Anthrax

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Blood Cells from Healthy Mule.

1. Red blood cells.
2. White blood cell.
3. Red blood cells, adhering to each other.

Blood Cells and Anthrax Germs taken from Stomach of a Horse-fly Found on Mule Having Anthrax.

1. Anthrax bacillus.
2. Red blood cell.
3. Partly destroyed red blood cell.
4. White blood cell.

DRAWINGS PHOTOGRAPHED AND GREATLY MAGNIFIED.

AGRICULTURAL COLLEGE, MISS.,
JANUARY, 1902.
ANTHRAX.

The disease among domestic animals commonly known in Mississippi as charbon, bears a very important financial relation to our live-stock industry. Like most other infectious diseases it has proven very much more destructive some years than others. Serious outbreaks have occurred in Mississippi in 1868, 1878, 1889 and 1901. So far as we can learn "Charbon" has been occasionally epidemic in Mississippi ever since 1836, and at times it has, in some sections, greatly embarrassed all farming operations. During last year an extremely fatal epidemic of anthrax occurred in some sections of our state. In view of this fact, and of the probability of its recurrence this year (unless the proper means are used to prevent it), it has been thought best to include in a bulletin a short article on the nature of charbon and the best means to prevent and suppress it.

History.—Anthrax is the oldest contagious disease of domestic animals of which we have any record. In profane history the disease is more or less accurately described before the Christian era. In sacred history it seems to be identical with the dreadful Egyptian scourge described as the "Sixth plague." Plutarch mentions outbreaks of anthrax in Rome about 740 B. C. Another writer of Italian history says that the disease was extremely fatal to live stock towards the middle and last of the sixteenth century, A. D. Unscrupulous meat vendors at times sold such diseased meat to their customers which resulted in many cases of death from anthrax in man. On this account the senate at Venice prohibited, under penalty of capital punishment, the offering for sale of the meat of cattle affected by anthrax.

In 1868 in Sharkey County, Mississippi, we are told that in addition to domestic live stock having the disease numerous deer were found in the woods victims of the same malady. During the same year one man is reported to have lost 40 out of 40 mules, another 50, out of 60 mules, with charbon.
In our visits to the Delta we tried to trace the history of the last outbreak of anthrax. It was practically impossible to visit every point of infection, and not possible to secure accurate information in every case. We heard that charbon appeared at Pine Bluff on the Arkansas river about the last of May, but we cannot speak positively as to this. We know that it started on Big Island, Ark. the first part of June. Mr Murray, who is connected with a lumber company on Big Island, says that the first animal he knew to have the disease there was a milch cow that came up one evening in a feverish condition with a slight swelling on her neck. The cow belonged to the lumber company and a negro was instructed to rub the swelling with turpentine. In about half an hour after first observed to be sick she was dead. The next animals to contract it were four mules, at least two of which had no visible swellings and died in about an hour after they showed first symptoms of sickness. At that time the nature of the disease was not known by the owner of this stock and some carcasses were thrown into the river.

