

The
Spread of Infectious Diseases
By the
Transportation of Stock ;
And
Their Prevention.

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Nature of animal diseases.

Health and disease.

An animal is a complex ^{machine} end
owed with certain attributes; its existence
is dependent upon the performance of
various functions, allotted to particular
organs which are composed of suitable
materials. When these organs are intact
and capable of performing their respective
duties; when the functions upon which
the life of the individual depends are
in perfect and harmonious action; and
when the laws which regulate them
and adapt them to the influences of
the external world are in full force—
then we say the animal is in a state
of good health.

But when this organism is submitted to certain influences or conditions which hinder or prevent a part or all of its component functions, a number of phenomena are manifested to which the term disease is applied. Disease is the expression of a diminution, an extension or disturbance of the vital powers; an unequal balancing of the organic functions tending to abstract from life that which is necessary for its proper maintenance.

Extension and periods of disease.

Different invasions of infectious diseases are distinguished by the degree and mode of extension. Conditions may be such that at certain periods of the year a particular disease may become more active and virulent and consequently may be more easily extended by the many agents of transmission and especially in a country which is covered by a net-work of railroads. The different stages of diseases are more distinctly marked in the case of contagious diseases and this may favor their development in different localities.

Influence of civilization on infectious diseases:—

As the great human family becomes multiplied and civilization rapidly advances, the demands of life become increased and more complicated; but intelligence which advances with civilization redoubles the efforts to maintain the equilibrium between the growth of population and the necessary supply of food. It is these demands which have brought the cultivation of the soil to such perfection; which have reclaimed lands not only barren and useless but positively injurious because they were the sources of pernicious maladies—the laboratory of pestilential emanations. These demands have also perfected and increased the number of domestic animals and thus commerce has been extended between countries and the chances of famine greatly reduced, which so frequently usher in the plagues of man and beast.

But on the other hand the more artificial conditions of life which are created and to which the domestic animals are forced to submit, bring into play new influences which modify their constitution in such a manner as to

render them susceptible to general maladies of a new type, e.g., foot and mouth disease of ruminants and swine and contagious pleuro-pneumonia of bovines.

Not only is human life endangered by the consumption of products from previously diseased animals or from the consumption of improperly cooked food but quite a number of animal diseases are capable, by intentional or accidental means, of transmission to man. Virchow has said that, "man is far more susceptible to infection from animal diseases than the latter from similar diseases of man". If we look about us we will find that a large per cent of these animal diseases were purely ^{of} local nature in their beginning and have been carried and spread by moving stock from place to place, either for grazing purposes or for immediate human consumption. Civilization then holds the key, largely, to the control of spreading animal diseases and incidentally to its future progress and preservation.

Causes of spreading diseases.

The causes affecting the spreading of a disease may be many and

varied. The atmosphere may change the quality of the food; discharges from the bodies of animals either diseased or too closely packed together; by neglect of hygienic laws; by exposure to severe hardship and tempestuous weather; by the introduction into the body of animal or vegetable organisms; existence of the peculiar morbid condition etc.

The predisposing causes of disease are to be sought in the various localities where they appear; in the varying atmospheric conditions; in the seasons, the food, water and the many influences which man brings to bear on the health of animals by labor and the artificial requirements of domestication.

Locality

When we know that each region, each soil, affixes an indelible impression on the nature and the physiognomy of the animals and plants which live upon them; that by its topographical situation, its configuration, elevation, geological and chemical constitution, the waters which irrigate it, lie on its surface, or flow as rivers through it; by the general condition of the atmos-

sphere - its purity or its contamination, the degree of transparency of the sky in connection with the amount of radiation from the ground, the temperature, humidity, prevailing winds, calms and storms, the kind of vegetation and the kind of culture pursued - when we know all this we may be satisfied that the character of a locality or a region possess a great predominance over other causes in maintaining or disturbing the health of the creatures dwelling therein and predisposing to or exciting the advent of various kinds of diseases.

Damp or marshy:-

The damp localities have one advantage over the dry in that as long as the organic material remains wet no germs will be given off to be scattered about by the wind but the predisposition in the animal body remains and the organic matter is always in a state of putrefaction so that as a rule it is more dangerous to move stock from such localities if infection is there previously.

Elevated or dry:-

The dry localities,

generally speaking are the healthiest. The air is generally pure and dry — pure owing to the great amount of sunlight together with the naturally dry conditions. Diseased animals are few with the exception of those brought there and less care needs to be exercised to prevent the spread of diseases by exchange of animals.

