

CATTLE

TUBERCULOSIS.

LEGGE

AND

SESSIONS

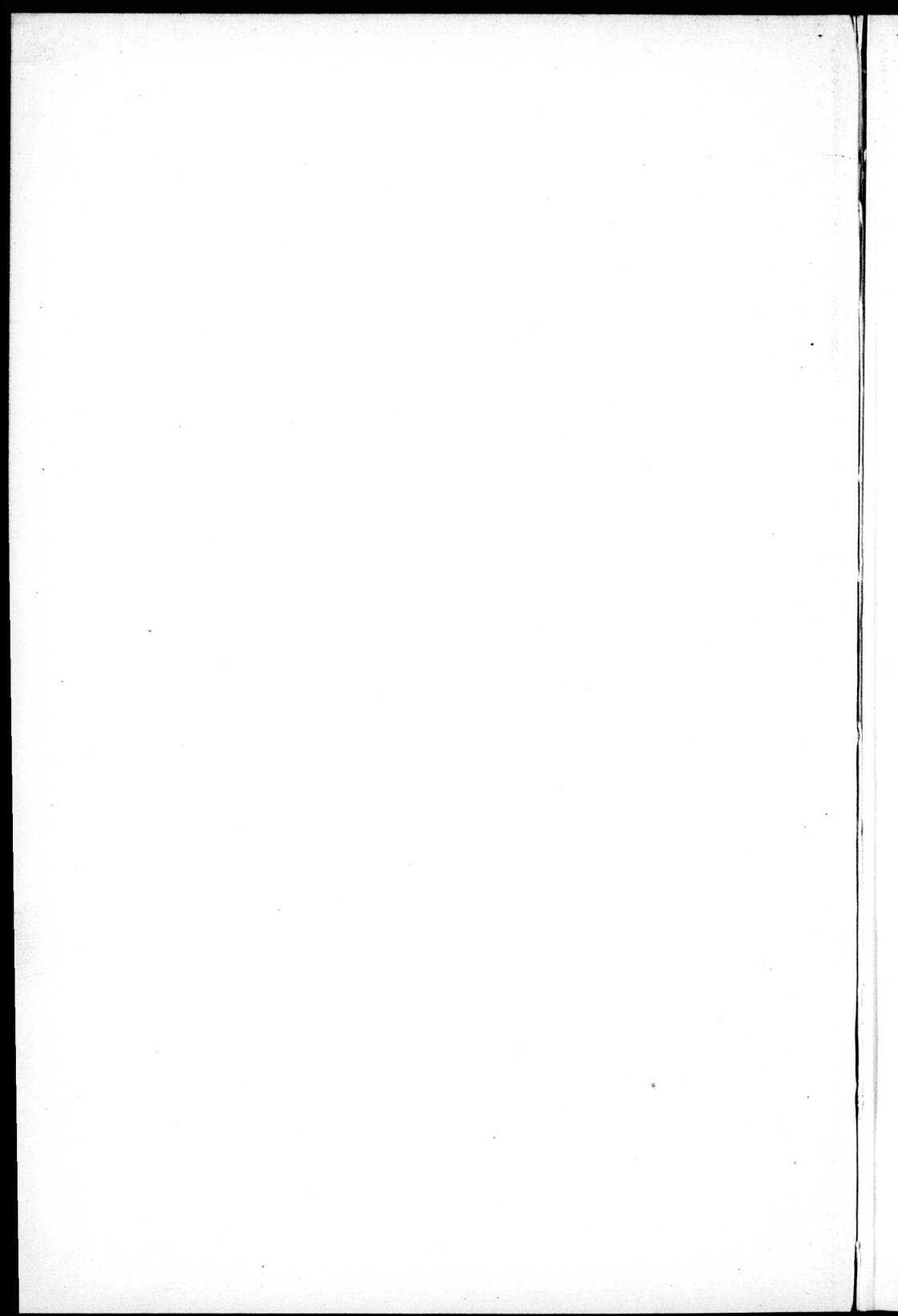
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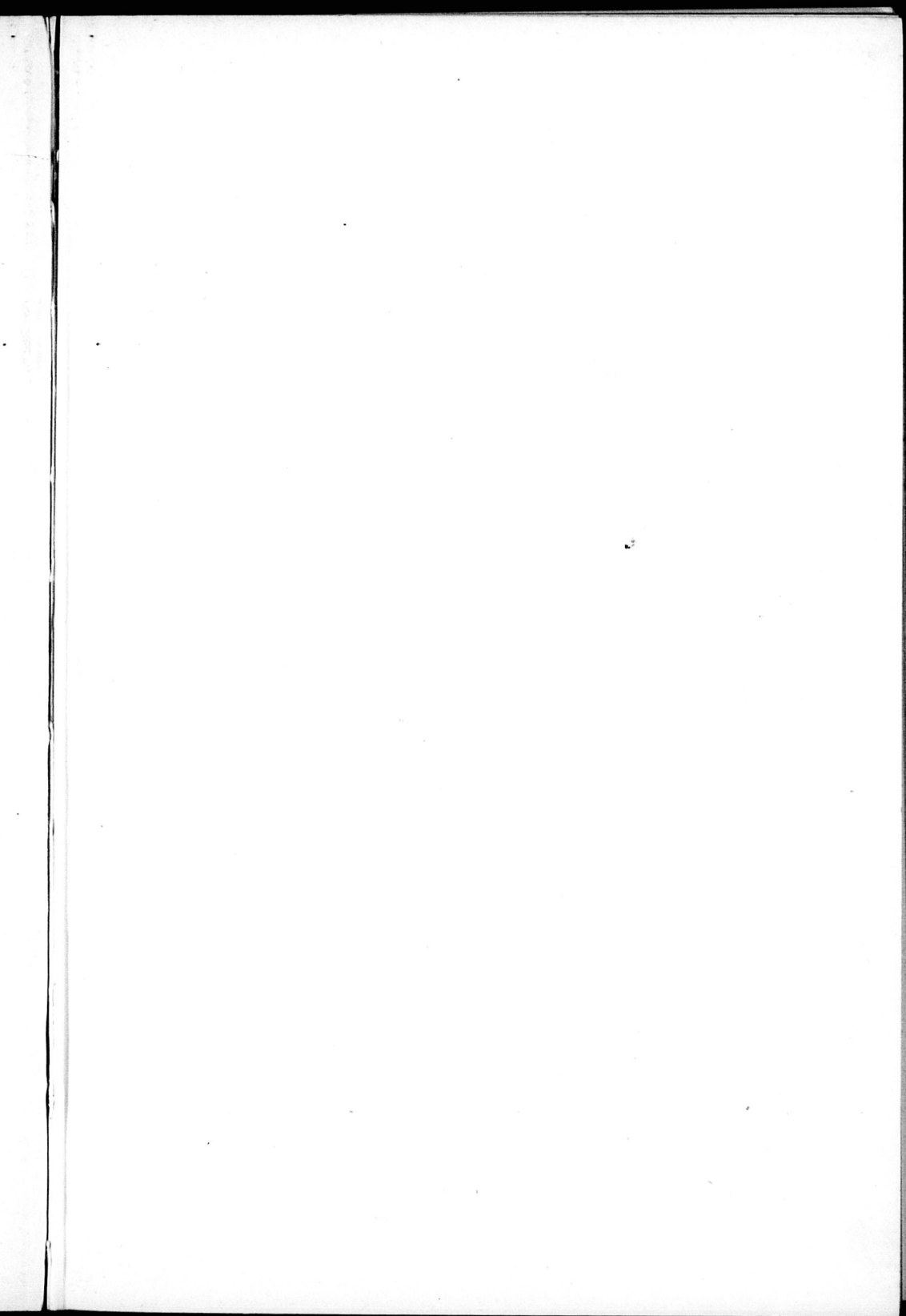
