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PLEURO-PNEUMONIA.

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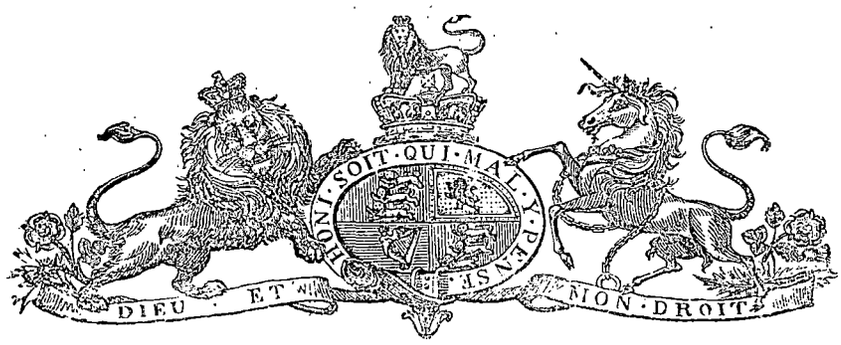

PLEURO-PNEUMONIA.

[BY MORRILL WYMAN, M.D.]

VARIOUS names have been given to the disease now known in this country as Pleuro-pneumonia,—some derived from the anatomical change observed or supposed, and others again from the supposed efficient cause. The corresponding name in common use here for the analogous disease in human beings is *Pleurisy* and *Lung-Fever*. It will be seen, however, on investigating the disease, that it is doubtful whether it can be considered as an ordinary lung-fever.

Authors curious in such matters have endeavoured to show that the disease was mentioned by Aristotle and by Virgil; but no description sufficiently exact upon which to found any decided opinion has been produced previous to that given in the year 1769, by Bourgelat, founder of the Veterinary School of France. The symptoms, causes, treatment, and effects, as exhibited by examinations of the chest after death, described by him, show that he had to deal with an acute inflammation of the lungs and pleura; but whether of the same nature as that now prevailing on the Continent does not appear. Until 1792, it appears to have been confined principally to horned cattle in Switzerland, the Jura, Piedmont, and the neighboring mountainous regions; but in that year, or soon after, it was found to have extended through the most of Europe, and, probably, has existed in Austria, Prussia, and in many places along the Rhine, from that time to the present. The disease which now exists in Belgium, and which has been so fatal, is believed by Verheyen to be a new disease; and either was not recognized, or did not produce serious effects, until 1837, when it manifested itself suddenly in four communes in Holland, afterwards invading Flanders and other provinces, and is still extending. From 1837 to 1839, Holland lost about 28,000 head of cattle from this disease alone.

It has been remarked, that the extension of the disease coincided with the French Revolution; and the subsequent movements of troops during the wars of the Consulate and Empire, carrying with them large numbers of cattle for their support, are supposed by some to be the cause of this extension. The mixing of these cattle with the different races inhabiting the plains and the crossings which must have followed, are also supposed to have had their influence in the development of new conditions more or less favourable to its extension.

In 1841 Pleuro-pneumonia broke out in England, having been preceded and accompanied by a disease exhibiting numerous vesicles, or small blisters, upon the lips and tongue, and in the cleft of the foot, known as the vesicular disease, or *Eczema Epizootica*. There it has remained raging with more or less severity to this time. Professor Simonds says: "It is worthy of a passing remark, that neither of these were imported diseases. It was not till several months after Pleuro-pneumonia had established itself in the country that an alteration took place in the tariff, by which live stock came in free of duty; and up to that time the high rate of duty prevented any importations of foreign cattle or sheep being made. This fact in itself is sufficient to prove that the malady was not imported by foreign cattle; besides which, the parts of the country where it was first observed could not possibly have had any immediate or direct connection with the ports. Pleuro-pneumonia had no sooner gained a footing, than, following the law of all epizootics, it quickly spread over a great extent of country, and continued to devastate our herds with almost unmitigated severity for the first few years. It has since assumed rather an enzootic form, and has prevailed mostly in those localities and places where secondary causes are in full operation to predispose animals to its influence,—hence its continuance in the ill-ventilated, over-crowded, and badly-drained cow-sheds of the metropolis and other large towns, and on the 'cold, retentive soils' and undrained farms in the country, especially such as lie in exposed situations."

Careful comparisons of the changes produced in the lungs by this disease, in England and France, have shown that the two countries are suffering from a similar malady.

About three years ago, at the request of the Agricultural Societies of England and Ireland, in connection with the English Government, an examination was made as to the existence of Pleuro-pneumonia, and other diseases of cattle upon the Continent. It was found in Belgium in a sporadic form, where it had prevailed for two years, being, as far as could be observed, independent of the usual influence of good and poor management, so far as the numbers attacked were concerned; but the disease assumed a more fatal character where the animals were not well cared for. In Holland, of forty-three villages, only eight were found to be free from Pleuro-pneumonia, and in those there were few cattle. About four fifths of the herds were diseased in those places where the disease prevailed. In one quarter, in 1857, 1502 died, and 2133 were killed by authority. The report says: "We are not surprised at the great extent of these losses, judging from what we saw of the secondary causes of epizootics in operation in the vicinity of Rotterdam. The cattle are often crowded into houses so thickly, that to pass between them is almost an impossibility, where the form and size of the building will frequently allow of the passage of a person along the centre only, where the heads of the animals nearly meet over their feeding-troughs; the height also being insufficient to stand upright in. No windows exist in many of these sheds, nor any other inlet for light and air except the door. The heat is almost suffocating, and the stench abominable."

In Westphalia and Hanover, the disease has existed, except at few intervals, and with varying severity, from 1807 to the present time. At present it is said not to be sufficiently prevalent to require any attention from the authorities, although those entering from Holland are still examined by veterinary surgeons.

Holstein seems to have suffered severely from the disease in question since 1842, its first appearance being nearly coincident with that in England; and in 1845 a commission was appointed, which came to the conclusion that the disease was highly contagious, and recommended "sequestration of the places where the disease exists, the immediate slaughter of the infected animals, the killing of the whole herd on the appearance of fresh cases, and the burial of the diseased cattle with their skins on, cut in various places, and sprinkled with chloride of lime." To carry out these details the most stringent laws were passed, and the whole matter put under the control of the police, who prevented the sale of any cattle which had been exposed within six months, and even then it was not permitted unless upon the certificate of a veterinary surgeon that they were free from disease.

The adoption of these measures in 1845 do not appear to have extinguished the disease, for we find it again prevailing in 1847; and, as before, commencing in Altona; so again in 1849 and 1851, and lastly, in the spring of 1856. In the last instance it was supposed to be imported from Hungary; the disease appeared after 180 oxen arriving from that country had been pastured in the vicinity of Hamburg, from which town it spread, by means of other cattle pastured in the same place, through the adjacent parts of Holstein. It almost simultaneously appeared in Mecklenberg, and already existed in several of the German States. Upon this, the importation of cattle into Holstein was forbidden from all places where Pleuro-pneumonia had existed within the six months previous. The same laws with regard to sequestration and slaughter were again put in force; nevertheless, the disease continued to prevail, and all farms where Pleuro-pneumonia had existed within six months were closed, and no animals allowed to leave them; the cattle were kept in stalls, or allowed to go to those pastures only from which all other cattle were excluded. Similar exclusive laws were, in 1856, adopted in Hamburg, allowing no cattle to be brought from any place in which the disease existed, under penalty of a heavy fine. Sweden and Norway adopted similar laws in August, 1856, and included in the list of forbidden places England and Scotland. The same year Pleuro-pneumonia appeared in the Duchies of Mecklenberg-Schwerin and Mecklenberg-Strelitz, especially in the month of March, in a village near Sternberg, where, after the death of several cattle, the remainder were killed and buried entire. This summary proceeding, it is remarked, "appears to have arrested the disease in that particular village; but cases are said to have occurred in other parts of the Duchies, notwithstanding that the import, export, and transit of cattle were forbidden, with regard to the village mentioned, until the following October."

From a consideration of the facts collected from the report above mentioned, of which we have endeavoured to give a summary, it appears that, notwithstanding all endeavours,—and they have generally been of the most sweeping and stringent character,—Pleuro-pneumonia has existed in most of the countries of Northern and Western Europe from 1841 to the present time. To this fact we shall have occasion to refer when we consider the contagiousness of this disease.

Pleuro-pneumonia made its appearance in Massachusetts in the summer of 1859. Disease affecting the pleura and lungs had frequently existed previously, either as ordinary inflammation,—more commonly at certain seasons of the year when the weather was cold and moist,—or as the result of bad management as regards the stabling or the feeding of the animals. Pleuro-pneumonia has also been pravalent among hogs, especially in the Western States, by which great numbers were destroyed in a short time. In the vicinity of Boston, and indeed in the same locality where the horned cattle were first attacked, the hogs had suffered severely a year or two before. In the summer of 1859 the disease broke out with greater severity, and destroyed more cattle than was ever known before in the same vicinity. It was first noticed in a Dutch cow which had recently arrived in the country. She was imported, with two other cows and a heifer, by W. W. Chenery, Esq., who obtained them from Purmerend,* about ten miles north of Amsterdam, where no disease was known to exist at the time. These cattle were sent to

* In the Beemster, a drained meadow of about 8000 acres.