Atmosphere

This is one of the most important agents in the propagation and diffusion of pestilence by its perpetual movement and its elasticity. Organic impurities, in small proportions, always exist in the air of places occupied by animals and it is but natural to suppose that quite large areas may become contaminated through the medium of the air.

Food, water, dwellings.

Food deficient in nutrient material favors disease. Animals are frequently underfed with material of bad quality or overfed with material of a highly nutritious quality; or they are fed at irregular intervals or the food is improperly prepared and unsuited to the digestive organs of the animal hence a

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large percent of the diseases of the common domestic animals are due to the feeding.

Water is also an important factor in the spreading of disease. Springs and wells may become contaminated from the surrounding country and also from the atmosphere. Storage water is easily infected and through lack of proper purification the germ may be introduced into the animal's system. A river may play a large part in the distribution of disease germ but the danger from this source is usually comparatively small.

The stables or dwellings in which the majority of our domestic animals are kept are seldom built according to the principles of sanitary science (with the exception perhaps of those built by the government) and so produce conditions favorable to germ growth and development. They may be poorly ventilated, the position or site may not have been well selected, the material used in construction may have been inferior and the arrangement inside badly planned. One could name a large variety of conditions which would be favorable to disease but it is useless here.

Individual Idiosyncrasies.

Individual peculiarities may be an active element in the production and development of disease. The temperament of the individual may produce conditions favorable to disease. This is more noticeable in the case of the horse.

Age and sex are also worthy of consideration. During the early stages of growth and also the latter part of life the predisposition is increased. Sex produces but little influence and this is mostly of a general nature.

The influence of breeds is quite important. One species or breed may be infected with a disease seemingly peculiar to themselves but when brought to other countries it is found that the disease is communicable to other breeds.

An animal may have a weak or a strong constitution owing to hereditary influences. The progeny of diseased animals inherit simply a predisposition to disease usually in the organs which are diseased in the parents.

Individual idiosyncrasies while unimportant in spreading infectious diseases simply by transporting stock, yet such individuals when placed in a herd, naturally strong, and becoming infected more easily

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than the rest, will harbor the germ and probably transmit it to the other individuals of the herd.

How diseases are spread by stock in transportation.

Infected animals are shipped in cars or vessels which may or may not be free from germ life. If they are free they are loaded with millions of pathogenic bacteria by the time they reach their destination. The germs are all through the bedding, the excretionary products, the partially eaten food and in all the cracks and crevices of the car or vessel. At present these cars are usually cleaned and disinfected before using again which eliminates further spread of the disease but the largest part of the damage has been done before we get to this stage. Stock yards and animals are found all along the route in the case of a railway and bits of the contaminated products of the cars are continually dropping through the cracks and these may carry with them myriads of the most virulent disease producing germs. Perhaps the animals are unloaded for feeding at several intermediate points and these will undoubtedly be polluted. Germs may be

distributed more easily than many of the common weeds and every one has some knowledge of how this may be done by railroads passing through different sections of the country.

If we follow the animals after they are unloaded we can find many sources of infection from them. The yards in which they are placed are contaminated and also other animals in the same vicinity. The germs will live in these yards sometimes for years and the animals which follow are in danger. From this aspect the question assumes gigantic proportions. A brief discussion of contagion or the active principle of disease will make its immensity clearer.

Contagion.

The terms contagion and infection are usually employed to designate diseases which may be communicated from one animal to another - from a sick to a healthy animal - infection however is used more particularly to distinguish those maladies which are transmissible through the medium of the air or by substances of various kinds without actual contact with the body of the diseased

creature while contagion implies the more obvious conveyance of the specific virus by direct touch or contact or by inoculation with the morbid material from the diseased animal. M. H. Hayes F.R.C.V.S. in Friedberger and Fröhner's, Veterinary Pathology, defines an infective disease as one, "that is caused by a living micro-organism which is capable of becoming developed in the animal body." It seems that the distinction between the two words is not very well marked. As it is the difference is simply one of degree.

Characters common to contagious diseases and their influence on traffic.

Contagious maladies are propagated and maintained by a virus, have a period of incubation and generally pass through a regular phase, and nearly all are characterized by more or less general modifications of the organism. Some are acute, some are chronic, some are manifested by a more or less general disturbance without much if any local disorder.

