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ANTHRAX.

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ANTHRAX is probably the most interesting, as it certainly is the most deadly, of all the micro-parasitic diseases, and the fact that it is practically a panzootic malady raises it to a position of importance far above that occupied by any of its congeners. Notwithstanding that the anthrax bacillus was the first in the now long list of pathogenic organisms to be investigated and determined, and notwithstanding that for a number of years innumerable workers have been engaged in the study of its nature, mode of growth, development, and dissemination, it still remains master of the situation, and it is as ubiquitous to-day as it has ever been.

To say that no advance has been made in the battle with this microbe would be beyond the truth, but to say that it is still one of the greatest of the powers for evil in the land is within the pale of truthful assertion.

Were it only the bacillus with which we had to deal, the battle probably would neither be prolonged nor fierce, but, as in the case of the seeds of noxious weeds, we have to deal with its more indestructible progeny, viz., its spores, and in our investigation into the origin of outbreaks of this malady we have to keep this fact prominently before our minds.

For the purposes of this paper it is not necessary that I should enter into lengthy details as to the character and growth of the bacillus. I shall content myself by drawing attention to some of its more practical aspects.

(1.) *The Bacillus and its Spores*.—As is well known the anthrax bacillus never forms spores within the animal body; it requires to gain access to the external world in order to enable it to fructify in this way. On, or mixed with, the surface soil of pastures and other lands, it rapidly undergoes sporulation, and as one bacillus is capable of generating a number of spores, it follows that, given a liberal supply of bacilli, a patch of earth contaminated by the blood or the discharges from the body of an anthrax animal soon teems with these destructive spores.

While the bacilli themselves readily succumb to the action of inimical forces, the spores possess an intense and enduring vitality, resisting the destructive influence of ordinary agencies to a greater degree perhaps than do the spores of any other known pathogenic organism.

(2.) *Methods of Entrance of Bacilli and their Spores into the Animal Body*.—These are mainly two: (a) by *inhalation* (through the medium of the air), (b) by *ingestion* (through the medium of food or water).

(a) *Infection by the Atmosphere* is, so far as animals are concerned, of rare occurrence; it could only possibly occur by the inhalation of some dried material such as blood, charged with spores. Such a method of infection is well known in man in that form of anthrax known as "Wool-sorter's Disease."

The clinical manifestations of the disease, when it is contracted by inhalation, occur to a very large extent in the lungs, at least primarily.

(b) *Infection through the Alimentary Canal* is practically the method by which animals contract the malady in so-called spontaneous cases in this country. Contaminated water or food is ingested by animals.

If the virus be in the form of bacilli, infection may not take place, as the bacilli, possessing only slight resisting powers, are largely destroyed by the gastric juice, *i.e.*, if exposed for a sufficient length of time to its action, and if the gastric juice is of good quality.

If the virus be in the form of spores, their resistant properties enable them to withstand the action of the gastric juice, and gastro-enteric infection results—the condition known as *mycosis intestinalis* is established.

While these propositions are, in the main, true, we know that material departures from the truth thereof frequently occur. Thus, dogs and pigs frequently become the victims of the malady by ingesting flesh, offal, and blood of anthrax animals at a period much too short after the death of the victims to allow of sporulation having taken place.

Animals are occasionally inoculated with anthrax virus accidentally, as by the medium of small wounds about the lower parts of the limbs, the lips, the mouth and the pharynx, and here it must be remembered that it is a matter of indifference, so far as virulence is concerned, whether the inoculating media be spores or bacilli.

The kinds of food which are most largely accredited with being the conveyers of the anthrax virus are fresh vegetable foods, but undoubtedly dry preserved foods, such as hay, grains, seeds of all kinds, cakes, meals, bran, etc., may become, and frequently are, the conveyancing media.

In various ways these substances may become mixed with dried

matter containing spores, or saturated with the blood and excreta of diseased animals, or with infected water or sewage.

In this way outbreaks of anthrax occur in places and districts where the disease has been previously unknown; hence the origin of the idea entertained by many laymen that the malady may be of spontaneous origin.

Animals most Susceptible to Anthrax.—In this country cattle and sheep must be placed in the front rank in this respect; the horse and the pig occupying a lower position, and the dog and a few other animals the lowest of all. According to Toussaint the susceptibility of the horse decreases as age advances.

In the vast bulk of the ordinary outbreaks in this country the primary victims are cattle and sheep, and even in cases where the malady makes its appearance primarily in the horse, it will be found on making strict search and inquiry, that either a cow or a sheep has died in the place (it may be many months previously), and that its carcase has been imperfectly buried in grazing land. I myself unearthed many years ago the carcasses of two sheep which had been buried at one spade's depth, two years before the date of a new outbreak amongst the sheep stock on a farm in Lanarkshire.

