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ANTHRAX,

WITH SPECIAL REFERENCE TO ITS SUPPRESSION.

BY

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U. S. DEPARTMENT OF AGRICULTURE,
BUREAU OF ANIMAL INDUSTRY,
Washington, D. C., February 17, 1911.

SIR: I have the honor to transmit herewith a paper on "Anthrax, with Special Reference to its Suppression," by Dr. Henry J. Washburn, senior pathologist in the Pathological Division of this bureau. This paper was included in the Twenty-sixth Annual Report of the bureau, but in order to make it available for wider distribution in pamphlet form in response to requests for information about this disease, I respectfully recommend its publication also in the Farmers' Bulletin series.

Respectfully,

A. D. MELVIN,
Chief of Bureau.

Hon. JAMES WILSON,
Secretary of Agriculture.

#439

CONTENTS.

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ANTHRAX, WITH SPECIAL REFERENCE TO ITS SUPPRESSION.

NATURE AND HISTORY OF THE DISEASE.

Anthrax may be defined as an infection due to specific bacilli which may attack every species of domestic mammal, and for this reason may become one of the greatest scourges of animal life. Man is by no means immune, although, fortunately, the malady as it appears in the human subject is usually less acute than the form seen in cattle and sheep. This is probably due to the fact that the lesions in man occur most frequently from infection of the surface of the hands or feet, while cattle and sheep are more likely to swallow the infectious germs with their food, thus giving the germs immediate entrance into the animal system, where they can exert their most harmful influence without check or control.

Historians record an outbreak of anthrax in the south of Europe in 1613 which started with the cattle and spread from them to the populace, ultimately becoming a veritable scourge and causing the death of more than 60,000 people. From this it is very evident that the disease was far more virulent and far more inclined to attack all species of mammals during these earlier centuries than it is at the present day. It is even recorded that many deer and other varieties of game animals were destroyed during these early periods.

At the present time cattle and sheep are the chief sufferers, and the outbreaks appear to be limited to animals that run upon low, moist lands of a more or less mucky character. In certain regions of the country, where the land is mainly hilly, it has been found that pastures exist in which there are wet, low places, and that anthrax appears every season among the cattle of these farms if they are allowed to pasture upon these damp areas, but when good fences are built around them and the stock is kept upon the dry portions of the pasture the disease quickly disappears. Should the fence become broken down, allowing cattle to invade the infected area at certain seasons of the year, they are very likely to contract anthrax. In fact, certain plats of ground of this description have been found to retain the germs of anthrax for several years, a circumstance which

has led many investigators to declare that the anthrax organism has the capability of growing from year to year without any artificial aid or cultivation, if only planted upon suitable soil; that it will sprout and grow, producing the plant and later the seed, thus providing a perpetual source of infection for the stock that may chance to be allowed to linger on this area of growing anthrax plants.

Because of the remarkable tenacity with which certain plots of ground retained their infection, Pasteur in 1880 reached the conclusion that the carcasses of animals dying from anthrax, even though deeply buried, retained their many infectious organisms and supplied them with such an amount of nutriment that they continued to multiply for years, and in this way produced an immense underground supply of virulent anthrax organisms. He decided further that these living infectious germs might be brought to the surface at any time through the agency of earthworms, and that, having reached the surface, they offered a very serious menace to any live stock that might wander into that vicinity. These suggestions were very generally accepted by the medical fraternity and for some years were taught as illustrative of the manner in which anthrax lurks in certain localities for years at a time; but later investigations by Kitasato have shown that spore formation by anthrax bacilli is very incomplete at a depth of 18 to 20 inches below the surface of the ground, and at even greater depths must be greatly suppressed by the presence of the products of decomposition. Koch has further stated that earthworms are incapable of taking up anthrax spores and bringing them to the surface.

Nevertheless, the fact remains that certain circumscribed areas of ground remain dangerous to stock from year to year. It is still an unsettled question whether the anthrax germs grow and multiply each season upon infected lands when conditions of moisture and warmth become favorable or whether the ground becomes infected at some certain time with bacilli, from which spores develop, which remain near the surface of the ground for years or until taken up by some susceptible animal.

Careful experiments have proven that anthrax bacilli flourish and retain their virulent properties in stagnant water for at least twelve months, and certain authorities claim to have observed them multiplying with no other nourishment than that afforded them by muddy water.