On Thursday June 13th the first case developed in a mule at Terrene Bolivar Co., Miss. On June 14th two other mules showed symptoms of the disease. Terrene is a river landing below the mouth of White river, where the stock on Big Island, Ark., were infected. It is interesting to note that the above mentioned mules, the first on the Mississippi side of the river to develop charbon were, when the disease developed, plowing on the inside of the levee along the river bank. It is very probable that these mules were bitten by flies coming from charbonous carcasses as they floated down the river. The planters, of course, did not approve of throwing such carcasses into the river, but it was much easier for a negro living near the river, when he lost a mule, to thus dispose of him than to burn or deeply bury him. A party said that while on a boat excursion he counted 25 carcasses in the water. Another person said that he counted 16 dead mules in a bend of the river against drift wood. The pilot of the river boat "Delta" said that a great many carcasses had floated down the river. On Monday July 8th the carcass of a mule was caught in a wheel of the "Delta" and so injured it that the boat had to stop several hours to repair damages. As soon as the disease was well understood stringent sanitary regulations were enforced by some of the city officials and by the county officials, and a change for the better was soon experienced after such regulations were enacted. There can be but little doubt to any unbiased mind that the disease spread many
miles in this way. Bolivar county has about 50 miles river front and for at least 25 miles along the river this disease, in a more or less severe type, could be seen. The disease spread along the river front almost invariably in a direction down stream. From the first point of infection at Terrene it spread in all directions. The owner of this stock at Terrene told us that he had on his farm 55 mules, of these he lost 39 with charbon, 12 of the remaining 16 had the disease and recovered, 4 only escaped the infection. Another planter, Mr. Chas. Scott, having places joining Terrene, lost 206 out of 430 mules. Mr. Dave Reinache a planter of the same community lost 30 out of 70 mules, 9 out of 12 cows, and 2 out of 40 sheep. Capt. Winter, a levee contractor, lost 40 out of 46 mules. At Benoit in Bolivar county we were told that one man lost 29 out of 40 mules and that about 160 others had died near the same town. While the above mentioned planters and scores of others we have not mentioned lost heavily, their loss was not as great in proportion to their means as was that sustained by many farmers operating on a small scale. Many of these owned only 4, 6, or 8 mules and lost them all. At and around Grace, Issaquena Co., a small town about 100 miles south of Terrene, Senator Dulaney said that 27 mules had died. At Rolling Fork, Sharkey county, a point some 15 or 20 miles south of Grace, I heard of only 7 cases with two deaths one of which was a cow. I saw only 4 of these cases, and made microscopic examination of the blood of two cases that were recovering, but failed to discover the anthrax bacillus. Carbon has also been reported at New Town Landing, south Warren county and along the river in Claiborn, Jefferson and Adams counties and also in Holmes and Hinds counties. In Adams county it is said to have occurred at Quitman Landing, a few miles north of Natchez. While we have no accurate data as to the loss in dollars and cents sustained by our State during the last summer from this dreadful scourge, we feel safe in estimating that it would not fall far short of a quarter of a million dollars.

Nature of Disease.—Charbon is a specific infectious disease of the lower animals readily communicable to man, due to the growth in the body of a short rod-shaped bacterium (the bacillus anthracis). Under the microscope the little rods appear to be about four or five times as long as they are thick. In the blood it multiplies by becoming elongated and dividing; thus one forms two, four, etc.; each new organism continuing the same process indefinitely. The disease cannot
possibly exist without the presence of this germ. In the body it breaks down the red blood cells and, as a rule, sooner or later results in death. Outside the body this rod-like plant goes to seed under circumstances not favorable for its development. These seeds or spores can stand both the heat and cold of our climate, and exist for years without loss of vitality. They are hard to destroy by germicides, hence the necessity of burning the bodies of all animals that die of charbon. These spores may be brought to the top of the ground by earth-worms when the carcasses are improperly buried. In the spring, when the river is rising, parts of such carcasses may be washed up and thousands of these little seeds washed away to infect other points. The practice of throwing such carcasses into the river cannot be too severely condemned, for infection may in this way be carried miles away.

