute inflammations there is a stiff straddling gait with the hind limbs, the

loins are tender, as ascertained by pinching on the spines or the transverse processes of the backbone, there is less difficulty experienced in backing than when there is sprain or fracture of the back or loins, and the animal is more likely to lie down though it costs an extra effort to rise, there is straining to discharge urine, which is passed in excess, in deficiency, in jets, in dribblets only, or not at all. In the larger animals the bladder and its excretory duct (urethra) are easily and satisfactorily examined by the hand introduced through the rectum or vagina and any tenderness, flaccidity, swelling, over-distension or foreign agent (stone) is easily made out. In the smaller breeds of horses and cattle even, the kidneys may be reached in this way and any heat, swelling, tenderness, etc., perceived. Then brain disease, dropsies and skin eruptions are common results of urinary disorder.

Examination of the Urine. But a certain class of urinary diseases are only to be made out by examination of the urine. Beside the modifications of quantity and flow already referred to, this may be altered: 1*st, in color,* as *white* from saline deposits, *brown* or *red* from blood clots and coloring matter, or from imperfectly oxidized albuminoids, *yellow* or *orange* from bile or blood pigment, *pale* or variously tinted from vegetable colors taken with the food: 2*d, in density* as measured by a hygrometer (urinometer), the natural urine being in the horse and ox 1030 to 1060, pig and goat 1010 to 1012, dog 1020 and cat 1058: 3*d, in chemical reaction,* acidity or alkalinity, as ascertained by blue litmus or red test-papers (healthy herbivorous urine is alkaline, turning the red papers blue unless after prolonged abstinence or a flesh diet; carnivorous and omnivorous urine is acid excepting when confined to a vegetable diet): 4*th, in organic ingredients,* as when it contains albumen (coagulable by boiling or by strong nitric acid or in the horse giving the liquid a ropy consistency), sugar, blood, bile, cylindroid microscopic casts of the uriniferous tubes or the eggs or bodies of worms: 5*th, in its salts*

which may crystallize out in the system or at once after the liquid is discharged, or after cooling, or finally may have to be precipitated by chemical reagents.

DIURESIS. DIABETES INSIPIDUS. POLYURIA.

Excessive secretion of urine. This may occur in any animal from agents, medicinal or alimentary, which unduly stimulate the kidneys. The horse, however, is the most frequent sufferer, being more than any other animal subjected to reckless dosing by those about him with private nostrums and much advertised quack preparations, and to the exclusive use of musty and injured hay and grain. Musty hay, grain or bran is perhaps the most common cause, the noxious agent being probably the cryptogams produced on this damp, heated fodder. Musty oatmeal will even affect the human being. New oats, very watery food like the refuse of distilleries, and cooked food, seleniteous waters, acrid diuretic plants in the pastures or hay, exposure to extreme cold and wet, and excessive thirst consequent on feeding salt or on irritation of the stomach are other causes. Whole flocks of sheep sometimes suffer at once from acrid plants eaten.

Symptoms. Frequent—often almost constant—passage of a very pale-colored urine in large quantities and of low specific gravity, insatiable thirst, rapid falling off in condition and spirits, sluggishness and weakness at work and perspiration on the slightest exertion. The discharges are comparatively inodorous and more like water than horse's urine, and contain little solid matter though the quantity of solids passed in twenty-four hours is in excess. The skin becomes rough and hide-bound and all the signs of ill-health set in, though the animal may suffer and survive for months or even a year. More commonly he dies early of exhaustion, or glanders supervenes and kills the patient.

Treatment is very successful in the early stages. Stop the use of faulty food and drugs and give dry wholesome

hay and grain with no suspicion of newness or mustiness Give a decoction of flaxseed freely with the water drunk, with phosphate of iron 2 drachms, Peruvian bark 4 drachms and iodide of potassium 2 drachms daily. Creosote may often be added with advantage.

BLOODY URINE. HÆMATURIA.

This occurs after sprains of the loins or blows on this region, with stone in the kidneys, urinary passages or bladder, cancer, tubercle or even abscess of the kidney, etc., or lastly some poisoned condition of the blood, as in malignant anthrax. Acrid diuretic plants, cantharides, May-bugs, etc., are occasional causes. When bleeding occurs from local irritation or in a tolerably healthy state of the blood it is partly at least in the form of clots and fibrinous casts of the uriniferous tubes, about one-hundreth inch in diameter, and entangling blood-globules. If from poisoned and disintegrating blood, there is a diffuse coloration with hæmatine, with perhaps fragments of blood-globules, but rarely perfect ones, clots or casts, and a similar oozing of blood is liable to take place at other parts of the body. The blood-coloring matter is easily distinguished from bile by chemical tests. It is less easily distinguished from the brownish-red albuminoids which escape by the kidneys in Azotæmia. Beside the passage of blood there may be the general signs of urinary disorder, but these are not constant. When gravel coexists gritty masses pass with the urine or collect on the hair of the prepuce.

Treatment. Remove the causes, give comfortable, dry dwellings, sound food, mucilaginous drinks (linseed tea, mallow, gums, elm, etc.,) and acid astringents (tincture of chloride of iron, sugar of lead, vinegar, buttermilk and oak bark). In profuse discharge cold water may be applied to the loins, while in inflammatory cases a sheep-skin or poultice may be first used and followed by a mustard plaster. (See AZOTÆMIA AND RED-WATER).

NEPHRITIS. SIMPLE INFLAMMATION OF THE KIDNEYS.

Causes. Blows or sprains in the region of the loins, stone in the kidneys, use of diuretics to excess, musty fodder, irritant or acrid plants in hay, too extensive blisters of Spanish flies, paralysis of the spinal cord.

Symptoms. A variable but often very high fever, heat or even swelling of the loins, tenderness often extreme beneath the bony processes about six inches from the spine, a stiff, straddling gait with the hind limbs, little marked in chronic cases but so severe as to amount almost to helplessness in the worst, the loins arched, progression difficult and attended in some cases by groaning, there is looking at the abdomen and colicky pains, more severe at one time than another. If the patient lies down it is with caution. In males there are alternate retraction and descent of the testicles, and in all there is likely to be frequent passages of urine in small amount, of a very high color and density, and containing fibrinous casts of the kidney tubes one-hundreth of an inch in diameter, and sometimes blood or even pus. The bowels are costive and there is a rapid pulse, an elevated temperature and excited breathing. The legs tend to swell uniformly from the foot up, and swellings may appear under the chest or belly, or even in internal cavities.

General ill-health, with stocking of the legs, casts in the urine and some tenderness of the loins to pressure, may be all that is seen in the chronic cases.

Treatment. In acute cases, with strong pulse and robust patient, an immediate advantage may be gained by bleeding, but this is rare. Give a laxative of olive-oil or raw linseed-oil, or in case of necessity of Glauber salts or aloes, accompanying this with an anodyne, (opium, belladonna, tobacco,) throw anodyne and mucilaginous injections into the rectum, and cover the loins with a fresh sheep-skin, the fleshy side in, or with a soothing poultice or fomentations, following this up in six or eight hours by a mustard poultice. Mucilaginous drinks may be given

freely, but diuretics are to be sedulously avoided and warm clothing used to favor sweating and thus relieve the kidneys of work. Laxatives and anodynes must be repeated as may seem necessary and finally a course of bitter tonics may be allowed.

ALBUMINURIA. BRIGHT'S DISEASE. DESQUAMATIVE NEPHRITIS.

This consists in inflammation of the kidneys, acute or chronic, with degeneration and shedding of the epithelium from the kidney tubes.

Symptoms. More or less awkwardness of gait behind, and tenderness of the loins, in some cases indisposition to lie down, thick, gelatinous, ropy urine, with microscopic casts of the kidney tubes, containing much spherical epithelium and granular matter. The urine coagulates in part in whitish flakes when boiled, or under the action of corrosive sublimate, acetate of lead or nitric acid. The general health suffers and the patient dies sooner or later of uræmia with dropsy, or of some other affection which has been aggravated by the impaired vitality and the excess of the elements of urine in the blood.

Treatment is not always satisfactory, though a certain proportion recover. Avoid exposure to cold, keep in a warm box and warmly clothed. Keep the bowels acting freely by a restricted diet of warm bran mashes, etc., or even by laxatives. Give tonics (phosphate of iron, quinia, willow bark,) and mineral acids and use mustard applications to the loins. If the kidneys fail to act, do not give diuretics, but use cupping over the part, or hot fomentations with water, or better still a strong infusion of digitalis.

Albuminous Urine, which is always ropy in horses, is no proof of the existence of Bright's disease, but is an attendant on nearly all extensive inflammations of important organs, on rheumatism, fevers and certain poisoned conditions of the blood.

SPASM OF THE NECK OF THE BLADDER.

Causes. Prolonged retention of urine in mares at work or in horses hard driven. Chill when heated. Nervous irritation. Is a common attendant on severe colic and gives way when that is relieved. Males suffer most frequently.

Symptoms. Frequent attempts to urinate, which prove ineffectual or secure a dribbling only after much pain and straining. There may be anxious looking at the flank and uneasy shifting of the limbs, or in cattle twisting of the tail. There is tenderness in the back part of the abdomen in the median line below. The hand, oiled and introduced into the rectum, will feel the distended bladder, with its firm dense neck and no enlargement either there or backward in the urethra, as from stone.

If unrelieved the bladder becomes immoderately distended and finally bursts, especially in ruminants. This is followed by tenderness of the abdomen, febrile symptoms, dullness and languor, and if the bladder is examined it is found to be flaccid and tender. Perforation of the lower part of the abdomen with the nozzle of a hypodermic syringe allows the escape of urine, easily recognized by its odor.

Treatment. Spreading fresh litter under the horse will sometimes induce staling. If not, use antispasmodics introduced by the rectum or even by the mouth (opium, laudanum, belladonna or hyoscyamus extract, tobacco smoke or solution, chloral-hydrate, lobelia, prussic acid, cyanide of potassium, etc.) Solutions of any of these agents may be rubbed on the perinæum. Sometimes the spasm will give way under gentle pressure on the bladder with hand or finger in the rectum. Finally, all other measures failing, the urine may be withdrawn with a well-oiled catheter. This should be $\frac{1}{3}$ inch in diameter for the horse, $\frac{1}{4}$ inch for the bull and a line for the dog. Contrary to the usual statement a small catheter may be passed in the bull when the penis is sufficiently extended

to efface the S-shaped bend of the penis. In the mare the spasm may be overcome by the insertion of one or two fingers through the opening which is found in the median line of the floor of the passage about four inches from the external orifice. In the cow care is required to enter the central orifice as there is a blind sac on each side.

PARALYSIS OF THE BLADDER

May occur from excessive over-distension, in connection with lock-jaw or rheumatism which prevents stretching to stale, with cystitis implicating the muscular coat, spasm of the neck of the bladder, or decomposition of the urine. It is attendant on disease or injury of the terminal part of the spinal cord, on broken back, etc., and is then associated with palsy of the tail and it may be of the hind limbs.

Symptoms. If the neck is involved the urine dribbles away constantly, without straining, is discharged in the sheath and runs down inside the thighs causing irritation and inflammation in both. If the neck is unaffected the urine accumulates in the bladder, causing over-distension, irritation and rupture. The urine decomposes, setting free ammonia which softens and dissolves the epithelium and establishes the worst type of cystitis.

Treatment. In cases of broken back or disease of the spinal cord attention must be given to that and, if remediable, the urine must be drawn off frequently with a catheter to prevent over-distension and injury to the bladder. In local paralysis, or after the spinal cord has recovered, apply a blister (mustard) between the thighs beneath the anus or vulva or over the back part of the belly inferiorly. Give belladonna extract (1 to 2 drachms), cantharides (1 to 3 grains) or nux-vomica (½ drachm for large herbivora). Use electricity.

INFLAMMATION OF THE BLADDER. CYSTITIS.

Causes. Abuse of diuretics, acrid diuretic plants in

the food, the application of blisters (Spanish flies, turpentine,) over too extensive surfaces, prolonged retention and decomposition of urine, irritation from stone in the bladder, etc.

Symptoms. If confined to the mucous membrane urine is passed frequently, painfully, in small quantities, with more or less floating mucus and flat, microscopic, fibrinous shreds of exudation entangling columnar or scaly epithelium. The bladder is very tender to the touch and if the finger is passed into it in the female its neck and walls are felt to be thickened, sometimes enormously. There are colicky pains, frequent looking at the flanks, uneasy movements of the hind feet or twisting of the tail. The gait is stiff and straddling. There is fever, usually slight. If the muscular coat is involved there is distension of the bladder, and if the neck participates the urine escapes involuntarily. If due to unrelieved stone that will be found on examination.

The case is most hopeful if due to irritants or some clearly removable cause.

Treatment. Remove the cause, whether food, drugs, blistering agents on the skin, stone, gravel or retained and decomposed urine. Give spare, soft, aqueous diet with mucilaginous agents (linseed decoction or tea, slippery elm, gums, etc.,) laxatives of olive or linseed-oil, soft pure water at will, and mucilaginous and anodyne injections into the bladder (gum Arabic 1 drachm, opium 1 drachm, tepid water 1 pint). Blisters may be used in paralysis. In severe cases these may be preceded by fomentations. Finally, when the acute symptoms have subsided, small doses of stimulating diuretics (copaiva, cubebs, juniper, buchu,) will often serve to tone up the mucous membrane.

INFLAMMATION OF THE URETHRA. GONORRHŒA. GLEET.

Causes. Like cystitis this may depend on irritants in the urine, taken by the mouth or applied to the surface, excessive copulation, connection with a newly-delivered

female or one that has otherwise contracted a vaginal discharge, mechanical injury to the penis in serving females, irritation from the passage or arrest of small stones or gravel.

Symptoms. Swelling and soreness in the sheath and penis, pain in urinating, the liquid coming in jets and frequently arrested because of the suffering. In dogs there is continual licking of the organ and soon a creamy pus drops from the orifice.

Treatment. If before the discharge of pus, give a laxative and foment the parts with warm water. Wash out any gravel. If after suppuration, use soothing or astringent injections (permanganate of potassa, acetate of lead, sulphate of zinc or nitrate of silver, 2 grains to 1 oz. water). Tonics and stimulating diuretics may be finally needed as in cystitis. A soft restricted diet is demanded.

STRICTURE OF THE URETHRA.

Usually a result of local irritation:—gravel, strong astringent injections used in the early stage of gonorrhœa or the healing of ulcers formed when that disease is neglected.

Symptoms. Great difficulty in urination, the liquid escaping in a fine stream and with pain. Frequent painful erections.

Treatment. Passing, daily, catheters of gradually increasing sizes, beginning with one just large enough to enter with gentle force.

EVERSION OF THE BLADDER

Can occur only in the female, from severe straining in irritation of the urinary organs, and especially after the organ has been rendered torpid or paralyzed by over-distension, severe parturition or otherwise. The animal strains violently and a red, tumid, rounded mass appears from between the lips of the vulva. On examining its surface near the neck the two orifices of the ureters may be detected with the urine oozing from them in drops.

Treatment. Wash with milk-warm water containing laudanum, and return, pressing the centre of the mass inward so as to correct the eversion. The main difficulty will be met in returning it through the contracted neck of the bladder, and if the eversion has lasted long enough to determine inflammation and softening great care will be requisite to avoid tearing the coats. Should straining be so violent as to threaten renewal of the eversion a truss may be applied as advised for eversion of the womb.

URINARY CALCULI AND GRAVEL. STONE.

These vary in chemical composition with the genus of animal and especially with the nature of the food. In herbivora the urine normally contains a large amount of the carbonates of lime and magnesia and of oxalate of lime, a small quantity of silica, sulphate and phosphate of lime, ammonio-magnesian phosphate, hippuric acid and sometimes uric acid, besides the more soluble alkaline salts. Carnivora, on the other hand, have an excess of phosphate of lime and magnesia, of sulphates and chlorides, more uric acid than the vegetable feeders but a minimum amount of carbonate and oxalate of lime and silica. The omnivora occupy an intermediate position, the salts of the urine varying with the frequent changes in the food.

The nature of the food determines the excess of particular salts in the urine and their precipitation in the form of crystals.

These *carbonates of lime and magnesia* which make up the bulk of most urinary calculi in horses and ruminants are due to the large amount of vegetable acids (citrates, tartrates, malates, acetates, etc.,) in plants. These becoming further oxidized are transformed into carbonic acid which unites with the magnesia or lime present in the blood.

Oxalate of lime is due to imperfect oxidation of the vegetable acids, oxalic acid containing an equivalent less of oxygen than carbonic acid. It appears in excess in cer

tain diseases of the lungs or other conditions which interfere with respiration.

Silica enters the system as silicate of potassa in food and water and especially in cyperaceæa, horsetails, oat-straw, oat-meal, etc. It is displaced as silica whenever it comes in contact with a stronger acid.

Phosphates enter the system in bran, in beans, peas, and the leguminous seeds generally, in oil-cake and rape-cake, or (the carnivora) in the flesh and bones. When present in undue amount in a given quantity of urine they tend to crystallize out, but when a large amount of phosphate of magnesia is present, it is only necessary that the urine should be retained longer than usual in the bladder and that decomposition should set in with evolution of ammonia, to have the insoluble ammonia-magnesian phosphate at once thrown down.

Sulphate of lime is derived from sulphates in the water or the oxidation of sulphur contained in the albuminoid principles of food.

Urea, Uric Acid, Hippuric Acid, Creatine, Creatinine, Kiestine, Leucin, Tyrosin, etc., are all nitrogenous elements, derived from the waste of muscle and gelatinous tissues, or from albuminoid matters in the food. Urea is to be looked on as the healthy product of such decomposition, while uric and hippuric acids, etc., are products in which the process of oxidation has stopped short, leaving the products in a less soluble condition and more liable to crystallize out of the urine. Impaired breathing from diseased lungs or otherwise and imperfect action of the liver, whether from local disease in that organ or from feverish states, with impaired functions generally, are therefore among the causes which strongly predispose to urinary calculi.

Beside these a certain amount of *mucus, fat, coloring matter* and even *blood* enter into the formation of urinary calculi.

Accessory Causes. To the above named causes favoring

the formation of urinary calculi, may be added all such as favor concentration of the urine. Thus scarcity of drinking water, excessive loss of liquid by the bowels or skin, (diarrhœa, dysentery, etc.,) dry winter feeding on hay and grain, feverish states in which little urine is secreted, and hard waters appear to have this effect. The last named cause is not generally credited by physicians but its coincidence with the prevalence of stone is exceedingly common.

Mode of Formation. The first requisite is that some solid body should exist as a nucleus around which layer after layer is crystallized, and hence the stone is always composed of a series of concentric layers. The nucleus may consist in a particle of mucus, fibrine or blood, a crystal deposited from over-saturated urine, or even a foreign body introduced from without. I have seen a large calculus in the kidney of a deer formed around a piece of wood which must have penetrated the kidney and broken off, while the wound by which it entered had healed up.

Appearance. Calculi vary much in character but the most marked varieties are the smooth stones formed by carbonates, oxalates, phosphates and silica, and the rough jagged crystalline specimens of ammonio-magnesian phosphates.

Renal Calculi. Those found in the kidney are usually moulded in the pelvis, though I have found many like small lentils in dilatations of the microscopic tubes in the substance of the gland. Cattle fed on dry hay and grain, during winter, rarely want small yellow crystalline masses in the pelvis. Even when so large as to distend the pelvis and weigh several ounces they are not always incompatible with good health and aptitude to fatten. When so large or rough as to produce manifest disorder, this appears as irritation of the kidneys, tender loins, stiff straddling gait, etc., with the passage of microscopic crystals, and perhaps blood or pus in the urine. In cattle and sheep the salts from the concentrated urine usually crys-

tallize out on the hairs around the opening of the sheath. All species of domestic quadrupeds suffer.

There is no satisfactory *treatment* and the great object is to prevent their formation by the measures named below.

Ureteral Calculi. These are lodged in the small canals which convey the urine from the kidneys to the bladder. They are usually formed in the pelvis of the kidney and being washed on with the urine are arrested in the ureter. The symptoms are more violent than those of renal calculi, since the flow of the urine is checked and the ureter and pelvis of the kidney are over-distended, while the kidney itself undergoes inflammation and, if the animal survives, is finally removed by absorption, the opposite kidney meanwhile enlarging and doing the work of two. The colics and general symptoms are like those of nephritis. The elastic distended ureter may sometimes be felt with the oiled hand introduced through the rectum. Like renal calculus this is usually irremediable. Antispasmodics will sometimes succeed by relaxing the duct and allowing the accumulated urine to pass the obstruction onward. They are best given by injection into the bowel. If nephritis sets in the treatment must correspond.

Cystic Calculus. Stone in the Bladder. Seen in all domestic animals.

Symptoms. Frequent straining to pass urine, which escapes in dribblets, in jets checked by a sudden arrest, or not at all. Blood in clots, and microscopic crystals or calculi usually pass with the urine. Examination with the oiled hand in the rectum will detect the rounded mass in the bladder, especially if it is partially filled with water. In the female it may be struck by a smooth metallic sound, or even touched with the finger.

Treatment. By breaking the stone into small pieces which may pass with the urine *(lithotrity)*, or by extraction whole after dilatation or cutting of the passages *(lithotomy)*. *Lithotrity* is effected with the lithotrite of the

surgeon and is only applicable to the female quadruped, in which extraction is usually easy and safe. A pair of long, round-bladed tongs like a glove-stretcher may be used to slowly dilate the neck of the bladder, after which the warmed and oiled forceps, the blades of which should be broad enough to cover the stone, are introduced and the stone being seized is slowly withdrawn by gentle oscillating movements. The injection of a little warm water into an empty bladder will greatly facilitate the seizure of the stone. The *male* is operated on standing or thrown on his right side. A *catheter* is passed up the urethra to the point where it bends forward over the hip bones and an incision about two inches long made down upon this in the median line. If the stone is small the forceps may now be introduced and the calculus withdrawn as in the female. If too large for this the passage must be dilated with a probe-pointed knife, guided by a grooved director or the index finger, the incision being carried obliquely between the point of the hip-bone and the anus. The stone once removed the opening may be stitched up and treated like any ordinary wound. In the ox a catheter should be passed as a guide in cutting, as the thickness of the erectile tissue over the arch of the hip bone and the small size of the urethra render the operation far more difficult than in the horse. (For further particulars see the author's larger work).

Urethral Calculi. Stone in the canal by which urine is discharged from the bladder. In horses these are found in the terminal end of the urethra and its papillæ on the glans penis. In the bull and ox in the S-shaped bend of the penis just above the scrotum, and in the ram in the same situation or, more frequently, in the vermiform appendix at the point of the penis. In horses the straining is violent and constant, in cattle and sheep it is little marked, but the tail is slightly raised and the accelerator urinæ muscle is seen contracting just beneath the anus as in ordinary urination. Examination along the course of

the urethra will detect one or more hard nodular enlargements at the S-shaped curve or elsewhere. If more than one are present, they may be made to grate on each other.

Treatment. If in the papilla or vermiform appendix, try to extract by manipulation. Should this fail, slit open the duct, or in the ram cut off the appendix. If higher up it must be cut down upon, through the skin, and extracted. In cattle it is desirable to first pull the penis backward or forward so that the incision may clear the scrotum with its excess of areolar tissue and fat.

PREPUTIAL CALCULI. STONES IN THE PREPUCE OR SHEATH.

In oxen and sheep urinary salts often crystallize out on the hairs and may even block the passage somewhat. They are easily removed by manipulation or with scissors. The accumulations of sebaceous matter, in the bilocular cavity on the end of the penis or in the sheath of the horse, sometimes receive this name. They are best removed by thorough washing with soap and warm water, and the parts may then be lubricated with sweet-oil.

SAND-LIKE DEPOSIT OR SOFT MAGMA IN THE BLADDER.

This is frequent in the horse, the spherical granules of carbonate of lime and magnesia remaining apart instead of becoming agglutinated into a stone. Its mildest form is shown in the passage of a white matter at the completion of the act of urination. When accumulated so as to fill half of the bladder or more, this comes away in large amount and is found within the sheath and on the inner sides of the thighs, for the urine escapes involuntarily and continuously.

Treatment. Wash out the bladder by pumping water through a catheter by means of Reed's stomach pump or a syringe, then shake it up with the hand introduced through the rectum and allow the muddy liquid to flow out through the catheter. Repeat this until the bladder is emptied and the water comes away clear.

Prevention. The next point is to prevent its forming anew by measures calculated to obviate urinary calculi in general. Correct any fault in feeding—excess of beans, peas, bran, etc.,—and any disorder in the liver functions. Give abundance of soft water, encouraging its ingestion by a fair supply of salt, let the food be aqueous, consisting largely of roots, especially carrots, and give daily in the drinking water 1 dr. caustic soda or potassa, or common ashes from hard wood. A course of bitters should also be given (cascarilla, columba, willow bark, gentian, quassia or others).

CHAPTER XIII.

DISEASES OF THE ORGANS OF GENERATION.

General causes. Inflammation of the testicle. Dropsy of the scrotum, Hydrocele. Water stones. Tumors of the sheath. Disease of the penis. Ulcers of the penis. Castration of males. Evil results of castration. Strangulated cord. Swelling of the sheath. Phymosis. Paraphymosis. Tumor on the spermatic cord. Castration of females. Castration of male birds. Abortion. Difficult parturition. Premature labor pains. Induration of the neck of the womb. Twisting of the neck of the womb. Polypus in the vagina. Wrong presentations, deformities, etc. Maxims for assisting in difficult parturition. Anterior presentation with head or fore limb turned back. Posterior presentation with one or both hind limbs turned back. With water in the head or abdomen. Disorders following parturition. Flooding. Retained afterbirth. Leucorrhœa, catarrh of the womb or va gina. Eversion of the womb or vagina. Inflammation of the womb, Metritis. Parturition fever, milk fever, parturient apoplexy.

Are mostly confined to breeding and dairying districts. They are largely obviated by castration and the virgin condition. Amongst the principal causes may be mentioned mechanical injuries, excitement and irritation accompanying coition, gestation, parturition, over-officious or ill-directed assistance in delivery, a very rich or poor diet, tuberculosis, poisons, (ergot, savin, rue, cantharides, etc.,) sympathetic irritation from excessive milking, from disease or injury of the mammary glands, of the urinary organs or of the rectum.

INFLAMMATION OF THE TESTICLE.

Occurs mainly from external injury, though it may be roused by excessive copulation, or by glanderous deposit or other diseased process in the organ. The animal moves

stiffly and with a straddling gait, and the testicle is enlarged, tender and frequently drawn up and dropped down again. It is to be treated with a dose of purgative medicine, restricted soft diet, fomentations with warm water, and smearing of the bag in the intervals with extract of belladonna, laudanum or some other anodyne. Should fluctuation announce the formation of pus, make an opening with a sharp knife to evacuate it, while if destruction of the gland is threatened castration must be performed.

HYDROCELE. DROPSY OF THE SCROTUM.

Usually associated with water in the abdomen. Distinguished from scrotal hernia by not passing back with a sudden movement but with a steady current and gradual diminution. The same treatment is needed as in ascites.

WATER STONES.

In geldings a considerable accumulation of water often takes place in multilocular cavities connected with the still pervious inguinal canal, which may be emptied by compression, the water returning to the abdomen with a continued thrill. They often disappear in winter to reappear the following summer. Though not injurious they may be removed by cutting down on the cavities and dissecting out the sacs.

TUMORS OF THE SHEATH.

These are easily removed by twisting them off. Some, however, bleed freely and these should have a stout waxed twine tied firmly round their necks and be then twisted or allowed to drop off. If bleeding occurs after removal seize the bleeding orifice with forceps and tie with a waxed thread.

DISEASE OF THE PENIS.

Small warty growths may be cut off with scissors or knife and the part cauterized with lunar caustic. The

soft condylomatous growths which occur in dogs may be treated in the same way. But when the large cauliflower-like masses are associated with hardening of the whole end of the organ, it must be amputated behind the indurated portion. The subject should be prepared by laxative diet, and, having been thrown, the yard is withdrawn, washed, and cut through gradually, beginning at its upper part and tying the arteries as they are reached. On reaching the urethra at the lower part of the yard it is to be dissected out, and cut across so as to leave it ¾ of an inch longer than the rest. Considerable bleeding from the venous cavities may come on a few hours later, and especially in hot weather, but may be easily controlled by dashing cold water between the thighs or stuffing the sheath with tow saturated with tincture of matico or muriate of iron.

ULCERS OF THE PENIS.

These may arise from accumulation of sebaceous matter but more frequently from the irritant discharges in a female recently delivered or suffering from leucorrhœa. They may be treated with a lotion such as the following:—sugar of lead, 1 dr.; carbolic acid, 60 drops; chloral-hydrate, 1 dr.; water, 1 pint.

CASTRATION OF MALES.

Numerous modes of castrating the male are followed, but in all the essential points are the removal or destruction of the testicles and the prevention of bleeding from the spermatic artery which is always found in the anterior portion of the cord. In small animals (pigs, lambs, calves, dogs, cats,) the testicle is seized so as to render the skin tense, and a free incision with knife parallel to the median line sets it free at once. The knife is now passed between the middle and posterior parts of the cord and the latter cut through. The anterior portion is then twisted and finally torn through, the upper part being

held by the finger and thumb of one hand while traction is made by the other. In the colt and old horses and bulls the structures are so tough that the cord must be seized by two pairs of pincers in order to accomplish satisfactory twisting.

Clamps (sticks) are very generally employed in horses, the important considerations being that the wood shall be tough and unyielding, that they shall be grooved to give greater security of hold, that they shall be tied together with well twined inelastic cords, and that when applied they shall be squeezed together with pincers, while the end is being tied, that the included tissues may have their vitality destroyed.

The other methods of tying, searing and scraping the artery, etc., cannot be described here, though one plan will succeed as well as another if properly done. For these and castration of *cryptorchids* (originals, rigs,) see larger work.

EVIL RESULTS OF CASTRATION.

Strangulated Cord. When the cord is left unduly long and the wound in the skin small, it may be strangled by the swelling and contraction, giving rise to intense suffering and high fever. The beast walks with a stiff gait, and the end of the cord is felt red and tense, protruding from the wound which grasps it tightly. All that is necessary is to enlarge the orifice with a knife and push up the cord to give permanent relief.

Swelling of the Sheath may occur, and especially in the young, from unhealthy states of the system, or from premature closure of the wound and imprisonment of matter. In all such cases reopen the wound with the fingers and apply fresh lard to prevent a second adhesion. It is a good plan to apply lard to the wounds in castrating to obviate adhesion. Next foment the parts continually with warm water to hasten the formation of matter. When a

free cream-like discharge is established the swelling will rapidly subside.

PHYMOSIS AND PARAPHYMOSIS. In such cases the penis may be imprisoned within the sheath or protruded and swollen so that it cannot be withdrawn. It may be necessary to incise the sheath or scarify the penis and apply cold water and other astringents, with manipulation to return the protruded organ.

TUMORS ON THE SPERMATIC CORD. This results from rough handling in castrating, from strangulation, or from inflammation consequent on the presence of irritants in the wound or exposure to cold. It may grow for years without disabling the animal; its growth may cease, leaving an inconsiderable thickening on the cord; it may acquire the size of a large udder of a cow, and contract numerous vascular adhesions to surrounding parts; or it may extend up through the inguinal canal into the abdomen, as felt on examination through the rectum.

Treatment. Those confined to the end of the cord may be removed like the testicle in castration. Those that have contracted adhesions to the thigh and sheath may still be removed with care, each vessel being tied as it is reached. But when the adhesions are very extensive and the tumor very large it is almost impossible to do this, and in the case of extension of the disease into the abdomen nothing can be done beyond partial destruction of the mass with caustics.

CASTRATION OF FEMALES.

In small animals this is done through the flank; in large, more conveniently through the vagina. The animal is stretched on its left side, the fore limbs and head being firmly secured and the hind limbs extended backwards. The hair is shaved from the flank a little below the angle of the hip-bone, and an incision made from above down, extending to an inch in the pig or bitch, or sufficient to introduce the hand in the heifer. Then with the finger or

hand, as the case may be, the womb is sought, backward at the entrance of the pelvis in the interval between the bladder and the straight gut. Being found, one horn or division is drawn up through the wound until its end is exposed with the round mass of the ovary adjacent. The latter is seized and cut or twisted off according to the size of the animal. Then the next horn and ovary are brought out and treated in the same way. The womb is now returned into the abdomen, and the skin accurately sewed up. Evil results are rare, though peritonitis may ensue from rough handling or exposure, and abscess or calcification of the wound is not unknown.

Cows are castrated by making an incision through the superior wall of the vagina just above the neck of the womb, and inserting two fingers, by which the ovaries are withdrawn and twisted off with a torsion instrument. Space will not allow of a fuller description in this work.

CASTRATION OF MALE BIRDS.

The bird is placed on its back with the left leg pressed against the abdomen and the right one stretched backwards and outward, an incision is made inside this thigh large enough to admit the finger, which is directed toward the back at the point of union of the last ribs with the backbone. There the testicles are felt in contact with each other and are separately detached with the nail and extracted through the wound. If lost in the abdomen after detachment there is no matter, they will adhere to the peritoneum and become absorbed. Lastly the wound in the skin is carefully sewed up with a fine thread.

ABORTION.

This consists of the expulsion of the fœtus before it can live out of the womb, but in the lower animals the term has been indiscriminately used for cases of premature parturition as well.

Causes. Blows or pressure on the abdomen, slips, falls,

riding of animals in heat, diseases of the abdominal organs, (tympanitis from wet, frosted or musty fodder, inflammation of the bowels, diarrhœa, poisoning by irritants taken with the food or otherwise, renal calculi or other diseases of the kidneys or bladder,) stalls too much inclined backward, overfeeding, plethora, hot, damp, relaxing stables, severe muscular exertion after long rest, exhausting feeding for milk at the expense of the system, breeding at too early an age, proximity to or contact with slaughter-houses or dead and decomposing animal matter, especially the abortion discharges of other animals, drinking putrid or iced water, disease, deformity or death of the fœtus, feeding on ergoted grasses or smutty wheat or corn, and, finally, the presence in the passages of a microscopic vegetable parasite (leptothrix vaginalis) which is easily transferred from one animal to another so as to procure abortion.

Symptoms. In the early stages of gestation abortion often takes place without any warning and is only ascertained by the animal again coming in heat. Later the preliminary signs and progress may be those of an ordinary parturition, or in other cases a whitish muco-purulent discharge may take place from the vulva for some time before abortion occurs. A filling of the udder and a loose, flaccid condition of the external generative organs often furnish premonitions.

Prevention. Treatment. Avoid the various causes above named when found to exist. Especially should attention be given to secure a diet and regimen which shall obviate indigestion, to eradicate from the hay-fields all irritant plants, to feed a certain amount of roots in winter to obviate urinary calculi, to cut meadows subject to ergot before they run to seed, or better still to plow them up and put under a rotation of other crops, to feed roots with ergoted hay or smutty corn if these must be consumed, to let the system be somewhat developed before breeding and not to milk too heavily the first year, to give pure air and water

and wholesome buildings, and, finally, to use anti-septics on the discharges and to keep all sound animals apart from the diseased or their products. A beast aborting, from whatever cause, should be allowed to run over several periods of heat before she is served again. When abortions have broken out in a herd good results have followed a course of chlorate of potassa in ½ oz. doses daily. When the beasts are plethoric benefit has been derived from bleeding or a bare diet with occasional mild laxatives. When run down by poor feeding or by early breeding and feeding for milk, a course of tonics (phosphate of soda, sulphate of iron, gentian and ginger,) has proved beneficial. When the discharge and other premonitory symptoms appear laudanum may be given in large and repeated doses to quiet the system and keep the tendency in check. Quiet and seclusion are no less essential. When the abortion becomes inevitable it must be allowed to proceed or assistance given if necessary as in parturition.

DIFFICULT PARTURITION.

Parturition is easy in most of the lower animals, the wedge-like outline of the fœtus when normally presented with the long head extended between the fore limbs rendering it an affair of mechanical simplicity. The same is true of the presentation of the two hind feet. If left to nature the passages are prepared by the relaxation of the ligaments of the pelvis and falling in on each side of the croup; they are then gently and equably dilated by the advancing soft and elastic water-bags; and then if the back of the fœtus is turned toward the back of the mother so that the curvature of its body may correspond to that of the pelvis, the process is rarely difficult or protracted.

Danger arises mainly from parturition being precipitated before its natural period, from unnatural conditions of the passages, from distortions of the fœtus or from turning back of one or more members so as to impair the regularity of the wedge and to increase the bulk posteriorly.

PREMATURE LABOR-PAINS.

Caused by excitement of travel, goring or riding by their fellows, blows and other mechanical injuries, violent purgation or diuresis, diseases of the digestive or urinary organs or womb, ergoted grasses, etc. If there is no relaxation of the pelvic ligaments and falling in at the side of the rump, no enlargement of the vulva, no dilatation of the neck of the womb nor any enlargement of the bag, place in a secluded place and keep quiet by repeated doses of opium. The pains will usually subside. Even if otherwise apparently prepared the closed neck of the womb will demand similar rest and anodynes, though a little solid extract of belladonna may in this case be smeared round the neck of the womb to favor relaxation.

INDURATION OF THE NECK OF THE WOMB is often erroneously supposed to exist in these cases, but such a conclusion need not be reached until the quieting treatment has been followed for one or two days without success and the neck of the womb remains rigid, nodular and gristly. Being fully convinced that the closure is due to disease it may be dilated by passing in a narrow-bladed, blunt-pointed (probe-pointed) knife and cutting to the depth of a quarter of an inch in four directions, upward, downward, to the right and left. Then the hand may be introduced with fingers and thumb drawn into the form of a cone and the passage gradually dilated. Or the sponge tents used by the physician may be employed.

TWISTING OF THE NECK OF THE WOMB so that the lower surface of the organ comes to look upwards or to one side, is a curious form of obstruction hitherto only seen in the cow. It may be surmised when labor-pains continue without any appearance of water-bags, and conclusive evidence is furnished by the neck of the womb being closed and thrown into spiral folds. Place the patient with its head uphill to relax the twisted neck and introducing the hand into the womb, seize the fœtus and press it against the uterine walls, while one or two men roll the

cow on its other side in the same direction in which the twist has taken place. If the womb is not distended by decomposition of a dead fœtus, nor attached to adjacent parts by inflammatory exudations the untwisting is easily effected, though several successive attempts may be requisite to secure it. Suddenly constriction around the wrist gives way, the water-bags enter the passage and delivery is easy.

Polypus in the Vagina. A tumor growing from the walls of this passage is another obstacle to parturition. By examination its point of attachment is found, and it should be slowly twisted off or, better still, removed by an *ecraseur*, an instrument with a pitch-chain which is gradually tightened so as to cut through the parts without loss of blood.

Dropsy of Womb or Abdomen, and Overdistended Bladder are further obstacles.

WRONG PRESENTATIONS, DEFORMITIES, ETC.

Maxims for Assisting in Difficult Parturition. Never interfere too soon. Let the water-bags burst spontaneously when they have fulfilled their purpose of dilating the passages. If there is no mechanical obstacle, let the fœtus be expelled by the unaided efforts of the mother. Never insert the arm for any purpose without first smearing it with oil or fresh lard. When the water-bags have ruptured and the pains have continued for some time without any presentation, examine. When one fore foot only and the head, or both fore feet without the head, or the head without the feet, or one hind foot without the other appears, examine. Whatever part is presented should be secured by a cord, with a running noose, before it is pushed back to search for the others. In searching for a missing member the dam should be placed with her head down hill and if recumbent should be laid on the side opposite to that on which the limb is missing. Even if the missing member is reached do not attempt to bring it up during a pain. Violent straining may be checked by pinching the back. If the passages have lost their natural lubricating

mucus, smear them and the body of the fœtus thickly with lard before attempting to extract. In dragging upon the fœtus apply force only when the mother strains, and pull slightly down toward the hocks as well as backward. If under the necessity of cutting off a limb, first skin it from near the foot and leave the skin attached to the trunk. Never cut off a member in the middle, but in the case of fore limb bring away the shoulder-blade, or in the hind the thigh-bone.

HEAD OR FORE LIMB TURNED BACK. Secure the presenting limbs with ropes having a running noose drawn tightly round the fetlock, or the head with a noose round the lower jaw, or still better round the neck behind the ears, then pushing them back secure the missing part and bring it into position. In searching for the missing parts it is well to follow those already presented. The left arm will usually answer best for a limb at the left side of the womb, and the right arm for the right. Reaching the shoulder, the hand may be slid down to beneath the elbow and that joint bent so as to bring the knee up; then the hand is slipped past the knee to the shank and by a similar movement, pushing back the upper part of the limb and pulling forward the lower, the foot is brought up and secured with a noose. All are then brought forward and delivery is easy. In order to bring up the missing part it is often needful that an assistant shall push back the body of the fœtus after the limb has been seized. The assistant may stand with his back to that of the operator and introduce his left arm along by the operator's right or *vice versa*. Or a smooth round pole like a fork-handle may be introduced and planted in the breast of the fœtus as a means of pushing it back. In either case the pressure should be slightly upward toward the back of the fœtus so as to bring up the breast and fore limb toward the passage. The *missing head* may be turned back on either side, downward upon the breast or upward upon the back. First ascertain its position, then if it cannot be reached by

pulling the limbs forward into the passage, push back the body in such a way as will favor the advance of the head. If the ear is reached the head may be pulled by it, till the socket of the eye can be gained, and the body being still pushed back the nose can soon be seized and brought up Often it is necessary to insert a hook into the eye socket or between the branches of the lower jaw, so that more force may be exerted. The ring in this case should be turned at right angles to the hook, and a cord passed from the hook side of the ring, to the opposite, and then knotted so that the greater the force applied the firmer it will hold.

PRESENTATION OF ONE HIND LIMB ALONE is recognized by examining it as far up as the hock, which cannot possibly be mistaken for the knee. The same principles are applied here. Noose the presenting limb, and pushing back upon it and the buttocks, bring up first the hock and then the foot, bending all the joints to their utmost. In the cow success can usually be counted on, but the long hind shanks of the foal often prove an insuperable obstacle, and it becomes needful to cut the hamstrings and, leaving the hock bent, to straighten out the limb above this and extract in this position.

PRESENTATION OF THE BUTTOCKS is to be recognized by the rounded mass, with the tail and beneath it the anus and perhaps the vulva. The process of extraction does not differ from that last described, but in very powerful mares the pains may be so violent and constant that it is impossible to bring up even the hocks, and the limbs have to be separated at the hip-joint and extracted separately, after which the trunk will come easily.

DOUBLE HEADS AND BODIES AND SUPERFLUOUS LIMBS have to be removed on the same general principles, but space forbids their further notice here.

WATER IN THE HEAD is often an insuperable barrier to delivery, to be easily recognized by manual examination.

and as readily relieved by plunging a knife through the membranes and evacuating the liquid.

WATER IN THE ABDOMEN is equally frequent and to be obviated in a similar manner.

DISORDERS FOLLOWING PARTURITION.

FLOODING. Bleeding from the walls of the womb. Mostly after a too hasty parturition in which the uterine walls are exhausted and fail to contract; or when the womb has suffered violence in extraction of the fœtus.

Symptoms. Bloodless pallor of the mucous membranes, coldness of the surface, weakness, weak pulse, with or without palpitation of the heart and discharge of blood from the vulva. The hand introduced into the womb finds that organ soft, flaccid, dilated and filled with liquid or clotted blood.

Treatment. Apply cold water or bags of ice to the loins and external genital organs, remove the afterbirth and clots with the hand and, if necessary, inject cold water, acids (vinegar, dilute mineral acids,) astringents (sugar of lead, tannin, matico, alum,) into the womb, and give small doses of acetate of lead or ergot of rye by the mouth. In desperate cases a large sponge soaked in tincture of the muriate of iron may be introduced into the womb and emptied by squeezing. If the patient is sinking it may often be saved by transfusion of blood from another animal.

RETAINED AFTERBIRTH. *Causes.* Premature parturition, poverty of condition, too hurried delivery and failure to establish subsequent contractions, adhesions, the result of pre-existing inflammation in the womb, etc.

If not removed it rots away piecemeal, a portion remaining and putrefying in the womb, causing irritation, discharge, rapid loss of condition and milk and in some cases absorption of putrid matter and poisoning.

Treatment. Various methods are followed. 1. Attach a pound weight to the mass, so that the constant tugging

may stimulate the womb to contraction and expulsion of the afterbirth. 2. Seize the mass close up to the vulva between two pieces of wood and dragging gently move it from side to side to titillate the passages and stimulate the womb to contraction. 3. Give a dose of physic (Glauber or Epsom salts) with aromatics (ginger, pepper, copaiva, cardamoms, caraway, etc.) 4. The most satisfactory method is to remove it by the hand, in twelve to twenty-four hours after parturition, before the neck of the womb has closed so as to forbid the introduction of the arm. In cows the protruding membranes are gently pulled upon by the left hand while the right is introduced into the womb and the connecting cotyledons or placentulæ of the membranes are, one by one, squeezed out from their connections with those of the womb. The process may be slow, as fifty such connections may demand separation, but patience will be crowned with final success, the great points being to tear nothing and to bring up and separate the last portions as perfectly as the first.

Prevention. In poverty-stricken animals much may often be done by warm sloppy food for a week or two prior to parturition.

Leucorrhœa. Catarrh of the Womb or Vagina. This often results from retained afterbirth or violence done in parturition, but may occur independently of both or even in the virgin animal. There is a whitish discharge from the vulva, fœtid if from retained afterbirth, with rapid falling off in flesh and milk, in spirit and appetite. The subjects can rarely be impregnated.

Treatment. Introduce a catheter into the womb, draw off the contained fluid, wash out with tepid water introduced through the tube, and inject one of the following solutions: 1 drachm of sulphate of zinc, sulphate of copper, acetate of lead, permanganate of potassa or carbolic acid, or ½ drachm chloride of zinc, dissolved in a pint of water and five ounces of glycerine added. This injection should be repeated daily until the discharge ceases. A

course of tonics should accompany this treatment (sulphate of iron 2 drachms, pepper 1 drachm, ginger ½ oz., gentian ½ oz. daily.

EVERSION OF THE VAGINA OR WOMB. The former may occur before parturition or even in the virgin state, the latter only after parturition. Hot, relaxing stables and regimen and too great a slope of the stalls backward are among the causes of the first, violence in parturition or in the removal of the afterbirth, of the second. Digestive and urinary disorders are further causes. The everted vagina forms a simple rounded mass easily distinguished from the bladder by the absence of the ureters, and from the womb by that of the two divisions or horns, and in the case of ruminants by the cotyledons. *Treatment* is simple: Adjust the slope of the stall, making the hinder part the higher; obviate costiveness, diarrhœa or any other source of irritation; and adjust a rope truss as follows: Take two ropes, each more than double the length of the animal, bend each double and intertwist them at this bend so as to circumscribe an oval opening a little larger than that of the vulva; this having been adjusted to this orifice the two upper ends are carried around the rump, crossed over each other repeatedly in their passage along the back and finally tied to a collar previously placed around the neck; the lower ends are carried down between the thighs, one on each side of the udder, and forward on the sides of the abdomen and chest to be fixed to the collar. It may be made as tight as seems necessary and will tighten with every effort at straining so that eversion becomes impossible. It may be made

Fig. 39.

Fig. 39—Rope truss for everted womb.

more secure by attaching the ropes to a surcingle as well. This truss must of course be removed when true labor-pains come on.

In eversion of the womb give a full dose of chloral, raise the hind parts, place the womb on a sheet, wash it with warm water and laudanum, wrap it tightly in a linen bandage, beginning at the free end, then press that free end inward and so with the successive parts till the whole has been introduced into the abdomen. Remove the loosened bandage and apply the truss.

INFLAMMATION OF THE WOMB.

Causes. Lacerations, bruises and other injuries in parturition or in removal of the afterbirth, exposure to cold or wet after parturition, retained afterbirth, etc.

Symptoms. Two or three days after parturition a shivering fit, colicky pains, looking at abdomen, plaintive cries, twisting of the tail, shifting of the hind feet, tenderness of loins and abdomen, arching of the loins, vulva red and swollen, frequent straining with fœtid discharge, the hand introduced into the womb finds both its neck and body dilated with fluid contents, the belly becomes tense and swollen, there is grinding of the teeth, insatiable thirst and loss of power over the limbs. The pulse and respiration are accelerated and the temperature of the body raised. It may end in poisoning of the blood with pus or absorbed putrid matters, or in gangrene, or if recovery ensues it may be perfected in two or three weeks. Peritonitis and enteritis frequently coexist and are equally fatal at this period.

Treatment. Wash out the womb, as in leucorrhœa, with chlorine water or a solution of chloride of lime, permanganate of potassa or carbolic acid, adding a solution of gum Arabic, glycerine and laudanum to render it more soothing. Give an active purgative (in the cow sulphate of soda 1 lb.) and follow this up by tincture of aconite four times a day, and nitrate of potassa and chlorate of potassa

once daily. A blister should be applied to the right flank (mustard and oil of turpentine in cow or sow, mustard alone for other animals). In case of prostration, weak pulse, stupor, etc., a free use of wine, quinine, camphor and general stimulants must be made, with antiseptics (chlorate of potassa, carbolic acid, sulpho-carbolates or bichromate of potassa).

PARTURITION-FEVER IN COWS. MILK-FEVER. PARTURIENT APOPLEXY.

Causes. Plethora, costiveness and the susceptibility attendant on parturition. It attacks mainly heavy milkers, animals in full flesh that have been well fed just before and after calving, and have been delivered easily with little loss of blood or nervous expenditure. It is most frequent in the hot season when the grass is most luxuriant and nutritive, but may occur at any season in the best class of cows.

Symptoms. Dullness, languor, uneasy movements of the hind limbs, a full, bounding pulse, red eyes, hot head and horns; soon the cow becomes weak on its limbs, unable to rise, lays the head back on the flank or dashes it on the ground, breaking the horns if the surface is hard, and struggles convulsively with its limbs. The surface may now be bedewed with perspiration, the eyes red, fixed or rolling convulsively, the pupils dilated, the heat of the head still greater and the pulse quicker and weaker. Sensation is completely lost, the skin may be pricked at any point without the slightest response and the eyeball touched without causing winking. Neither dung nor urine is passed, the intestines and bladder being also the seat of paralysis or torpor.

In one form of the disease the heat of the head, delirium and violence may be almost entirely wanting, the prominent symptoms being the fever, accelerated pulse and breathing, elevated temperature, loss of power over the limbs, paralysis of sensation, inappetence, torpor of

bowels and bladder. Both forms are exceedingly fatal, almost all attacked within two days after calving perishing, and a large proportion of those taken ill during the first week.

Prevention. Spare diet (starvation in the plethoric) for a week before and after calving, an active purgative (Epsom salts) to act as soon after calving as possible, plenty of fresh, cool air, milking, if necessary, before calving and thrice daily after. In the full flush of grass it is needful to keep plethoric parturient subjects in-doors, upon dry hay with plenty of salt and water, or on a very bare pasture. Even if attacked a week after calving they usually recover.

Treatment. If the animal is seen before it goes down, bleed four or six quarts from the jugular, but never after the pulse has lost its fullness and hardness; apply ice-cold water, bags of ice or a solution of an ounce each of nitre and sal ammoniac in a quart of water to the head round the base of the horns, give a powerful purgative, (2 lbs. Epsom salts, ½ oz. carbonate of ammonia, ½ dr. nux vomica,) apply friction to the limbs, draw the milk off at frequent intervals and repeat the ammonia and nux vomica every four hours. The nux vomica may be replaced by strychnia, 1 grain with 2 or three drops of vinegar in a teaspoonful of water and injected under the skin twice with four hours interval, or ergot of rye may be used instead. The fever may often be materially reduced by enveloping the whole body in a sheet wrung out of cold water, and covering up with one or several dry ones according to the season.

In the second or torpid form of the disorder there is often no call for cold applications to the head, while purgatives and nux vomica are especially demanded.

CHAPTER XIV.

DISEASES OF THE MAMMÆ (UDDER) AND TEATS.

Bloody-milk. B ue or viscid milk. Congestion and inflammation of the mammary glands, Garget, Mammitis. Impervious teat. Sore teats, Scabs, Warts. Simple and cancerous tumors of the glands.

BLOODY-MILK.

Causes. Blows on the udder or commencing inflammation from any other cause; heat or rut; a sudden accession of rich food, causing local congestion with increased flow of milk; the consumption of acrid plants (ranunculus, hydropiper, resinous shoots, etc.,) and the conditions which give rise to red-water. The milk may have a red sediment from feeding madder, logwood and other agents.

Treatment. If from congested glands, a saline laxative followed by nitre, restricted diet and bathing with cold water. If from acrid plants, withhold them, give a laxative to clear away any yet retained in the stomach and follow up with small doses of nitre and acetate of lead. If from partial congestion, with a somewhat nodular state of the gland and but little heat or tenderness, rub daily with compound tincture of iodine mixed with three times its bulk of water. Milk carefully and gently.

BLUE OR VISCID MILK.

Due to cryptogams in this liquid. Remove from the vicinity of decomposing animal matter, withhold food or water containing vegetable germs and administer, daily bisulphite of soda (2 drs., cow).

CONGESTION AND INFLAMMATION OF THE MAMMARY GLANDS. GARGET. MAMMITIS.

Causes. Blows on the gland, lying on a cold or sharp stone, sores on the teats, leaving the milk unduly long in the bag (hefting), standing in a current of cold air, exposure in cold showers or inclement weather, rich milk-making food too suddenly supplied, indigestion, or indeed any derangement of the general health is liable to produce this disease in an animal in full milk. Ewes often lose their bags or their lives from sudden weaning of their lambs, or cows from neglect in milking. Some aliments, like cotton seeds, are dangerous.

Symptoms. There may be simple warm, hot, tense (caked) bag, or there may be a circumscribed nodular mass in the centre of the bag. In severer cases there is lameness on the affected side, a red, hot, tense painful gland, with no secretion or only a bloody clotted mass. These cases come on with violent shivering, high temperature, strong rapid pulse and quickened breathing, dry nose, costiveness and suppression of urine. They may end in abscess, induration or gangrene, or a perfect recovery may ensue.

Treatment. In mild cases with no fever and little pain, rub well with camphorated spirits or weak iodine ointment or *with plenty of elbow-grease.* Milk thrice a day and rub for a considerable time on each occasion. If unequal to active rubbing put a good hungry calf to the udder.

In the severe cases, if seen in the shivering fit, give a strong cordial (ginger, pepper, whisky, brandy, gin or ale in several quarts of warm water) and envelop from head to tail in a thick rug wrung out of water as nearly boiling as possible, covering all with several dry blankets and binding firmly to the body; give copious warm water injections and bring if possible into a sweat. When this has lasted half an hour uncover gradually, rub dry and cover with a light dry wrapping.

If the disease has advanced further and there is already

active inflammation in the gland, foment continuously with warm water or support in a poultice containing boric acid, cutting holes for the teats, adding a little belladonna to relieve the pain. Give an active purge (salts) and follow up with aconite and nitre. Draw off the milk frequently, using a milking tube if the act is very painful. If the discharge

Fig. 40.

Fig. 40—Milking Tube.

smells sour inject a weak solution of carbonate of soda and permanganate of potassa (5 grains of each to 1 oz. of water). If the gland becomes hard and indurated, rub with iodine ointment or mercurial ointment, not both. If matter forms, open with the knife. If gangrene ensues, use lotions of carbolic acid or chloride of lime. Many sheep do well with a coating of tar on the gland. In the advanced stages nourish well and give tonics (sulphate of iron, gentian, columba).

IMPERVIOUS TEAT.

From concretions from the milk, which are freely movable in the teat and up into the gland. From polypus in the teat hanging by a band from the mucous membrane and hence movable only in narrow limits. From thickening of the mucous membrane and contraction of the walls of the duct to absolute closure. From the formation of a membrane across the duct of the teat. From closure of the external orifice of the teat effected in the healing of a sore.

Treatment. Concretions may be extracted by manipulation or with a grooved director, the teat having been first relaxed in a warm solution of belladonna. Polypi are removed by making a free incision through the teat, twisting off the tumor, accurately sewing up the wound

and milking for some time with a tube. The obliteration of the duct by contraction of its walls or by a membranous growth is to be met by a *bistuori caché* (a knife one

Fig. 41.

Fig. 41—Bistuori Caché.

line in breadth hidden in a groove of a sharp-pointed handle, but which can be pressed out of its case so as to cut to any extent desired) and a silver or gutta-percha teat tube to be kept tied in the newly made channel until it heals. It is well to leave these surgical operations until the milk is dried up. A simple instrument is in use by dairymen, consisting of a steel probe flattened out to two lines at one extremity and with finely sharpened point.

SORE TEATS. SCABS. WARTS.

Sores, chaps and scabs on the teats are to be treated by soothing applications. One ounce each of spermaceti and almond-oil melted together will often suffice. Or 5 grains each of balsam of Tolu or Peru may be added. Or a solution of 5 grains of sugar of lead or chloral-hydrate and ½ oz. each of glycerine and water. But no plan will succeed without gentle milking, with dry teats, especially in winter, or in bad cases without the use of a milking tube. Warts are to be removed by the knife, scissors and caustic.

Simple and Malignant Tumors of the mammary glands are met with in all species of domestic quadrupeds and demand removal with the knife.

CHAPTER XV.

DISEASES OF THE EYES.

Trichiasis. Torn eyelids. Superficial inflammation of the eye. **Simple ophthalmia.** Conjunctivitis. Parasites on the eyes. Specks or films on the eye. Ulcers of the transparent cornea. Tumors of the transparent cornea. Enzootic ophthalmia in cattle and sheep. Internal ophthalmia. Inflammation of the deep structures of the eyeball. Iritis. Choroiditis. Retinitis. Recurring ophthalmia. Periodic ophthalmia. Moon-blindness. Cataract. Palsy of the nerve of sight. Amaurosis. Glass eyes. Glaucoma. Cancer. Staphyloma. Worms in the eye.

TRICHIASIS.

Turning in of the eyelashes ; a common cause of inflammation. Snip off the offending hair with scissors.

TORN EYELIDS.

Should be accurately brought together and held by collodion, which is to be laid on with a brush, layer after layer, until strong enough to hold safely. If this is not at hand bring together with a quilled suture—the stitches, with carbolated thread or catgut, being tied round two quills lying on the respective flaps, so as to prevent puckering of the edges and to secure even healing. If the lips are brought into accurate apposition and stitches placed closely together, the quills may be discarded. To prevent rubbing of the healing and itching eye, turn the animal round in the stall and tie short to the two posts so that the head cannot reach either. Feed from a bag hung in front and cut open half way down to admit the nose.

SUPERFICIAL INFLAMMATION OF THE EYE. SIMPLE OPHTHALMIA. CONJUNCTIVITIS.

Causes. Blows with whips, etc., hay-seed, chaff, dust, lime, thorns, etc., in the eye; standing in a current of cold air; irritant emanations from dung and urine; obstruction of the lachrymal duct with swelling at the inner angle of the eye and hardened mucus in the orifice of the duct as seen in the floor of the chamber of the nose; in horse and ox, the presence of a worm—*filaria lachrymalis*—inside the eyelids; and in pigs of the measle bladder-worm—*cysticercus cellulosa*—in the fat around the eye.

Symptoms. Red, sore, watery eyes, with or without fever according to the severity of the attack, soon followed by a bluish or white film or opacity extending no deeper than the surface of the transparent part of the eyeball. The swelling of the eyelids may extend to the hollow above the eye, filling it up. There is no suffering or winking when brought into a bright light, nor any undue contraction of the pupil as compared with healthy eyes. If foreign bodies are present they will be detected by examination.

Treatment. Hay-seed, chaff, etc., may be removed with a pair of small forceps, with the point of a lead pencil, or with the head of a pin covered with a soft handkerchief. Lime and sand may be similarly removed or washed out with a fine syringe. Thorns may be picked out with a needle, the animal having been first thrown and the eye fixed with the fingers or by putting the patient under the influence of ether or chloroform. Or if not too deep they will slough out of their own accord in a day or two. The patient must be protected from cold or any other apparent cause of illness, should take a dose of physic, and have the affected eye covered with a cloth constantly wet with a solution of 1 dr. sugar of lead or sulphate of zinc, 10 grains morphia and 1 pint water. It is often best to use it tepid but if used cold it should be maintained so.

WHITE SPECKS AND CLOUDINESS OF THE EYE.

These are the results of inflammation and if confined to the transparent outer coat of the eye may usually be removed by touching them daily with a feather dipped in a solution of 3 grs. nitrate of silver in an ounce of distilled water. Such an application should never be made while the part is still inflamed and the eyelids swollen and red, as it will then be painful and injurious. It will usually fail to remove the speck when that consists in a thick cicatrix following an ulcer, or when red vessels are seen running across it.