A look at some of the most seriously infected localities in this country will help us to understand the conditions which tend to perpetuate the infection. Upon the rice plantations of the South, where the fields are annually submerged to favor the starting of the rice plants, many of the animals used in the cultivation of the crops contract anthrax and die as a result if driven over the infected lands after the water has subsided and a few days of hot weather have intervened.

Where tanneries are located upon or near to streams there is great danger that anthrax will be brought to them upon hides and then be scattered over the low lands lying downstream from the point where the tanning process is carried on. This state of affairs exists especially near to those tanneries which work upon goat or sheep pelts from foreign countries. Infection in the form of spores adheres to these hides so persistently that ordinary fumigation fails to destroy it, and repeated outbreaks of the disease occur wherever such skins are unpacked and manufactured into leather. In making mention of this danger Professor Law writes:

> Since 1892 anthrax has prevailed along the banks of the Delaware River for a distance of 40 miles in New Jersey and Delaware, destroying from 70 to 80 per cent of the farm stock. The great morocco industry on this river draws infected hides from India, China, Russia, Africa, and South America, and the spores are carried and distributed by the hides.

Delafond studied the vitality of anthrax bacilli in 1860. He placed some blood from a sheep dead of anthrax in a glass container to which free access of air was granted. This was kept in a cool place at a temperature ranging variously from 45° to 60° F. (10° to 15° C.). When examined at the end of the fourth day it was found that the length of the filaments was increased, but that their diameter had remained unchanged. After eight to ten days their length was four or five times as great as when first brought under observation, thus proving that a veritable growth of the bacillus had taken place outside of the animal body and without the presence of animal heat.

In a letter from China to the London Lancet we read:

> The disease which has been destroying cattle throughout this district continues its ravages, though with diminished virulence, probably because there is now a scarcity of susceptible cattle. The mortality has varied from 50 to 75 per cent of the infected animals. To determine the extent of the disease I made inquiry as to the number of hides exported during the first three months of this year. They say that more than 260,000 left Peking, and that half a million would not be too high an estimate for the whole district. As no cattle are being slaughtered, this represents, approximately, the loss of cattle from the plague.
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> The foreign firms that export hides, wool, bristles, and hair are in the hands of Chinese middlemen who roam about the interior buying here and there from the agricultural classes. I have been over some of the factories in Tientsin and have observed the steps they take to clean the stuff before its export. Bristles and hair are thoroughly well boiled in soda solution, wool is roughly carded and shaken free of as much dust as possible by machinery, and hides are sorted out and packed with naphthaline. The exporters claim that any further disinfection than is now given would spoil their goods and increase their expenses.
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> The real difficulty does not lie with the *Bacillus anthracis* but with its spores, whose natural resistance is increased by their being embedded in the grease and dirt of the material while it is being dealt with in wholesale bulk in China. There can be little doubt that the passage home through the Indian Ocean and the Red Sea in the warm hold of a ship is all-conducive to their propagation and preservation, so that when the time comes for bristles and hair being

carded and separated out by workers at home these spores are liberated in an active condition, ready for human infection to a much greater extent than is the case in China.

Aside from the danger of direct infection to animals pasturing on infected areas, there exists the added danger of inoculation through the agency of hay or other crops that have been grown upon infected areas of land. The process of drying and curing the hay or forage does not lessen this danger, for drying favors the development of spores, and these, mingling with the dust and fragments of the dried forage, may be taken up by the wind and blown about, or may cause serious damage simply by being eaten by susceptible animals.

FORMS OF THE DISEASE.

The disease may appear in one of three forms—apoplectic, acute, or subacute.

The apoplectic form is most frequently seen attacking cattle or sheep at the beginning of an outbreak before the animals of the vicinity have developed any degree of natural immunity to the infection. Here the animals present symptoms of cerebral apoplexy. They reel and fall, bloody liquid flows from the body openings, and death soon follows. If the body is opened and search is made for evidence of disease, it may be quite impossible to detect any definite lesions or any change in the tissues.

The acute form of the disease develops more slowly, but becomes well established in twelve to twenty-four hours after the premonitory symptoms are noticed. In these cases the fever is intense (104° to 107° F.). The animal is greatly prostrated. Cerebral congestion causes excitement, which is followed by drowsiness and staggering gait. There is frequent passage of bloody urine, followed by convulsions and death. In this type of the disease, as well as in the apoplectic form, post-mortem examination of the carcass may fail to reveal any definite lesions.