Rotterdam, where Pleuro-pneumonia is said generally to exist, and there remained several days, until they were shipped on the 6th of April. On the 23rd of May, after a voyage of forty-seven days, they arrived in Boston, in bad condition. One of the cows had been mutilated on the voyage, and another had been unable to stand for twenty days, and was carried out of the city on trucks, and, with the other three, taken to the "Highland Stock Farm." This farm is in Belmont, about six miles northwest of Boston, upon the summit of "Wellington Hill," an elevation remarkable for the beautiful views it affords of the surrounding country, and for its healthfulness. The barn is square, about fifty feet by the side, and the part in which the cattle are stabled not far from eight feet high. The arrangement is such that the heads of the cattle are directed towards a square opening in the centre, from which the animals are fed. In the roof is an opening for ventilation, connected with the room in which the cattle are kept; a few windows were originally placed in the walls of the barn, and others have been since added, by which the amount of air has been materially increased. The barn is probably more closely built than usual in the country, and, previously to the addition of the windows, deficient in ventilation. The farm being used for a stock farm and the propagation of select animals, the feeding and general management were particularly attended to, and the animals fared better than is common,—perhaps luxuriously. The number of cattle kept in this barn at the outbreak of this disease was forty-two; the number of the whole herd about sixty.

The spring being far advanced, and the grass available, those of the animals which were well enough were pastured during the day, but came to the barn at night. Of the two cows that were ill on their arrival, the one that was carried home on trucks was killed a week afterwards, May 31st, and was buried: the second died June 2nd, two days afterwards, and was buried. Neither of them was supposed to have any disease of the lungs, either at the time they died, or after the nature of the disease that followed was understood; they were supposed to have died solely from the effects of the voyage and the treatment then received.

The third cow, which was confined in a pen in the barn, with from twenty to thirty head of cattle, was taken sick about the 20th of June, seventy-five days after leaving Rotterdam, and died on the 29th June. She was not examined after death, but the symptoms were believed by the surgeon who attended her to be the same with those of the cattle which died afterwards. The fourth animal, which was imported on the 23rd of May, has remained in good health to the present time. This, then, is the history of the whole importation,—two died, soon after their arrival, of injuries; one was taken sick twenty-eight days after arrival, and died in nine days, probably of Pleuro-pneumonia; the fourth remains well.

About the first week in August a cow, imported from Holland in 1852, sickened; she died on the 20th of the same month. This animal was examined, but it was questioned whether she died of Pleuro-pneumonia. Other fatal cases soon followed; and in the course of two months nearly all those lost during the epidemic died. Examinations were made, and it was soon ascertained that the disease was essentially an affection of the lungs and pleura. An ox that was fatally diseased was killed on the 26th of October, and more carefully examined than any previously; both lungs were much diseased, in a manner which we shall have occasion to describe further on. No age was spared, nor did it appear that strength and vigor enabled the animals to resist the disease. The whole number lost was thirty, of which three were slaughtered. Of the races, it was thought that a greater proportion of the Dutch stock lived than of the other. A bull has been in the barn throughout the disease, and has received, so far as could be perceived, no detriment. A "mammoth cow," as she is designated, weighing 2300 pounds, calved on the 2nd of December; two days after became sick, and died in five and a half weeks, of very extensive Pleuro-pneumonia. The calf was suckled by the mother four days after she became ill; it was then transferred to a native cow, procured for the purpose, and placed in the same barn with the diseased animals until she also became diseased. This cow was killed on the 2nd of June, and an examination proved the existence of Pleuro-pneumonia in its early stage and to a moderate extent; but the calf has not only been well, but is remarkable for strength and beauty, weighing at the age of six months 800 pounds.

One of Mr. Chenery's cows was sent from his home farm, more than a mile distant, to the "Highland Stock Farm," and replaced by another from the Stock Farm. The first cow became diseased with Pleuro-pneumonia after being placed in the barn with the other cattle; but the one sent to the home farm did not have Pleuro-pneumonia, although both that and another killed with her, in October, showed signs of what was supposed to be phthisis.

Two calves died of Pleuro-pneumonia in the course of the autumn, without communicating the disease to six or eight others, occupying, until the time of their death, the same pasture. No isolation was thought necessary or attempted until the 1st of September, and then the isolation ceased after a few weeks, and was not again resumed till about the middle of April, 1860. No care was taken to prevent the communication of the disease to cattle occupying the adjoining farms, from which they were separated by a common stone-wall only. Notwithstanding this freedom of communication, which certainly allowed of their putting their noses together, no instance of the transmission of the disease is known to have occurred to any animal living within twenty miles of Belmont. No death from Pleuro-pneumonia occurred at Mr. Chenery's farm after the 8th of January, 1860. Several animals remained ill for a considerable time, some entirely recovering their former health and strength, and are now living apparently quite well, and others continuing in an uncertain state, until they were killed in autumn, to determine the progress and mode of termination of the disease.

On the 29th of June, the day on which the first cow died (one of the four imported from Rotterdam), three calves were sold to a farmer in North Brookfield, a town in Worcester County, about fifty miles west of Belmont. The farmer took them home by the railway, and drove them from the station to his farm, a distance of five miles. On the way, one of the calves was observed to falter, and at the end of the journey was evidently sick. It was placed in a barn with forty head of cattle, where it remained four days. It became more sick, and was removed to another barn, containing twenty cattle, where it died in ten days. Of the other two calves, one has remained perfectly well, the other has appeared somewhat ill, but both are living. About a fortnight after the return of the calf, an ox of the herd of forty fell sick and soon died. Two weeks after the death of this animal, a second died; and subsequently, at somewhat longer intervals, others died, until eight were lost. Of the twenty in the barn where the calf died, all were apparently well on the first of the following November, when eleven young heifers were sold at auction, and, with the remaining nine, distributed among various herds, but all in the same vicinity. All these herds were found by the Commissioners, in the following April, six months afterwards, to be more or less diseased. During the winter, six or eight of the oxen of the herd of forty, where the sick calf remained four days, were used in drawing lumber, and apparently well. They stayed a single night with a herd which subsequently became diseased. Another animal of the same herd was sold to a man in New Braintree, an adjoining town, and he also lost a number of his cattle. A yoke of cattle from the same herd of forty above mentioned were sold and went into a herd in the same town,—North Brookfield,—where they remained only five days; one-third of this herd became diseased. This yoke of oxen again, still apparently well, were placed in a team of twenty-two yoke of catttle, and used a day and a half in moving a building from Oakham to North Brookfield, a distance of four or five miles The whole of these cattle are said to have become diseased, and subsequently eleven other herds, to which these cattle belonged, also became diseased. Animals were found diseased, and badly diseased, after standing in a road in North Brookfield while diseased animals were in a barn on the other side.

Animals which had become diseased in Brookfield were driven to other towns, and in the course of the journey other animals were near them, or in a condition to be "exposed," as it is termed in the evidence taken before the Committee of the Legislature. In one instance fifty were in this condition, and in other instances several were in the same pasture, and yet the amount of subsequent disease was very slight. Beyond a space of ten or twelve miles square, around North Brookfield, the cases of disease are believed to have been very few.

The appearance of the disease in Belmont and in Brookfield, and the increasing amount of the disease in the latter town, alarmed the inhabitants, and application was made to the Legislature, then in session, for the enactment of such laws, and the taking of such other measures, as would tend to the arrest of the disease. Accordingly, April 4, 1860, an Act was passed "to provide for the Extirpation of the Disease called Pleuro-pneumonia among Cattle," which is as follows:—

"SECT. 1. The Governor is hereby authorized to appoint three Commissioners, who shall visit, without delay, the several places in this Commonwealth, where the disease among cattle, called Pleuro-pneumonia, may be known or suspected to exist, and shall have full power to cause all cattle belonging to the herds in which the disease has appeared, or may appear, or which have belonged to such herds since the disease may be known to have existed therein, to be forthwith killed and buried, and the premises where such cattle have been kept cleansed and purified; and to make such order in relation to the further use and occupation of such premises as may seem to them to be necessary to prevent the extension of the disease.

"SECT. 2. The Commissioners shall cause all cattle, in the aforesaid herds, not appearing to be affected by the disease, to be appraised before being killed, at what would have been their fair market value if the disease had not existed; and the value of the cattle thus appraised shall be allowed and paid out of the Treasury of the Commonwealth to the owner or owners thereof.

"SECT. 3. Any person who shall knowingly disregard any lawful order or direction of said Commissioners, or who shall sell or otherwise dispose of an animal which he knows, or has good reason to suspect, has been exposed to the aforesaid disease, shall forfeit a sum not exceeding five hundred dollars.

"SECT. 4. The Commissioners shall make a full report to the Secretary of the Board of Agriculture, of their proceedings, and of the result of their observations and inquiries relative to the nature and character of the disease.

"SECT. 5. The Commissioners shall duly certify all allowances made under the second section of this act, and other expenses incurred by them, or under their direction, in the execution of their service, to the Governor and Council; and the Governor is hereby authorized to draw his warrant therefore upon the Treasury.

"SECT. 6. This act shall take effect from its passage, and continue in force for the term of one year thereafter, and no longer."

For carrying out the provisions of this Act, 10,000 dollars were appropriated.

Three Commissioners were appointed by the Governor, as contemplated by this Act. They visited Mr. Chenery's farm on the 16th of April, examined his cattle, and pronounced a large number of them diseased. Three were killed and buried, and the remainder were confined to the barn in which the disease first appeared. Brookfield and its vicinity was then visited, where the disease was found to have existed nearly a year in one herd belonging to Mr. Stoddard. The Commissioner (Evidence before Legislative Committee, May 31, 1860, p. 22) says: "I forget the precise number, but Mr. Stoddard had lost a great many cattle,—I think fifteen. A very large portion of the remainder were condemned as diseased, and the condition of the remainder I would not attempt to say anything about, although I have my opinion about it. The herds exposed to Mr. Stoddard's, last autumn, or when

they came to the fall feeding,—all those herds exposed early in the autumn,—presented unmistakable and very extensive signs of disease. Now, let us come down to a period more recent. Animals exposed to animals brought from Mr. Stoddard's on the first of November, and transported from one place to another, and carrying the exposure with them, in the early part of the winter presented slight marks of the disease. The longer it lodges in a region, the more decided and fixed it is; so that it is in one solid mass in North Brookfield, apparent, distinct, and unequivocal."