Pigs and dogs may and do contract the malady by eating the flesh and blood or the viscera of anthrax animals obtained from knackeries, slaughter-houses, and similar places, and that quite independently of the appearance of the disease in other animals located on the same premises.

Primary outbreaks in horses in this country (they are common in India) are seen only in horses at pasture, or in the case of animals feeding on foreign food stuffs. Except under the latter conditions, I venture to say that primary outbreaks of anthrax amongst stabled or housed horses are in this country of extreme rarity.

One often sees outbreaks of the disease amongst cows in town byres, and amongst yard fed cattle (and not infrequently we get isolated cases only under these conditions), but they are more exposed to the probable means of contamination, *e.g.*, dirty roots or tubers, than are horses.

General Clinical Characters of Anthrax.—Anthrax is, as has already been said, the most deadly and intractable malady to which animal flesh is heir. Fortunately it does not, like foot-and-mouth disease and allied affections, assume epizootic proportions, but occasionally in sheep and cattle it attains such proportions as to warrant us almost in speaking of it as an enzootic malady.

Its *fatality* is extreme; 50 per cent. would, as a rule, be considered a moderately satisfactory mortality, though in the case of sheep and cattle the mortality may be comparatively small, especially when the disease has been contracted by ingestion.

In horses and pigs, owing to one peculiar clinical manifestation of the disease referred to hereafter, the fatality is great.

Duration uncertain.—In very many cases no premonitory symptoms of the existence of the disease are noted. An animal is observed to be apparently well one hour, only to be found dead the next. In others—especially in the case of sheep—its duration may extend over several days, or an animal may suffer from its secondary effects for many weeks.

Clinical Manifestations of the Disease.—In the earliest stages the animal may be dull and listless; on the other hand, it may evince a considerable degree of nervous perturbation.

Thus, cattle are frequently observed to have a wild and excited appearance, they are easily startled, and when excited exhibit clonic spasms (twitching) of the muscles of the flank or face; in other cases the nervous derangement is shown by frequent rigors or by shivering.

Sheep will frequently leap high into the air if attempts are made to secure them, or if suddenly approached. Both cattle and sheep show a tendency when at pasture to isolate themselves, and the latter are frequently found (when such exists) in a ditch; pigs retire to the corner of their styes, and often bury themselves under their bedding.

In horses the premonitory indications are mostly of a subdued type, there being great dullness, unwillingness to move, drooping of the head, lopping of the ears, great depression, and lowering of the temperature of the extremities. In some animals, especially when the disease is localised in the alimentary organs, colicky pains are observed, and in the vast majority of cases the bowels at the outset are more or less costive; they may be relaxed at a later stage.

The normal functions—appetite, rumination, digestion, and lactation—are rapidly suppressed, and are not usually restored until convalescence takes place.

Considering in the first place what I call the *four cardinal symptoms of disease*, viz., the condition of the pulse, the respiration, the temperature, and the character of the mucous membranes, we find that the *pulse* is, from the outset, increased in rapidity. During the stage of excitement (when such exists) it may be full and strong, or thrilling and bounding, and under these conditions there may be palpitation of the heart.

In the absence of such nervous excitement the pulse tends to increase in rapidity, to become weaker and smaller, and finally thready and imperceptible. There may be, and frequently is, in subacute cases, material variation in point of time, rhythm, or force in the pulse beats. Even in cases where there is no evidence of nervous excitement, the cardiac pulsation is, in my experience, pronounced, and the action of the heart irritable, and these conditions tend to persist.

The *respiration* is, in most cases, disturbed; the respiratory act being increased in rapidity and sometimes of a jerking character. In the horse the nostrils are widely distended, and when the characteristic throat lesion is present there is *roaring*. This symptom is, indeed, one of the first to be observed—as it is in the pig, though less markedly in this animal,—and when roaring exists the nose is usually extended. If the lungs are materially affected the respiration becomes laboured and dyspnoeic, and, in the horse particularly, it may be accompanied by a discharge of frothy sanious fluid, or a yellowish coloured serosity from the nostrils—there may be even epistaxis. Salivation is common, and often profuse.

Temperature.—One of the most common and most constant symptoms of anthrax is an early rise of temperature—usually very marked—varying from 104° F. to 107° F., or even higher, and this temperature persists throughout the attack until some time before death, when it may fall to the normal or even below it. In subacute cases the

temperature may oscillate very markedly, but the tendency is for it to remain high, and in cases of recovery to lower gradually.

Mucous Membranes.—The condition of the mucous membranes is best observed in the horse. At the outset they may be only slightly injected, but as the case progresses they become darker; they may ultimately assume a modena red (venous) hue, or become of a deep yellowish-red, or rusty coloured.