The third form of anthrax, the subacute, is the most common. The symptoms are like those of the acute form except that they are of slower development. Instead of becoming established in twelve to twenty-four hours, one to seven days may be required. The fever is very high. Serious colics are often present. Local anthrax tumors appear externally, first near the shoulders, neck, and head, and are usually due to local injury or bruising, which gives rise to a collection of bacilli within the blood vessels of the part, whose resulting inflammation gives rise to the swellings or carbuncles. These tumors are at first hard and circumscribed, but later become cold, insensible, diffuse, and fluctuating. An examination of the carcass of an animal dead of anthrax of the subacute form will probably show many lesions or alterations. Hemorrhages may be found in almost all parts of the

body. Serous infiltrations may be present beneath mucous membranes and skin. There will be swelling of the spleen, the liver, and the kidneys, and the blood will be of a muddy or tarry appearance and incoagulable. The cavities of the body contain more or less bloody effusion, and the lymphatic glands are swollen and contain small hemorrhages. The red blood cells have become broken down in large numbers and the serum of the blood has been markedly reddened. The walls of the intestines may appear perfectly normal, but hemorrhages are frequently seen, especially in the walls of the duodenum.

The subacute form is the one most commonly met, and it is the only form which responds favorably to treatment. Death ensues so quickly in the other two forms that attempts at treatment are of but little use.

Isolated or sporadic cases are usually of the subacute form, and are frequently limited to the formation of a tumor or carbuncle at the point of the body at which the infective germs first gained their entrance.

THE ANTHRAX BACILLUS.

The anthrax bacillus is a straight rod with ends slightly concave. It can not grow without the presence of air, but will grow in temperatures ranging from 55° to 106° F. It is not capable of motion. It measures 4 to 6 μ in length and about 1 μ in breadth. The bacilli multiply by fission, or dividing into two, or they may multiply much as corn does by the formation of seeds or spores, which sprout and produce a new anthrax plant when placed under suitable conditions. This simile may be carried further, for, like a tender blade of corn, the anthrax plant or bacillus may be destroyed very easily by the application of heat or cold, but the seed or spore will resist considerable heat and is unaffected by freezing, still retaining its virulence in spite of being subjected to either temperature.

When cultivated artificially and grown in the laboratory, a luxuriant growth may be obtained by planting upon any of the culture media commonly used for bacterial growth. The organisms grow rapidly and produce dense, thick clumps on potato, gelatin, agar, or other solid material. They grow with equal readiness in fluid media such as beef broth, milk, etc., but will not produce spores while growing in media of this character, as spores can not develop except in the presence of free air or oxygen.

METHODS OF COMBATING INFECTIOUS DISEASES.

Whenever attempts are made to control or suppress an infectious disease a thorough study of its character must be made, as the measures to be applied will very largely depend upon the results of such

investigation. Take foot-and-mouth disease, for instance. This has become so firmly established in the flocks and herds of certain European countries, especially in the southeastern portion, that it is considered almost an endemic, and while the stock owners are constantly trying to suppress the disease, they never go at it with the fixed purpose of obtaining its complete eradication. But in this country the circumstances are very different. Here the outbreaks have only occurred after long intervals, and in every instance, save one, have been traceable to some definite source. The number of animals attacked in each outbreak has been comparatively small. Hence, in view of the rapid transmission of the infection, not alone by sick animals, but by men, dogs, or chickens that may chance to come in contact with infected cattle or stables, any dallying, experimental measures must not be considered for a moment; and, taking this view of the matter, the immediate slaughter of all infected and exposed susceptible animals has been insisted upon each time that the disease has appeared within the borders of this country.

How very different is the method of dealing with Texas fever. But these differences of treatment are only such as are demanded by the differences in the characters of the two infections. Texas fever is known to be dependent for its origin upon the bite of an infected cattle tick, by means of which the minute parasite which destroys the blood cells of its victims gains entrance to the circulatory system, and multiplying rapidly breaks down so many blood corpuscles that fatal fever quickly results. To obviate this disease, all that is necessary is to keep the cattle free from contact with infectious ticks or to immunize them by the careful application of blood or ticks under proper precautions. Present endeavors of the Bureau of Animal Industry toward the suppression of Texas fever are being extended along these very lines. By establishing and maintaining the Texas fever quarantine line, it is preventing southern cattle from bringing dangerous ticks into northern pastures where their presence would quickly act as a scourge. The Bureau is also doing an immense amount of work in removing all infectious ticks from certain regions of the South, not with a view to saving the cattle of these regions from death from Texas fever, because they have become immune to that disease, but for the purpose of making these cattle more valuable than they are at present, as they may be given free bills of health for shipment to northern points and northern markets just as soon as it can be shown that they originate in tick-free districts.