Concerning the liability to infection by the anthrax germ, most authors classify the lower animals in the following order: ox, sheep, goat, horse, stag, antelope, deer, camel, cat, rabbit, guinea-pig, mouse, hare, tame-rabbit, dog, pig and fox. Ducks, chickens and pigeons are said to contract the disease in severe epidemics, while birds of prey are refractory to it. In the recent epidemic of anthrax we have experienced, our observations do not coincide exactly with the above order of receptivity. On one farm where a milch cow died of anthrax during the night there were in the same lot 30 hogs and about 20 head of sheep. During the night some of the hogs ate the entire udder and part of the abdominal muscles of the cow and within a few days fifteen of the hogs died of the same disease. The sheep kept constantly in the same lot at night, and when I last heard from them—some four weeks after death of the cow and hogs—not a single one had contracted the disease. We think that this can be explained, however, by the fact that there was no grazing in the lot and that the sheep were not sheared, hence were not very subject to the bite of insects. The following animals contracted anthrax in this epidemic: mules, horses, cattle, hogs, goats, sheep and dogs. We were told that chickens on a certain badly infected farm also died of charbon, but we did not have an opportunity to confirm this by microscopic examination of their blood. During an outbreak of charbon that we saw in Tunica county three years ago, some little pigs crawled through the cracks of their pen, went several hundred yards and ate parts of a charbonous carcass that had been left on the commons. Within a few days the pigs died; the half starved mothers ate parts of the pigs and they too died of charbon.
The charbon germs may gain access to the body (1) by the feed, grass, hay, grain or drinking water; (2) by the bites of flies and other insects that have previously bitten diseased animals; (3) by the germs gaining access to wounds, and (4) by the parasite entering the lungs.

The rapid spread of our recent epidemic of charbon has, we feel sure, been due mainly to the inoculation of healthy animals with anthrax virus by the bite of insects. There are several species of horse-fly common in our state probably all of which have aided in disseminating this virus. The disease seemed to spread more rapidly with the increase in number of flies; and where there were few flies the contagion did not appear to spread so rapidly. There is a small grey horse-fly called by some of the planters the "charbon-fly" on account of their supposed ability to originate charbon. In some parts of the country these little pests were seen by the millions. The flies cannot in and of themselves produce charbon, but they may by abstracting quantities of blood so deplete the system as to render it more subject to the disease. They cannot cause the disease in any other way than by disseminating virus. This one can do, (1) by sucking blood from a diseased animal then running his long infected proboscis into a capillary blood vessel of a healthy animal thus inoculating him; (2) by carrying infected material on his feet to infest other animals; (3) probably after death of the fly the germs may undergo spore formation and thus make a new focus of infection where the fly dies or wherever his disintegrated stomach mixed with dust may be blown. Recently we caught a fly sucking blood from a mule with anthrax. We decapitated the fly, dissected out his stomach, spread some of the blood from stomach of the fly upon a cover glass and by means of the microscope in a few minutes demonstrated the presence of numerous anthrax germs in the blood from the fly as well as that taken directly from the mule. The half-tone on title page is from a drawing we made upon dissecting the fly.

Symptoms.—These vary with the virulence of the attack and the mode of infection. If infection has taken place from within, as by infected food, the system may be thoroughly infested with germs without local swellings and even before we are aware the animal is sick. In such a case the animal may show nervous symptoms which is followed by profound stupor, interrupted occasionally by periods of excitement. The fever increases, pulse weak and rapid (from 75 to 120 per minute).
The mucous membranes of the body become bluish in color and the breathing rapid. In such an acute attack of the disease the animal may die in from twenty to thirty minutes after first symptoms of anthrax are noticed. In a levee camp which I visited a few years ago the contractor had all of the mules he thought to be healthy taken out early in the morning and put to work. About 9 o'clock one of his best animals appeared to be sick, presenting about the symptoms I have already described. The harness was at once removed, the animal rested a few minutes in the shade and then started to the camp, but died before reaching it. In some cases the nervous symptoms predominate, breathing becomes loud and labored, the animal may rear up in a fit of delirium, utter groans of agony, and suddenly fall dead.

Most cases of anthrax are much slower than the above mentioned type, lasting from a few hours to several days and are accompanied by more or less swelling on some part of the body. These swellings occur as a rule along the belly, sheath, udder, chest, neck or throat. They often start as the result of inoculation by the bite of an insect as already indicated. The rapid and progressive swelling is produced by increased flow of blood to the part in order that the white blood cells—the sentinels or "scavengers" as they are sometimes called—may, if possible, rid the system of the intruding charbon germ. The result, alas! between these two is too often that the bacillus anthracis increases more rapidly than does the white blood cells and becomes the more successful of the two combatants, resulting in an ever increasing edematous swelling with progressive emaciation, weakness and death. If on the other hand the infectious germ has, by some agency been weakened and is not capable of extremely rapid multiplication, the application of a liniment to the local swelling will stimulate the activity of the leucocytes (white blood cells), and these may overcome the germ. The administration of a purgative and laxative food will aid the blood in eliminating waste products of broken-down tissue. In this case we will have fever and more or less weakness but this will be followed by a restoration of all the functions to their normal conditions, and a healthful state of the system. In such cases the animal may require from a few days to two or three weeks to recover.—One can readily see that bleeding the animal only lessens the number of white blood cells at the command of the system and lessens chances for recovery. Some, however, get well in spite of bleeding.