In all severe cases, as oxidation becomes interfered with, the membrane of the mouth becomes dark in colour, often livid, and there is frequently in the horse a foul odour in the mouth.

In cattle a comparatively common symptom is the discharge of a peculiar jelly-like tenacious material, of a dirty red colour and having a peculiar sickly odour from the bowels, and the urine may be high coloured or even blood-stained.

In some cases the victim shows signs of brain derangement—either in the direction of coma or of convulsions with delirium—and the animal may die in a state of coma, or, particularly in cattle, in a state of madness, with frothing at the mouth, champing of the jaw, gnashing of the teeth, or even tetanic spasms of the muscles of the neck or face.

In Pregnant Animals, even in the advanced stages of pregnancy, death of the foetus and abortion or premature birth is very common, and not infrequently it is the indirect means of saving the life of the dam. Up to a comparatively few years ago, there were few pathologists who acknowledged that transmission of anthrax took place from the mother to the foetus. Quite twenty years ago, in the case of the ewes (in Lanarkshire) already mentioned, I demonstrated the fact of such transmission taking place. Similar transmission, I may remark in passing, also takes place in cases of septicæmia. Transmission from the mother to the offspring by sucking may, but does not necessarily, occur, but the offspring of an animal the subject of anthrax is usually unhealthy and unthrifty, and it is more likely to die than it is to live.

The External Manifestations of Anthrax are few; in fact, except in the horse and pig, there are usually none.

In these animals one of the most constant, and certainly the most diagnostic, is swelling, usually more or less sudden, of the connective-tissue round the throat, between the jaws, and down the neck, and often the lymphatic glands are enlarged.

In the horse, owing to the pigmentation of the skin, no discoloration (except in white horses) can be seen, but in all bad cases in the pig it is, if life is prolonged, marked.

This condition is well seen in a photograph illustrating a case recorded by Mr Marriott, A.V.D., in the *Veterinary Journal* for March 1889, p. 173, and for directing my attention to this photograph I have to thank my colleague Professor Dewar.

In the horse too, there is often marked ecchymoses of the nasal and conjunctival membranes, and occasionally of the mouth and the vulva.

Post-mortem Lesions.—If there is any one aspect of anthrax of which it may be said that it is unvarying and characteristic it is this. Granted that one may have an occasional case in which the usual *post-mortem* conditions are absent, or only slightly marked, but the contrary is the rule, and even though one may meet with occasional cases in which there are departures from the normal, I do

not hesitate to say that no man living ever came across a series, say of three, four, five, or six cases (I might even reduce the number to two), in which there was an almost entire absence of the characteristic macroscopical lesions of the malady.

Directing our attention to the carcase, we often find in animals that have died that it is greatly swollen, and that there is oozing (especially in the horse) of bloody foam from the nostrils and the anus, the mucous membrane of the rectum being often everted and dark in colour; there is a tendency (if no blood is withdrawn during life) to rapid decomposition, but if blood has been abstracted (especially in the early stages of the disease) as in the case of cattle or sheep, this tendency to putrefaction is not marked and the muscular tissue may indeed be of its normal colour, firm, and well set. But in advanced cases, even if blood has been withdrawn, the flesh is dark in colour, the fat stained of a reddish hue, the capillary vessels of the connective-tissue and the serosæ engorged with blood of a dark colour, and often of a treacly consistence; and from the severed ends of the cutaneous vessels a small stream of dark blood flows over the exposed surface of the carcase.

All the large systemic vessels are, in unbled animals, engorged with blood semi-coagulated, and of a damson-pulp hue, and from the blood and the carcase there is given off a peculiar sickly (anthrax) odour. Systemic effusions (often of a yellowish colour in the horse—colourless usually in the pig) and extravasations, more or less extensive and varied in character, are in most instances discovered. When the throat has been affected the connective-tissue is charged with blood plasma or hæmorrhagic, and the neighbouring glands are œdematous, congested, or hæmorrhagic. In the horse the effusion is usually of some shade of yellow in colour; in cattle it is straw-coloured; in the pig it is usually colourless.

The Lymphatic Glands are, as a rule, more or less enlarged, suffused with lymph, softened, congested, or extensively hæmorrhagic.