"The practice adopted by the Commissioners was, whenever a herd of cattle was found exposed, the cattle were appraised, and a surgeon was appointed to pass judgment upon the number of diseased animals. After that judgment, the remaining animals that were pronounced sound were killed, and passed—as in the case of Mr. Stoddard—to the credit of the owner, after an appraisement made by three persons." The average appraisement was about thirty-three dollars a head.

Exactly what constitutes "exposure" is not clearly defined. Being in the same team, in the same barn, or in the same herd, and even passing along a road by a barn in which a diseased animal was, seems to have been considered by one of the Commissioners as an exposure sufficient to cause disease. Measures to ascertain the exact amount of disease do not appear to have been very carefully taken. The animals pronounced sound by the surgeons were not examined, and of those pronounced diseased, a part only were submitted to examination after death.

Eight hundred and forty-two cattle were killed by the Commissioners, and buried according to law. How many of these were diseased the Commissioners had no accurate means of determining; they depended upon the "pronouncement" of the surgeon for all their information upon this point. Of the animals which have been killed, or have died naturally in the course of the epidemic, and have been examined, it is supposed that about two hundred have exhibited evidence of the disease. Of those which have died naturally, the disease has been proved, by examination after death, to have existed in seventy or eighty. The killing of the diseased and healthy animals commenced about April 16th, and was continued till May 10th, about three weeks. By that time it had branched off in various directions to various towns. "It assumed such proportions, that it was very evident that the Commissioners had not the funds to perform the operations required by the law." The law confined the Commissioners to one operation,—killing and burying. They stopped killing the herds, and the policy was then changed to circumscribing the disease, by isolating the herds just as fast as possible. According to custom, many cattle were driven, for pasturing, to different towns in the counties in New Hampshire bordering upon Massachusetts. Some of these are said to have been affected with the disease.

This state of things induced the Commissioners and others to petition the Governor to call a session of the Legislature, to take measures for the extinction of the disease. An extra session was called, and a committee of seven from the Senate, and fourteen from the House, was chosen, which held its first meeting May 31. The Commissioners stated before the committee, at its first meeting, that eight hundred and forty-two cattle had been killed, and that their appraised value was something more than twenty thousand dollars. It was also stated that, according to a careful estimate, there were on the 18th of May one thousand head of cattle that had been so exposed as to require that they should either be killed or isolated until it is proved that they are free from disease. The amount of disease was believed to be increasing. Witnesses testified that cattle had been driven, in some instances, to a distance of twenty miles from Brookfield, which had exhibited unmistakable signs of disease after death. One of the selectmen of a neighboring town to Brookfield, in his official capacity, had received information that many cattle in that town had been exposed, and that the disease, in the opinion of physicians, seemed to be fast spreading in the town. Two animals were stated to have died of the disease in Holden, after having been pastured, or driven with and exposing about fifty animals in a small circuit, and these animals were exposing others. The whole tendency of the testimony taken went to show that the disease was contagious and extending its ravages. It was stated that the amount required for the extermination of the disease would now exceed fifty thousand dollars in addition to that already expended. One of the Commissioners said: "I will state the reasons why I have no sort of doubt of the speedy extermination of the disease. I am satisfied that on the western line of this disease the progress has stopped. On the line of the road running from West Brookfield to Ware, with the exception of a number of cattle which were killed in Pelham,—a very ordinary farming town where there are few cattle,—and which were driven over from Brookfield, I don't think the disease has gone. In Pelham I think it has entirely stopped. I understand there is a little fear about it to-day, but nothing decisive. But on the road from West Brookfield to Ware, the disease is thoroughly exterminated I have no doubt, and the Commissioners have every reason to suppose the disease may be entirely eradicated by proper measures."

Under the fear and anxieties expressed by some of the witnesses, and the hopes held out by others, of the speedy extermination of the disease, if certain stringent measures were adopted, the following bills were passed on the 12th of June, 1860, and approved by the Governor. The first had reference to the prevention of the disease, and the second more especially to the appointment of a Medical Commission of Examiners of Diseased Animals, and the establishment of a hospital or quarantine for the study and cure of the disease:—

"*AN ACT concerning contagious Diseases among Cattle.*

"Be it enacted, &c., as follows:—

"SECT. 1. The Selectmen of towns, and the Mayor and Aldermen of cities, in case of the existence in this Commonwealth of the disease called Pleuro-pneumonia, or any other contagious disease among cattle, shall cause the cattle, in their respective towns and cities, which are infected, or which have been exposed to,

infection, to be secured or collected in some suitable place or places, within such city or town, and kept isolated; and when taken from the possession of their owners, to be maintained, one fifth of the expense thereof to be paid by the town or city wherein the animal is kept, and four fifths at the expense of the Commonwealth, such isolation to continue so long as the existence of such disease or other circumstances renders the same necessary.

"SECT. 2. Said Selectmen and Mayor and Aldermen, when any such animal is adjudged, by a veterinary surgeon or physician by them selected, to be infected with the disease called Pleuro-pneumonia, or any other contagious disease, may, in their discretion, order such diseased animal to be forthwith killed and buried at the expense of such town or city.

"SECT. 3. Said Selectmen and Mayor and Aldermen shall cause all cattle which they shall so order to be killed, to be appraised by three competent and disinterested men, under oath, at the value thereof at the time of the appraisal, and the amount of the appraisal shall be paid as provided in the fist section.

"SECT. 4. Said Selectmen and Mayor and Aldermen are hereby authorized to prohibit the departure of cattle from any enclosure, or to exclude cattle therefrom.

"SECT. 5. Said Selectmen and Mayor and Aldermen may make regulations in writing, to regulate or prohibit the passage from, to, or through their respective cities or towns, or from place to place within the same, of any neat cattle; and may arrest and detain, at the cost of the owners thereof, all cattle found passing in violation of such regulations, and may take all other necessary measures for the enforcement of such prohibition, and also for preventing the spread of any such disease among the cattle in their respective towns and cities, and the immediate vicinity thereof.

"SECT. 6. The regulations made by Selectmen, and Mayor and Aldermen, in pursuance of the foregoing section, shall be recorded upon the records of their towns and cities respectively, and shall be published in such towns and cities in such manner as may be provided in such regulations.

"SECT. 7. Said Selectmen and Mayor and Aldermen are authorized to cause all cattle infected with such disease, or which have been exposed thereto, to be forthwith branded upon the rump with the letter P, so as to distinguish the animal from other cattle; and no cattle so branded shall be sold or disposed of except with the knowledge and consent of such Selectmen and Mayor and Aldermen. Any person, without such knowledge and consent, selling or disposing of an animal known to be affected with such disease, or known to have been exposed thereto within one year from such sale or disposal, shall be punished by fine not exceeding five hundred dollars, or by imprisonment not exceeding one year.

"SECT. 8. Any person disobeying the orders of the Selectmen or Mayor and Aldermen, made in conformity with the fourth section, or driving or transporting any neat cattle, contrary to the regulations made, recorded, and published as aforesaid, shall be punished by fine not exceeding five hundred dollars, or by imprisonment not exceeding one year.

"SECT. 9. Whoever knows or has reason to suspect the existence of any such disease among the cattle in his possession, or under his care, shall forthwith give notice to the Selectmen of the town, or Mayor and Aldermen of the city where such cattle may be kept, and for failure so to do, shall be punished by fine not exceeding five hundred dollars, or by imprisonment not exceeding one year.

"SECT. 10. Any town or city whose officers shall neglect or refuse to carry into effect the provisions of sections one, two, three, four, five, six, and seven, shall forfeit a sum not exceeding five hundred dollars for each day's neglect.

"SECT. 11. All appraisals made under the provisions of this act shall be in writing, and signed by the appraisers, and the same shall be certified to the Governor and Council, and to the Treasurer of the several towns and cities wherein the cattle appraised were kept by the Selectmen and Mayors and Aldermen respectively.

"SECT. 12. The Selectmen of towns, and Mayor and Aldermen of cities, are hereby authorized, when in their judgment it shall be necessary to carry into effect the purposes of this act, to take and hold possession, for a term not exceeding one year, within their respective towns and cities, of any land, without buildings other than barns thereon, upon which it may be necessary to enclose and isolate any cattle, and they shall cause the damages sustained by the owners in consequence of such taking and holding to be appraised by the assessors of the town or city wherein the lands so taken are situated, and they shall further cause a description of such land, setting forth the boundaries thereof, and the area as nearly as may be estimated, together with said appraisal by the assessors, to be entered on the records of the town or city. The amount of said appraisal shall be paid as provided in the first section, in such sums and at such times as the Selectmen or Mayor and Aldermen respectively may order. If the owner of any land so taken shall be dissatisfied with the appraisal of said assessors, he may by action of contract recover of the town or city wherein the lands lie a fair compensation for the damages sustained by him; but no costs shall be taxed, unless the damages recovered in such action, exclusive of interest, exceed the appraisal of the assessors. And the Commonwealth shall reimburse any town or city four-fifths of any sum recovered of such town or city in any such action.

"SECT. 13. This Act shall take effect from its passage."

"AN ACT in addition to an Act concerning contagious Diseases among Cattle.