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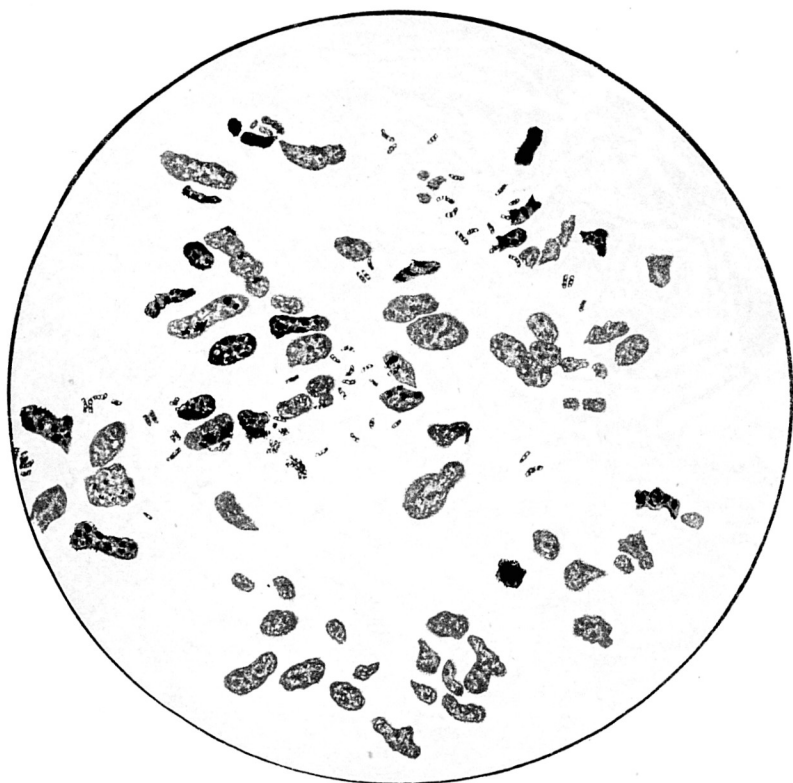
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CATTLE TUBERCULOSIS.