ULCERS OF THE TRANSPARENT CORNEA.

These also follow inflammation and are to be recognized by the visible breaks or abrasions in the surface layers of the transparent coat of the eye. Apply the same agent as for specks but of double or treble the strength, and improve the general health by a liberal diet and a course of tonics (sulphate of iron, nux vomica, cinchona).

TUMORS OF THE TRANSPARENT CORNEA.

These, if not of a cancerous nature, nor connected with the vascular colored curtain which encircles the pupil (the iris), may be removed with the knife or scissors, the part touched with a stick of nitrate of silver, and a lotior like that used for simple ophthalmia applied on a cloth.

ENZOOTIC OPHTHALMIA IN CATTLE AND SHEEP.

This affection attacks one or several herds or flocks in a locality, at any season and without apparent cause, excepting proximity. The symptoms are those of simple ophthalmia, but of a severe type, with much fever and complete clouding of the eye from exudation into the whole thickness of the transparent cornea, followed by ulceration, and sometimes perforation of this membrane, loss of the humors of the eye, and permanent blindness.

Treatment. Separate the sound from the diseased and

from the pastures or buildings where the malady has appeared. Give the affected strong purgatives (salts) followed by diuretics (nitre), place in a dark, quiet, dry building, and keep a cloth over the eye saturated with a solution of a drachm each of nitrate of silver and carbolic acid and 10 grs. of morphia to a quart of distilled water. Blisters may be applied to the cheeks or behind the ears (Spanish flies 2 drs., lard ¾ oz., for cattle; twice the amount of lard for sheep; rub well in). The resulting ulcers may be treated in the ordinary way.

INTERNAL OPHTHALMIA. INFLAMMATION OF THE DEEP STRUCTURES OF THE EYEBALL. IRITIS. CHOROIDITIS. RETINITIS.

Causes. Severe blows or other forms of local irritation; extremes of darkness and light; exposure to a draught of cold air, to a storm; various constitutional disturbances, especially those of the digestive organs.

Symptoms. Like those of superficial ophthalmia, but with more fever, constitutional disturbance, accelerated pulse, loss of appetite, increased heat of body, and above all with retraction of the eye into its socket, protrusion of the haw from its inner angle over its surface, closure of the lids and contraction of the pupil when brought into the light, and the presence of a turbid liquid behind the transparent cornea, with white floating flakes, and a yellowish or whitish deposit at the bottom of the chamber. The brilliant reflection of the iris or curtain is also largely impaired. As the disease advances a white speck or cloud appears in the lens, behind the pupil and iris.

Treatment. Place in a dark building with pure, dry air, purge (cow, salts; horse, aloes; dog, castor-oil,) and follow up with febrifuges (nitre, digitalis; in dogs or pigs tartar emetic); apply alternately by means of a rag over the eye a lotion of 20 grs. acetate of lead, 20 drops extract of belladonna and 1 quart water, and one of 20 grains sulphate of zinc, 20 drops of tincture of (physostigma)

Calabar bean, and 1 qt. water, changing twice daily; blister the face or neck as for enzootic ophthalmia.

RECURRING OPHTHALMIA. PERIODIC OPHTHALMIA. MOON-BLINDNESS.

Attacks solipeds only.

Causes. Hereditary predisposition; breeding in damp, cloudy, foggy or marshy localities; keeping in damp, close, ill-conditioned stables; the irritation about the head attendant on teething; clogging the digestive organs by feeding wheat or maize without salt or sulphate of soda the presence of worms in the intestines; whatever lowers the general health, and the general causes of iritis.

Symptoms. Like those of internal ophthalmia with, in many cases, increased tension and hardness of the eyeball, and its deeper retraction into the orbit. The main difference is in the liability to recur, at intervals of three weeks, a month or more, if the exciting causes have not been removed, until the subject is left blind. In the intervals between the attacks the transparent coat of the eye retains a hazy bluish cloudiness around its border, the iris is wanting in its normal lustre, the anterior chamber has often a slight deposit at its lower part, and the upper eyelid is bent at an unnatural angle about one-third of its length from the inner angle. After two or three attacks a cataract remains.

Prevention. Avoid, for breeding purposes, all horses belonging to an affected family; all localities that are damp, foggy, cloudy or relaxing; as well as ill-appointed stables. Maintain good health and condition by sound feeding, watering, housing, grooming and exercise. When threatened remove to a drier and more bracing climate.

Treatment. As for iritis. Some cases, like rheumatism, are benefited by colchicum and the free use of alkalies (carbonates or acetates of potassa or soda). Those that present increased tension and hardness of the eyeball should be early treated by *iridectomy* which can, however

only be undertaken by the surgeon. All cases should have a course of tonics (oxide of iron, nux vomica, ginger) as soon as the violence of the fever has abated, and should be submitted to a regimen calculated to improve their condition so as to ward off a new attack. Recovery from a particular attack may be expected in from 6 to 10 days, and this contributes to sustain the reputation of such ridiculous resorts as knocking out the wolf teeth, and such injurious ones as cutting out the haw (hooks).

CATARACT.

This is the most constant result of internal ophthalmia, though it may occur from other causes, such as diabetes or uræmia. The condition is opacity of the lens, and may be recognized as a white speck, or a white fleecy cloud filling, in the worst cases, the whole of a widely dilated pupil. It is best seen with the animal looking out of the stable door, and with a dark background. A still more satisfactory examination can be made with a lighted taper in a dark room. Three images of the taper are reflected, (1) from the surface of the eye (cornea), (2) from the anterior surface of the lens, and (3) from the posterior surface of the lens. The two anterior are upright, the posterior is inverted. If either of the two posterior images is changed into a diffuse white haze in passing over any part of the pupil it implies an exudation into that part of the lens—a cataract. Haziness of the large anterior image is only caused by opacity of the cornea.

Treatment. Newly formed cataracts will sometimes clear up, by absorption, under such treatment as is adopted for inflammation, but the rule is that an opacity of the lens once found, is permanent. In cattle and sheep the lens may be extracted or depressed as in man, but in the horse such an operation would be worse than useless, as without spectacles he could never see things in their right form or position, and would become an incorrigible shyer. Better leave him blind. Cases not due to recurring oph-

thalmia may be benefited in the long run by applying a drop of phosphorated oil (phosphorus 2 grs, almond-oil, 1 oz.,) to the eye, daily, for several months.

PALSY OF THE NERVE OF SIGHT. AMAUROSIS. GLASS EYES.

Causes. Congestion, tumors, dropsy, or other disease of the brain. Injury to the nerve of sight by pressure or otherwise. Inflammation with exudation into the retina. Excess of light. It may be symptomatic from overloaded stomach, from bloodlessness, and sometimes from gestation.

Symptoms. Eyes unnaturally clear from wide dilatation of the pupils. Failure of the pupils to contract when exposed to light or sunshine, or to dilate in darkness. The subjects do not wince when a feint is made to strike them unless the hand produces a current of air. The animals step high to avoid obstacles and have very active ears, which are constantly exercised to make up for lack of sight.

Treatment. If due to removable cause stop this, then blister the cheek or behind the ear, as for ophthalmia, and give nerve stimulants (strychnia, nitrate of silver, etc.)

Among the other affections of the eye are *Glaucoma*, the true nature of which can only be ascertained with the ophthalmoscope; *Cancer* which demands the skill of the anatomist for removal; *Staphyloma* or vascular tumor of the cornea; *Worm in the eye* (*Filaria Oculi*) which is to be extracted by skillful puncture; etc.

CHAPTER XVI

DISEASES OF THE NERVOUS SYSTEM.

General causes. Epilepsy. Falling Sickness. Chorea, St. Vitus's Dance, St. Guy's Dance. Vertigo, Megrims in horses. Lock-jaw, Trismus, Tetanus. Convulsions, Fits. Sleepy Staggers, Coma Somnolentum. Apoplexy. Inflammation of the Brain, Phrenitis, Encephalitis, Cerebral Meningitis. Inflammation of the spinal cord, Myelitis, Spinal Meningitis. Epidemic Cerebro-spinal Meningitis, Cerebro-spinal Fever. Enzootic Myelitis in sheep. Trembling, Hydro-rachitis. Paralysis. Loss of sensation or voluntary motion. General Paralysis. Paraplegia, Palsy of the hind limbs. Hemiplegia, Palsy of one lateral half of the body. Facial Paralysis. Other local palsies. Stomach Staggers, "Loco," and Acute Lead Poisoning. Sunstroke.

The frequency of these affections bears some relation to the development and activity of the great nerve centres and especially the brain. They are often symptomatic of other diseases, the irritation being conveyed along the nerves to the nerve centres so as to derange their functions; at other times they have their origin in these centres themselves. Among common causes may be named: exposure to intense heat or cold, especially with a dry parching atmosphere; excess of light; deranged or excited circulation, as in loss of blood or plethora, obstacles to the return of blood from the head, by the jugular veins, or imperfect supply from thickening of the cranial bones; the influence of poisons, pressure, etc.; severe overexertion; digestive, hepatic and urinary disorders, and parasites.

EPILEPSY. FALLING SICKNESS.

This is seen in dogs, cattle, horses and pigs in about the order named. It usually exists independently of any

observable change of brain structure. Thus, in dogs it follows distemper, or depends on teething, worms in the stomach or intestines, or acari (pentastoma) in the nasal sinuses. In pigs indigestible substances in the stomach may determine it. Brown-Sequard showed how it could be developed at will in Guinea-pigs by tickling the neck and has even produced it in the human subject. In all animals it may be looked on as, generally, a reflex act. Abscesses, tumors, etc., of the brain have been found in certain instances in horses, and the malady has supervened on a severe fright and chase, or a broken horn or other injury to the head in cows. Probably in these cases the disease of the brain has rendered it more susceptible to the impression coming from a distant part of the body. The disease has proved hereditary in cattle.

Symptoms. Sudden loss of sensation and voluntary movement, with convulsive contraction of the muscles of the trunk and limbs. The patient may or may not appear dull or stupid for some time, but the attack is always sudden, the victim crying, falling to the ground, stiffening all over, with clenched jaws, frothing at the lips and fixed red eyeballs. The attack may last for one or several minutes, after which the muscles relax and the animal becomes conscious but retains considerable dullness or languor for a day or more. The attacks are more or less frequent according to the activity of the exciting cause.

Treatment. Remove the causes—worms or other irritants in the intestinal canal or elsewhere:—in excitable plethoric animals restrict diet and give more exercise; in the bloodless, feed highly and give iron and bitters; in dyspeptic pigs give sound food and bitters (gentian, quassia, camomile, boneset, serpentaria, myrrh,) with iron. In excitable stallions castration is usually needful. During the attack inhalations of chloroform or ether, or the injection of these agents or of chloral-hydrate will serve to cut short the attack. If dependent on irritation of some known part of the surface, attacks may be obviated by

cutting the nerves proceeding from this part, or better by light firing with an iron at a red or white heat.

CHOREA. ST. VITUS'S DANCE. ST. GUY'S DANCE.

Mainly seen in the dog and horse. Occurs in subjects debilitated or worn out by disease, as in dogs by distemper. There is no constant structural change in the brain, but the occurrence of the disease as a consequence of exhausting disorders and the excess of urea, etc., in the urine, may be taken as implying an altered state of the blood, and of the processes of sanguification.

Symptoms. Momentary spasms of the voluntary muscles, leading to jerking of one or more limbs, of the head or of the entire body. This continues without intermission in sleep as in waking, and, by wearing the subject out, increases the disorder. In the horse it occurs mainly in the hind limbs, but will also attack the fore, and temporarily the muscles of the body.

Treatment. Re-establish health and vigor by abundant nourishment, open air exercise, tonics (sulphate and carbonate of iron, cascarilla, quinia,) cold baths, rubbing dry afterwards, and strychnia. Nerve sedatives (chloral-hydrate) may be given to check or moderate the spasms.

VERTIGO. MEGRIMS IN HORSES.

An equine disease characterized by sudden and temporary loss of sensation and voluntary motion, with trembling, and it may be champing of the jaws, but without the general spasms of epilepsy.

Causes. Brain disorders such as tumors, congestions, effusions, etc., or modified circulation from compression of the jugular veins, or disease of the heart. Plethora is a frequent cause in the young.

Symptoms. The animal drawing a load, especially uphill, with a tight collar, driven hurriedly in extreme heat, or in a strong glare of sunshine or snow, suddenly hangs on the reins, slackens his pace, staggers a little perhaps,

and if not stopped drops in harness, first, it may be, starting to one side, or rearing up so as to fall back over the driver. If stopped on the first sign of failing, the attack may usually be warded off. If it has taken place, the loosening of the harness and a few minutes rest will generally bring the animal round, so that he can get on his legs, but he remains nervous and excitable for several days.

Prevention. Treatment. In plethoric young horses improve the condition by restricted diet and regular increasing exercise, or turn out to grass for a time. Give an occasional laxative and diuretic. Avoid tight or badly fitting collars or whatever presses on the veins of the neck. Shelter the top of the head from the direct rays of the sun by a sunshade. Wear a wet sponge constantly between the ears when at work. When the premonitory symptoms appear, stop, slacken the collar, cover the eyes, apply cold water or ice to the head and neck; blood may even be drawn from the palate, the temporal artery or the jugular vein. This should be followed by an active purgative (aloes, Glauber salts,) and nerve sedatives (chloral-hydrate, bromide of potassium). A laxative diet must be kept up for some time or a run at grass allowed.

LOCK-JAW. TRISMUS. TETANUS.

This consists in persistent (tonic) cramps of the voluntary muscles. When confined to those of the face it is *trismus* or *lock-jaw*, when general *tetanus*.

Causes. Wounds, especially of unyielding structures, like the foot, the firm fibrous layers covering the limbs, shoulder or croup, or the bones (tail). Wounds implicating large sensory nerves, or enclosing rust, gritty matters, or castrating clamps, or subject to chafing as between the thighs, are occasional causes. In other cases exposure to cold or wet or a continual dropping on some part of the body is the cause. In still others it appears without any obvious reason, though probably from internal lesions.

It is remarkable that it rarely occurs until wounds are well advanced in healing. In lambs it has been observed in connection with overfeeding of the ewes on trefoil, grain, etc., as well as from exposure.

Symptoms. General stiffness; hardness of the affected muscles; protrusion of the haw, from the inner angle of the eye, over the ball, becoming more marked if the animal is excited, as by jerking up the head; in the worst cases the head is elevated and carried stiffly, the tail raised and trembling; the legs directed slightly outward like four immovable posts, and in walking are lifted almost without bending; the animal cannot lie down, or if he gets down, rouses the spasms fatally in his struggles to rise; the bowels are always torpid; the breathing is excited and in bad cases stertorous; and though the spasms never give way they occur in paroxysms, which are easily roused by movement, the presence of strangers, loud talking, banging of doors, rustling of straw or any other noise or commotion. It usually proves fatal by the cramps of the muscles of the throat (larynx) and chest.

Treatment. Secure perfect quiet in a dark box, safely locked from curious observers; place slings beneath the patient so that he can stand clear of them or rest in them at will; remove straw or other source of excitement; feed very soft bran mashes or thick gruels, from such a level as does not require any dropping of the head to reach them; give a strong dose of purgative medicine (horse, aloes; sheep, ox, sulphate of soda or magnesia; swine, dog, castor-oil), following this up by antispasmodics thrice daily (belladonna, prussic acid, chloral-hydrate, lobelia, tobacco, physostigma, etc.), or these may be given by injection, or chloroform, ether, or nitrite of amyl by inhalation. If it does not excite the animal too much, give a steam bath, or a thorough perspiration with hot rugs, covered with dry ones. The bowels must be kept open by small doses of powdered croton seeds or podophyllin mixed with solid extract of belladonna and smeared on the back

teeth as often as may be necessary. A bad case will require six weeks to acquire complete ease of movement.

CONVULSIONS. FITS.

Seen most frequently in young dogs and cats during teething and in bitches at the period of parturition or when reduced by suckling a large litter. In dogs or pigs they are common from indigestion or intestinal worms, and will occur in all animals from disorders in the brain or poisons in the circulation. The *symptoms* are those of sudden agitating spasms of one or more parts of the body, usually protrusion and redness of the eyeballs, and frothing from the mouth, with complete insensibility. *Treatment* consists in removing the causes as far as ascertained; lance inflamed gums; expel worms or irritating matters from stomach and bowels; correct dyspepsia by good feeding, air, exercise, lodging, and by tonics (bitters, iron, etc.) The convulsions may be checked by such agents as ether or chloral-hydrate given by inhalation or injection.

SLEEPY STAGGERS. COMA SOMNOLENTUM.

A chronic disease of horses characterized by drowsiness with impaired consciousness and voluntary movement, without fever. It may be associated with pressure on the brain by tumors, soft or bony, but above all by serous effusion. Increase and decrease of the brain, and thickening of its membranes are other occasional concomitants. It appears to be at times connected with deranged blood-forming processes, as in diseases of the right heart, lungs and liver, or with defective elimination, as in kidney disorders.

Symptoms. Sleepiness, listlessness, want of life and intelligence, a stupid demented look in the eye, drooping lids, unsteadiness in the gait, perhaps only seen in turning or backing; in worse cases the patient will twist the legs over each other in walking straight, or will even rest the head or haunches on manger or stall. The bowels are

torpid. The symptoms are like those of stomach staggers without the abdominal disorder.

The animal may recover so as to work well in winter, while utterly useless in summer, and this state may last for several years. A complete recovery is rare and yet it is occasionally seen, everything depending on the structural changes existing. But even in the incurable cases the progress may be retarded by treatment.

Treatment. In hot weather keep in a cool well-aired place, or in the open air in the shade. Give soft laxative diet, free access to cold water and an occasional purgative (sulphate of soda). A course of tonics (iron, nux vomica, gentian,) and diuretics (digitalis, iodide of potassium, bromide of potassium,) are often useful. Blisters may be applied to the neck or limbs if there seems to be effusion. The correction of any existing disorder in the lungs, liver or kidneys, will increase the prospects of cure; when well enough to use, such horses should wear a breast-strap in place of a collar, and should not be overdone. They should never be used for breeding purposes.

APOPLEXY.

Sudden loss of sensation and voluntary motion from effusion on the brain, and associated with a turgid condition of the blood-vessels of the head and neck.

Causes. It occurs in plethoric animals during exertion, in those suffering from softening of the brain, the result of plugging of the vessels with fibrinous clots, of concussion, congestion, etc. The *symptoms* are congestion of the head, dullness, heaviness, followed by complete paralysis, sensory and motor, loud stertorous breathing, and dilatation of the pupils.

Treatment. In the early stages, before the patient is paralyzed, apply cold water or ice to the head, bleed from the temporal artery (just behind the eye) or the jugular vein, keep perfectly quiet, and freely open the bowels.

INFLAMMATION OF THE BRAIN. PHRENITIS. ENCEPHALITIS. CEREBRAL MENINGITIS.

This is seen in all domestic animals but especially in horses, oxen and sheep. Among the *causes* may be mentioned: blows on the head with concussion of the brain or fracture of the cranial bones; plugging of the vessels in the brain by clots formed in diseases elsewhere; infection of the blood with pus or putrid animal fluids; sudden changes of temperature; exposure to extreme heat or cold; the over-exertion of plethoric animals; alcoholic poisoning from feeding spoiled products of distilleries; congestion from a tight collar, loss of jugular, or diseased heart; sympathetic nervous disorder from indigestion; the growth of tumors or parasites in the brain; feeding on ergoted grasses or smut.

Symptoms. If the brain substance alone is involved there is usually dullness, stupor, and palsy, sensory and motor: if the membranes covering the brain, there is more violence, delirium, irregular movements, pawing, stamping, champing the teeth, and partial or general convulsions. In either case there is trembling, elevated temperature, excited pulse and breathing, heat about the upper part of the head, injected glaring eyes, rolling or set, extreme excitability and violent trembling even when just roused from stupor. The patient will sometimes bore the head against an obstacle, or rest his haunches on any object within reach. The violence is not necessarily continuous, but usually occurs in paroxysms, leaving intervals of stupor and comparative quiet. During the paroxysm the subjects may cry: horses neigh, cattle bellow, sheep bleat, pigs squeal and grunt. During the periods of stupor the pulse and breathing are usually slow, and this applies also to those cases in which the disease has merged into a condition of vertigo, coma or paralysis.

Treatment. Apply ice or cold water to the head, give injections of turpentine and oil, a strong purgative (horse, aloes and croton; sheep, ox, Glauber salts and croton

pig, croton beans,) with chloral-hydrate and ergot; bleed from the temporal artery and jugular vein, and follow up with diuretics and sedatives (nitre, bromide of potassium). The animal should be kept in a cool airy stall. If paralysis follows, treat as for that disease.

INFLAMMATION OF THE SPINAL CORD. MYELITIS. SPINAL MENINGITIS.

The *causes* are similar to those of *phrenitis*. The disease may show itself by paroxysms of convulsions, with exalted temperature, increased circulation and rapid breathing, finally merging into paralysis; or it may be manifested at once by palsy without previous spasms, but with coldness, and usually dryness, of the paralyzed part, though the anterior part of the body may be bathed in perspiration. There may be tenderness on striking the spines in the affected region of the back, and there is great pain and unsteadiness in any attempt at movement even though the patient may be able to stand. There is no redness of the urine as in *azotœmia*.

Treatment. Apply cold water or ice to the affected part of the spine; cup or leech, if this can be done; purge as in *phrenitis*, adding ergot of rye or chloral-hydrate. As improvement sets in blister the back (cantharides, mustard, etc.,) and give diuretics, chloral-hydrate, bromide of potassium, ergot of rye. Care must be taken to turn the patient often if unable to stand, giving a soft dry bed, and to draw off the water frequently with a catheter unless it is passed spontaneously.

EPIDEMIC CEREBRO-SPINAL MENINGITIS. CEREBRO-SPINAL FEVER.

Inflammation of the substance and coverings of the brain and spinal cord in horses, sometimes prevailing widely in stables or cities, from some cause acting generally. The true cause is unknown, though in many cases debilitating conditions, like unwholesome food or water,

overwork, sudden exposure to intense heat or suddenly induced plethora will serve as immediate excitants of the morbid process. It is peculiar to no season but has not been recognized in Europe.

Symptoms. These are varied according to the case. Some are seized abruptly with cramps of the voluntary muscles, especially those of the neck and hind limbs, which soon give place to general palsy—motor and sensory. In other cases the onset is slow. There may be trembling, dullness and lassitude for some hours or days, or there may be some local paralysis, like that of the throat or lips, incapacitating the animal from swallowing liquids, or causing profuse slavering. But sooner or later, in all cases alike, paralysis sets in and the animal is barely able to support itself, or, if worse, lies prostrate on his side with limbs extended and flaccid. If the case is to prove fatal, coma and complete stupor usually precedes death. If recovery ensues, appetite is often preserved throughout and restoration of the general health precedes the disappearance of the palsy, sometimes by several months. The pulse throughout is little varied being usually slow and soft at first, and weaker and more rapid as the disease advances. Breathing, at first little affected, becomes deep and stertorous as coma sets in. The surface temperature is cool and that in the rectum usually natural. The bowels are generally costive and the urine unchanged and may pass involuntarily. Tenderness of the spine may sometimes be detected by percussion and will guide to the precise seat of local disease.

Treatment. The disease is very fatal, though varying much in successive outbreaks. Excepting in cases of complete paralysis and coma the patient should be placed in slings and have what laxative food (bran mashes, roots, etc.,) he will take. Cold lotions (nitre and sal-ammoniac) or bags of pounded ice and bran should be applied to the spine, and hand-rubbing and mustard or other stimulating embrocations. to the limbs. Copious injections of warm

water may be thrown into the rectum, containing in solution aloes or other purgatives. Opium or chloral-hydrate may be given to relieve extreme pain or spasm, but the agents which are especially demanded in the early stages are bromide of potassium and ergot of rye. These may be used as injections or, still better, subcutaneously, the first in strong solution, the last as *ergotine*. When swallowing is perfect they may be administered by the mouth. When the acute symptoms have passed, stimulants (ammonia, ether, alcoholic fluids,) and tonics (quinia, cascarilla, boneset, etc.,) may be given and blisters (mustard, Spanish flies,) applied along the spine. The remaining palsy must be treated on general principles. (See Paralysis).

ENZOOTIC MYELITIS IN SHEEP. TREMBLING. HYDRO-RACHITIS.

The true cause of this affection is unknown, but it has prevailed, especially on newly limed land which has undergone a great temporary increase of fertility. In some parts of Scotland its prevalence is circumscribed by the windings of a river (Tweed) and without any ostensible cause; or it is fatal on one slope (south) of a hill while the opposite escapes; or again it prevails on the richest table-lands. It attacks mainly lambs or sheep under $1\frac{1}{2}$ years old and proves very fatal, often destroying the entire offspring of the year.

Symptoms vary somewhat. Many lambs appear paralyzed when dropped, either in the hind or fore extremities or both, others are attacked a few days or weeks later. Sometimes the head or entire body is drawn to one side by tonic spasm, in other cases there is spasmodic movement of the limbs in progression (louping-ill). There is usually much apparent stupor and drooping ears, but the patient is easily startled and in its efforts to escape will tumble headlong. A nervous trembling is frequent and there is tenderness or itching of the loins or croup.

Treatment of the lambs would be on the same general

principles as in inflammation of the spinal cord in other animals but will rarely pay. *Prevention* is to be sought by keeping breeding ewes and young sheep from newly limed land; by using none for breeding under two years old, and, by close attention to food, water and shelter, to secure good health during pregnancy.

PARALYSIS. LOSS OF SENSATION OR VOLUNTARY MOTION.

Loss of voluntary motion is known as *Motor paralysis*, *loss of sensation* as *Sensory paralysis* or ANÆSTHESIA. Paralysis is also *peripheral* when it occurs from injury to the nerves (chilling, tearing, cutting, pressure, inflammation, degeneration, etc.,) and *central* when it arises from injury to the great nerve centres, the brain and spinal cord. Sensory and motor paralysis may exist independently of each other, and loss of sensation on one side of the body may coexist with increased sensitiveness on the other. An injury to one side of the brain usually paralyzes sensation or motion on the opposite side of the body. Injury to the lower part of one lateral half of the spinal cord, paralyzes motion on the same side of the body behind the lesion; while an injury to the upper part of one lateral half of the cord paralyzes sensation on the opposite side behind the hurt, and in a small adjacent part of the same side, while the rest of this side behind the lesion is rendered more sensitive. Space forbids our following further the indications furnished by the nature and seat of the paralysis, as to the probable lesions in the central nervous system; this must be left for a larger work.

GENERAL PARALYSIS.

Paralysis of the face, trunk and extremities, but without the implication of the muscles of respiration, may arise from pressure on the brain, or as a reflex action from distant organs (impacted stomach, constipation, pregnancy, etc.,) and may not be incompatible with life. It from section or cutting of the spinal cord in front of the

fifth neck-bone (broken neck, pithing,) it is promptly fatal by abolishing respiration.

PARAPLEGIA. PALSY OF THE HIND LIMBS.

This is a common form of paralysis resulting from broken back or loins, or it may be reflex from disordered digestion, etc. (in horses, cattle, dogs). It may also occur from tumors or parasites in the spinal cord, from bony swellings the result of sprains, from inflammation and softening of the cord, and from lolium temulentum (darnel), and the newly ripened seeds of its allies, lolium linicola (flax rye-grass), and lolium perenne (perennial rye-grass). The chick vetch, millet, ergot and various blood poisons (taurocholic acid, leucin, tyrosin, urea, etc.,) have a similar action.

HEMIPLEGIA.

This consists in paralysis of one lateral half of the body, to the exclusion of the other, usually as the result of some disorder of one side of the brain or spinal cord. It occurs in all animals but less frequently than paraplegia.

FACIAL PARALYSIS.

This sometimes occurs from a continuous current of cold air striking on the side of the face, but also from bruises behind the eye and joint of the jaws, by a badly fitting bridle, a collar, or apparatus commonly used for breachy horses. Cows suffer from similar injuries from stanchions. Finally it may result from disease of the brain or middle ear.

Other *local paralyses*, such as of the *ear*, *eyelids*, *lips*, *tongue*, *larynx*, *tail*, etc., result from corresponding causes.

Treatment for paralysis. Our first object must be to remove the cause, whether this consist in digestive, urinary or uterine disorder, in congestion, inflammation, or pressure on the brain or nerves. When a nerve is cut across, we must wait for its reunion. When the cause is irre-

movable the paralysis is necessarily incurable. In cases of inflammation we must proceed as advised for inflammation of the brain or spinal cord. Then apply cold douches and friction to the paralyzed part, followed by a blister. Blisters may also be applied to the neighborhood of the nerve-centre presiding over the part. In some cases the application of the hot iron lightly is beneficial. A current of electricity directed along the course of the nerve or through the paralyzed muscles may be repeated daily with the best results; or nerve-stimulants (nux vomica, strychnia, nitrate of silver, etc.) may be given twice daily, commencing with small doses and gradually increasing them until twitching or slight cramps of the muscles are seen; then stop their administration for a few days, and resume with half the former doses. Never continue when the system is affected, as shown by muscular jerking. In some cases of local paralysis (retina, etc.) excellent results are obtained from subcutaneous injections of strychnia.

STOMACH STAGGERS AND ACUTE LEAD POISONING.

These are affections commencing with functional stomach and brain disorder, and leading to congestion and inflammation of the great nerve-centres, and deserve a special notice.

The *stomach staggers* of horses and cattle usually arise from eating particular articles of food, such as the different forms of rye-grass, millet, vetches, tares, etc., when ripening and not yet cured. A poisonous principle exists, which, in the case of the Lolium temulentum, has been separated as an extract, and administered with fatal effects to horses, cattle and dogs. It acts by paralyzing the stomach and congesting the brain. Cattle will suffer similarly from the very rich vegetation of spring, from the dry, irritating fibrous grass mixed with the aftermath, or from a sudden change from soft to hard water. In Southern Kansas, Indian Territory, and New Mexico, the "loco" plant produces a similar nervous disorder with an increasing fondness for the plant, and finally death.

Symptoms. The first effect is drowsiness, the horse being sluggish at work and falling asleep while eating or drinking, or the ox leaving his fellows and lying down with his head on his flank, his eyelids semi-closed and his pupils dilated. The bowels continue to move, passing undigested matter and wind, the abdomen is full and the seat of frequent rumbling, and the appetite is retained, so that the torpid stomach is still further over-distended. This state of things may continue for several days, and is followed by imperfect control over the limbs, hind or fore, so that the subject sways unsteadily in walking, and leans his head on the manger and his quarters on the stall, when in the stable. Sometimes paraplegia is the first sign, drowsiness being absent throughout. The drowsiness in time gives place to restless and involuntary actions, jerking of the head, champing of the jaws, pushing the head against the wall, movements of the limbs, walking in a circle or straight forward regardless of obstacles, springing or dashing violently about, convulsions, etc. These periods of violence or delirium occur in paroxysms, leaving intervals of comparative, though not absolute, quiet and stupor. If not carefully secured the animals often kill themselves during one of these paroxysms. The pulse and breathing are slow at first, but accelerated in the later stages.

Acute lead poisoning in cattle results from eating red or white paint (often the refuse of paint-pots, which has lain for years in the soil), sheet lead, spent bullets, etc., or from drinking from dishes which have held sugar of lead, or of soft water that has run through leaden pipes or stood in leaden cisterns. The *symptoms* are usually indistinguishable from those above described, the preliminary dullness and drowsiness merging into active delirium, with reckless dashing about and violent bellowing.

Treatment in all cases consists in stopping the ingestion of the poison and carrying off from the bowels any that still remains there. Double the usual amount of purgative medicine must be given, with stimulants, their action

favored by injections and the brain symptoms kept in check by applying cold water or ice to the head, as well as by bromide of potassium. In *lead poisoning* sulphate of magnesia or soda are the appropriate purgatives, and ½ oz. sulphuric acid should also be given in two pints of water to precipitate in an insoluble form any lead that may still be retained. If later there is a suspicion of lead being retained in the system give iodide of potassium. Should paralysis persist when the active symptoms have passed away, treat that on general principles.

SUN-STROKE.

This is especially common in horses in the hot months and in the large cities, but is seen in cattle and sheep as well, when exposed to the full glare of the sun. Among the causes which co-operate in its production may be mentioned foul, badly aired stables, tight collars or girths, overwork in hot weather, heavy milking in cows, obesity, poor, unwholesome food, and indeed any health-deteriorating condition. Horses are usually attacked while being speeded, or at heavy draught work, in a collar, and exposed to the direct and reflected rays of the sun, as in a valley, on a hillside or in the streets of a city.

Symptoms. Sometimes without any observed premonitory sign the horse will suddenly stop in harness, droop his head, prop himself out on all four limbs, pant violently, fall, and after some convulsive movements, die in a state of coma, marked by stertorous breathing. In other cases the attack is slower, the horse flags in gait, responds very imperfectly, if at all, when urged, hangs on the bit, may perspire freely, or have a dry burning surface, and becomes unsteady on his limbs. If still urged he falls, but if allowed will stand with legs extended, head low and stretched out, nostrils dilated, superficial veins distended, eyes protruded and red, pupils contracted, breathing rapid and wheezing or deep and stertorous, the pulse quick and weak, and the heart-beats tumultuous

This is followed by prostration, a state of unconsciousness, palsy or convulsions and death. If recovery ensues it is followed by dullness, uncertain movements of the limbs, drowsiness or other sign of brain disease.

Treatment. Douche the head and neck with cold water, and make the same application to the whole body, unless the weakness of the patient forbids this. Throw stimulating injections into the rectum (ammonia, or oil of turpentine and oil). If the convulsions are aggravated by the douche use injections of chloral-hydrate instead. Apply frictions and mustard embrocations to the limbs and the sides of the neck, especially when unconsciousness and coma come on. Improvement may be expected when the pupils dilate, and above all when consciousness returns. A failing pulse should be met with stimulants by the mouth and rectum. To *prevent* sun-stroke much may be done by keeping in vigorous health, avoiding ill-aired stables, using breast-straps in place of collars, and wearing a sun-shade and a small wet sponge on the top of the head.

PARASITES IN THE BRAIN. See *Parasites.*

CHAPTER XVII.

SKIN DISEASES.

Classification. General Causes and Treatment. Congestion of the skin, Chafing, Chilling, Irritants, Sun's Rays. Congestion with Pimples, Papules. Inflammation with Blisters, Vesicles. Inflammation with Pustules. Inflammation of horses' heels, Swelled Legs, Cracked Heels, Grease, Grapes, Scratches. Inflammation of the skin with nodular swellings, Tubercles, Surfeit, Urticaria. Scaly skin disease, Pityriasis, Mallenders, Sallenders, Scratches. Boils, Furuncles. Nervous irritation of the skin, Neurosis, Prurigo. Warts. Callosities, Black-pigment Tumors. Epithelial Cancer. Parasitic skin diseases. Common Ringworm. Tinea Tonsurans. Honeycomb Ringworm, Favus. Diffuse Baldness, Tinea Decalvans, Parasitic Pityriasis. Parasitic Grease. Contagious Foot-rot. Mange. Scab. Itch. Scabies, Acariasis. Ticks. Ixodes. Warbles, Larva of the Gadfly. Attacks of Flies, Maggots. Sheep-tick. Melophagus Ovinus. Fleas. Lice. Erysipelas. Wounds—cut, punctured, bruised, torn, poisoned. Burns. Scalds.

Skin Diseases will be considered under the following heads:

1. *Diseases due to general causes* and embracing all the grades of inflammatory action:—congestion—a red pointed eruption (papules)—a similar eruption with minute blisters (vesicles)—the formation of larger hemispherical blisters (bullæ)—the formation of pus in these vesicles (pustules)—the formation of round nodular transient swellings (tubercles)—the excessive production of scales or dandruff (squamous)—pustules with circumscribed sloughing of the deeper layers of the skin (boils).

2. *Diseases manifested by deranged sensation*—Neurosis.

3. *Diseased growths*—warts—callosities—epithelial cancer, etc.

4. *Parasitic diseases*,—vegetable and animal.

5. *Diseases connected with a specific poison*—different forms of variola (pox)—measles—scarlatina—erysipelas—malignant pustule, etc.

6. Wounds. Burns. Scalds.

General causes. These are exceedingly varied. Many cases are the result of simple local irritation, as chafing, radiating heat, cold and wet, chemical and mechanical irritants, or the presence on the skin of parasitic plants or animals. A large class is due, however, to disorders of internal organs with which the skin is in sympathy, or that have failed to transform or throw off elements that prove cutaneous irritants by their presence in the blood, or when being excreted abnormally through the skin. Disorder of the liver, stomach, bowels, kidneys and lungs, are especially apt to act in this way. Sometimes skin disease is a mere symptom of general ill-health.

General treatment. The first object is to discover and remove the cause; then if the disease is of an inflammatory nature and acute, soothing agents may be applied to the irritated skin—fomentations with tepid water, oxide of zinc powder or ointment, starch, lycopodium, spermaceti and almond-oil, solutions of sugar of lead, sulphate of zinc, or carbolic acid, collodion, etc. Give internally cooling laxatives (sulphate of soda, tartrates or citrates of soda or potash,) and diuretics (acetate of potassa or ammonia, carbonate of potassa or soda). In weak states tonics are often wanted whereas in plethoric subjects depletion is equally essential. A cool, clean, airy stable and cleanliness of the skin are all-important.

If the disease is not so recent or the acute symptoms have been subdued, a more stimulating class of local applications are in order: ointments of iodine, sulphur, mercury, nitrate of mercury, tar, oil of tar, oil of turpentine, oil of cade, etc., may be used. Supersedents too may be given internally: sulphur, antimony, arsenic, mercury, Dunovan's solution, are examples.

CONGESTION OF THE SKIN.

Simple redness, heat and tenderness with no dark color nor eruption. This may coexist with all the different forms of inflammatory eruption according to the degree of irritation at different points.

It occurs: From *chafing*, in the axilla, between the thighs, in the heels or under the harness in hot weather; from *chills after being wet*, in the heels of horses and on the teats of cows exposed to wet in winter; from *hardened mud* in the space between the hoofs in cattle, sheep and pigs; and from *the sun's rays* in white-faced or white-limbed animals.

Treatment. If the surface is only tender, wash clean, and apply a solution of table salt, sugar of lead (½ oz. to 1 qt.) or a little camphorated spirit. If the surface is abraded (raw) use bland powders (oxide of zinc, starch, lycopodium,) wool, collodion, glycerine 1 oz. aloes 20 grs., or, if it can be kept covered, sulphurous acid solution and glycerine (equal parts), laxatives, diuretics or tonics must be used according to the indications. It is all-important to avoid further irritation. Light, well-fitting harness must be used, and the stuffing taken out and the part beaten down where necessary, to avoid pressure on a sore. Zinc fittings to the top of the collar are often very serviceable. So too, must exposure of affected heels to damp or mud, and the wetting of teats in milking, be carefully avoided. Lotion, sugar of lead, opium, camphor.

CONGESTION WITH SMALL CONICAL PIMPLES. PAPULES.

In this case there is an eruption of finely-pointed pimples without any watery exudation or blister. It is usually itchy and even painful, and by reason of rubbing may go on to exudation with great thickening of the skin, bleeding, scabs and open sores. Horses, especially, suffer in spring and autumn at the time of shedding the coat, the eruption often confining itself to the neck, shoulders and limbs. On turning back the hair on parts which are itchy or sore,

but that have not suffered from rubbing, the nature of the eruption will be seen, especially if a slightly magnifying glass be used. The affection usually gives way readily under the use of weak alkaline washes (carbonate of soda 1 dr., water 1 pint,) or soap-suds, a restricted laxative diet and gentle laxatives.

INFLAMMATION WITH VESICLES.

In this form of skin disease papules are crowned with little blisters, so small and pointed as to require a magnifying glass to make them out distinctly (eczema), or as large as a small pea and rounded (herpes, bullæ). These forms are common in horses and dogs, and to a less extent in ruminants, especially in connection with disorders of digestion. Highly stimulating food, clipping and hot weather are particularly favorable to their development. Boiled food, diseased potatoes, green food or any change of diet may cause them. One form of this affection is induced by a too extensive use of mercury to the skin. Cattle suffer from eating the refuse of distilleries and gardens, garbage from kitchens, etc.; sheep are attacked after exposure to cold rains. Old horses suffer from an inveterate form in connection with bad food and want of grooming and wholesome stabling. In dogs too, it becomes inveterate and chronic, the whole skin being denuded of hair and of a bright scarlet, with the characteristic eruption mixed with cracks, sores and scabs (red mange). In the milder forms, dogs suffer mainly inside the thighs or on the scrotum; horses suffer under the harness and especially at the root of the mane and under the saddle, but the eruption may spread over the whole body; cattle suffer on the limbs, especially the hind, but not exclusively so.

The other eruptions are often mingled with the vesicles, the hairs become bristly, and as the skin is broken by rubbing, a bloody or straw-colored exudation concretes in scabs and mats the hair together, while elsewhere extensive raw sores appear.

Treatment. Give a saline or oleaginous laxative, and follow up with acetate of potassa or other alkaline agents in the drinking water. If there are signs of disordered liver give small doses of podophyllin to keep the bowels slightly relaxed; if debility, bitter tonics. A restricted non-stimulating diet, (herbivora, mashes, roots, etc.; carnivora, bread and milk, oatmeal porridge, etc.,) pure air, cleanliness and skin washes of carbonate of soda or potassa containing a few drops of carbolic acid will prove valuable. In dogs this last agent should be omitted.

In all forms of chronic and inveterate eczema the scabs should be soaked in oil for a few hours and removed by washing, after which more stimulating applications may be resorted to:—ointments of sulphur, iodine, iodide of sulphur, sulphuret of potassium, mercury, nitrate of mercury, etc., with or without alkalies. In some cases a few drops of oil of vitriol in a quart of water, will much relieve the itching and pain. In others the same end must be sought by adding prussic acid or cyanide of potassium in small amount, great care being taken to prevent the patient from licking it. Internally, use supersedents—arsenic, with or without iodide and bromide of potassium; or small doses of Dunovan's solution may be resorted to in bad cases.

INFLAMMATION WITH PUSTULES.

This differs from vesicles in this, that the elevations on the skin have the scarfskin raised by the formation below it of a white, purulent matter, in place of clear liquid. The prominent forms are those with large pustules (ecthyma), and those with small (impetigo). The hair stands erect, and scabs form on the surface covering the sores, especially after rubbing. Even if not rubbed they dry up in scabs which soon fall off.

Horses suffer mainly at the root of the mane, on the neck, the rump, and on the lips and face, especially if white; cattle and sheep, especially the young, are at-

tacked on the lips and other delicate parts of the skin (vulva, etc.,) and pigs and dogs on any part of the body.

Causes. It is often chargeable on some disorder of digestion as the result of unwholesome food or a sudden change of food, as from dry to green, or from one kind of pasturage to another. In young animals (foals, calves, lambs, kids, pigs,) it appears to be an occasional result of heated or otherwise unwholesome milk. Vetches affected with honey-dew have produced it in white horses or in white spots of those of other colors; and buckwheat has affected white sheep, pigs, goats, etc., in the same way. It may, however, arise from habitual exposure to cold and wet, local irritation, as from rubbing, etc., or from disorder of other internal organs.

Treatment consists in softening the crusts with oil, washing them off with soap-suds, and applying soothing or gently astringent agents to the part (spermaceti and olive-oil, benzoated oxide of zinc ointment, lime-water, sugar of lead lotions, etc.) When it attacks the root of the mane cut off the hair, and if the pain is excessive foment or poultice until the eruption comes to a head when some of the above agents may be applied. When the pustules have burst and show little tendency to healing, this may often be hastened by touching the sores with a pointed stick of lunar caustic, or a weak solution of this agent (2 grs. to 1 oz. water) may be lightly painted over the part. The internal treatment consists in the administration of laxatives followed by bitters (gentian, quassia, boneset, cascarilla, willow bark, etc.,) and diuretics. In obstinate or long-standing cases the same treatment may be followed as in chronic eczema.

INFLAMMATION OF THE HEELS IN HORSES. GREASE.

The skin in the region of the heel is so vascular and so abundantly provided with oil-glands, and is so frequently exposed to irritants, wet, cold, mud, filth, etc., that a special notice of its inflammatory condition seems demanded

The *causes* are a lymphatic constitution, with a tendency to stocking of the legs; a weak circulation, diseased heart, liver or kidneys, with swelled legs; washing the heels with caustic soap; leaving them wet and muddy when put in the stall; currents of cool air striking on the heels; irritant fumes from accumulated dung and urine; soaking of the heels in putrid pools in the straw-yard; standing in snow, or in the slush of melting snow; and besides, any of the constitutional causes of other skin diseases. To these might be added *horse-pox*, *foot-mange*, and an eruption associated with a *vegetable parasite*, but we must leave these to be considered with specific and parasitic diseases.

Symptoms. We find all grades of inflammation in the heel: 1st, Simple swelling with dry heat, tenderness and great lameness from inability to stretch the skin and bring the heel to the ground: 2d, Transverse cracks or chaps more or less extensive: 3d, A pinkish-white fœtid discharge from the surface with oftentimes some moderation of the lameness: 4th, The eruption of pustules of variable size: 5th, The formation of fungous growths (grapes), over the affected surface, of a size from a pea to a cherry, red, angry and covered with a fœtid discharge. This last form often invades the frog constituting *canker*. The same occurs in sheep as the result of long continued irritation to the skin of the coronet, and is the worst form of non-contagious *foot-rot*. 6th, A sixth form of the affection (*scratches*) is much more common in our light American horse, exposed in the deep mud of spring, and consists in minute excoriations, becoming covered with thin scabs which remain tender and troublesome for an indefinite length of time.

Treatment. The prime essential is to avoid the cause, whether exposure to filth, cold, wet, local irritants, low condition, or disorder of some internal organ or function. If the inflammation runs high a cooling laxative (Glauber salts, aloes,) and mild diuretics (nitre, iodide of potassium,) should be given, unless contra-indicated by low condition

or debility. Tonics (iodide of iron) should be conjoined with gentle diuretics for weak patients, and the food should be cooling (in part green or roots). Gentle pressure from a bandage evenly applied from the foot up, is beneficial.

In simple inflammation, without eruption or discharge, apply cloths wet with a weak solution of sugar of lead or other astringent, and in winter cover these with a dry bandage to prevent freezing. Or a poultice may be applied with a little sugar of lead lotion on the surface.

When cracks have appeared, apply a similar lotion with the addition of a few drops of carbolic acid or grains of chloral-hydrate (enough to give it an odor); or sulphurous acid solution, water and glycerine in equal proportions, covering promptly and perfectly with a bandage; or, glycerine and aloes, etc.

In case of discharge or pustules the lotion may be made with chloride of zinc or lime in place of sugar of lead, or finely powdered charcoal may be sprinkled over the poultice; carbolic acid or chloral will be equally in place.

When fungous growths appear more active measures are demanded. Strong carbolic acid may be applied to them individually, or better, pledgets of tow, saturated with tincture of the muriate of iron, should be bound on by a tight bandage extending from the hoof up. Or the growths may be snipped off with scissors and the muriate of iron applied; or they may be individually strangled by a stout thread tied round their necks, or cut off with the sharp edge of a red-hot blacksmith's shovel, a cool one being held beneath to protect the skin. Then apply any one of the antiseptics above mentioned.

Scratches are among the most obstinate forms of the affection because not severe enough to demand the seclusion of the horse from wet, mud and snow. In feeding the subjects of this affection avoid all buckwheat, maize or other heating agents, and if it proves obstinate resort to the various internal remedies advised for chronic eczema

Locally use benzoated oxide of zinc; glycerine and aloes; camphorated spirit and chloral; the same with a few drops of tincture of chloride of iron, etc. When irritation subsides and the scales drop off, leaving a healthy-looking surface, smear with a bland ointment (spermaceti and almond-oil).

CUTANEOUS INFLAMMATION WITH NODULAR SWELLINGS. TUBERCULES.

The most remarkable example of this is what is known to horsemen as *surfeit*, by veterinarians as *urticaria*. It occurs in spring and autumn in horses, cattle and pigs, and is at once connected with moulting and sudden changes of food or of weather. With some fever, there appear on different parts of the body swellings varying in size from a pea to a walnut, and often running together so as to form extensive patches, which will close the nostrils, eyelids or lips, and put a stop to feeding or even threaten suffocation. There is little pain or tenderness and the swellings are very transient, appearing and disappearing on different parts at short intervals.

Treatment consists in clearing out the bowels by a purgative (horse, aloes; ox, salts; pig, oil or jalap,) and following this up with bitters (gentian, etc.,) and diuretics (nitre, carbonates of soda and potassa).

SCALY SKIN AFFECTIONS. PITYRIASIS.

These are exemplified in the scurfy, scaly affections which appear in the bend of the knee (mallenders) and hock (sallenders) and on the lower parts of the limbs, by *scratches*, and by a scaly exfoliation and shedding of hair of the mane and face of old horses, and of different parts of the body in cattle. Some of these like *mallenders*, *sallenders* and *scratches* may commence as papules or vesicles, while the scaly affection of the face is often connected with a vegetable growth, but this form is distinguished by extreme tenacity, and a gradual progress from its point of

origin; that which is dependent on constitutional causes is more diffused. They depend on the general causes of skin diseases;—heating, unsuitable diet, sudden changes, imperfect grooming, heats of summer, disorders of the lungs, bowels, liver or kidneys, on oxalic acid in the blood, and some constitutional causes. Beside the scurfiness and loss of hair, the itching is often so extreme as to render the subject almost unmanageable, and useless for work.

Treatment. A moderate laxative diet consisting in part of roots (carrots and turnips,) the free administration of alkalies (carbonate of potassa or soda, etc.,) and if still inveterate, a prolonged course of arsenic will be requisite. Locally use mercurial ointment or, if extensive, sulphur or tar ointment, etc.

BOILS. FURUNCLES.

These are too well known to need description. They consist in circumscribed inflammation of the deep layers of the skin, with pustule and sloughing of a limited part of the fibrous tissue. They are not uncommon on the legs of horses, and if a number appear in succession are a source of great trouble.

Treatment. While still a simple inflamed nodule they may often be arrested by incising crucially with a sharp knife and applying cold water bandages. Or apply a poultice or thick wet cloth to bring quickly to a head. If the resulting sore is indolent or unhealthy touch with nitrate of silver. The free internal use of alkalies (carbonate of soda) sometimes checks their production.

NERVOUS IRRITATION OF THE SKIN. NEUROSIS. PRURIGO.

This is often seen in horses that are overfed on grain (especially the more stimulating varieties) and hay, and that have close, unwholesome stables. Hot weather is also a cause. Though occasionally associated with pimples or even vesicles, the irritation is found to be equally

severe on parts devoid of eruption, yet the integument tends to become thickened and rigid as the disease persists. The irritation may be slight or so severe that the harness cannot be kept on. It must not be confounded with rubbing of the tail from pin-worms.

Treatment. Purge, put on restricted diet, with roots wash the skin with soap and water, and apply water slightly soured with oil of vitriol. If this, with carbonate of soda internally, fails to cure, a long course of arsenic is demanded.

WARTS. CALLOSITIES. CANCER. BLACK PIGMENT TUMORS.

WARTS are to be removed by scissors and the part burned with some caustic (lunar caustic if near the eye, butter of antimony, blue-stone, chloride of zinc, etc., elsewhere). Or they may be destroyed by tying a thread tightly round the neck of each, or by the use of the hot iron.

CALLOSITIES are common under the saddle (sitfasts). A circumscribed portion of skin, the seat of a former chafe, has become thickened and indurated to almost horny consistency. The skin around the edges is inflamed, raw and angry. It can usually be loosened by a poultice, so as to be easily removed by a sharp knife, after which it is to be treated as a common sore.

BLACK PIGMENT TUMORS (Melanosis) are exceedingly common in gray and white horses, attacking the black parts of the skin (anus, vulva, udder, sheath, lips, eyelids, etc.,) and though sometimes cancerous are often quite harmless, and should always be removed with the knife.

EPITHELIAL CANCER is not common in the lower animals but is seen in the lips of horses and cats. Here again the knife is the best remedy.

PARASITIC DISEASES OF THE SKIN.

COMMON RINGWORM. TINEA TONSURANS.

This is common in horses, cattle, dogs and cats, as well as in man, and is readily transmitted from one to the

other. It is especially common in winter or spring, and occurs as round bald spots on the face or elsewhere covered with white scales, and surrounded by a ring of bristly, broken hairs, or split hairs with scabs around the roots and some eruption on the skin. Soon this ring of broken hairs is shed and a wider bristly ring is formed. Among the naked eye characters the breaking and splitting of hairs in the ring, and the perfect baldness of the central

Fig. 42.

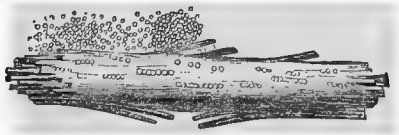

Fig. 42—Hairs with spores of Trichophyton Tonsurans. From the horse. —MEGNIN.

part are the most significant. Chloroform bleaches the affected hairs, while the sound ones are unaffected. The microscopic appearances are the presence in the hairs and hair follicles of a vegetable parasite (*trichophyton tonsurans.*)

Treatment. Shave the hairs from the affected part, or better, pull them out with a pair of pincers and paint with tincture of iodine, or a solution of corrosive sublimate (40 grains to 1 pt. of water), or of bisulphite of soda ($\frac{1}{2}$ oz. to 1 pt.)

HONEY-COMB RINGWORM. FAVUS.

Common in *cattle, dogs, cats, rabbits* and *chickens*, as well as in children (*scald-head*). It shows the same general appearance of baldness advancing from a centre, which is described above, but a cup-shaped yellowish scab results which has obtained for it the name. The parasite (*Achorion Schönleini*) appears to be but another form of the fungus of ringworm affected by its conditions of growth and especially by the weak or unhealthy condition of the host. *Treat* as for common ringworm.

Fig. 43.

Fig. 43—Hair with spores of Achorion Schönleini, from the horse.—MEGNIN

DIFFUSE BALDNESS (TINEA DECALVANS). PARASITIC PITYRIASIS

Two other forms are seen in the horse, one attacking any part of the body, and recognized by the agglutination of five or six hairs together in a white crust, and the other attacking the heads of old horses, and characterized mainly by the scurfy product. Both are exceedingly inveterate, though not attended with excessive itching, and demand the persistent use of tincture of iodine or corrosive sublimate lotions in order to effect a cure.

Fig. 44.

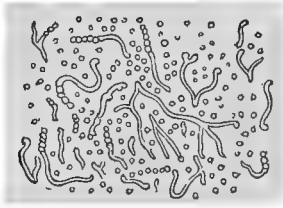

Fig. 44—Microsporon Adouinii from Parasitic Pityriasis in the horse.—MEGNIN.

In all those cases the harness, brushes, combs and woodwork must be washed with a solution of caustic potassa or soda, and then wet with iodine ointment or a solution of corrosive sublimate, otherwise all treatment may be fruitless. Horse blankets should be boiled for a length of time.

PARASITIC GREASE. CONTAGIOUS FOOT-ROT IN SHEEP.

In inflammation of the horse's heel, attended with fungus-like growths (*grapes*), a vegetable growth is often present and seems to be a main cause of the disease. The *contagious foot-rot* in sheep presents the same appearance of the skin, and is presumably due to a similar parasite. With or without an abrasion, the matter from a diseased foot produces in the healthy one swelling, excoriation and fungous growths round the top of the hoof, as well as an excessive growth, softening and loss of cohesion of the horny elements below.

Fig. 45.

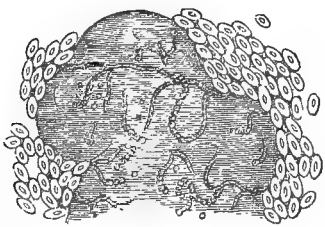

Fig. 45.—Oidium Batracosis from parasitic grease.—MEGNIN.

Treatment consists in laying bare the diseased surface, and applying active caustics and parasiticides. Pare the horn to the quick and apply tow soaked in tincture of muriate of iron, butter of antimony, solution of blue-stone or nitrate of silver, bind up firmly, and repeat the dressing daily. All overgrown horn must be carefully removed, and means taken to prevent irritation from dried mud, etc.

MANGE. SCAB. ITCH. SCABIES. ACARIASIS.

These names among others are given to diseases of the skin caused by acari. Of parasitic acari there are three principal species: *Sarcoptes*, which burrow in canals in the scarfskin and are difficult to find and eradicate, and *dermatophagus* and *dermatocoptis* which live on the surface or among the scabs and are more easily disposed of. Another

Fig. 46.

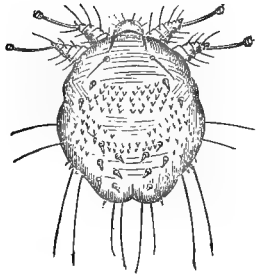

Fig. 47.

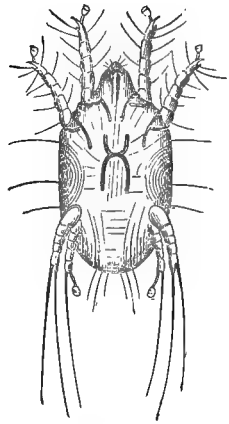

Fig. 48.

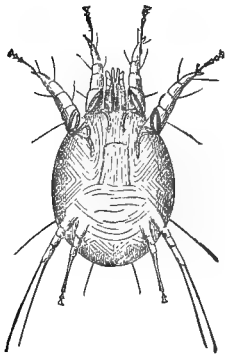

Fig. 49.

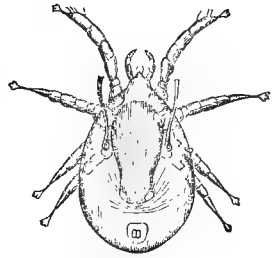

Fig. 50.

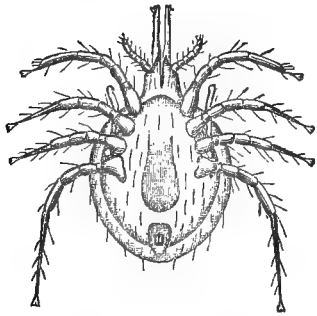

Fig. 51.

Fig. 46—Sarcoptes Equi. Female. Fig. 47—Dermatophagus Equi. Female. Fig. 48—Dermatocoptes Equi. Female. Fig. 49—Dermanyssus. (Hen louse.) Fig. 50—Gamasus of Fodder. Fig. 51—Demodex.

species—*demodex*—inhabits the sebaceous glands of the skin in sheep and dog and causes much irritation with *acne-like* eruption. Among acari occasionally parasitic may be mentioned: the *dermanyssus* (misnamed hen louse), the *gamasus* of musty hay, and the *leptus* (misnamed jigger in the Western States), all excepting the last living on the surface and easily discovered. Lastly a *tyroglyph* is accidentally parasitic on all domestic animals.

Of the *sarcoptes* there is one species lives on the horse, which will temporarily inhabit the skin of man; a second is peculiar to the goat; a third is common to dogs and swine, a fourth to cats and rabbits and a fifth to chickens horses and foxes.

One species of *dermatophagus* lives on the heels and legs of horses, another on the tail, neck, etc., of cattle, and a third on the pastern, limbs, and less frequently the trunk, of sheep.

Of *dermatocoptes* there is also a particular species for each of these animals—horse, ox and sheep—though usually confounded with each other. These are the most common causes of mange and from their non-burrowing habits are most easily disposed of.

Accessory causes. Though the reception of the acarus is the one essential cause of mange, yet others conduce to its speedy diffusion—as poor condition, filth and warm seasons. Some acari, like the *dermatophagi*, may even seem to suspend operations in winter and cause little or no trouble until the following spring.

Symptoms. We must state these in general terms, throwing the whole class into one group. There is intense uncontrollable itching, aggravated by hot weather or buildings, and by perspiration. If the affected part is scratched the animal shows his gratification by moving his body as if rubbing, and especially (in horses) by a nibbling movement of the lips. In sheep the wool is torn off, and white tufts hang on the dark surface of the fleece. The skin is thickened and rendered rigid by exudation into its sub-

stance, as well as by the accumulation of crusts on the surface. In fine skins, like that of the sheep, there is a distinct papular eruption, and in all there are excoriations and even deep sores and ulcers from the incessant and desperate rubbing. The bare patches are less absolutely so than in ringworm, for hairs still adhere at intervals and though the hairs may be broken they show less brittleness or tendency to split up. But the one reliable sign is the presence of the *acarus*, which may often be recognized by the naked eye when a little of the scurf is placed on a plate of glass and closely watched. The scabs will be seen to move and a little observation will enable one to detect the almost invisible insect. A low magnifying power is a great help. To find the sarcoptes it may be necessary to expose the skin to the warm rays of the sun, to detach a crust and tie it for twelve hours on the skin of the arm, when the acarus will be found in the centre of a pale red papule and may be removed with a needle.