"Be it enacted, &c. as follows:—

"SECT. 1. In addition to the Commissioners appointed under the provisions of chapter one hundred and ninety-two of the acts of the year one thousand eight hundred and sixty, the Governor, by and with the advice and consent of the Council, is hereby authorized to appoint two additional persons to constitute, with those now in office, a board of Commissioners upon the subject of Pleuro-pneumonia, or any other contagious disease now existing among the cattle of the Commonwealth.

"SECT. 2. When said Commissioners shall make and publish any regulations concerning the extirpation, cure, or treatment of cattle infected with, or which have been exposed to, the disease of Pleuro-pneumonia, or other

contagious disease, such regulations shall supersede the regulatinns made by Selectmen of towns and Mayors and Aldermen of cities, upon the same subject-matter, and the operation of the regulations made by such Selectmen and Mayors and Aldermen shall be suspended during the time those made by the Commissioners as aforesaid shall be in force. And said Selectmen and Mayors and Aldermen shall carry out and enforce all orders and directions of said Commissioners, to them directed, as they shall from time to time issue.

"SECT. 3. In addition to the power and authority conferred on the Selectmen of towns, and Mayors and Aldermen of cities, by the act to which this is in addition, and which are herein conferred upon said Commissioners, the same Commissioners shall have power to provide for the establishment of a hospital or quarantine in some suitable place or places, with proper accommodations of buildings, land, &c., wherein may be detained any cattle by them selected, so that said cattle so infected, or exposed, may be there treated by such scientific practitioners of the healing art as may be appointed to treat the same. And for this purpose said Commissioners may take any lands and buildings in the manner provided in the twelfth section of the act to which this is in addition.

"SECT. 4. The Governor, by and with the advice and consent of the Council, is hereby authorized to appoint three competent persons to be a Board of Examiners to examine into the disease called Pleuro-pneumonia, who shall attend at the hospital at quarantine established by the Commissioners mentioned in the foregoing section, and there treat and experiment upon such number of cattle, both sound and infected, as will enable them to study the symptoms and laws of the disease, and ascertain, so far as they can, the best mode of treating cattle, in view of the prevention and cure of the disease, and who shall keep a full record of their proceedings, and make a report thereon to the Governor and Council, when their investigations shall have been concluded: *provided,* that the expense of said Board of Examiners shall not exceed ten thousand dollars.

"SECT. 5. The Selectmen of the several towns, and the Mayors and Aldermen of the several cities, shall, within twenty-four hours after they shall have notice that any cattle in their respective towns and cities are infected with, or have been exposed to, any such disease, give notice in writing to said Commissioners of the same.

"SECT. 6. The Commissioners are authorized to make all necessary regulations for the treatment, cure, and extirpation of said disease, and may direct the Selectmen of towns, and Mayors and Aldermen of cities, to enforce and carry into effect all such regulations as may, from time to time, be made for that end, and any such officer refusing or neglecting to enforce and carry out any regulation of the Commissioners shall be punished by fine not exceeding five hundred dollars for every such offence.

"SECT. 7. The Commissioners may, when in their judgment the public good shall require it, cause to be killed and buried any cattle which are infected with, or which have been exposed to, said disease, and said Commissioners shall cause said cattle to be appraised in the same manner provided in the act to which this is an addition; and the appraised value of such cattle shall be paid, one fifth by the towns in which said cattle are kept, and the remainder by the Commonwealth.

"SECT. 8. Whoever shall drive or transport any cattle from any portion of the Commonwealth east of Connecticut River to any part west of said river before the first day of April next, without consent of the Commissioners, shall be punished by fine not exceeding five hundred dollars, or by imprisonment in the county jail not exceeding one year.

"SECT. 9. Whoever shall drive or transport any cattle from any portion of the Commonwealth into any other State before the first day of April next, without the consent of the Commissioners, shall be punished by fine not exceeding five hundred dollars, or by imprisonment in the county jail not exceeding one year.

"SECT. 10. If any person fails to comply with any regulation made, or with any order given by the Commissioners, he shall be punished by fine not exceeding five hundred dollars, or by imprisonment not exceeding one year.

"SECT. 11. Prosecutions under the two preceding sections may be prosecuted in any county in this Commonwealth.

"SECT. 12. All appraisals made under this act shall be in writing, and signed by the appraisers and certified by the Commissioners, and shall be by them transmitted to the Governor and Council, and to the treasurers of the several cities and towns wherein the cattle appraised were kept.

"SECT. 13. The provisions of chapter one hundred and ninety-two of the Acts of one thousand eight hundred and sixty [except so far as they authorize the appointment of Commissioners] are hereby repealed, but this repeal shall not affect the validity of the proceedings heretofore lawfully had under the provisions of said chapter.

"SECT. 14. The Commissioners and Examiners shall keep a full record of their doings, and make report of the same to the next Legislature, on or before the tenth day of January next, unless sooner required by the Governor; and the said record, or an abstract of the same, shall be printed in the annual volume of Transactions of the State Board of Agriculture.

"SECT. 15. The Governor, with the advice and consent of the Council, shall have power to terminate the commission and board of examiners whenever in his judgment the public safety may permit.

"SECT. 16. This act shall take effect from its passage."

After these acts were passed and the Commissioners named in the first bill commenced their investigations, they were unable to discover any case or cases of the disease which were recent or in active stage. Nor could it be ascertained that any death from the natural course of the disease had occurred *after the 12th of the preceding April,* just two months before the passage of the acts.

Nothing was therefore left for the medical commission to investigate, but the effects of the disease upon the surviving animals which were diseased, or which were supposed to have been exposed to disease. The first of the investigations upon slaughtered animals did not take place, however, until the 11th of October. The results showed that animals which had been ill and had recovered their usual signs of health,

presented more or less evidence of previous disease in the lungs, now completely arrested, and that some of those which had been freely and continuously exposed presented no evidence of the disease either during life or after death. In no case is it understood that the examination revealed disease in active state.

Various opinions have been expressed as to the probable re-appearance of the disease after the herds had returned to the barns from their summer feeding in distant and secluded pastures. Even those who did not believe in the highly contagious character of the disease were doubtful whether an influence might not still exist in or about the barns, local in its nature, or which would be developed by close stalls and large numbers, which might aid in another outbreak. While, on the other hand, those who believed in its resemblance to small-pox in its contagious characteristics, could not but believe that it would be spread over the hills of New Hampshire and return with the returning herds.

So far as the evidence collected up to the first week in December of the present year goes, it would appear that the fears of neither were destined to be realized. The disease seems to have swept over the community and disappeared like many of those epidemics which affect the human race, the causes of the rise and disappearance of which are still unexplained.

Pathology.—To understand the changes which take place in the lungs, it must be remembered that their structure is peculiar. Starting from the windpipe, this tube divides and subdivides in the lung, reaching to all parts of it. At the end of each minute division a collection of little bladders is found, numbering from twenty to thirty, each of which is united by a small tube with the sub-divisions of the windpipe just mentioned. Into these small *air-vesicles* the air makes its way, and in these the changes constituting the essential part of respiration take place. This group of twenty or thirty is surrounded by a layer of membrane, separating the group from its neighboring group, forming, therefore, a little lung by itself. A number of these lobules, again forming a group, are also separated from others by a still firmer and thicker membrane than the former, and much more readily distinguished. And lastly, a third order is arranged in a similar manner, the individuals of which are composed of a number of those last described, and the surrounding dividing membrane is much more obvious, thicker, and looser than the last, allowing the different lobules to move freely upon each other. It is this membrane, or *inter-lobular tissue*, which plays so important a part in this disease, and which renders possible in the bovine animals results which do not occur in lungs differently constituted. The whole lung is enclosed in a membrane, *the pleura*, and by a continuation of the same membrane the ribs are also lined, leaving a sack or cavity between the lungs and ribs, which may be filled with fluid during disease, compressing the lung and rendering it useless.

In animals killed early in the disease the *inter-lobular tissue* is, in isolated spots, more filled with blood than natural, and, probably in consequence of infiltration with a watery fluid, its color is changed to a light yellow; a little more advanced, and this tissue is found to be thickened by a deposit into its meshes, by which it is rendered firmer and more visible. The minute blood-vessels which ramify over the walls of the *air-vesicles* are enlarged, exhibiting small spots of blood of the size of pins' heads, giving a dotted appearance to a section of the lung. At this time a watery fluid, *œdema*, gradually appears in the diseased part, and in variable quantity, so that in some parts no air can enter, while in others it is only partly excluded. The air-tubes are also filled with the same fluid, so that fresh air cannot pass through them. These changes may, and generally do, take place in the deeper-seated portions of the lung without affecting the *pleura*. But if the disease attacks a portion near the surface, the pleura becomes inflamed, and is covered by a whitish layer upon its surface and a deposit beneath it, similar to that first mentioned as occurring in the *inter-lobular tissue*. The increase of blood, and the small points of blood, are seen in a circumference of a few lines to half an inch. The disease attacks more frequently one lung only, and, it is thought, more frequently the left, or seizes one first and then passes to the other. In very rare instances both lungs are attacked at the same time.