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Section of the tuberculous udder of a cow, the udder of which is now at the museum of the Royal Veterinary College. The section was made through a part of the udder in which the tubercular process was well advanced. The nuclei (blue) still stain distinctly, but between them is a homogeneous-looking mass in which the tubercle bacilli (stained red) are scattered in considerable numbers.

(From the Report of the Royal Commission on Tuberculosis. 1890.)

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CATTLE TUBERCULOSIS:

A Practical Guide to the Farmer, Butcher,
and Meat Inspector.

THOMAS MORRISON BY

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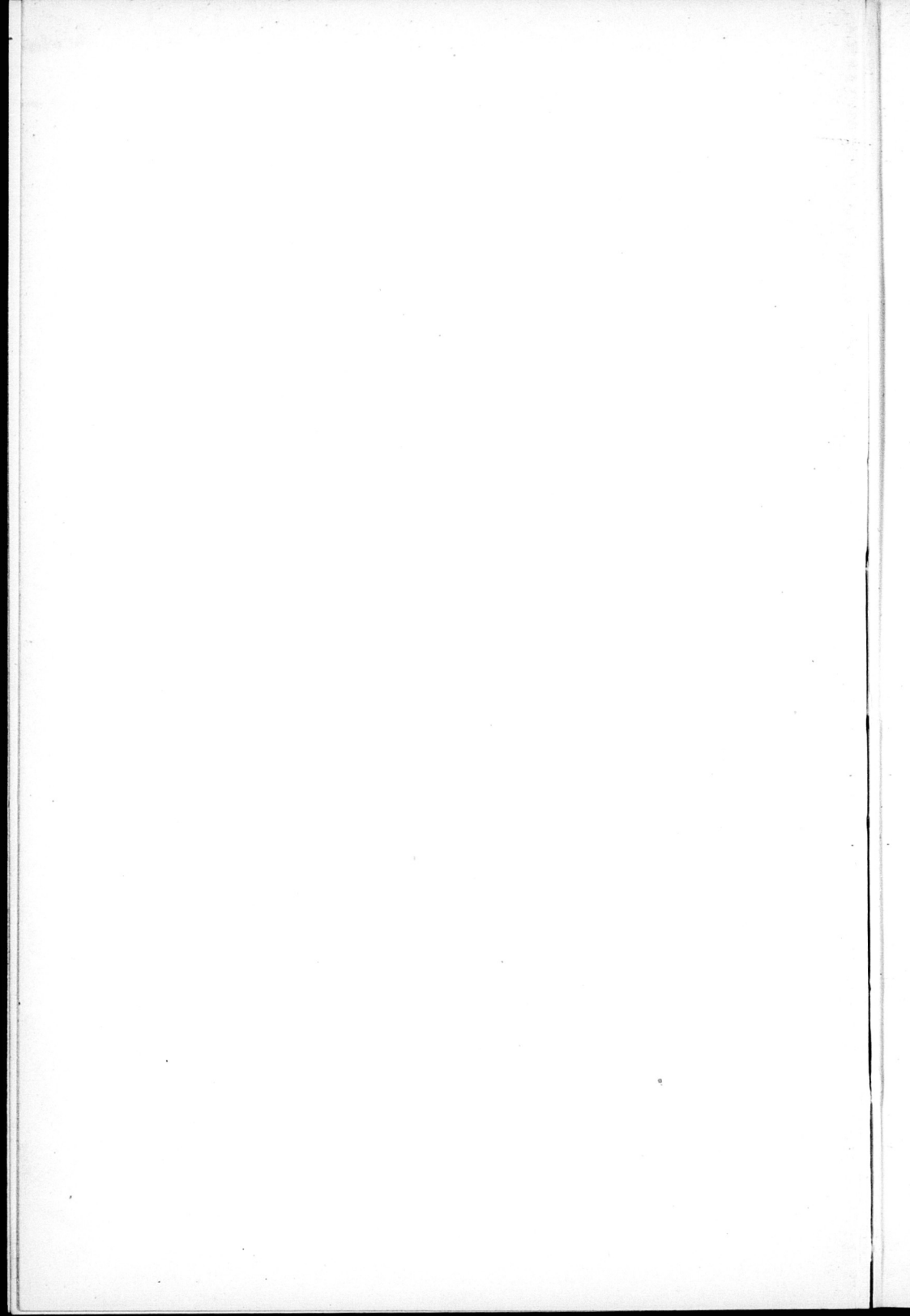
AND

HAROLD SESSIONS, F.R.C.V.S.