There are a number of serious contagious diseases which terminate fatally in almost every case of attack. For these no treatment is attempted, but preventive measures may be applied with the greatest assurance that further spread may be stopped. Such is rabies. Once the disease develops, no known treatment will avail to save the

patient's life; but if inoculative treatment is applied soon after the victim is bitten by the rabid dog the chances for recovery are excellent.

In studies of the various infectious diseases it has been found that one of the most desirable means of preventing their extension is to furnish the susceptible and exposed animals with artificial immunity. This is the case with tuberculosis, blackleg, anthrax, rabies, hog cholera, Texas fever, and the like. Many animals prove to be naturally immune to these diseases, while others must be made immune by inoculation with suitably prepared materials before they are able successfully to withstand attacks from the specific organisms which cause the several maladies.

Educated investigators the world over have expended a vast amount of effort and study in attempts to discover and perfect the most effective and at the same time the most practicable means of immunizing animals against the more destructive of the infectious diseases. Immense amounts of money have been appropriated for the advancement of these researches, both from governmental sources and from gifts of private wealth. The goal sought by these searchers along lines of agricultural interest is the discovery of some means by which immunity may be conveyed to a large number of animals readily and at slight expense.

VACCINATION AS A PREVENTIVE.

Satisfactory immunity is readily granted to cattle at the present time against the ravages of blackleg or symptomatic anthrax, through the injection beneath the skin of the susceptible animal of some material containing the living but weakened germ of the disease. The amount of this material is so graduated that it causes the prompt development of the very disease that is being guarded against, but only in a mild and comparatively harmless degree. There is considerable elevation of temperature, and there may even be limited tumor formation, but only in the rarest cases does this type of blackleg, that has been intentionally produced by inoculation, progress so far that the animal is seriously injured. The value of artificially produced immunity in the struggle against this disease is shown by the fact that the losses of young cattle which reached from 15 to 20 per cent in certain infected localities previous to the discovery of vaccine treatment, have been reduced to one-half of 1 per cent at the present time where vaccines are used.

It is at once apparent that hard and fast conclusions can not be drawn favoring vaccination against anthrax from results obtained in the suppression of blackleg by the use of blackleg vaccine. But there are a sufficient number of points of similarity between the two dis-

eases to justify considering the two together. They are so similar that for many years no distinction was made between the two maladies, but all cases were called anthrax.

The successful vaccination of cattle against either of these two troubles must consist in giving the animal that is to be safeguarded a sufficiently severe attack of the disease that is feared to provide the body tissues with such a degree of resistance that no germs can be taken into the system in fatal numbers and remain to find lodgment and nurture there. After such vaccination the animal is safely protected and can go with perfect safety into fields that would have proven deadly before the vaccination was performed.

Just how this immunity is obtained is still an open question, but it is very manifest that the attenuated organism is able by its growth to affect the tissues (some say the animal cells, others the fluid tissues) in such a manner that virulent organisms of the variety presented in the vaccine can not possibly thrive, and without the rapid multiplication of virulent organisms within the animal tissues there can be no disease.

Blackleg vaccine is prepared from the affected muscle of an animal dead of that disease. Anthrax vaccine is produced by the cultivation in beef broth of pure cultures of anthrax bacilli, hence may be manufactured in unlimited quantities without having recourse to any animal suffering from the disease.

Starting with a thrifty culture of anthrax bacilli growing in a flask of bouillon, Pasteur, in 1881, by a series of experiments found that subjecting it to a temperature of 108.5° F. for twelve days would so lower the virulence of the organisms that they would only exceptionally cause death when injected into rabbits. Continuing the attenuation by subjecting the bacilli to the same degree of heat for twelve days longer, or twenty-four days in all, he discovered that he had in his possession a living culture of anthrax bacilli that had lost its power for killing cattle, sheep, rabbits, or guinea pigs, although still capable of killing white mice. This was the beginning of the practical preparation of anthrax vaccine, for he soon found that cattle or sheep when inoculated with the culture of twenty-four days' attenuation would survive the treatment and would gain a very material power in resisting infection from inoculations with bacilli of a high degree of virulence. This power of resistance is needed to enable them to withstand the injection of the second and stronger vaccine, which, having been subjected to attenuating heat for only twelve days, is possessed of considerable virulence.