Treatment.—The experiences of all countries and ages shows
that in dealing with charbon we must rely on preventive measures.

1. Establish a rigid quarantine. It is just as impossible for us to check and prevent charbon without such sanitary measures as it is to suppress smallpox or yellow fever without obeying this all-important law. Place all sick animals in a small inclosure to themselves—at least one-half mile away from all healthy ones. Move the healthy animals to a new and uninfected lot. It is very necessary to have the sick and healthy animals thus separated, as flies will go from sick to the well animals and readily inoculate them.

Sometimes a person is at a loss to know how his stock came in contact with the virus of certain contagious diseases. During the recent epidemic charbon occurred among mules belonging to a Mr. Edwards who lives some distance from the Mississippi river. Upon looking for the immediate source of infection it was found that a negro living upon an adjoining place had ridden a mule to the river near Terrene (where the disease started) to catch some fish. The negro’s mule contracted the disease and spread it among Mr. Edward’s mules before he could protect them by vaccination. We should not only put the sick and healthy mules in separate enclosures but lock them up securely. In the South where we have on every plantation many negro families, it is very important to see that in an epidemic like this the mules are not ridden at night. During this panic charbon appeared on two of the State convict farms but there the managers found it more easy to stamp out the disease, for at night they lock up the negroes instead of the mules.

We should try in every way possible to protect the healthy animals from flies. If we can, rest them in a dark stable. We may prepare an offensive application as follows: Cut one-half pound of hard soap into small pieces and dissolve in one gallon of boiling water, pour into this two gallons of fish oil and stir until cool. For use, add one part of the emulsion to from six to twelve of pure water. Apply to the body once or twice daily with a broom or brush. Gnat oils, sold by some druggists, are very highly recommended. Strong solutions of Chloral-napthallum seems to be an efficient agent. Smoke in the lot will aid in repelling flies. Coals of fire mixed with cotton seed or other organic matter may be placed in tin buckets and hung on the harness so as to keep smoke about the animals while at work. Screens should be placed over the windows and about doors of the stable. Flies are worse in the afternoon and early in the mornings so it is well to be especially careful to prevent them at that
time. When we can do so, it is well not to take them out in the morning until late and replace them in the dark stable early in the afternoon.

(2) Burn the carcasses of all animals that die of charbon. This is very necessary, as parts of the single carcass may be scattered far by insects, dogs, and buzzards, and result in infecting many healthy animals. The animal should be burned where he dies. If this cannot be done, he should not be dragged over the ground and in that way run the risk of infecting everything the body touches. If he must be hauled away to burn, plug the natural openings with cotton or some soft substance to prevent infectious material escaping, and haul on a slide so that the boards upon which the carcass has been placed may be burned. The carcass may be burned much more easily if we dig two trenches about two feet wide, two feet deep, and six or eight feet long so that they cross each other in their middle. Place pieces of iron or green poles across these trenches where they meet, place the carcass on these poles, light-wood below, heavier wood above, saturate with coal oil, and set on fire. In this way the carcass of a horse or mule may be burnt up, in a few hours by the use of about \( \frac{3}{4} \) of a cord of wood. Some states have a law to the effect that all animals found to have anthrax are killed and at once destroyed, and all animals on adjoining places vaccinated. I learned that recently anthrax appeared on a farm in the Delta belonging to Mr. Kirk. There were about 50 mules on this farm two of which contracted charbon. Mr. Kirk had these taken away, shot and burned, and lost no other animals from the disease.