The *dermanyssus* may not be found on the skin unless the subject is examined in the stable at night. They are large and easily detected when bright crimson, from being gorged with blood. There is always the suspicious proximity of chickens or their dung, the latter swarming with gray acari.

The *demodex* living in the hair follicles of dogs, causes loss of hair and prominent red nodules (acne) while the sebaceous matter squeezed from the follicles contain specimens of the acarus.

The *sarcoptes* of chickens attacks the comb, wattles and feet, causing great irritation.

Treatment is local, though nourishing food, cool clear air, clean dry buildings, and the avoidance of crowding or exertion are important auxiliaries. By soap-suds, preceded if necessary by oil, break up and remove the scabs and crusts; then apply thoroughly with a brush, oil of tar 1 oz., whale-oil 20 oz., or ½ lb. each of tar and sulphur,

and 1 lb. each of soap and alcohol. For sheep with heavy fleeces baths are very efficient. The following example will neither stain the wool nor materially endanger the sheep. Tobacco 16 lbs., oil of tar 3 pints, soda ash 20 lbs., soft soap 4 lbs., water 50 gallons: Boil the tobacco and dissolve the other agents in a few gallons of boiling water, then add water to make up to fifty gallons, retaining a temperature of about 70° Fah. This will suffice for 50 sheep Each sheep is kept in the bath three minutes, two men meanwhile breaking up the scabs and working the liquid into all parts of the skin. When taken out he is laid on a sloping drainer and the liquid squeezed out of the wool and allowed to flow back into the bath. A second

Fig. 52.

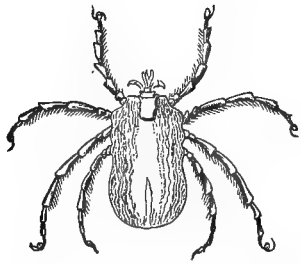

Fig. 52—Ox-Tick.—VERRILL.

and even a third bath may be necessary in inveterate cases. For newly shorn sheep oily applications are better, being less liable to be washed off by rains. One part of oil of tar to 40 parts castor-oil or lard will usually suffice, but sulphur may be added if desired. The common use of mineral poisons, and especially the compounds of mercury for sheep dips, must be strongly deprecated.

In all cases an essential part of the treatment is to dress with similar agents, or with a strong solution of caustic potassa, all harness, brushes, combs and wood-work, and to subject blankets to prolonged boiling. In pastures, dress every rubbing post, tree, stump, stone, or wooden fence, or change the field.

TICKS. IXODES.

These are common on stock in some parts of the country and may be picked off or dressings applied as for acari.

LARVA OF GADFLY. WARBLES.

These may be found in little rounded tumors the size of hazel-nuts, on the backs of cattle in winter and spring, each tumor having a hole in the centre through which the grub may be seen or extracted. A second species attacks sheep as well as cattle, while a number of others in different countries, but especially in the tropics, live in the skin of man and a variety of animals. Where gadflies

Fig. 53.

Fig. 53—Œstrus Bovis. Gadfly of ox.—CLARK.

Fig. 54.

Fig. 54—Larva of same. Warble.

abound, animals are greatly terrified and injured by their attacks. The best *treatment* is to examine all cattle in spring and squeeze out and destroy the grubs found in their backs, enlarging the openings with a knife when necessary. This cuts off the supply of flies for the coming year and a universal practice of this might be expected to kill them out.

ATTACKS OF FLIES (DIPTERA). MAGGOTS.

The attacks of flies are often very troublesome and even fatal to stock. Many agents such as oil, infusions of walnut leaves, rue or wormwood, are used to drive them off but with only partial success. To protect the heads of sheep a mixture of camphor, turpentine and asafœtida is very effectual.

Sheep suffer much in some localities from the larva of the blowfly, laid on any damp or dirty part of the skin, as on the tails and thighs when scouring. In such neighborhoods the existence during summer or autumn of a dark wet spot on the skin, of a white tuft of wool, or of wriggling of the tail will demand immediate attention.

Treatment. Clip off the wool and filth, pick off all maggots and apply oil of turpentine or of tar 5 oz., camphor 1 dr., asafœtida ½ dr.; dilute carbolic acid or kerosene may be used in the absence of anything else. To prevent the attacks use the sheep dip advised for scab, or cut off the dirty wool and apply carbolic acid 1 part, water 50 parts.

SHEEP-TICK. HIPPOBOSCA (MELOPHAGUS) OVINA.

This is a dipterous insect degraded by the non-development of its wings. It is best met by the dips advised for

Fig. 55.

Fig. 55—Sheep-Tick with egg. Magnified.

scab. It is especially important to dip lambs, after affected ewes have been shorn, as the insects migrate to the young where they find more wool to shelter them.

FLEAS.

These, like the hippoboscidæ, are wingless diptera. We have a variety each for the dog, cat, hen and dove, and in tropical America the *pulex penetrans* or *Chigoe* which burrows under the skin and there lays its eggs to be hatched out in the flesh. Persian Insect powder is one of

the best agents to dust over the animals as well as over carpets, rugs, etc., on which they have lain; or wash with the yolks of eggs and a teaspoonful of oil of turpentine to each egg; or a mixture of an ounce of oil of anise-seed and ten ounces olive-oil may be rubbed over the body and washed off with soap six hours later. Sprinkle the soil

Fig. 56.

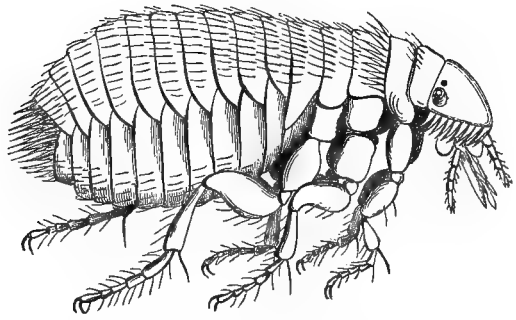

Fig. 56—Cat Flea. Enlarged.—VERRILL.

where the animals roll with quicklime, carbolic acid, or petroleum; deluge kennels and roosts with boiling water and afterward paint the cracks with oil of turpentine; dip mats or rugs in boiling water, and litter the buildings with fresh pine shavings.

LICE.

These are degraded wingless hemipterous insects. There are two kinds: *blood-suckers* (*hæmatopinus*), with narrow head and long trunk-like sucking tube; and *bird-lice* (trichodectes), with very large, broad head, and no sucking tube, but biting jaws.

Of the *blood-suckers* there is one species each for:—horse and ass; horse and ox; ox; goat; swine, and dog and ferret.

Of *bird-lice* there is a species each for:—horse and ass; ox and ass; sheep; goat; dog; cat; duck, and goose; two for the peacock; three for the turkey; four for the pigeon; and five for the hen.

Fig. 57. Fig. 58. Fig. 59.

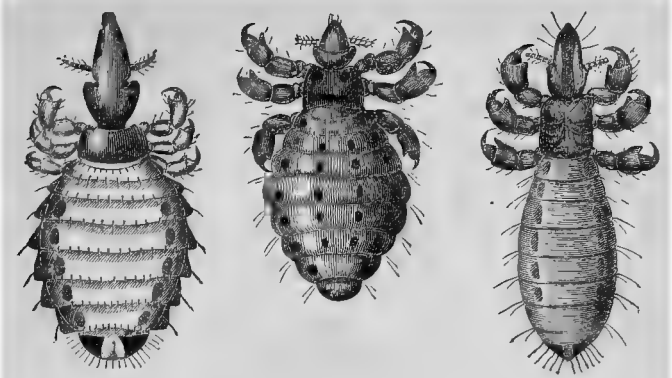

Fig. 60. Fig. 61. Fig. 62.

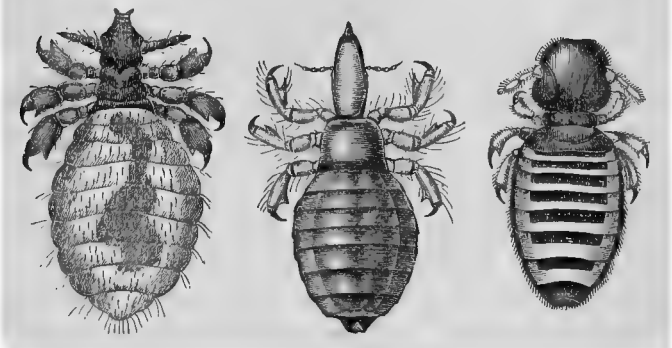

Fig 57—Hæmatopinus of Horse and Ass. Fig. 58—Hæmatopinus of Ox. Fig. 59—Hæmatopinus of Calf. Fig. 60—Hæmatopinus of Dog. Fig. 61—Hæmatopinus of Pig. Fig. 62—Trichodectes of Horse.

They may be safely treated by sprinkling with powdered wood ashes or by rubbing with sulphur ointment or whale-oil, with water saturated with petroleum or kerosene, or with a solution of sulphuret of potassium or lime (4 oz. to 1 gall. water). Clean the buildings, clothes, etc., as for fleas.

Fig. 63. Fig. 64. Fig. 65.

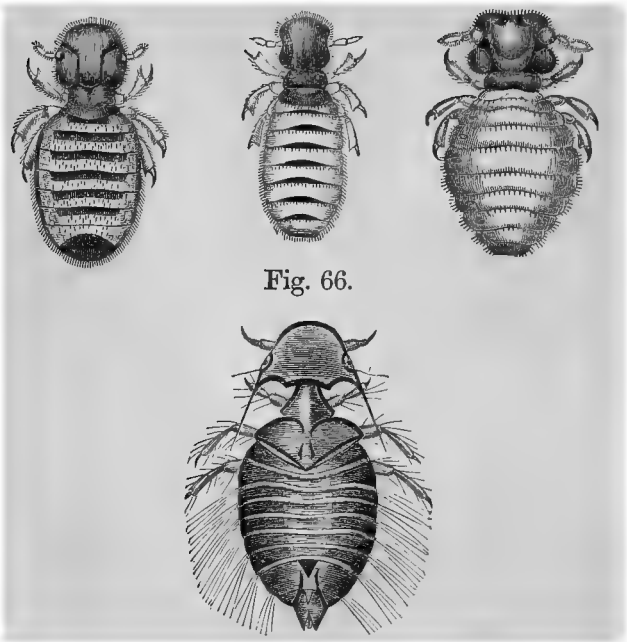

Fig. 66.

Fig. 63—Trichodectes of Ox. Fig. 64—Trichodectes of Sheep. Fig. 65 - Trichodectes of Dog. Fig. 66—Goniodes Stylifer of the Turkey.

ERYSIPELAS.

A specific, diffuse, spreading inflammation of the skin, often involving the loose connective tissue beneath, and sometimes the internal organs, associated with fever, an unhealthy state of the blood, and usually a poison by which it may be communicated to another animal with broken skin.

Causes. An unhealthy (septic, etc.,) condition of the atmosphere, the presence of impurities in the blood, from foul air or food, plethora, exhausting work, debilitating diseases, disorders of the liver, kidneys or other blood-forming or purifying organ, or the absorption of putrid

matters from a sore or other diseased surface. Sheep, horses and swine fed on green or even harvested buckwheat are liable, and all animals kept in close, filthy, unhealthy places or in the vicinity of accumulations of decomposing animal and vegetable matters. Sudden suppression of an habitual discharge, heating food, and new grain and forage are occasional causes. But probably all of these do little more than lay the system open to the attack which would otherwise be escaped. More direct or exciting causes we find in local irritation,—as exposure to a hot sun (newly-shorn sheep), chafing inside the elbows or thighs, the presence of rancid fats on the skin, injuries from the harness, bites of insects, etc., burns, scalds, wounds, dropsies of the limbs, and above all the keeping of patients with open sores where there is excessive emanation from decomposing organic (especially animal) matter, or the dressing of erysipelatous and healthy sores with the same sponges.

Symptoms. There is usually a preliminary fever, loss of spirit and appetite, heat of the skin, accelerated pulse and breathing, constipation, high-colored, scanty urine, and elevation of the temperature of the rectum, soon followed by a diffuse, hot, tender, shining, itching swelling, spreading from a wound or other seat of irritation or even on a previously healthy skin. In white skins the redness is very deep, the shade being darker according to the gravity of the case, and disappearing under the pressure of the finger only to reappear quickly on its removal. The swelling will be greater, according as the inflammation involves the skin only, extends to the connective tissue beneath (phlegmonous), or is complicated by a liquid exudation (œdematous). It shows a tendency to wide and rapid diffusion over the skin, its advancing border being always abruptly elevated from the healthy integument, though at points where it is recovering it may subside gradually and insensibly to the healthy surface. The inflamed skin is tense and smooth, but pits on pressure,

and often presents vesicles on its surface. After a few days the swelling and redness may diminish, and the blisters dry up into scales, which drop off, leaving a dark, red, tender surface; or cracks may form with a sluggish, unhealthy action and little tendency to heal. When matter forms it is liable to be diffused without any limiting membrane as in an ordinary abscess, and to lead to extensive death and sloughing of the skin and subjacent structures, or to absorption of pus and its deposit in internal organs, with fatal results.

In *horses* it is seen mainly about the head, chest, belly and hind limbs, and is especially liable to prove œdematous. It is distinguished from *Anthrax* and *Purpura Hœmorrhagica* by the presence of the wound or sore, by the low inflammatory character of the swelling, by the greater tendency to suppuration, and the implication of the adjacent lymphatic glands.

Cattle suffer especially about the head but also on other parts of the body. *Sheep* suffer mainly about the head, but often and more severely about the udder, belly and inner side of the thigh or arm, and it may be elsewhere.

Swine are mainly attacked about the head and neck, and less frequently on the inner side of the limbs, the chest or belly.

Treatment. Open the bowels freely (horse, ox and sheep, Glauber salts; swine and dog, castor-oil,) following it up by frequent and full doses of tincture of muriate of iron and a nourishing, easily digested diet. In case of much weakness or with very low fever use stimulants, alcoholic or ammoniacal as they may be demanded, but never if they cause dryness of skin and rise of temperature. Diuretics may be used in œdematous cases, but in a guarded manner because of the depression. To the affected skin apply warm fomentations, by preference, with weak solutions of tincture of muriate of iron, hyposulphite of soda or sulphate of zinc. Sometimes dry applications have a good effect,—as a mixture of sulphate of zinc and

starch. Iodized collodion too is often of service. If matter has actually formed it should be let out with the lancet, the wound being dressed with a solution of muriate of iron to prevent unhealthy action.

WOUNDS.

These are divided into *simple clean cuts (incised), stabs, pricks and punctures (punctured), bruised or crushed (contused) and torn (lacerated).* *Clean cuts* often heal readily when the edges are brought together accurately and retained so. But such union by *adhesion* is most probable in strong, healthy, well-conditioned animals, and least so in the weak, poor and diseased. In *fowls* it is almost invariable, in *swine* nearly equally so, in *dogs, cattle* and *sheep* there is still a strong tendency to adhesion, while in *horses* all wounds readily form matter and primary adhesion throughout is exceptional. Bleeding should be checked, (see *wounds of arteries*, etc.,) clots washed off with a stream of tepid water, foreign objects carefully removed with fingers or forceps and the wound closed with as little exposure as possible. The edges may be stitched together by means of a curved flat needle with silk or linen, well waxed or steeped in a weak solution of carbolic acid, or better, with catgut which has been steeped for a month in oil and carbolic acid, or with silver or other metallic wire. It may be closed by a continuous stitch as in sewing a glove, when adhesion is to be expected, or by separate stitches a half to three-fourths of an inch apart when primary union is more doubtful. To secure uniform approximation of the edges or pressure on the different parts, the stitches may be passed round a quill placed on each lip of the wound (quilled suture). Or pins may be passed through the lips at suitable distances and a few fibres of tow twisted around each like the figure 8. Small wounds may have their edges shaved and layer after layer of collodion applied until the covering is strong enough to hold them together. The use of a weak solution

of carbolic acid or other antiseptic agent will further favor adhesion if it can be applied without causing movement of the lips of the wound.

If the wound fails to heal by prompt adhesion, *granulations* form, covered with a thin layer of pus, and these gradually fill up the sore, leaving a scar. Or if the lips of the wound are still kept together the granulations may adhere (secondary adhesion), or finally small sores will *scab* over and healing take place beneath.

Granulating wounds may be washed daily with a stream of tepid water, after the three first days, and may be covered with a simple dressing of tow saturated in water or oil to which a little carbolic acid has been added. When necessarily left bare the same liquids may still be applied. When the granulations become soft, flabby and projecting (*proud flesh*), touch lightly with a stick of lunar caustic, and expose to dry air. When they become indolent and when healing and contraction come to a stand-still, apply gentle stimulants—tincture of myrrh and aloes, etc. When the deeper parts of the lips of the wound do not come in contact, pads may be applied on each side to keep them in apposition. Granulating wounds usually heal by contraction from their edges, and if this is arrested by adhesion to bones and other firm parts beneath, further healing may be impossible. In this and other cases of tardy healing, the implanting of thin slices of scarfskin, just cut with a sharp instrument from other parts of the integument, and their retention with strips of sticking plaster, will usually hasten the process.

Punctured wounds often heal promptly, and especially in animals prone to primary adhesion, when cleansed, kept at rest, with warm dressings and pressure on their deeper parts. If inflammation occurs in the deeper parts with suppuration, it may be necessary to enlarge the opening to allow of a ready discharge, and to let it heal outward by granulation.

Bruised and torn wounds may be treated like punctured

ones, and in birds, pigs and dogs, and in the more vascular parts of the larger animals, will often heal by adhesion. Should they fail to do so, they ought to be stitched together, not too closely, and allowed to heal by granulation. Parts that are absolutely dead may be removed, but none that continue to show signs of life, and above all, no skin that can possibly be saved.

Poisoned wounds should be promptly cauterized (*See Canine madness, Malignant anthrax, Lymphangitis*). *Subcutaneous wounds,* in which the deeper parts are injured with little or no breach of the skin, mostly heal satisfactorily, and the main object should be to secure a suitable position of the part, lest distortion should occur from undue contraction or extension of the structures in healing. For wounds that have resulted in *fistula,* see *poll evil, fistulous withers* and *quittor.* Whenever a foreign body is lodged in a wound it should be removed because of its tendency to cause *fistula,* especially in horses.

BURNS AND SCALDS.

The gravity of these will vary much according to their extent and depth. The treatment of the more severe is rarely desirable in the lower animals, because of the danger of fatal results from internal complications; or of ruinous distortions from the contraction of cicatrices. For slight burns apply cold water, Goulard water, water perceptibly sweetened with carbolic acid or flavored with oil of turpentine, keeping this up until the violent pain and inflammation have subsided. Success attends the exclusion of air by covering the part thickly with flour or cotton wool until irritation is past. The same end is gained by bathing the burn with oil of turpentine and afterward covering with resin ointment. When large blisters have formed, puncture with a needle and smooth down the cuticle on the skin by gentle pressure, following up with the soothing measures already recommended. When the skin is still more deeply burned and sloughing

is inevitable, the stimulating applications (oil of turpentine with resin ointment, equal parts of linseed-oil and lime-water, etc.,) are still more demanded. As the sloughs separate, the detached parts should be cut off with as little irritation as possible, and when the severe irritation subsides soothing applications will be in order. Finally, the healing process will be greatly hastened by ingrafting thin slices of scarfskin as advised under wounds.

CHAPTER XVIII.

GENERAL DISEASES OF BONES, JOINTS AND MUSCLES.

Lameness, symptoms, at rest and in exercise. Diseases of Bones. Inflammation. Ostitis. Periostitis. Softening. Enlargement. Suppuration. Ulceration. Scrofulous (Tubercular) Disease of Bone. Softening and Rarefaction of Bone. Rickets. Osteo Malacia. Softening in Cows. Softening in Horses. Big-head. Fractures. Diseases of Joints. Inflammation. Arthritis. Synovitis. Ulceration. Bony Deposit. Anchylosis. Open Joint. Inflammation of Bursæ and Sheaths of Tendons. Diseases of Muscles. Ruptures. Inflammation. Fatty Degeneration. Rupture and Section of Tendons. Sprains. Thickening. Shortening. Calcification.

LAMENESS.

As the three following chapters will embrace most of the different causes of lameness, the more prominent manifestations of this failing may be here noticed.

Standing. The patient should be approached quietly and when you are certain he is free from all exciting causes. If resting on all four limbs, the pastern of the lame one will usually be more upright than the others. One fore foot advanced eight or ten inches in front of the other suggests some tenderness of the heel or the structures in the posterior region of the lower part of the limb. Bending of the knee and fetlock and resting of the foot on the toe, without any advance in front of the other, usually implies disease of the shoulder or elbow. The advance of both fore feet, the rest being taken on the heels, and the hind limbs brought well forward under the body, should direct attention to the front of the feet. Resting

of one foot more frequently and for longer periods than its fellow is suspicious.

Lying. An inclination to lie down, and remain so, is to be similarly regarded. If the animal remains down persistently, we may infer great suffering, fractures or much weakness.

In Exercise. Lameness may be shown in the walk, but better in the slow, easy trot, the animal being led in hand with about three feet of free rein and without noise or other cause of excitement. Some horses manifest a bridle lameness from the mere leading, but if the leader goes first on the left side and then on the right, the drooping of the head will correspond first to the one foot and then to the other, showing it to be only a feint. In all cases of lameness in a single limb the foot is rested on the ground with less weight and is raised as quickly as possible. There is therefore not only the visible halting on that limb, but a lower sound made by striking the ground and thus the ear comes to assist the eye in detecting the ailing member. If one fore limb is affected, the head and anterior part of the body are elevated when its foot comes to the ground, but drop firmly when the sound foot is planted. A depression of the opposite hind limb accompanying the elevation of the head, when the failing fore limb comes to the ground, must not lead to the suspicion of lameness behind.

In single lameness behind, the gait resembles that seen in lameness before, the haunch on the diseased side being raised when the foot is planted and allowed to droop thereafter until the opposite foot reaches the ground. In some, the elevation is the prominent feature, in others the depression, but in all the rising and falling are greater than in the opposite quarter.

With lameness in both fore limbs the step is short, the stroke on the ground weak, the rest of each foot on the ground shortened, the shoulders are carried upright and stiff, the head is raised, the loins are arched, the croup

droops, and the hind limbs are brought unnaturally for ward beneath the belly.

Lameness in both hind limbs is marked by the backward position of the fore feet, the short rest and weak impulse of the hind on the ground, the extension and drooping of the head, and above all the difficulty of backing.

Lameness in the two limbs on the same side determines a gait approaching the *amble* or *rack*, with the firm planting of the opposite members. Lameness of one fore and the opposite hind produces a simple exaggeration of the gait caused by disease in one of these limbs. When the cause of lameness exists in more than one limb it is difficult to make the animal keep the trot.

In all cases it is well to have the animal driven or ridden so as to heat him, and then keep him perfectly still for half an hour to cool, before completing the examination, as many lamenesses will disappear when the subject is warmed by exercise.

DISEASES OF BONES.

These may be divided into :—*inflammation* of the bone itself (*ostitis*), or of its fibrous covering (*periostitis*), which may result in *softening*, *consolidation* or *induration*, *enlargement*, *bony growths* and *tumors*, *abscess*, *ulceration* and *death* (*necrosis*). Beside these there are the degenerations and diseases of bone such as *deficiency* or *excess of earthy salts*, with bending or brittleness of the bones ; *tubercle*, *cancer*, and *sarcomatous*, *cartilaginous*, *cystic*, *vascular or other tumors*, etc.

But the great mass of bone diseases in the domestic animals consist in inflammation and its results, to which, accordingly, the following remarks will be mainly confined. Every bone is permeated even in its densest parts by an abundant network of minute blood-vessels, and studded throughout with microscopic soft elements (nuclei) which appropriate the suitable materials from the

blood and build them up into the hard bony texture. If these nuclei are injured their powers of assimilation are modified, their numbers are multiplied, and they become surrounded by an excess of semi-fluid matter (lymph) with, it may be, one of the following results:—1st, the softening of the bone and the removal of its earthy salts, until it can be cut with a knife or gives way under the weight of the animal:—2d, the transformation of the lymph into pus on the surface of the bone or in its interior, where it may remain imprisoned for an indefinite length of time:—3d, the hardening of a limited amount of lymph in the cells or inter-spaces of the bone, compressing the blood-vessels, limiting the supply of blood and favoring ulceration or even death of the part:—4th, from the above cause, or from a perversion of the plastic or assimilating powers of the nuclei, ulceration sets in on the surface or in the interior of the bone, and the bony matter is steadily removed to be replaced by an irregular excavation or a cavity filled by a bloody ichor:—5th, the swelling may completely close the blood-vessels of the bone or the inflammation may cause coagulation of the blood within them throughout a considerable portion, which accordingly dies, and has to be removed as a foreign body:—6th, short of those extreme conditions and more commonly, the exudation leads to a partial softening and general swelling of the inflamed part, and this becoming consolidated and hardened there is a material increase of size:—7th, and by far the most frequently, the inflammation affects the superficial layer of bone and its investing fibrous membrane, and the exudation, taking place between these, is soon consolidated into a layer or tumor of bone on the surface:—8th, any exudation on the outer side of the fibrous covering is also liable to be calcified and to form hard tumors, but these do not acquire the true bony texture like that formed between the membrane and the bone.

General Symptoms. In the slightest forms of inflamma

tion there may be little or no lameness, though usually there is a halt on the affected limb when trotted on a hard surface. The affected portion of the bone is tender to pressure or percussion, and is the seat of swelling at first soft and yielding, but later hard and resistant. In the severer forms the bone itself is softened, extensive exudation of lymph takes place around it, and the investing soft structures become the seat of violent inflammation and swelling; lameness is then extreme. In the slighter and chronic cases there is no disturbance of the general health, but in the more acute and severe, intense and even fatal irritative fever may come on.

When suppuration takes place in the interior of a bone the matter may remain imprisoned indefinitely, the spot being marked by a general increase of the bone, and lameness persists. If suppuration takes place between the bone and its fibrous covering the danger is even greater, for the matter is liable to separate the bone and membrane, producing further inflammation or ulceration, or even death of the bone—the supply of blood being cut off. The superficial abscess is to be detected by its fluctuation beneath the fingers, as in abscess of soft parts.

Ulceration may result from pressure of matter, etc., or from exposure to the air. If without external opening, it is not easily recognized, but there is lameness and tenderness, with little alteration of the surface of the bone, or the presence of slight bony deposits alternating, it may be, with soft open spaces. If the ulcerated bone is open to the air, it is found to be softened in texture, breaking down readily under the pressure of a probe, and in the centre of the ulcerous cavity rounded bony deposits are felt, as evidence of an effort at repair. The discharge is then ichorous, and abounds in gritty particles and earthy salts. If this discharge has commenced to decompose it smells badly.

Death of bone is always associated with an open sore discharging a very fœtid ichorous fluid, with gritty parti-

cles and the power of rapidly blackening silver. If probed the hard bone is felt without any fibrous covering, and if seen this is black, yellowish, white, or of some allied shade and without any of the pink aspect of healthy bone

General Treatment of Inflammation in Bone. Unless in the very mildest cases, the first object is to check the inflammation by soothing measures. A purgative is usually desirable. Rest is indispensable. Whenever possible such a position should be given to the part as will obviate pressure, weight, or gravitation of blood toward the disease. Soothing local measures, such as fomentations with warm water; a thick wet bandage covered with dry; the persistent application of cold water, by continuous showering of the part, the water being brought from a bucket placed at a higher level, by means of an elastic tube fastened to the body; in certain cases ice-bags may be applied; or cooling astringent lotions, such as vinegar and salt; acetate of lead ½ oz., vinegar 2 qts., carbolic acid 60 drops, etc. This may have to be kept up from five to fifteen days. When heat and tenderness have subsided, counter-irritants are to be used. In slight cases rubbing with compound iodine ointment, or with a mixture in equal parts of liquor ammonia and olive oil may suffice. In others we must use active blisters such as Spanish flies 2 dr., camphor 5 grs., alcohol 5 drops, lard 1 oz. Or a drachm of the Spanish flies may be replaced by a drachm of iodide or biniodide of mercury. In either case the hair should be cut off and the ointment well rubbed in for several minutes against the direction of the hair. The animal's head should be tied short for twelve hours, to prevent gnawing of the part and blistering of the lips. After this the surface is to be smeared with lard, daily, until the scab drops off. In still other cases the hot iron may be demanded. It should be applied in points, each application being very temporary, to avoid the effect of radiated heat on the adjacent skin. The usual distance between the points is from ½ to ¾ inch, and the depth will

vary in different cases. When the irritation from the hot iron has passed off, blisters may be applied if necessary.

In all cases the use of counter-irritants must be stopped and soothing measures resorted to when it becomes evident that active inflammation has been set up anew in the bone. A long period of rest is essential to allow of the hardening of the newly formed bony tissue or of the old bone which has been softened or otherwise altered by disease.

Matter forming in the interior of a bone is to be evacuated by boring down to it with a circular saw (trephine). Matter forming between the bone and its investing membrane must be promptly evacuated with a sharp knife or lancet.

Simple ulceration is to be treated like an ordinary wound, the pressure or other cause of its existence having been first removed. A nourishing diet and a course of tonics (cinchona, gentian, etc.,) are usually demanded.

A *dead bone* should be removed. If a simple scale or film on the surface, it may be taken off with a sharp knife or chisel. If larger the bone-forceps or saw may be necessary. It may sometimes be needful to remove a piece of live bone with the circular saw, to make way for the extraction of a dead portion imprisoned within. Should the outer fibrous covering of the bone be preserved intact, new bone may be formed in place of the old, but never so perfect in form, and, as a rule, the extensive loss of an important bone, in one of the lower animals, renders it useless and should warrant its destruction.

In no case should a cutting operation on a bone be undertaken while the soft parts around it are in a state of acute inflammation, as, although the diseased or dead parts should be removed, the adjacent bone is likely to take on unhealthy action and to prove worse than at first.

In case of new bony deposits and tumors, it is rarely desirable to resort to cutting instruments, unless when they have a broad mass and narrow neck, connecting

them to the parent bone. In this case they can be laid bare and removed with bone forceps or chisel. Other forms are best left to nature after all unhealthy action has been subdued, and will materially diminish when preserved from hard work, strains, jars and all excitants to renewed growth. When continuous gentle pressure can be applied without irritation it greatly favors absorption. In some instances the distension of the fibrous membrane covering a bony swelling is the main cause of continued inflammation and lameness. This is to be met by dividing the membrane with a narrow-bladed knife inserted to one side of the swelling, much care being requisite to avoid entrance of air, injury to joints, etc.

SCROFULOUS (TUBERCULOUS) DISEASE OF BONES.

This is mostly seen in young animals when the bones are soft and growing rapidly, and may be suspected when the patient comes of a tuberculous family. It will attack any part but is especially common in the lower part of the limbs and is one form of "*foul in the foot.*" It attacks the ends of long bones or the whole bulk of short ones, those parts, in short, which have an open cancellated texture. The interspaces of the bony tissue fill up with gelatinoid lymph, which may or may not pass into the yellow cheesy tubercle, and similar changes take place on the surface, long outgrowths appearing, the interstices of which are filled by the same product. Ulceration ensues, sores form in the skin, discharging an unhealthy matter, the softened bony tissues may be felt breaking down under a probe, and the ends or processes of the bones may be found detached from the shaft or median part.

There may be coexisting tubercle in the lungs, bowels, etc., with cough, expectoration, diarrhœa, etc., and sometimes in young animals the navel remains open and the urine dribbles from it continually.

Treatment is hardly advisable as tuberculous animals are undesirable alike for breeding or for human food. It

consists in securing a good nurse, well fed on grain as well as fodder if the patient is young, or good feeding if beyond this stage. Lime-water in the sucking, and in all subjects tonics (phosphate of iron, hyposulphite of iron, cinchona, cod-liver oil, pancreatine, etc.)

SOFTENING AND RAREFACTION OF BONE.

RICKETS. Young animals (puppies, sheep, calves and, less frequently, foals,) often suffer from an imperfect nutrition of the bones, with a deficiency of earthy salts, so that the bones, especially those of the limbs, bend under the weight of the animal and assume various unsightly distortions. The affection runs hereditarily in certain families, and its appearance is often determined by insufficient, excessive or injurious food, such as poor, sour or fevered milk or inadequate substitutes. Anything that undermines the general health will develop it in a predisposed subject. The malady may usually be checked by a change to rich or moderate feeding, as the case may demand, a dose of pepsin wine at each meal, with dry warm airy sleeping places and access to the open air, sunshine and gentle exercise. Puppies may have bones to gnaw at will. In cases of severe threatened distortion much benefit may be derived from support by well-padded bandages.

SOFTENING OF BONES IN DAIRY COWS. This resembles rickets in its dependence on the nature of the food, but appears only in breeding cows. It is a disease of poor sandy and gravelly soils, the vegetation of which is deficient in earthy salts, and even on these is shown only after a dry season when the fodder is at its worst. Diseases of digestion and assimilation will also, exceptionally, determine it. The parts that primarily suffer are the bones of the haunch, the disease resembling in this respect the *osteo malacia* of women who have borne children.

Symptoms. Lameness, difficulty in rising, with some alteration of form in the quarters are the first signs, and an examination of the pelvic bones by the oiled hand in-

troduced through the rectum will detect a want of symmetry on the two sides, from bulging, irregular swellings at different points. In more advanced stages the bones break and crumble under the body's weight and the animal remains constantly down, unable to rise. A depraved appetite and a tendency to eat all sorts of unnatural objects, though a common symptom in breeding cows, is excessive in many of these cases, and the patient mostly loses flesh rapidly, though some will remain fat for a length of time.

Treatment. Change the locality to one with a richer fodder or bring the wholesome fodder to the animals, and add, liberally, grain (barley, maize, oats, beans,) from sound localities. Fresh air, sunshine and dry resting places are all important. Avoid breeding again until health is fully established, or better, fatten for the butcher.

Softening of Bones in Horses. The *big-head* of the Mississippi valley, is a manifestation of a general fault in nutrition, showing itself in all the bones of the body more or less. Like the affection of cows it consists in a steady increase of the canals and cavities in bone, with their contained soft or plastic matter, at the expense of the hard bony structure. With the continuous enlargement of the bone there is an extreme thinning of the microscopic bony plates, until the structure can be easily cut with a knife or crushed under the pressure of the finger. The interspaces are filled by a red bloody mass, with the natural elements more or less modified and the addition of many spherical cells, or later of fat. As the disease advances the bones can no longer afford a firm attachment for the ligaments and tendons, but crumbling, dislocations and fractures are inevitable. There is some fundamental fault in assimilation, and though it may be determined primarily to the face by the hard work of grinding flinty maize, or its development may be precipitated by poor feeding, unwholesome stabling, overwork and abuse, yet its true primary cause is unknown. It is mainly or altogether a disease of early life, under seven years old.

Treatment should be directed to the improvement of the general health by tonics, (cinchona, nux vomica, cascarilla, boneset, willow bark, myrrh, oxide of iron, phosphate of iron, etc.,) carminatives, (ginger, pimento, fennel, fœnugrec, cardamoms, coriander,) pepsin, sound nutritious food, (given soft-boiled or steamed if necessary) pure air, exercise in sunshine, grooming, etc.) No good can be expected of advanced cases, but only of those seen in the early stage, with some stiffness, and swelling of bone, and the passage of phosphates, to excess, in the urine.

FRACTURES.

These are *simple* when a bone is broken across; *comminuted* when broken into several pieces; and *compound* when the soft parts are torn so as to establish a communication between the broken ends and the external air. The two last are extremely dangerous, but the first is more hopeful. Simple fractures, however, vary in gravity according to their kind. Thus in the very young the break is liable to be imperfect, with a number of pointed processes locking into each other (*greenstick fracture*) and as the ends are easily and accurately replaced and the bones soft and vascular, repair is prompt and perfect. In others the break is directly and smoothly across, or with indentations and processes, so that when the ends are placed in apposition they cannot slide past each other; these too are easily repaired. A third class are broken obliquely or with a bevel, so that the broken surfaces slide upon each other under the contractions of the muscles, and the sharp ends are continually jerked into the soft parts around. The continuous movement prevents union and the irritation of the soft parts sets up inflammation so that such fractures may prove as troublesome as the *compound*.

Symptoms. Disuse of the affected bone, distortion of the part, shortening, if it is the main bone of a limb, trembling of the muscles over the injury, a grating sensation conveyed to the hand on moving the broken bone,

unnatural mobility of the part, and the suddenness of the injury from a wrong step or some mechanical violence. In cracks and partial fractures of bones with a strong investing fibrous membrane, there may be no displacement, increased mobility nor grating, but only a tender line across the bone with or without a slight elevation.

Treatment. The first thing to be done is to bring the broken ends into correct apposition and retain them there by splints and bandages. No matter if the soft parts are inflamed and swollen, to leave the sharp ends jerking into them with each contraction of the muscles, will only make matters worse, whereas the removal of this source of irritation will usually entail immediate improvement. If from the oblique or comminuted nature of the fracture the bones cannot be so placed and retained, recovery need not be expected, at least without distortion.

To bring the ends together accurately, it may be necessary to employ extension and counter-extension. A strong sheet or blanket is crossed over the inside of the upper part of the limb and held to keep the body still; while extension is effected by lines attached to the foot, a block and tackle may be used, but cautiously, in view of the increased power thereby obtained. It may even be needful to relax the muscles by placing the animal under the influence of ether, chloroform, or chloral-hydrate. While the limb is being extended the operator brings the broken ends together correctly, and splints are applied.

These may be made of sheets of gutta-percha softened in warm water and applied so as to adapt themselves to the inequalities of the limb; of strong pasteboard with the edges torn (not cut) and softened in water to allow of its being moulded to the surface; of starch bandage, a long cotton bandage three inches wide, laid on accurately, layer above layer, and starched as applied so that it dries into a perfectly fitting and hard resisting case; a plaster bandage consisting of a long roll of the same kind with plaster of Paris thickly dusted between its layers, and the whole

dipped in water before it is applied; or pieces of sheet-iron carefully padded to prevent chafing and secure perfect adaptation, and bound firmly by a surface bandage; or wooden splints may be fashioned to the form of one side of the limb and applied with a sufficient internal padding. It is usually needful to apply one of these wooden or iron splints outside the starch or gutta-percha cases, in the larger animals, to give the requisite solidity. In all cases the limb should be accurately wrapped in a long narrow strip of cotton or linen as a protection before the application of the bandage proper. The bandage should always extend to the extremity of the limb (hoof or claws), otherwise the uncovered portion will swell, inflame, and perhaps die. It should not only fix immovably all the joints below the fracture but if possible the next above as well, as by this means, as well as by the enforced immobility of the muscles, the perfect rest of the broken ends is secured.

If swelling existed before the application of the bandage, it may become loose in a day or two and should be re-opened and more accurately applied, care being taken to secure equal pressure from the extremity up. The starch bandage may be slit open up the side and when properly padded reapplied with the one edge overlapping the other as far as necessary, and fixed by a long bandage applied over all. The plaster bandage may be adapted by filling up the interval between the soft skin bandage and the plaster case with a thin pulpy mixture of plaster of Paris and water poured in at the top.

The limb should be kept in the bandage for a month or six weeks, and will require a rest of two or three months more, for the consolidation of the new tissue, before being put to work.

Fractures in the upper parts of the limbs of quadrupeds, which it is impossible to fix by bandages, may yet recover with very little shortening or distortion if the break is transverse. Fractures of these parts and of the ribs

recover with a considerable enlargement around the seat of the break, which may be afterward absorbed in part or in whole, as the bone is consolidated. The same holds good of fractures of other parts when movement is allowed between the divided ends during recovery.

Slings. For large quadrupeds with broken limbs *slinging* is absolutely essential. The simplest mode is the following:—Four strong posts are fixed to the ground and roof, so as to form an oblong, inside which the four feet of the animal may stand. A strong horizontal bar is then fixed to the two posts on each side at such a height as to correspond to the middle of the body. Then the animal being walked into the frame a horizontal bar is fixed between the two front posts so high as to cross the lower part of the neck, and another between the two hind posts at about the height of the stifle. Next a strong sheet (new sail cloth is best) is fixed to the one side bar by being wound round and nailed at the outer side, and having been passed beneath the body, is fixed to the opposite bar in the same way. It must be just sufficiently far back to clear the fore limbs, and just so loose as to allow the patient to stand over it without pressure or chafing, or to settle himself into it at will. In the male, care must be taken to have it narrow enough not to cover the sheath.

It is often necessary to allow an animal to become fatigued by standing for a day or two before being put in a sling, otherwise he may be very irritable at first. Care must be taken not to let him feel the sling beneath him until it is ready to be fixed, as many patients will settle down into it the moment it is felt.

DISEASES OF THE JOINTS.

Here in addition to bone we have gristle, fibrous tissue (capsular and binding ligaments) and synovial membrane, a thin vascular structure which secretes the albuminous glairy fluid known as joint-oil.

INFLAMMATION. ARTHRITIS. SYNOVITIS.

Here again the most common lesion is inflammation from which most of the others follow as consequences. This may begin in the bones as a result of concussion, blows, etc., and extend through the cartilage and ligaments to the synovial membrane; or it may originate in the ligaments as a consequence of sprains or other injuries or in the synovial membrane from wounds opening the joint and exposing it to the air; or it may be a local manifestation of some constitutional disease such as rheumatism, tubercle, glanders, farcy, etc., or finally it may be due to plugging of the blood-vessels in consequence of pus, ichor or fibrinous clots washed on through the vessels from some distant seat of disease. In all cases the whole of the joint structures tend to be involved and the symptoms are similar.

The succession of changes may be as follows: the inflamed synovial membrane throws out a serous fluid filling the joint to excess; the ligaments and adjacent connective tissue also throw out a semi-liquid exudation which forms a yielding swelling around the joint, susceptible of indentation with the fingers; the cartilage covering the ends of the bones softens and is changed into a fibrous material or is even absorbed, leaving the bone bare; the bone exposed in this way may ulcerate, if that has not previously commenced, or it may be partially repaired by the deposit of a dense ivory-like layer (eburnation), the smooth glistening surface of which glides smoothly on that of the opposite bone; lymph may be exuded from the exposed surface of the bone and from the interior of the synovial membrane, and this, as well as what is outside the joint, may be developed into fibrous tissue restricting the movements of the joint, or more frequently into bone which binds the bony structures together and abolishes all movement *(stiff-joint, anchylosis)*; in very severe cases the lymph inside and outside the joint degenerates into pus, and this makes its way through the

tissues to the surface, is discharged and leaves an open joint, which soon determines a further increase of the inflammation and destructive changes. In tuberculous diseases of the joints there is the softening and enlargement of the ends of the bones, a gelatiniform exudation, and its cheesy degeneration; in rheumatism there is little tendency to suppuration; in glanders, farcy, plugging of vessels, etc., there is the specific deposit or an early suppuration.

General Symptoms. The joint is swollen, tense and elastic, is kept partially bent, is hot and tender, the parts around it may retain the indentation made by the finger, and the suffering is greatly increased when the joint is moved. There are all grades from heat, tenderness, swelling and habitual flexion of the joints, with the capacity of working off the lameness during exercise, to severe forms in which no weight can be thrown upon the limb, and the attendant fever is so intense that appetite is gone, thirst is ardent, breathing and pulse greatly accelerated, the heat of the body raised to a high point and the patient may die from the constitutional excitement.

When suppuration takes place there is an aggravation of all the symptoms, with frequent shivering, and the gradual absorption of the soft parts renders the fluctuation more and more evident up to the period of rupture. Preceding stiff-joint there is a long period of subacute inflammation, the joint being kept immovable by the pain and the abundant exudation, until ossification ensues.

Tuberculous disease of the joints occurs in young animals, the offspring of consumptive families, and is marked by the enlargement and softening of the ends of the bones, the formation of wounds or ulcers, and, it may be, disease of the lungs or bowels.

Rheumatic disease is characterized by its tendency to move from joint to joint or muscle, by its aggravation under the influence of cold and damp and improvement under warmth and sunshine, and by its indisposition to

suppuration. Glanders, farcy, plugging of the vessels, etc., are distinguished by the presence of the coexisting disease in other parts.

General Treatment. In severe cases secure immobility in the joints by placing in slings, and, if necessary, by the application of a smart blister around the articulation. In the absence of the blister apply cooling or soothing lotions as for inflammation of bone and follow this up by blisters or firing when the inflammation has in the main subsided and the heat and tenderness disappeared. In the slight, subacute and chronic forms the counter-irritants may be applied at the first. When anchylosis threatens it is sometimes advisable to favor it by active blistering and rigid immobility of the joint. If ulceration of the joint surface occurs the hot iron usually gives the best results. If suppuration has ensued the pus must escape by an external opening and our efforts must be thereafter directed to limiting the inflammation as far as possible and obviating death by the general fever, or uselessness, by destruction of the joint.

In the severer forms a purgative should be given at the outset and this may be followed by a soft laxative diet (mashes, roots, green food,) and diuretics, (carbonates or acetates of potassa or soda, colchicum, etc.,) especially when there is reason to suspect any rheumatic complication. In some cases of this, as of bone disease, in which there is imperfect assimilation and the passage of an excess of phosphates in the urine, a course of bitters and iron tonics is demanded.

Tuberculous disease of the joints demands similar treatment with due attention to the general health to correct, if possible, the unhealthy state.

OPEN JOINT.

This results from an incised, punctured, lacerated or contused wound and will vary in gravity according to the nature of the wound and the certainty of inflammation ensuing. If there is a simple minute puncture or cut, the

wound may close without this result, but if the tissues are severely lacerated or bruised, as in case of falls, etc., a certain amount of inflammation must necessarily ensue.

Treatment. Never probe such wounds. Sand or gritty matter must be removed by a stream of tepid water or the most careful picking, and the lips of the wound brought together if necessary by stitches, but with as few as possible and those only passing through the skin. Perfect quiet must be secured by slings, splints, bandages or, if the opening is small, by a blister enveloping the joint but leaving a clear space of an inch around the wound. In the absence of the blister, the joint may be irrigated with cold water continuously applied as for ostitis, or a poultice may be applied with a weak solution of carbolic acid poured over its surface, or the same carbolic lotion (1 part to 100 water) may be applied by means of saturated cotton bandages covered with dry. Coagulating agents (powdered alum, acetate of lead, sulphate of zinc, etc.,) are sometimes used to close the wound by a clot of synovia, and if this has been effected it should never be disturbed by picking or dressing, but left to be expelled when the wound is finally closed by the growth of granulations from its lips. The greatest danger lies in the movement of the joint which stimulates the secretion of synovia and keeps the wound open; in the introduction of atmospheric air into the joint, and in the decomposition of the morbid liquids in the wound. Hence, perfect rest, closure of the wound and the use of antiseptics like carbolic acid are all-important.

The general treatment is the same as for arthritis from other causes.

If suppuration ensues there is the greatest danger of destruction of the joint.

INFLAMMATION OF THE SYNOVIAL CAVITIES—BURSÆ AND SHEATHS OF TENDONS.

Bursæ are little synovial cavities placed between the skin and prominent bony processes to favor the gliding of

the one on the other. *Thecæ* are similar sacs interposed between bones and fibrous cords (tendons, 'igaments,) or between two such cords, to favor gliding. Each may be the seat of inflammation with its consequences—over-distension from excessive secretion of serum :—exudation of lymph, with thickening, induration, adhesion, calcification of the walls, or with suppuration.

It may be developed by wounds, punctures, cuts, bruises, sprains or rheumatism, and is manifested by heat, pain, tenderness and an elastic swelling (wind-puff, wind-gall,) the enlargement usually remaining after inflammation has subsided. This condition, as well as induration or calcification of the walls, causes material deformity. Suppuration is evinced by a great increase of the heat and tenderness, with a more distinct and superficial fluctuation and a surrounding engorgement which pits on pressure.

Treatment consists in rest, a relaxed posture of any tendons implicated, and soothing, cooling or astringent applications as in the early stages of sprains or ostitis. A purgative, and restricted diet are equally necessary. When heat and tenderness have subsided a small blister (see periostitis) will often cause absorption of the liquid; or it may disappear under pressure maintained for two hours at a time, twice daily at first, and increased by two hours daily; or finally, the liquid may be drawn off by the nozzle of a hypodermic syringe and the sac compressed with a bandage (and, if necessary, pads) saturated in an astringent cooling lotion. After evacuating the liquid an injection of compound tincture of iodine 1 part, water 2 parts, may be thrown in and expressed again after three minutes, the part being afterward covered with wet bandages.

For suppuration a simple subcutaneous bursa may be laid freely open and allowed to heal by granulation, or a thread may be drawn through the cavity and the pus drawn off, while cooling lotions are applied to the surface

DISEASES OF MUSCLES.

RUPTURE OF MUSCLES.

The red flesh is rarely torn in life and never by voluntary contraction. Though torn across with ease after death it will resist much more during life than the white fibrous cord by which it is attached to the bones. Muscles are usually torn by some extreme involuntary contraction, as in recovering from a wrong step or slip, or in the extreme contractions of lock-jaw. Rupture is recognized by the sudden pain and inability to use the muscle, and, if it is superficial, by tenderness, by a depression in the seat of the tear, and a bulging of the muscle above and below it. Later the depression may be filled by a soft compressible clot.

Treatment consists in the approximation of the divided ends by such a position as will relax the muscle and by a tight bandage from the foot up if it be in a limb.

INFLAMMATION OF MUSCLE.

This is usually the result of rheumatism but may arise from continued use or from local injury. It is manifested by swelling and extreme tenderness of the muscle in question, with loss of contractile power. If rheumatic it has the further characteristic of shifting from place to place. It may result in abscess, or thickening of the fibrous investing membrane, or in calcareous, granular or fatty degeneration. It must be treated by rest, with soothing local treatment like any ordinary inflammation, and matter may be evacuated with knife or lancet, but the degenerations may be looked upon as permanent.

Fatty degeneration is common in overfed animals, above all in those bred for early maturity and great aptitude to fatten (improved cattle, sheep and pigs,) and is quite irremediable. It may also arise from paralysis, the result of injuries to the nerves as in *roaring.*

RUPTURE OF TENDONS. SECTION OF TENDONS.

These are not uncommon in horses during severe ex-

ortions, as on the race-course, the back tendons being the most common seat of the injury. Whether torn across or divided with a cutting instrument, they are readily repaired by the exudation of lymph between the divided ends and its organization into white fibrous tissue. It is necessary to support the limb so that the divided ends may be placed in apposition and retained thus for three or four weeks. Inflammation is to be checked by ordinary means.

SPRAINS.

When subjected to over-exertion, sinews become the seat of sudden severe pain, inflammation, exudation, thickening and shortening. Sprains occur mainly from severe and continued over-exertion, or from the sudden jerk consequent on taking a wrong step when fatigued and unable readily to recover the balance. They are most frequent where tendons play over a bony process, but may occur at any part, and are of all grades from those producing a slight halt, with almost imperceptible thickening of the tendinous cord, to those in which the cord has been extensively torn and becomes the centre of a most violent inflammation.

Treatment. When violently inflamed or the seat of extreme pain, the tendon should be rested and relaxed by giving a suitable position to the limb, and fomented with warm water or showered continuously with cold, until heat and tenderness have been subdued. Or cooling astringent lotions may be used as advised under ostitis. A laxative and restricted diet are often essential. When heat and tenderness have subsided, occasional showering with cold water and hand-rubbing, or stimulating liniments (camphorated spirit; liquor ammonia 1 part, olive-oil 2 parts; camphorated spirit and peppermint water equal parts, etc.,) may be used. The same agents may be applied to very slight cases at the outset. Or blisters may be applied as advised under ostitis.

THICKENING, SHORTENING, CALCIFICATION OF TENDONS.

These are the results of severe or repeated sprains. If slight they may be benefited by time, gentle exercise (at grass), and an occasional blister of iodide of mercury. In cases with such thickening and shortening as to impair usefulness, after all inflammation has subsided the tendons may be cut across by a narrow-bladed knife, making an almost imperceptible skin wound, the ends drawn apart by full extension of the limb, and the case treated like an accidentally ruptured or cut tendon. If this operation is performed in a warm season, antiseptics must be applied to the wound.

CHAPTER XIX.

SPECIAL INJURIES OF BONES, JOINTS AND MUSCLES.

Fracture of the lower jaw. Injuries by bit and curb. Fracture of the upper jaw; of the bones of the nose; of the frontal bones; of the crest of the poll; of the base of the cranium. Dislocation of the lower jaw. Open Joint between upper and lower jaws. Cancer (Encephaloid) of the Orbit. Tooth-like tumors under the ear. Poll Evil. Fistulous Withers. Fractured Processes of the neck-bones. Broken neck. Fracture of the Spinous Processes of the back and loins. Sprain of the back or loins. Transverse Fracture of the back or loins. Broken Back. Laceration of the muscles beneath the loins. Fracture of the croup. Injuries to the bones of the tail. Fractured Ribs. Wounds penetrating the chest. Shoulder lameness. Tumors on the shoulder. Sprain of the Coraco-radial tendon. Shoulder-sprain. Sprain of the muscles outside the shoulder-blade. Disease of the shoulder-joint. Other affections of the shoulder. Affections of the elbow and arm. Tumors on the point of the elbow. Wounds of the elbow. Fracture of the point of the elbow. Disease of the elbow-joint. Fracture of the arm bone. Fracture of the fore-arm. Sprain of the radial ligament. Sprain of the back tendons behind the knee. Thorough-pin of the knee. Synovial swellings in front of the knee. Inflammation of the knee. Dislocation of the knee. Wounds of the knee. Speedy cut. Broken knees. Splints. Sore shins. Fracture of the splint bones; of the shank-bone. Sprains of the back tendons; of the suspensory ligaments. Wind-galls. Sesamoiditis. Sprain of the inferior sesamoid ligaments. Elastic swellings in front of the fetlock. Cutting. Bruises on the fetlock. Fracture of the pastern bones. Bony growths on the pastern bones. Ringbones. Sprain of the flexor tendons behind the pastern. Fractures of the hip-bones; of the outer angle; of the inner angle; of the point of the hip; through the shaft of the bone; into the joint. Sprain of the hip. Displacement of the Abductor Femoris. Disease of the hip-joint. Dislocation of the hip. Fracture of the thigh-bone; the neck; the shaft; the lower end. Fracture of the knee-cap. Dislocation of the knee-cap, stifled. Disease of the stifle. Fracture of the leg between the stifle and hock; Tibia; Fibula. Sprain or laceration of the muscle which bends the hock. Sprain of the hamstring. Rupture of the hamstring. Capped hock. Displacement of the tendon

playing over the point of the hock. Sprain of the flexor tendon behind the hock. Thorough-pin. Distension of the sheath of the extensor tendon in front of the hock. Fracture of the inner maleolus. Fracture of the point of the hock and other hock bones. Bone spavin. Inflammation of the true hock joint. Bog spavin. Dropsy of the hock joint. Blood spavin. Curb. String-halt. Other causes of lameness.

FRACTURES OF THE LOWER JAW.

These take place in the anterior part occupied by the front teeth, or more frequently on one side, between these and the grinders. In simple fractures with no great tendency to movement an exclusive diet of soft mashes will often suffice, a double halter being so arranged that the animal cannot possibly reach either fodder or litter. If the fracture is between the front teeth a copper or silver wire wound round two teeth on opposite sides of the break may fix the parts sufficiently. If further back and very mobile, it may still be retained at times by using the tushes as fixed points from which to carry the wire. Where these cannot be availed of, the jaw may be perforated by a fine drill in front of the fracture and behind it, and the two parts firmly bound together by a silver wire. If this is not available, a mould of gutta-percha or wood is made to fit the lower jaw and sides of the face from the throat as far as the chin, and this is strapped on by four belts, one passing behind the ears, one in front of them, one on the middle of the face and one on the nose but four inches above the nostrils. The straps may be held together by another or a simple cord passing down the middle of the face, and the two lower ones should be slightly elastic. This should be kept on till union is effected and no hard food should be allowed for two months.

In cases of compound comminuted fractures remove all foreign bodies and detached pieces of bone, and make an opening in the case, through which the wound may be dressed with antiseptic liquids (carbolic acid 1 part, water 100 parts).

INJURIES BY BIT AND CURB.

These often cause slight fractures or superficial necrosis on the upper or lower borders of the jaw. Extract detached pieces or scrape off dead, and when the wound has healed drive with a snaffle.

FRACTURE OF THE UPPER JAW.

This is much less serious. If at the anterior part fix by wiring the teeth together. If further back and associated with discharge from the nose, trephine the sinus (see diseased teeth), remove detached pieces of bone and inject with a weak astringent solution (diseased teeth).

FRACTURE OF THE BONES OF THE NOSE.

Here the depression of the space between the nostrils and the difficulty of breathing are characteristic. Shave the skin above and below the fracture; make a smooth cone of wood, rounded at the apex and just large enough to fit the nasal passage; with this inside the nose raise the bone to its proper position and strap it there by strong adhesive plaster passing over the interval of the fracture. In obstinate cases we can resort to plugging of one nostril with tow, or of both nostrils if tracheotomy has been first performed.

FRACTURE OF THE FRONTAL BONES.

If beneath the level of the eye the danger is slight and after removal of detached pieces of bone it may be treated like an ordinary wound. If above, the depressed bone must be raised with a lever to avoid compression of the brain when exudation takes place. Fracture of the process which forms the upper boundary of the eye-socket may be raised in the same manner to avoid subsequent blemish.

FRACTURE OF THE CREST OF THE POLL (OCCIPITAL).

If split straight down and without opening the cranium and exposing the brain, the animal should be tied so that

the nose is kept habitually protruded and the injury treated like a simple wound. It may be needful to use astringent lotions or even to make a counter-opening below to secure a perfect recovery.

FRACTURES AT THE BASE OF THE CRANIUM.

These are usually due to blows on the poll, the shock being conveyed through the harder structures and expended fatally on the softer bones below. Being in contact with the most vital parts of the brain and beyond the reach of surgical interference such fractures are fatal.

DISLOCATION OF THE LOWER JAW.

This sometimes occurs in the dog, from opening the jaws too widely in giving pills, etc. The jaw is slightly advanced and held open in spite of all attempts of the animal to close it. Wrap the thumbs very thickly in cloth, and seizing the lower jaw press it forcibly downward and backward when it will slip in with a jerk and the jaws will close firmly.

OPEN JOINT BETWEEN THE UPPER AND LOWER JAWS.

A wound exists midway between the eye and the root of the ear, discharging a glairy fluid when the animal chews. Fix the jaws by a bridle with straps drawn tightly around the nose, feed thick gruels and soft mashes only and treat as advised for open joint.

CANCER (ENCEPHALOID) OF THE ORBIT.

This occurs in horses and cattle, great, angry, bleeding, fungous growths appearing from the soft and hard structures about the orbit. The only hope lies in early removal.

TOOTH-LIKE TUMORS UNDER THE EAR.

These are manifested by a running sore, just above and behind the joint between the upper and the lower jaw, with a hard object to be felt at the bottom. Their ex-

traction can only be undertaken by one intimately acquainted with the parts.

POLL EVIL.

This is of two kinds: 1st, A simple abscess, the result of a blow or other local injury, and which is only serious because of the strong enveloping fibrous membranes that imprison the matter beneath them; and 2d, disease of the joint between the head and the first bone of the neck, or between the first two bones. The first, if unrelieved, will usually give rise to the second, since the surface of the bones becomes the seat of disease which gradually extends to and involves the joint. The milder form may be distinguished by the superficial position of the swelling and fluctuation, and by the comparative freedom and ease with which the head is moved, whereas in the other the head is carried very stiffly and cannot be moved on the neck without extreme suffering.