In his early investigations he made experiments upon a flock of 50 sheep. Half of these were vaccinated with his attenuated culture of anthrax bacilli. Twelve days later they received an inoculation with

stronger vaccine, and forty days after this the whole flock was inoculated with a virulent anthrax culture. Two days later the vaccinated animals were all sound, while the checks were all dead.

Following this striking demonstration by Pasteur, 60,000 sheep and 6,000 cattle were at once treated in France. The following year the same form of treatment was applied to 270,000 sheep and to 55,000 cattle. Since that time this method of vaccinating against anthrax has found very general application in France whenever losses have occurred, making it evident that certain fields or pastures have become infected with anthrax bacilli. As a result, Nocard and Leclainche state that anthrax has disappeared from many sections in which it formerly decimated the live stock and that the medical doctors at the same time reported a disappearance of malignant pustules from among their human patients.

Soon after this method of immunization by the use of attenuated cultures had become suitably tested and perfected in France, steps were taken to supply vaccinating material to other countries, and reports of its successful application were soon received from Russia, South America, Australia, and other lands.

Other investigators, fearing to use the living anthrax bacillus, even though greatly attenuated, have turned their attention to the production of a serum that should possess immunizing powers equal to those of the attenuated organism. The immunity granted by serum inoculations becomes effective very quickly, but does not last long unless reinforced by the addition of virulent material at about the time that the serum is injected. At first the virulent material was injected a few days after the serum had been applied, but the latest recommendations are that they should be given simultaneously; wherefore it is now customary to inject immunizing serum into one side of the animal's neck and virulent serum into the other side before releasing it.

Very interesting facts have been disclosed through the efforts of various investigators to perfect sera for immunizing in outbreaks of anthrax. It is well known that a very small amount of virulent blood will serve to convey the disease from an anthrax carcass to a healthy animal. A fly can easily carry enough on his proboscis to kill a horse. It may safely be admitted that a single drop is sufficient to cause the death of a horse; yet Sobernheim has, by means of repeated injections, using cultures gradually increasing in virulence, produced such a high degree of immunity in a horse that it withstood the injection into its veins of 500 c. c. (about 17 fluid ounces, or more than a pint) of the most virulent anthrax culture obtainable. This is a good illustration of the word "immunity." It is something that this horse in question has received into his system through the sev-

eral inoculations of sera that enables him to receive unharmed an injection of living anthrax fully ten thousand times as large as the amount that would have sufficed to kill him previous to his immunization.

Another peculiarity discovered by investigators along these lines is that a culture of anthrax bacilli that has once been attenuated can then be cultivated indefinitely without necessarily causing any alteration in the degree of its virulence. If we let 100 represent the virulence of an active, fresh culture, and 10 the degrees of virulence in one that has been greatly attenuated, it has been repeatedly shown that one can cultivate the attenuated germs for many generations without causing any observable alteration from this virulence rating of 10; yet it only requires the single passage of this material through a white mouse to restore its virulence at once to approximately 100.

In this country the Delta lands of the Mississippi Valley are most thoroughly permeated with anthrax infection. The losses through anthrax have there been enormous, due in great measure to the large number of valuable mules owned and worked upon the sugar plantations. Dr. W. H. Dalrymple has for years been engaged in fighting this plague in Louisiana, and he reports as follows on the results of preventive inoculation:

> Perhaps the most convincing evidence of the beneficial effect of this method of prevention in Louisiana is the fact that those localities which suffered most from yearly, or at least periodic, epizootics of anthrax, before vaccination became so generally adopted, have experienced the past summer a wonderful degree of immunity from the disease which, I think, we must attribute to the fact that the use of the lymph is now almost general in these sections and that greater attention is being directed to the more careful disposal of the dead animal, our people more fully appreciating its being the chief source from which this most deadly disease is spread.
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> I believe we are gradually solving the anthrax problem in the Pelican State, and the progress we have already made is, I think, considerable and fairly satisfactory when we take into account the erroneous and visionary ideas which prevailed up to ten or twelve years ago regarding the true nature of the disease and the most potent factors in causing its spread.
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> I question very much if ten years ago a single dose of preventive vaccine was used or an anthrax carcass destroyed as a sanitary precaution against the spread of the disease in our State. To-day there are probably 40,000 or 50,000 doses of vaccine used, and carcasses are being much more carefully looked after, which I feel indicates some progress at least.