The form and mobility of the contagious element or germ is by no means constant. Some are round and some are long or short filaments which

may branch and form a beautiful network. The two last named classes form spores and it is in this form that we can compare them to the seed of higher plants. These spores will maintain life under a variety of conditions. It is in this form that they exert such an important influence on traffic. The spores may be carried thousands of miles from their original habitat and develop and prosper even if the new conditions are not exactly the same as the original. Such spreading of disease germs is preventible if proper means are taken as to disinfectants etc. These germs are an evolutionary form of plant life but it would be better in some cases to think of them as the result of spontaneous generation since then we would be compelled to maintain our animals in a proper state of health.

Escape of disease germs from the body.

It is commonly known that disease germs do not pass off from the animal body through the medium of the breath. When a transmissible disease has attacked an animal, the disease germs may be developed generally over

the system or they may be localized and thrown out by accidental secretions. But usually solids, fluids, exhalations, secretions and excretions are impregnated with the virulent element so that there is nothing to prevent the germs escaping freely from the animal body.

Vitality of disease germs.

The spore form of disease germs have a greatly enhanced vitality. They may survive indefinitely without change, and in some cases resist even a boiling or a freezing temperature for a length of time. Some bacteria use up a large amount of oxygen by way of respiration while others can adapt themselves to a comparative privation of oxygen or altogether without air.

The action of the atmosphere seems to destroy the germs in a short time but if they are shut up where the air cannot reach them, they may be preserved for many years. Bacteria have been known to live in closely packed hay for many months and become active again when the hay was used.

Important infectious diseases
which may be distributed by trans-

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porting stock, and a few suggestions regarding their prevention.

Tuberculosis.

This is the most widely spread bovine disease, being found in nearly all parts of the world. It is however more fatal in some parts than in others. In Mexico about thirty four (34) per cent of the animals killed for food are infected, while in the polar regions, the northern part of Sweden and Norway, the steppes of Russia and in some of the isolated and but little frequented islands, such as Iceland and Sicily, the disease occurs very seldom or not at all. It is always found in the most densely inhabited districts and especially in cities. It does not occur in Japanese cattle or wild cattle. In secluded districts in which close attention is given to maintaining the purity of the local breeds, tuberculosis is rarer than in most places where there is much traffic and where foreign cattle are imported.

The disease is most frequently observed in cattle, pigs, and birds and less often in carnivorous animals and in

horses. The apparent absence in sheep and goats seems to be due to a lack of special research with those animals. It also occurs in many wild animals especially when kept in captivity.

The cause of the disease is due to the penetration of the tubercle bacillus into the tissues of the body although the mode of infection may vary. The infection is usually transmitted by cohabitation. Cases are known in which a "new-comer" infected all the animals in the herd. This was probably brought about by the drying of tubercle material after it was coughed up, and its diffusion through the air, or the depositing of such material on the feed which other animals ate. Animals may become infected merely by licking each other.

When the disease is introduced into the body from the digestive system the tubercle bacillus is nearly always in the spore form, otherwise, it would be killed by the acid of the gastric juice.

Merely local lesions are caused at first, and these develop into the general constitutional disorder. The greatest danger of spreading the infection by trans-

porting animals is probably when thorough bred animals are placed in a herd for breeding and grading-up purposes. The predisposition to the disease is frequently greater in high-bred stock and one cannot be too particular in his choice.

Tuberculosis is curable in its very early stages when it is of a local nature. When the disease becomes general only prophylactic measures are applicable such as supporting the strength of the individual by a rational system of food and management; separation of the healthy animals from the diseased; early slaughter of the sick; exclusion of the affected animals from breeding and the proper disinfection of sheds, stables etc.

It is a question ^{whether} veterinary police regulations should be adopted and enforced or not. Because the disease seems to be so general and the time of development of the bacillus so great that the danger of increasing the infection to any great extent by transportation of diseased animals is apparently reduced to a minimum.

Anthrax.

Anthrax is distributed all

over the globe, in every country from pole to pole. It occurs in all domesticated animals ~~animals~~ as well as the undomesticated. It is most frequently observed however in cattle, pigs and sheep.

The disease is due to the bacillus anthracis, which belongs to the rod-like schizomycetes and which is specially characterized by the production of spores of high resistance and great vitality. The bacilli and spores are not frequently transmitted directly from one animal to another but the transmission is affected by intermediate bearers such as utensils, people and insects. The development of the germ seems to depend to a considerable extent on the condition of the ground as regards moisture and the surrounding country in general. The infectious elements are extremely tenacious of life and consequently are easily transported by the large number of common carriers.