Treatment. When seen early with only a slight inflammatory swelling behind the poll and no fluctuation, purge and keep a cooling lotion (tincture of arnica 2 oz., iodide of potassium 1 dr., vinegar 1 qt., camomile infusion 1 qt.,) constantly applied to the part, the patient at rest, and the head tied up to the rack. If matter has formed and fluctuation is felt, however deep, it must be opened at once. Select the part where fluctuation is most marked and plunge a knife into the cavity. Then with a bent probe find the lowest point of the sac and cut down upon this, making a large opening from which the matter may flow as it forms. A tape should be tied in the wound and the sac syringed out daily with a stimulating wash (chloride of zinc ½ dr., water 1 qt.,) until from the disappearance of swelling and matter it becomes evident that the sac is obliterated, when the tape may be cut, pulled half way out and left hanging from the lower wound until the upper is closed, when it may be completely withdrawn. When new sacs of matter appear these must be promptly opened

and treated in the same way. A change of dressing is sometimes needed as one appears to be losing its effect (tincture of muriate of iron 1 oz., water 1 quart). In obstinate cases it is sometimes needful to lay the sacs open by an extensive incision and treat like an ordinary wound. But all these operations are only safe in the hands of those who are intimately acquainted with the structure of the part.

In case of disease of the bone it may be felt bare at the bottom of the sac, by probing, and may be scraped to remove any dead or diseased part, and expose sound bone which may undergo the healing process.

If the joint is implicated the case may be deemed desperate, as it is usually only a question of time for the spinal cord to become involved.

FISTULOUS WITHERS.

This is analogous to the milder form of poll evil, differing only in its site, which is on the spines above the shoulders. It is to be treated in the same way, by free incision, the formation of a dependent orifice and injections. If the spinous processes are diseased they should be removed with bone forceps until a healthy surface is exposed.

FRACTURED PROCESSES OF THE NECK BONES.

This may arise from muscular effort but more commonly results from jamming between two heavy bodies. If on one side only, the head is drawn to a side; and in any case the detached piece of bone may be felt among the muscles and grating even may be produced by moving it. The only treatment is to keep the head in one position until the detached parts have become adherent, which they usually do with a visible swelling. If abscess or fistula forms the detached bone must be extracted.

TRANSVERSE FRACTURE OF THE BONES OF THE NECK

These occur from pitching on the head, and are fatal from the sudden cessation of breathing.

FRACTURE OF THE SPINOUS PROCESSES OF BACK AND LOINS.

This is detected by the mobility, with or without grating of the spines implicated. If comminuted the splinters should be extracted; if simple, replace them and retain by a pitch plaster on each side, or with a saddle having a high tree and plenty of padding at the sides to support the fractured bone.

SPRAINS OF THE BACK OR LOINS.

There is inability to back, above all when mounted, or to turn quickly in a circle, tenderness at a given spot on pinching along the back, drooping when mounted, and difficulty in urination from the pain attendant on curving the back. It has come on suddenly after slipping, falling, bearing a heavy weight, etc., and is independent of fever. It is distinguished from partial *paraplegia* by the perfect sensation in the hind parts, by the absence of any change in their temperature as compared with the rest of the body, and by the retention of perfect sensation and motion in the tail.

Treatment. Place in a narrow stall in which the patient cannot turn his body or even his neck; apply slings to prevent any attempt at lying down; foment with warm water if there is much pain; when that has subsided, blister. It is all-important to give laxative diet, and to correct any costiveness or other impairment of the general health.

TRANSVERSE FRACTURE OF BACK OR LOINS.

This occurs suddenly from an evident cause, such as slipping, over-weighting, a wrong step, or struggling when cast for an operation. If displacement has not taken place there is an exaggerated manifestation of the same symptoms as in sprained back, but if the bones are displaced, or when the resulting inflammation and swelling have produced pressure on the spinal cord, there is *paraplegia*, coldness of the body behind the seat of fracture

though that in front may be hot and perspiring; the tail is implicated in the palsy, and there is much tenderness and often a manifest depression of the seat of fracture.

Treatment. The slighter forms are treated like sprained loins. In the more severe, the subject should be destroyed at once. If after recovery in other respects a certain lack of power remains, it must be treated like *paraplegia.*

LACERATION OF THE MUSCLES BENEATH THE LOINS.

This occurs from the hind limbs slipping unexpectedly backward or from their going back into a ditch which the animal is attempting to leap. The manifestations resemble those of broken back, as there are difficulty in rising, and an imperfect control over the hind limbs, which are dragged awkwardly forward and not advanced so far as in health. But there is no indication of paralysis and no alteration of temperature or sensibility in the hind parts, the functions of the tail are perfect, and examination through the rectum detects a soft doughy swelling, with heat and tenderness beneath the loins. *Treatment* is by slings and fomentations to the loins. If the horse is unable to get up, raise him by block and tackle and he will easily stand. Several weeks are wanted for repair of the injury and the patient should have a run at grass before returning to work.

FRACTURE OF THE CROUP (SACRUM).

Seen in cattle and less frequently in horses, and caused by riding each other or by the fall of heavy bodies on the part. There is a manifest depression at one point of the medium line of the croup, and the tail usually hangs paralyzed. Examination with the oiled hand in the rectum at once detects the displacement, which is always downward. With one hand in the rectum pressing on the depressed bone and the other pulling the tail, the bones may be replaced and should be held so by a stiff leather

sheath well padded, fixed round the root of the tail and connected in front with a surcingle and collar. Recovery of power over the tail may be looked for.

INJURIES TO THE BONES OF THE TAIL.

Fracture and dislocation are easily reduced and the bones maintained in proper place by a bandage. If the bones are crushed, or the seat of caries or necrosis, the member should be amputated above the injury. Docking scissors are best for this purpose, but the organ may be laid across a beam and chopped off with one blow of a hatchet. The hair should first be removed from the part to be cut, and what is above this part tied up to the rump. After the amputation the hair is drawn down over the stump and firmly tied, as close to it as possible, so as to compress the arteries and check bleeding. In cattle and other animals, with short hair on the tails, bleeding may be prevented by a flat tape tied round the tail above the stump for eight hours, or the arteries may be tied, or finally, they may be seared with a hot iron, the part having been first dusted with powdered resin.

FRACTURED RIBS.

These usually result from falls, blows and other forms of mechanical injury, and may be easily detected by a depression or soft part at the seat of fracture. If simple, they will be readily repaired under the influence of rest and girths to restrict the movements of the chest. But if comminuted, abscesses may form or necrosis ensue, demanding the removal of the dead or morbid matters. If the fractured ends have been driven in so far as to penetrate the lung a still more serious complication is met. The air rushes from the tubes of the lacerated lung into the pleural cavity during each inspiration, and as it cannot find its way back, the whole of that half of the chest is soon filled with air and the lung compressed into a small solid mass attached to the lower end of the wind-

pipe, and opposite the base of the heart. The lesion is thus liable to prove fatal, though if arrested early by the exudation of lymph in the wound of the lung, the air may be absorbed and recovery may ensue.

WOUNDS PENETRATING THE CHEST.

Whether connected with broken ribs or only involving the muscles between the ribs, these lead to the accumulation of air in the chest and collapse of the lung, as when a broken rib has torn the lung tissue. The edges of the wound, having been driven in, act like a valve allowing the entrance of air during the expansion of the chest, but forbidding its escape when that cavity collapses. It is far more serious than the accumulation of air in the chest from a torn lung, as decomposition and irritation are set up by the presence of germs which are filtered out in passing through the lungs. Unless the wound is small and can be closed early, it is necessarily fatal.

SHOULDER LAMENESS.

The lameness which accompanies injuries to the shoulder may be so characteristic as to be recognized at a glance. The specific features are, the carrying of the head low; the dragging of the toe on the ground in advancing the limb; the swinging of the foot outward so as to describe the arc of a circle in bringing it forward; and, if severe enough, the standing with joints partly bent, the heel raised and the toe resting on the ground, but without any advance of the lame foot in front of the other.

TUMORS ON THE SHOULDER.

Often preceded by chafing or galling, these consist of inflammation and suppuration beneath the large flat muscle which covers the front of the shoulder *(levator humeri)*. The tissues around the matter become thickened and indurated to an extraordinary extent, so that it is often impossible to detect any fluctuation, yet it may be

assumed in all cases of considerable swelling that matter really exists, and the recovery will not ensue until that has been evacuated. In slight cases only will a little nut-like induration form without matter.

Treatment. In cases in which injury has just been sustained, suspend work or drive in a breast strap, and treat as for chafing. If a tumor forms, first subdue the more active inflammation by a dose of physic and a wet rug slung over the shoulder for several days; then open it with a knife, or preferably, draw off the liquid once or twice, at intervals of two or three days, with a cannula and trocar, and then, when the sac has been reduced to a small size, lay it freely open with the knife and treat like an ordinary wound. In very large tumors it may be necessary to push the cannula in as far as four or even six inches before the matter is reached, but the operator must persevere, directing it always toward the exact centre of the swelling. The small solid tumors are to be cut out with the knife, a straight vertical incision being made through the skin, directly over the mass, which is then dissected out, and the skin brought together with stitches and treated like a simple wound.

SPRAIN OF THE CORACO-RADIAL TENDON. SHOULDER SPRAIN.

This is a sprain of the large tendon which passes over the point of the shoulder (the most prominent part directly in front), and in bad cases the double pulley over which it plays in front of the upper end of the arm bone is involved in inflammation and ulceration.

Symptoms. Pendent head, dragging toe, swinging outward of the foot when being advanced, shortness of the step, and a tendency to stand with the toe only resting on the ground and the limb bent but not advanced. Swelling of the point of the shoulder is sometimes, though rarely seen, but pressure on this point with the thumbs will detect tenderness, which is especially marked as compared with that of the other shoulder. The pressure should be

made successively on the inner side of the tendon, on the outer and on its centre.

Treatment. First subdue the inflammation by rest, a high-heeled shoe and a wet rug kept hanging continually over the shoulder (a blanket folded several times and tied round the neck and chest), with or without a purge and restricted diet. When the heat and tenderness have subsided apply a smart blister over the point of the shoulder, and repeat if lameness persists. In obstinate cases it may be needful to use the hot iron, but only on the outer side of the joint, and never on the point where the collar rests.

SPRAIN OF THE MUSCLES OUTSIDE THE SHOULDER-BLADE.

This is a sprain of the muscle which fills up the posterior cavity on the outer side of the shoulder-blade and plays over the outer side of the shoulder-joint (outer tubercle of the head of the humerus). It occurs mainly in young horses when first put to plow or in others going on uneven ground and stepping unexpectedly into holes. In the endeavor to recover the equilibrium on stepping into a furrow or hole, this muscle which forms the outer support of the joint is injured and there result heat, swelling and tenderness on the outside of the joint and a most characteristic gait. The horse may walk, or even trot, without much apparent lameness, but standing directly in front of him the affected shoulder is seen to roll outward from the body to a far greater extent than the sound one. Soon the muscle begins to waste rapidly, and in bad cases the shoulder-blade may be denuded until it appears to be covered by nothing but skin.

Treatment. In the first stages, with heat, swelling and tenderness outside the joint, rest, employ a wet rug, etc., as for sprain of the coraco-radial tendon. When this has subsided allow exercise on smooth ground (walking, working in light cultivator,) and increase the circulation over the wasted muscle by active friction with straw or a piece

of wood: or by mild blisters (ammonia 1 pt., oil 2 pts.: or Spanish flies 1 part, alcohol 25 pts., steeped for 24 hours and strained): or stimulate with a galvanic battery. It may take months to refill the cavity, but in all recent cases perseverance will be rewarded. In old standing cases with fatty degeneration of the muscles, a very partial restoration only can be effected.

It must be added that wasting of the shoulder muscles is a common result of all lameness entailing disuse of the limb and hence many injuries of the feet and elsewhere are referred to the shoulder and designated *sweeny (Schwinden)* by wiseacres. In the absence of the peculiar gait above described, of the early heat, swelling and tenderness outside the joint and the rapid wasting of the muscle, the cause of the *sweeny* should be sought elsewhere than the shoulder.

DISEASE OF THE SHOULDER-JOINT (INFLAMMATION, ULCERATION, ETC.)

In the large quadrupeds, in which swelling and tenderness on handling are rarely seen, disease in the joint is to be mainly distinguished by the general symptoms of shoulder lameness and the absence of any of the signs of local disease in the tendons, already described. Movement of the joint by drawing the limb forward, and especially by drawing it backward, will usually give rise to pain, sometimes of an extreme nature.

In dogs the capsule of the joint is found to bulge on each side of the coraco-radial tendon which plays over the point of the shoulder, and tenderness may be shown when it is handled.

Treatment. When inflammation is very severe rest and soothing measures should be first resorted to. In the majority of cases it assumes a subacute type and is to be treated by a high-heeled shoe, rest and counter-irritants. Repeated blistering with Spanish flies may suffice, but in obstinate cases and whenever there is reason to suspect

ulceration, the hot iron is most serviceable, applied round the outer side of the joint only.

OTHER AFFECTIONS OF THE SHOULDER.

The shoulder-blade is subject to fracture, ulceration and necrosis; the muscles beneath the bone to lacerations; the joint to dislocations (rare in large quadrupeds); and the lymphatic glands inside the joint to abscess (especially in strangles), all of which must be treated on general principles, space forbidding their further notice in the present work. Shoulder lameness may further arise from liver disease, which see.

AFFECTIONS OF THE ELBOW AND ARM.

Lameness in the region of the elbow is characterized by the inability to extend the joint fully or to bear weight upon it in this condition. In bad cases the elbow and knee joints are kept semiflexed when standing still, and when walking or trotting the dropping of the head and body is extreme, in consequence of a similar flexion. Movement of the joint will also give rise to symptoms of tenderness.

TUMORS ON THE POINT OF THE ELBOW.

These are usually caused by the heels of the shoe when the horse lies with his fore limbs bent under him (cow fashion) from undue narrowness of the stall.

Symptoms. There is first a hot, tender swelling, and if the source of injury is kept up, this may increase by small degrees to a very large size. Soon the swelling fluctuates from contained serum and it may remain thus indefinitely, the liquid being confined by the tough fibrous walls. Or the serum may be absorbed leaving a hard nut-like tumor with no sign of fluctuation.

Treatment. Sooth the early inflammation by fomentations or a wet rug hung over the part, and keep on a soft laxative diet. If the amount of serum thrown out is

limited, it may be entirely re-absorbed by using tincture of iodine to remove the swelling. If more abundant let it be drawn off with a cannula and trocar and the sac injected with compound tincture of iodine diluted in double its bulk of water. If this is not available, lay the sac freely open at its lower part and heal like a common wound. If a hard mass is left beneath the skin it is to be cut out as advised for those on the shoulder.

By way of *prevention* the stall must be widened, and, in the case of animals that will lie on the breast, a pad or girdle of two or three inches thick must be strapped round the pastern at night to prevent the heel striking against the elbow. This pad must be soft, covered with chamois's leather, made without a seam on its outer side, and buckled above and below so that nothing hard may touch the elbow.

WOUNDS OF THE ELBOW.

Wounds in this situation are often complicated with air under the skin puffing up the whole region, having been pumped in by the movements of the elbow. Rest is requisite and the wound may be treated as others.

FRACTURE OF THE POINT OF THE ELBOW.

This is easily recognized, as the leg dangles, bending at the elbow and knee, and it is impossible to bear any weight on it. On taking hold of the back of the elbow the process of bone is found to be detached and loose. If excessive swelling prevents this, place the foot upon the ground, bend back the knee forcibly and let an assistant raise the opposite fore foot. If the bone is broken he will drop, if the muscles only are injured he may stand.

Treatment. If the injury has occurred from a kick, which has seriously contused the joint surfaces, all treatment may be futile, but if not, the case will be hopeful and especially in the young. Bring the detached bone as nearly as possible into position and retain it by a pad placed inside the elbow, and a bandage and splints con-

tinued from the foot up. The patient must be placed in slings.

DISEASE OF THE ELBOW-JOINT.

This must be diagnosed by the general symptoms of elbow lameness and by pain in moving the joint, but especially when it is fully extended.

Treatment as for diseased shoulder-joint, the applications in this case being made to the elbow. If far advanced or if connected with fracture of the lower end of the arm bone or of that forming the point of the elbow, it will usually be unsatisfactory.

FRACTURE OF THE ARM BONE.

Fracture of the large bone between the point of the shoulder and the elbow may occur from blows, or even wrong steps, and is often attended by much swelling from extravasation of blood. The only resort is to place the animal in slings and keep him perfectly quiet. In rare cases recovery has taken place with no distortion, the broken ends, in a transverse fracture, remaining in apposition. Usually they are drawn apart by the muscles and ride over each other so that the limb is shortened. Such a result is only desirable in breeding horses and in stock for dairy or butcher.

FRACTURE OF THE FORE-ARM.

Fractures between the elbow and knee in horses or cattle necessarily leave the animal unable to rest on the limb; if in dogs or cats one of the bones may be broken while the other remains unharmed and weight can still be borne. There is trembling of the muscles, distortion easily felt on carrying the hand down the inner side along the line of the bone, and grating when the limb is moved.

Treatment. If the fracture is very oblique treatment will rarely pay in horses, but if transverse or jagged so that the bones do not ride, the case is very hopeful. Set

ting the bones, with the aid of extension and counter-extension, or even ether if necessary, applying splints and bandages from the foot to the elbow, and placing in slings (if a large animal) are the essential conditions.

SPRAIN OF THE RADIAL LIGAMENT.

This is an injury of a strong, flat, fibrous band, coming from the lower third of the fore-arm and joining the back tendons just above the knee. It is characterized by a tendency to carry the pastern upright, or even to flex the knee and to stumble. The knee cannot be fully flexed without much pain, and there is a hot tender swelling immediately behind the bone and extending from the knee about four inches upward.

Treat by rest, a laxative, a high-heeled shoe, and fomentations or cooling astringent lotions; followed when heat and tenderness subside by active blistering should lameness continue.

SPRAIN OF THE BACK TENDONS BEHIND THE KNEE. THOROUGH-PIN OF THE KNEE.

This is manifested by a tense fluctuating swelling on each side of the back tendons just above the knee and behind the bone of the fore-arm; also of a swelling behind and immediately below the knee, pressure on one of these swellings causing the filling up of the others and *vice versa*. There may or may not be much lameness, or impossibility of flexing the knee so as to bring the fetlock pad in contact with the elbow.

Treat the inflammation as in sprained radial ligament, and the liquid distension by blister, by bandage and pads shaped like half of an egg cut longitudinally, or still better by evacuating the liquid with the nozzle of a hypodermic syringe, and then applying pressure with wet bandages.

SYNOVIAL SWELLINGS IN FRONT OF THE KNEE.

These are of three kinds: 1st, the distension of a bursa or formation of a serous cyst under the skin, exceedingly

common in heavy cattle; 2d, distension of the theca of one or more of the four tendons which pass over the front and outer side of the knee; 3d, and finally, disease inside the knee-joint and distension of its capsule. The first is superficial though often possessed of very thick walls, is generally diffused over the front of the joint, and is little affected by flexion or extension. The distended thecæ extend vertically along the lines of the tendons, reaching above and below the joint and are bound down at intervals by transverse bands; their size is little affected by bending the joint. Distensions of the joint capsule appear in the intervals between the tendons, do not extend beyond the joint except in very extreme cases, and disappear in part or entirely when the joint is bent; in this case the joint is rarely kept fully extended in standing and cannot usually be flexed to make the fetlock touch the elbow.

Treatment. For *Subcutaneous cysts* puncture with nozzle of hypodermic syringe, draw off the liquid and compress strongly with wet bandages. If this cannot be done, pass a tape from above downward through the cavity of the sac, and keep in until resulting suppuration has ceased, when it may be withdrawn from above downward a little at a time. Excess of inflammation may be subdued by fomentations and thick wet bandages.

The *distended thecæ* may be punctured with a nozzle of a hypodermic syringe and subjected to pressure, or treated with strong blisters (biniodide of mercury 2 dr., lard 1 oz.,) repeatedly applied; or simple pressure will suffice if kept up for some weeks increasing the time daily. Setons would be dangerous.

For *distended joint* see below.

INFLAMMATION OF THE KNEE-JOINT.

This may be seen in all stages from that in which the animal starts forward perceptibly at the knee and manifests suffering when you try to fully extend it by strong

pressure on its anterior surface, to the most violent and destructive inflammation with extensive exudation of lymph and even the formation of abscess. It tends to leave the puffy swellings of its capsule referred to under the preceding heading, or distinct hard bony enlargements on the anterior surface of the joint. The animal stands squarely upon his feet with no inclination to raise the heel, and in action carries the knee-joint comparatively unbent, takes a fairly long step and comes down with greatest force on the heels so as to wear the shoe at this point. A rider has a peculiar sensation of the chest sinking under him. The lameness increases with exercise, especially on hard surfaces.

Treatment. Rest, without shoes; subdue inflammation by soothing applications, after which blister the part. If the animal persists in using it too freely, apply splints and bandages to fix the joint, and place in slings.

WOUNDS OF THE KNEE.

Dislocation of the knee-joint with laceration of the lateral ligaments occurs, and though if put in splints and slings the patients will sometimes recover with a stiff knee, the result is a very undesirable one.

Bruise of the Inner Side of the Knee. Speedy Cut. This usually results from a blow with the opposite foot, in horses with high action, in those with narrow chests, or, above all, in horses driven in the snow-path. It is manifested by an inflammatory swelling on the prominence of bone inside the joint, resulting in a permanent scar, a serous sac or an abscess. Its early or inflammatory stage may be treated by lotions of cold water or astringent liquids, kept constantly applied; the serous effusion by pressure or by drawing off the liquid through a fine tube, and then bandaging, and abscess by a free incision with a knife or lancet.

To *prevent* keep the foot rather bare inside, with the shoe slightly beveled from its wearing to its bearing sur-

face, allow no ragged nail clinches to project, and re-adjust the shoe sufficiently often (every three weeks). Or a boot may be worn extending from the fetlock to the knee and with a rim at its upper part to warn the animal when his foot approaches this point.

Wounds in Front of the Knees. Broken Knees. Usually sustained in falling, but it may be by striking against a manger or other hard object. They are of all degrees of severity: 1st, simple loss of hair and slight abrasion of the scarfskin; 2d, a severe bruise of the skin without laceration; 3d, a wound extending no deeper than the skin; 4th, a wound laying bare the tendons and opening their sheaths; 5th, a wound laying open the joint and exposing the bones with or without laceration of the tendons; and 6th, when the joint is opened and the small bones of the knee broken.

Treatment. 1st, With simple abrasion no treatment is needed; 2d, if much bruised tie short to a high rack to prevent lying down and bandage lightly, using a mild astringent lotion (sugar of lead ½ oz., carbolic acid 60 drops, water 2 qts.); 3d, in all cases in which the wound extends through the skin it is desirable to bend the knee to the position occupied when wounded so that the deep wounds may correspond with the superficial, and wash off with a stream of tepid water or soft clean sponge all dirt or foreign bodies, but never probe nor run any risk of opening cavities which have not been injured. Any shreds of tissue which are absolutely dead should be cut off, but never remove any skin, however contused, as it will all be wanted. Then cutting the hair from the flaps of the wound above and below bring them together by straps of plaster or tow dipped in shellac paste, leaving sufficient intervals for the escape of matter. If the wound inflames and swells, give a purgative and dress with the lotion advised for bruised knee. In all severe cases it is desirable to sling the patient after the first few days to obviate any attempt to lie down, which would seriously protract the

case; 4th, the exposure of the tendons, with escape of glairy synovia, will entail more swelling and fever and permanent enlargement of the joint, but will demand the same course of treatment; 5th, when the tendons are crushed or torn and the joint opened, and above all when the bones are broken we have cases of increasing severity and in few such is it desirable to subject to treatment, unless the patient is to be valuable for breeding purposes. Considerable death of tendon and even necrosis and elimination of bone may be expected and the patient can only recover with a stiff joint. In addition to the measures already recommended, it becomes imperative to encase the limb up to the elbow in splints and bandages, as for a fracture, leaving open the part in front of the knee for dressing the wound.

SPLINTS.

These are circumscribed inflammations of the periosteum and small bones in the region of the shank, involving or not the shank-bones themselves, and resulting in small bony swellings. They occur almost invariably on the inner

Fig. 67.

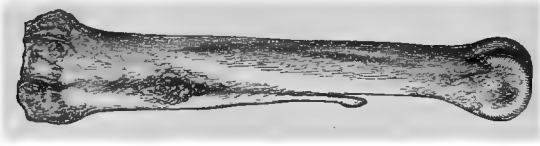

Fig. 67—Splint.

side of the limb, between the large and small bones of the shank, and may usually be recognized by running the fingers down the slight groove formed between the main shank-bone and its small accessory one behind. It usually connects the large bone to the small (anchylosis), but may be confined to the posterior part of the small bone, or may extend across the back of the shank-bone and appear at the same level on the inner and outer sides of the limb

alike. In old horses it is not unfrequent to find the small bone united to the large along two-thirds of its length. If situated high up and close to the knee, it is more likely to cause continued lameness than if lower down. Again if an animal has several splints and other diseases of bone he is highly objectionable, as being predisposed to bone disease.

Symptoms. Beside the feeling of the splints on handling, as above mentioned, these symptoms may be seen. The patient may walk sound, or even trot so, on soft ground, but is exceedingly lame when trotted on a hard surface, and this lameness increases with exercise. The extreme drooping of the head is characteristic. Even before the formation of the splint tenderness may be shown on pressure, and some little heat recognized. In some cases considerable soft swelling may be felt in the early stages. In acute cases, threatening abscess, the lameness is extreme.

Treatment. In the early stages, rest, purge, and apply cooling lotions. When heat and tenderness subside, blister. Some cases will recover promptly, others require repeated blistering and a long period of rest. If heat and great tenderness return, resort again to soothing measures. In extreme tenderness, threatening the formation of matter, the periosteum should be divided with a very narrow-bladed knife which is passed through the skin half an inch below the swelling and carried up over it. The part must then be covered by a wet bandage.

INFLAMMATION OF THE MEMBRANE COVERING THE SHANK-BONE. SORE SHINS.

This occurs especially in over-worked young horses. Racers are very liable, but cart-horses are not exempt There is general tumefaction of the shank-bone or of some part of it, usually the lower, with a lameness greatly resembling that of splints. If slight and circumscribed, the exudation that takes place between the membrane and

the bone is ossified, giving rise to permanent thickening, and exudation outside the membrane may follow a similar course, causing a very considerable swelling. In the more severe cases, the abundant exudation, separating the membrane from the bone, may cut off the supply of blood and entail necrosis; or the lymph may degenerate into pus which burrows beneath the membrane, separating it from the bone and destroying the life of the latter.

Treatment. In mild cases treat like splints. In the very severe with great tenderness and doughy swelling of the bone, make a series of incisions through the membrane covering the bone, with a very narrow-bladed knife and by valvular wounds, passing the blade a short distance beneath the skin before cutting down on the bone. Then apply the lotion advised for broken knees.

FRACTURE OF THE SPLINT BONES.

The lower ends of the small bones of the shank are liable to be broken, the lesion being made out by the swelling at the point and the unnatural mobility of the lower end of the bone, though grating is not to be expected. No treatment is needed beyond a cooling bandage and rest.

FRACTURE OF THE SHANK-BONE.

This is broken by kicks, blows, or simply by concussion in exercise. The superficial position of the bone renders all distortion very apparent, and this with the impossibility of resting weight on the limb and the grating of the broken ends when handled are unmistakable.

Treatment. If comminuted, as it often is, the animal had best be slaughtered. If only compound, hopes may be entertained, especially in young animals, an opening being made in the bandage to dress the wound. If simple and the fracture not too oblique, nothing is easier than to set it, to envelop it in a bandage extending over and

fixing the knee, and to keep the patient in slings until union has taken place.

SPRAINS OF THE BACK TENDONS.

These are the two cords which form the posterior line of the limb between the knee and the fetlock. About midway down the shank the front one is joined by a strong cord coming from the upper end of the cannon-bone and the lower row of small knee bones. This last is by far the most frequent seat of sprain, so that the swelling and tenderness are observed between the upper half of the cannon-bone and the round cord which forms the posterior outline of the limb. In other cases the tendons have participated in the sprain, and they too are thickened and tender from the middle of the shank (the point of junction with the ligament) down to the fetlock. In a third class the sprain is confined to an inch or two above the fetlock. In these the swelling is to the two sides if the anterior of the two tendons is injured and backward if the posterior is sprained. The *symptoms* are a stumbling gait, with a tendency to stub the toe into the ground and to bend over at the knee and fetlock; an inclination to stand with the knee and fetlock slightly bent, the pastern upright or the heel a little raised; then passing the hand along the line of the tendons and in front of them in the upper half of the bone, the thumb on one side and the fingers on the other, any slight thickening is easily recognized, and if heat exists and pain on pinching, your suspicions are confirmed. In old bad cases the stay ligament and lower half of the tendons are greatly thickened throughout and the knee kept constantly bent, sometimes to the extent of causing the patient to walk on the front of the hoof. In other cases the cords are knotted, hard and wanting in suppleness, showing calcification of their substance.

Treatment. In the early stages of severe cases, rest, shorten the toe, apply a high-heeled shoe, and apply hot fomentation continuously, or cold astringent lotions

When heat and tenderness have subsided the high-heeled shoe may be dispensed with, the foot shod level and active blisters applied. The preparations of the iodides of mercury are among the best. In old cases of extreme contraction the tendons can be cut across by a narrow-bladed knife with as little external wound as possible, and the limb extended to its proper form and retained there by splints and bandages until new fibrous tissue fills up the interval between the divided ends. The operation is performed in the middle of the shank below the connection with the stay ligament and is very successful in appropriate cases, restoring a helpless cripple to perfect usefulness. For the minutiæ of the operation the reader is referred to our larger work. Calcified, knotted tendons are utterly unsuited to it.

SPRAIN OF THE SUSPENSORY LIGAMENT.

This structure lies between the shank-bone and the back tendons and extends from the back of the lower part of the knee to the little bones (sesamoids) which form the pulley for the tendons behind the fetlock, with prolongations forward on the sides of the pastern to join the extensor tendon of the foot. The seat of sprain may be at any part but is usually in the lower third of the shank, where it divides into an inner and an outer branch. The sprain may cause but the slightest perceptible swelling on one of these branches or the ligament may be completely torn across, the fetlock descending to the ground and the toe turning up. Any injury to this ligament is likely to cause more persistent lameness than a corresponding injury to the back tendons, seeing it is a mechanical support to the fetlock and is always on the strain when the animal stands upon the limb.

Symptoms. Persistent, often severe lameness, upright pastern, stumbling gait or undue lowering of the fetlock when weight is thrown upon the limb. Then by bringing the fingers and thumb down the line of the cord felt im-

mediately behind the lower half of the shank-bone between it and the back tendons, some enlargement is detected with heat and tenderness. In bad cases, with descent of the fetlock, the whole length of the cord is thickened and the infiltration of the surrounding parts gives the whole back of the limb a soft doughy feeling. *Treatment* is much less satisfactory than in sprains of the back tendons but the principles are the same, though a much longer period of rest and blistering is usually demanded. In severe forms with descent of the fetlock, that must be supported by splints and bandages, in the same manner as after cutting the back tendons, otherwise the limb will be permanently distorted. These severe cases, which usually result from the most violent exertions in racing or hunting, rarely recover so as to be fit for such work in future, though they may be useful for service at a slow pace.

SPRAIN OF THE BACK TENDONS OVER THE FETLOCK PULLEY. WIND-GALLS. SESAMOIDITIS.

This is the result of sprains or severe exertions and is always associated with round elastic synovial swellings on each side of the tendons, familiarly known as *puffs* or *wind-galls*. Similar swellings arise, independent of sprains, as the result of over-exertion or dropsy of the part. The swellings may become solid by coagulation of the lymph and may be absorbed or organized, or the inflammation may attack the bone, leading to ulceration and bony deposits. Similar bony deposits with or without ulceration may take place on these small bones in connection with injuries of the suspensory ligament.

Treatment. Simple *wind-galls*, dropsical or from over-exertion, may be made to disappear by persistent pressure with a bandage and pads applied at first two hours twice a day, and two hours more every day thereafter, until they can be kept on all the time. It may, however, require five or six weeks and should be stopped if it

causes inflammation in the sac. Another plan is to draw off the liquid through the nozzle of a hypodermic syringe and apply a firm wet bandage. In some quiet animals a weak solution of iodine may be injected, but this is too often injurious or at least fruitless, from the irritability of the horse. Recent puffs will sometimes disappear under strong astringent lotions (oak-bark and alum) or under an active blister, or after firing, the contraction of the skin during healing appearing to be a principal cause of their absorption.

Where there is sprain with much heat, tenderness and tension, treat by rest, purgative, a high-heeled shoe, and fomentations or cooling astringent lotions, to be followed by blisters when the tenderness subsides.

Disease of the bones (*Sesamoiditis*) must be treated with severe blisters and even firing, with long continued rest, but if ulcers already exist on the gliding surface of the bones a complete recovery need scarcely be looked for.

SPRAIN OF THE INFERIOR SESAMOID LIGAMENTS.

The ligaments below these pulley-shaped bones behind the fetlock are sometimes sprained, causing great lameness with swelling and tenderness below the fetlock pad. *Treat* as for injury to the suspensory ligament.

ELASTIC SWELLING IN FRONT OF THE FETLOCK.

These are of two kinds: 1st, a serous abscess or enlarged bursa under the skin: and 2d, the distension of a large synovial bursa between the extensor tendon and the capsule of the joint. The first swells out as a uniform rounded tumor on the front of the joint. The second has at first the appearance of a double tumor from the swelling appearing at the two sides of the extensor tendon, and it is only in severe cases and advanced stages that these meet over the centre. They usually result from pricks or bruises, though the second form may be associated with sprain. Any existing inflammation should be subd ued by

soothing measures and a blister applied early to secure absorption of the liquid if possible. Should this fail the liquid may be drawn off as advised for wind-galls, and the part tightly bandaged. Or a free incision may be made in the lower part of the sac and wet bandages applied to keep down inflammatory action, while the sac is obliterated by healing from the bottom.

DISEASE OF THE FETLOCK JOINT.

This is occasionally the seat of simple dropsical effusion, causing it to swell out like wind-galls on the inner and outer sides, just above the sesamoid bones. The swellings are, however, placed more anteriorly than distensions of the tendinous sheath, and pressure upon them does not cause bulging nor fluctuation behind and below the fetlock, on the line of the tendons. This is not necessarily connected with lameness, though if the result of inflammation of the joint, that is more likely. Inflammation of the joint may be recognized by the habitual resting of the leg, which starts forward at the fetlock, by the appearance of wind-galls just described, and by a swelling heat and tenderness of the entire joint. Bending the joint fully causes intense pain as does also full extension.

Treatment does not differ from that of other inflamed joints. (See page 401.)

DISLOCATION OF THE FETLOCK.

This occurs like that of the knee in connection with rupture of the lateral ligaments. We have had recoveries so as to be very useful for farm work by reducing the dislocation and fixing with splints and bandages, but this cannot by any means be calculated on.

BLOWS ON THE INSIDE OF THE FETLOCK. CUTTING.

Like *cutting* on the inner side of the knee, this arises from blows received in action. Weak animals with turned-out toes and distorted feet are most liable. It is to be

treated by soothing measures, and if the bones or joints become involved, treat as advised for the respective injuries.

To *prevent*, let the feet be kept a little bare on the inner side and the shoes slightly leveled off, but avoid lowering the foot or thinning the shoe on the inner side. On the contrary a very slight thickening of the shoe on the inside is sometimes beneficial, by straightening up the fetlock and removing it from danger. If this fails wear a leather boot with a projecting rim, or a simple woolen bandage. In weak subjects benefit is often derived from bringing into a better condition of health.

FRACTURES OF THE PASTERN BONES.

These are exceedingly common in horses running on hard ground or even on soft movable sand. They are of all degrees of severity, from a simple split without separation of the broken pieces, to a complete shattering of the bone into a dozen fragments or more. Simple fractures are usually oblique, or even vertical, the bone being split in two nearly equal lateral halves, but transverse breaks are also seen.

Symptoms. In shattered specimens the case is easily made out and the victim should be destroyed at once. In cases of detachment sufficient to allow grating when the bones are moved (flexed and extended) there is as little difficulty. But in cases of splitting without detachment, the parts being held firmly together by the strong fibrous investments, the case is liable to be mistaken. There is the fact that the injury occurred suddenly during action, the horse at once showing lameness, more extreme on hard ground; there is no injury to ligaments nor tendons; but pain when the pastern is fully flexed, and with or without swelling on the bone there is a line of tenderness which can easily be traced with the fingers and corresponds to the fracture.

Treatment. Place the patient in slings, and if grating

is heard apply a strong bandage to above the fetlock. If no grating sooth the early inflammation for a day or two, then render the parts immovable by a smart blister on the front and sides of the pastern from the hoof to the fetlock. Such cases usually do well, though if the fracture extends into a joint the recovery is likely to be imperfect.

In the smaller animals bandages are requisite for fracture of the digital bones.

BONY GROWTHS ON THE PASTERN BONES. RINGBONES.

These usually begin as inflammation of the membrane covering the bones, and at such points as give attachment to ligaments, namely: the lateral aspects of the lower or small pastern bone, and of the lower end of the upper or

Fig. 68.

Fig. 68—Ringbones—high and low. The rough irregular deposits of new bone are shown on the lateral parts of the large and small pastern bones respectively.

large bone. There is a circumscribed, tender and somewhat elastic swelling, with more or less soft, doughy engorgement of the investing soft parts, and in course of time the exuded matter, at first soft, becomes hard and

bony. The process in the early stages often appears to consist in the dragging of the periosteum and vessels from the surface and the development of bone beneath. But as the disease advances the whole surface of one or both bones may become involved, leading to a general deposition of new bony matter, extending, it may be, over the joint between the two pastern bones, or between the lower pastern and the bone of the foot, and abolishing all movement. Ringbones may also take origin in partial fractures, in concussion, in rheumatoid disease, and in faults of nutrition, in which the earthy salts are largely passed with the urine.

Symptoms. Lameness may be almost altogether absent, or it may be extreme in such cases as are attended by active inflammation of the bone or joint, or when the joint has become fixed by bony deposit. The heel may be first brought to the ground or, in the hind foot, the fetlock may knuckle over and the toe strikes first. The lameness is worst on hard ground and usually increases with exercise. Swelling may be scarcely perceptible and confined to the inner or outer side of one pastern bone, or it may be an extreme enlargement of the whole pastern region. It may be hard throughout in old cases, or softer and slightly elastic at points where active disease is still going on. Forcible bending of the pastern causes much pain, as also pressure on the swelling and especially on the softer and more recent deposits.

Treatment. Rest, second the indications of nature in order to secure an easy position, using a high-heeled shoe when the animal walks on the toe and a thin-heeled one when he walks on his heel. If there is very active inflammation adopt soothing measures first and then blister severely or even fire. Corrosive sublimate and camphor 20 grains of each, muriatic acid 10 drops and oil of turpentine 1 oz. is often useful in such cases, but should be watched and washed off when sufficient exudation has taken place, otherwise it may blemish. In firing it is usu-

ally desirable to penetrate the skin in points, but never keep the hot iron long in contact with it lest the radiated heat destroy the integument. It is often needful to allow a rest of several months for consolidation of the new deposit. When the joints are much affected the only cure is by the growth of bone over them and the abolition of movement, and then there remains some stiffness though there may be ability for slow work. Old horses recover less satisfactorily than young ones. If there is reason to suspect a rheumatic complication or any general fault in nutrition these must be attended to.

SPRAIN OF THE FLEXOR TENDONS BEHIND THE PASTERN.

This is of two kinds, though both in almost the same seat. Opposite the first pastern joint the posterior tendon divides into two branches which passing over the inner and outer sides of the other tendon are inserted on the corresponding aspects of the head of the small pastern bone. Between these branches the other tendon plays over a raised fibro-cartilaginous pulley, its gliding being favored by a synovial sac. This last tendon may be sprained as it plays over this pulley, in the median line of the back of the limb, and either of the branches of the other tendon may be sprained close to its attachment on the inner or outer side of this pulley.

Symptoms. Standing quiet the animal keeps the fetlock and pastern joints slightly flexed, the foot advanced six or eight inches, the heel slightly raised and the toe resting on the ground. In action he steps short and stubs the toe into the ground and generally improves as he warms up to work. The toe of the shoe wears faster than the heel, and the heel in old standing cases may be a little contracted, but it is not unnaturally warm, nor is there wincing on tapping the quarter or the sole to either side of the body of the frog, with a hammer. This serves to distinguish from disease of the small pulley-shaped bone of the foot—the misnamed *coffin-joint disease.* Pressure

on the tendons in the hollow of the heel causes much pain and wincing, and the precise seat of injury may be ascertained from the position of greatest suffering—in the median line, to the inner side or to the outer.

Treatment. Shorten the toe, apply a high-heeled shoe and surround the pastern with bandages soaked in cold water or some cooling astringent lotion. A purgative will be useful if inflammation runs high. When heat and tenderness subside, any remaining lameness may usually be removed by a blister on the front and sides of the pastern.

FRACTURES OF THE HIP-BONES.

FRACTURE OF THE OUTER ANGLE. In young animals a little nodule from the extreme angle is often broken off by blows before it has acquired a firm connection with the parent bone. In the old, the fracture usually extends deeper, three, four, or six inches in breadth being often detached. In either case the fragment is drawn downward by the muscles leading to a greater or less flattening of the quarter, and it usually becomes attached to the parent bone by fibrous tissue or even bony union. In some instances, the fragment acting as a foreign body sets up inflammation with suppuration and a running sore. The slighter cases are not necessarily attended by lameness but if much bone has been detached, with considerable flattening, there is more or less halting on the limb. *Treatment* consists in keeping the animal still until union has been effected, or in case of a running sore a free incision should be made and the fragment of bone extracted.

FRACTURE OF THE INNER ANGLE NEAR ITS JUNCTION WITH THE BACKBONE. This is less frequent than the last but still tolerably common. It causes considerable lameness, and grating is heard when the limb is moved backward and forward. The oiled hand introduced through the rectum may feel the outline of the bones on the two sides, and detect the change from the natural form on the broken one. If it has been done for some time, there is a soft pasty swelling on the inner side of the bone.

FRACTURE OF THE POINT OF THE HIP. As in the case of the outer angle, the posterior one is very liable to sustain fracture of a small portion which is developed apart from the rest of the bone. In other cases several inches in breadth of the bone is detached. In both cases alike it is drawn downward so that the prominence on one side of the tail is greater than on the other. It may be unattended by lameness and tends to grow on below, though it will sometimes remain detached and form a running sore in which case it must be removed by the knife.

FRACTURES THROUGH THE SHAFT OF THE HIP-BONE. These may be in front of the hip-joint, behind it, or through it. Again, they may be simple or comminuted. If the fracture does not implicate the joint, weight may still be rested on the limb, but if through the joint the limb is held useless. The dragging lameness of hip disease is always present and grating may be felt by seizing the outer and posterior angles of the hip in the two hands while the animal walks. Examination with the oiled hand in the rectum will enable the observer to ascertain the exact seat and nature of the injury.

Treatment of Fractures of the Hip. If through the joint, or much shattered, the animal should be at once destroyed. If a simple fracture the patient should be put in slings and kept still for a month or six weeks. In such cases recovery may be expected.

SPRAIN OF THE HIP.

This is one of the most common injuries of the hip and is located in the tendon of the largest muscle of the buttock as it plays over the large process on the head of the thigh-bone. Its exact site is easily found in thin horses by the prominence over the joint and midway between the anterior and posterior angles of the hip-bone. There is the usual dragging hip lameness, a quick short step with the affected limb, the hip being moved as little as possible, suffering when the member is drawn forward and tender

ness to pressure on the seat of the sprain. Swelling and heat are rare because of the depth of the lesion. In cases of any standing the muscles of the quarter waste.

Treatment. Long continued rest, with at first fomentations, and later, active and repeated blisters, or even the hot iron applied in points. Some chronic cases do well under a combination of exercise and counter-irritants as follows: rub the affected quarter with oil of turpentine, then take out and exercise in a circle until covered with perspiration; then return to the stable, rub down and clothe with a double wet blanket over the lame quarter. Repeat daily for some time.

DISPLACEMENT OF THE ABDUCTOR FEMORIS.

Lean cattle are subject to a peculiar form of hip lameness, from displacement backward of the large muscle which plays over the prominence at the head of the thigh-bone. The high, bony process presses on the anterior border of the muscle, preventing it from resuming its natural position. The anterior border of the muscle forms a prominent painless cord extending from behind the hip-joint to below the stifle. In moving, the toe is dragged along the ground, being extended backward, and the limb is flexed with effort and often in a sudden and convulsive manner, and accompanied by a dull sound. These symptoms are most marked if the animal is made to step over a bar of six or eight inches high as he leaves the stable.

Treatment. Some recover under good nourishment with or without blisters, but usually it is best to make an incision over the front of the cord an inch or two below the head of the thigh-bone and cut the border of the muscle across with a narrow-bladed knife. The animal may be kept quiet by the bull-dog pincers in his nose, and by drawing the opposite limb forward with a line passed through a collar.

DISEASE OF THE HIP-JOINT.

This may be connected with a partial fracture of the bones of the quarter extending into the joint, with laceration of the ligaments, with ulceration of the bones, or with simple synovitis, from over-work, rheumatism, or other cause. The symptoms strongly resemble those of sprain of the hip, but there is no pain on pressure upon the prominence on the head of the thigh-bone, but often much suffering when the limb is drawn outward and backward, so as to place the ligaments on the stretch. It is attended with wasting of the muscles of the quarter.

Treatment. Rest, sling if at all convenient, foment the quarter with a thick rug repeatedly folded, and finally blister actively or, still better, fire. A long period of rest is usually necessary.

DISLOCATION OF THE HIP.

This is almost unknown in the horse excepting in connection with fracture, but is not very uncommon in lean cattle and small animals as a consequence of falls and dragging of the limb to excess in any one direction. It will even happen from extreme dragging of the limb outward when caught over a bar. Displacement is usually *forward* or *backward.* In the former case the limb is shortened, the prominence of the head of the thigh-bone carried forward and the toe turned out. In the latter the limb is elongated, the prominence of the head of the thigh-bone carried backwards and the toe turned inward. Dislocations inward and outward are also described and would be marked by the deviations of the limb from its normal position, and the depression or increased prominence of the head of the thigh-bone.

Reduction. Lay the animal on the opposite side of the body; maintain the body immovable by a strong sheet carried between the thighs and held by several men or fixed to a firm object; attach a band round the limb above the hock and let two men drag upon this, or one man

carefully with the aid of a block and tackle; meanwhile the operator, seizing hock and stifle, must turn the upper part of the limb in a direction opposite to the displacement. If *forward* the hock is raised and the stifle depressed; if *backward* the stifle is raised and the hock depressed; if *inward* a smooth round billet of wood is to be placed between the thighs to act as a fulcrum upon which the limb is depressed when sufficiently stretched; if *outward* the lower part of the limb must be drawn outward and upward, while weight is thrown on the thigh-bone; or by movements of the limb it may be changed to a dislocation forward and reduced from that position. It may be necessary to relax the muscles by a full dose of chloral-hydrate before attempting to reduce. When reduced, the head of the bone slips in with a jerk and an audible sound, and the limb assumes its natural position. The animal may then be let up, and should be kept quiet and alone for several days. These cases do far better than could be expected from the anatomical arrangements of the part.

FRACTURE OF THE NECK OF THE THIGH-BONE.

This is not uncommon in small animals, especially dogs, but very rare indeed in the large quadrupeds. It is marked by shortening of the limb, inability to use it, and grating when it is moved. If the finger or hand is passed into the rectum and pressed against the crest above the hip-joint, while an assistant draws the limb outward, the prominence of the head of the thigh-bone may be felt above the crest. This can only occur in two other conditions;—fracture of the outer rim of the cup receiving the head of the thigh-bone, and outward dislocation of the hip-joint without fracture. The latter may be distinguished by the absence of grating, while the first is as serious as the fracture of the neck of the bone.

Treatment is useless in the large quadrupeds, but in the small, a firm retentive starch bandage for the whole limb will often secure recovery.

FRACTURE OF THE SHAFT OF THE THIGH-BONE.

This is marked by inability to use the limb, muscular trembling, swelling on the inner side of the thigh, and grating, felt or heard, when the limb is moved in various directions. In the larger quadrupeds nothing can be done beyond slinging and quiet, which may prove successful in exceptional cases, but in small animals, dogs and cats especially, a well applied starch bandage will usually be a success.

FRACTURES OF THE LOWER ENDS OF THE THIGH-BONE.

These are recognized by great pain and swelling in the stifle, with grating when the joint is seized between the hands and the limb moved. It may be considered irremediable in the large animals, and recoveries are imperfect in the small.

FRACTURE OF THE KNEE-CAP.

The small bone in front of the stifle is sometimes fractured either across or vertically, causing local swelling and tenderness with inability to use the limb, which is drawn backward and outward. It is irremediable.

DISLOCATION OF THE KNEE-CAP.

Not uncommon in certain breeds of horses, this usually occurs when standing at rest in the stable or rather after rising. The limb is drawn forcibly outward and backward, the foot resting on the toe, and the animal is helpless to move it. The bone may be felt displaced at the outer side, at what should be the most prominent anterior point of the stifle. In young horses it may be attended with ulceration of the pulley over which it plays, but, in the adult, this is very exceptional.

Reduction may sometimes be effected by starting the animal with a whip, the limb being brought forward under the violent effort and the bone meanwhile slipping into place. More commonly it is requisite to draw the foot

forward, either by simply lifting it, or by the aid of a rope having a noose round the fetlock, and passing through a collar on the neck. While the limb is being advanced, a hand should be placed on the bone outside the stifle to press it into position. When reduced keep on a level (not slippery) floor; apply a shoe with a toe piece projecting an inch in front of the hoof, and curved up; and finally put a smart blister on the joint.

Second Form. A modification of the above is seen in horses and cattle, in which the knee-cap is drawn too high during extreme extension of the stifle, and then pulled outward by the abductor muscles; its inner lateral ligament slips into the notch above the pulley, over which the bone should play, and the animal remains helpless with the limb drawn back as in ordinary dislocation. There is a depression in front of the upper part of the stifle, surmounted by a swelling which is soft, not hard, as it would be were the current explanation of *cramp of the muscles* correct. The reduction is by the same method advised for ordinary dislocation, and the after treatment identical.

DISEASE IN THE STIFLE JOINT.

If *between the knee-cap and its pulley* the patient usually drags the toe on the ground, steps short and brings the foot forward with a swinging outward motion. The leg is kept half bent when standing, the knee-cap is felt to move loosely on the pulley, causing pain, and an elastic fluctuating swelling is felt beneath it in the intervals between the three descending ligaments. In disease of the *inner or outer division of the true joint* the animal stands with it in the same position, but in walking it may either be jerked up suddenly, or in the worst cases, this joint and the hock are carried in a stiff extended position and the principal movement is in the hip. An elastic swelling may usually be felt beneath the knee-cap but it is less prominent than in disease of the pulley, and the bone is less mobile and does not cause pain when moved.

Treatment. All cases require a high-heeled shoe excepting such as are attended with dislocation of the knee-cap, in which case a thin-heeled shoe with a projection forward at the toe is indicated. Rest is essential, and in case of very acute inflammation, fomentations should precede repeated blistering or firing. A long rest is imperative. In ulceration of the bones and dislocation of the knee-cap in young animals, the fault is mainly in nutrition, and a rich diet, tonics, pure air and sunshine are demanded.

FRACTURE OF THE LEG BETWEEN THE THIGH AND HOCK.

The *principal bone of this region (tibia)* lying superficially on the inner side of the leg is very liable to fracture from kicks. The *symptoms* are patent enough when the fracture is complete, the bone hanging useless, and the broken ends being easily felt beneath the skin. But in very many cases the bone is only split part of the way through and the patient may show little lameness, may even do a fair day's work or perform a long journey with his broken bone. But with the occurrence of the exudation and softening around the seat of injury, the bone gives way under a slight strain, and thus the fracture appears to have occurred from getting up in the stall, though several hard days' work may have been done since the injury was received.

Treatment. In all cases of blows on the inner side of the leg in which a line of tenderness extends from the point of the bone which has been struck, place the animal in slings and wait for repair. A compound or comminuted fracture of this bone need hardly be treated in large quadrupeds. A simple transverse fracture may recover in slings, with a firm bandage and splints from the foot up to above the stifle. I have had a fair recovery even with a very oblique fracture, but this should only be attempted in valuable breeding animals.

The *smaller bone of the leg (fibula)* may be fractured by falling in shafts or across a pole or beam. The resulting

lameness is most puzzling as the broken ends of the bone are held together by fibrous tissue, and though they move hinge-like no grating is produced. Then the bone is so deeply covered by muscle that it cannot be felt. A blow on the outer side of the hind leg, just below the stifle, inducing persistent lameness, with tenderness on pressure along the line of the bone on the outer side of the limb, and without any other apparent injury, implies fracture of this bone.

Treatment. A month's absolute rest and one or more blisters over the seat of injury.

SPRAIN OR LACERATION OF THE MUSCLE WHICH BENDS THE HOCK.

This is often sprained at its lower part, and especially in its inner branch which passes over the front and inner side of the lower part of the hock joint, giving rise to a swelling exactly in the seat of bone spavin. It is distinguished by its tense, elastic nature and by its position on this tendon rather than above or below it.

Treatment. A smart blister, or this failing, evacuate with a fine nozzle of a hypodermic syringe and then apply a wet bandage or blister. This form is rarely hurtful.

When more severely sprained the swelling, heat and tenderness may be felt in front of the hock or on the anterior and outer side of the stifle according to the seat of injury. The limb is usually carried very straight, there being little or no bending of either hock or stifle. It is to be *treated* in the ordinary way by soothing measures followed by blisters or firing.

Lacerations of the muscle, or more frequently *rupture of the tendon* occurs, causing the hock to be carried straight and the shank dangling nearly in a line with the leg. In some instances from violent contraction of the extensor muscles, the foot may be jerked out backward when the patient is started. In injury to the muscle there is at first a depression at the part with swelling above and

below, but soon the hollow fills up and may become prominent, soft and doughy. In rupture of the tendon the depressed interval, or later, a soft doughy swelling on the line of the cord in front of the hock, is sufficiently characteristic.

Treatment. Rest, and astringent lotions to the part (acetate of lead 3 drs., water 1 qt.) These cases almost always do well.

SPRAIN OF THE HAMSTRING.

This is productive of lameness with manifest pain in extending the hock and a jerk in lifting the limb and is easily recognized by the firm swelling of the cord above the point of the hock. It is to be treated by a high-heeled shoe, with fomentations and subsequently blisters to the part.

RUPTURE OF THE HAMSTRING.

This is much more serious, the hock and fetlock bending so as to render the limb useless whenever weight is placed upon it. The separation of the divided ends can easily be felt through the skin.

Treatment. If in large quadrupeds place in slings. In all apply an immovable bandage, and splints extending from the foot to some way above the hock, so as to keep that joint fully extended.

CAPPED HOCK.

This is of two kinds: 1st, a serous distension of a bursa which exists between the skin and the point of the hock; and 2d, sprain of the tendon inserted on the point of the hock (gastrocnemius) or of the one which plays over it (perforatus).

1. The distension of the subcutaneous bursa usually results from kicks or blows and is to be feared as indicating vice, but rarely causes lameness. The soft fluctuating swelling is directly backward from the point of the

hock, and may be of almost any size. Slight and recent cases may be *treated* by a purge and soothing lotions to be followed as soon as heat and tenderness subside by a smart blister (iodide of mercury 2 drs., lard 1 oz.) Should the sac remain, evacuate with the nozzle of a hypodermic syringe and apply a wet elastic bandage; or open by a small orifice below and heal like an ordinary wound. To *prevent* its repetition is a much more difficult matter as it usually implies the cure of a vice. Stretching prickly bushes or chains behind him, tying chains or logs to the limb above the hock, or applying hobbles are all more likely to ensure permanent injury to a nervous animal than to cure him of his vice. A kicking strap will often succeed in harness.

2. In case of sprain of the tendons, the swelling takes place at the two sides and above rather than at the point of the hock. It is more or less tense but elastic and even fluctuates on pressure. It is often attended with severe lameness which may become permanent in connection with ulceration of the bone. It is to be treated like an ordinary sprain by high-heeled shoe, and fomentations or cold astringent lotions, followed by blister. If swelling remains it may be punctured and compressed as in the first form of *capped hock*, but a seton should not be used.

DISPLACEMENT OUTWARD OF THE TENDON PLAYING OVER THE POINT OF THE HOCK.

This is a rare occurrence, the tendon being traceable as a firm cord across the outer side of the bone in place of over its summit. It seems impossible to restore it to its place, as the band which fixed the tendon to the inner part of the bony process has given way. Fortunately the animal is often little incommoded after the subsidence of the preliminary inflammation, and I have known one do excellent carriage work, the only objection being the unsightliness of the hock.

SPRAIN OF THE FLEXOR TENDON (PERFORANS) BEHIND THE HOCK. THOROUGH-PIN.

This tendon plays over the back of the hock, to the inner side of the bony process which forms its point, and has a large synovial sheath extending above and below the joint. When sprained at this point there is lameness, a tendency to knuckle over at the fetlock, and a round, tense, elastic, fluctuating swelling on each side in front of the point of the hock and in the hollow between the hamstring and the bone. Pressure on the one side causes bulging on the other, and pressure on both causes fluctuation on the line of the tendon below and behind the hock.

Treatment. A high-heeled shoe, rest, fomentations, or cooling lotions and a purgative. When heat and tenderness subside, blister, repeatedly, or even fire when there is reason to suspect disease of the bone. When all lameness has passed off leaving only a puffy swelling, or when that has appeared without lameness as the *result of work*

Fig. 69.

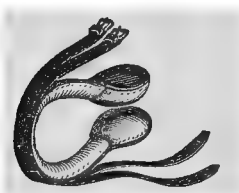

Fig. 69—Spring bandage for thorough-pin.

or as a *dropsical effusion*, apply a spring bandage with two smooth round pads pressing on the inner and outer swellings. The accompanying cut may enable any saddler to construct such an instrument, the spring being made of good spring steel and covered with leather.

DISTENSION OF THE SHEATH OF THE EXTENSOR TENDON IN FRONT OF THE HOCK.

This causes a tense fluctuating swelling at the front and outer side of the hock. It is rare and not usually injuri-

ous, but may be treated like similar synovial swellings elsewhere.

FRACTURE OF THE INNER MALLEOLUS.

This consists in fracture of the bony prominence on the inner side of the hock at its highest point. It usually results from a blow with the opposite foot in fighting flies. There is more or less swelling of the part, with an unnatural mobility of the process and in some cases distinct grating. It is not unfrequent to have a wound in the skin and a flow of glairy synovia from the opened joint. In other cases, independently of fracture, there is inflammation and enlargment of the bony eminence.

Treatment. Rest is imperative, as the fracture often implicates the joint. If synovia escapes use a sugar of lead lotion (1 oz. to 1 pt. water and 60 drops carbolic acid), or even apply a blister around the joint, leaving the space of an inch around the wound untouched. In other cases rely on soothing applications, followed by blisters when heat is diminished. Such cases usually do well, even an open joint being harmless from the wound being at its upper part. Even pieces of bone may be taken out with portions of the joint surface and yet a satisfactory recovery ensue.

FRACTURE OF THE POINT OF THE HOCK.

This may merely implicate the extreme summit of the bone in young horses or it may occur lower down in the middle of the bony process. There is much lameness and difficulty in bringing the foot to the ground, the limb being often kept raised and semi-flexed, and the detached portion may be felt in front of the point of the hock, or a line of tenderness may be detected across the middle of that bone, detachment and grating being obviated by the strong fibrous investment.

Treatment. If a portion has been detached from the summit, place in slings, extend the joint and replace it,

retaining it in position by firm pads of tow placed in the hollow in front of the bone and a strong starch or plaster bandage extending from the hoof to beyond the hock. When there is no detachment, soothe the parts till heat and tenderness subside and then blister, allowing a long period of rest.

FRACTURES OF THE OTHER HOCK BONES.

If these implicate the upper or true hock joint, they are usually beyond remedy, but if the lower flat bones only, they present symptoms like those of bone spavin, and may recover by union of the small bones.

BONE SPAVIN.

This consists in disease (inflammation, ulceration, bony deposit,) of the small flat bones in the lower and inner

Fig. 70.