The material which Doctor Dalrymple used so successfully and which called forth the above encouraging report was manufactured in accordance with Pasteur's findings and consisted of a double inoculation with attenuated anthrax cultures.

In carrying out tests for the determination of the reliability of attenuated living cultures the Bureau of Animal Industry has succeeded in immunizing test animals to such a perfect degree that they were able to withstand subcutaneous injections of extremely

virulent anthrax cultures. Cattle, sheep, goats, burros, and a mule were subjected to these fortifying inoculations, and were later proven to be immune to anthrax. The first injection caused but slight disturbance of the health of any animal, and only slight elevation of temperature. The second injection resulted in somewhat higher temperatures, and in a few cases in transient indifference to feed. The final test of their immunity was made with a pure culture of anthrax bacilli of the highest degree of virulence obtainable. The application of this severe test soon resulted in very high temperatures and in rather general refusal of feed for a day or two; but this test far exceeded in severity any chance for infection that the animals could have incurred by pasturing over infected lands. Pure anthrax bacilli were forced into the tissues in great numbers, and the ultimate survival and full recovery of the animals after this severe treatment offers the best possible argument in favor of preventive inoculation in all cases in which animals are positively known to be exposed to contact with anthrax bacilli in infected stables or pastures.

The material used in vaccinating against anthrax has many dangerous properties, since it contains living anthrax organisms; hence it should never be used except in regions in which the disease has already appeared, and it should be used only by qualified veterinarians, as careless handling might result in the serious extension of the very disease that it was desired to eradicate. Vaccines for this work should be obtained from reliable manufacturers, as the use of weakened or diluted material can only lead to disappointing results.

The season of the year in which the vaccination is undertaken makes considerable difference in results, for it has been shown that there is a natural tendency toward the suppression of the disease in the infected plats of ground during the winter months.

OTHER PREVENTIVE MEASURES.

In future attempts to eradicate anthrax from infected districts preventive inoculation will undoubtedly play a very important part. But there are many other steps which should be taken into consideration in addition to the vaccination. Infected areas should be thoroughly drained and kept under cultivation for some time before attempts are made to pasture stock upon them. Sunlight greatly hinders the development of anthrax bacilli, and the repeated stirring of the soil favors the action of the sun's rays.

The complete destruction of all anthrax carcasses is also a very important matter. This is best accomplished by burning, but as this method of disposal is impractical in many localities, deep burial may be practiced instead. Covering the carcasses within their graves with quicklime adds another valuable precaution against further dissemi-

nation of the infection. No animal dying from anthrax should ever be skinned or cut open, as the blood from such sources is one of the most dangerous means of spreading the infection, being charged while in the animal with great numbers of bacilli, which quickly turn into spores as soon as spread about upon the surface of the ground. All discharges from the body openings should also be burned or buried deeply, as these are frequently of a virulent character.

One of the most common obstacles to sanitary police control of outbreaks of anthrax is the opposition of the owners of the affected animals to any regulation which requires them to dispose in a safe and satisfactory manner the cadavers of animals dying from the disease. Many localities have failed to secure legal enactments demanding suitable destruction of infectious carcasses, and others which have laws upon their statute books have an opposing public opinion that largely nullifies the real intent and purpose of the law, with the result that carcasses filled with deadly material are allowed to lie about in the fields to be scattered by prowling dogs or birds; or they may be dragged to the nearest stream and thrown into the water, only to be floated along bearing their infection to neighboring properties. A little practical application of the golden rule by interested stockmen would, under these circumstances, not only prove beneficial to their neighbors, but the benefits would be felt upon their own properties in later seasons. It is imperative that all carcasses of animals dying from anthrax should be safely burned or buried if the eradication of the infection is ever to be reached.

There are some encouraging features to be noted in connection with outbreaks of anthrax. One of these is the limitation of the infection to certain restricted areas. Another is that the disease does not sweep across a whole State in a few days, as foot-and-mouth disease is inclined to do. A third is that drainage of the infected parcels of ground usually removes the danger. So let those who have suffered losses of stock from anthrax take courage and resolve to ward it off in the future by fencing, draining, and plowing infected plats, by burning or burying deeply all infected carcasses, and by the vaccination of the healthy animals that are unavoidably exposed. Such methods will lessen the losses and cause the gradual disappearance of the plague.

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