Anthrax may be transmitted by contact with the blood, by liquid exudations, by portions of the diseased carcass, fat, skins, hair, wool, bristles etc and bowel evacuations and rarely through

the atmosphere. The most frequent and best carriers of infection are either diseased animals, their excretions or their products.

There is no satisfactory treatment of the disease known. Bleeding is sometimes made use of but its effectiveness is doubtful. In regions where there seems to be a natural predisposition to the disease the soil should be well drained and an abundance of pure water supplied. Carcasses, secretions, dung, litter, etc, of all diseased animals should be burned and the stables, sheds, yards, etc thoroughly disinfected.

Inoculation with attenuated bacilli will produce immunity in cattle and sheep but this immunity lasts only for a short time, usually about a year, so that it is always best to observe strictly the hygienic laws governing the disease. Inoculation is more practicable in cattle than in sheep and is coming to be a very successful means of preventing the disease.

A good instance of the spread of anthrax is given by Dr. W. H. May in the report of the Bureau of Animal Industry for 1890.

An epidemic occurred among the mules on several plantations, in the Yazoo bottoms of western Mississippi. Upon investigation Dr. Wray found that the mules affected were the ones the negroes used in traveling from place to place at night. Dr. Wray further states that a herd of infected mules were driven from a small creek to the hills east of Yazoo City thereby spreading the disease on both sides of the road along which they passed.

Swine Plague or Cholera.

Swine plague, cholera and swine fever are treated in this discussion as one ~~and~~ the same disease. It occurs in England, America Sweden, Denmark, Germany, Austria, Serbia and France. It is propagated by contagion by the specific contagia does not seem to be very well defined. Faults in diet and management may account largely for its contagiousness. The germ may enter the body by several routes, such as lungs, intestines and skin. The large dissemination of the disease is caused chiefly by the traffic in young hogs. Cholera is often introduced by apparently healthy animals. The young hogs may

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have a natural predisposition to the disease or it may be on account of their weaker constitution owing to age. The period of incubation is comparatively long and the virus has a great power of resistance so that it remains active for many weeks in the yards of the dealers and in the trucks or cars used in transportation and thereby tending to infect all the hogs which pass through the yards or vehicles of transportation.

As a means of prevention the diseased animals should be killed and burned and all animals with which they have come in contact, whether susceptible to the disease or not, should be isolated until there is no danger of further infection. All utensils and things that have come in touch with the infected animals should be thoroughly disinfected. Quarantine laws regulating the shipment of stock from the infected regions should be established and the railroads should be forbidden to ship young hogs from an infected district except by license from the local authorities until the plague has been pronounced at an end. When infected hogs have been conveyed by rail, boat or other means of transport the vehicles of transport as well as barns, docks or yards and

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other places in which the diseased animals have come in touch, should be thoroughly disinfected.

Glanders.

Glanders is found in all latitudes and all climates. Where there is little or no intercourse with a country there is little or no glanders such as Ireland and other northern countries. Glanders is essentially a disease of the horse and holds a somewhat similar position to those animals as tuberculosis does to cattle. It may however be transmitted to all domestic animals, except cattle, and to man.

The disease may be transmitted either directly or indirectly and by extremely different intermediate bearers. Harness, clothing, pails, stable tools, fodder, litter are good examples of transmission agents. The discharge from the nostrils, possesses the highest degree of infectiousness and so the importance of keeping glandered horses in seclusion. The bacilli may occur in any organ as well as in the blood. They probably reach the nasal mucous membrane by being inhaled along with the air in the form of dry dust or by reciprocal smelling in some cases. The skin also

affords another place of entrance.

Some writers* say that treatment is never justifiable on account of the danger of the extension of the disease to man and other animals. It is not curable in any form so far as our present knowledge is concerned.

Prophylactic means are about the most effective and satisfactory measures which can be adopted. All glandered horses should be destroyed and the things they have come in contact with should be thoroughly disinfected. The severest precautionary police measures should be adopted and enforced. Districts as well as individual diseased animals should be strictly quarantined for the bacillus is so easily transported by stock and all common carriers.