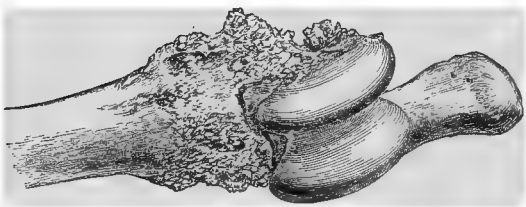

Fig. 70—Bone Spavin affecting both inner and outer sides of the joint.

part of the hock joint, often implicating those of the outer side as well. It may be manifested by local swelling, heat and tenderness, or these may be altogether absent as in cases of ulceration in the centre of the joint between the flat bones—(*Occult Spavin*). The swelling, when it does exist, is on the antero-internal aspect of the lower part of the articulation, to be seen by standing about two feet from the fore limb and looking across the front of the joint. It is hard and to be distinguished from the tense, elastic swelling caused by sprain of the inner branch of the flexor tendon, and from the soft distended vein (so-

called *blood spavin*) which passes across this part of the joint. The bony swelling may be more to the front, or more backward on the inner side of the hock, or it may even show mainly on the outer side. It frequently implicates the head of the shank-bone, and in bad cases may extend up to the true hock-joint and even abolish its movement. Lameness, which is usually present in recent cases and is the only symptom in *occult spavin*, is shown by moving stiffly on the toe, when the horse is turned from side to side of the stall. The same stiff walking on the toe is seen for the first few steps in starting, after which it disappears, but there remains a stiffness and lack of bending in the hock and stifle joints which a little practice will enable one to recognize. There is sometimes, however, a jerking up of the limb as in *string-halt*. If turned quickly in a narrow circle the animal drops on the limb, carries it stiffly or even rests on the toe only. If the lameness is only moderate it will usually disappear when the patient becomes warmed up at work, hence the propriety of placing him in a quiet stable for twenty minutes before examination.

Treatment. Rest; a high-heeled shoe; fomentations and laxatives are appropriate to the early inflammatory stages. Later, counter-irritants are demanded. Blisters of any kind will usually succeed. The hot iron is perhaps even more efficient. Deep firing in points is especially beneficial. Some cases will resist all these modes of treatment, but recover after section of the flexor tendon which passes over the swelling. Other methods are pursued with variable success. All may do well in young horses with no constitutional infirmity, and all will fail in some old subjects.

INFLAMMATION OF THE TRUE HOCK JOINT. BOG SPAVIN.

Inflammation of the upper or principal joint of the hock, where nearly all the movement takes place, occurs from overwork, sprains, rheumatism, punctures, wounds, fract-

ures, etc. There is a puffy fluctuating swelling with heat and tenderness on the antero-internal side of the upper part of the joint, where in the natural state there is a hollow or depression. There is also a similar swelling behind in the seat of *thorough-pin* but distinguishable in that it can be pressed forward by compression, the anterior swelling meanwhile filling up, but there results no swelling below and behind the hock as in *thorough-pin.* The lameness resembles that of *bone spavin,* but there is perhaps more tendency to a jerking up of the limb. The disease may go on to ulceration of the joint, to bony deposit, and even to anchylosis with abolition of all movement.

Treatment. Rest, and use a high-heeled shoe. In case of very violent inflammation use soothing measures (fomentation), and when extreme heat and tenderness have subsided use blisters as for bone spavin, or still better, the hot iron applied lightly at nearly a white heat.

Open joint is to be treated here as elsewhere, an active blister being often of great advantage in arresting movement, closing the wound and abating inflammation.

Bog spavin is most obstinate in old animals and in rheumatic constitutions with cracking of the joints in starting a walk.

DROPSY OF THE HOCK JOINT. BOG SPAVIN.

An excessive secretion of joint-oil, from over-exertion, or a dropsical effusion into the cavity of the joint produces a swelling having all the characters described above, but without heat, tenderness or lameness. It may sometimes be benefited by a blister or even by a bandage wet with some strong astringent lotion, but as it is only a blemish and does not interfere with the animal's usefulness it is best, as a rule, to let it alone.

BLOOD SPAVIN.

This is a dilatation of the vein which runs over the

seats of *bog* and *bone spavins* and being harmless should not be interfered with.

CURB.

This is a swelling, at first soft and doughy, but later hard and resistant, in the median line of the limb and just behind the lowest part of the hock joint. It is best seen by standing to one side of the limb and looking directly across it. The injury is usually a sprain of the tendon *(perforatus)* which plays over the front of the hock, though in some bad cases the ligament of the hock beneath this is injured as well. There is heat and tenderness with more or less lameness and a tendency to knuckle forward at the fetlock. *Curby hocks* are congenital in some horses and cannot be looked on as disease, but rather distortion.

Treatment. Keep quiet, put on a high-heeled shoe, and apply hot fomentations or cooling lotions until inflammation moderates, when an active blister may be applied. In some severe cases this may require to be repeated or resort must be had to the hot iron, but this is altogether exceptional.

STRING-HALT.

This is the name given to a habit of suddenly jerking up the hind limb when raised from the ground. It may be shown only in turning from side to side in the stall and in starting, or it may appear in walking and trotting as well. Again, the jerk may be comparatively slight, or so extreme that the fetlock may even strike the belly. Its cause is often contraction of the tibial fascia, though it is a reflex nervous act and may perhaps be determined by a variety of local injuries. If any such can be found they should be corrected. Section of the tibial fascia often succeeds. The affection is usually aggravated with time and the animal is sooner fatigued and worn out than other horses.

OTHER CAUSES OF LAMENESS.

See Lymphangitis, Embolism, Farcy, Dropsy, Grease, Horse-pox, Mammitis, Rheumatism, Cramps, Palsy, Liver Disease, etc.

CHAPTER XX.

DISEASES OF THE FOOT.

General causes. Maxims for shoeing. Disease of the bony pulley and flexor tendon of the foot. Pedal Sesamoiditis. Podotrochilitis. Navicular disease. Coffin-joint lameness. Side-bones. Fractures of the bones of the foot. Inflammation of the foot. Laminitis. Founder. Chronic Laminitis. Convex soles. Pumice foot. Cracks in the hoof-wall. Sand-crack. Quarter-crack. False quarter. Horny tumor of the Laminæ. Corns. Bruises of the sole. Pricks and binding with nails. Incised wound of the sole Distortions of the coffin-bone. Contraction. Treads on the coronet. Fistula of the coronet. Quittor. Powdery degeneration of the deep parts of the wall. Seedy toe. Inflammation of the secreting membrane of the frog with discharge. Thrush. Canker. Simple foot-rot in cattle and sheep. Contagious foot-rot. Foot-rot from Tuberculosis.

Nearly all of these pedal diseases are directly or indirectly the result of faults in shoeing, and the absence of care for the feet. Here, accordingly, it would be appropriate to describe the structure and functions of the foot, and to lay down the rational principles of shoeing. But our space forbids more than the merest mention of points which are absolutely indispensable to the understanding of what is to follow.

The internal frame-work, or skeleton of the horse's foot, consists of three bones:—the lower end of the coronet (small pastern) bone, which corresponds to the upper margin of the hoof; the coffin (pedal) bone, which is imbedded inside the hoof and has a similar imperfectly conical outline; and a long narrow pulley-like bone (small sesamoid, or navicular) extended across the back part of the coffin-bone, its upper aspect forming a prolongation backward of the joint surface, while its lower face is cov-

ered by fibro-cartilage, and constitutes a pulley, over which plays the flexor tendon of the foot. These are subject to like injuries with similar parts elsewhere. Thus the bones are liable to fracture, to absorption from pressure, to ulceration, to bony outgrowths, to induration, to softening, to death and exfoliation, in connection with pricks with nails or other sharp bodies. The joint is subject to inflammation, in connection with wounds, rheumatism, overwork, etc. The flexor tendon is exposed to sprains, and, together with its synovial sheath and the sesamoid bone, to inflammation, ulceration, and the formation of new structures, which impair or destroy the functions of the part.

The posterior third of the hoof has for its frame-work an elastic cushion, which makes continuation of the bones backward, without maintaining their rigidity. This cushion comprises two lateral fibro-cartilages that extend backward from the heels of the coffin-bone, and the upper elastic borders of which may be felt under the skin, just above the hoof, in the region of the quarter; also in the median line and continuous laterally with the cartilages, a thick pad of white and elastic fibres, corresponding in position to the horny frog, and known as the *elastic frog*. These are subject to inflammation, suppuration, ulceration, ossification, fractures, necrosis, etc. In its healthy condition this cushion obviates the shocks, jars, concussions, bruises (corns), fractures and lameness which would necessarily result were this region occupied by unyielding bone. It further allows of expansion of the heel under continuous use and application of moisture, and its contraction under prolonged disuse and drying.

Covering this bony and elastic frame-work is a dense fibrous net-work, with interspaces and canals for the passage of blood-vessels and nerves, firmly bound to the bony and elastic structures by its deeper surface and to the hoof by its superficial. On the outer surface of this fibrous net-work is the membrane secreting the horn. The part

which forms the hoof-wall is prolonged as a band around the upper margin of the wall, and from the heels forward above the cleft at each side of the frog. It is shaggy throughout with soft conical processes (villi), from $\frac{1}{3}$ to 2 lines in length, which extend into the horny tubes and secrete them. The membrane forming the sole is covered by similar villi which pass into the horny tubes of the sole, and that covering the *elastic frog* has corresponding but smaller villi. Between the fibrous net-work and the inner surface of the hoof-wall and bars, the mode of union is by a series of 500 to 600 leaves (laminæ) projecting on an average $1\frac{1}{2}$ or 2 lines, and each having on its lateral aspects from 30 to 60 microscopic secondary laminæ. These are interleaved with the same number of primary and secondary horny laminæ forming an extent of connecting surface which would beget incredulity if named. These inner fibrous and vascular laminæ secrete the horny laminæ that are interleaved with them, besides giving off an amount of moisture, which being absorbed by the cells of the adjacent horny wall, serves to keep that soft, yielding and tough. So intimate is the union between each of these secreting surfaces and the horn covering it, that the fibrous net-work will often be torn from the bone, rather than the horn from the sensitive parts. This is above all true of the laminæ. This close connection further renders active inflammation in these structures acutely painful, for there being no loose tissue to yield to the exudation, it compresses these dense structures and violently tears them apart. Thus extensive effusions of serum or pus endanger separation and shedding of the hoof. A less acute inflammation of any of those secreting surfaces leads to the production of unhealthy horny growths. Thus disease of the secreting membrane at the coronet will determine a bulging, ragged, brittle line of horn from above downward on the hoof-wall, or, what is worse, a crack or fissure extending to the quick. Disease of the laminæ will determine the formation of a great mass of soft, spongy, yielding horn between

the horny laminæ and the hoof-wall, causing a falling in of the wall anteriorly, and a descent of the margin of the coffin-bone so that it will press upon and even perforate the sole *(pumice foot)*. In other cases there is merely a circumscribed horny growth pressing inward on the quick at a particular point (*keraphyllocele*). If the secreting surface of the sole is involved similar horny tumors may be formed, as in *corns*. Disease of the secreting membrane of the frog may determine an unhealthy secretion from the cleft (*thrush*) or an excessive growth and loss of cohesion of the horny fibres (*canker*).

In addition to these disorders originating in the deeper structures we have a further list that take their origin in unnatural states of the horn. And for these the current modes of shoeing are mainly chargeable.

At all points the hoof undergoes a steady condensation from its inner to its outer layers. In a transverse section of the hoof-wall the deeper tubes are open, spacious and surrounded by soft, yielding, elastic horn, while those near the surface are exceedingly minute and surrounded by a far greater amount of dense, hard and exceedingly resistant horny matter. The outer surface is especially close in its texture, and as the tubes run through the whole length of the wall to its lower or wearing surface, where they are closed by attrition, comparatively little exhalation of moisture can take place from this part of the horn in its healthy state. But it is far different when the dense surface layer has been removed by the rasp, and the open ends of the tubes exposed all over the surface of the wall. Then evaporation and drying go on rapidly, the hoof becomes hard and brittle and follows its constant tendency, when dry, to turn in at the heels and coronet, causing absorption of the parts beneath and laying the foundation of disease.

The sole and frog naturally increase in density from the quick outward, but the horn breaks up into plates before becoming detached. the plates being separated from

each other and from the tough elastic horn above by layers of powdery horn, which serve along with the plates to protect from bruises and check evaporation. In their healthy state, therefore, sole and frog are as well protected against evaporation, drying and shrinking as is the wall. But the case is altered when, with buttress or drawing-knife, these native protectors are removed and the tough elastic horn is laid bare. Then each horny tube exhales its moisture, the horn dries and shrinks, drawing inward the lower borders of the hoof-wall and pressing upward, often painfully, on the quick. Nor can the sole any longer bear contact with hard bodies, but bruises and injuries are the constant result.

The injury in both cases may be lessened somewhat by the use of suitable *hoof ointments* but the process may be likened to that of supplying a man with a wooden leg after you have ruthlessly cut off his own sound one. The substitute may permit of the limb being used but the difference, in utility, safety and durability, is almost infinite.

Among other injuries by shoeing may be mentioned unequal strain thrown on different parts of the hoof for want of a uniform bearing on the shoe; bruises of the sole from the shoe being improperly fitted, or left on too long until it has grown out over the shoe, or been drawn forward by the excessive growth at the toe until the heel settles on the sole between the wall and the bars; misdirection of the bones and joints by leaving one side of the hoof much higher than the other, or by leaving the toe or heel unnaturally long or short; pricks and binding by nails, etc., etc. Long-continued compulsory idleness in a stall, exposure to prolonged moisture, with intervals of drying, and continued contact with decomposing liquids, and to the irritating ammoniacal fumes of dung and urine are further destructive conditions for the horn.

Maxims for Shoeing. The proper care, preparation and preservation of the foot is of far more consequence than the form of the shoe. The hoof must be preserved from

knife and rasp, excepting the line around its margin and lower surface on which the shoe is to rest. This may be pared or rasped, as a rule, until the elastic horn of the sole is reached, and forms, with the lower border of the wall, a continuous smooth bearing surface of a breadth equal to perhaps one and a half times, or twice the thickness of the latter. But this only in a perfect foot. One that has a ragged furrow between the sole and wall cannot be treated in this way. Both sides, inner and outer, must be left perfectly uniform in height. The height of heel and toe must be determined by the natural form of the foot, excess and deficiency being alike avoided. As a rule paring has to be done mainly or alone at the toe, but in some cases the heels grow excessively as well. While avoiding paring out of the heels and bars as the prolific cause of *corns*, we must equally avoid the retention of hard flakes of horn in this situation, where, imprisoned by the hoof-wall, the bar and the shoe, they act as foreign bodies and bruise the heel, as would a stone or a mass of hardened clay. That part of the sole which is uncovered by the shoe may have the surface-flakes removed with a blunt instrument, but should never be touched with a knife. The frog need never be touched, though there is no harm in removing ragged hanging shreds and patches. The sharp edges of the hoof-wall should be slightly rounded with a file to prevent splitting. The shoe should be of a weight proportionate to that of the horse and to the work expected of him, and of a breadth of web adapted to the protection demanded by the nature of the sole. Its upper or applied surface may be perfectly level, unless when an unhealthy convex sole demands that it shall be leveled off toward its internal border. Its outer border should exactly correspond to the margin of the hoof-wall, without projecting beyond it, or requiring that the wall be cut down to its dimensions. When applied the upper surface should fit accurately at all points to the hoof. Bad as it is for horn to be seared, it is bet-

ter to apply the shoe, momentarily, at a dull red heat, that any imperfection in fitting may be detected and remedied, than to hurry on a shoe which bears unequally on different points. If the sole joins the wall without a break, the two forming one continuous bearing surface, and if both are of their natural thickness, the shoes are better to be coarsely fullered and the nails driven low, the fullering becoming finer and the nails being driven lower as we proceed from before backward, especially on the inner side. When the nails have been drawn up and riveted any roughness of the rivets may be removed with a file, but this should not touch the hoof if it is possible to avoid it. In turning down the clinches better make a slight depression beneath each with the point of the drawing-knife than an extended transverse furrow with the rasp, as is usually done. Remove the shoes before the hoofs have overgrown them so as to allow them to settle on the sole, and above all before the growth of the toe has drawn the shoe forward and let the heel press upon that part of the sole.

DISEASE OF THE BONY PULLEY AND FLEXOR TENDON OF THE FOOT. PEDAL SESAMOIDITIS. PODOTROCHILITIS. NAVICULAR DISEASE.

This affection, misnamed *Coffin-joint Disease*, implicates the lower surface of the small sesamoid bone of the foot, its synovial sac and ligaments, and the flexor tendon which plays over it.

Causes. It is especially the disease of fast horses, and may be largely charged to friction between the tendon and its bony pulley, to overwork and concussion. But it may also depend on injuries to the foot from bad shoeing; undue paring; setting in of the shoe on the sole; imprisoned flakes of horn acting as foreign bodies; bruises from stones or hardened clay; rasping, hardening and contraction of the foot; drying and shrinking of the foot from standing too long idle in the stall; injury to the

quick from uneven bearing of the shoe in connection with misfitting shoes or breaking of the hoof-wall; injuries from nails driven into the quick or picked up on the road; a rheumatic constitution; impaired nutrition with increased elimination of phosphates from the system; or an extension of disease from the digestive organs as in an over-feed of grain, or a drink of cold water when hot and fatigued, etc.

Symptoms. *Pointing* the affected foot eight or ten inches in advance of the other, with the heel slightly raised when standing quietly in the stable. This symptom

Fig. 71.

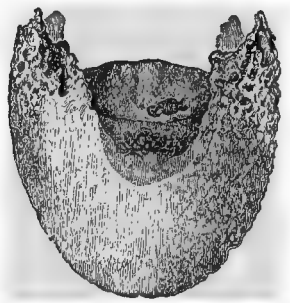

Fig. 71—Ulceration of the small sesamoid bone of the foot, and distorted heels of the coffin-bone.

may last for months before lameness is shown. Stepping short and on the toe with a great tendency to stumble when first moved from the stable, which lameness may entirely disappear after going a mile or two. It is worse when cooled off after a long drive, but it may appear intermittently while at work, as occasional stumbling or dropping on the sound foot for some time at first. The toe of the shoe is more worn than other parts owing to the peculiar gait. The foot feels hot, especially in its posterior part, and in acute cases the soft parts may bulge over the coronet and the pastern arteries throb with unusual force. The foot too. soon diminishes in size, especially in

the quarters and heels, where the heat, drying and disuse are greatest. Testing the margin of the hoof with pincers will not elicit tenderness, unless there is accompanying disease of the lateral parts of the foot (corns, bruises, pricks, absorption or distortion of the heels of the pedal bone, side bones, etc.,) but tapping the sole with a hammer on each side of the body of the frog, or striking the wall in the region of the quarter will cause the patient to flinch. Pressure with the thumb over the middle of the flexor tendon, on its inner side or on its outer, as deeply as can be reached in the hollow of the heel, the foot being bent back, causes suffering. There is more or less wasting of the muscles of the limb from disuse, but this is especially marked on the breast, above the elbow and outside the shoulder-blade. Hence the disease is usually referred to the shoulder as *sweeny*. It is most readily confounded with sprain of the flexor tendon behind the head of the small pastern bone, but is easily distinguished by the heat and contraction of the heels and the tenderness of the centre of the sole and the quarters to strokes of the hammer. To distinguish it from other diseases of the feet I must refer to these individually.

Treatment. Usually unsatisfactory except in certain recent cases. First soothe inflammatory action, give a laxative (aloes), remove the shoes, shorten the toe, and keep standing from morning to night in a puddle of wet clay without stones or gravel, in which the animal will sink to the top of the hoof. At night place in a comfortable dry stall with a poultice on the diseased foot. Unless the inflammation is severe, apply a mild blister to the front and sides of the pastern. If not applied at first this should be resorted to as soon as inflammation moderates, and is to be repeated when the effects of the first pass off. Cases that resist this treatment will frequently recover under the action of a seton passed through the frog, and a run for a month or two in a damp pasture free from stones. The recovery may be a restoration to perfect soundness, when

the surface of the bone has not been diseased, or it may be a removal of lameness in connection with a union of the bone and tendon when the surface of the former has been the seat of disease. In the last named case, the recovery is likely to be the more permanent, while many cases of apparent recovery, in the early stages, are followed by relapse. The frog seton is introduced at the hollow of the heel and brought out at the body of the frog, but as there is much danger of wounding the tendon or bursa in incompetent hands, it can only be safely undertaken by the veterinary anatomist.

All other methods failing, resort is often had to cutting the nerves passing to the foot, so as to remove all sensibility. This should never be done unless the feet can be carefully picked out and sponged every time the animal returns from work, and kept covered with thick wet swabs all the time he stands in the stable. Neglect is sure to be followed by rapidly advancing disease in the bone, extension of inflammation to the structures around, abundant exudation, and destruction of bones and joints. Even with the best of care this will occur in the advanced stages of the disease, unless indeed the bone and tendon grow together. For description of *neurotomy* see larger work.

SIDE BONES.

These consist in extensive ossification, from the heels of the coffin-bone into the lateral cartilages. Their great cause is improper shoeing; cutting away of the bars or sole, so that the wall turns inward and bruises the sole; pressure of the shoe on the sole whether from misfitting or from being left too long on; uneven bearing of the shoe, throwing too much strain on one part; pricking or pinching with nails driven too near the quick; the pressure of the dry hard horn after undue paring or rasping, and the continuous irritation which attends the partial separation of sole and wall. They are especially common in heavy horses with upright pasterns and the toe shortened rela-

tively to the heels or shod with high heel calkins, so as to increase concussion in action.

Symptoms. Lameness with a short stilty step, and a tendency to stumble from the attempt to avoid shock on the heels. The pasterns are upright and the heels often deep and strong. Pressure on the prominence above the hoof at the quarter, detects tenderness and a hard unyielding structure instead of the usual yielding elastic gristle. Bruises of the heel (corns) with bloody discoloration of the horn is almost a constant result of extensive side-bones, the sensitive sole being pinched between the bone and hoof.

Fig 72.

Fig. 72—Ossified lateral cartilages. Side bones.

Treatment. Subdue any existing inflammation by rest, blisters or even firing at the coronets, and apply a bar shoe, the bar resting on the bulbs of the frog, and keep the hoof-wall, at the heels, rasped lower than the rest of the bearing surface, so that daylight can be seen between this part and the shoe. The same shoeing must be kept up when the horse is put to work or he will soon fall lame again from bruising of the heels.

Excision of the ossified cartilage and neurotomy have been resorted to with success, but are inapplicable to most cases.

FRACTURES OF THE BONES OF THE FOOT

The small sesamoid may be broken after it has been weakened by superficial and internal absorption. The pedal bone may give way from concussion when previously softened by disease, or in cases of blows on the surface.

laceration and detachment of horn, or wounds with nails or other sharp bodies implicating the bone. The sudden and extreme lameness following an evident injury or a long-standing disease may arouse suspicions of this and if grating can be heard the case is certain. *Treatment* is rarely successful, excepting in circumscribed fractures from wounds, in which case the detached bone must be removed.

INFLAMMATION OF THE FOOT. LAMINITIS. FOUNDER.

This consists in inflammation of the sensitive parts of the foot, but predominating in the anterior portion of the laminæ, where the greatest strain comes in standing.

Causes. The disease may arise from direct injury as in over-exertion on hard roads, blows, bruises or freezing of the feet, pricks or binding with nails, continued injury from a badly applied shoe, or the constant strain upon the feet during a long sea voyage. It may also occur from a sudden chill, from drinking cold water when heated and fatigued, from overloading of the stomach with grain, from muco-enteritis, the result of an over-dose of purgative medicine, or from diseases of the lungs (pneumonia, bronchitis). Small and deformed feet and large flat ones often suffer. Horses with heavy fat carcasses are also predisposed.

Symptoms. When not caused by direct injury to the foot, it is usually ushered in by fever and general stiffness and soreness of the surface, with or without shivering, but independent of any tenderness of the foot. If not relieved these are soon followed by tenderness of the foot, usually predominating at the anterior part, but sometimes settling in the heel and causing *pedal sesamoiditis.* When acute inflammation is developed in the laminæ of the fore feet the horse is in a high fever, with full hard pulse, excited breathing, distended nostrils, extension of the fore feet forward, so that they rest only on the heels, and bringing of the hind feet far forward be-

neath the belly, to bear as much of the weight as possible. If moved, the horse groans, sways himself back on his hind parts, and drags the fore feet on their heels, or balancing himself on the hind, lifts both fore feet at once and brings them down again on their heels. The affected feet are warm, even hot, and the animal refuses to have them lifted because of the pain consequent on standing on one. If they are struck with a hammer the animal winces and groans. The arteries on the pasterns throb violently. The hairs of the mane and tail may often be pulled from their follicles, showing the general implication of the skin.

If one fore foot only is affected it is kept raised and advanced. If the hind feet, they are advanced beneath the belly, and the fore feet carried as far backward as possible to bear the greater part of the weight.

Treatment. In the initial stage, with general stiffness but no special tenderness of the feet over other parts, vascular and nervous tension may be relieved and the disease suddenly cut short by full doses of sedatives (lobelia, tobacco, aconite,) with warm clothing to encourage perspiration. Even at a more advanced stage when the feet are becoming congested and tender, the same may be resorted to, the feet being enveloped in warm poultices, and the animal encouraged to lie down by supplying a clean comfortable bed of straw. Or in place of poulticing the feet, we may seek to improve the circulation by walking without shoes on a soft newly plowed field, the heels having been slightly lowered, if very high, to allow pressure on the sole, or the patient may even be walked on a hard surface after a long bar shoe with broad web and a slight rising at heel and toe (rocker fashion) has been applied. But walking can never be resorted to when the extreme tenderness and fever show that active inflammation has set in. In this case a mild laxative (aloes) must be given (unless already purging) and followed up by aconite or other sedatives, the feet must be enveloped in large

poultices and the animal encouraged to lie down. Should he refuse to lie down the hoof-wall should be rasped down to let the sole come in contact with the ground. In severe cases the coronet may be scarified with a sharp lancet and the foot placed in a bucket of warm water or fomented with the same to favor bleeding. In the course of two days, if the suffering, fever and local tenderness are increasing rather than abating, the sole may be thinned and opened at the toe, so as to evacuate any serous exudation and limit the separation of the horn from the quick, the poultices being kept on after as before. In the course of ten days or a fortnight the inflammation should have subsided far enough to warrant the application of a blister to the pastern and an ointment to the hoof, while the patient is turned out on a soft wet pasture or kept standing a part of his time on wet clay.

CHRONIC LAMINITIS. CONVEX SOLES. PUMICE FEET.

If the inflammation persists in a slight form, an excessive growth of soft, spongy horn takes place in front of the laminæ at the toe, separating the coffin-bone from the hoof-wall and allowing its anterior border to press upon the sole or even to perforate it. The hoof-wall becomes covered with rings usually running together at the toe, where it bulges out below and falls in above. Complete restoration cannot be expected in the worst cases of this kind, but much may be done for the majority. Put on a thick broad webbed bar shoe beveled toward the inner side on its upper surface and thinner at the heel than the toe, dress the sole and wall daily with hot tar, apply gentle blisters around the coronet, and keep in a very soft damp pasture. The new growth of horn may grow down almost perfect in appearance, but it retains an undesirable brittleness.

CRACKS IN THE HOOF-WALL. SAND-CRACK. QUARTER-CRACK.

The predisposition to this is usually to be found in rasping and drying of the hoof-wall, in uneven bearing of

the shoe, in alternate soaking of the hoof in water and drying, and in treads or other temporary wounds or injuries to the coronet. The crack extends from the coronet downward, for a variable distance, in the direction of the horny fibres. If attended by lameness, the laminæ are usually being pinched between the edges of the crack, the irritation is perhaps further increased by the presence of sand and dirt, and fungous growths may appear in the sore.

Treatment. A carefully applied bar shoe having an even bearing all round the foot; a nail driven through the edges of the crack and riveted so as to hold them together; a transverse groove, $\frac{3}{4}$ to 1 inch in length, cut to the quick just above the upper end of the crack, and active stimulation or slight blistering of the coronet above this point will usually succeed in obtaining an unbroken growth from above, and when the crack has grown off at the lower border the hoof is perfect. But the inflammation will sometimes demand poulticing; the nail may have to be replaced by a metallic plate fixed to the hoof on each side of the crack by screws not exceeding a line in length; a gaping crack may require filling with gutta-percha or other hard substance to keep the edges immovable; or finally, it may be requisite in bad cases to cut out a V-shaped piece of horn, the apex corresponding to the middle of the crack and the two limbs to the coronet on the two sides of the crack.

FALSE QUARTER.

This is similar to a sand-crack in appearance but caused by such destruction of the secreting structure at the top of the hoof that it is impossible to obtain a growth of horn to fill up the interval. Palliation by careful shoeing is all that can be accomplished.

HORNY TUMOR OF THE LAMINÆ.

This is a result of sand-crack, the irritation leading to an increased secretion of horn on the inner surface of the

hoof-wall, which in its turn may press on the quick and cause lameness. With or without any remains of sand-crack there is tenderness on pinching that part of the hoof, and when the shoe is removed and the hoof pared, there is observed a semicircular encroachment on the sole by a white spongy horn extending in from the hoof-wall. Wet swabs on the foot and rest may subdue any inflammation, but should lameness persist, the only resort is to cut out a triangular portion of the wall including the tumor, poultice the part, then cover with tar and wait for the horn to grow down in a healthy condition.

CORNS.

These are at first simple bruises of that part of the sole included between the bars and the wall at the heel, but later there is often an increased production of horn and the formation of a horny tumor which presses injuriously on the quick. In other cases the bruise causes active inflammation and the formation of matter, which if denied escape below, will burrow toward the coronet or less frequently around the toe and give rise to disease in the deeper fibrous network, the cartilage or the bone. In these last conditions it usually results in a fistula (quittor). In other cases the corn is *pared out* as is supposed, but the heels, having lost the mechanical support of the sole, curl forward and inward, repeat the bruise continually, keep up the inflammation and suppuration and what is equivalent to an open sore in the heel. The irritation often produces absorption of the margin of the bone at the heels with bony deposits above or below, and ossification of the lateral cartilage, a condition which almost necessarily perpetuates the bruises or corns (see *side bones*). Corns may exist in either heel but are usually in the inner or weaker one, and prevail above all in flat feet with low weak heels.

Symptoms. Lameness with a tendency to *point*, with the heel slightly raised when at rest, and a short, stilty, stum-

bling step when moved. Pinching the affected heel with pincers or tapping it with a hammer causes wincing. If the shoe is removed and the heel pared out, the horn may be seen to be blood-stained, but unless this is seen on removing the flakes, no one should allow curiosity to lead to a deeper search. If suppuration has taken place the tenderness is extreme, often causing the animal to keep the foot raised and scarcely daring to touch the ground with the toe, a tender swelling usually appears at the coronet above the affected heel, and pinching or hammering of the heel is unendurable. A horny tumor may be recognized by symptoms similar to those shown in *keraphyllocele.*

Treatment. If a recent bruise and uncomplicated, apply either a bar shoe or a common one, but rasp down the bearing surface of the affected heel to avoid pressure as advised for side bones, and place the feet in water or keep the wall moist with wet swabs, and the sole with oil meal or clay packing. When tenderness has subsided, smear the hoof with ointment and work carefully. Remove the shoe early enough to prevent pressure on that heel, and in preparing the foot retain the strength of the heel by preserving the elastic horn of the sole between wall and bar. Never allow this to be pared and weakened unless it be to evacuate matter or sand, or for the removal of a horny tumor.

If suppuration has taken place, pare down the heel until the matter escapes, remove all horn detached from the quick, and pare the horn around this to a thin edge, poultice until the surface is smooth, dry and not at all tender, then apply a bar shoe, a leather sole, and a stuffing of tow and tar or crude turpentine (pine pitch). No pressure should be allowed on this heel until the sole has grown up to its natural level, as a support. Horny tumors may be removed by paring out and treating as above advised, until the sole attains its natural growth. If old-standing corns are connected with death of a por-

tion of the heel, of the foot bone or ulcération of the lateral cartilage, these must be scraped or cut off before improvement is to be expected. If connected with *side bones*, they are liable to be kept up by frequent pinching of the quick between the bone and horn, and demand careful shoeing to avoid pressure on the heel. Some cases may be benefited by cutting out the side bone.

BRUISES OF THE SOLE.

Whether resulting from badly applied shoes, stones, accumulated gravel or dried mud, these are to be recognized, like corns, by pinching the hoof or tapping it with a hammer, and are to be treated on precisely the same principles, relieving the pressure when necessary, soothing the parts, opening when matter has formed, followed up by poulticing and bar shoe with leather sole and tar stuffing.

GRAVELING is closely allied to the above, dirt having worked up through the unnatural groove between the wall and sole, and set up suppuration. Except in the careful removal of the foreign elements, treatment does not differ from that of suppurating bruise or corn.

PRICKS AND BINDING WITH NAILS.

These usually occur in thin weak feet or such as have been reduced by over-cutting and rasping till there is little to hold the nails; in the case of nail stubs being left in the hoof from a former shoeing so as to turn the new nails in a wrong direction, and when the blacksmith is too stupid to recognize the difference between the stroke of driving a nail into the soft spongy horn and the hard firm outer horn of the wall. Simple binding with the nails may cause intermittent or persistent lameness, and there is flinching on striking the heads of the nails or the wall with a hammer, or in compressing the margin of the hoof with pincers. If matter forms there are all the local tenderness and inability to use the foot spoken of in suppurating *corn*. In simple pricks an examination of the nail

clinches usually reveals one higher than the rest, and if this is a posterior one it is all the more suspicious. A nail may be driven too near the quick and yet not cause lameness for a week or two, until some slight shifting in the position of the shoe causes it to press painfully.

Treatment. In slight cases the withdrawal of the nail may be all that is necessary. In more severe it may be requisite to punch the nail holes nearer to the toe, to drive the nails low, to apply cold water or other soothing agent to the foot and to rest for a day or two. If matter has formed the course of the offending nail must be followed with the drawing-knife, the pus evacuated and the parts treated afterward as in suppurating *corn*. If the bone has been reached and a dead scale exists on the surface this must be cut down upon and removed.

INCISED AND PUNCTURED WOUNDS OF THE SOLE.

That part of the foot which is uncovered by the shoe is liable to penetrating wounds from nails, glass and other sharp bodies on the ground, as well as nails, pitchforks, broken planks, etc., against which they may kick. Such wounds are dangerous according to their depth and position. If from a clean nail, and no deeper than just to penetrate the quick, they are usually of little consequence, and a little tar or gutta-percha may be used to fill the wound, if any, until it is seen whether inflammation will ensue. If deeper, a vertical wound will be most serious in the middle third of the sole, because of the implication of the flexor tendon and small sesamoid bone, and the risk of *pedal sesamoiditis*, or even an *open coffin-joint* resulting. If in the anterior third, the danger lies mainly in injury to the lower surface of the coffin-bone, with death and removal of a thin scale which must be thrown off before the wound can close. If in the posterior third the elastic frog alone is wounded and will heal very readily.

Treatment will vary accordingly. The simple removal of the foreign body may suffice. Cold applications may be

needed, matter may require an opening to escape, or the bone may have to be scraped to expose a living surface. But in wounds of the tendon or joint the foot must be wrapped in cloths, the heels raised if standing, and a constant stream of cold water kept up on the part, by having a caoutchouc tube attached to the limb and foot and acting like a syphon to bring the water from a bucket at a higher level. This may require to be kept up day and night for several days. The subsequent treatment is like that for *pedal sesamoiditis.*

DISTORTIONS OF THE COFFIN-BONE.

Under this head may be named a great variety of deformities, the result of disease. Thus in long continued inflammation of the laminæ the fibrous net-work in front of the coffin-bone is partly ossified, giving this part a convex aspect from above downward. Continued irritation of the sole will equally develop a bony enlargement which is associated with a circumscribed convexity and tenderness of the sole. The pressure of a horny tumor, whether on the laminæ, the quarter or elsewhere, corresponding to and pressing on the bone, will cause absorption and depression of the bone to an equal extent. The pressure on the anterior border of the coffiin-bone, when separated from the hoof-wall and resting upon the sole, leads to extensive absorption and rounding of this part with a bony deposit above, on its front. Persistent irritation along the lateral borders of the foot from binding with nails, or the separation of the wall and sole, with or without the presence of gritty matters in the groove, causes absorption and rounding of the sharp lateral margins of the coffin-bone. But the heels of the coffin-bone are the parts which above all suffer in this way. Bruises from setting in of the shoe, from gritty matter or hard clay, especially if a furrow has been formed between wall and sole, from curving forward and inward of the heels when the supporting sole has been pared out *in search of corns*

or to prevent their formation; pressure from curving in of the wall which has been allowed to grow too long without support from the sole, or has been rasped till it dries or withers; uneven bearing of the shoe; all undue paring of heels and quarters contribute to produce absorption and rounding of the naturally sharp border of the coffin-bone at its heels, bony deposits above and below, induration, softening, ulceration or death of more or less of the bony tissue, and permanent unsoundness.

The existence of such distortions must be ascertained from the unnatural appearance of the hoof; the signs of a horny tumor; a rugged unhealthy hoof-wall; a flat or convex appearance of the sole in whole or in part, a deep furrow between sole and wall; wasting and diminution of the foot as a whole, but especially of the heels and quarters; and it may be side bone or fistula. There is more or less tenderness of the feet and stilty careful gait, or there may be extreme lameness. It will be observed that these distortions are usually connected with some other disease of the feet, and the symptoms will vary according to the nature of the accompanying lesion.

Such changes of bony structure are permanent as a rule, so that our attention must be given, first to the removal of any unnatural condition which has caused and is perpetuating them, and then to secure such a system of shoeing as will allow of the utilization of the animal in spite of the acquired deformities. The hoof must be encouraged, by ointments, stimulants to the coronets, and perhaps a cool moist pasture, to grow as nearly as possible to the natural condition. Then the shoe must be applied so as to secure the greatest extent of bearing surface, without injury to the deformed and weak points. In many cases a bar shoe is wanted to avail of the frog for bearing weight; a leather sole may be necessary in others; a broad web to the shoe, on one or on both sides, may be essential for protection; in other cases the upper surface must be beveled; in still others the nail-holes must be stamped only

around the toes; clips, small nails, artificial repairs of breaches in the hoof-wall may be resorted to, but it is beyond the scope of this work to do more than hint at what can only be accomplished by a combination of anatomical knowledge, mechanical skill and manual dexterity.

CONTRACTION.

This is a great bugbear of horsemen, since it exists in nearly all the affections of the foot. It is usually a result and symptom of disease, attending as we have seen on many different maladies, in which the hoof shrinks from the heat, dryness and disuse. It may also occur from simple idleness in a stall; from overgrowth of the hoof-wall, which curls in for want of support from the sole and moisture from the laminæ; from hardening and shrinking of the heels as the result of rasping, or of alternate soakings and drying; from undue paring of the heels, bars and frog, thus removing the natural supports; and from the effects of the shoe and nails in preventing the normal expansion in growth, and in removing the frog and sole from use and pressure. Thus produced it is not a direct cause of lameness and feet can be shown in which the two heels overlap each other without such a result. Yet such contraction implies wasting or absorption of the internal sensitive structures, diminution of the basis of support, with a corresponding weakness and tendency to disease under slighter determining causes than in the healthy state. The simplest treatment is to remove the shoes round the edges of the hoof-wall to prevent splitting, and keep standing sixteen hours a day, for two or three weeks, in a puddle of wet clay, then use hoof ointments freely, and apply a shoe with equal bearing throughout and without any bevel on its upper surface.

TREADS ON THE CORONET.

These are especially common in winter when the shoes are sharpened for frost. They are dangerous because of

the frequent implication of the horn-secreting structures, so as to cause *false quarter*, and from the tendency of matter to burrow beneath the horn and in the supporting fibrous net-work to form a *fistula*. They should be thoroughly cleansed from all sand and mud, the inflammation subdued by soothing applications (wet bandages or weak astringent lotions) and care taken to prevent the further introduction of dirt. To this end a simple covering of tar will sometimes suffice, but in other cases a carefully applied bandage is essential. Muddy roads should be avoided until healing is complete.

FISTULA OF THE CORONET. QUITTOR.

Causes. Treads and other wounds of the coronet; suppurating corns, bruises, pricks and wounds of the sole; suppuration from the working in of sand or gravel between the sole and wall; irritation from sand-cracks and false quarters, and disease of the coffin-bone or its cartilage.

Symptoms. Following on some one of the above disorders there is a tender swelling at the coronet, which bursts, discharging a more or less whitish serous fluid and shows no tendency to dry up nor close. If probed it is found to lead into one or more small canals in the fibrous net-work which covers the bone and elastic structures of the foot, and it may be to diseased or dead portions of bone or gristle.

Treatment. If the inflammation is very violent the foot should be enveloped in a large poultice and a laxative administered. When moderated, inject a slightly caustic solution in the direction of each canal and as far as possible. (Bichloride of mercury 5 grains, spirits of wine 1 oz., muriatic acid 20 drops). Less depends on the composition of the mixture than on the application. Inject it three times the first day, twice the second and once a day thereafter. When the discharge has ceased and the wound is almost superficial, stop the injection and apply a simple dressing of wet tow. In aggravated cases with disease of

the lateral cartilage or bone, these may require to be cut out or scraped, but our limits will not permit a further notice of this.

POWDERY DEGENERATION OF THE DEEP PARTS OF THE WALL. SEEDY TOE.

The result of uneven bearing of the shoe, the formation of furrows between the sole and wall, direct violence, as blows, or the too tight hammering of clips, etc., this is manifested by an irregularity or dryness of the affected part of the wall, and the formation of a cavity, filled with horn powder between the laminæ and the wall of the hoof. Clear out the cavity until the tough healthy horn is reached, then fill with warm tar and shoe carefully to give a uniform bearing. A clip may be useful as a support to the undermined horn but it is destructive to hammer it tight. The dressing must be repeated at each shoeing until the cavity is filled up.

INFLAMMATION OF THE SECRETING MEMBRANE OF THE FROG WITH DISCHARGE. THRUSH.

Causes. Exposure to wet and filth; standing on dung, or in a dirty, wet yard; stuffing the feet with cow-dung; bruises of the frog; undue paring; wounds of the frog; accumulation of dried mud or gravel in the cleft; extension of disease from the skin of the heel, etc.

Symptoms. Fœtid discharge from the cleft, soreness of the skin behind this, lameness or not according to severity.

Treatment. Wash out the diseased part, pare away all ragged detached horn, and apply some astringents (dry calomel pressed in on a pledget of tow; tar with a few drops of sulphuric acid on the surface; carbolic acid; or finely powdered sulphate of copper or zinc).

CANKER.

This is a more inveterate inflammation of the frog, and it may be the sole, representing in the horn-secreting

structures that aggravated affection of the skin of the heel in which red fungous growths appear. It may be preceded by *thrush* and is due to the same general causes, though it is also attributed to a parasitic fungus. It is especially common in coarse lymphatic subjects.

Symptoms. A rapid growth, from the frog or sole or both, of a soft, unhealthy, spongy horn, the tubes of which are unnaturally large, open and wanting in cohesion, so that they often stand apart from each other, and have the appearance rather of a fleshy material than of horn. If cut down it may grow up to the same level in twenty-four hours, and the enlarged villi are reached and bleed long before this would have happened in healthy horn. As in thrush there is a most offensive discharge, and the disease is very obstinate to treat.

Treatment. Cut down the fungous horn till blood comes, and the adjacent horn to the same level. Then cover with tow soaked in tincture of muriate of iron and apply firm pressure by slips of wood placed side by side with one end of each resting above the web of the shoe at the toe, and the other on a slip extending across the bulbs of the frog and resting above the heels of the shoe. This must be removed and the dressing renewed at least once in twenty-four hours. Should the course of improvement seem lagging, change the dressing for carbolic acid, chromic acid, the mineral acids, sulphate of copper or iron, chloride of zinc, quicklime, chloride of antimony or other caustic, resort being had to a new one in every instance as the former seems to lose its effect. The removal of the entire sole is essential to recovery in some cases.

SIMPLE FOOT-ROT IN CATTLE AND SHEEP.

This is a simple inflammation of the horn-secreting structures and adjacent skin, the result of direct irritation. Wearing of the sole to the quick from long journeys on hard roads; curling in of overgrown walls on the sole on

soft, boggy pastures; wounds with sharp bodies like nails, glass, etc.; the accumulation and drying of clay or mud between the claws; softening of the horn and irritation from standing on hot reeking manure; irritation of the skin around the coronets by iced water, etc.

Symptoms will vary according to the form, but in all there is lameness, often severe, the sheep getting down on its knees to feed, and an examination of the foot shows the nature of the injury. In the case of wounds with nails, glass, etc., the heat of the hoof will show the injured one, and a slight paring will detect the wound if not the offending body.

Treatment. In case of a simple superficial rawness between the claws, clean the part and touch with a feather dipped in a mixture of one part of sulphuric acid and three or four parts of water; or the surface may be smeared with tar and a bandage tied between the claws and around the pastern. In case of the formation of matter beneath the horn the foreign body, if any, should be removed, the detached horn pared away until we reach that which is still connected with the quick, the surrounding horn should be pared down to a thin edge and the sore covered with tar, with a few drops of sulphuric acid on the surface, the whole being closely bound up in a bandage. In exceptional cases the severity of the inflammation may demand a poultice, over the surface of which a weak solution of sugar of lead may be poured. One tar dressing is often enough, but the foot should always be examined a few days after, and any hindrance to the healing process removed. Bad cases with fungous growths must be treated like similar cases in the horse.

Sheep kept in low, soft pastures should have the hoof shortened by a knife or toe nippers at short intervals, to prevent injury to the sole.

CONTAGIOUS FOOT-ROT

Presents symptoms resembling those of *simple foot-rot*, but usually begins at the coronet unless in the case of

pre-existing sores, and tends to produce fungous growths of the skin around the margin of the hoof and a degeneration of horn in some respects comparable to *canker*. It is mainly to be recognized by its spread in a flock as a sequence of contact with diseased animals, and without any sufficient cause in their management or in the dampness of the locality.

Treatment does not differ materially from that of *simple foot-rot* except that a preference must be given to antiseptics in the selection of caustic dressings. Hydrochloric acid reduced with thrice its bulk of water; chloride of zinc 1 dr., water 1 pint; carbolic acid; butter of antimony, may be cited as examples. Much more important, however, is it to separate the sound from the diseased, and from contaminated pastures and buildings, and to thoroughly cleanse and disinfect the latter before they are again used for the shelter of flocks (see *Disinfection*).

FOOT-ROT FROM TUBERCULOSIS.

This is common in cattle and sheep, the disease commencing in the digital bones, which are enlarged with interstitial and surrounding deposit, leading to open sores, open joints and complete destruction of the member (see *Tuberculosis*).

CHAPTER XXI.

DISEASED GROWTHS

The limits of the present work forbid any systematic description of the various degenerations of tissue (fatty, mineral, amyloid, pigmentary, etc.,) and of the tumors or diseased growths which appear in different parts of the system. The last will only be noticed so far as to point out the principal distinctive characters of the malignant tumors or cancers, and the simple.

Simple Tumors are composed of elements like those previously existing at the same or some other part of the body; they do not tend to draw surrounding structures into their substance, but grow between these and push them aside; usually they are surrounded by distinct sacs which separate them completely from surrounding tissues except where the blood-vessels enter; they do not tend to produce swellings in the nearest lymphatic glands, by reason of propagation of elements absorbed from the diseased mass, nor an unhealthy constitutional state—dyscrasia—tending to the formation of such diseased masses in internal organs; and their elements tend to be resolved mainly into fat or gelatine by boiling, which shows there is little albumen in their structure.

Cancers, on the other hand, usually contain elements unlike any previously existing in the system. The presence of large cells, each containing smaller ones (nuclei) in its interior, and these still smaller nuclei (nucleoli), was at one time thought characteristic of cancer, and though this cannot now be maintained, yet the abundance of such

cells, or of any cells, implying the growth of the tumor is always highly suspicious. These tumors have no clearly-defined limit, nor limiting sac, but grow in the natural structures, drawing them into their substance and transforming them into a cancerous mass. Hence, a cancer near the surface will often lead to a depression at first by the drawing in of the skin, and in the mammary glands the drawing in of the teat is a most characteristic early symptom. They are hereditary, tending to appear in the offspring at the same age as in the parent. They lead to early and painful swelling of the adjacent lymphatic glands, of the internal lymphatic glands and of the spleen, and produce or aggravate the unhealthy constitutional state on which the deposition of cancer depends. If removed, there is a great liability to the formation of cancer in the same situation or some other, and especially if we fail to remove the whole organ in which the disease primarily appeared. They are more vascular, and grow faster without apparent cause (mechanical injury, exposure,) than simple tumors. Finally they contain an excess of albumen, and the larger the proportion of albumen, of cells and granules, the more rapid is the growth and the more redoubtable the result.

The *Hard Cancers* (*Scirrhus*) are firm and crisp under the knife, and from the cut surface exudes a whitish fluid —cancer-juice—containing the characteristic cells and granules. *Soft* or *Brain-like Cancer* is very soft and friable, bleeds freely when wounded, contains a great excess of cells and granules, and from its rapid growth pushes existing tissues aside so as to feel more circumscribed. It is the cancer of the young and of particular organs, such as the eye, grows rapidly, opens early, exposing a raw, unhealthy, bleeding surface, and has a short and fatal course. It is often complicated by an extensive production of black pigment (melanotic cancer). In *Epithelial Cancer* the morbid product consists mainly in epithelial cells, and it grows downward into the substance of the

tissues as well as outward from the skin. It is slow to implicate adjacent lymphatic glands, or to produce a constitutional dyscrasia with internal deposits, and hence its removal is much more frequently successful. *Colloid Cancer* is characterized by the formation of a mucous or gelatinous liquid containing a kernel of granules and rounded simple or nucleated cells, enclosed in spherical cavities, surrounded by a delicate membranous stroma, made up of the former tissues of the part. *Osteoid Cancer* of ivory-like hardness, with a vascular surface and interspaces, has not been observed in the lower animals.

Treatment of Tumors. Recent simple tumors, still largely cellular, may sometimes be removed by stimulating embrocations, as iodine ointment or tincture, camphorated spirit, soap liniment, etc. Others may be greatly reduced or even entirely removed by the occasional injection into their substance, through a very fine needle-like tube, of discutients (weak solutions of iodine). In cystic tumors the evacuation of the liquid through a fine cannula or needle-like tube, and the injection of a weak solution of iodine (one part of the compound tincture and three parts water) will often succeed. But most frequently, and especially in old-standing tumors, resort must be had to the knife or to caustics. Excision with the knife is the quickest and usually the preferable mode, but in some dangerous situations caustic may be preferred. Its employment is founded on the fact that it tends to eat away the diseased mass sooner than the healthy; but this partial immunity of the sound tissues will not warrant the use of such agents as caustic potassa or soda, which quickly permeate all cell structures alike and destroy them. Nitrate of silver, chloride of zinc, sulphate of copper, terchloride of antimony, or the mineral acids, are usually preferable. Protection against cold, ill-health arising from other sources, mechanical injuries and exposures to cold or wet are important elements in treatment.

For cancers, an early and extensive removal with the

knife may be said to hold out the only hope. The whole organ in which the cancer grows should be cut out, as a rule, to insure the removal of all diseased elements, and any interference is to be deprecated when the adjacent lymphatic glands are already enlarged.

Attempts have been made to dissolve and remove cancers and other tumors with pepsin, and with considerable success, the agent virtually digesting the diseased products with little pain, while the healthy tissues remain unaffected.

APPENDIX.

ACTION, DOSES, ETC., OF MEDICINES.

To some readers a few words of explanation may be necessary in order to the proper understanding of the drugs and their doses.

1. EXPLANATION OF TERMS.

Alteratives change in some unexplained way the conditions and functions of organs.

Anœsthetics deprive of sensation and suffering.

Anodynes allay or diminish pain.

Antacids are antidotes to acids.

Anthelmintics kill or expel worms.

Antiperiodics obviate the return of a paroxysm in periodic diseases.

Antiseptics prevent, arrest or retard putrefaction.

Antispasmodics prevent or allay cramps.

Aperients gently open the bowels.

Aromatics, strong-smelling stimulants which dispel wind and allay pain.

Astringents cause contraction of vital structures.

Carminatives, warming stimulants (Aromatics).

Cathartics freely open the bowels.

Cholagogues increase the secretion of bile.

Demulcents sheathe and protect irritated surfaces.

Diaphoretics cause perspiration.

Discutients dispel enlargements.

Disinfectants destroy infecting matter.

Diuretics increase the secretion of urine.

Ecbolics cause contraction of the womb.
Emetics induce vomiting.
Expectorants increase the secretion from the air tubes
Febrifuges counteract fever—lower temperature.
Laxatives (Aperients).
Narcotics allay pain and produce sleep.
Parturients (Ecbolics).
Purgatives (Cathartics).
Refrigerants diminish heat.
Sedatives depress nervous power or lower circulation.
Soporifics induce sleep.
Stimulants temporarily excite the nervous or circulatory system.
Sudorifics (Diaphoretics).
Sialogogues increase the secretion of saliva.
Stomachics improve digestion.
Tonics gradually and permanently improve digestion and nutrition.
Vermifuges kill and expel worms.

2. GRADUATION OF DOSES.

The doses given may be held applicable to full-grown animals of medium size, therefore some allowance must be made in any case in which the patient exceeds or comes short of the average of his kind. A similar modification must be made as regards young animals, not only on account of their smaller size but also of their greater susceptibility. The following table may serve as a guide:

HORSE, ETC.	OX.	SHEEP.	SWINE.	DOGS.	
3 years.	2 years.	1½ years.	15 m'ths.	½ year.	1 part.
1¼–3 "	1–2 "	9–18 m'ths.	8–15 "	3–6 m'ths.	½ —
9–18 m'ths.	6–12 m'ths.	5–9 "	6–8 "	1½–3 "	¼ —
5–9 "	3–6 "	3–5 "	3–6 "	20–45 days.	⅛ —
1–5 "	1–3 "	1–3 "	1–3 "	10–20 "	$\frac{1}{16}$ —

Allowance must also be made for a nervous temperament which usually renders an animal more impressible

for habit or continued use which tends to decrease the susceptibility for individual drugs, for idiosyncrasy which can only be discovered by observing the action of the agent on the particular subject, and for the influence of disease when that is likely to affect the action. Thus in most diseases of the brain and spinal cord and in some impactions of the stomach, double the usual quantities of purgative medicine will be necessary, while in influenza and other low fevers half the usual doses may prove fatal. In acute congestion of the brain, stimulating narcotics (opium, belladonna, hyoscyamus,) would aggravate the symptoms, etc.

3. FREQUENCY OF ADMINISTRATION.

Anodynes, Antispasmodics, Narcotics, Sedatives and Stimulants may generally be repeated once in four or six hours in order to maintain their effect. Alteratives, Diaphoretics, Febrifuges, Refrigerants and Tonics may be administered twice daily. Purgatives should only be given when necessary and should never be repeated until from the lapse of time we are assured that the first dose is to remain inoperative. Thus unless in urgent need, a horse should not take a second dose of physic under thirty-six hours after the exhibition of the first, and in all cases, until the medicine has worked off, he should be kept at rest and allowed only warm bran mashes and water with the chill taken off. In ruminants a second dose may be ventured on in twelve or sixteen hours, and in carnivora and omnivora in from seven to ten hours. Emetics should be given in full doses and repeated in five or ten minutes if they fail to take effect, their action being further solicited by copious draughts of tepid water and tickling of the back of the mouth with a feather.

4. FORM TO ADMINISTER.

Drugs may often be given as powder or solution in the food or water; they may be made into a soft solid with

syrup and linseed meal, rolled into a short cylinder and covered with soft paper; they may be converted into an infusion with warm or cold water, or into a decoction by boiling; or they may be powdered and suspended in thick gruel or mucilage. They may be given, in a liquid form, from a horn or bottle; or, as a short cylinder or pill, may be lodged over the middle of the root of the tongue; or, as a sticky mass, they may be smeared on the back teeth; or they may be given as an injection into the rectum; or finally, in the case of certain powerful and non-irritating agents, they may be injected under the skin.

No agent should be given until sufficiently diluted to prevent irritation, if retained a few minutes in the mouth, and irritants that will not mix with water (oil of turpentine, croton oil, etc.,) should be given in a bland oil, in milk or in eggs after having been thoroughly mixed.

DRUGS AND DOSES.

When not otherwise stated, the doses for the horse may be given to ox, ass and mule, and those of the sheep to the goat and swine.

ACETIC ACID, antidote to acids, cooling astringent: Horse 1 dr; ox 2 drs; ass 1 dr; sheep 1 scr; dog 2-3 drops.

TINCTURE OF ACONITE, sedative, diaphoretic: Horse 20-30 drops; ox 30-40 drops; ass 15-20 drops; sheep 3-5 drops; dog 1-3 drops.

ALCOHOL, stimulant, diuretic, narcotic: Horse 1-3 oz; ox 3-6 oz; ass 1 oz; sheep ½ oz; dog 2 drs. *Locally* cooling astringent.

BRANDY, WHISKY and GIN, stimulant, diuretic, narcotic. Horse 3-6 oz; ox 6-12 oz; ass 2-5 oz; sheep 10 oz; dog ½ oz. *Locally* cooling astringent.

STRONG ALE, stimulant, diuretic, narcotic: Horse 1-2 pts; ox 2-4 pts; ass 1 pt; sheep ½ pt; dog 2 oz. *Locally* cooling astringent.

BARBADOES ALOES, purgative: Horse 4 drs; ass 3-4 drs; dog ½ dr.

CAPE ALOES, purgative: Horse 5 drs; ass 4-5 drs.

ALUM, astringent: Horse 2-3 drs; ox 3-4 drs; ass 2 drs; sheep ½-1 dr; dog ½-1 scr.

AMMONIA, LIQUID, diffusible stimulant, antispasmodic, antacid, diuretic: Horse ½ oz; ox ½-1 oz; ass 2-4 drs; sheep ½-1 dr; dog 10 drops. *Locally* blister.

AROMATIC AMMONIA, diffusible stimulant, antispasmodic, antacid, diuretic: Horse 1-2 oz; ox 2-4 oz; ass 1-2 oz; sheep ½-1 oz; dog 1 dr. *Locally* blister.

CARBONATE OF AMMONIA, diffusible stimulant, antispasmodic, antacid, diuretic: Horse 2-4 drs; ox 4-6 drs; ass 2 drs; sheep ½-1 dr; dog 10-15 grs. *Locally* blister.

MURIATE OF AMMONIA, stimulant, discutient, alterative, diuretic: Horse 2-4 drs; ox 4-6 drs; ass 2 drs; sheep ½-1 dr; dog 20 grs. *Locally* cooling discutient.

ACETATE OF AMMONIA, SOLUTION, diaphoretic, diuretic, stimulant: Horse 2-3 oz; ox 3-4 oz; ass 2 oz; sheep ½-1 oz; dog 2 drs.

ANISE-SEED, stomachic, carminative: Horse 1 oz; ox 1-2 oz; ass 1 oz, sheep 2-4 drs; dog 1-3 scr.

ANTIMONY, TARTARIZED (TARTAR EMETIC), emetic: Swine 5 grs: dog 2-4 grs. Sedative, diaphoretic: Horse 2 drs; ox 2-4 drs; ass 2 drs; sheep 1-2 scr; swine ½-1 gr; dog ¼-½ gr. *Locally* blister.

ARECA NUT, vermifuge, tæniafuge: Horse 1 oz; ox 1 oz; ass 1 oz; sheep 3 drs; dog ½-1 dr.

ARNICA TINCTURE, stimulant, diuretic: Horse 1 dr; ox 1 dr; ass ½ dr; sheep 1 scr; dog 10 drops. *Locally* cooling, soothing.

ARSENIC, alterative, nerve tonic: Horse 5 grs; ox 5-8 grs; ass 3-5 grs; sheep 1 gr; swine ½ gr; dog 1½ gr. *Locally* caustic, parasiticide.

ASAFŒTIDA, diffusible stimulant, carminative, vermifuge: Horse 2 drs; ox 4 drs; ass 1-2 drs; sheep ½-1 dr; swine ½ dr; dog 10-20 grs.

AZEDARACH, vermifuge: Horse ½-1 oz; ox 1 oz; ass 3-4 drs; sheep 1-2 drs; swine 1 dr; dog 20 grs.

BELLADONNA, anodyne, antispasmodic, narcotic: Horse 2 oz; ox 2 oz; ass 1-2 oz; sheep ½ oz; dog 5 grs.

BELLADONNA, EXTRACT, anodyne, etc.: Horse 2 drs; ox 2-3 drs; ass 1-2 drs; sheep ½ dr; dog 1-3 grs.

ATROPIA (alkaloid of Belladonna), anodyne, etc.: Horse 1-2 grs; ox 1-2 grs; ass 1 gr; sheep ⅓ gr; dog $\frac{1}{16}$ gr.

BALSAM OF PERU, stimulant, antispasmodic, expectorant: Horse 1 oz; ox 1-1½ oz; ass ½-1 oz; sheep 2 drs; dog ½ dr.