Respiratory and Circulatory Organs.—Ecchymoses and congestion of the nasal and sometimes bronchial mucous membrane are in some cases seen, especially in the horse. There may be congestion (patchy) of the lungs; œdema, or even consolidation and hæmorrhages, with the presence of frothy mucus (often blood stained, sometimes yellow in colour) in the tubes. Intense injection of the small vessels of the mediastinal tissue and of the connective-tissue at the base of the heart and the root of the lungs, with numerous hæmorrhages—usually punctiform or petechial—in the connective-tissue sheaths of the large vessels. The pleural cavity largely contains serum or blood plasma, and the pleura is often ecchymosed. The heart is usually flaccid, and filled—especially the right ventricle—with imperfectly coagulated blood; there is frequently inter-muscular hæmorrhage, and in from 80 to 95 per cent. of cases sub-endocardial hæmorrhages—especially in the left ventricle, the endocardium of the right ventricle and the large vessels being more usually deeply stained. In subacute cases the heart-muscle presents the histological changes common to all fevers. All the large vessels are crammed with black semi-coagulated blood.

Abdominal Organs.—The pharynx may show evidence of congestion or even hæmorrhage; the mucous membrane of the stomach in simple-

stomached animals, and of the abomasum in ruminants, is either congested, hæmorrhagic, or darkly stained. The mucous membrane of the small intestines is in much the same condition; the hæmorrhages are, however, more constant and more severe. The bowels usually contain a large quantity of semi-fluid, dark coloured, jelly-like material, which gives to the bowel externally, a dark or slaty hue. The mucous membrane of the large intestine, when involved, is mostly of a dark red colour from staining. The rectal membrane, as is often seen before the *post-mortem* is made, is frequently markedly congested or deeply stained.

The large vessels of the intestines and the small vessels of the mesentery are usually engorged with blood.

The Mesenteric Glands present the same conditions as do the lymphatics, but in case of intestinal infection these conditions exist in a greater degree. The abdominal cavity often contains serum or blood plasma.

The Liver is nearly always enlarged, congested, friable, and charged with dark blood—it may be hæmorrhagic.

The Spleen presents more constantly than any other organ the lesions of anthrax; it is, in the vast majority of cases, enlarged (often extremely so), its capsule tense, its pulp diffuent and tarry or damson-like; it is often ruptured. Even in the less extreme cases it has a peculiar blue slaty colour, and presents a nodulated surface, the nodulations, when cut into, showing circumscribed areas of congestion or hæmorrhages.

The Kidneys are very much congested and often hæmorrhagic, and their capsules ecchymosed.

The Uterus.—In pregnant animals the serous investment is often ecchymosed and congested; there is infiltration of lymph between the coats and into the connective-tissue round the broad ligaments, and often punctiform hæmorrhages.

The Placenta gives evidence of extravasation and effusion, and more or less marked lesions of blood depravation are found in the tissues of the foetus.

Diagnosis of Anthrax.—The correct diagnosis of such a fatal malady is, I need scarcely say, a matter of the greatest importance, alike to animals themselves, their owners, their attendants, and the public generally, and no honest conscientious professional man can undertake an investigation into the nature of a virulent malady, in connection with which there is even a suspicion of the existence of anthrax, without feeling that the weight of a solemn burden has been placed on his shoulders.

Whatever doubts may arise in reference to the existence of the malady in the living animal, few ever arise in connection with *post-mortem* investigation, especially if we have a large mortality to deal with.

Apart from the macroscopical conditions already described, we can bring to our aid the microscope, and we can utilise inoculation and cultivation.

In addition we have frequently secondary evidence in the shape of the death of pigs or dogs which have eaten some of the anthrax tissues, blood, or offal, and, unfortunately, we have, too frequently, most startling and deadly secondary evidence in the inoculation of the

veterinary surgeon or of other persons who have conducted the *post-mortem* examination.

Practically the only malady which the trained veterinary surgeon is likely to confound with anthrax is septicæmia, but the attendant conditions are so dissimilar that his embarrassment should never be anything more than temporary.

One object of this paper is to vindicate my position in reference to a recent unfortunate outbreak of disease in the stud belonging to the Messrs Wright at Silloth.

In one sense this is absolutely unnecessary, as nothing has occurred to shake the position I took up, but the correctness of my diagnosis in that case has been challenged and I do not intend to allow the challenge to remain unanswered.

A detailed account of the outbreak in question (for which I am indebted to Messrs Little & Son, M.R.C.V.S.) is appended to this article; my own connection with it was as follows:—

On the 9th of May I received a wire from Mr Little of Abbey Town, asking if I could go to Silloth at once, and stating that several mares had died suddenly and that poisoning was suspected. In response I left for Carlisle in the evening and reached Silloth the following morning, arriving at the farm of the Messrs Wright about ten o'clock. On my way south the thought occurred to me, "Seeing that there has been a number of sudden deaths is it not possible that this is anthrax?" and on meeting Mr Little at Silloth he at once showed me a telegram which he had received from Mr Carlisle, asking for news as to the cases, and adding the query "What about anthrax?"

My first care on arriving at Mr Wright's was to examine the living animals, and the following are the notes taken by me as to symptoms at the time.