An interesting case of the distribution of glanders is reported by the Kansas State Sanitary board in 1901. It occurred in Sumner County, Kansas on the main traveled wagon-road from Wellington to Oklahoma territory. Starting at the Kansas-Oklahoma line, the board found (3) ~~three~~ diseased animals. Two miles north of this five diseased animals were found, one mile east of here and a half a mile north, four diseased horses were found,
* Billings.

about eight miles north there was seven glandered horses and three or four miles north of this three horses had the glanders and there were several cases found at Wellington. It was a question for some time why the disease should appear at these few scattered places along the road and not at others. Finally it was discovered that a man, who had a glandered horse, had driven from Wellington to Oklahoma and had stopped at the places where the glandered horses were afterward found and tried to trade horses, thereby bearing the infection.

Contagious pleuro-pneumonia of cattle.

The presence of this disease in certain districts is constant. This constancy is exhibited in such countries as Austria, France, England, Belgium and some parts of Germany, America, Africa and Australia. The disease is most frequently met with in large herds, in which there is a frequent change of cattle, and along great thoroughfares. Those countries which do not import any cattle are usually free from the disease. It is an infective disease peculiar to cattle and cannot be transmitted to any other species of animals except under certain conditions. It is an inflammation of the lungs and pleurae

and may be introduced by diseased cattle or by common bearers such as cattle dealers, attendants, vehicles, utensils and feed. The sheds in great cattle markets are very instrumental in the spread of the disease. The disease is especially common in beet-sugar districts on account of the trade in cattle, which is more active because the cattle are moved back and forth continually, as the supply of feed from the unused parts of the beets, varies. The importance of the disease and its bearing on the transportation of cattle is well set forth by James Law in his, "Farmer's Veterinary Adviser", from which the following paragraph is taken:-

"England imported the lung fever of cattle in 1842, just one year before we did, was soon very generally infected, and has continued so to the present time. Up to 1869 it is estimated that England had lost, almost exclusively from this disease, 5,549,780 head of cattle, worth £ 83,616,854 (say \$400,000,000). For the succeeding nine years, up to 1878, the losses have been, in the main as extensive so that we may set them down as now reaching at least \$500,000,000 in deaths alone, without counting all the contingent expenses, of deteriorated health, loss of markets, progeny, crops, manure etc., disinfection, quarantine etc.

With us no attempts have been made to estimate the losses, but they cannot exceed an inconsiderable fraction of those above named; and thus we have slept on in a pleasant dream of immunity."

As preventive measures importation should only be permitted from countries free from the disease, in vessels which have not carried infected stock for at least three* months and if necessary quarantine at the place of landing. The sick should be destroyed and the things they have come in contact with should be thoroughly disinfected by strong disinfecting agents. Sanitary police laws should also be established. Inoculation as a means of prevention, like medical treatment is not at all effective.

Foot and mouth disease.

This disease occurs chiefly in cattle, sheep, pigs, and goats. Horses, dogs, cats, and birds are less frequently attacked. Man is easily infected. The disease is of great importance from a pecuniary point of view owing to its severity and the rapid manner in which it spreads through the stock of a country. It is known to have been communicated by contagion in Western Europe, Great Britain and Iceland where it was

*Law.

introduced in 1839-42 and in North and South America where it was imported in 1870. It always follows the track of commerce similar to other infectious and contagious diseases. It may be transmitted either directly or indirectly. The infective matter is contained in the discharge of ulcers, saliva, milk, faeces, urine, expired air, perspiration and exhalations from the body. The disease spreads very rapidly through a country and is aided very materially the more extensive the network of railroads.

For prophylaxis diseased animals should be secluded from the rest and the things they have come in contact with, disinfected. Inoculation sometimes proves quite effective in mild cases.

Texas fever.

This is an infective fever peculiar to the low malarial grounds bordering on the Gulf of Mexico and capable of being transmitted to the cattle of higher lands of the same and other states in a more vital form. The disease is usually unnoticed in Texan cattle but becomes exceedingly fatal in northern animals. The infection is carried by the Texas cattle tick which furnishes a suitable host for the protozoan to which the disease is due. Frost destroys the organism. The disease has never been shown

to be conveyed from one northern animal animal to another in the North. The greatest danger arises from the shipping of infected animals during the summer months. It can be avoided by quarantine until after frost when traffic would be safe.

Conclusion

The subject has been given a general treatment touching lightly those infectious diseases which are most dreaded. It has been shown that the wide dissemination of such diseases is due very largely from the transportation of stock. Disease always follows traffic and commerce and so civilization. Veterinary medical science is doing much to eradicate these maladies but the best efforts have not yet been put forth. The time will come when such diseases will form but a small part of man's troubles on this planet and until that time we can only work and wait.

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