BENZOIN, stimulant, antispasmodic, expectorant: Horse 1 oz; ox 1-1½ oz; ass ½-1 oz; sheep 2 drs; dog ½ dr.

BORAX, nerve sedative, uterine stimulant: Horse 2-6 drs; ox ½-1 oz; ass 2-4 drs; sheep ½-1 dr; swine ½ dr; dog 5-10 grs. *Locally* astringent, parasiticide.

BISMUTH, SUBNITRATE, soothes irritation of the stomach and bowels: Horse 2 drs; ox 2-4 drs; ass 1-2 drs; sheep 20 grs; swine 10-20 grs; dog 5-10 grs. *Locally* soothing, healing.

BLACKBERRY ROOT, astringent: Horse 2-4 drs; ox ½ oz; ass 2 drs; sheep 2 scr; dog ½ scr.

BLUE-STONE (copper sulphate).

BONESET, stimulant, tonic, diaphoretic: Horse ½-1 oz; ox 1 oz; ass ½ oz; sheep 2-3 drs; swine 2 drs; dog ½-1 dr.

BROMIDE OF POTASSIUM, nerve sedative: Horse 2-4 drs; ox 4 drs; ass 2-3 drs; sheep ½ dr; dog 5-10 grs.

BUCHU, stimulant, diuretic: Horse 4 drs; ox ½-1 oz; ass 3 drs; sheep 1 dr; dog 10-20 grs.

BUCKTHORN SYRUP, purgative: dog ½-1 oz.

CALOMEL, purgative: Horse 1 dr; ox 1-2 drs; ass 1 dr; swine 1 scr, dog 3-4 grs. Alterative: Horse 1 scr; ox 1-3 scr; ass 1 scr; swine 3-4 grs; dog ½-1 gr.

CAMPHOR, calmative, antispasmodic: Horse 1-2 drs; ox 2-4 drs; ass 1 dr; sheep 1 scr; dog 3-10 grs.

CANTHARIDES, stimulant, diuretic: Horse 5 grs; ox 5-10 grs; ass 3-5 grs; sheep 1-2 grs; dog ⅙-⅓ gr. *Locally* blister.

CAPSICUM, CAYENNE PEPPER, stimulant, aromatic: Horse 2-3 drs; ox 2-4 drs; ass 1-2 drs; sheep 1 scr; swine ½-1 scr; dog 2-5 grs. *Locally* irritant.

CARAWAY SEED, stomachic: Horse 1 oz; ox 1-2 oz; ass 1 oz; sheep 2-3 drs: swine 2 drs; dog 1 scr.

CARDAMOMS, stomachic: Horse 1 oz; ox 1-2 oz; ass 1 oz; sheep 2-3 drs; swine 2 drs; dog 1 scr.

CASCARILLA, stimulant, bitter tonic: Horse ½-1 oz; ox 1 oz; ass 4-6 drs; sheep 1 dr; dog 10 grs.

CARBOLIC ACID, sedative, anodyne, astringent, antiseptic, disinfectant: Horse ½-1 dr; ox 1 dr; ass ½ dr; sheep 10 drops; dog 5 drops.

CASTOR-OIL, purgative: Horse 1 pt; ox 1-1½ pts; ass 1 pt; sheep 3-4 oz; dog ½-1 oz.

CATECHU, astringent: Horse 2-5 drs; ox 3-8 drs; ass 2-3 drs; sheep 1-2 drs; dog 10-30 grs.

CHAMOMILE, stimulant, tonic: Horse 1 oz; ox 1-2 oz; ass 1 oz; sheep 2 drs; dog ½ dr.

CHERRY BARK, WILD, expectorant: Horse ½ oz; sheep 2-3 scr; swine 2 scr; dog 1 scr.

CHLORAL-HYDRATE, sedative, antispasmodic: Horse, ½ oz; ass ¼-½ oz; sheep 1 dr; dog 20 grs. Soporific: Horse 1 oz; sheep 2-3 drs; dog ½ dr.

CHLOROFORM, stimulant: Horse 1-2 drs; ass 1 dr; sheep 1 scr; dog 5-10 drops. Anæsthetic.

CINCHONA, PERUVIAN BARK, bitter tonic, antisepfic, antiperiodic: Horse 1-3 oz; ass 1 oz; sheep 2-4 drs; dog 1 dr.

CINNAMON, stomachic: Horse 4-6 drs; ox ½-1 oz; ass 4-6 drs; sheep 1-2 drs; dog 10-20 grs.

COD-LIVER OIL, tonic: Horse 4-6 oz; ox 6-8 oz; ass 4-6 oz; sheep 1-2 oz; dog ½ oz.

COLCHICUM, diuretic, sedative: Horse ½-1 dr; ox 1-2 drs; ass ½ dr; sheep ½ scr; dog 2-8 grs.

COLOCYNTH, bitter purgative: dog 2-5 grs.

COLUMBO, bitter tonic: Horse 4-6 drs; ox ½-1 oz; ass 2-3 drs; sheep ½-1 dr; dog 10 grs.

CONIUM, EXTRACT, sedative: Horse 1 dr; ox 1-2 drs; ass ½-1 dr; sheep 10-15 grs; swine 10 grs; dog 2-5 grs.

COPAIVA, stimulant, diuretic, expectorant: Horse 2-4 drs; ox 3-4 drs; ass 2-3 drs; sheep ½-1 dr; dog 10 drops.

COPPER, AMMONIATED, tonic, antispasmodic, astringent: Horse 1-2 drs; ox 1-2 drs; ass 1 dr: sheep 10-20 grs; dog 1-5 grs.

COPPER, IODIDE, tonic, discutient: Horse 1-2 drs.

COPPER, SULPHATE, tonic, astringent: Horse ½-1 dr; ox 1-2 drs; ass ½ dr; sheep 10 grs; dog 2-4 grs.

CROTON SEEDS, purgative: Horse 10-12; ox 15-20; ass 8-10; sheep 2-3; dog 1-2.

CROTON OIL, purgative: Horse 15-20 drops; ox 20-30 drops; ass 12-18 drops; sheep 5-8 drops; dog 3-4 drops.

CREAM OF TARTAR, diuretic: Horse 1 oz; sheep 4-6 drs; dog 1 dr. Laxative: Horse 5 oz; ox 5-8 oz; ass 5 oz; sheep 1-2 oz; dog ½ oz.

DANDELION EXTRACT, TARAXACUM, diuretic, laxative, bitter: Horse 1-1½ oz; ox 2 oz; ass 1 oz; sheep 3 drs; dog 1 dr.

DIGITALIS, sedative, diuretic: Horse 15-20 grs; ox ½-1 dr; ass 15 grs; sheep 5-15 grs; swine 2-10 grs; dog 1-3 grs.

DOVER'S POWDER, sedative, diaphoretic: Horse 3 drs; ox 3-4 drs; ass 2 drs; sheep 2 scr; swine 1 scr; dog 2-4 grs.

ERGOT, checks bleeding, parturient: Horse ½-1 oz; ox 1 oz; ass ½ oz; sheep 1-2 drs; dog ½ dr.

ETHER, diffusible stimulant: Horse 1-2 oz; ox 2-3 oz; ass 1 oz; sheep ½ oz; swine 2-4 drs; dog 1 dr.

FENNEL SEED, stomachic: Horse 1 oz; ox 1-2 oz; ass 1 oz; sheep 2-4 drs; dog ½ dr.

FILIX MAS., EXTRACT, MALE SHIELD-FERN, vermifuge, tæniacide: Horse 1 oz; sheep ½ dr; dog 10-20 drops.

GALLS, OAK, astringent: Horse 4-6 drs; ox 1-2 oz; ass 4 drs; sheep ½-1 scr; swine 1-2 scr; dog 1-3 grs.

GALLIC and TANNIC ACID, TANNIN, astringent: Horse 1-3 scr; ass 1-2 scr; sheep 5 grs; dog 1-3 grs.

GENTIAN, bitter tonic: Horse 4 drs; ox ½-1 oz; ass 4 drs; sheep 1-2 drs; dog 10-20 grs.

GINGER, stimulant, stomachic: Horse 1 oz; ox 2 oz; ass ½-1 oz; sheep ½ oz; swine 2 drs; dog 2 scr.

GLAUBER SALTS (SODA SULPHATE).

HENBANE, HYOSCYAMUS, EXTRACT, sedative, antispasmodic: Horse 2 drs; ox 2-4 drs; ass 1-2 drs; sheep ½-1 dr; swine ½ dr; dog 5 grs.

HEMP, INDIAN, EXTRACT, antispasmodic, soporific, narcotic: Horse ½-1 dr; ass ½ dr; sheep 10-15 grs; swine 5-10 grs; dog 1-2 grs.

HYDROCYANIC ACID (PRUSSIC).

IODINE, alterative, discutient: Horse 10-20 grs; ox 20-30 grs; ass 10 grs, sheep 5-10 grs; swine 5 grs; dog 1-2 grs.

IODIDE OF POTASSIUM, alterative, diuretic: Horse ½-1 dr; ox 1-2 drs; ass ½ dr; sheep 3 scr; swine 1-2 scr; dog 1 scr.

IPECACUANHA, emetic, sedative: Swine 1-2 drs; dog 15-20 grs. Diaphoretic, expectorant: Swine ½ dr; dog 3-5 grs.

JALAP, purgative: Swine 1-2 drs; dog ½-1 dr.

IRON, PEROXIDE, tonic: Horse 2-4 drs; ox 4 drs; ass 2 drs; sheep 1 dr; dog 5-10 grs. Antidote to arsenic.

IRON, SULPHATE, tonic: Horse 2-4 drs; ass 2 drs; sheep 1 dr; swine ½ dr; dog 2-5 grs.

IRON, CARBONATE, tonic: Horse 2-4 drs; ass 2 drs; sheep 1 dr; swine ½ dr; dog 2-5 grs.

IRON, IODIDE, tonic, discutient: Horse ½-2 drs; ox 1-2 drs; ass ½-1 dr; sheep 15-30 grs; swine 10-20 grs; dog 1-8 grs.

IRON, TINCTURE OF MURIATE, astringent, checks bleeding: Horse ½-1 oz; ox 1-2 oz; ass ½ oz; sheep ½-1 dr; swine 10-30 drops; dog 5-10 drops.

KINO, astringent; Horse ½ oz; ox ½-1 oz; ass 2-4 drs; sheep 1-2 drs; swine ½-1 dr; dog 10 grs.

KOUSSO, vermifuge: Sheep 2-3 oz; dog 1 oz.

LAUDANUM (OPIUM).

LEAD ACETATE (SUGAR OF LEAD), astringent, sedative: Horse 1-2 scr; ox 2-3 scr; ass 1 scr; sheep 10-15 grs; dog 2-5 grs.

LIME-WATER, antacid, astringent: Horse 4-5 oz; ox 4-8 oz; ass 4 oz; sheep 1 oz; dog 1 dr.

LIME, CARBONATE, CHALK, antacid, astringent: Horse 1-2 oz; ox 2-4 oz; ass 1 oz; sheep 2-4 drs; dog 8-12 grs.

LIME, CHLORIDE, CHLORINATED, checks tympany, disinfectant: Horse 2-4 drs; ass 2 drs; sheep 1-2 drs.

LINSEED OIL, laxative: Horse 1-2 pts; ox 1-2 qts; ass 1 pt; sheep ½ pt.

LOBELIA, sedative, antispasmodic, expectorant: Horse 1-2 drs; ox 1-3 drs; ass 1 dr; sheep 15 grs; swine 5-15 grs; dog 1-5 grs.

MAGNESIA, antacid, laxative, antidote to arsenic: Horse 1-2 oz; ox 2-4 oz; sheep 1 oz.

MAGNESIA, SULPHATE, EPSOM SALTS, laxative ox 1-2 lbs; sheep 4-6 oz.

MALLOW, demulcent: Freely.

MENTHA PIPERITA (PEPPERMINT).

MERCURY WITH CHALK, HYDRARGRUM CUM CRETA, antacid, laxative: Calf 10-15 grs; dog 5-10 grs.

MERCURIAL PILL, BLUE PILL, laxative: Dog 5 grs.

MERCURY, SUBCHLORIDE (CALOMEL).

MURIATIC ACID, HYDROCHLORIC ACID, tonic, astringent, caustic, disinfectant: Horse 1 dr; ox 2 drs; ass 1 dr; sheep 20 drops; dog 2-5 drops.

MYRRH, stimulant, tonic: Horse 2-4 drs; ox 4-6 drs; ass 2 drs; sheep 1-2 drs; dog 15-20 grs.

NITRE (POTASSA NITRATE).

NITRIC ACID, tonic, astringent, caustic: Horse 1 dr; ox 2 drs; ass 1 dr; sheep 20 drops; dog 2-5 drops.

NUX VOMICA, nerve stimulant, tonic: Horse 10-30 grs; ox 20-40 grs; ass 10-20 grs; sheep 5-15 grs; dog ½-3 grs.

OAK BARK, astringent: Horse 1 oz; ox 2-4 oz; ass 1 oz; sheep 4 drs; swine 2-3 drs; dog 1-2 drs.

OLIVE OIL, laxative: Horse 1-2 pts; ox 2-3 pts; ass 1 pt; sheep 3-6 oz; dog 1-3 oz.

OPIUM, narcotic, sedative, anodyne, antispasmodic: Horse ½-2 drs; ox 2-4 drs; ass ½-1 dr; sheep 10-20 grs; dog ½-3 grs.

OPIUM, TINCTURE, LAUDANUM, narcotic, sedative, anodyne, antispasmodic: Horse 1-2 oz; ox 2 oz; ass ½-1 oz; sheep 2-3 drs; dog 15-30 drops.

MORPHIA, MURIATE, narcotic, sedative, anodyne, antispasmodic: Horse 3-5 grs; ox 5-10 grs; ass 3 grs; sheep ½-1 gr; dog ¼-½ gr.

PEPPERMINT, OIL, stomachic, antispasmodic: Horse 20 drops; ox 20-30 drops; ass 20 drops; sheep 5-10 drops; swine 5 drops; dog 3-5 drops.

PERUVIAN BARK (CINCHONA).

PEPPER, BLACK, WHITE, stomachic, stimulant: Horse 2 drs; ox 3 drs; ass 2 drs; sheep 1-2 scr; dog 5-10 grs.

PIMENTO, stomachic, stimulant: Horse 2 drs; ox 3 drs; ass 2 drs; sheep 1-2 scr; dog 5-10 grs.

PODOPHYLLIN, purgative, sedative: Horse 1-2 drs; ox 2 drs; ass 1 dr; sheep 10-20 grs; swine 6-8 grs; dog 1-2 grs.

POMEGRANATE ROOT BARK, vermifuge: Horse 1 oz; ox 1-2 oz; ass 1 oz; sheep 2-3 drs; swine 1-2 drs; dog 20-30 grs.

POTASSA ACETATE, antacid, diuretic, diaphoretic: Horse 6-8 drs; ox 1 oz; ass 4-6 drs; sheep 1-2 drs; dog 10-20 grs.

POTASSA NITRATE, diuretic, febrifuge: Horse, 6-8 drs; ox 1 oz; ass 4-6 drs; sheep 1-2 drs; dog 10-20 grs.

POTASSA BICARBONATE, antacid, diuretic: Horse 6-8 drs; ox 1 oz; ass 4-6 drs; sheep 1-2 drs; dog 10-20 grs.

POTASSA CHLORATE, stimulant, diuretic, refrigerant, antiseptic: Horse 1-4 drs: ass 1-2 drs; sheep 20-40 grs; dog 5-15 grs.

POTASSIUM IODIDE (IODINE).

POTASSIUM BROMIDE, nerve sedative: Horse ½ oz; ass 2-4 drs; sheep 2 drs; swine 1 dr; dog 20 grs.

POTASSIUM CYANIDE, sedative, antispasmodic: Horse 1-2 grs; ox 2 grs; ass 1-2 grs; sheep ½ gr; dog ¼-⅛ gr

PRUNUS VIRGINIANA (WILD CHERRY).

PRUSSIC ACID, sedative, antispasmodic: Horse 20-30 drops; ox 30-40 drops; ass 15-20 drops; sheep 5-8 drops; swine 5 drops; dog 1-3 drops.

PUMPKIN SEEDS, vermifuge, tæniafuge: Dog ½ oz.

QUINIA, SULPHATE, bitter tonic: Horse 20 grs; ox 20-30 grs; ass 15-20 grs; sheep 6-10 grs; swine 5-10 grs; dog 2-6 grs.

RHUBARB, laxative, tonic: Horse 1 oz; ox 2 oz; ass 1 oz; sheep 1 dr; dog 20 grs.

RESIN, diuretic: Horse 4-6 drs; ox ½-1 oz; ass 4-6 drs; sheep 2-4 drs; swine 2 drs; dog 20-30 grs.

SOAP, diuretic, antacid, laxative: Horse 1-2 oz; ass 1 oz; sheep 2-6 drs; swine 2-4 drs; dog 20-60 grs.

SODA, BICARBONATE, antacid, diuretic: Horse 4-6 drs; ox 4-8 drs; ass 4 drs; sheep 1-2 drs; dog 5-30 grs.

SODA, SULPHITE, BISULPHITE, HYPOSULPHITE, antiseptic, disinfectant, alterative, relieves tympany: Horse 1 oz; ox 2-3 oz; ass 1 oz; sheep 2-6 drs; swine 2-4 drs; dog 20-60 grs.

SODA SULPHATE (GLAUBER SALTS), purgative: Horse 1-1½ lbs; ox 1-2 lbs; ass ½-1 lb; sheep 6 oz.

SODIUM, CHLORIDE (COMMON SALT), tonic, vermifuge, purgative: Horse 1-2 oz; ox 2-4 oz; ass 1 oz; sheep 2-4 drs; swine 1-3 drs; dog 10-30 grs.

SANTONIN, WORMSEED, SEMEN CONTRA, vermifuge: Horse ½-1 oz; ass 4 drs; sheep 2-4 drs; swine 1-3 drs; dog 10-60 grs.

SQUILL, diuretic, expectorant: Horse ½ dr; ox ½-1 dr; ass 20-30 grs; sheep 10-15 grs; dog 1-5 grs.

SILVER, NITRATE (LUNAR CAUSTIC), nerve tonic: Horse 5 grs; ox 5-8 grs; ass 2-4 grs; sheep 1-2 grs; dog ⅛-½ gr.

SPANISH FLIES (CANTHARIDES).

SPIGELIA, vermifuge: Horse ½-1 oz; ox 1-2 oz; ass ½-1 oz; sheep 2-4 drs; swine 2-3 drs; dog 1 dr.

STRYCHNIA, nerve tonic: Horse 1-2 grs; ox 1-3 grs; ass 1 gr; sheep ⅓-1 gr; swine ⅓ gr; dog $\frac{1}{40}$-$\frac{1}{10}$ gr.

SULPHUR, laxative: Horse 3-4 oz; ox 5-6 oz; ass 3 oz; sheep 2 oz; swine 1½-2 oz; dog 2-8 drs. Expectorant, diaphoretic, alterative: Horse 1 oz; ox 1-2 oz; ass 1 oz; sheep 6 drs; swine 4-6 drs; dog ½-1 dr. Parasiticide.

SWEET SPIRITS OF NITRE, SPIRIT OF NITROUS ETHER, stimulant, antispasmodic, diuretic, diaphoretic: Horse 1-2 oz; ox 3-4 oz; ass 1 oz; sheep 3-6 drs; dog ½-2 drs.

STRAMONIUM, narcotic, sedative: Horse 20-30 grs; ox ½-1 dr; ass 15-30 grs; sheep 5-10 grs; swine 4-6 grs; dog 2 grs.

SULPHURIC ACID, tonic, refrigerant, caustic: Horse 1 dr; ox 2-4 drs; ass 1 dr; sheep ½ dr; swine 20 drops; dog 5-10 drops.

TOBACCO, sedative, antispasmodic, vermifuge: Horse 4 drs; ox 4-6 drs; ass 4 drs; sheep 1 dr; swine ½ dr; dog 5-6 grs.

TAR, expectorant, antiseptic: Horse ½-1 oz; ox ½-2 oz; sheep ½ oz.

TURPENTINE OIL, stimulant, antispasmodic, diuretic: Horse 1-2 oz; ox 1-1½ oz; ass ½ oz; sheep 1-2 drs; swine 1 dr; dog ½ dr. Vermifuge. Horse 2 oz; ox 2-3 oz; ass 1-2 oz; sheep 4 drs; swine 2-3 drs; dog 1-2 drs.

VALERIAN, diffusible stimulant, antispasmodic, vermifuge: Horse 2 oz; ox 2-4 oz; ass 2 oz; sheep ½ oz; swine 2-3 drs; dog 1-2 drs.

VALERIANATE OF IRON, nerve tonic: Dog 4-5 grs.

VERATRUM, sedative: Horse 1 scr; ox ½-1 dr; ass ½-1 scr; sheep 5-10 grs; swine 5-8 grs; dog 2 grs.

WILD CHERRY BARK, expectorant: Horse 1 oz; ox 1½ oz; ass 1 oz; sheep 3 drs; dog 30 grs.

ZINC CARBONATE, astringent, tonic: Horse 2 drs; ox 2-4 drs; ass 2 drs; sheep ½-1 dr; swine ½ dr; dog 10-15 grs.

ZINC, SULPHATE, astringent, tonic: Horse 1-2 drs; ox 2-3 drs; ass 1 dr; sheep 15-30 grs; swine 10-20 grs; dog 2-3 grs. Emetic: Swine 15 grs to 1 dr; dog 8-15 grs.

BLISTERING, ETC.

As an example of a simple blister for the horse the following may be given:—

Powdered Cantharides	2 drs.
Camphor	5 grs.
Oil of Lavender	10 drops.
Lard	1 oz.

Mix thoroughly. When applying it, first cut the hair from the part, then rub the ointment well in with the palm of the hand and against the direction of the hair, for four or five minutes. The animal should be tied short to a high rack or otherwise prevented from reaching the blistered surface with his lips until it is well raised. Then the application may be washed off with soap-suds and the part smeared daily with lard. The blister should not be repeated until the effects of the first have passed off.

For cattle, ½ oz. oil of turpentine or 10 grs. tartar emetic may be added to the above blister. For pigs cantharides and turpentine may be used alone, 1 of the former to 4 of the latter. For dogs and sheep equal parts of strong aqua ammonia and olive-oil may be used and rubbed in as often as may seem requisite.

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THE END.

THE

LUNG PLAGUE

OF

CATTLE,

CONTAGIOUS PLEURO-PNEUMONIA.

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THE LUNG PLAGUE OF CATTLE.

THE BOVINE PNEUMONIC PLAGUE.—PLEURO-PNEUMONIA CONTAGIOSA.

Nomenclature.—Generally known in English veterinary literature as *Pleuro-pneumonia,* this affection has been consequently largely misapprehended by the medical mind. It is naturally assumed that the malady, like other inflammations of the organs within the chest, is caused by exposure, inclement weather, changes of climate or season, imperfect ventilation, etc., etc. There is, however, no proof that such is the case, and hence it is impolitic to retain a name which is misleading to the educated mind, and conveys no definite conception to the uneducated. Other names that have been at different times employed are equally objectionable: *Peripneumonia, Peripneumonia pecorum enzoötica* or *epizoötica, Peripneumonia exudativa enzoötica* or *contagiosa, Peripneumonia pecorum epizoötica typhosa, Pleuro-pneumonia interlobularis exudativa, Pneumonia catarrhalis gastrica asthenica, Pleuritis rheumatico-exudativa.* If we add the term *contagious* (*contagiosa*) to any of these definitions we only remove the difficulty a short step, for the physician still concludes that the affection is due to local or general causes, and that if it arises in one animal under such circumstances, it may in one million subject to the same conditions, that its general prevalence at any time or place

may be altogether due to the environment; and that the doctrine of contagion is either founded on insufficient data, or true only in a restricted sense and entirely subsidiary to the generally acting causes. But the malady as known to veterinarians of to-day is always and only the result of contagion or infection, therefore we should select a name better adapted to set forth this character without the risk of misleading. This we have in the *Lung Plague of Cattle*, the near counterpart of the *Lungenseuche* by which it has been long known in Germany. The old term *Pulmonary murrain* is equally good.

The German *Lungenseuche* is especially apposite, the real meaning being *Lung-contagion*, which conveys the idea of transmission by contagion only.

Definition.—A specific contagious disease peculiar to cattle, and manifested by a long period of incubation (ten days to three months), by a slow, insidious onset, by a low type of fever, and by the occurrence of inflammation in the air-passages, lungs, and their coverings, with an extensive exudation into lungs and pleuræ.

History.—As in the case of all genuine plagues, smallpox, cholera, rinderpest, aphthous fever, etc., we know nothing of the original source of the *lung-fever contagium*. We know the disease only as it is introduced into a country or herd by a diseased animal or some of its infecting products. In ancient as in modern times, in the Old World as in the New, the malady can ever be traced in connection with the aggregation of cattle in herds made up from different districts and countries. Aristotle, writing three hundred and fifty years before Christ, says. "The cattle *which live in herds* are subject to a malady during which the breathing becomes hot and frequent. The ears droop and they cannot eat. They die rapidly, and the lungs are found spoiled." Here the facts that cattle alone suffered, that large herds suffered most, that the lungs were the seat of the diseased changes, and that

the mortality was high, all point toward the probable existence of this plague at that remote epoch. Equally indefinite are the reports of the ancient Greek veterinarians, and still more so those of the Roman writers on bucolics. At a later date Valentini describes a fatal lung disease of cattle which all acknowledge to have reference to the *Lung Plague*, and from this time onward the records of the disease become more frequent and definite. The modern history of the malady may, however, be all summed up in this, that whenever the commissariat demands of a large army led to the aggregation of cattle from all quarters, and especially from the east of Europe, then this and other animal plagues have gained a wide extension.

Into Holland the Lung Plague was imported in 1833 from Prussia by a distiller, Vanderbosch in Gelderland. In 1835 it was conveyed thence to Utrecht, thence to South Holland, North Brabant, West Flanders, Drenthe, Groningen, Overyssel, and finally in 1842 to Friesland. Destruction of the sick, by order of the government, was resorted to, and Friesland was freed from the plague until 1845, when it was again introduced in cattle from Overyssel in connection with the active traffic established by the demands for the British trade. Another effort was made to kill out the disease, but the trade had grown to great proportions, and as often as it was crushed in one district it re-appeared in a new locality. After 1847 the attempt was abandoned, and the malady spread with increasing rapidity. In the last six months of 1847 there were but 16 stables infected; in 1848 58 different outbreaks occurred. By 1863 between 5,000 and 6,000 of the 14,000 cow-stables in Friesland had suffered from the disease, and the annual mortality had risen from 5.25 per thousand in 1850 to nearly 40 per thousand.

From Holland it was imported into Cork, Ireland, in 1839 by Dutch cows sent by the British Consul at the

Hague to an Irish friend. In Ireland it met with the most favorable conditions for its propagation, the great mass of the young store cattle having been in the habit of changing hands and pastures several times a year, of passing on each occasion through public markets where they mingled with herds from all quarters, and of being transferred after every sale to common pastures where the cattle of different owners are turned out together at so much per head. (See Prof. Ferguson's Report to The Privy Council, 1878.) In two years the whole island was infected, and diseased stock were being exported to the adjacent island of Great Britain. The following year the Free Trade Act was passed, and immediately Great Britain was deluged with a steady influx of infected cattle from Holland, Belgium and France on the one side, and from Ireland on the other. Since that period England has been ravaged continually, excepting only in those districts (the Highlands) which breed their own cattle and never admit strange stock. The yearly losses from this plague alone have been no less than $10,000,000 per annum. (Gamgee).

From England the plague was carried back to the Continent, infecting at different times the more northern countries of Sweden, Denmark, Norway, Schleswig-Holstein, Oldenburg and Mecklenburg-Schwerin; also to the more distant lands of Long Island in 1843 and 1850, to New Jersey in 1847, and to Australia in 1858.

From Holland it was conveyed in the systems of infected cattle to the Cape of Good Hope in 1854, and to Massachusetts in 1859.

The introduction of the disease into the more distant countries has been so fruitful in evil results that it demands to be noticed in greater detail.

Into Brooklyn, Long Island, it was introduced in 1843 in the system of a ship cow, purchased by Peter Dunn from the captain of an English vessel. From Dunn's

herd it spread to others adjacent and speedily infected the whole west end of the island, as will be noticed later at greater length.

Into Massachusetts the plague was introduced on the 23d of July, 1859, in the bodies of four Dutch cows, imported by Winthrop W. Chenery, of Belmont, near Boston. These cows were procured from Purmerend and the Beemster, and were kept in stables for several days at the port of Rotterdam—an infected city—before being put on board the vessel. They were shipped April 6th, passed forty-seven days at sea, and were ill during the last twenty days, one of the number having been unable to stand. On landing two were able to walk to the farm, while the other two had to be carried in wagons. The worst cow was killed May 31st, and the second died June 2d. The third did well till June 20th, when she was severely attacked and died in ten days. The fourth recovered. On August 20th another cow, imported in 1852, sickened and died in a few days, and others followed in rapid succession.

In the first week of September Mr. Chenery isolated his herd, and declined all offers to purchase, being now convinced that he was dealing with the *Bovine Lung Plague* of Europe.

Unfortunately, on June 23d he had sold three calves to Curtis Stoddard, of North Brookfield, Worcester Co., one of which was noticed to be sick on the way to Curtis's farm. Several days later Leonard Stoddard (father of Curtis) took this calf to his farm to cure it, and kept it in his barn with forty cattle for four days, when he returned it to his son. It died August 20th. Curtis Stoddard lost no more until November 1st, when he sold eleven young cattle to as many different purchasers, and wherever these went the disease was developed. In one case more than 200 cattle were infected by one of these Stoddard heifers. Of the nine cattle which he retained, seven were killed and found to be badly diseased.

An ox of L. Stoddard's sickened two weeks after he had returned the diseased calf to his son, and soon died. Two weeks later a second was taken ill and died; then a dozen in rapid succession. From this herd were infected those of the following: Messrs. Needham, Woodes, Olmsted, and Huntingdon. Olmsted sold a yoke of oxen to Doane, who lent them to assist with twenty-three yoke of cattle in removing a building in North Brookfield. These belonged to eleven different herds, all of which were thereby infected.

This will suffice to show how the disease was disseminated. In the next four years it was found in herds in the following towns: Milton, Dorchester, Quincy, Lincoln, Ashby, Boxborough, Lexington, Waltham, Hingham, E. Marshfield, Sherborn, Dover, Holliston, Ashland, Natick, Northborough, Chelmsford, Dedham, and Nahant, and on Deer Island.

By the spring of 1860 the State had been roused to its danger, and in April an Act was passed "to provide for the extirpation of the disease called pleuro-pneumonia among cattle," which empowered the Commissioners to kill all cattle in herds where the disease was known or suspected to exist. With various intervals this and succeeding commissions were kept in existence for six years, and the last remnants of the plague having been extinguished, the last resigned definitely in 1866. The records show that 1164 cattle were slaughtered by orders of the Commissioners, in addition to others disposed of by the Selectmen of the different towns in 1863, when the commission was temporarily suspended. The money disbursed by the State was $67,511.07, and by the infected towns $10,000, making a grand total of $77,511.07, in addition to all losses by deaths from the plague, depreciation, etc. Dr. E. F. Thayer, Newtown, was the professional Commissioner who brought this work to a successful end.

An importation into New Jersey in 1847 is recorded, to check which the importer, Mr. Richardson, is said to to have slaughtered his whole herd, valued at $10,000, for the good of the State. Unfortunately all New Jersey men were not so public-spirited, and subsequent importations from New York and mayhap also from Europe have since spread this pestilence widely over the State.

From New Jersey it spread to Pennsylvania and Delaware, and thence to Maryland, District of Columbia and Virginia, in all of which it still prevails

Of the progress of the disease southward from New York the records are somewhat imperfect, yet sufficient to show a steady advance. Robert Jennings records its existence in Camden and Gloucester Counties, N. J., in 1859, and its introduction into Philadelphia in 1860. It spread to "The Neck" in the southern part of the county, killing from 30 to 50 per cent. of infected herds, and spread in 1861 into Delaware, and into Burlington Co., N. J. In 1868 Mr. Martin Goldsborough assured Professor Gamgee of the extensive prevalence of the disease in Maryland, infection having been introduced by cattle from the Philadelphia market. The professor personally traced the disease in New Jersey, Pennsylvania, Maryland, District of Columbia, and Virginia, and makes the following assertions:

"That the Lung Plague in cattle exists on Long Island, where it has prevailed for many years; that it is not uncommon in New Jersey; has at various times existed in New York State; continues to be very prevalen in several counties of Pennsylvania, especially in Dela ware and Bucks; has injured the farmers of Maryland, the dairymen around Washington, D. C., and has penetrated into Virginia."

He adds a table compiled by Mr. G. Reid, Ingleside Farm, Washington, D. C., and showing that in an average of 471 cows kept in Washington and vicinity, 198 had

died of Lung Plague since its introduction, 39 head perished in 1868, and 16 in 1869 up to the date of report.

More recently illustrations of the existence of the disease in these States have been frequent, and among comparatively recent cases the author has been consulted concerning a high class Jersey herd near Burlington, N. J., in 1877, and a herd of imported Ayrshires in Staten Island, later in the same year.

In 1878 the town of Clinton, N. J., was invaded, the infection coming through a cow that had staid for some days in New York city. This was alleged to be an Ohio cow, but had staid long enough in New York to have contracted the affection.

In 1847 Ayrshire cattle taken from Scotland to Denmark conveyed the plague into that country. The infected cattle were, however, at once placed in quarantine and the spread of the malady was prevented. Mr. R. Fenger, whom I met at Edinburgh in 1862, stated that there had been but three dairies attacked, all by reason of infected cattle imported, and that all had been crushed out so that for three years the kingdom had been free from the disease.

Schleswig-Holstein has repeatedly imported the plague by the introduction of foreign cattle, but has invariably stamped it out by quarantining the infected places and destroying the sick cattle. One of these importations consisted of Ayrshire cattle brought from Scotland in 1859. A still more serious invasion took place on the occasion of the late Prusso-Danish war; the commissariat parks of the invading army having been supplied from infected districts carried the plague wherever they went, but true to her record, on the return of peace, the province went vigorously to work, drove out the pestilence, and for years past has been free from the infection.

In 1860 Norway was infected by a cargo of Ayrshire cattle, imported for the Agricultural College at Aas. The

disease broke out three months after their arrival, and was limited by the slaughter of all native cattle with which the Ayrshires had come in contact, and by the strict quarantine of the Ayrshires themselves. Since that time Norway has remained sound.

Sweden imported the Lung Plague from England, by cattle imported in 1847. By stringent measures of suppression it was speedily exterminated, and this impunity has since been maintained.

Oldenburg derived the disease from England through Ayrshires imported for breeding purposes in 1858. This, together with other invasions, she has crushed out by the remorseless use of the pole-ax. The same remark applies to Mecklenburg-Schwerin and Switzerland.

For the history of the introduction of this plague into Australia see "Infection through Pastures." Its conveyance to the Cape of Good Hope was described by Rev. Daniel Lindley, missionary to South Africa, before the Massachusetts Legislative Committee, in 1860.

The importation took place in 1854 in the body of a bull brought from Holland by a gentlemen of Cape Town with the view of improving his stock. The bull was about two months on the passage, and had been six weeks at the Cape before any sign of sickness appeared in him. He died, but conveyed the disease to a great number of cattle, and it had spread very widely before the colonists suspected its true nature. The Cape is a great unwooded and unfenced pasture-land, dotted with thickets and jungles, and over this the cattle, the source of the colonist's wealth, are scattered in herds of from one to five hundred head on an average. Wherever lions and tigers have been exterminated these cattle are allowed to roam day and night where they please; they accordingly wander long distances, and herd mingles with herd from one side of the country to the other. All the produce of the country is brought from the interior to the

seaports in ox-wagons, and all imported goods are carried inland in the same way. This describes a country of 2,400 miles across destitute of railroads and navigable rivers, and which is being constantly traversed from side to side by hundreds of ox-wagons and thousands of working oxen. The disease once introduced and favored by such conditions speedily spread in every direction and bade defiance to any attempt at suppression.

Mr. Lindley related various instances from his own knowledge of the disease having been conveyed by ox-teams two and three hundred miles, and of its wide extension in the new localities, and contrasted them with examples in which chief and people, warned of the approach of the pestilence, resorted to spear and shield to exclude all traveling teams and cattle, and thereby saved their own herds, though only a half a mile off the victims of the plague lay unburied in great numbers.

Causes of the Disease.—The known cause of the disease may be summed up in one word, *contagion.* All sorts of causes have been invoked to account for the *spontaneous* appearance of the disease; but the theorists should first assure themselves that they have seen a *spontaneous* case before attempting to account for it. Delafond attributed it to: 1. Impurity of the air in stables; 2. Excessively rich food; 3. Secretion of milk to excess; 4. Chills of the skin in inclement weather, and the breathing of cold air when suddenly taken from a warm stable; 5. Drinking iced water; 6. Waters charged with corrupting organic matter; 7. Overwork in summer; 8. Hereditary predisposition; 9. Some unknown atmospheric and telluric conditions usually referred to as *epidemic influences.* The answer to one and all these allegations is this: that these have all prevailed to an equal extent at different times in different parts of the world, and do so still; but no one of them, nor all put together, can be shown to have produced this disease in any country from which cattle, and

cattle products, from an infected country have been rigidly excluded. In many cases, indeed, we find these alleged causes operating with the greatest intensity in isolated countries where this malady has never been known. The cow-stables of England were far worse ventilated at the beginning of the nineteenth century than they are to-day; yet this disease was unknown in Great Britain until Dutch and Dutch-infected Irish cattle were imported in 1842. None feed with a more lavish hand than dairymen, yet the dairy countries of Denmark and Schleswig have only known this disease as the result of importation, and have long since freed themselves from the pest. The Channel Islands, which produce the richest milkers in the world, have never known this disease, but only because all landing of foreign cattle is criminal. Inclemency, variability and extremes of the weather are above all characteristic of the Highlands of Scotland, yet the Highlands, which breed their own stock and suffer a large egress but no ingress of cattle, have never been ravaged by this affection, whereas in the mild and equable Lowlands it has decimated the herds yearly. The immunity of countries with the rigorous climates of Norway, Sweden, Denmark, Massachusetts, Vermont, New Hampshire, Maine, and above all our Western plains, where the cattle are often wintered without shelter, is even more striking in this respect. Iced water and corrupt malarious water are all that the cattle can obtain in many of our Western States, but there is no evidence that this disease has ever existed anywhere in the West, and no danger whatever attaches to our Western cattle until they have entered infected localities in the East. Similar remarks may be made of overwork and hereditary predisposition, as also of epidemic and telluric conditions, which are but cloaks for ignorance, and a persistent adherence to an unfounded idea.

The same is true of distillery feeding, of low, damp marshy pastures, of fodder spoiled by wet, or decomposition, or covered by cryptogams, of extreme changes of climate, etc., etc. All these are brought into play in many of our Western States; no climatic change could be more severe than that to which our Texan cattle are subjected in being transferred to Nebraska or Minnesota, yet not all of these conditions combined have ever generated *de novo* the germ of the Bovine Lung Plague. Had it done so in a single instance on our unfenced cattle ranges we must inevitably have passed through the same experience as Australia and the Cape of Good Hope, each infected by a single sick animal and each speedily ravaged throughout by this most insidious and unrelenting pestilence.

The incontrovertible fact that we can point to no country (out of the centre of the eastern continent) in which this disease prevails, into which we cannot also trace its introduction in the system of an infected animal, or some of its products, must put to silence all claims to its *spontaneous development* in those countries. This grand truth, that the disease is only known to-day as the result of contagion, dawned upon some of the best medical minds of the last century. The renowned physiologist, Haller, writing in his native Switzerland, the mountains of which had been maligned as the source and native home of the plague, claimed that, on the contrary, it was utterly unknown save as the result of importation. The last quarter of a century has sustained Haller's representation of a century before; the disease has been exterminated and the herds of the Alpine and Jura mountains and valleys freed from the pest. A list of other states which have expelled this disease from their borders deserves to be mentioned in this connection; these are Norway, Sweden, Denmark, Schleswig-Holstein, Oldenburg, and Mecklenburg-Schwerin in the Old World, and Massachusetts and

Connecticut in the New. To the same purpose speaks the immunity of Spain and Portugal, guarded by their peninsular position, the bold walls of the Pyrenees, and the entire absence of cattle-traffic; of parts of Brittany and Normandy, of the Channel Islands, and of the Highlands of Scotland, that breed their own stock and never import. To the same end speaks also the absence of the disease in our Western States, and in Massachusetts since 1864, when she crushed out the imported plague. The disease, then, is only known as a contagious malady, and the unhygienic conditions above referred to only favor its propagation so far as they favor the preservation of the morbid germ already in existence, or weaken the animal vitality and power of resistance and lay the subject more open to disease. Faulty surroundings will greatly favor the dissemination of the disease, but have never been known to generate it. The primary origin of its germ is as great a mystery as in the case of small-pox or plague.

But for some readers this is not enough; it may be conceded that the true Lung Plague of European cattle is only propagated by contagion, and that in the absence of importations of sick cattle and their products no country need fear an invasion of this disease, and yet doubts and objections of all kinds are raised: 1. Is the present lung disease of cattle in certain of our Eastern States the genuine Lung Plague of Europe? 2. Conceding that it is the same disease as respects its origin, has it not lost much or all of its virulence in being transplanted to the New World? 3. Allowing that it is at once the Lung Plague of Europe and that its virulence is preserved on the American Continent, is it not the case that its infection can only be propagated by the direct contact of the sick with the healthy cattle, while the transmission of the virus through any intervening medium renders it inoperative?

1. *Was the New York disease imported?*

(*a*) From different old residents (including Wm. Geddes, of Brooklyn, and Hugh T. Meakim, of Flushing) who were in the milk business in Brooklyn at the time of the importation the following facts have been obtained.

The first diseased cow was introduced from England on the ship "Washington," in 1843, and was purchased by Peter Dunn, a milkman, who kept his cows in a stable near South Ferry. This cow soon sickened and died, and infected the rest of his cows. From this the disease was speedily conveyed into the great distillery stables of John D. Minton, at the foot of Fourth street, and into the Skillman street stables, Brooklyn, through which my informant, Fletcher, showed the Massachusetts Commission in 1862. In this long period of nineteen years the plague had prevailed uninterruptedly in these Skillman street stables, and the Commission reported that they "found some sick with the acute disease," and having killed and examined one in the last stages of the affection, stated that it "showed a typical case of the same malady which existed in Massachusetts."

As dealers found it profitable to purchase cheap cows out of infected herds and retail them at a sound price, the malady was soon spread over Brooklyn and New York city. One or two cases will enable us to trace one unbroken chain of infection down to the present time.

(*b*) In 1849 Wm. Meakim, of Bushwick, L. I., kept a large dairy, and employed a man with a yoke of oxen in drawing grains from the New York and Brooklyn distilleries. A milkman on the way who had lung fever in his heard, persuaded the man to use his oxen in drawing a dead cow out of his stable. Soon after the oxen sickened and died; and the disease extending to his dairy cows, Mr. Meakim lost forty head in the short space of three months. The stables having thus become infected, Mr. M. continued to lose from six to ten cows yearly for the

succeeding twenty years, or as long as he kept in the milk business. This, which is but one instance out of a hundred, covers fifteen years of the plague in the Skillman stables and brings the record down to 1869. It will be observed that this was the first occurrence of any such sickness in Mr. Meakim's herd; it commenced, not in the cows cooped up in hot buildings and heavily fed on swill, but in the oxen that were almost constantly in the open air, but which had been brought in contact with a dead and infected cow; the infection of the cows followed, and for twenty long years no fresh cow could be brought into these stables with impunity.

(*c*) Dr. Bathgate, Fordham Avenue and 171st st., New York, informs us that twenty years ago (1859) his father kept a herd of Jerseys, which contracted the disease by exposure to sick animals, and that all efforts to get rid of it failed, until when, several years later, the barns were burned down. The devouring element secured what the skill of the owner had failed to accomplish—a thorough disinfection.

For some time so prevalent was the disease that Dr. Bathgate did not dare to turn his cattle out in the fields lest they should be infected by contact with cattle over the fence. Since the period of the infection of his own herd, he knows that the pestilence has been constantly prevalent in many of the dairies around him. This bridges over the time from the Skillman street and Meakim cases down to the present day.

(*d*) Twenty years ago (1859) Mr. Benjamin Albertson, Queens, Queens Co., L. I., purchased four cows out of Herkimer County herd which had got belated and had been kept over night in a stable in Sixth street, New York, where the cattle market then was. These cows sickened with lung fever, and infected his large herd of 100 head, 25 of which died in rapid succession, and 19 more slowly. He was left with but 60 head out of a herd,

after purchase of the four, of 104 animals, and honorably declined to sell the survivors at high prices to his unsuspecting neighbors, but sold a number at half price to a Brooklyn milkman, who already had the disease in his herd, and knew all the circumstances.

(*e*) Twelve years ago (1867) Lawrence Ansert, Broadway and Ridge st., Astoria, bought of a dealer two cows which soon after sickened and died, and infected the remainder of his herd of 18. Eight of them died of the disease, and he fattened and killed the remaining ten, and began anew with fresh premises and stock. He has lost none since.

(*f*) The next case, like the last, affords a most instructive contrast to the first two, as showing how the disease may be permanently eradicated by proper seclusion. In 1872, Frank Devine, of Old Farm House Hotel, West Chester, purchased from a dealer a cow which soon sickened and died. The disease extended to the rest of his herd, and in seven months he lost thirty-six cows He appreciated the danger of contagion, and began again with new stock, keeping them rigidly apart from the infected beasts and premises, and from that time onward avoided all dealers and bred his own stock, with the happy result that in the last six years he has not had a single case of lung fever in his herd.

These are but examples of what has been happening all over the infected district for the last thirty-six years.

2. *Has the Affection become less virulent in America?*

The above mentioned cases may be referred to as a partial answer to this question, yet it will be more satisfactory to adduce some more recent cases as showing that the lapse of time has not modified the virulence of the contagion.

(*a*) The Blissville distillery stables are alleged to have contained 800 to 900 cattle when visited late in January,

1879, by Professors Liantard and McEachran, whereas, on the occasion of my first visit, February 10th, there were only between 600 and 700, and up to the time they were quarantined, some days later, a large number had been culled out and slaughtered in anticipation of State interference. Of those that remained 64 were found so badly diseased that they were killed and sent to the offal dock, while from 100 to 150 showing slight symptoms, were sold for beef. Here we have one-tenth of a large herd severely attacked, and if we add those that were picked out by the owners in anticipation of quarantine, and the infected animals disposed of for beef, there is considerably over a third of the whole that were under the influence of the disease.

(*b*) In the course of last year (1878), William Post, Old Westbury, Queens Co., L. I., bought a cow out of a passing herd that had been brought by Levy, a dealer, from Brooklyn stables. She infected his whole herd and his brother's to such an extent that they had to slaughter both herds, and, after a time, begin anew with fresh stock. From that time, as before, they have kept sound.

(*c*) Mrs. Murphy, Brooklyn, last year bought a cow from McCabe, a New York dealer, which infected all of her herd, so that she had to slaughter the whole, and has given up the milk business.

(*d*) In January, 1879, Mr. Judson, Watertown, Conn. (and Gramercy Park Hotel, New York), bought two cows of Hecht, a New York dealer. They took ill soon after, and infected his original herd of ten. All were placed in quarantine by the Connecticut authorities, but were smuggled off by Hecht (who had purchased them at a ridiculously low figure), and shipped to New York, where they were slaughtered by order of the authorities. This is a case of the introduction of disease into a hitherto sound locality and State, and has therefore a special significance

(*e*) Mrs. Kelly, Hazleton, Jamaica, L. I., bought a cow from a Williamsburgh dealer named Brown, in the latter part of 1878. This cow sickened and died, and fatally infected the remaining three cows of her herd, so that she is now without any, and has resigned the milk business.

(*f*) Mr. Wheelock, Roslyn, L. I., late in 1878 bought two cows from a New York dealer. They sickened soon after, infected the rest of his herd, and six were lost before the plague could be stayed.

(*g*) Mr. Kenyon, Roslyn, was so satisfied it was not the lung fever that he purchased two of Mr. W.'s cows. One of these sickened and died, and infected several others of his herd, one of which had to be destroyed by order of the State authorities.

(*h*) Mr. Gilbert Miller, Cantito, Westchester Co., in July, 1878, took in a Jersey cow sent from Motthaven as a present to his son-in-law. Three months later his herd was generally infected, and the Jersey cow and two others died.

(*i*) The herd of M.'s sister-in-law, Mrs. Robertson, which was kept across the street, sickened in October, and, up to the time of my visit, early in March, five out of twelve had died.

(*j*) Mr. Collins, of 50th street, New York, had a Jersey cow which suffered, in August, 1878, from some disease of the lungs that was denied to be the lung fever by the veterinarian who attended her. On September 20th her calf was sent to Solomon Mead, Greenwich, Conn., who had agreed to keep it two years. The calf died two weeks after arrival, and infected ten of his herd, five of which had died, and five were recovering at the period of my visit (March 21). The herd at that time numbered thirteen.

(*k*) Mr. Griffin, Greenwich, Conn., occupied a farm alongside Mr. Mead's, and had his herd infected by a

cow which broke out of Mead's herd and got, for a very short time, into his (Griffin's). At the time of my visit Mr. G. had lost one, and had two in course of apparent recovery. As he was just over the Connecticut line, and out of the jurisdiction of New York, the sick had to be left, and the result has been that a number of his remaining herd of twenty-six have been infected and have died since.

(*l*) Mr. Carr, 146th street, New York, had a cow sent on trial, last February, by Geissmann, a Yorkville dealer. She stood but one night in his stables; was removed next day because she looked bad, and another cow sent in her place. Three out of the five remaining cows contracted the lung fever, and, when slaughtered by the State authorities, May 12th, showed most extensive disease of the lungs. Since that time the whole herd has been slaughtered.

(*m*) Mr. Tone, 114th street, New York, purchased a cow of Kramer, a New York dealer, early in October, 1878. She took ill and finally died in February, 1879. At the time of our visit, May 14th, two other of his cows were suffering from the lung plague in a chronic form, and their destruction had to be ordered for the protection of the herd.

(*n*) About January 1st, 1879, Isaac Billard, dealer, of Cutchogue, L. I., took a drove of 112 calves and yearlings from the infected sheep-house, 60th street, New York city, to which we have traced a number of outbreaks. He sent them by cars to Bridgehampton, and sold them to farmers in the towns of Southampton and Easthampton. In April a floating rumor of disease in these towns reached us; but, on inquiry, its correctness was denied, and it was only later that definite information could be obtained. May 6th to 8th I visited these towns, in company with another member of the Veterinary Staff, and condemned and ordered to be slaughtered 16 head out

of 6 herds into which calves of the Billard drove had been taken. Taking the first herd visited as an illustrative case: John E. White, of Sagg, bought of Billard one bull calf, which sickened soon after, but apparently recovered, or, rather, as is too often the case, the disease subsided into a chronic form. This strange calf infected 13 more of his herd, 5 of which had died before our arrival, while 9, including the bull calf, were destroyed and paid for by the State. In this case 6 of the condemned animals were supposed by their owner and his neighbors to be in good health, and it was only when they had been destroyed, and the extensive diseased changes in the lungs had been shown, that they became convinced that a serious blunder had not been committed. This is an every-day experience with us, and illustrates how the disease is spread by cattle which an ordinary observer would consider to be perfectly sound.

Since that date more of Mr. White's herd have contracted the disease, and he is now left with but 13 out of his original stock of 30 cattle.

Outbreaks took place in no less than ten different herds into which calves from the same drove were taken, and but for the energetic measures adopted in stamping out the disease, the losses in Suffolk County must have proved most extensive.

Mrs. Erath, 73d street, New York, bought a cow from Seaver, a dealer, who then kept his cows in the infected sheep-house, 60th street. This cow sickened on February 15th, and notwithstanding active suppressive measures, five out of her remaining herd of nine were lost before the plague was stayed.

Patrick McCabe, 72d street, New York, had five cows in 1871. He bought a fresh cow of a dealer named McDonald, which sickened six weeks later, and infected his cows, all of which perished. He bought four new cows, but he lost the whole in two months. Then he got a

fresh stable and new cows, which have kept sound until the present year. One fresh cow, bought this year, suffered, but was carefully kept apart until disposed of by the State inspectors.

Joseph Schwab, 149th street and Southern Boulevard, seven years ago, bought of a dealer a cow said to have come from New Rochelle. She sickened and infected his herd, of which he lost twenty-three in a few months. Seven of the herd recovered. A year later he again began to buy, but only from sound herds, and since that time has escaped, until recently when an infected calf was taken in from a dealer.

Udell Cohen, 14th street, New York, kept 14 cows, and in March, 1879, bought 3 of Jacob Strauss, a dealer. One of them was sick from the first, but after a few weeks improved. Then two others sickened and died. In June 5 others sickened and the whole were sold to a butcher. Cohen moved to New Jersey and started anew.

Cases like these ought to convince all that this disease is eminently and most dangerously contagious. No one who has studied the plague in Europe can truthfully claim that it is less infectious here than in the old world. What misleads many is, that during the cooler season many of the cases assume a subacute type, and others subside into a chronic form with a mass of infecting material (dead lung) encysted in the chest, but unattended by acute symptoms. But this feature of the disease renders it incomparably more insidious and dangerous than in countries where the symptoms are so much more severe, that even the owners are roused at once to measures of prevention. In moderating the violence of its action, the disease does not part with its infecting qualities, but only diffuses them the more subtilely in proportion as its true nature is liable to be overlooked. A main reason why unobservant people fail at first sight to see that the lung fever is contagious is, that the seeds

of the disease lie so long dormant in the system. A beast purchased in October passes a bad winter, and dies in February, after having infected several others. She has had a long *period of incubation*, and when the disease supervenes actively, she has passed through a chronic form of illness, so that when others sicken people fail to connect the new cases with the infected purchase. Then, again, in an ordinary herd of 10 or 20 head, the deaths do not follow in rapid succession, but at intervals of a fortnight, a month, or even more, and those unacquainted with the nature of the disease suppose that it cannot be infectious, or all would be prostrated at once.

Pertinent to this point are the following remarks extracted from a letter of the author which appeared in the New York *Tribune*, March 12th, 1879:

"THE DISEASE NEVER ARISES IN THIS COUNTRY BUT AS THE RESULT OF CONTAGION.

"That this malady is contagious is shown every day in the course of our work. Wherever we find it existing in a herd we obtain a history of a recent purchase, or of some other form of exposure by which the herd has been infected. To give illustrations would be to record the whole history of our course in stamping it out so far. But this is not enough. The disease is not only contagious, but in this country it is only propagated by contagion. Throughout the immemorial ages of this, the oldest of continents, the herds of buffalos roaming over its plains never contracted this affection. Yet buffalos are susceptible to this disease, as well as our domesticated cattle. And if the buffalos on the unfenced plains had once developed the malady it would have remained as a permanent plague, as it has throughout all historic periods in the open steppes of Eastern Europe and Asia, since 1854 in Southern Africa, and since 1859 in the wide stock ranges of Australia. During the long period that has elapsed since the colonization of America the cattle have been subjected to all the conditions of life that have beset them since; but until 1843, when an infected cow

was imported into Brooklyn, the malady was unknown Since that date it has never at any time been absent from Brooklyn and Long Island.

"On the contrary, Massachusetts, which imported this animal plague in 1859, set herself vigorously to the work of exterminating it. In the next five years she killed and paid for over 1,000 cattle, but in so doing she killed the contagion, and since 1865 has not known this disease. Cattle have lived in innumerable herds in the Western States, subjected to all possible privations and to the greatest trials in the way of travel, crowding, filth and starvation, but on no occasion has this lung plague been developed, and to-day I believe the cattle of those States are as sound as are the buffalos of the plains. In Europe this plague always extends on the occasion of any great war, and devastates the countries through which the armies pass, but only because the commissariat parks are supplied from infected districts. During the late American war our commissariat herds were subjected to as great privations, with the additional drawback of the absence of the smooth-paved roads of the Old World, but the plague never broke out in those herds nor ravaged the States where the armies were operating. The explanation is that the cattle supplies were drawn from uninfected regions, and in the absence of the specific imported disease-germ no abuse was capable of producing it in America. The swill-milk stables of the West are as much crowded, as filthy and as ill-ventilated as those of New York and New Jersey. But the swill-stables of the West never produce this disease, while those of the seaboard into which the germ has been introduced are ravaged to a ruinous extent. If more proof is wanted of the purely contagious nature of the malady, it is to be found in the entire absence of the plague from the Highlands of Scotland, the Channel Islands, Brittany, much of Normandy, Spain, Portugal, Norway and Sweden. These places breed their own stock and rarely or never import strange cattle, therefore this poison exotic to their soil has never gained a foothold. Norway and Sweden have, indeed, imported the plague, but speedily expelled it by the only effectual method of exterminating the poison. The same is true of a number

of other European nations, as well as Massachusetts and Connecticut. The remark is as true to-day of Western Europe and America as it was a century ago when made by the immortal Haller of his own native Switzerland, that *the disease never appears but as the result of the introduction into a country or district of an animal from an infected place.*"

Can the Bovine Lung Plague be Transmitted by Mediate Contagion?

This question will be best answered by adducing a few instances of the infection of animals otherwise than by immediate contact. These will be arranged under different headings according to the channel through which the contagion was conveyed.

A. *Contagion through the Atmosphere.*—Some years ago, the hypothesis was advanced in England that this disease could not be conveyed from animal to animal by *mediate contagion*, but that, in order to its transmission, the sick animal must be brought into direct contact with the healthy. It is difficult to see how such an absolute claim can be advanced in the face of the every-day observation that, when a sick animal is introduced into one end of a stable, the plague often skips many intervening ones to strike down a beast near the farthest end of the building. In such a case the air is the *medium* through which the virus is carried, and the contagion is unquestionably *mediate*.

The experiments conducted at the Brown Institution, in September, 1876, March, 1877, and August, 1878, in which healthy cattle were exposed to the emanations from diseased lungs without any ill result, are quoted as disproving contagion through the air. But one or several failures to convey a disease is no proof that the disease in question is not contagious. I might quote the example of the enthusiastic non-contagionists who clothed themselves with the linen fresh from the bodies of cholera

patients, lay with them in the same beds, and even drank their blood with impunity. The results did not prove that cholera was non-virulent, but only that they did not furnish the conditions necessary to induce contagion. We now know that if they had experimented with the bowel dejections of cholera patients cholera would have been produced, in all susceptible subjects, on given days after their passage.

It seems highly probable that a flaw no less serious entered into the experiments conducted at the Brown Institution. If the emanations from the lungs of a sick animal can infect a healthy cow at the farther end of a long stable, there seems no good reason to conclude that the fresh lungs, warm from the sick beast, cannot give off emanations virulent to any susceptible animal. This question of the *susceptibility* of the healthy animals exposed is the first that suggests itself; and in the report of the experiments in question there is not a hint that this susceptibility had been tested. Had the animals that resisted exposure to the *diseased lungs* been afterwards infected by *contact* with *sick cattle*, the claim that the lungs could not convey the disease after their removal from the body would have been rendered much more plausible. At present, the thousand cases of the conveyance of the virus through the air of a stable must be held as more authoritative than the three negative results from the diseased lungs at Brown Institution.

B. *Contagion by Pulmonary Exudation Introduced into the Nose.*—Prof. Baldwin, of Glasnevin, informs me that, many years ago, he soaked a sponge in the liquid from a diseased lung and stuffed it into the nostril of a sound animal, which, in due time, showed all the symptoms of the lung fever.

C. *Contagion Carried by Attendants.*—As this has been warmly debated on the other side of the Atlantic, I shall record three cases which ought of themselves to settle the question.

1. In the winter of 1847–8 infected oxen were unwittingly purchased to be fed on the farm of Pitcox, East Lothian, Scotland. The disease spread through the whole herd, causing most extensive losses. The cattleman on the farm was the son of the steward on the neighboring farm of Pleasants. The buildings and feeding-courts on the one farm were about a mile and a half apart from those on the other, and at the season named the cattle on the two places were closely confined in their respective yards. The man attending the sick cattle on Pilcox paid a weekly Sunday visit to his parents at The Pleasants, and never failed on such occasions to go in to see how his father's cow was doing. In the course of a few weeks the father's cow contracted the plague, and from her the malady spread to all the cattle on the farm, entailing heavy losses on the owner.