If buried, however, the body should be under at least four feet of earth, away from running water, and covered with chloride of lime before covering with dirt.

(3) Vaccinate all animals that have not contracted the disease. We cannot leave this subject without urging the absolute necessity of vaccinating each year, early in the spring, all live stock in permanently infected districts. The efficiency of vaccination as a preventive agent has proven itself beyond doubt to be the best and only successful means of preventing anthrax occurring among animals in infected regions. In a report of a commission appointed by the French government to investigate this subject it is shown that where the animals were exposed directly to the infection of anthrax that the mortality was reduced from 80 per cent. to about 1 per cent. when protected by vaccination. Recent cases that have come under our
observation would scarcely justify us in making any definite statement along this line, other than to say that the mortality was very materially reduced when the animal contracted the disease between the first and second vaccination, and practically reduced to zero when vaccinated sufficiently long before exposure to infection. Senator Dulaney, of Issaquena county, vaccinated at the beginning of the epidemic his 300 levee mules and had lost none when we last heard from him. J. P. Alexander & Co., of Harward, Ark., vaccinated, we were told, mules and cattle, 400 in number, and lost none. Graves & Vinton Cotton Co., of Memphis, Tenn., own five plantations, three in Mississippi, one in Louisiana and one in Arkansas. About 250 mules work these places and all of these mules were vaccinated last April. So far as we could learn none of them had died. That this company believes in vaccination is shown from the fact that they compel their managers to vaccinate all their mules every spring before time for anthrax to appear. The Delta Banking and Trust Co., of Vicksburg, owns a large plantation, the former Richardson estate, at Dahomy, Miss., on which they had 400 mules vaccinated in June after charbon had appeared in the neighborhood. Fourteen mules in all died, but none after the vaccination had time to render them immune. Vaccination against charbon is certainly a cheap insurance against the disease when carefully made early in the season with good virus, freshly prepared. The essential points to be observed are to thoroughly cleanse the hypodermic syringe, needle and skin at the point of injection and to follow to the letter the printed instructions accompanying each package of virus.

Anthrax vaccine virus can ordinarily be obtained from wholesale druggists in Memphis or New Orleans. The vaccination consists in inoculating with two lymphs of different strength at intervals of five or ten days. When ordering the virus send for a hypodermic syringe and needle for making the inoculation. About ten days after making the second inoculation the animal should be immune to charbon, but prior to this time experience has shown us that he may contract it. Every year animals in permanently infected districts should be vaccinated about the middle or first of April.

4. Disinfect the premises, burn all the trash around the barn, destroy the feed and watering troughs by fire, and change the feed if it appears to be the source of infection. If stall has a dirt floor it is well to excavate it three or four inches and burn or deeply bury the dirt. Wash sides of stable, blankets, harness and everything that has come in contact with the diseased animal with some disinfectant,
such as chloride of lime (one pound to four gallons of water); or crude carbolic acid (one pint to one bucket of water). In a few days whitewash stable well, and do not use for several weeks.

Medical Treatment.—But little encouragement can be given along this line. In many outbreaks medicine seems powerless, as the course of the disease is so rapid that the victims die before any treatment can take effect. No specific for this disease in its severe type has, so far as we know, ever been discovered. Open the system with some purgative, say one pint of linseed oil or one pound of sulphate soda, which may be combined with fifteen or twenty grains of calomel. Paint the swelling with compound tincture of iodine or some strong liniment. In addition to this some have claimed success in treating the disease with the following mixture: iodine crystals one ounce, potassium iodine two ounces, pure water twelve ounces. Mix well and give one or two tablespoonfuls of the mixture in a quart of water every three or four hours. Do not bleed the animal, as this only weakens him and makes him more subject to the influence of the virus. After handling animals with anthrax we should wash our hands well with some strong antiseptic.