10th May 1894.—Visited farm with Mr Little V.S. Examined five mares.

- (1.) Black mare, "Daisy," in foal, pulse 44, respiration 20, temp. 99·1°, mucous membrane slightly injected, mouth peculiar aromatic foul odour.
- (2.) Brown mare, "Sally," in foal, pulse 40, respiration 16, temp. 100·1°, mucous membrane much injected, mouth strong odour.
- (3.) Brown mare, "Betty," in foal, pulse 52, respiration normal, temp. 100·1°, mucous membrane injected, mouth slight odour. Catarrhal discharge from nose.
- (4.) Brown mare, "Blossom," in foal, pulse 48, respiration 20, temp. 100·3°, mucous membrane slightly injected, mouth slight odour.
- (5.) Brown mare, "Bonny," foal at foot, pulse 48, respiration normal, temp. 100·2°, mucous membrane slightly injected, mouth slightly foul, foal healthy.

After examining the live animals we proceeded to our *post-mortem* work; examining in the first place the stomachs and large intestines of two animals whose death took place the previous day.

The *post-mortem* lesions in each case were so similar in character that it will not be necessary for me to give them for each individual case. Of the three dead mares examined, two were heavy in foal.

In one of the carcasses decomposition had commenced, but the others were in very fresh condition.

Beginning with the alimentary canal, we found that the villous portion of the mucous membrane of the stomach, extending as far as the pylorus, was intensely inflamed, the mucosa being thickened and softened; the mucous membrane of the small intestines was absolutely normal in all cases except one, in which there was a little congestion and the chyle was slightly blood-stained; the mucous membrane of the double colon and of the cæcum was the seat of an extensive diffuse inflammatory process, and in three cases myriads of minute miliary greyish coloured granulations were observed in the deep layers of the mucosa; the intestinal contents were mostly in a semi-fluid condition, of a peculiar dark colour, and gave off a peculiar odour. There was no staining and no hæmorrhages in any part of the mucosa of the stomach or intestines. On minutely examining the miliary nodules alluded to we found that they presented two very different conditions: firstly, in the earliest stages they were firm and bore a close resemblance in size to millet seeds; they were white in colour; secondly, in the more advanced stages they had undergone purulent changes.

In the worst case there were groups of minute ulcers corresponding in site and extent to previously existing groups of granulations. My opinion of these granulations at the time was that they were formed of inflammatory products, and that they were located in the lymph follicles. This opinion has since been confirmed by a microscopical examination made by Professor M'Fadyean, to whom I forwarded a section of the bowel.

The Peritoneum was absolutely normal, and there was no excess of peritoneal fluid; the uteri and placenta of the two pregnant mares were healthy and the foals in splendid condition.

The Mesenteric Glands slightly swollen and suffused, but otherwise healthy.

The Liver in each case was normal in size and *pale in colour*; it had the general appearance and characters of commencing fatty degeneration.

The Spleen in each case was absolutely normal.

The Kidneys in two cases somewhat congested, otherwise normal.

The Thorax and the whole of the *respiratory organs* presented no pathological lesions whatever, except that in one case there was a little congestion of the lung, with bronchial effusion.

The Pericardium, Heart-muscle, and Endocardium were entirely free from extravasations or ecchymoses.

The Pleura healthy; no excess of pleural fluid.

There was an entire absence of systemic effusions and extravasations, and the condition of the flesh and fat was perfect.

After completing the general *post-mortems* I requested Mr Little, jun., to lay open the throat of each animal individually; there was no lesion whatever observable there.

During the course of the examination Mr Little collected a large quantity of blood from the abdominal cavity of the worst case; this blood I handed to my colleague Mr Stockman the following morning, and he at my request made a careful examination for anthrax bacilli, with absolutely negative results.

I subsequently received from Mr Little the viscera and a quantity of blood from mare No. 7. The only points to which I shall direct attention here are the condition of the stomach and of the blood. The former presented identical conditions with those seen in the other cases, except that the inflammatory lesion was more advanced. The blood presented no peculiarity to the naked eye, and it had no distinctly putrefactive odour. A microscopical examination of this blood, made by Mr Stockman, showed an entire absence of anthrax bacilli; it revealed, however, the presence of putrefactive organisms. Subsequently Mr Stockman inoculated a rabbit with some of the blood; the result was negative.

It must be remembered that mare No. 7 died really more from the effects of delayed labour and suffocation than from the effects of the original malady.

From the history of these cases, what was the natural conclusion as to their nature? Certainly not anthrax, or, if it was, the whole history, the clinical manifestations, and the *post-mortem* lesions form a new revelation in reference to the characters and course of anthrax.

In order to illustrate the unvarying nature of the lesions of anthrax in the horse, I may direct attention to the record of two typical outbreaks.