Here the cow first attacked on The Pleasants was not an animal that had been recently introduced, for her owner had been steward under the former tenant several years before and had staid on under the new tenant, keeping the same cow throughout. A bull was kept on the farm, so that his cow was never taken from the premises. There was no plague in the district prior to the outbreak at Pitcox. The new tenant's own cows had never been sick, had all been a year or more in the place before the plague broke out, and were kept in a stable at the opposite side of the farm buildings, and about fifty paces from where the steward's cow stood in a stable alone. Infection from that source was, therefore, out of the question. Finally the feeding bullocks on The Pleasants were black West Highland cattle, from a race and locality in which this disease had never prevailed; they came on the place in sound health, and remained more than long enough, before contracting the disease, to have developed the symptoms of it had they brought the germs in their systems; they maintained excellent health until weeks after

the steward's cow had been attacked, and finally they, as well as the farmer's cows, almost without exception contracted the plague, showing clearly that they had not acquired that immunity which comes from a previous attack of this affection. The facts recorded are vouched for by the author, who was resident on The Pleasants at the time and personally watched the developments. These facts will warrant but one conclusion, viz.: that the infection was carried by the steward's son who was in daily attendance on the sick cattle at Pitcox, and weekly visited his father's cow at The Pleasants.

2. William Walker of Quincy, Mass., was present at Squantum when cattle suffering from Lung Plague were slaughtered there by order of the Commissioners. He closely examined portions of the diseased lungs and walked through the blood of the slain animals. He then rode home a mile and a half, went to his barn and fed his cattle. These in due time developed the disease. He sold two of his cattle to E. B. Taylor, and of his herd of 21 all but three fell victims to the pestilence. (See Report of Cattle Commissioners of Massachusetts for 1863).

3. In February, 1879, when we began the *stamping-out* of the plague on Long Island, a gentleman of the name of Ditmas Jewel took a great interest in the welfare of the suffering milkmen, and visited one or more of the worst-infected stables daily. He owned one favorite family cow, a Jersey, which was kept alone in a private stable, separated by ample grounds from all adjacent herds. She was never removed from these premises, nor were other cattle admitted, yet, towards the end of March, she sickened, and soon perished, presenting the most characteristic lung-plague lesions.

These cases are conclusive, as in no one instance was there any possibility of *direct contact* with sick animals, while in all there was the *mediate contact* through the persons and clothes of the visitors.

D. *Contagion through the Infected Buildings.*—This form of contagion is so exceedingly common that an apology would be needed for referring to it were it not for the hardihood of some in denying all *mediate contagion.* Distillery stables, where the cattle of many owners mingle, soon become infected in infected localities, and from that time onward they remain infecting, though all sick animals are excluded. Dealers' stables suffer in a similar way; and thus, after a dealer has kept an infected animal in his place, he continues for months or years to disseminate cattle that infect others, though it may be impossible to find a sick beast on his premises at any time in the interval. One or two cases may, however, be particularized:

John Miller, Farmingdale, L. I., traded with a Brooklyn dealer, January 1st, 1879, for a cow, which, soon after, fell ill and died. He shortly after purchased another cow, and placed her in the same stable, but she also sickened and died. After this, he placed a calf in the stable, but this also perished; and at present the stable remains unoccupied.

Mrs. P. Gregory, 12th street, Brooklyn, had two cows and one calf in her stable in the end of February, 1879. When visited, one cow was very sick, and both were destroyed, the stable being afterwards washed with disinfectant liquids. The calf was disposed of for veal. Two months later, Mrs. G. purchased a new cow from a man who had kept her as a family cow for some years, and put her in the same stable in which the first had stood. Ten days after, she showed symptoms of disease, and, when slaughtered, showed the characteristic lesions of lung fever.

Mr. Addick, Sunnyside, near Dutchkills, L. I., kept on an average 22 cows, and for two years has lost heavily. Early in the present year he left the place, and the stable was let to Patrick Hollihan, who bought in fresh cows. Some of these he got May 1st of J. & J. Wheeler, dealers

and some July 3d of Patrick McCabe, dealer. In both cases the fresh cows came from the country and went to the stables, with our permits, furnished after examination. Aug. 19th four cows were found to have the lung plague and were slaughtered.

Patrick Greene, West Farms, New York Co., took his present place in April, and stocked it with 32 fresh cows. About May 1st sickness appeared in his herd and then for the first time he learned that his predecessor had lost heavily during the past year. In company with Dr. Hopkins I visited his place May 14th and found seven sick cattle, which were accordingly slaughtered. On two subsequent occasions, four more diseased cows had to be disposed of, in spite of the fact that the buildings had been disinfected with chloride of lime and carbolic acid. Fumigation of buildings and animals twice daily with the smoke of burning sulphur was now enjoined, and up to the time of writing (three months) no new case has appeared.

Messrs. Niedlinger, Schmidt & Co., brewers, 406 E. 27th Street, New York, had a cow die a year ago (August 1878) with symptoms implying lung plague. Another was put in the same stable three months later, has done poorly since, and Aug. 18th was found to have lung plague, and sacrificed accordingly.

E. *Infection through the Manure.*—Mrs. Power, Franklyn Avenue, Brooklyn, kept 8 cows, and had made no purchase since the autumn of 1878. On March 26th one of her cows was found to be affected with lung fever, and was killed in consequence. The only appreciable source of contagion was the manure, which had been drawn from infected city stables, and spread on a lot where these cows were turned out on fine days for exercise. In spite of the plowing-under of the manure as soon as the frost would allow, three more of her cattle have sickened, and had to be killed May 12th. As further evidence of the con-

tagious nature of the affection in this case, Mr. K., her neighbor, who had visited and handled her first sick cow, has since lost one out of his herd of eleven, with unequivocal symptoms and lesions.

F. *Contagion through Infected Pastures.*—It is to an example of this medium of contagion that Australia owes her present bovine lung pestilence. In 1859 a short-horn cow was imported by Mr. Boodle from England into Melbourne, and was found to be affected with the lung plague. All of Mr. Boodle's cattle were killed and paid for by private subscription; his farm was then quarantined, and the colonists fondly hoped that the danger had been averted. It happened, however, that a teamster who worked his ox-teams on the streets during the day, turned them into these proscribed pastures at night under cover of the darkness, and when later these animals perished, they had already infected large numbers belonging to different herds and districts. What was thus begun by the cupidity of the teamster, was repeated again and again in quick succession, and on every side, for the herds of different owners roamed at large on the unfenced pastures, the healthy grazed where the sick and infected had preceded them, and soon the greater part of that immense island-continent lay in the grasp of the relentless pest.

This method is a fruitful source of infection around our cities and villages. The cattle of different owners are turned out in summer on the commons and unbuilt lots of the city and suburbs, and even if herded by an attendant or staked on a given spot, they go in successive days on places where infected stock have been before them, and inhale the deadly *contagium*, from which the owner thinks he has been carefully guarding them.

Wherever the practice of pasturing the cattle of different owners on unfenced lots is allowed, the work of exterminating the disease is most seriously retarded, if not rendered altogether futile, the expense to the State is in-

definitely enhanced and prolonged, and the hope of any future riddance of the pestilence is rendered extremely problematical.

G. *Contagion through Pasture or Fodder.*—An instance which came under the author's observation in East Lothian, Scotland, in the years from 1856 to 1862 was nearly allied to the above. On the Beil estate the deer-park was not fully stocked with game, and the right of pasturage for a certain number of cattle was let yearly. Prior to the date mentioned cattle affected with the plague had been placed in this field, and after this the affection developed year after year in the herds there turned out. That the infection came from the field was unquestionable, as the stock turned out on the deer-park were often from farms near by, where they had been kept all winter and where there had not been a trace of the disease for years. As the park was vacated by all but the deer and sheep for four or five months of the year, it is hardly credible that the *contagium* survived in the soil for that length of time through all the changes of a British winter, and it seems more reasonable to conclude that it had been covered up under great accumulations of dried leaves, or in hay stored for the use of the animals.

In conclusion it is well to add that this denial of *mediate contagion* is sustained by but very few living veterinarians, who cling to this as others still obstinately claim the absence of all contagion whatever, direct or indirect. But the best authorities, including Delafond, Bouley Reynal, Gerlach, Roloff, Rychner, Röll, Lafosse, Flem ing, etc., etc., advance the doctrine of mediate contagion as amply proved and indisputable. Rychner says, "The affection breeds a disease-germ—a contagion of a volatile nature. That it attacks the cow that stands in an uncleansed, infected stable, the many proofs of its conveyance through men, and through horses that have

stood in stables as mates with cattle, its constant extension in a stable or in a herd, and finally its sure arrest by the seclusion of stables and localities afford the most conclusive evidence of this." (Bojatrik.) Röll says, "Contamination occurs from the contact of sound animals with the sick on roads, pastures, in stables, through the medium of food, of straw that has been breathed upon and soiled by infected beasts, by the utensils that have been used for the latter and by the persons who have attended them." (Pathologie und Therapie.) Fleming says, "Healthy cattle have been contaminated after being lodged in stables that were occupied by diseased ones three or four months previously. Hay soiled by sick cattle has induced the disease after a longer period; and pastures grazed upon three months before have infected healthy stock. The flesh of diseased animals has also conveyed the malady; and it is recorded that the contagion from cattle buried in the ground infected others fifty or sixty feet distant." (Veterinary Sanitary Science.)

Vitality of the Virus.

There is much difference of opinion with regard to the power of the virus to resist ordinary destructive influences. In many cases the free exposure of an infected place for three or four months to the action of the air has purified it so that fresh stock have been introduced with impunity. On the other hand, instances can be adduced in which cattle have been infected by being placed in stables in which sick cattle had been kept at least four months previously. Other things being equal, it will be preserved longest where it has been dried up and covered from the free access of the air. Thus, in very dry and close buildings, in those having rotten wood-work, or deep dust-filled cracks in the masonry, and in those with a closed space beneath a wooden floor, it clings with the

greatest tenacity. Again, when the buildings contain piles of lumber, litter, hay, fodder or clothing, the virus is covered up, secreted and preserved for a much longer time than if left quite empty. In these last it is preserved just as it is in woolen or other textile fabrics and carried from place to place by human beings.

As carried through the air the distance at which the virus retains its infecting properties varies much with varying conditions. The author has seen a sick herd separated from a healthy one by not more than fifteen yards and a moderately close board fence of seven feet high, and in the absence of all intercommunication of attendants, the exposed herd kept perfectly sound for six months in succession. On the other hand, infection will sometimes take place at a much greater distance without any known means of conveyance on solid objects. Röll quotes 50 to 100 feet, while others claim to have seen infection at a distance of 200 and 300 feet. But it may well be questioned whether in such cases the virus had not been dried up on light objects, like feathers, paper, straw or hay, which could be borne on the wind. This, from being in thicker layers, would escape the destruction that would have befallen it had it been carried in the air only as invisible particles.

How does the Infection enter the System?

The seat of the disease, its progress, and the results of all attempts at inoculation favor the presumption that the virus is usually taken in with the air breathed. Not only are the lesions concentrated in the lungs, but they begin with cloudiness and swelling of the smaller air tubes and surrounding connective tissues. The exudation into the interlobular tissue, the congestion of the lung tissue itself, and the implication of the lung covering, are secondary phenomena. In other words, the disease begins where the inspired air must lodge the germs. Thus the inoculation of the virulent lung products on dis-

tant parts of the body of a sound beast rarely determines the characteristic lesions in the lungs, in place of which it induces in the seat of inoculation an exudation, less abundant, as might be expected from the greater density and resistance of the integument, but which can, like the morbid lung products, be inoculated on sound animals with protective effect. It seems probable that the poison is multiplied in both cases, but that the special loose and susceptible texture of the lung renders its production incomparably more abundant, as the continuous ingress and egress of air through the diseased organ renders it immeasurably more infecting.

How Long is a Diseased Animal Infecting?

Proof is wanting as to the infecting nature of the disease during the incubation stage. If negative evidence were of any value in a case of this kind it would be easy to adduce cases in which the removal of an animal as soon as it showed symptons of the plague had apparently saved the rest of the herd. In other cases the malady has been eradicated from a herd by careful watching and the prompt removal of every animal as soon as sickness appeared. The period of greatest virulence is that at which the fever runs highest and when the lung is being loaded with the morbid exudation.

But it must not be inferred that with the subsidence of the fever the danger is removed. It is a matter of every day observation that animals which have passed through the fever, that are now thriving well or giving a free supply of milk, and to ordinary observers would appear in perfect health, retain the power of transmitting the disease to others. This may continue for three, six, nine, twelve or according to some even fifteen months after all signs of acute illness have disappeared. This is easily explained: The tendency of the disease is to interrupt the circulation in the most severely affected parts of the lung; this accordingly dies, and the exudation immedi-

ately around this becomes developed into a tough fibrous envelope, which closes off the dead mass from the adjacent lung and from all communication with the external air. The dead and imprisoned mass now undergoes a process of breaking down, liquefaction and absorption, commencing at the surface and slowly advancing toward the centre. The encysted portion of dead lung is one mass of infecting material, and as it undergoes no change, except that of liquefaction, and exhales at no time any putrid odor, it remains infecting so long as it retains the solid form. At the outset more than half a lung may be thus encysted, and five or six months after alleged recovery we still find masses of from one to two pounds weight, waiting for the slow process of solution. Whenever there are indications of the existence of such encysted masses the animal should be looked on as infecting and disposed of as summarily as if in the acute stages of the disease.

PERCENTAGE OF ANIMALS SUSCEPTIBLE TO THE DISEASE.

The number of animals that contract the disease by exposure to the contagion is somewhat irregular. The French Commission of 1849 found that of 20 animals drawn from a healthy locality and exposed to infection, 16 contracted the plague, 10 of them severely. Twenty per cent. remained refractory. In warmer climates the mortality is greater. Dr. Lindley quotes examples from his South African experience, in which whole herds of 80, 130 and several hundred died without exception. We find approximate results in the hot summer of New York, and a reference to cases quoted above will show the destruction of whole herds without exception. During the winter season the disease is far less violent in its manifestations and a greater number of exposed cattle resist it.

ALLEGED INSUSCEPTIBILITY OF THE DIGESTIVE ORGANS.

In 1868-9 at the Veterinary College at Alfort, portions of the diseased lungs and several pints of the liquid ex

pressed from them were administered to animals without any bad result. Even if we could rely on such negative testimony, they would be of slight significance, as the food devoured by the ox is at the same time breathed upon, and any existing virus is likely to be directly inhaled.

Animals Susceptible.

Unlike the other great cattle plagues (Rinderpest and Aphthous Fever) this confines its ravages to the bovine genus. Currency has at different times been given to reports of the infection of sheep, goats and deer, but the transmission of the malady to these animals has never been satisfactorily proved. In Great Britain sheep have mingled in the fields with infected cattle for thirty-seven years without any observed transmission of the malady to the sheep. The same is true of Australia and the Cape of Good Hope, where the plague has driven many colonists to replace their cattle by sheep. Goats live in a large proportion of the stables in New York and Brooklyn, yet we have never seen a goat infected. As respects deer, the lung plague prevailed for a series of years in the deer park at Biel, Scotland, but the deer never suffered. These, it is true, are but negative proofs; they show only that in certain climates and conditions exposure fails to produce infection; what might occur in a different environment which materially modified the disease, remains to be shown. At present there is no reliable testimony that other animals than cattle will contract the affection.

Among cattle no race, breed nor age materially modifies the susceptibility. In countries where the malady has prevailed for centuries the attacks are somewhat less severe; but this holds true of all plagues of man or beast. In time the more susceptible races die off, and by a natural selection the survivors have the disease in a

milder form. Sex gives no immunity; bulls suffer as much as cows, and oxen and calves, if equally exposed, furnish no fewer victims than bulls and cows.

Immunity Conferred by a First Attack.

Like the different forms of variola (small-pox, sheep pox, cow-pox, etc.), rinderpest, measles and scarlatina, the lung plague is usually taken but once by the same individual. Some claim that the immunity lasts but about two years, after which the disease may be contracted anew; but the mass of evidence goes to show that second attacks are exceptional, and they are probably no more common than second attacks of small-pox, measles or scarlatina. The acquired immunity in infected districts gives a special value to animals that have passed through the disease, and upon this are based the practices of protective inoculation, and of the exposure of young and valueless calves to the infection, that the losses from the plague may be materially reduced.

Mortality.

In recording the mortality caused by the plague the most varied figures are set down by authors. Much of the discrepancy arises from the point of view taken. Thus if we estimate the losses as a percentage of all the cattle in a district, they will appear very small inasmuch as it is rare to find all the herds affected. Thus Loiset states the losses for the entire bovine race of the department *du Nord*, France, at 4 per cent. per annum. For distillery stables, sugar factory stables, etc., it was 12 per cent., and for farms but 2 per cent. This is accounted for by the frequent changes in the former and the inevitable introduction of contagion. The same applies to city dairies where he found a mortality of 25 or 26 per cent. In the Nord in 19 years it had killed 212,800 beasts of a total value of 52,000 000 francs (over $10,000,000).

Yvart, estimating for infected herds only, stated the losses in Aveyron, Cantal and Lozere at 30, 40, 50, 68, and even 77 per cent., the average being at least 35 per cent.

Gamgee secured records of 88 dairies in the city of Edinburgh for the year 1861–2 and found that with an average holding of 1830 the plague cut of 1075 or over 58 per cent. The yearly loss was £14,512 ($70,000). The actual losses in Dublin and other large cities were found to correspond, those of London alone being estimated at £80,000. The losses for the British Isles, computed from agricultural statistics, the records of insurance companies, etc., were close upon £2,000,000 ($10,000,000) per annum.

Finlay Dunn shows from the English Cattle Insurance Co.'s statistics that from 1863 to 1866 the losses from this plague were 50 to 63 per cent. per annum.

In Holland Sauberg records a yearly loss of 49,661 head, while in Wurtenberg it amounted to 39 per cent.

Mr. Lindley's observations in South Africa show that in that hot, dry climate the disease was most virulent even in cattle kept in the open air, and it was no uncommon thing for entire herds of several hundreds to be carried off by the pestilence. This is precisely in keeping with what we see in the hot summers of New York; the disease at this season becomes unusually violent, all cases are acute and run a rapid and often fatal course and it is not uncommon to see a whole herd swept off without exception. This is a fact of supreme importance in view of the continued neglect of the plague in the more southern of our infected States. Should it be allowed to spread farther south and west where the semitropical summers will increase its severity and death rate, we shall have ourselves to blame for the results, and can no longer plead excuse on the ground of ignorance.

Period of Incubation. Latency.

The time that elapses between the receiving of the germs into the system and the manifestation of the earliest symptoms of the disease, varies greatly. Delafond sets it at from six to sixty days, Verheyen from ten to sixty days, the French Commission extends the period to sixty-seven days, Reynal has seen it exceed ninety days, and Röll and Gamgee quote from eight days to one hundred and twelve. It is true that Gamgee qualifies this by the statement that when an animal sickens four months after purchase, two or three latent instances of the diseases have preceded the obvious one. Australia, South Africa and Norway were each infected by cattle that had shown a period of incubation of three months. I have frequently seen cases in which cattle have passed three or four months after the purchase in poor health, yet without cough or any other obvious diagnostic symptom, and at the end of that time have shown all the symptoms of the lung plague. But, as such cows are considered by the ordinary observer to be well, and as many of them will convey to the mind of the veterinarian nothing more than unthriftiness, we must, as a working rule, accept as possible an incubation of three or even four months. All quarantine regulations for this disease must be based on this occasionally long period of latency.

As regards the real or regular period, we may deduce something from the exudation and swelling in the tail in inoculated cases. The average period is on the ninth day, though it may appear as early as the fifth, or it may be delayed till the thirtieth or fortieth day. In the experimental transmission of the disease by cohabitation, under the French Commission, a cough—the earliest symptom—appeared from the sixth to the thirty-second day, and sometimes continued for months, though no acute disease supervened.

It should be added that hot climates and seasons abridge the period of latency; thus, the disease will develop more rapidly in summer than in winter, and in the south than in the north. Any febrile condition of the system will also favor its rapid development; therefore, symptoms are often hastened by parturition, by *heat*, (*œstrum*), and by other exciting conditions.

Symptoms.

These vary in different countries, latitudes, seasons, altitudes, races of animals and individuals. They are *caeteris paribus*, more severe in hot latitudes, countries and seasons, than in the cold; in the higher altitudes they are milder than on the plains; in certain small or dwarfed animals, with a spare habit of body, like Brittanies, they appear to be less violent than in the large, phlegmatic, heavy-milking, or obese short-horn, Ayrshires and Dutch; a newly infected race or cattle in a newly infected country suffer much more severely than those of a land where the plague has prevailed for ages; and finally certain indivduals, without any appreciable cause, have the disease in a much more violent form than others which stand by them in precisely the same conditions.

Sometimes the disease shows itself abruptly with great violence and without any appreciable premonitory symptoms, resembling in this the most acute type of ordinary broncho-pneumonia. This, however, is mostly in connection with some actively exciting cause, such as exposure to inclement weather, parturition, overstocking with milk, heat, etc.

Far more commonly the symptoms come on most insidiously, and for a time are the opposite of alarming. For some days, and quite frequently for a fortnight, a month or more, a slight cough is heard at rare intervals. It may be heard only when the animal first rises, when it leaves the stable or when it drinks cold water, and hence

attracts little or no attention. The cough is usually small, weak, short and husky, but somewhat painful and attended by some arching of the back, an extension of the head upon the neck, and protrusion of the tongue. This many continue for weeks without any noticeable deviation from the natural temperature, pulse or breathing, and without any impairment of appetite, rumination or coat. The lungs are as resonant to percussion as in health, and auscultation detects slight changes only, perhaps an unduly loud blowing sound behind the middle of the shoulder, or more commonly an occasional slight mucous rattle, or a transient wheeze. In some cases the disease never advances further, and its true nature is to be recognized only by the facts that it shows itself in an infected herd or on infected premises, and that the victim proves dangerously infecting to healthy animals in uninfected localities. It may be likened to those mild cases of scarlatina which are represented by sore-throat only, or to the modified variola, known as chicken-pox.

In the majority of cases, however, the disease advances a step further. The animal becomes somewhat dull, more sluggish than natural, does not keep constantly with the herd, but may be found lying alone; eats and ruminates more tardily and less frequently; breathes more quickly (20 to 30 times per minute in place of 10 to 15); retracts the margins of the nostrils more than formerly; the hair, especially along the neck, shoulders and back, stands erect and dry; the muzzle has intervals of dryness, and the milk is diminished. The eye loses somewhat of its prominence and lustre, the eyelids and ears droop slightly, and the roots of the horns and ears and the limbs are hot or alternately hot and cold. By this time the temperature is usually raised from 103 degrees, Fahrenheit, in the slightest or most tardy cases to 105 degrees and upward to 108 degrees in the more acute and severe. Auscultation and percussion also now reveal decided changes in the lung tissue.

The ear applied over the diseased portions detects in some cases a diminution of the natural soft breathing murmur, or it may be a fine crepitation which has been likened to the noise produced by rubbing a tuft of hair between finger and thumb close to the ear. Where this exists it is usually only at the margin of the diseased area, while in the centre the natural soft murmur is entirely lost. In other cases a loud blowing sound is heard over the diseased lung, which though itself impervious to air and producing no respiratory murmur is in its firm, solid condition a better conductor of sound and conveys to the ear the noise produced in the larger air tubes.

Percussion is effected by a series of taps of varying force delivered with the tips of the fingers of the right hand on the back of the middle finger of the left firmly pressed on the side of the chest. Over all parts of the healthy lung this draws out a clear resonance, but over the diseased portions the sound elicited is dull as if the percussion were made over the solid muscles of the neck or thigh. All gradations are met with as the lung is more or less consolidated, and conclusions are to be drawn accordingly.

In other cases we hear on auscultation the loud, harsh, rasping sound of bronchitis with dry, thickened and rigid membranes of the air tubes, or the soft, coarse, mucous rattle of the same disease when there is abundant liquid exudation and the bursting of bubbles in the air passages. In others there is a low, soft, rubbing sound usually in jerks when the chest is being filled with or emptied of air. This is the friction between the dry, inflamed membrane covering the lungs and that covering the side of the chest, and is heard at an early stage of the disease, but neither at its earliest nor its latest stage. Later there may be dullness on percussion up to a given level on one or both sides of the chest, implying accumulations of liquid in the cavity. Or there is a superficial dullness on percus-

sion, and muffling of the natural breathing sound with a very slight, sometimes almost inaudible, creaking due to the existence of false membranes (solidified exudations) on the surface of the lung or connecting it to the inner side of the ribs. This is often mistaken for a mucous rattle that can no longer take place in a consolidated lung in which there can be no movement of air nor bursting of bubbles in breathing. The mucous rattle is only possible with considerable liquid exudation into the bronchial tubes and a healthly, dilatable condition of the portion of lung to which these lead. In rare cases there will be splashing sounds in the chest, or when the patient has just risen to his feet a succession of clear ringing sounds becoming less numerous and with longer intervals until they die away altogether. These are due to the falling of drops of liquid from shreds of false membrane in the upper part of the chest through an accumulation of gas into a collection of liquid below. It has been likened to the noise of drops falling from the bung-hole into a cask half-filled with liquid. Peculiar sounds are sometimes heard as wheezing in connection with the supervention of emphysema and others which it is needless to mention here.

In lean patients pressure of the tips of the fingers in the intervals between the ribs will detect less movement over the diseased and consolidated lung than on the opposite side of the chest where the lung is still sound.

As seen in America, in winter, the great majority of cases fail to show the violence described in books. The patients fall off rapidly in condition, show a high fever for a few days, lie always on the same side (the diseased one), or on the breast, and have a great portion of one lung consolidated by exudation, and encysted as a dead mass, and yet the muzzle is rarely devoid of moisture, the milk is never entirely suspended and may be yielded in only a slightly lessened amount as soon as the first few days of active fever have passed.

During the extreme heats of summer, on the other hand, the plague manifests all its European violence. The breathing becomes short, rapid, and labored, each expiration is accompanied by a deep moan or grunt, audible at some distance from the animal. The nostrils and even the corners of the mouth are strongly retracted. The patient stands most of its time, and in some cases without intermission, its fore legs set apart, its elbows turned out, and the shoulder-blades and arm-bones, rapidly losing their covering of flesh, standing out from the sides of the chest so that their outlines can be plainly seen. The head is extended on the neck, the eyes prominent and glassy, the muzzle dry, a clear or frothy liquid distils from the nose and mouth, the back is slightly raised, and this together with the spaces between the ribs and the region of the breast-bone are very sensitive to pinching, the secretion of milk is entirely arrested, the skin becomes harsh, tightly adherent to the parts beneath and covered with scurf, and the arrest of digestion is shown by the entire loss of appetite and rumination, the severe or fatal tympanies (bloating), and later by a profuse watery diarrhœa in which the food is passed in an undigested condition. If the effusion into the lungs or chest is very extensive the pallor of the mouth, eyelids, vulva, and skin betrays the weak, bloodless condition. The tongue is furred and the breath of a heavy, feverish, mawkish odor, but rarely fœtid. Abortion is a common result in pregnant cows.

Course. Termination.

In summer, when the disease shows its greatest violence, the mortality is not only high, but early. Cattle will die after a few days' illness from the great prostration attendant on the enormous effusion into the organs of the chest, the impairment of breathing and the impairment or suspension of the vital functions in general

Others die early from distension of the paunch with gas. In others, still, the profuse scouring helps to speedily wear out the vital powers. In severe cases, that survive for some time, the rapid loss of flesh is most surprising. A loss of one-third of the weight in a single week is by no means uncommon, and even one-half may be parted with in the same length of time in extreme cases.

In fatal cases, with a moderately rapid course, all the symptoms become more intense for several weeks, the pulse becomes more and more small, weak and accelerated and finally imperceptible, the breathing becomes rapid and difficult, the mucous membranes of the mouth, eyes, etc., become pale and bloodless, emaciation goes on with active strides and death ensues in from two to six weeks.

In other cases and especially in cold and dry weather a portion of dead lung may remain encysted in the chest, submitting to slow liquefaction and removal, and such animals will go on for months doing badly, only to sink at last into such a state of debility that death ensues from exhaustion and weakness.

In others, still, the retention of such diseased masses and the consequent debility, determines the appearance of consumption (*tuberculosis*), which cuts off the animal.

Purulent infection and rupture of abscesses into the chest are other causes of death in this disease, but neither of these has so far come under my notice.

In cases about to recover, the symptoms gradually subside, life and appetite are re-acquired, and a more or less rapid recovery takes place. In the most favorable the exudations are slowly re-absorbed and the lung may be restored to its natural state. In others, the exudation, which is mostly in the interlobular tissue, becomes in part organized into fibrous material which, in contracting, compresses the lobules of lung tissue, lessening their capacity for dilation, and leaving the animal short-winded and predisposed to emphysema and other lung

troubles. If kept quiet, such convalescents fatten rapidly.

Far more frequently, in this country at least, a mass of lung is entirely lost, being divested of its vitality, enclosed in a fibrous cyst, and slowly liquefied and absorbed through a course of several months. These continue to do poorly for a number of months and may yet entirely recover, the whole dead mass having been finally removed and the sac having contracted into a dense fibrous structure. Even in this case if the patient has been able to bear up under the continued drain, and has escaped consumption and other risks, it may finally be successfully fattened.

Appearances of the Chest and Lungs after Death.

If the disease is seen in its earliest stages the changes are altogether confined to the tissue of the lung. From the examination of the lungs of several hundred diseased animals I can confidently affirm that the implication of the serous covering of the lung (pleura) is a secondary result. In all the most recent cases we find the lung substance involved and the pleura sound, while in no one instance has the pleura been found diseased to the exclusion of the lung tissue, or without an amount and character of lung disease which implied priority of occurrence for that. Yet in all violent attacks the disease will have proceeded far enough to secure implication of the pleura as well, and hence we may describe the changes in the order in which they are usually seen when the chest is opened.

The cavity of the chest usually contains a quantity of liquid varying from one or two pints to several gallons, sometimes yellowish, clear and transparent, at others slightly greenish, brownish-white and opaque or even exceptionally slightly colored with blood. This effusion contains cell-forms and granules, and gelatinizes more or less perfectly when exposed to the air.

On the surface of the diseased lung and to a less extent on the inner side of the ribs is a fibrinous deposit (false membrane), varying from the merest rough pellicle to a mass of half an inch in thickness, and in the worst cases firmly binding the entire lung to the inner side of the chest and to the diaphragm. These false membranes are usually of an opaque white, though sometimes tinged with yellow, and in the deeper layers even blood-stained, especially over an infarcted lung. A noticeable feature of these false membranes and one that serves to distinguish them from those of ordinary pleurisy is that they are commonly limited to the surface of the diseased portion of lung, or if more extensive that portion which covers sound lung tissue is much more recent, and has probably been determined by infection from the liquid thrown out into the chest.

In the lung itself the most varied conditions are seen in different cases and at different stages of the disease. The diseased lung is solid, firm and resistant, seems to be greatly enlarged because it fails to collapse like the healthy portion when the chest is opened, is greatly increased in weight and sinks in water. When cut across it shows a peculiar linear marking (marbling) due to the excessive exudation into the loose and abundant connective tissue which separates the different lobules of the ox's lung from each other. This exudation is either clear, and therefore dark as seen by reflected light, or it is of a yellowish-white, and when filled with it the interlobular tissue appears as a net-work, the meshes of which vary from ¼ line to an inch across, and hold in its interspaces the pinkish-gray, brownish-red, or black lung tissue.

When only recently attacked the lung may present two essentially different appearances:

1. Most frequently the changes are most marked in the interlobular connective tissue, which is the seat of an abundant infiltration of clear liquid, a sort of dropsy,

while the lung tissue, surrounded by this, retains its normal pinkish-gray color, and is often even paler and contains less blood than in health. It has, in short, become compressed by the surrounding exudation, and air and blood have been alike in great part expressed from its substance. (See Heliotype.) This extreme change in the tissue surrounding the lobules and the comparatively healthy appearance of the lobules themselves, have led many observers to the conclusion that the disease commenced in this connective tissue beneath the pleura and extended to the proper tissue of the lung. There is, however, as pointed out by Professor Yeo, a coexistent disease of the smaller air tubes corresponding to the lobules, that are circumscribed by this infiltration, and there is every reason to believe that the infiltration in question is the result of antecedent changes in the air tubes.

2. Less frequently we find the lobules of the lung tissue presenting the first indications of change. The lobules affected are of a deep red and more or less shining, yet tough and elastic. They do not crepitate on pressure, yet they are not depressed beneath the level of the adjacent healthy lung tissue as they would be if collapsed. The interlobular connective tissue, devoid of all unhealthy exudation, has no more than its natural thickness, and reflects a bluish tint by reason of the subjacent dark substance of the lung. Here the lung tissue itself is manifestly the seat of the earliest change—congestion —and the interlobular exudation has not yet supervened. Specimens of this kind may be rare, but a number have come under the writer's observation, and in lungs, too, that presented at other points of their substance the excessive interlobular exudation.

Both of these forms show a tendency to confine themselves to particular lobules and groups of lobules of the lung. They correspond, in short, to the distribution of

particular air tubes and blood vessels, as will be explained further on. The fact, however, is noteworthy as characteristic of this disease, that it attacks entire lobules, and the limits of the diseased lung tissue are usually sharply marked by the line of connective tissue between two lobules, so that one lobule will be found consolidated throughout, and the next in a perfectly natural condition.

The two forms just described differ also in cohesion and power of resistance. The lung saturated with the liquid exudation has its intimate elements torn apart and is more friable, giving way readily under pressure, while that in which there is red congestion but no extensive exudation, retains its natural elasticity, toughness and power of resistance.

Hepatization.—Another condition of the diseased lung tissue, more advanced than either of those just described, is the granular consolidation or hepatization. In this condition the affected regions of lung are as much enlarged as in the dropsical condition, but they are firmer and more friable, and on their cut surface present the appearance of little round granules. These granules are not peculiar to the lung tissue proper, though most marked on this; they characterize the interlobular connective tissue as well. They consist mainly of lymphoid cell growths, filling up the air cells, the smaller air tubes, the lymph spaces and the meshes of the connective tissue. The color of these portions varies from a bright reddish-brown to a deep red, according to the compression to which the lung tissue has been subjected by the exudation in the early stages. (See Heliotype.)

Infarction.—Another form of lung consolidation is of a very dark red or black and always implies the death of the portion affected. The dark aspect of the diseased lobules forms a strong contrast with the yellowish-white interlobular tissue, excepting in cases where that also becomes

blood-stained, when the whole presents a uniform dark mass. This form has the granular appearance of that last described and on microscopic examination its minute blood-vessels are found distended to their utmost capacity with accumulated blood globules. This black consolidation is always sharply limited by the borders of certain lob ules or groups of lobules which are connected with a particular air tube and its accompanying blood vessels, and the artery leading to such lobules is as constantly blocked by a firm blood-clot. The mode of causation is this: The artery being in the centre of a diseased mass, becomes itself inflamed. As soon as the inflammation reaches its inner coat the contained blood coagulates; the vein is usually blocked in the same way. The blood formerly supplied by the artery to certain lobules is now arrested; that in the capillary vessels of these lobules stagnates; nutrition of the walls of the capillaries ceases and these losing their natural powers of selection allow the liquid parts to pass freely out of the vessels, leaving the globules only in their interior. More blood continues to enter them slowly from adjacent capillaries supplied from other sources, and as this is filtered in the same way by the walls of the vessels, these soon come to be filled to repletion by the globules only, and hence the intensely dark color assumed. The color is often heightened by the escape of blood from the now friable vessels into the surrounding tissue, and it is by this means that the interlobular tissue is usually stained. (See Heliotype.)

This black hepatization, or as it is technically called, *infarction*, is an almost constant occurrence in the disease as seen in New York, and the death and encysting of large portions of lung is therefore the rule. If too extensive, of course the patient perishes, but not unfrequently a mass of lung measuring four or six inches by twelve is thus separated without killing the animal

If at a later stage we open an animal which has passed through the above condition, the following may be met with: A hard, resistant mass is felt at some portion of the lung, usually the lower and back portion, and on laying it open it is found to consist of dead lung tissue in which the hepatized lobules and interlobular tissue, the air tubes and blood vessels are still clear and distinct, but the whole is separated from the still living lung by a layer of a white pus-like liquid, outside which is a dense, fibrous sac or envelope, formed by the development of the surrounding interlobular exudation. From the inner surface of this dense cyst, the firm, thick bronchial tubes and attending vascular systems project in a branching manner like dirty white stalactites, and these with the interlobular tissue thickened by its now firmly organized exudation, may form bands extending from side to side of the cavity. (See engraving.)

At a still more advanced stage the dead and encysted lung tissue is found to have been entirely softened and the sac contains but a mass of white liquid debris, or, still later, a caseous mass of its dried, solid matters, upon which the fibrous covering has steadily contracted, so as to inclose but a mere fraction of its original area. In hundreds of post mortems we have only once seen the dead and encysted lung the seat of putrid decomposition, and never found the cavity opening into a pervious air tube.

There remains to be noticed the condition of the air tubes and accompanying vessels in the diseased lungs. In all cases where we see the starting point of the disease we find in the small tubes leading to the affected lobules, a loss of the natural brilliancy of the mucous membrane which has become clouded and opaque, and the tissue beneath it infiltrated and thickened. In more advanced cases and above all, in those showing the dropsical condition of the interlobular tissue, we find a simi-

lar infiltration into the connective tissue around the air tubes and their accompanying vessels, and in the hepatized lung this is always seen as a thick, firm, resistant white material, having the compressed and contracted and often plugged air tubes and vessels in the centre. (See Heliotype.) These thickened masses have already been referred to as standing out in stalactite form from the inner wall of the sac in which the dead (necrosed) lung is undergoing solution.

Nature of the Bovine Lung Plague.

That the plague is determined by an infecting material conveyed from beast to beast there can be no doubt. The intimate nature of this material has never been determined. No special anatomical element, no specific organism of animal or vegetable origin has been detected as constant in the diseased organ and peculiar to it. Yet the presence of a specific *contagium* is demonstrated in all our experience of the disease as above recorded, and in the prophylactic value of inoculation to be referred to below. This infecting material, as will be seen by the records of inoculation, rarely affects the lungs when first lodged on a raw surface of some other part of the body, differing in this essentially from most other specific disease poisons which have a definite seat of election in which their morbid processes are invariably established, no matter by what channel they may have entered the body. Since the lung plague contagium does not usually affect the lungs when introduced by some other channel it follows almost of necessity that when it does attack the lungs it must have been introduced into these direct. If it has been inhaled in the air it will fall upon one of two points—the air tubes, or the air cells—and there begin its baleful course. This is exactly in accordance with the early lesions as described above.

1. If arrested, as it most commonly will be, in the air

tubes, and if it attacks most severely the most delicate and susceptible parts, the membrane lining the smallest branches, it will determine the cloudy swelling so constantly seen in these. As the deeper layers and the adjacent connective tissue is invaded, the exudation and cell proliferation giving rise to the extensive thickening of the peribronchial tissue, as already described, will compress the different vessels and obstruct the flow of liquids through them. The lymphatics as being incomparably the most delicate and compressible will be the first to suffer and the obstruction of these will lead to engorgement and dropsy in the parts from which they draw the lymph. The lymphatic vessels and networks are marvelously abundant in the interlobular tissue and few and small in the lung lobules themselves, hence the obstruction of these vessels as they lead out from a given section of lung will lead to a dropsical effusion into the interlobular tissue while the inclosed lobules are still comparatively unaffected. This sufficiently explains the excessive liquid exudation into the interlobular spaces without starting with the assumption that this is the primary step of the disease.

The subsequent congestion, exudation and cell-proliferation in the lobules themselves sufficiently account for the changes which these subsequently undergo.

2. If, on the other hand, the infecting material succeeds in reaching the air cells it will, of course, make its earliest inroads on their delicate walls. Then will follow the early congestion, redness and consolidation of the lobules, and, only later, the extensive interlobular exudation, when the disease in the air tubes and the extensive exudation around them shall have compressed the accompanying lymphatic vessels. In this way is explained the second manner of invasion which I have described above.

The records of inoculation abundantly support these views. Though a number of experiments record the oc-

currence of cough ten to fifteen days after inoculation, yet among the multitudes of inoculated beasts, there has been no evidence of extensive disease of the lungs that can be demonstrated to have been of this nature. The local changes in the seat of inoculation are like those met with in the lungs in the ordinary forms of the disease, allowance being made for the natural differences of structure, and that they are specific is sufficiently evidenced by the now almost universal acceptance of the prophylactic value of inoculation. The conveyance of the disease from an inoculated animal is by no means unknown. We have seen instances in which the plague appeared to start in a stable from inoculated animals, and a very striking instance is recorded by Reynal in which an inoculated Brittany cow conveyed the affection to two others that stood beside her in the stable of the Alfort School. There is therefore every reason to believe that the contagium propagates itself in whatever tissue of a susceptible animal it may be lodged and that there the morbid processes are localized.

Prevention.

Under this head we take up that phase of the affection which is vital to the interests of America. That this plague is an exotic all history testifies. That animals susceptible to its *contagium* (buffalos) have existed in America for immemorial ages without a single instance of the spontaneous generation of the pestilence, is unquestionable. That any such spontaneous generation of the *contagium* would have been propagated and perpetuated in the widely wandering herds of buffalo as it has in the Old World steppes, the South African ranges and the Australian plains, is indisputable. That this Old World contagion can be crushed out of the New World States and driven back to its ancient haunts in Europe and Asia, and its more recently conquered territory in Africa and Australasia, is equally certain.

In view of the overshadowing importance of the extinction of this and other imported animal plagues, the author cannot be charged with remissness. For over a decade he has been continually sounding notes of alarm and picturing to the nation the terrible and irretrievabl devastation that must overtake us should the deadly exotic plagues reach our western plains. Coming down to recent times he pressed the matter strongly on New York in his lectures before the State Agricultural Society in 1877 and 1878 (see Transactions). He again brought up the subject in his paper read before the Centennial gathering of veterinarians at Philadelphia in 1876, and at frequent intervals in the New York *Tribune*, the *Farmers' Advocate* and the *National Live Stock Journal*. The following article from the *National Live Stock Journal* for March, 1878, is a sample of these, which should be studied to-day by all legislators, stock-owners and good citizens:

"The Greatest Danger to our Stock. The Lung Fever. Contagious Pleuro-Pneumonia.

"The *Journal* has frequently called attention to the great dangers that beset our live stock from imported plagues of foreign origin. During the past year the sudden invasion of Western Europe and England by the rinderpest roused the agricultural community from their dream of safety, and called forth from the Treasury an order remarkable alike for its promptitude and good intentions, and for the fatal blunders which rendered it worse than a dead letter. Once more there seems a prospect of a renewal of these apprehensions, the Russo-Turkish war having led to an extension of this cattle plague into Hungary, from which the Atlantic coast and Great Britain may be any day infected, owing to the activity of the stock trade. Should this unfortunately take place, it will find us no better prepared than we were a year ago, and our Treasury order, now in force, will freely invite the disease to enter, provided it makes its advent respectably—in the systems of *blooded stock*, and not in poor cross-bred animals, which it would

be ruinous to import, even if sound. A similar welcome is extended, by implication, to all those ruminants which are devoted more particularly to luxury, and have not been degraded to such vulgar utilitarian objects as the production of meat or wool. Yet all ruminants are subject to rinderpest, and this malady was carried to France in 1866 by two gazelles, as other plagues have often been carried to new countries by the privileged *blooded stock.*

"But we started out to notice a danger which is no longer separated from us by the broad barrier of the Atlantic, and whose malign presence is not to be dismissed by any one of ten thousand contingencies, as is the case with the possible advent of the rinderpest. This danger stands in our midst, and is steadily gaining in force as it encroaches further and further, showing how certain it is, if unchecked, to lay the whole country under contribution, and inflict most disastrous and permanent losses. The lung fever of cattle, imported into Brooklyn, L. I., for the first time, in 1843, in a European cow, has never since been at any time entirely absent from our soil. From this center it has slowly and irregularly extended over a portion of New York, New Jersey, Pennsylvania, Maryland, Delaware and Virginia, besides having repeatedly invaded Connecticut. The slowness of its extension has begotten a false sense of security, and no real apprehensions of serious consequences remain from an animal poison which has been for over a third of a century hidden away in the near vicinity of the Atlantic coast.

"To disturb this comfortable and restful condition of the public mind is an unpleasant task, which nothing but the imperative sense of duty would compel us to undertake. But this disease has a history, which we can only ignore at our peril; and as its records can now be drawn from all quarters of the globe, we can have before us an unequivocal testimony as to what will inevitably happen under given conditions of climate, surroundings and treatment.

"England imported the lung fever of cattle in 1842, just one year before we did, was soon very generally infected, and has continued so to the present time. Up to 1869 it is estimated that England had lost, almost exclusively from this disease, 5,549,780 head of cattle, worth £83,-

616,854 (say $400,000,000). For the succeeding nine years, up to 1878, the losses have been, in the main, as extensive, so that we may set them down as now reaching at least $500,000,000 in deaths alone, without counting all the contingent expenses, of deteriorated health, loss of markets, progeny, crops, manure, etc., disinfection, quarantine, etc. With us no attempts have been made to estimate the losses, but they cannot exceed an inconsiderable fraction of those above named; and thus we have slept on in a pleasant dream of immuuity.

"It is even alleged that the disease has, in a great measure, been shorn of its virulent power, by being transplanted to the shores of the New World, and that we may comfort ourselves with this and continue to ignore its presence. If, on the other hand, it can be shown that the difference is in no material respect affected by climate, but altogether determined by the surroundings, it will be well for us to attend to the facts of the case, and face the real danger. The lung fever, which had really entered England, by a special importation, some time before the free trade act of 1842, was, by virtue of this act, thrown upon her in constantly accumulating accessions. The ports at which the continental cattle were landed, and the markets in which they were sold—London (Smithfield Market), Southampton, Dover, Harwich, Hull, Newcastle, Edinburgh, etc.—insured the mingling of the imported stock, week by week, with the native store cattle. Then, if they failed to find a profitable sale, they were sent by cars to other and inland markets, where they were again and again brought into contact with numerous herds of store cattle, by which the germs of the disease were taken in and carried all over the country.

"With us, on the other hand, the disease was long confined to the dairies of Brooklyn and New York, where the cows were kept until they died, or were fattened for the butcher. A few, doubtless, found their way to the country, and by these the disease was carried to different farms, which were thus constituted centres of contagion from which the adjacent country became infected. But any such movement from the city dairies was necessarily of the most restricted kind, and it never took place to any great distance. It would have been folly tc move a

common milch cow, worth $40 to $70, to the West, where she could be bought for one-half or one-third of that sum. The same deterrent condition existed in the case of the farms on which the diseased city cows had been brought. Sales were no doubt occasionally made from infected herds, to secure the apparent value of an animal which the owner had good reason to believe to be doomed, and as such animals would, for obvious reasons, be sent as far from home as possible, this became a principal means of the formation of more distant centres of contagion and the wider diffusion of the malady. But with us the disease has hitherto had to fight against the heaviest obstacles—the current of cattle traffic having been almost without exception from the cheaply-raised herds of the West to the profitable markets of the East. The exceptions have only been in the case of thoroughbred stock, and hitherto our Western stock has escaped contamination by this means.

"The wonder is not so much that the plague has failed to reach the West, but that in the face of such tremendous obstacles it has succeeded in invading all of the six or seven States that are now infected. In Great Britain, where some would have us believe that the disease is more virulent, we can point to a more satisfactory record. There the great body of the country has been infected for thirty-five years, but the greater part of the highlands, exclusively devoted to the raising of cattle and sheep, has enjoyed the most perfect immunity. Here, under nearly all possible predisposing causes of lung disease—altitude, exposure, cold, chilling rains and fogs, the piercing blasts of the Atlantic and German Oceans—this contagious lung disease has never penetrated, though severely ravaging the lowlands immediately adjacent. The explanation is, that these hills support none but the native black cattle, and other breeds are never introduced. In spite of the alleged virulence of the disease in England, it has proved powerless to enter this magic circle from which all but the native stock is excluded. The same holds true concerning some parts of Normandy, Brittany, the Channel Islands, Spain, Portugal, Norway, Sweden, etc.

"The fact that the disease has maintained a foothold

among us for thirty-four years, and in spite of all obstacles has made a slow but constant extension, is sufficient ground for the gravest apprehensions. A disease-poison which shows such an obstinate vitality and such persistent aggressiveness cannot be allowed to exist among us without the certainty of future losses which will eclipse those of Great Britain by as much as our herds of cattle exceed those of that nation. A recent outbreak in Clinton, N. J., caused by a cow brought from Ohio, suggests the possibility of the disease having already reached the latter State, an occurrence which was inevitable sooner or later, but the actual existence of which must enormously increase our dangers. With every such step westward there is the introduction of more diseased and infected cattle into the natural current of the traffic, and the earlier probability of the general infection of all parts to the east of such ultimate centres of disease. There is, further, the infection of more cattle cars which, carried west, may be the means of securing a rapid extension of the plague to our most distant States and Territories.

"Relative Dangers of the Poisons of Lung Fever and other Plagues.

"The persistent vitality of the *lung-fever poison*, in comparison with that of any other animal plagues, is noteworthy. It has held a tenacious grasp on the United States for over a third of a century, though forbidden by circumstances to make a wide extension. *Aphthous fever* (foot and mouth disease), on the other hand, though twice imported into Canada within the last ten years, and on one occasion widely spread in New York and New England, was on each occasion easily and early extinguished, and with little or no effort on the part of the States. It might indeed almost be said to have died out of itself. Even the dreaded *rinderpest* has its poison early destroyed by free exposure to the air, in thin layers, at the ordinary summer temperature. Numerous experiments on hides hung up and freely exposed in warm weather, have shown that the infecting power is lost as soon as they are quite dried. But the poison of lung fever maintains its virulence for months in the dry state

in buildings, and we have known parks, with sheds, that proved regularly infecting year after year to all cattle turned into them. In other cases we have known the virus carried for miles on the clothes of attendants, and thus introduced into new herds.

"A far greater danger lies in the lengthened period during which the poison of lung fever remains dormant in the system. This averages about three weeks or a month, but may extend, in exceptional cases, to not less than two or even three months. An ox or a cow which has been exposed to the contagion may, therefore, be carried from one extremity of the continent to the other, may be exposed in a succession of markets, and may change hands an indefinite number of times, and be all the while in the best apparent health, though infallibly approaching the manifestation of the disease, and for the latter portion of the time spreading the germs of the malady to others. There is here an opportunity for the unscrupulous to sell off exposed and infected animals without the purchaser having the least suspicion of foul play. There is also the strong probability of animals that have contracted the disease by accident, in cars or otherwise, in passing to a new home, mingling with the herd of the new owner and infecting them extensively before there is a suspicion that anything is amiss. This long period of incubation after the animal is infected, and the equally long period of latency of the malady in animals he has infected, one or two of which only will be attacked at intervals of a month, lull suspicion as to the presence of contagion, and it is too often only after great damage has been done that the truth dawns on the mind.

"In aphthous fever and rinderpest, on the other hand, the disease shows itself in from one to four days after infection, and the surrounding animals are so rapidly attacked after the coming of the infected stranger, that there is no room for hesitancy as to the existence of contagion. Nor can the victims of these diseases be carried far from the point where they have been infected and disposed of as sound animals, so that in the very vigor and promptitude of their action we have an excellent basis for their restriction and control.

"DANGER OF INFECTION IN OUR UNFENCED STOCK RANGES.

"It is needful to note the above-named insidious progress and stealthy invasions of the lung fever, and to contrast them with the more prompt and open manifestations of the other animal plagues, in order to show the great peril to which we are subjected by the presence in our midst of a *pestilence* which literally *walketh in darkness.* Let us now consider the prospective infection of our great stock ranges. That this is inevitable, though slow, at the present rate of progress of the plague, has been sufficiently shown. That it might occur any day by an animal infected in an Eastern farm or stock-yard, or in a railroad car in which it was sent for the improvement of the Western herds, must be abundantly evident to every one who has read this article. If we now add the fact that more than one *thoroughbred Ayrshire* and *Jersey* herd has been infected with this disease during the past year, we are at once confronted with a strong probability of an early Western infection. Let us remember that thoroughbreds alone are carried West for improvement of native herds, and that a bull of the Ayrshire, Jersey, Holstein, or short-horn breed, taken from a herd now or recently infected, may be carried to any of our Western Territories and mingle for a month with the native herds before his own infection is so much as suspected; and we can conceive how imminent is the danger when the infection has reached our *Eastern thoroughbred cattle.*

"To illustrate the result of the infection of our unfenced stock ranges, I must quote another page from the history of this disease in other countries. The instance of Australia is the most recent as well as the most striking. The lung fever was introduced into Melbourne in 1858, by a short-horn English cow, which died soon after landing. Having been confined to an inclosed place, there is every reason to believe that with her the disease would have ended, had not a teamster turned his yokes of oxen into the infected park under cover of the night. These oxen working on the streets infected others, the disease soon spread to the open country, and the mortality increased at an alarming rate. Vigorous measures for its suppression were adopted, thousands of infected and dis-

eased cattle were slaughtered, but all proved of no avail Not only were the free, roaming herds infected, but so many places were contaminated that it was soon perceived that help from this source was not to be expected. Destroy a whole infected herd, and you still left the infection in the station from which, in its unfenced state, other herds could not be excluded, and where they were certain to take in the germs of the malady. After enormous losses had been sustained by the combined operations of the pest and the pole-ax, it was concluded that the remedy was worse than the disease, and the colonists reluctantly fell back on the expedient of inoculation. This is based on the fact that the disease is rarely contracted a second time by the same animal, and it can be practiced on all calves with losses at the rate of from two to five per cent. only, so that the mortality is insignificant as compared with the thirty to fifty per cent. which perish where the affection is contracted in the ordinary way. The great objection to inoculation is, that it can only be practiced at the expence of a universal diffusion of the poison, and of its maintenance in a state of constant activity and growth. With such a universal diffusion of the virus, the stock owners are virtually debarred from introducing any new stock for improving the native breeds, or infusing new vigor or stamina, inasmuch as such new arrivals would almost certainly fall early victims to the plague. Australia, therefore, now suffers from the permanent incubus of the lung plague, and can only import high-class cattle at great risk.

"This is an occurrence of yesterday, but it is only a repetition of the immemorial experience of the steppes of Russia. There we find the same conditions of great herds roaming free over immense uninclosed tracts, and all the facilities for an easy and wide diffusion of animal poi sons. There, accordingly, we find the home, in all ages, of the animal plagues of the Old World. To these endless steppes Europe and European colonies owe their frequent invasions of *lung fever*, *rinderpest*, *aphthous fever*, and *sheep-pox*. To these are to be charged the losses, to be estimated only by many thousands of millions, which have repeatedly fallen on the other civilized countries of the world. From these steppes the disease has spread over

the continent on the occasion of every great European war, dating from the expulsion of the Goths from Hungary by Attila and his Huns, in A. D. 376, down to the present Turkish war, which has secured the extension of the rinderpest to Hungary at least. On these steppes, too, the Russian veterinarians believe the rinderpest, at least, to be an imported disease derived from Eastern and Central Asia, yet all their efforts to crush out this or the lung fever, though receiving the freest support from the Russian Government, have failed. The same conditions exist, to a large extent, at the Cape of Good Hope; and there, too, the lung fever, imported in 1854, has acquired a permanent residence.

"Preventive Measures Demanded.

"Such is the history. Now comes the question pregnant with weal or woe to our future stock, agricultural and national interests. Shall we learn from the disastrous experience of others and extirpate the lung plague from the United States while it is still possible, or shall we sit quietly by with folded hands and await the inevitable, early or late, infection of our open Western stock ranges, and then repeat, for the benefit of other nations, the already twice-told tale of a desperate and extravagant but fruitless attempt to suppress a plague which we have criminally allowed to pass beyond our control? With or without a prodigal but vain effort to crush out the poison, the results may be thus summed up: The infection of stock-yards, loading-banks, cars and markets, and a general diffusion of the plague over the Eastern States. This would imply a national loss, by cattle disease, like that of England, but much more extensive in ratio with our great numbers of stock. Thus England, with her 6,000,000 head of cattle, has lost in deaths alone from lung fever in the course of forty years over $500,000,000. We, therefore, with our 28,000,000, should lose not less than $2,000,000,000 in the same length of time, allowing still a wide margin for the lower average value per head in America. And this terrible drain is for deaths alone, without counting all the expenses of deteriorated health in the survivors, of produce lost, of loss

of progeny, of loss of fodder no longer safe to feed to cattle, of diminished harvests for lack of cultivation and manure, of quarantine and separate attendants wherever new stock is brought on a farm, of cleansing and disinfection of sheds and buildings, etc., which become absolutely essential in the circumstances.

"We do not include the expense of supervising the trade, examining and quarantining the stock at the frontier of every State, and of the disinfection of cars, loading-banks, stock-yards and markets. If such were resorted to, after an extensive infection of our Western herds by lung fever, the cattle trade would be virtually stopped. Thus a safe quarantine for store cattle of not less than three months would be absolutely essential. Then the quarantine yards and sheds would be continual centres of infection, and would require to be very extensive, thoroughly isolated from each other, and constantly and perfectly disinfected, the air as well as the solids, to prevent the infection of newly-arrived stock. Such an incubus upon the trade would amount to a virtual prohibition. In rinderpest, sheep-pox, and aphthous fever, quarantine is a comparatively simple and available expedient, as the disease shows itself within a week; but, in lung fever, with the germs lying unsuspected in the system for one or two months, a protective quarantine is practically impossible wherever an active cattle trade is carried on. Hence in the countries of Central and Western Europe, through which the active traffic from the East is carried on, a complete control is usually maintained over rinderpest and sheep-pox, while the people have resigned themselves to the prevalence of lung fever as an unavoidable infliction. The same holds in Great Britain. Twice within eleven years has she crushed out invasions of rinderpest, and repeatedly has the same thing been accomplished for sheep-pox; but the lung fever is accepted as a necessary evil, between which and her large importations of continental cattle she must make a deliberate choice.

"Happily, in these United States, we are as yet under no such compulsion. The lung fever on American soil is still confined to the Eastern States and to inclosed farms, from which it is quite possible to eradicate it thoroughly

Of this possibility we have abundant evidence, alike in the Old World and the New. In several countries of Western Europe, through which there is no continuous cattle traffic between nations on opposite sides, this disease has been killed out and permanently excluded by an intelligent veterinary sanitary supervision. Sweden imported the disease in Ayrshire stock in 1847, but at once circumscribed the infected herds and places, slaughtered the diseased, disinfected all with which they had come in contact, and promptly extinguished the outbreak. Denmark, invaded the same year from a similar source, and on several subsequent occasions from Holland and England, as often quenched the poison by analogous measures. Oldenburg, Schleswig and Norway, successively invaded by the importation of infected Ayrshires, in 1858, 1859 and 1860, respectively, enjoyed a similar happy riddance, through the application of the same system of suppression. Switzerland, long slandered as the native home of the lung plague, has at last awoke to the truth of the statement of the immortal Haller, made more than a century ago, that this disease only occurs 'when an animal has been brought from an infected district'; and by the judicious use of suppressive measures, has permanently rid the country of the pestilence and demonstrated that the Alpine air is as clear and wholesome for beast as for man.

"In America, Massachusetts and Connecticut have furnished examples equally striking. The former imported the disease in Dutch cattle in May, 1859. In April, 1860, when it had gained nearly a year's headway, an act was passed, and a commission appointed, with full power to extirpate it. After the slaughter of 932 cattle, it was believed that this had been achieved; but new centres of infection were discovered in the two succeeding years, and it was not until 1865 that the commonwealth was purged of the poison. Since that year the lung fever has been unknown in Massachusetts. Connecticut has had a like experience, Her proximity to New York City and Long Island has brought upon her a series of invasions; but, profiting by the experience of her neighbor, she has, on each occasion, grappled successfully with the enemy, and driven him from her midst.