In a more advanced stage, the lung undergoes such changes as give it, when cut, a marbled appearance; this appearance occurs in masses of the size of an apple or larger, till it involves one quarter or one half of a whole lung. The pleura, to the same extent of surface, is of a yellow color, or, if more diseased, has a yellow, soft layer, of variable thickness, and a similar product on the corresponding pleura lining the ribs; also upon the midriff, and the *pericardium*, or heart-case. At the same time an effusion of fluid, of a clear citron-yellow color, into the cavity between the two *plurœ*, of a variable quantity, and more or less compressing the lung. As the œdema in the *inter-lobular tissue* increases, the lung increases in weight from four or five pounds, in its natural condition, to twenty or thirty pounds, and sixty pounds has been stated by some observers. It is then firm, compact, liver-like; it does not crepitate when cut through, and air cannot be blown into it, as the *air-vesicles* are bound together by the exudation poured out into the surrounding tissue. The cut surface presents the marbled appearance above mentioned in a striking degree, an appearance not seen in ordinary inflammation of the lungs, which has attracted the attention of observers, and is considered by some writers as one of the diagnostics of the disease. The cause of this peculiarity is to be found in the fact that layers of inter-lobular tissue being infiltrated, and of a different color from the lobules which they enclose, afford a sort of network, or setting for them, of a somewhat irregular quadrilateral form, not very unlike the veining of some kinds of marble. From the cut surface a red-colored fluid can be pressed, which, when removed, leaves the lung permeable to air. But the lung does not collapse when the chest is opened; it fills the whole cavity, giving a volume two or three times that of a lung in its ordinary collapsed condition. Croupous inflammation producing true hepatization is very rarely found. Deposits upon the surface of the pleura are formed, and this soft and now easily removed layer covering the lungs being in close contact with that lining the ribs, the two become united and produce adhesions, which in a later stage are difficult to separate. In some cases the deposit of lymph is an inch or more in thickness, completely lining the pleura, like another membrane. Serum is also poured into the cavity of the *pleura*, in some instances in quantity

varying from a pint to a pailful, keeping the two surfaces separate, and preventing the adhesions just described, or occasionally rounded masses are floating in the serum, resembling lumps of fat.

As the disease advances, the exudation into the *inter-lobular tissue* increases, becomes more firm and resisting when divided, and does not differ from the products of inflammation of a recent date in other parts. The bronchial blood-vessels are surrounded by this layer of exudation, their walls are thickened, and their calibre diminished, and in the smaller branches even completely obstructed by coagulable lymph. In the next stage, and for which these deposits around the lobules and the plugging of the vesicles prepare the way, is peculiar and exceedingly interesting. The central portions of the lung and exudation, of irregular shape and of greater or les size, are gradually cut off from their means of support, and become dead, and lie loose within the surrounding more favorably situated parts. If the separated piece is not large, it not unfrequently is enclosed in a capsule of organized tissue, like that which forms in other parts around foreign bodies, thus completely shutting it up, and removing it from contact with the neighboring parts. Within the capsule changes are constantly going on upon which the safety of the animal depends. In the recent cases pus is found, in some instances amounting to a pint or more; and loose, floating in the pus, is the hard mass of separated lung tissue, easily recognized by its structure and resemblance to the other inflamed parts. In some instances the separation between the surrounding lung and the enclosed mass has been only partly accomplished, the enclosing capsule having formed upon one side, while upon the other the mass retains its connections with the living lung.

The fluids contained within the capsule are, in favorable cases, gradally absorbed, leaving a pap-like mass, not absorbable, which may be still further changed into a yellow, granular, brittle mass, easily crushed under the fingers, and of a light yellow color. Masses have been found three or four inches in diameter, which are supposed to have had their origin in this manner. In the course of time, in the small masses, the absorbable fluids being removed, lime salts are formed, and chalky concretions occupy their place; the capsule, as its contents are removed, gradually contracting, and the surrounding lung as gradually supplying its place. If the masses are very large, it is not probable that these changes often occur. In such cases the mass lies, totally unconnected with surrounding lung, in the condition of a dead, mortified structure, in which case it may be a sufficient source of irritation to destroy life; or, by means of open blood-vessels,—cut off and not closed, or if closed, again opened by ulceration,—pus, or other diseased fluids, may enter the circulation, and thus become the cause of death. Even here, however, the case may not be hopeless if the mortified mass is near the root of the lung, where the bronchial tubes are quite large, for through these the gradually decaying lung may find an exit, and be entirely expectorated. The cavity in such cases becomes lined with a smooth mucous membrane performing its functions in a regular manner. In such cases the bronchial tubes terminate abruptly, and of their full diameter, just at the wall of the cavity; or if the tube ran along one side of the cavity, a part of its walls may be removed, the remaining portion being found firm and cartilaginous beneath the new membrane. The explanation of the remarkable results now described may probably be as follows. The exudation into inter-lobular tissue, which is at the best imperfectly organized, together with the plugging of the blood-vessels, diminishes the supply of blood to the parts within. The exudation may, as it becomes organized in its more favorable parts, contract in a manner not unlike that which takes place in the liver from an inflammatory deposit, and thus, although more safe itself from destruction, cut off what little circulation is left for the remainder, which is then destroyed.

A restoration of the functions of the lungs may also take place in a different manner. The lung has suffered in these cases from exudation like that formerly described; but the amount is less, and the resulting constriction is less, producing in a diminished degree obstruction to the flow of blood. The effect of this retarded flow of blood is the separation of its serous portion producing œdema. As the inflammation subsides, or perhaps before, the serous fluid is either absorbed or finds its exit through the bronchial tubes, and is discharged from the mouth or nose. The lung may then, after a time, resume its natural functions.

The condition of the blood has not been investigated sufficiently to speak with any certainty as to its variation from the healthy standard, except as regards the amount of fibrine, which, in conformity with analogous diseases, has been stated to be increased.

With regard to the other organs, no constant changes are observed. The heart is described as flabby, and with the walls thinner than natural. The liver is frequently somewhat enlarged. The condition of both these organs may perhaps be explained by the impediment offered by the lungs to the circulation of the blood. The milk, which is deficient in quantity, is found to be coagulated by heat, showing a larger amount of albumen, and the udder is tender.

Symptoms.—When the disease first made its appearance at Belmont, it was in a single individual; no other case occurred for more than a month after the death of the first; but in the following two months the disease raged, and then very decidedly diminished, nearly all that were lost having died during those sixty days. At Brookfield, after the first animal died, there was a short interval before a second was attacked, and subsequently the animals became diseased at intervals of about a fortnight, after which the malady ceased, although all had not been affected. This seems to have been observed in other countries,—a single case at first, a rather rapid increase in numbers, and a subsequent more slow diminution, with longer intervals between successive cases.

It seems to be pretty generally admitted, that the number of animals affected, and the mortality, is greatly influenced by the season and food. Cold, wet weather increases it, when the animals are exposed in fields; and a hot, vitiated atmosphere, when they are confined in stables. It is more severe and active, and of a shorter duration with the young, well-nourished than with those who are feeble and old.

It is generally supposed, especially by those who believe that contagion is the sole origin of the disease, that there is a period of latency or incubation, during which certain changes are going on in the system, not perceptible, but essential to the future outbreak. This period is supposed by some to extend from five days to six weeks; but of this there is no decided evidence.

One of the earliest and most constant symptoms is a peculiar, short, dry, cough,—not very decided,—more especially occurring in the morning, or after the animal has taken drink, or on rising to the feet after lying; quickened respiration. The animal is dull, sluggish; refuses food; inclined to separate itself from the herd, to seek quiet, sheltered places, and generally to abstain from the usual movements. The secretion of milk is diminished. Later, there is an uncommon play of the wings of the nostrils; breath quick, short, unequal; the muzzle is dry and hot; there are chills from time to time, especially towards evening; the horns and ears are alternately cold and warm; the whole body exhibits a peculiar stiffness; the midriff and the muscles of the abdomen are rigid and strained, as indicated by the diminished movements in respiration. If the disease is rapid, and the animal well nourished, the respirations are, from the beginning, from 25 to 40, instead of 22 to 25, as in health, attended by groans; the animal opens its mouth, protrudes the tongue. When the disease is slower in its progress, and the animal weak, the breath is short and grunting; respirations not deep, and the air forced out in starts; often panting, with strong movements of the flanks, especially after drinking or taking food. The peculiar cough becomes less hoarse, dryer, and more painful, and during the coughing the back is curved, the neck stretched out, and a shaking of the whole body. The severer the disease the less cough, and in the most rapid cases there is almost none. In young, well-nourished animals the visible lining membrane of the nostrils is reddened and dry; later, the redness gives place to a yellowish white, or a pale color; this last is seen from the first in those badly nourished. After a time, a clear and thin, or a tough and thick, and variously colored fluid is discharged from the nose, and is not removed by the tongue of the animal. Pieces of hardened excretions are thrown off like those found in the air-tubes, with relief to the breathing. Pressure upon the chest, behind the shoulder, and upon the withers, is painful, and the animal shrinks and groans.

Auscultation and *Percussion* furnish valuable indications of what is going on within the chest during this stage of the disease. By auscultation—listening with the ear upon the sides of the chest—it is ascertained that over the diseased parts the sounds of respiration are altered from the equal, breezy character of health, to a loud rattling sound, or that it is entirely wanting; in the one case indicating solidification of the lung beneath, and in the other the presence of fluid in the chest compressing the lung, or that the air is in some way excluded from the organ. By percussion (which is best practised by striking with one or more of the tips of the fingers of the one hand upon a rib of the animal or upon the finger of the other hand, laid firmly upon the rib or other part to be examined) we also obtain information as to the condition of the chest. If the part, when thus struck, gives out a dull sound, it indicates that the lung beneath is more or less solid, and if the sound is perfectly flat, like that obtained from percussing the flank, for instance, it indicates that the part contains no air, but instead contains a solid or a fluid. From similar examinations, the condition of the air-tubes can with great certainty, upon physical principles, be determined; so, also, the progress the animal has made towards recovery, the amount of effused fluid or solid matter enveloping the lungs or lining the ribs. As the signs thus obtained improve the lung improves. When the condition of the animal is as just described, auscultation gives a loud sound, as though the air were blowing through a tube, and an absence of the sounds obtained by listening to the respiration of a healthy animal. These sounds are to be sought for on the sides, from the elbow and shoulder backward as far as the midriff extends. In the same part the sounds given out by percussion is deficient, dull, or perfectly flat.