The first of these records is one by Mr Meredith, A.V.D., India; it is given in the *Veterinary Journal* for September and October, 1889, and my attention was directed to it by Professor Dewar.

In this record twenty-seven cases are dealt with. In eleven of these throat lesions were pronounced; in sixteen cases there were marked stomach lesions—mainly congestion and staining; in fourteen cases marked intestinal lesions of the same character; in eighteen cases engorgement of the liver; in nineteen cases splenic lesions more or less pronounced; in fourteen cases lung lesions. Eight out of the twenty-seven recovered.

The second record is of an outbreak which occurred in the practice of Mr Robert Watson, Eccles, Newtown, Berwickshire, in June of last year, and the particulars of which were furnished by that gentleman's assistant, Mr Harle, who also forwarded to me specimens of the most typical lesions.

In this outbreak two cart mares, a four-years-old colt, and a yearling were the victims. In all the most observable symptoms were those due to the typical throat lesions, and the *post-mortem* conditions presented in the organs and blood sent to me were those characteristic of anthrax. In addition to the horses, a number of sheep and cattle were in this case attacked, and the steward was inoculated during the process of skinning a sheep.

Taking all the circumstances of the Silloth cases into consideration, I was forced to the conclusion, as the Messrs Little and Mr Carlisle had been forced before me, that the cause of the mortality was an irritant poison, and from my knowledge of its action I strongly suspected that the poison was arsenic in a partially dissolved state. That Dr Aitken has failed to discover a poison does not disprove the theory; it is not the first mystery of the kind either in man or animals, and it will not be the last.

HISTORY OF THE OUTBREAK AT SILLOTH FARM, CUMBERLAND,
AS COMMUNICATED BY MESSRS LITTLE, M.R.C.V.S.

On the morning of 9th May last, when Mr Wright of Silloth Farm first went through his stables, he found his driving horse lying dead in the stall, and also noticed an in-foal mare (No. 3) in the next stall off her feed. She was immediately removed to a loose-box. On entering another box he found a young mare with foal at foot (No. 2. "Silloth Lass") also ill.

We were summoned to attend at 8 A.M., and on arriving at 9 A.M. found the mare No. 2 very ill. Symptoms when first seen:—Animal lying and very unwilling to rise, in fact scarcely capable of doing so; respiration quick; pulse 112; mucous membranes highly injected; ears lopped; lips pendulous; anxious expression of countenance; she lay down about 9.30 A.M. She then passed a quantity of semi-fluid fæces. Before death, which occurred at 10 A.M., slight tetanic spasms came on, which affected chiefly the muscles of respiration, neck, and head. This mare had foaled on the 7th, two days previous to her death. There were no signs of illness in the foal; it was lying sucking the mare when she could not rise, during the last half-hour of her illness. The mare foaled on the day she was due.

No. 3.—"Diamond" was the next mare our attention was drawn to. Due to foal 25th May. This mare was noticed off her feed in the morning, and put into a box; when examined her breathing was fast, 56 per minute; pulse 98; temperature 103°; mucous membranes highly injected and thickened. The animal showed slight symptoms of abdominal pain, lay down two or three times, but made no attempt to roll; broke out into perspiration, but afterwards became exceedingly cold. This mare's bowels were slightly relaxed, but she did not pass much fæces; gradually grew weaker; pulse up to 112; dropped suddenly about 3.30 P.M., and died immediately.

After examining the above mare we thought it most prudent to make a *post-mortem* of the horse that was found dead in the morning, but in the meantime we suggested that more advice should be obtained, as we were then under the impression that we had some poison to contend with. Mr Carlisle was at once telegraphed for, and we proceeded with the *post-mortem*. We found the lungs and heart healthy with the exception of froth in the bronchial tubes; the liver and spleen healthy except that they were slightly congested. The stomach was inflamed in patches, principally the villous portion, and through the pylorus into the duodenum. The small intestines were healthy, but the large bowels showed signs of disease; the contents were in a fluid state and of a darkish colour; the mucous membrane highly congested, and in patches inflamed, with a tendency to ulceration, the worst portion being the blind point of the cæcum.

No. 4.—"Nellie." In the morning this mare was at Silloth Dock, a distance of about a mile, for a load of building material, and was noticed very dull; on arriving at the farm she was put into a box, about 11 A.M. She showed slight symptoms of colic, and occasionally passed small quantities of soft fæces; mucous membranes injected as in other cases; respiration not much quickened; pulse 11 A.M. 96, 5 P.M. 112, 9.5 P.M. 120; temperature from 102°-104.2°. Towards evening she began to show brain symptoms, wandering about the box,

and standing quiet at intervals ; later at night bored her head against the wall ; pupils dilated, and staggering gait ; she died about 8 A.M., 10th May. She was due to foal 19th May.