"What has been done by the Scandinavian nations, by Oldenburg and Switzerland, by Massachusetts and Connecticut, can be done by all of our Eastern States. On this point the teaching of history is as unequivocal as on the certainty of the irreparable results if our open Western stock ranges were infected. The one indispensable prerequisite to success is the vigorous and simultaneous action of the various infected States, and its persistent maintenance until the last infected beast has disappeared and the last contaminated place or thing has been purified. It matters little whether controlled by State or National government, if vigor and uniformity of action can be secured; but, as such combined and unflagging work is necessary, it could be best controlled by an intelligent central authority. The United States Government is as much called upon to defend her possessions against an enemy like this—so implacable, so relentless and so certain, if not repelled, to lay us under an incubus which will increase with the coming centuries, and dwarf the prosperity to which we are entitled—as against the less insidious one who attacks us openly with fire and sword. Let the national Congress consider this matter well. Let every stock-holder press it upon his Representative as a matter that cannot be safely ignored even for a single day. Let boards of agriculture, farmers' clubs and conventions, granges, and all citizens who value the future well-being of the nation, unite in a strong representation on the subject. If the present Congress should neglect it, let citizens make it a test question to every future candidate for their suffrages, and elect only such as are pledged to carry suppressive measures into effect. The danger threatens all classes alike, though the first sufferers will be the stock-owners; for every tax upon production necessarily enhances the value of the product; and, as agricultural progress must be seriously retarded, the tax will not fall upon meat alone, but upon every product of the farm. Nothing can excuse a continued neglect of this subject, the dangers surrounding which increase from day to day, and the final results of which, if once it reaches our Western and Southern States and Territories, can only be computed by the prospective increase of our population and our herds of cat-

tle. For this is not like an evil preying on our currency, banking, trade, or manufactures, the full extent of which may be, in a great measure, seen from the beginning, and the repair of which may be at any time inaugurated by legislative enactment. The animal plague only increases its devastations as we increase the numbers of our herds, and threatens soon to acquire an extension to which no legislation can oppose a check, and a prevalence in the face of which the most desperate efforts of the nation will prove of no avail. Thus, our cattle are increasing at the rate of 13,500,000 every ten years, so that, by the end of this century they may be exactly doubled, with a prospective loss, if our Western and Southern ranges are infected, of $130,000 000 yearly in deaths alone.

"The choice is now in our power. So far as we know, our stock-raising States and Territories are still unaffected. We can still successfully meet and expel the invader; next year it may be too late."

On April 15th, 1878, the New York Protective Bill became law, but no practical application of it was made until the present year. In the New York *Weekly Tribune* for November 27th, 1878, another call for action was made in connection with the prevalence of the disease around Washington. This was immediately quoted by various English papers and a demand was made for the embargo of American cattle. It was followed by the condemnation at Liverpool of the cattle shipped in January, on the *Ontario*, from Portland, Maine, by the institution of special inquiries by H. B. M. Consul-General in New York, by the mission of Professor McEachran on the part of the Dominion Government in the end of January, 1878, and his report that the plague existed in Washington, Philadelphia and Brooklyn, by the author's commission from Governor Robinson, February 6th, and his report of the presence of the plague in Kings and Queens counties, on February 9th, and by the Privy Council order of the same date that all American cattle should be slaughtered on their arrival at English ports. With

characteristic promptitude, Governor Robinson delegated General Patrick as his representative, and invested him with plenary powers to crush out the contagion.

This much may be allowed as showing the progressive steps that led to the inauguration of the present movement for the extermination of this disease on the Western Continent. In turning to consider specific measures for the prevention of the plague we must pass the different methods under review, consider which are adapted to our case and which inapplicable, and make references to special measures demanded by the the conditions of particular localities.

1. Protection of a Country against an Invasion of the Lung Plague.

(*a*) *Total Exclusion of Foreign Cattle and their unmanufactured Products.*

In the above it has been conclusively shown that no country has been invaded by this disease that has not imported cattle from without, and that countries like Spain, Portugal, the Channel Islands, the Scottish Highlands, Norway and Sweden that do not import but raise their own cattle exclude the pestilence though it may be raging fiercely at their very doors. If America were once purged of this desolating pest, and if for her permanent protection it were necessary to prohibit all importation of cattle, immunity would be cheaply bought at such a price. America can now show as good blood in her different races of cattle as is to be found in Europe; but if it were otherwise, what is the present or prospective value of a Duchess to the risk entailed on our 30,000,000 head of horned cattle and their offspring for all future time?

Of unmanufactured products, hides and hair are alone important, and as regards both, the risk is infinitesimal. Yet it cannot be denied that the contagium is preserved

for months in dried buildings, and as the same thing seems possible as regards dried hides and hair, it would seem that to insure perfect safety it must be enacted that no foreign hides should be carried in cars or other vehicles to be afterwards used for the conveyance of cattle or about places where cattle are found, and that cattle shall be rigidly excluded from all tanneries where foreign hides are received.

That such precautions are necessary is shown by the facts, that in the past year 3,039 cattle were attacked in 38 English counties; 1,522 in 23 Scotch counties; and 32 in 5 Welsh counties; that 1,932 head are reported attacked in Germany; that 698 are reported in Holland; that in France the existence of the plague is reported from the Department of the Rhine, La Rochelle, Ruen, Roubaix, Bourdeaux and Nantes; and that Switzerland and Belgium are infected.

(*b*) *Importation subject to a Quarantine which shall insure Protection.*

Exeptional cases will arise when it seems of the highest importance that foreign cattle should be admitted. This can only be done safely after a quarantine at the port of landing under the eye of an expert. The length of such quarantine must be determined by the time that the seeds of the plague may lie in the system unrecognized. We have seen that this cannot be safely stated at less than three months, therefore, the quarantine should last for this length of time. The infection of Norway and Australia by cattle that had passed through an incubation period of three months and of South Africa after a period of three and a half months must settle this period without appeal.

This having been represented to the Treasury Department an order was issued, July 19th, 1879, imposing a quarantine of 90 days on all European cattle, "except where State or municipal laws provide for the quaran-

tine of such cattle, and in such cases collectors will permit the proper officers to quarantine them in such manner as the State or municipal authorities require." This unfortunate exception allows the State or municipality to interfere so as to make the law a dead letter. There is nothing in this order to hinder the Aldermen of Brooklyn, or Baltimore, from authorizing the importation of European cattle, subject to one or eight days quarantine, and thus maintaining a permanent centre of infection in Long Island or Maryland. To protect the nation this law must be national and subject to no exception. If Section 2,493 of the Revised Statutes does not give the power to make it so, Congress should enact a law which shall be imperative for every port, all State and municipal rights to the contrary, notwithstanding. The country has too much at stake in this matter to sacrifice it to an idea.

(*c*) *Restrictions on Cattle from Neighboring States having an Insufficient Quarantine or none.*

If we exclude cattle, etc., from an infected country it follows, of necessity, that we must apply the same rule to any country that has an unrestricted trade with infected districts, or a trade the restrictions of which afford no sufficient protection against the introduction of the disease. This affects the United States in two ways: first, it will apply to importations made from Canada and Mexico, and second, it will apply to the cattle traffic between the Federal States themselves.

This matter was strongly urged on the Treasury Department, and July 11th the following order was issued:

"TREASURY DEPARTMENT,
"WASHINGTON, D. C., July 11th, 1879.

"*To the Collector of Customs, Chicago, Ill.:*

"The instructions of this department of February 27th, 1879, prohibit absolutely, under the authority of Section 2,403 of the Revised Statutes, the importation of neat cat-

tle from England. It is stated that neat cattle have lately been imported into Canada from England, and then shipped to the United States. You are hereby instructed that on the arrival at your port of any neat cattle from Canada, they shall not be admitted to duty under any conditions unless you shall be satisfied, first, that they were not imported into Canada from England, directly or indirectly; or second, that if imported into Canada from England, directly or indirectly, they did not arrive in that Dominion within ninety days prior to their arrival at your port. In no case shall such cattle from Canada be admitted if you have reason to suspect that they are affected with infectious cattle disease.

"Very Respectfully.

"A. V. FRENCH,

"*Assistant Secretary.*"

This is very well so far as it goes, but it fails to meet the case. It protects us against disease in imported English cattle, but not against Canadian cattle that may have mixed with imported cattle in the same herd and thereby contracted disease. Taking into account the occult forms of the disease and the occasional long incubation of two or three months, security would demand that we should exclude all cattle that had within three months come in contact with English cattle imported within six months of the arrival of such Canadian cattle at an United States port. Here we must allow for two successive incubations of three months each in the English and Canadian cattle respectively.

It is further deficient in not imposing a similar prohibition on the cattle imported from the other infected countries of Europe, and stock that have come in contact with these. At present we have the anomaly of United States importers of Dutch cattle having to submit them to a quarantine of ninety days, while the Canadian importer may introduce the same animals and ship them to us at once, free from all restrictions. Here the

discrimination is altogether in favor of the Canadian importer, who is virtually offered a premium upon his imports. Let *all* Canadian cattle importations from Europe be subjected to a three months' quarantine and let all cattle that have come in contact with such animals suffer a similar detention and we shall have meted out to them the same justice we apply at home, and established a reasonable protectorate over our native herds. We have at present no law to accomplish this; and, notwithstanding the best intentions, "The Treasury Department" cannot interfere with the traffic in Canadian cattle, unless they have been imported from Europe within three months. Here there is a field for legislation, and if Canada will not extend her quarantine so as to make it a protection to herself and us, Congress must step in and forbid the importation of Canadian cattle, except under a quarantine of three months. As already remarked of the fountain—Europe—so of the channel—Canada—the United States can better afford to do without her cattle than they can risk the infection of their home herds.

2. Protection of Herds in Infected Countries having no Legislation.

While individual States decline to stamp out this pestilence, we must offer such suggestions as shall aid the citizens to protect themselves. The following suggestions are submitted:

(*a*) *Breed your own stock.*

All experience with this plague shows that it spreads in direct ratio with the changes of stock. Countries and districts which, like the Channel Islands, Denmark, Norway and Sweden, breed their own stock and never import, preserve healthy herds. Single herds, even, that are kept secluded, escape in the most plague-stricken countries, though the disease is raging all around them. It is the dealer, who is constantly changing his

stock, and those who buy from the dealer, that lose by the infection. As a single instance, I may repeat what an Irish Earl (Lucan) told me of his experience. On his Irish estates he lost heavily and continuously, until he decided to exclude all strange cattle and men. The moment a beast was observed sick he removed it from the herd, and in three months his stock was healthy and continued so. This is the common experience of those who *breed their own stock,* and instances are given in this article of its perfect success in the plague-stricken districts in New York.

(*b*) *If compelled to buy, do so in a healthy district and transport in disinfected cars or by roads where there will be no contact with suspicious herds, and in no case through a district in which infection is known to exist.*

(*c*) *When newly purchased cattle are taken in, place them in quarantine in a safely enclosed barn or lot, at least* 100 *paces distant from all other cattle, and under special attendants.*

The need for these precautions must be evident, as the disease sets in and makes some headway before even a watchful attendant will observe any signs of illness.

3. Measures for Restricting the Mortality of the Plague in Generally Infected Districts.

(*a*) *Preventive Medication.*

In infected herds much may be done to check the development of individual cases, by the daily administration of astringent tonics, and especially if they are also disinfectant. In herds at pasture and even in those kept in close and notoriously infected city stables, the daily use of 2 drachms sulphate of iron (ferric sulphate) has frequently, in our experience, put a limit to the disease within a month. If to the sulphate is added one drachm of carbolic acid, the efficacy will be increased. The same virtue has been claimed for a number of other astringents which it is needless to mention.

What is better, because more prompt in its action, is the inhalation of the fumes of burning sulphur.

To Dr. Dewar, of Kirkcaldy, Scotland, belongs the credit of having first tested this agent on the bovine lung plague. He selected a city stable where sickness had been continuous for 20 years, and where the last victim had been hauled off three days before. He had the herd fumigated twice a day for half an hour each time and had no other case of sickness. I can furnish a number of similar cases. Patrick Green, West Farms, put a large herd in infected stables in April last and by July had lost nine head. He began fumigating the remainder and has not lost an animal since. Timothy Ryan, Ridgewood, kept a herd of about 25 cows and had lost 20 within a year. His place was so saturated with the infected products that our own inspectors and veterinarians from a distance concluded that burning would be the only effectual purifier. He began fumigating June 15th, and though 7 of his remaining 22 cows were fresh from the country, he has not had a case of sickness since —now three months. This measure must be applied most thoroughly to be effectual and cannot be trusted to check disease which has already seated itself in the lungs. It is only when the germs have been deposited on the surface of the air passages and have not yet made their way deeply into its substance that good results can be hoped for. The following printed instructions are distributed to the owners of infected herds:

"The surviving herd should be shut up in a close building for half an hour once or twice a day, and made to breathe the fumes of burning sulphur. Close the doors and windows, place a piece of paper on a clean shovel, lay a few pinches of Flowers of Sulphur upon it, and set it on fire, adding more sulphur, pinch by pinch, as long as the cattle can stand it without coughing. Continue for a month."

(*b*) *Isolation.*

When a herd is infected, the arrest of the disease cannot be hoped for unless the sick are removed from the healthy. The constant breathing of the infected air is likely to be much more deleterious than the preventive medication will be beneficial. On the other hand, the prompt removal of the sick on the first appearrnce of illness will often succeed in checking the disease, irrespective of any other measure.

(*c*) *Inoculation.*

Under this heading must be considered: 1st. What inoculation is. 2d. Does successful inoculation prove vicarious of the plague? 3d. If vicarious, when is it applicable? 4th. In what conditions is it to be condemned?

Inoculation: Its Author, Mode, Etc.

In December, 1850, Louis Willems, M. D., of Hassalt, Belgium, son of a large distiller, began his essays on inoculation. To determine the susceptibility of different animals, he inoculated with the exudation matter from diseased lungs 6 rabbits, 23 pea-fowls, a number of chickens, 4 dogs, 3 sheep, 7 hogs and 2 goats, but in all the wounds healed without any unhealthy action. These animals were accordingly set down as insusceptible. Accidental wounds of human beings were equally harmless. He instituted experiments on several cattle which he inoculated with the liquids from healthy lungs. The result was only slight inflammation followed by healing.

He inoculated three cattle, respectively, with blood, buccal mucus and intestinal tubercle taken from sick cows. These produced but slight inflammation, followed by prompt recovery.

He inoculated 108 cattle with the pulmonary exudation of diseased lungs. In a period averaging fifteeen days after inoculation a swelling occurred in most of these in the seat of inoculation, and though afterwards kept in an

infected stable all these animals resisted the disease. Of fifty uninoculated animals placed in the same stables, seventeen became diseased.

He further re-inoculated ten cattle that had been already successfully inoculated, and all the wounds healed promptly without any local swelling such as marked the other cases from the tenth to the thirtieth day.

In none of these cases was there any indication of disease of the lungs, and in a number that were killed these organs were found healthy.

He concluded that when the virus is inoculated on a susceptible animal, "a new disease is produced; the affection of the lungs with all its peculiar characters is localized in some sort on the exterior;" and that this disease is preservative against all future attacks of pleuro-pneumonia.

Various commissions were appointed by different European Governments to determine the matter by experiment. The Dutch Commission composed of the Faculty of the Veterinary School at Utrecht reported in 1852 that out of 247 head of cattle inoculated sixteen afterward contracted the disease, these being mainly composed of such as had the least local swelling in the seat of inoculation. They reported that inoculation had "a power, at least temporary, of securing against the contagion of pleuro-pneumonia."

The Belgian Commission, presided over by Professor Verheyen, inoculated 197 cattle, fourteen of which were afterward kept in stables with infected animals without contracting the disease.

The French Commission, presided over by Professor Bouley, inoculated 54 cattle, of which 48 survived and were made to cohabit with diseased stock. But one of these contracted the plague.

Meanwhile Dr. Willems and 54 veterinary surgeons inoculated 5,301 head of cattle, of which 55 afterward

contracted the lung plague on exposure to infection, and in periods varying from the 17th to the 136th day after the operation.

In England a commission was appointed and after a series of experiments in 1854–5 they reported adversely.

Since that time inoculation has been adopted extensively in Europe and still more largely in Australia and South Africa, until to-day it is acknowledged by all who have given attention to the subject that for the individual animal, it is as surely protective as is vaccination for small-pox, and that attacks of lung plague after successful inoculation are little if at all more frequent than are second attacks of variola.

Mode of inoculating.—The material to be used in inoculating is the fresh liquid exudation that may be pressed from the substance of a lung in the earliest stage of the disease. If it is to be preserved for any length of time it is best done in hermetically sealed glass tubes. A glass tube one-third inch in diameter is drawn out to a point at each end and sealed in a blowpipe flame, the whole length of the tube having been heated to redness before the second end is closed. This destroys all germs that may be present in the tube and expels most of the air. When the liquid has been drained from the lung into a clean dish one end of the tube is immersed and broken off under the surface. Immediately the fluid rises in the tube and nearly fills it. The open end is again to be sealed in the blowpipe flame and the tube packed away in a safe place till wanted.

The most eligible place to inoculate is the tip of the tail, since in case of excessive swelling or threatened gangrene the diseased portion of the organ may be cut off and a possibly fatal result avoided.

The mode of inserting the virus differs with the operator. Dr. Willems plunged a lancet, charged with the

virus, several times through the skin on the end of the tail. In Australia, a worsted thread charged with the pulmonary exudation is drawn through beneath the skin and left *in situ.* Sticker used a hollow needle with diamond-shaped point attached to an India rubber bag containing the fluid. The needle having been inserted under the skin, the bag is squeezed so as to lodge a single drop in the tissues as it is withdrawn. As a modification of the same I have always used the common hypodermic syringe carefully purifying it with boiling water before and after use. Nicklas and Bartels recommend that the liquid be lodged immediately beneath the epidermis, as being less likely to cause dangerous and gangrenous swellings than if inserted more deeply. Aside from this, that method is the best that exposes the inserted matter least to the action of the air, there being less danger of putrefaction and dangerous swellings. In my experiments with the hypodermic syringe I have lost from two to four per cent from such swellings and there can be little doubt that even these could have been saved had the tails been amputated in time.

After treatment is seldom wanted. Willems recommends a pound of Epsom salts on the tenth day after the operation. In case of much swelling, astringent and antiseptic washes are recommended, but prompt amputation is much safer and if resorted to early enough usually prevents those extensive swellings around the root of the tail and in the pelvis which occasionally prove fatal.

Can the Lung Plague be Spread by Inoculated Cattle?

Almost all advocates of inoculation deny that an inoculated animal is at all dangerous to others. In this they throw the gravest doubt on the value of the operation as a preservative. The liquids inoculated are the virulent products of the lung plague, and as these do not induce disease of the lungs but only of the tissues where they

are inserted, it cannot be supposed that they exert any influence on the economy through any direct action on the normal seat of the disease. If protective at all it must be by reason of the reproduction of the germs in the blood or in the seat of inoculation. If in the blood there must be danger of their being given off by the various free surfaces and notably by the lungs. If in the tail, there is still the risk of the germs escaping from the wound, drying up in the building and being inhaled by other cattle with fatal results. It is true that the risks are incomparably less from germs escaping from a wound in the tail than from those exhaled with every breath from the diseased lung and diffused through the whole surrounding atmosphere. Yet even from the inoculation wound the disease has been conveyed. Reynal mentions the case of an inoculated Brittany cow at the Alfort Veterinary School which infected two others standing with her.

I have now under observation a stable into which the lung plague is alleged to have been introduced through the inoculation of the cows four months ago. The stumptails attest the reality of the inoculation, the raw ends of several its recent adoption, and yet the sickness prevails. Again, it has been shown in localities in New Jersey and elsewhere when inoculation has been practiced on a previously healthy herd a certain number of animals have afterward manifested the disease.

Reason and experience agree in showing that the poison may be thus introduced into healthy stables and therefore *inoculation must be absolutely condemned* whenever a speedy and effectual *stamping out* of the disease is desired. No country has ever succeeded in exterminating this plague by practicing inoculation, The most ardent votaries of the practice, Belgium, Holland, Prussia, England, Australia, South Africa, New York and New Jersey have preserved the plague for decades in spite of the

most earnest efforts of this kind. It may be conceded that by means of inoculation the disease has been quickly passed through individual herds, and that when a country or district makes inoculation universal that the mortality is greatly reduced, yet the adoption of the operation for healthy herds but multiplies the centres of infection, and when a country is subjected to this, the plague is inevitably kept up by the occasional contamination of young and uninoculated animals.

On the other hand, there are conditions in which inoculation is to be commended. On the steppes of Eastern Europe and Asia, on the open lands of Australia and South Africa, where herds mingle day by day and infection cannot be rooted out by any process of slaughter and disinfection, the practice of inoculation is found to reduce the losses to a minimum. In certain other conditions the operation would be admissible. In the case of large herds occupying insular or equally secluded localities, where the contagion is already widely diffused and still spreading from beast to beast, it may be good policy to inoculate the whole herd, and after recovery from the inoculation to subject the whole to inspection and dispose of any still showing traces of the plague. In such a case all calves born in the herd must be either destroyed or immediately inoculated as circumstances may suggest. If calves are constantly coming their destruction will be requisite, as a continuous inoculation will entail the maintenance of the plague. In this way such an insular place might be cleared of the plague in a few months, whereas the resort to a similar course in a thickly settled district has always been shown to keep it up.

Passing the Young through the Plague.

In some countries, where the plague is all but universally distributed, those running large dairies have found it profitable to pass all their stock through the disease

while calves. Mr. Harvey, of Glasgow, packed his calves in close buildings, sandwiching them between sick animals, and thus passed all susceptible ones through the disease. He afterward turned these out on a farm to grow up and finally introduced them into his city dairy as milch cows. The loss of 20 per cent. of his calves was a small outlay as compared with as many cows in milk, so that he found the course quite a profitable one. It is needless to say that this practice is still more objectionable than inoculation, and like that should be strictly prohibited wherever measures are being taken to eradicate the disease.

STATE MEASURES TO STAMP OUT THE PLAGUE.

1. For Country Districts with Inclosed Farms.

(*a*) *Prevent Importation from Infected Countries or Channels.*

This subject has been already discussed above and need only be referred to here as indispensable to the stamping out of the disease. It is needless to attempt to crush within our own borders that which we are constantly introducing the seeds of from abroad. As well keep sowing our land with thistles while we are toiling day and night to eradicate them.

(*b*) *Proclaim Infected Localities.*

This is all essential for the protection of the public who could not otherwise avoid such places in the purchase and transit of stock. The insertion of such proclamation in the local papers and the posting of it in the post-offices or other places of public resort, will usually serve every purpose. The proclaimed district may be one or more towns, counties, or states, as the case may be, and thus the proclamation may come from Governor or President, in different cases.

(*c*) *Stop all Markets and Fairs in Infected Districts.*

Wherever cattle are brought together from different herds, any existing contagion is spread with their distribution. Where lung plague exists there is the strongest temptation, and the amplest opportunity for the owner to pick out the apparently healthy from the infected lot and send them to market. Many of them will not sicken for one or two months after the purchase, and by this time they will have infected many herds in all districts, far and near. To avoid this otherwise inevitable result, all collections of cattle in infected districts, whether for sale or exhibition, must be strictly prohibited.

(*d*) *Stop all Movement of Cattle in Infected Districts except under License after Examination of the Herd by an Expert.*

To the movement of cattle from herd to herd there is precisely the same objection as there is to markets and fairs. The existence of the disease in a herd is often unknown to the nearest neighbors, as its publication would interfere with the sale of stock, meat or milk. It is, therefore, an easy matter for an unscrupulous owner to sell the still apparently healthy animals, one by one, to unsuspecting parties and thus realize a salvage from his own infected herd by spreading the plague widely throughout the herds of his neighbors. If, however, cattle are moved only after *the herd* has been examined by a veterinarian and an assurance has been given that no contagious disease has been present in it for the past six months, this danger is in great part done away with. It is requisite, however, to examine the whole herd from which the animals are to be moved, as otherwise infected animals in which symptoms have not yet developed will pass the closest scrutiny and be sent on to spread the pestilence.

(*e*) *Prohibit the Pasturage together of the Cattle of different Parties except under the Affidavit of each Owner that His*

Stock has been clear of Contagious Disease for the Past Six Months Immediately Preceding.

Here the danger is the same as in the case of fairs and markets, and without the restriction named, apparently sound cattle from infected herds or premises are sent upon common pastures and when later the different herds are taken back by their respective owners they carry with them the seeds of sickness and death to others.

(*f*) *Prohibit Absolutely the Pasturage of Cattle on Unfenced Grounds and Highways.*

In infected localities pasturage on roads and open lots is one of the most fertile sources of infection. Healthy herds turned out in this way come in contact with neighboring or passing infected ones, or with the places where they have immediately preceded them; apparently sound cattle from infected herds carry the virus to healthy ones or breathe upon and soil the grass on which these afterward browse, and thus the malady is spread ere any suspicion is aroused. Many think to save their stock by having them herded or tethered, but the idea is a most fallacious one, as may be seen from the examples of the transmission of the contagium through pastures in Australia and elsewhere. The only course of safety is to exclude all cattle from open lots and highways and to utilize the products of such by mowing and soiling when this is necessary.

(*g*) *License Stud Bulls in Healthy Herds to Serve Cows from Sound Herds.*

The danger of contagion from sending cows from infected herds to healthy bulls, and *vice versa*, necessitates this provision. Yet as the business usually demands dispatch, a license may be given for all safe bulls in the district and a running permit to the owners of sound herds of cows empowering them to take cows to the nearest of such bulls without loitering or pasturing them on the way.

(*h*) *Make it Incumbent on all Cognizant of the same to Report to a Designated Official all Cases of Disease in Cattle Supposed or Suspected to be Contagious.*

This is, of course, especially incumbent on the owners, but should be made to embrace all attendants, veterinarians, visitors and all good citizens. The reasons for this are obvious, but they will be set forth more fully under the head of *Indemnity*.

(*i*) *Make it the Duty of Some Designated Local Authority to Receive this Report and to Order an Examination by a State Veterinary Inspector.*

Such local authority ought to be a Justice of the Peace, Police Magistrate or other Judge of the District, who can not only administer the law but promptly punish offenders. The judges in question will then make themselves acquainted with the law and will mete out more rigid justice to parties brought before them than if they had no such direct duty in the matter. They come to the subject already clothed with the dignity and authority of the law, and the moral influence is far better than if a State official, outside the judicial bench, had to apply the law and appear to prosecute the offenders. Besides, if a magistrate is not directly interested in the matter and specially acquainted with it, he will often decide a case in favor of the offender and to the serious detriment of the sanitary work.

(*j*) *Indemnity. If the Inspector Ascertains the Existence of Lung Plague, he shall Estimate the Value of the Sick, or have it done by Disinterested Appraisers, and Report the same to the Local Authority as the Basis of Indemnity.*

The principle of allowing indemnity for animals slaughtered is fundamental to success, and according to the liberality of the award, is usually the success of the work of extermination. Withhold indemnity and owners withhold reports of sickness, hide away or slaughter the diseased and throw the remainder of the infected herd

on the market with most disastrous results. The main purpose of the indemnity is not, as many suppose, the re-imbursing of the owner for his loss, but rather the speedy discovery and extinction of every centre of contagion. The real value of the sick animal is usually of no account, and considering the danger of immediate and prospective infection of other animals by proximity and through the infected buildings, the dangers incident to its preservation far more than counterbalance the actual worth. But the prospect of a recovery, of having an animal that is no longer susceptible to the disease, and the many drawbacks in the way of injury to business, will usually deter the owner from making his losses public. In all countries where the disease has been rooted out it has been found that no penalty for concealment is half so effectual as a liberal remuneration for animals sacrificed. Then, again, an indemnity which will encourage owners to report is a measure of the wisest economy. While the existence of disease is concealed, the State is thrown back on a slow and laborious examination of herd by herd and beast by beast, conducted by veterinarians, and even then there are a thousand ways of secreting the sick in out-of-the-way places and subjecting only the apparently healthy to examination. Where, on the other hand, the owners have every encouragement to report sickness, the skilled veterinarian is only wanted to decide as to the nature of the sickness reported, and the State is saved at least nine-tenths of the expenses for professional inspections.

For these, among other reasons, I have always advocated a liberal indemnity: and every day's experience with the plague shows more and more clearly the wisdom of this. The sick should, therefore, be appraised at their full value as if in health and the award should be no less than half of this estimate. I would even favor a two-thirds value as more efficient and economical, as it would

insure a more prompt report of every case of illness. The only objection to a full sound value, and it is an insuperable one, is, that it places a premium on sickness and would encourage the unscrupulous to convey infection into an unmarketable herd for the purpose of disposing of them to the State. If this danger is guarded against it will be found that the highest award for sick animals slaughtered will prove most profitable to the commonwealth. It will assure what is almost unattainable in any other way—a speedy and economical success.

(*k*) *Diseased Animals to be Slaughtered under the Eye of an Inspector, their Hides Slashed and the Carcasses Deeply Buried in a Secluded Place.*

The importance of this need hardly be insisted on. So long as a sick beast is preserved it is but multiplying the poison, diffusing it through the air, and storing it up in the buildings. This poison it is impossible to circumscribe, absolutely, except by its instant destruction. It may be wafted on the air, carried on straw, paper and other light bodies on which it has been dried, in the clothes of visitors, on the coats of domestic animals (horses, dogs, sheep, goats, cats), or of wild (rats, mice, skunks, etc.), and by numerous channels it will elude our vigilance and extend to neighboring herds. (On this subject see *Mediate Contagion.*) The only course of safety is to stop the production of the poison and bury what already exists where it can be no more exhumed. Before burial the hide should be extensively cut to prevent its removal for sale.

(*l*) *Disinfect the Premises, Utensils and Attendants.*

To kill the sick without subsequent disinfection of the premises is futile. *Stamping out* is by no means confined to the use of the pole-ax. Every place and object on which the virus may have been lodged must be subjected to an exhaustive disinfection if we would stay the progress of the plague.

For stables our printed instructions embrace what follows:

"1. Remove all litter, manure, feed and fodder from the stables; scrape the walls and floor; wash them if necessary; remove all rotten wood.

"2. Take Chloride of Lime one-half lb., Crude Carbolic Acid 4 ozs., and water one gallon; add freshly burned Quicklime till thick enough to make a good whitewash; whitewash with this the whole roof, walls, floors, posts, mangers, drains, and other fixtures in the cow stables.

"3. Wash so as to thoroughly cleanse all pails, buckets, stools, forks, shovels, brooms, and other movable articles used in the buildings, then wet them all over with a solution of Carbolic Acid one-half lb., water one gallon.

"4. When the empty building has been cleansed and disinfected as above, close the doors and windows, place in the centre of the building a metallic dish holding one lb. Flowers of Sulphur; set fire to this and let the cow shed stand closed and filled with the fumes for at least two hours. The above should suffice for a close stable capable of holding 12 cows. For larger or very open buildings more will be required.

"5. The manure from a stable where sick cattle have been kept must be turned over and mixed with Quicklime, 2 bushels to every load; then hauled by horses to fields to which no cattle have access, and at once ploughed under by horses.

"6. The pits, where the manure has been, must be cleansed and washed with the disinfectant fluid ordered for the building (Sec. 2).

"7. The surviving herd should be shut up in a close building for half an hour once or twice a day, and made to breathe the fumes of burning sulphur. Close doors and windows, place a piece of paper on a clean shovel, lay a few pinches of Flowers of Sulphur upon it, and set it on fire, adding more sulphur, pinch by pinch, as long as the cattle can stand it without coughing. Continue for a month.

"8. Give two drachms Powdered Copperas (Green Vitriol) daily to each cow in meal or grains; or, divide 1 lb. Copperas into 50 powders, and give one daily to each adult animal.

"9. Do not use for the surviving cattle any feed, fodder nor litter that has been in the same stable with the sick. They may safely be used for horses and sheep."

In certain cases further measures are needed, as removal of the flooring and soil beneath, or even the cremation of the entire structure. Drains must also be cleansed.

(*m*) *Quarantine the Premises for Three Months after the last sick Animal has been Killed or has Recovered.*

Free and continuous exposure to air is one of the best disinfectants, and after the disinfection the exposure of the empty premises with the doors and windows open for three months will usually complete the purification.

(*n*) *Hay, Fodder and Feed in Infected Buildings to be Destroyed or Fed to Horses, Sheep or Pigs.*

It is needless to insist upon this as such fodder has been subjected to the fever-laden breath of the sick and should only be used for animals that are insusceptible to the contagion.

(*o*) *Manure from Infected Herds to be thoroughly Disinfected with Chloride of Lime, or Hauled out by Horses to Fields adjoining no Cattle Pastures, and then Ploughed under.*

Though we cannot say that the defecations as passed are infecting, yet, as they lie in and around infected stables, they are liable to take up and convey the infection, and we have repeatedly traced outbreaks to this source.

Like fodder, however, it is harmless to horses, and provided these do not stand as mates with cattle they may be safely used in disposing of it. In the vicinity of cities it can be safely applied on market gardens.

(*p*) *Pastures where Sick Animals have been to be Secluded for Three Months after their Removal.*

We have already seen the danger of infected pastures and notably in the case of Australia, and as these cannot be purified artificially we must allow time for the action of nature's great natural disinfectants. The time necessary will vary somewhat in different cases, thus in a mild climate with frequent alternations of rain and sunshine it may be considerably less than in the dry Australian climate, or in the winter season of our northern States when everything is for months bound up in frost. Three months may be fairly accepted as a good average.

(*q*) *Make a Register of each Infected Herd with a Personal Description of every Animal.*

By adopting this precaution a perfect control may be kept up by non-professional inspectors, and the frequent visits of the more expensive veterinarian largely dispensed with. The check too is all but perfect, as, if an animal disappears it must be accounted for and no beast can be replaced by another without detection.

For this purpose a personal description is usually a better safeguard than any mark or brand which may be counterfeited.

NEED FOR SPECIAL MEASURES IN CITIES.

The eradication of the Lung Plague from fenced country districts is a very simple affair, to be easily and speedily accomplished at but little cost, but when we come to the cities we find a totally different state of things, requiring special restrictive measures. To illustrate this I must enter somewhat into the nature of the city dairy interest.

Supply of Fresh Cows.

Under ordinary circumstances the fresh cows are supplied from country districts and most of them come in sound. When, however, disease exists in the adjacent country the city is the readiest market for animals from

an infected herd, and the unfortunate farmer too often unloads his suspicious beasts on the still more unfortunate city milkman. Such cows pass through the ordinary channels, and in their course infect cars, ferry-boats and cattle-yards so that ere they reach their destination they have often done most material damage. Thus, when we began our work in New York we traced many outbreaks to cows from infected districts in New Jersey, and others to the infected sheep-house at 60th street, where many fresh cows were kept for sale. This was promptly stopped; but we had then scarcely begun to meet the difficulties.

The fresh cows are mostly sent to the city consigned directly to dealers, or to speculators who in their turn employ cow-dealers to dispose of them at a commission. On their arrival by boat or rail some are sold directly to the milkmen, and the others are mostly sent to dealers stables to be disposed of later. A number of the New York dealers keep their cows in the Union Stock yards at 60th street, and until the present law was enforced they kept them in the sheep-house.

We must go a step further to show the dangers of this. A great majority of the city milkmen are poor, keeping from one to a dozen cows, and their losses are so heavy that they can rarely get money enough to pay for their cows when bought. The cows are accordingly left with them on trial, and the payments made in installments. If a cow fails to milk as represented she is rejected and the dealer replaces her by another, taking the first to another customer, or in the absence of a customer back to his own stables, or as was the case formerly in New York back to the Union Stock Yards. Such cows transferred from city stable to stable in many cases carried contagion with them, and when returned to the dealer's stable or stock-yard they infected these places and indirectly all cows that afterward passed through these. Thus it

was that every dealer's stable became sooner or later a pest-house and a centre from which the disease was constantly spread in all directions. The same was the case with the Union Stock Yards where at first we found sick animals standing that had been brought in from city stables.

A second dangerous practice of dealers was the peddling of cows which were driven from herd to herd, and too often at night or during the heat of midday, were stabled with herds where they happened to be overtaken. In this way they usually took in the disease germs if they were not already affected, or if they had already taken them in they diffused them wherever they went.

Then, again, the cows that were given out on trial were too often those that were in the earlier stages of the disease, or but partially recovered from it, that were doing badly in consequence, and as no one cared to keep them they made a hasty progress through a number of herds, infecting them all in turn.

Pasturage on Commons.—Another prolific source of the disease in cities, is found in the abundance of open grounds intended for building and held by speculators in prospect of sale. On such unfenced grounds the poorer owner of two or three cows and even the holder of a score or more, turn out their cattle daily to pasture, and as herd mingles with herd the sick infect the healthy, and soon a whole neighborhood is contaminated by one sick beast. There is usually an understanding that sick cows are to be kept in, but this is often neglected, and even where adopted it but hides the danger for the slightly affected and those that are recovering, but retain in the chest an encysted mass of infecting material, are turned out and transmit the disease freely. Some seek to protect their cows by herding them on such places, and others by staking them, but all such measures must be futile so long as they are allowed to graze where sick cattle have been before them.

It is from this cause, mainly, that the disease has been always more prevalent at the end of the summer than in spring, and at the present time we still find more disease in districts such as Brooklyn and its outskirts, where, owing to local obstructions, we have been unable to enforce a sound pasturage law, than in New York and elsewhere, where this law has been respected. In these city commons we have the counterpart, on a small scale, of the immense common pastures of the Russian steppes, and the Australian and South African ranges, and it is mainly to this characteristic and to the special features of the cow trade in the cities that the lung plague has been maintained in America for the past 36 years.

Facilities for Secret Sale and Slaughter.—The preservation of the plague in cities is further favored by the ease with which the sick may be thrown on the meat market. In country districts the prejudice is so strong that it is usually impossible to dispose of even a sound animal from an infected herd to any district butcher. But in the cities the source of the beef is not so easily ascertained and butchers are not slow to kill anything that stands upon four legs. Hence the owner will often hide the existence of the disease to save his milk business and dispose of the sick for beef.

Were the city possessed of but one abattoir, this might be easily controlled; but when slaughter houses are scattered every where and cattle are killed at all times of the day and night, this is difficult or impractible and at best very expensive.

I cannot do better than quote the measures we have adopted in New York to meet these conditions.

1. Control of Imports.

Source.—Cows and store cattle are admitted only as they come by the Hudson River R. R. and Harlem R. R. from points north of Putnam County; by the New Haven

R. R. from Connecticut; by the Erie R. R. from points west of Rockland county and excluding stations between Goshen and the western line of Orange County, such cattle to be transferred from the Oak Cliff stock-yards to the Union stock-yards, N. Y., by a special boat—the *Can isteo*—retained for this purpose.

Store cattle from New Jersey and Long Island are absolutely excluded, excepting in the case of private cows that have been kept apart from all other cattle, have been healthy for at least six months and are to be kept in a private stable or pasture in New York. Such are admitted on permit given after examination by an inspector.

Point of Arrival and Detention.—All fresh milch cows and other store cattle must come to the Union Stock-Yards and enter the yards set apart for them where they will be inspected and detained until ready to go to their final destination.

With characteristic energy, the Union Stock-Yard Company have constructed a number of new yards for this purpose on the south side of 59th street and have subjected the sheep-house to a thorough disinfection so that cows, etc., can be safely kept in the new yards and calves in the sheep-house. Thus our most prolific source of disease has been abolished.

Distribution of Cows to City Dairies.—No cow is allowed to leave the stock-yard to go to any dealer's stable in New York and be thence transferred to a milkman's stable. If she enters a dealer's stable she must remain there until ready for slaughter and must go straight to the abattoir. Cows sold to milkmen must go from the yards on permit, direct to the milkman's stable. Once a cow has entered a milkman's stable she cannot be transferred to another milkman, to a dealer's stable nor to the Union Stock-Yards. She must be kept on from year to year or fattened and killed for beef.

Here, at one blow, we do away with the infecting deal-

er's stable and the pestiferous system of peddling cows from herd to herd and of placing infected cows for trial in a number of herds successively.

In such a city as New York it was impracticable to stop the cow market; but by this arrangement we can control it so as to reduce its evils to the minimum. The system as above sketched has only been perfected for a short time, but already it has given the most encouraging results having almost completely extinguished the plague in that city. The milkmen heartily approve it, as they now receive their cattle with a guarantee of health, and by buying at the yards they have a better choice and can make better terms than under the old system of buying from the dealer's stable and peddler's drove. Then, too, they find that the introduction of a fresh cow is not the signal for a new appearance of disease, as was so commonly the case in times past. It would be difficult, to-day, to impose upon a New York milkman a cow that comes without General Patrick's permit and the inspector's marks. Most dealers who formerly kept their cows at the Union Stock-Yards like the system, for a sale is now a *bona fide* sale and brings the money in place of promises to be redeemed little by little at uncertain intervals. Some grumble, but only because they can no longer pursue their calling at the expense of a constant propagation of disease.

Disuse of Quarantine Notices.—In a locality controlled as New York city now is, the posting of quarantine notices on buildings is more injurious than beneficial. No cows can enter the premises except with a permit on which the destination is stated and none can leave except for immediate slaughter. The object of the notice is fully attained by these measures, and the notice on the building without accomplishing any good, imperils the sale of milk from the herd, and, in fear of this, the owner is liable to hide the existence of disease. For

the same reason that I advocate a liberal indemnity, I advocate the disuse of quarantine notices in such circumstances. Here, as everywhere, the best success depends on the hearty co-operation of the owners of cattle.

Control by the Police.—An order of the Commission of Police was obtained calling upon the force to apprehend all parties moving cows or other store cattle without a permit signed by General Patrick, and to impound all cows or other cattle pasturing on streets or unfenced places. To their credit, be it said, they have carried out this satisfactorily and have contributed in no small degree to the success of our work. Reference has already been made to the value of magistrates as local authorities, and I would here suggest the vital importance of providing in any future law, that the police and village constabulary assist in carrying out its provisions.

Denying Permits, etc.—Any dealer who violates the rules is punished by the refusal of permits for the movement of cattle until he gives bonds to abide by the law in the future, and in case he continues to violate, he is prosecuted by the District Attorney.

Movement of Calves and Store Cattle.—These are detained in the yards until sold and then sent on permit to their destination.

Examination of all Dead Cattle at the Offal Dock.—All animals that die in the city of New York are sent to the offal dock and thence to the rendering works at Barren Island, so that by sending an inspector daily to this dock to open all dead cattle, we can trace the existence of the disease to any part of the city and take the necessary steps for crushing it out. In this way one man can accomplish more than five would if engaged in the examination of herds, beast by beast.

Systematic Inspection of Herds.—Notwithstanding the difficulties attendant on a personal inspection of the animals, this is vigorously prosecuted and now the greater part of the city has been overhauled.

Other Measures.—Beside the above, we apply in the cities all the rules above cited for the country concerning pasturage, bull-licenses, reporting sickness, inspection, condemnation, appraisement, slaughter, indemnity, disinfection, quarantine, disposal of fodder litter, manure, etc., and the registration of herds.

I need only add that since its complete adoption our progress has been most gratifying and we can now almost claim a perfect immunity for New York city.

But our safety as a State depends on the safety of our neighbors, and we need to secure such action from the separate infected States as shall banish the plague from the Continent. With New York as a great centre of cattle trade from the South as well as from the West we must inevitably become infected anew unless we keep up an expensive and vexatious system of quarantine against New Jersey, Pennsylvania, Delaware, Maryland, Virginia and District of Columbia. The disease is slowly spreading south and west from Alexandria. I have a list of 20 herds infected in one line south of that city within the past three years. The plague threatens to reach our southern and western ranges whence it will be as impossible to eradicate it as from the Russian steppes, Australia and South Africa, and from which continuous accessions of infection will be thrown upon our Middle and Eastern States, and shall we hesitate to call upon the National Government to interfere? This is a question of incomparably more moment to the western and middle States than to Delaware, Maryland or Virginia. To throw the burden of the extinction of this disease on these States is as impolitic as it is unjust. If ever there was a question which in its future bearing affected the United States as a whole it is this.

It would be highly appropriate that the Agriculturists of the different States, Western and Southern, as well as Eastern, should petition Congress to take this matter up

and adopt such measures as would forever rid our country of this most insidious of all animal plagues. At all hazards the work ought to be done and that speedily. If State rights stand in the way, let the money at least be supplied, as it rightfully ought, from the National exchequer, and applied by the different States through their own officials under the supervision of some responsible department—say the Agricultural Bureau, a Live Stock Disease Commission, the National Board of Health, or even the Treasury Department. It is folly and worse to quarrel about the means until the plague shall have passed beyond control. Action is wanted, of a prompt and decisive nature, by the General Government or with its assistance, and those who are most deeply interested in the subject should press this upon the Government until such action shall have been secured.

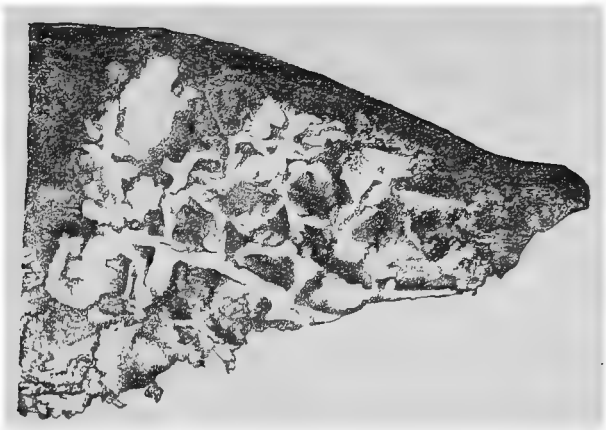

FIG. 1.—PORTION OF DISEASED LUNG FROM AN ADVANCED CASE OF LUNG PLAGUE. The lung tissue has been softened and removed, leaving the exudate in the interlobular tissue circumscribing empty cavities—like a honey-comb. From photograph by Rockwood, Union Square, New York.

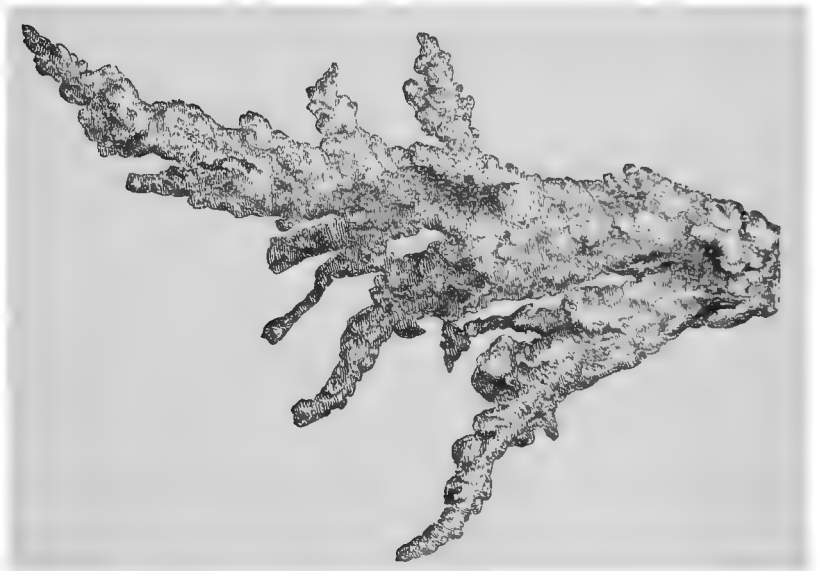

FIG. 2.—PORTION OF DISEASED LUNG FROM AN ADVANCED CASE OF LUNG PLAGUE. The lung tissue has disappeared, leaving the air-tubes and surrounding vessels and connective tissue filled with organized exudate, and having a branching arrangement. From photograph by Rockwood.

A MUCH needed book. Should be carefully studied and mastered by farmers.—*N. Y. Times.*

FROM the pen of such an author is a sufficient inducement for every one to buy and carefully read it. Will give to the common reader as well as to the scientific man much valuable information.—DR. LIAUTARD, *President Veterinary College, New York.*

IT will prove of immense benefit to the farmers and stock owners generally on this continent, and at the same time it will be of great service as a book of reference to the veterinary practitioner.—PROF SMITH, *President Veterinary College, Toronto.*

IT is plain, practical and comprehensive, and will be found what its name implies, a valuable and reliable adviser in the many cases of stock ailments that farmers and stock men have so often to deal with. —*Practical Farmer.*

A BOOK that no farmer can afford to be without.—*Rural New Yorker.*

THIS is a very useful work. It treats of the diseases to which farm animals are subject in a very plain, practical and thorough manner.—*American Agriculturist.*

THOUGH many books of veterinary science have appeared in this country, prior to the one whose title we put in our head line, they have all been so defective in comprehensiveness, and frequently so untrustworthy in their teaching, as to render it most desirable that some one fully competent for the task should undertake to furnish a satisfactory work on the diseases of domesticated animals in the United States. The republication of British authors has not supplied the deficiency, as a different manner of feeding and a different climate modify diseases, and indeed produce new ones which are entirely unknown in the British Isles. Prof. Law, whose name has for a long time been agreeably familiar to readers of *The Tribune*, will be generally acknowledged as the fittest possible person for such service, and we gladly commend the result of his labors to all keepers of stock. * * * * Though we have dwelt chiefly on that chapter of the "Veterinary Adviser" which treats of contagious diseases, on account of the great public interest that attaches to many of them, the succeeding chapters are not less interesting to keepers of live stock, as due attention is paid to all the minor maladies to which horses, cattle, sheep, and swine are subjected. The author's extensive knowledge of veterinary literature and his varied practical experience have been happily utilized by describing diseases concisely and in language intelligible to all.—*New York Tribune.*

PLAIN and practical it will direct the common farmer how to relieve distressed animals whenever relief is practicable. Prof. Law in his book sets forth in the plainest language the knowledge he has gleaned both of the nature of the diseases which assail domestic animals, and the proper treatment of them. And what is of quite as much importance, he discusses the sanitary measures by which good health and vigor may be preserved.—*The Husbandman.*

THIS is a handsome duodecimo volume of over four hundred pages, and we are much pleased with it in the fact that the author has labored to bring it within the comprehension of that class who need it. Most works of this class are lumbered up with so much learning

in technical language, that they fail of ever meeting the wants of laymen. Prof. Law has wisely avoided this fatal error, and has made his book what he calls it, a "Veterinary Adviser for Farmers." —*Wallace's Monthly.*

From a careful examination of the work it impresses us as one of immense value to the live stock interest of the nation, and a copy should be in the hands of every farmer. It is comprehensive, including the diseases of horses, cattle, sheep, swine and poultry. The work is eminently practical. Some veterinary works are so technical as to be of little use to the plain farmer, but this is made so plain as to be readily comprehended by any man of ordinary intellect. A most valuable feature of the work before us is an appendix which gives the doses of the different medicines recommended for the different species of domesticated animals. The press uniformly pronounce it the best work on the subject that has yet appeared. No farmer's library is complete without it.—*Southern Live Stock Journal.*

I am delighted with it. It cannot fail to be exceedingly useful to the young veterinary practitioner as well as to the farmer.—Williamson Bryden, Esq., V.S., *Boston, Mass.*

Deserves to attain to a healthy old age.—Prof. Murray, M.R.C.V.S., *Detroit, late of Royal Agricultural College, Cirencester, England.*

"The work is especially designed to supply the need of the busy American farmer who can rarely avail of a scientific veterinarian" says the preface, and a careful examination would lead us to indorse this claim. The maladies are well described, their salient features are given in detail, and as far as may be, their causes, thus affording a guide to a rational treatment. The book is copiously illustrated and has been prepared at considerable expense. We trust it will meet with a successful sale, for we think it the most valuable book on the subject that has yet appeared.—*Scientific Farmer.*

We think, when the demand for veterinary literature is supplied by works which are mere advertisements of secret medicines, it was high time that some competent and honorable veterinary surgeon should undertake the task of writing a work on the various diseases to which the domesticated animals are subject in this country. We think we can safely say that Prof. Law has accomplished this task in a most satisfactory manner, as the various diseases are described in as brief and plain a manner as is compatible with giving all the information that is required on the subject. We most heartily commend this work to the farmers of Michigan who need in their daily practice just such a work.—*Michigan Farmer.*

A very valuable book. It is full of excellent information pertaining to veterinary matter which every farmer should possess. It is liberally illustrated, and although the text is very clear, the cuts make it yet more easily understood by all who read it.—*Western Rural.*

One of the most valuable books ever issued from the American press, for the general farmer, is that recently published by Prof. Law, of Cornell University, entitled "The Farmer's Veterinary Adviser." It is designed especially to supply the wants of such as

are so situated that they cannot avail themselves of the services of a scientific veterinarian, and as such it is plainly written, concise and comprehensive.—*National Live Stock Journal.*

The country is flooded with miserable, trashy books—literary garbage, so to speak, of one sort or another. Now and then a really excellent production appears—the gift, perhaps, of a brain that is nearly if not altogether inspired—and yet occasionally such, even in our day, meets at first but a poor reception. * * * But we started out to call attention to a very admirable book—a book that fills a vacancy and supplies a long-felt want. The "Veterinary Adviser" is just simply a very straightforward and well written treatise, suited in every way to the wants of the farmers for whom it is especially intended; and we do not hesitate to say that it should occupy an honored place in the library of every agriculturist who has any money invested in live stock. It tells all about the different diseases of our domestic animals—it discusses the best methods of treating these diseases, giving cause and cure, together with much sensible comment in relation to disinfectants, preventives, etc. No agriculturist with the education necessary to the comprehension of plain English could possibly be the owner of the "Farmer's Veterinary Adviser" without deriving from it information to the value of many times its cost; and in the case of those owning blooded stock it should be regarded as a part of the outfit impossible to be dispensed with.—*Farmer's Home Journal.*

It treats of a subject upon which we have a professional judgment, and a subject of importance to the public, viz: the diseases of all our domestic animals—not a few of which are communicable to man. The profound ignorance which prevails almost universally on this subject has led to more pecuniary loss, more absurd and oppressive legislation, more caprice and injustice in the administration of the law, than any one, not aware of the facts, would probably be willing to believe. Prof. Law has written with complete originality and marked ability. In the volume before us, though not a large book, will be found more information, and in a form more available to the non-professional man, than can be had from any other book on the science in ours or in any language. While we desire to recommend this work to every stock man and every farmer as something he cannot afford to do without, we desire at the same time to urge the great public importance of this subject. It has often been to us a matter of surprise that those who have devoted special attention to the subject of legal medicine, have so completely ignored the great light that would be thrown upon their labors by the study of this branch of science. * * In all sincerity we regard the "Farmer's Veterinary Adviser" as the best and most useful work extant on the subject of veterinary science. If whosoever is the owner of one valuable animal will be advised by us he will send and get it without delay.—*Southern Planter and Farmer.*

This work gives in a condensed form the plainest account of the the diseases of our domestic animals with treatment rational and of easy application. Here we find an intelligible account of all the modern contagious diseases, some of which, happily, have not yet reached our shores. Dr. Law unites a thorough veterinary educa-

tion in Europe and extensive practice in this country. These rare opportunities he has improved to give us a work well fitted for the American farmer, and the existence of such a book only needs to be known that it may be appreciated and adopted. All arranged so as to be easily found and with such plain descriptions as can be understood by the unprofessional reader.—*Massachusetts Ploughman.*

WILL be found very valuable and effective.—*Columbia Co.* (*N. Y.*) *Times.*

RECIPES and prescriptions by the thousand have been published for the cure of disease, and preparations and combinations of drugs have been advertised and sold without limit by people who are as ignorant of the laws of health as they are unfamiliar with the anatomy of the patients they propose to cure. The "Farmer's Veterinary Adviser" is a different book. We are not personally acquainted with the author, but of this we are sure, that any one of ordinary ability can see at a glance that this book is an original production and from beginning to end the author's own work, and is written by one who understands his profession and knows just what he is talking about. Unlike many books of its class, this not only gives directions for the treatment of animals when they are sick, but better still, indicates the treatment necessary to prevent animals from becoming sick. It is a work valuable not only for reference in times of trouble, but more than that, it is a guide to the every-day management of domestic animals with regard to their health and usefulness. The "Veterinary Adviser" is designed to teach the farmer how to keep his animals healthy, how to know their diseases when they appear and how to treat them. We have seen no book on the diseases of animals which we can recommend with so much confidence as this of Prof. Law. It contains over 400 pages, treats upon almost every disease that animal flesh is heir to, and will pay for itself a dozen times over in the hands of every intelligent man who owns horses, cattle, sheep or swine.—*New England Farmer.*

HE has undertaken to combine, in what may be termed a "Popular Medical Adviser," scientific and familiar language. And in this he has succeeded; that is so far as success is ever attained in such an undertaking. The general appearance of the volume is excellent, and we like its arrangement. The chapters on contagious and epizootic diseases and on parasites are concise, and may be sufficiently well understood by an intelligent reader, offering him a large amount of information on very important subjects. The remaining chapters, which are well classified for reference, may be advantageously consulted by the veterinary student and practitioner as well as by others, who may be sure of their diagnosis. With regard to the preparation of the foot of the horse in shoeing, we support the opinion of Prof. Law in every particular, and there can be no subject of greater interest to the farmer or medical man, dependent as they both are upon the services of this animal.—*Boston Medical and Surgical Journal.*

A COMPACT and thoroughly practical guide to the prevention and treatment of disease in domestic animals. In a terse manner it describes every disease, sets forth their symptoms and prescribes the proper treatment to follow. The work is invaluable to every farmer

in the land and none should fail to provide themselves with a copy. The Professor through this work becomes a public benefactor.—*The Spirit of the Times.*

In the briefest possible way every disease is described, its symptoms set forth and the treatment prescribed. The man who resorts to the book does not have to wade through a sea of discussions to find what is the matter with his horse, ox, or sheep and to discover the mode of cure. A book that will enable the stock owner to dispense with the services of perilous quacks. The qualified veterinary surgeons will thank the Professor for his work since death to the quacks means the promotion of their business interests.—*The Turf, Field and Farm.*

This is a splendid work, chock-full of valuable information, and replete with practical tests, the author being standard authority on these subjects throughout the United States. It tells all about each and every disease to which our domestic animals are subject, gives hints about the breeding management and care of animals, in a word it is just the thing for the farmer or stock breeder to have on hand for reference.—*Chatauqua Farmer.*

This is a dangerous book so far as the interests of the professional are concerned, as it is so plain and professionally correct, that any common sense man may doctor his own animal. No farmer or horseman can afford to be without a copy.—Dr. Horne *in Country Gentleman.*

Has been pronounced by the highest authority to be the best book on the diseases of animals published. It is absolutely a necessity to farmers, treating the various diseases to which domesticated animals are subject in an able and practical manner.—*The Spirit of the Times.*

A much needed book. It is an excellent work tersely but plainly written, and treats upon almost every ailment of domestic animals in a manner that can be understood by any farmer of ordinary education. Prof. Law is one of the most thorough of veterinary scientists of the day, and we are glad that he so well qualified should have undertaken the task of instructing farmers upon some points that it is necessary for them to know. Many a valuable animal is sacrificed and many a slight and arrestable illness becomes dangerous and chronic because in its first stages the farmer does not know how to treat it, and the aid of a qualified veterinarian is not at once attainable. For these reasons no farmer's stock in trade is complete without a work on veterinary surgery and we know of no work that fills the bill so well as this one of Prof. Law.—*Canada Farmer.*

Much as we despise the general run of works which profess to make every man his own cattle doctor, good manuals on the veterinary treatment of animals are much needed to guide the stock owner. The dissemination of sound elementary knowledge in the diagnosis and treatment of disease would be a great benefit. The farmer at least should be more intelligent than the cow-leech, and should know enough to dispense with his services. A well trained intellect and logical mind may be intrusted with some knowledge of diseases of men and animals without necessarily converting him into an igno-

rant quack. We are tempted to make these remarks after perusing a recent American work by Professor Law, of Cornell University No work in the English language which we have seen comes so nearly up to our ideal of what a veterinary manual for stock owners should be as this little volume. Ostensibly written for American farmers, this work will be found useful to all who have the care of live stock in the Old as well as the New World. The need for it is of course more in America than in England where the aid of skilled veterinary surgeons is more readily obtained than on the other side of the Atlantic, where they are few and far between. The work thoroughly attains the object for which it was written. The language used is of the simplest kind. All technical terms are explained. There is none of the jargon of the pedant, too common in modern veterinary works. The diseases of animals are classified, the symptoms, treatment, prevention and cure given in intelligible English. Carefully prepared illustrations accompany the text where necessary, and it contains an admirably prepared appendix of the action and doses of medicines recommended, and withal an ample index. It combines a veterinary dictionary and manual and its instructions are clear and concise. All the common diseases incident to animals in this country will be found described in its pages, for Professor Law, though an American by adoption, had extended experience when residing in his native country as Professor of Veterinary Science in the late Albert Veterinary College, Bayswater, and the New Veterinary College, Edinburgh, where he was a colleague of Professor John Gamgee's. Such a work as "The Farmer's Veterinary Adviser" deserves an extended circulation in this kingdom, and we should be glad to see an English edition of the work brought out under the auspices of some one of our enterprising publishers on this side of the Atlantic.—*The Country, London, Eng.*