During the febrile stage, which sooner or later succeeds that now described, the pulse is full and hard in well-nourished animals, weak and full in those poorly nourished, and beating from 45 to 50 or 60 in a minute in the adult; an increase of 10 or 15 above the healthy standard. In the beginning of this stage the animal stands with the back up, the neck outstretched, removed from the crib, if in the stall, or separated from the herd, if in the pasture. If standing, the body is immoveable, with the hinder feet moving backward and forward. They seldom lie down, and for a short time only, resting upon the diseased side or upon the breast-bone. The hair is dull and without gloss. Temperature of the skin diminished, and the perspiration has a peculiar odor, especially where many animals are collected in the same barn. The eye has, with the well-nourished and strong, a fiery, staring look; with the weak, it is sunk in the orbits. The appetite and rumination are suspended. Drinking is troublesome, and provokes cough; clear cold water is preferred. The mouth, at first dry, discharges in the advanced stage an offensive saliva. The milk is poor and deficient in quantity. Urine, dark-colored; the excrement is from the beginning deficient, seldom voided, hard, dark-brown, or, in severe cases, as black as turf. The common sensibility is blunted and the powers of perception diminished. Sometimes an œdematous, puffy swelling arises about the head, and a tumor of the same character under the breast. Abortion occurs; there is jaundice. The pulse is weak and small,—from 80 to 100 in the minute, especially towards the end of life. The respiration is groaning, diminished, and from 30 to 40 in the minute, rattling, and affording by auscultation the various sounds indicating a large quantity of fluid in the air-tubes.

The duration of the disease varies with the character of the epizootic, with the strength and constitution of the animal, and its condition as regards nourishment. It varies also with the kind of disease,—that is, whether it affects the lungs, producing the changes in them which have been described,—excluding the air —or whether fluid is poured into the chest compressing the lung rapidly. After the febrile period has commenced, the disease usually reaches its height in from seven to fourteen days, seldom earlier, often later. The period which precedes this feverish stage varies much in its length, from a day or two to several weeks, and it is this which produces the great variations in the length of the whole malady.

If the disease terminates in death there is great emaciation; the extremities, the base of the ears, and

the roots of the horns become cold, the respiration is more and more labored, and life gradually terminates either from suffocation or extreme weakness.

An imperfect cure is another form of termination of, with a secretion of water into the chest or into the pericardium, interfering with the action of the heart, or a watery fluid in the lung, of a chronic nature, interfering with respiration.

Lastly, there may be a perfect cure in time, succeeding upon the imperfect cure, or more directly, by the removal of the fluids within a short period after the first stage, in which case the amount of secretions is not large, and not passing beyond the stage when they are readily absorbable.

Nature of Pleuro-pneumonia.—In considering this question, the first point is, to ascertain whether the disease can be distinguished by its symptoms and pathology from other diseases affecting the same organs. From diseases affecting other organs—from typhoid fever, or *Rinderpest*, as it is called in Europe, a generally admitted contagious disease—it is easily distinguished. The peculiar, or diagonostic marks by which it can be distinguished from ordinary Pneumonia, sporadic Pneumonia, have not as yet been pointed out. Delafond (*Traité sur la Maladie de Poitrine du gros Bètail connue sous le Nom de Peripneumonie Contagieuse*, p. 110), who believes in two distinct diseases of the lungs, one contagious and one non-contagious, says, " As for myself, I frankly declare, when such cases have been presented to me, I have often been embarrassed to decide which of the two diseases it was." After going over the whole history of the disease, he says, " I do not believe it is possible to be positively certain." The post-mortem appearances he does not consider distinctive. It should be borne in mind, however, that he does not describe the disease precisely as it appears in Holland, or as it has appeared in Massachusetts during the late epidemic. The insufficiency of the means of distinguishing the two diseases will be seen from the following points, which he considers as probably indicating the contagious form. If the disease appears in an animal recently purchased; if from a diseased locality, or of a diseased race; if parted with readily for a low price, or sold by a cow-dealer; if she coughs and is emaciated; if all the symptoms of Pneumonia while alive or after death are present; if other animals in the neighborhood are also, after a time, attacked by the same disease. These obviously do not decide the question. Attempts have been made to show a specific character, like that of small-pox, for instance, especially by those who believe in the efficacy of inoculation. Peculiar molecules, having a characteristic movement, were said to have been discovered but on investigation by competent human pathologists, the statement was not confirmed. A German author asserts that the marbled appearance of the lung, and the tendency to form a capsule around the diseased portions, are characteristic, while the French, on the other hand, see no such constant changes. It is also said that the herdsmen are able to distinguish between the two diseases without fear of mistake, although they are unable to point out these differences to the veterinary surgeons. Kreutzer (*Die Einimpfung der Lungenseuche des Rindviehes als das bewärteste Schutzmittel gegen diese Seuche*, p. 204) asserts that this is no more strange than that Guenon's *milk mirror* should have been discovered by an ignorant herdsman, and be overlooked by veterinarians. The difference between the two case seems to be, that in the former the herdsman points out nothing, and in the second he points out something that all can examine.

Inoculation for the prevention of the disease, or for the purpose of rendering it mild, is also cited as evidence of its specific nature, and if established would be the strongest evidence that could be brought forward. The peculiarity of the disease thus produced consists (Kreutzer, p. 244) "in the fact that it localizes its effects (in the tail,—the place inoculated) in a part of little importance to life, and spares the lungs; which, when the disease is taken by natural infection, are always attacked." Other experimenters, however, who went to Belgium from England for the express purpose of investigating the claims of the practice, declare that they see nothing in innoculation but the introduction of diseased matter into the system, which frequently destroy the tail or produces fatal disease in the lungs, by a process well known in human pathology as purulent absorption. They showed, in fact, that the same effects could be produced upon animals which have never been known to be susceptible to this disease—the dog and the ass, for instance—as in horned cattle; and that when immunity has followed inoculation, it has quite as probably been dependent upon coincidence or upon those causes, whatever they may be, which regulate the outbreak, the spread, and the disappearance of epizootic diseases, as upon any supposed protective power of inoculation. It appears, therefore, that the advocates of the specific nature of the disease have thus far failed to make out a case.

Of the causes which certainly predispose to this disease, all appear to agree in assigning to impure air, in close, ill-ventilated, and undrained stables, the most prominent place. Especially is this true when animals are at the same time crowded, and the food stimulating or highly nourishing, which would under other circumstances render them more liable to inflammatory diseases. Recent calving, or an excessive secretion of milk, together with that kind of nourishment—the refuse of breweries, for instance—which stimulates the flow of milk, is also believed to be a predisposing cause. The drinking of cold water, especially in the winter season, the sudden chills which are produced by this and the exposure of the heated and debilitated animals when driven from a warm stable to their watering-place, the changes of temperature and hygrometric condition of the atmosphere from day to night, when the cattle are pastured upon low grounds, or when they are allowed to remain without suitable protection during cold and long-continued storms, are not without effect upon the health. Especial stress has been laid upon the influence of change of residence. It has been observed that the disease very soon follows upon long and fatiguing journeys, whether these are effected by marches or when conveyed by railway. In either case the conditions are new and strange. The fatigue is great, the food is of various kinds and at very unequal intervals, the crowding in railway cars is excessive, and it is probable that the effects of such treatment would soon be obvious here as in Europe, were it not that the transportation is principally for the purpose of slaughter, and time

is not afforded for their development.* Indeed, those causes which produce pneumonia under ordinary circumstances also produce the disease in question.

Contagion has been alleged as not only a cause of the disease, but as the principal cause. The evidence upon this point is exceedingly contradictory, and yet it is obvious that it is one of the most important questions, so far as the prevention or extirpation of the disease is concerned. The spread of contagious diseases being under control, while those which follow the laws of epidemics are very slightly if at all prevented from spreading, except by placing the animals under circumstances which would prevent the production or spread of disease generally,—such as good food of a sufficient quantity, and cleanliness, with proper ventilation, protection from the intemperature of climate, and especially avoiding overcrowding.

There are difficulties in examining the question. The tendency is to assume a contagious origin of disease, especially if its nature is obscure, besides which, if it is prevalent and severe, and produces a panic among the observers, their statements must be taken with caution. One of the reasons for the general assumption of a contagious origin under these circumstances is, that it is considered a complete explanation in a single word. But it must be remembered that there are two conditions necessary for the propagation of contagious diseases,—a contagious property in sufficient concentration, and a predisposition on the part of those exposed. Erysipelas, under ordinary circumstances, is non-contagious; under others, it is believed to be decidedly contagious. Even small-pox requires peculiar conditions for its extensive spread, otherwise it would be equally prevalent at all times, instead of exhibiting an outbreak at considerable intervals of time. Contagious diseases rarely arise spontaneously, and such occurrence would be evidence against contagion. Epidemics, on the other hand, make their appearance in widely separated places, so nearly at the same time as to preclude the probability of contact. But once having appeared, they have a progress which much resembles that of contagion, and may easily mislead careless or incompetent observers. A few years ago, a person sick with cholera was brought from a neighboring town, where it was then prevalent, among friends living upon a wharf in Brighton, where the predisposing causes—bad ventilation, overcrowding, and filth—were well marked. The person died, and within fourteen days eleven other cases followed, five of which proved fatal; one of these was of a cabin-boy on board a vessel lying at the end of the wharf. Here, one might say, is unquestionable contagion, no cases having existed within several miles. But one of the persons ill of cholera was carried from this place to an open, well-ventilated house, a quarter of a mile distant, and although as constantly visited by friends, and, so far as contagion went, as favorably situated for the communication of the disease as in the former instance, not one contracted it. Here the argument was as strong upon the other side. Many facts of this kind have been observed in various places, as well as others of a different character, but all tending in one direction; and hence the now established belief in the non-contagious nature of cholera. Unfortunately for our knowledge of the disease in question, no experiments were made as to its mode of communication. It is obvious that had such been tried, all complications could have been excluded, and decided results obtained. First, healthy cattle could be sent to an unhealthy barn among diseased cattle; and, secondly, a diseased animal could be sent to a healthy barn among well cattle. If, in the first case, the cattle became diseased, it would, so far as it went, prove that a cause of disease existed in the animals, or the locality, or both; and, in the second, that a cause sufficiently powerful of itself to produce disease existed in the animals,—that is, that the disease was contagious. Instances of both these conditions, though perhaps not sufficiently numerous or sufficiently uncomplicated to settle the point, are believed to have occurred in the course of the disease in Massachusetts.