No. 5.—“Silloth Rose.” Three years' old ; not in foal. She was standing in the stable during the forenoon with other horses, and was not noticed ailing till noon when she was fed. She then refused her food, and when put into a box lay down two or three times, and showed slight symptoms of colic ; we immediately gave her a dose of anodyne medicine. The chief symptoms in this case were :—respiration accelerated ; mucous membranes injected ; fæces passed in small quantities and softer than normal. The colicky pains soon left her. The pulse between 12 noon and 9 P.M., was 96-120 ; temperature 103°-107°. The symptoms did not vary much during the afternoon, except that extreme dulness was shown, along with a rapid rise of temperature. She was left at 12 midnight and found dead at 5 A.M., on 10th May.

Mr Carlisle arrived at Silloth by train at 3 P.M., 9th May, and, after examining the two mares then ill, concurred with the opinion we had then formed, and suggested sending for Professor Walley, as matters were assuming a very serious aspect. Shortly after his arrival we made a *post-mortem* of the mare that died in the morning, with appearances somewhat similar to those of the horses already described. We may here state that in the earlier *post-mortems*, made in cases where respiration was much quickened for some time before death, the bronchial tubes were found full of froth.

We then examined the remainder of Mr Wright's horses in the stables, viz :—four in-foal mares, and one in a box with foal at foot : a pony used for carrying the milk into Silloth, and two young horses in the hands of the breaker. Nothing could be seen amiss with any of them until an examination was made of the pulse, etc. Their outward appearance was quite normal.

No. 6.—“Bet” was the next mare that died. On examination of her at 5 P.M., pulse was found to be 56 ; temperature 100·4° ; she was feeding but was restricted to bran mash ; at 8.55 P.M. pulse was 54 and temperature 100·3°. The bowels relaxed during the following day, 10th May ; pulse was 52-56 and temperature normal. 11th May, from 2 P.M. to 7.55 P.M. pulse was 66-100 ; temperature 100°-103·3° ; bowels relaxed but passed little fæces. She did not feed well during the latter part of day. 12th May, from 11 A.M. till 5 P.M. pulse was 102-104, and temperature 102°-100°-104·1° ; the breathing quickened ; mucous membranes highly injected ; not feeding ; passed very little fæces. She died between 12 midnight and 5 A.M. She was due to foal 20th May. Her carcase lay over Sunday. No *post-mortem*. She was skinned on the 14th.

No. 7.—“Blossom.” On 9th May, 4.40 P.M. pulse was 60 ; temperature 101° ; at 9 P.M. pulse was 58, and temperature 101° ; the mucous membranes were slightly injected ; the feeding was also restricted to bran mash ; the bowels were open. 10th May at 2 P.M. pulse was 48 and temperature 100·3° ; at 5 P.M. pulse was 54 and temperature 100·3°. 11th May at 7.30 P.M. pulse was 50 ; temperature 100·4°. 12th May at 11.10 A.M. pulse was 78, and temperature 101·3° ; at 5 P.M. pulse was 64, and temperature 100·1°. 13th May 11.10 A.M. pulse 72, temperature 102·4°. 14th May 11.10 A.M. pulse 84, temperature

104'4°. She showed symptoms of foaling on the evening of the 13th, but that was not accomplished till the 14th. She died during the night of the 14th. This mare was due to foal 19th May. We fully expected this mare to recover, but in administering medicine (as we did to the four mares left in the stable, and one in a box with a foal at foot, as an antidote against mineral poison) a small quantity passed into the trachea and set up inflammation of a lobe of one lung, with quickened breathing, and a bloody discharge from nostrils as long as she lived.

The *post-mortem* of this mare was made on the afternoon of the 15th, about 12 hours, if not longer, after her death. The *post-mortem* appearances very much resembled the others, except the inflammation of one lung previously mentioned.

We will now take the three mares that recovered :—

No. 8.—“Bonny.” 9th May, pulse 58; temperature 101°. 10th May, pulse 48; temperature 101°. 11th May, pulse 48; temperature 101°. 12th May, pulse 42; temperature 101°.

No. 9.—“Sally.” 9th May, pulse 54; temperature 101°. 10th May, pulse 49; temperature 100°. 11th May, pulse 44; temperature 100°. 12th May, pulse 36; temperature 100'4°.

No. 10.—“Daisy.” 9th May, pulse 60; temperature 100'3°. 10th May, pulse 44; temperature 99'1°. 11th May, pulse 50; temperature 101°. 12th May, pulse 44; temperature 100'2°.