It is generally assumed that the only animals that can be affected by Pleuro-pneumonia belong to the bovine class. But contagionists say it can be transmitted by the application of the contagious matter, either directly by contact or indirectly through a considerable intervening space. Its vehicle in the latter case is the breath, which derives its material of disease from the inter-lobular cellular tissue of the lungs. It adheres to living and dead bodies, to rough, woolly, hairy bodies, such as straw, hay, clothes of men, coverings of animals of the bovine class, and perhaps every other species of animals. The walls of barns are essentially the bearers of contagion, and continue to be such even after all trace of the original vehicle of the disease has vanished. It can increase its power when once introduced, so that from one case it can reproduce and multiply itself until it has affected hundreds upon hundreds of individuals. Still more, a piece of clothing which has become infected, may infect another piece with which it is in contact, and this last thus become a bearer of disease. The disease also sometimes becomes fixed in a locality, and that when this locality is of a very limited extent. It has a great tenacity, and the animal retains the power of communication, not only through the feverish stage, but during the subsequent non-feverish condition, extending through eight or ten weeks after the cure has apparently been accomplished. The influence does not necessarily attack those nearest, but often falls upon those which stand at a distance; some animals resist for a long time, finally yielding, while others resist permanently. Such are the views set forth by a firm believer in the contagious nature of the malady. (Kreutzer, p. 337.) Delafond (p. 213) thinks that the disease presents all the general characteristics of contagious diseases, and has collected a considerable number of instances of diseased animals introduced into herds, in stalls, and in the fields, in which the introduction was followed by one or more cases of a similar disease. But his opinion does not agree with that just cited as to the power of those who touch, approach, or take care of diseased animals, to transmit the disease to healthy animals by the same proximity and care. Neither does he consider it proved that animals of different species may be the means of transmitting the affection; he believes that many of the accounts of subtle contagion are entirely fabulous, and that the elements of contagion do not spread to a great distance from the sick, and are by no means of the same activity as the elements

* Swine brought from the Western States are exceedingly liable to fatal pneumonia soon after their arrival in the Eastern cities; and although it spreads rapidly when once it appears in a herd, it is not deemed contagious.

of typhus and other well-known and admitted contagious diseases. In investigating the period of incubation, or the time which elapsed between exposure and the appearance of the disease, fifty cases have been collected in which the moment of exposure and that of the development could be satisfactorily determined. From which it appears that the period in question was—

6 days in 2 cases.	20 days in 19 cases.	38 days in 1 case.
8 „ „ 2 „	25 „ „ 1 „	40 „ „ 1 „
12 „ „ 3 „	30 „ „ 1 „	60 „ „ 1 „
15 „ „ 19 „		

Hence we see that nearly four-fifths of the whole number fell sick between the fifteenth and twentieth days and nine-tenths before the last-named day. It is also to be observed that the variation in the period of incubation from six days to sixty is without analogy in any other contagious disease.

Those who oppose the view of contagion see a sufficient cause in the combined influences previously mentioned as having a great bearing upon its course and upon its development in a locality. They believe that the atmospheric conditions and those circumstances, of a character but little understood, leading to the spread of epidemics generally, are also in action in this. But it is denied that the disease bears any relation to those which are well known to be contagious,—to the contagious typhus, on the one hand, or to glanders or diseases having a local expression, on the other. Still less does it resemble sheep-pox, or any eruptive disease of animals. Neither has it been made to appear that any affection of the lungs or pleura in man or horse or swine or dog ever shows any contagious property. It is admitted, by contagionists and non-contagionists, that the disease may and does arise under circumstances which preclude the probability of any contagion, unless we admit an intensity and persistence in its elements which are abundantly disproved by the non-communication in cases much more favorably situated,—that, in fact, the disease arises spontaneouly. If it arises spontaneously, then the circumstances for its propagation, if contagious, are the most favorable possible, and the disease should spread with the greatest certainty and rapidity; but this certainty and rapidity have not been observed to accompany spontaneous development. The history of the disease in Holstein shows that the strictest measures and most careful destruction of all existing disease did not prevent its continuance or recurrence after a very short interval. It was very apt to recur in nearly the same locality, *endemic,* when no evidence could be brought forward to show an introduction from abroad.

The following experiments will show how great is the power of resistance under the circumstances stated, "I wished," says Dietrichs (Delafond, p. 227), "to ascertain whether the emanations which escape from animals ill with peripneumony can transmit it to healthy animals placed beside them. To this end I obtained a cow five years old, and assured myself of its perfect health by examining it while eating and drinking, and by making it cough by pressing the larynx, and placed it between two oxen with peripneumony. Those two animals were in a small stable, and so fastened that each could reach the food of the other. The oxen ate very little, being in an advanced stage of the disease; the cow, on the contrary, ate not only the intentionally small quantity of food given her, but also ate that which was covered with the mucus from the nostrils and the saliva of the oxen. This cow was left in this condition for two days, when she was returned to her former stable, and was replaced by another, also healthy. This last remained with the oxen a day and a half; when one of the two died, she was left with the survivor two days and a half longer. The ox was then killed, and the autopsy proved the existence of well-marked peripneumony." The results of these experiments demonstrated non-contagion.

The following experiment by a competent observer was tried in France. Pleuro-pneumonia was rife in Bligny, and Gaullett was sent by a government official to investigate it. "I separated the diseased from the healthy animals, although in my judgment it is not a contagious disease. To establish my opinion, I tried an experiment at my own risk; I bought a healthy cow six years old, in a neighboring commune, where the disease was unknown, and drove her to Bligny and put her in a stable with a cow and ox attacked with the *epizootic,* and deemed incurable. The healthy cow was placed between these two animals, the ox on the right and the cow on the left. The first died three days after the commencement of the experiment, and the cow in five days. On opening the ox I took the serous and purulent matter, still warm, and, making a vertical incision two and a half inches long between two of the ribs of my cow, I detached the skin with the bistoury and introduced into this broad wound beneath the skin a pledget wet with the purulent matter, and secured it with a bandage. I kept the animal two days on solid food. During this time a considerable tumefaction appeared about the inoculated wound, accompanied by great sensibility; some days after an eschar formed and was detached, the wound was dressed with a digestive; the engorgement soon diminished, and in less than fifteen days the wound was healed.

"This animal experienced no indisposition. I sold her to a man who kept her two years in good health and flesh; but not being a good milker, he sold her to a butcher. When she was killed I assisted at the opening, and found the organs of the chest perfectly healthy."

Nine animals were inoculated with the nasal mucus, and with saliva from diseased animals, without any other effects than those which usually follow the introduction of foreign matter derived from other sources; no evidence of Pleuro-pneumonia followed. To this Delafond objects, that it is not proved that the matter used was expectorated, it might have been from the nose only; this objection, however, will hardly avail when we remember that the expired air is assumed by the contagionists to be the vehicle of contagion, and that it adheres to whatever moist, or even dry substance, with which it comes in contact.

The *Mark Lane Express and Agricultural Journal* for October 8, 1860, has a report of a recent meeting of the Ipswich Farmer's Club, at which Pleuro-pneumonia was discussed, and the opinion of several of the members obtained with regard to contagion. Instances were given in which its origin was believed to be spontaneous. Mr. H. Biddel referred to a dairy of nine cows kept by him some years since. They had all been on the farm several years, with the exception of one, which came from a farm where the disease had never been known. The disease broke out, and the whole either died or had to be slaughtered. Another member had known a lot of bullocks bought at a fair, and when they were brought home, divided into three different lots, and sent to three different farms; two lots were visited with the disease, the third entirely escaped. In another case a lot of thirteen was bought; the disease appeared, four or five had to be slaughtered, and the rest were immediately sold; they went to a farm about four miles distant, where they were fattened and did well. Prof. Simmonds, whose report has already been quoted, still considers the disease contagious, but admits that it differs from all others in this respect, that the morbific matter is in some cases a long time dormant in the system, and can be got rid of by purgatives and diuretics, and that these means, with stimulants and iron, and generous feeding, will often rid a herd of the disease. This statement would indicate an origin quite different from any known contagion.