The above mares No. 8, 9, and 10, passed very little fæces from the 10th to the 12th, but on the 13th a fair quantity was passed by all of them, and they commenced feeding again, and in a day or two did not show the least sign of having been ailing. The bowels of the last two mares that died were in a condition similar to the three last described. The mare No. 10 had not been in the stable for some time. She had foaled about a week when the illness commenced, and was in a box with her foal; the foal never ailed anything, and was sucking the mother the whole of the time. No. 9 foaled about a week after recovery, and both she and her foal did well. No. 8 mare was due to foal on 17th June. She foaled somewhere near that time, and both are doing well. We may also state that the foal from the first mare that died, “Silloth Lass,” is doing very well. It is confined on a small piece of ground with a pony, and is eating every day over the graves of the animals buried there.

Professor Walley arrived at Silloth Farm on 10th May at 10.30 A.M. There were then three mares lying dead, viz. Nos. 3, 4, and 5 for *post-mortem* examination. Professor Walley made a careful examination of the carcasses of the whole three, and also of the viscera of those that had died previously, and he carried away portions of the viscera, etc., and a quantity of blood for examination and analysis. The food on the premises was also carefully examined by Professor Walley, and portions were carried away by him for analysis. He agreed with the opinions already given that the *post-mortem* lesions were those of poisoning.

The horses were all skinned in the boxes where they died, and were cut up and carried to the grave. None of the men who did this work were free from wounds on their hands. Mr Wright's dogs and others were eating the flesh and licking the blood of the carcasses whenever they could get to them. The cats also ate the flesh, and the poultry

about the place were pecking at the carcasses the whole time. The food that Mr Wright's horses were getting was hay of very good quality, crushed corn, and twice a week boiled corn; also small quantities of potatoes. Very little bran was used on the farm—only to cattle newly calved, and mares foaled. The mares Nos. 3, 4, and 6, and the first horse that died got no bran. No cake had been used for some considerable time. The cattle were getting the same feed as the horses, perhaps a little less hay and more straw.

The horses and cattle were all getting water from a large pond on the road side, quite clear of any chance of contamination. The men occasionally watered some of the horses at a pump in the yard, the water of which was used for domestic purposes.

None of the mares showed the least sign of premature parturition, except the mare that foaled prematurely on the 14th, the day before her death. She was due to foal on the 19th. Neither the pony nor the young horses in the breaker's hands ever showed any signs of disease, although they were fed the same as the other horses. There were also five-yearling colts on the premises during the night, and these were fed similarly to the other horses. On the day that we first visited the farm, our own horse was put into the stall where No. 3 mare was taken out of that morning, and cleaned up the corn that she had left in the manger, and which had been given to her that morning. Our horse continued to stand in that stall and others, at intervals, in the same stable for nearly a week, and was fed on the same food as had been given to Mr Wright's horses, without showing any signs of disease.

The blood and viscera sent to Carlisle and Edinburgh were from mare No. 7.

TABLE SHOWING STATE OF PULSE AND TEMPERATURE OF DIFFERENT ANIMALS AFFECTED, AND TAKEN AT THE SUGGESTION OF MR CARLISLE.

| Day. | "Bonny" | | Day. | "Blossom." | | Day. | "Sally." | | Day. | "Daisy." | | Day. | "Bet." | | Hour. |
|----------|---------|-------|----------|------------|-------|----------|----------|-------|----------|----------|-------|----------|--------|-------|-----------|
| | Pulse. | Temp. | | Pulse. | Temp. | | Pulse. | Temp. | | Pulse. | Temp. | | Pulse. | Temp. | |
| Wed. . | 56 | 101° | Wed. { | 60 | 101° | Wed. { | 54 | 100°1 | Wed. { | 60 | 100°3 | Wed. { | 56 | 100° | |
| Thurs. . | 48 | 101 | | 58 | 101 | | 48 | 100 | | 54 | 100°3 | | 54 | 100 | |
| Fri. . | 48 | 101 | Thurs. { | 48 | 100°3 | Thurs. { | 49 | 100 | Thurs. { | 44 | 99°1 | Thurs. { | 52 | 100°1 | |
| Sat. { | 42 | 101 | | 54 | 100°3 | | 41 | 100°4 | | 50 | 101 | | 76 | 100 | |
| | 40 | 101°1 | Fri. . | 50 | 100°4 | Sat. { | 36 | 100°4 | Sat. { | 44 | 102 | Fri. { | 80 | 102 | 2 P.M. |
| | | | | 78 | 103°3 | | 36 | 100°3 | | 48 | 101°3 | | 100 | 103°2 | 5 P.M. |
| | | | Sat. { | 64 | 100°1 | | | | | | | Sat. { | 102 | 102°1 | 7.30 P.M. |
| | | | | | | | | | | | | | 104 | 104°1 | |