"On the banks of the Almond, in the county of Mid-Lothian, are situated three farm-steadings, about 600 yards from the river, upwards of 60 feet above it, and 360 above the level of the sea, with a good southerly exposure. Milch-cows are kept in the two westmost steadings, and feeding cattle in the eastmost. About eight years ago, in the autumn, the cows in the westmost steading were attacked by Pleuro-pneumonia; fiercely and fatally it raged among the stock for about two months, till the number of empty stalls in the byre showed the sad havoc which had been committed, and which the farmer did not think prudent to repair at the time. Though there was no communication held between the adjoining steadings, the disease made its appearance among the stock in the next steading, a few weeks after it had commenced in the former one. After decimating the cows here also for some time, it attacked the feeding cattle of the eastmost steading, among which it continued more or less throughout the winter. The cattle, both in courts and byres, were attacked by it; and it is worthy of remark, that some weeks before the feeding cattle were affected by the Pleuro-pneumonia, the murrain went through the whole stock. Now it is somewhat curious, that during the whole of that autumn and winter the disease lingered amongst the cattle in these three steadings, and never, in one case, travelled beyond them north, south, east, or west. In connection with the steading where the feeding cattle were kept there was another steading, where about twenty cattle were fed in courts, at a distance of half a mile from the former steading, at a much higher altitude, and considerably more exposed. Not the least precaution was taken to prevent any communication between the different lots of cattle in the two steadings; on the contrary, the same servants fed them, and on the disease breaking out, all the cattle at the two steadings were bled by the same men on the same day. Not one of the cattle in the upper steading was affected by the disease, while most of those in the lower one were sold off after being attacked. Last summer, on the same farm, two lots of cattle were grazing, the one on the fine sheltered haughs at the side of the river, the other in an exposed field beside the upper steading, about 150 feet above the river. One after another of the cattle on the haughs were attacked by Pleuro-pneumonia. The farmer, finding that none of his other cattle were affected, thought that the disease arose from the great differences of temperature to which the cattle were subjected during the day and at night. During the day, the temperature was very high in the haughs, as they were mostly surrounded by woods, and the sun beat upon them; at night a cold chill air rose from the river. He accordingly removed the cattle from the haughs, and put them beside the others in the exposed field. There was not another case of Pleuro-pneumonia on the farm during that season. In none of the cases narrated above could the disease be traced to infection. Again has it broken out in the district without any assignable cause, excepting atmospheric; but we are glad to say, that, though its ravages are as extensive as ever, the attacks are by no means so virulent, and there are more cases of recovery than formerly."—*Journal of Agriculture, London, July*, 1858.

If we now turn to the origin of the disease in Massachusetts, we find that the first animal which sickened could not, by a possibility, have been exposed to any animal ill of the disease within seventy-five days, unless we suppose the two cows which died from the effects of ill treatment and the hardships of the voyage were affected by it. Of this there is no evidence; on the contrary, we have the opinion of those who had the care of them, and subsequently became familiar with the symptons, that they had no reason to believe that they had any affection of the lungs. There is no reason to believe that the disease previously existed among other cattle of the herd, and we are therefore compelled, in the absence of other facts, to admit that it remained dormant seventy-five days, or that it arose spontaneously in Belmont. But if we remember that, of the fifty cases cited, not one became ill later than sixty days after exposure, we must consider the latter supposition the most probable. That the disease did not propagate itself in the open air seems probable from the fact that the two calves which sickened and died, the one with the herd, and the other a few days after, did not communicate it to the nine which occupied the same pasture. So again, the fact that the neighboring animals did not become diseased, although for several weeks, when the epidemic was most virulent, no care was taken to prevent communication. The fact that an animal placed in the barn with sick animals became diseased, and another taken from that barn did not communicate disease to those with which it was subsequently placed, also points to the probability that a much closer and longer continued exposure in the diseased locality itself is required for the development than was at one time supposed.

The outbreak of the disease in Brookfield upon the introduction of the calf from the Belmont herd has, on the other hand, more of the appearance of contagion. But the evidence would be much more conclusive if the facts were definitely stated; we know but little more from the evidence taken before the Legislative Committee, than that the animal was sick. That animals became sick after the introduction

of the calf is unquestioned, and it may be in consequence of such introduction ; but it is a question whether the outbreak did not occur in consequence of certain conditions existing in a limited territory, whether, in fact, it was not analogous to the cases of cholera above-mentioned. If the conditions under which the disease was supposed to be communicated had been studied carefully, the question of contagion could have been much more easily settled. But we have only the general statement, that all animals diseased could be traced to an *exposure* to others also diseased. The exposure was very different in different cases ; in some cases, it was standing in the same barn, in others, passing a barn where there were sick cattle. The case following the death of the calf occurred in a fortnight, and others again once a fortnight, until eight were lost in a herd of forty ; and these were all that were lost from that herd, although all were equally exposed for the four days the calf was there. Of the twenty which were in the barn where the calf died, in the early part of July, all were apparently well in the November following, but in the month of April were found to be diseased ; whether the disease had commenced just previously to its discovery, as in the first cases which occurred, does not appear. If these cattle were well in November,—and there is no evidence to the contrary,—the disease was in the state of incubation at least four months ; but the longest term, according to the statistical account of a contagionist above given, was sixty days. If, on the other hand, we assume that the animal had gone through the active stage unobserved, and the disease was then in a chronic condition, we are met with the statement of the Commissioners, that an animal that was not diseased until the 20th of January ceased to be able to communicate Pleuro-pneumonia before the 28th of the next March, about sixty days. We can only say, that such variations are unknown in other contagious diseases of men or animals, and besides do not correspond with the facts collected by those who have had more ample means of investigating the disease in Europe, and in whose opinions so much confidence is placed. Another point is worthy of notice. When any of the diseased cattle came in contact with a herd in Brookfield, the contact was said to be followed by disease in some of the herd ; but when diseased animals were driven to other towns, and in the course of their journey "exposed" those they met, the exposure was not followed by disease. The number was sufficiently large to constitute a fair experiment ; in one instance, fifty head, and in others several were in the same pasture, and yet almost no disease followed. The disappearance of the disease was peculiar, and certainly not such as would have been expected if the contagious element was as active and the number of the exposed as great as was represented. At Mr. Chenery's it appears to have accomplished its work in about two months, and to have been confined almost exclusively to the barn in which it first appeared. It was not communicated by the diseased calves in the pasture to other animals in the same pasture, although they were together during the whole disease until it terminated in death ; it was not communicated by animals transferred from the barn to another containing animals apparently in proper condition for its reception if contagious. In Brookfield, the "infected district" was more extensive, and the disappearance here also quite peculiar. The Commissioners had attempted to destroy it by destroying every case which had the disease, or which had been exposed to it. In this they were disappointed; they found it spreading wider and wider ; they ceased slaughtering and commenced a certain amount of isolation. One thousand head of cattle were believed to have been exposed, and application was made to the Legislature for greater power to meet this increase. On the 12th of June the power was granted, but the disease had already ceased two months before, and has not as yet reappeared. From this it may be inferred, that the eight hundred and forty cattle were killed to very little purpose, or, at least, that slaughtering was inferior to isolation, and the cattle could have been saved. It may also be inferred, that either the disease was not contagious, or that the conditions constituting exposure were not understood, and consequently the facts for determining its contagious nature wanting. It seems to be quite certain, that those circumstances which in the commencement were considered abundant evidence of exposure to contagion, and were believed to be almost invariably followed by disease, in about a thousand similarly situated cases towards the decline produced no effect. It would be difficult to explain this upon purely contagious grounds, unless we adopt the theory, quite unsupported by facts, that the contagious element constantly diminished, and at each transmission was transmitted constantly in a feebler degree, until too weak to affect the system.

Whether contagious or not, in other countries it has passed from place to place in the manner of an epidemic, and has not been controlled by those measures which usually control diseases resembling small-pox, with which it is so frequently compared. Contagious diseases are often epidemic, and the outbreak of those which are usually considered epidemic sometimes occurs as an *endemic*, immediately upon the introduction of an active cause; as in cholera. It is probable that the two classes gradually shade into each other, and that here, as elsewhere in nature, there are no great leaps.

On the whole, the Massachusetts disease appears to have followed the law of other epidemics, spreading for a time, while the epidemic influence lasted, and then disappearing without the apparent circumstances under which it arose being materially changed.

If such be the case, it is obvious that we cannot expect any more good from indiscriminate slaughter of all deemed to be exposed to its influence than can be obtained by simply removing, even to a moderate distance, the well from the sick. We say removing the well from the sick, for in this way all causes of a local nature are removed as well as the emanations from the diseased. Especially should overcrowding be avoided ; for if there is anything well established, it is that overcrowding tends to produce disease among the healthy and increases its severity where it already exists.

These precautions, with free ventilation, good nourishment, and a very moderate use of drugs, appear at present the principal measures we can bring to bear upon this exceedingly fatal epidemic, and with the judicious use of them, we have the testimony of distinguished veterinarians that a herd may be rid of it.

The following is a Summary of the facts and inferences with regard to contagion :—

1. Contagionists admit that Pleuro-pneumonia often arises spontaneously in widely separated places; it has thus appeared on the continent of Europe and in England, where the duties prevented importation.

2. The most stringent measures of slaughtering and isolation have not prevented its spread.

3. It has disappeared after a limited period without change of measures.

4. No Pleuro-pneumonia of man or animals is know to be contagious ; it has been and is now prevalent among swine without evidence of contagion.

5. Two forms of Pleuro-pneumonia are admitted by contagionists ; one contagious and the other non-contagious; but these two diseases cannot be distinguished during life or after death.

6. The limits of the period of incubation are greater than those of contagious diseases.

7. It is believed possible by contagionists to eliminate by treatment the contagious influence during the period of incubation.

8. Animals purposely and fully exposed to the disease have not contracted it.

9. Experiments have not proved that it can be communicated by inoculation.

10. In Europe the question of contagion is still undecided.

11. The great majority of diseases the contagiousness of which has been fairly questioned have proved non-contagious.

12. Upon the grounds assumed by contagionists, the appearance of the disease in Belmont was probably spontaneous.

13. The disease may have been introduced into Brookfield, but disappeared spontaneously.

14. The evidence of contagion is similar in character and not greater in degree than that for the contagion of Cholera, and in both respects very different from that of small-pox.

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