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CONTENTS.

	PAGE
CHAPTER I.	
INTRODUCTION	7
CHAPTER II.	
SYMPTOMS OF THE DISEASE	19
CHAPTER III.	
MEASURES OF PREVENTION	23
CHAPTER IV.	
CONDITIONS AFFECTING MEAT INSPECTION IN GREAT BRITAIN AND ABROAD	39
CHAPTER V.	
NATURE OF INSPECTION REQUIRED, AND QUALIFICATIONS OF MEAT INSPECTORS	45
CHAPTER VI.	
EXAMINATION OF TUBERCULOUS CARCASSES	51
CHAPTER VII.	
UTILIZATION OF TUBERCULOUS CARCASSES	55
CHAPTER VIII.	
INSURANCE AGAINST LOSS FROM SEIZURE	64

INTRODUCTION.

VERY few subjects have given rise of late years to so much discussion and difference of opinion as that of bovine tuberculosis. The disease affects the interests of widely different sections of the community, but in respect to each it is a matter of some difficulty to estimate exactly the amount. Farmers complain of the losses inflicted on them by its prevalence in their herds, resulting in the death of a certain number of animals; in the lowered price that an animal thus affected fetches when sold; and the great difficulty, nay, impossibility in many cases, of telling whether an animal is affected with the disease or not. The butchers complain loudly that they are the parties whose interests suffer most largely, owing to the risk they are at any time exposed to of having an animal, bought in perfectly good faith as sound, seized and destroyed by an officer of the sanitary authority, because, after slaughter, it may be discovered to be affected with the disease. The veterinary profession is interested in the subject from the point of view of its causation, of the extent to which it prevails in domestic animals, and of its treatment and prevention. The medical profession is brought into relation with the disease in two ways: first, because of the identity of the bacillus in human and bovine tuberculosis, and of the probability of the transference of it from animals to man, either in the meat or in the milk derived from animals affected with the disease; and, secondly, because medical officers of health are the servants of the local authorities to prevent the sale of unwholesome food. Lastly, the general public is interested in the subject from a desire to have eliminated one of the sources, even if

it be a small one, from which the scourge of consumption in man may arise.

When the knowledge we have to-day as to the causation of the disease and of its effects is compared with that which was possessed ten years ago, it must be acknowledged that the advance has been immense.

The majority of farmers and butchers then would probably have been mystified by the word 'tuberculosis,' nor would medical officers of health have imagined that it was necessary to condemn the carcasses of animals affected with the disease on the ground that there was a risk to the human subject of contracting the disease from the meat.

During the interval the matter has been subjected, both on the scientific and practical side, to the close scrutiny of two Royal Commissions, and as a result of their investigations it is possible to show wherein the existing law requires to be relaxed and wherein it requires to be strengthened.

It is now held that consumption in man and consumption in the lower animals is caused by the same bacillus, an organism belonging to the lowest form of vegetable life, and so small that in order to be properly examined it must be magnified four or five hundred times in all directions. When it gains access into the system, whether of animals or men—and in both it finds an entrance most readily into the lungs—it lives and multiplies on the tissues in such a way as to destroy their functions, and in the destructive process forming little lumps, or 'tubercles.'

In man, as everyone knows, consumption of the lungs is by far the most common form in which the disease appears, and causes annually in England and Wales over 40,000 deaths—more deaths, in fact, than is caused by any other disease. It is most fatal between the ages of fifteen and forty-five. This form cannot be shown to be caused by eating tuberculous meat or drinking tuberculous milk, but is due to the contagion spreading from man to man by the inhalation of dust to which is attached particles of dried sputum containing the tubercle bacillus. There are, however, many other forms in which the tubercle bacillus develops in man, and the most interesting of these, for our present purpose, is consumption of the bowels, or 'tabes mesenterica.' This form occurs in children, and it is but reasonable to suppose that,

if there is contagion in the food, the alimentary canal along which it passes will become affected by it.

Statistics show that consumption of the lungs in man during the last forty years has diminished by about 37 per cent., which further tends to prove that the eating of meat affected by tuberculosis can have little influence in causing the disease. But statistics over the same period with regard to consumption of the bowels show that there has been no corresponding diminution—that it has diminished, in fact, only by about 5 per cent., and, consequently, one is driven to the conclusion that there is some cause at work in maintaining this special form of the disease which is not present in the former case. Seeing that milk is the staple food of children, and it has been definitely shown that tubercle bacilli exist in the milk when the udder is tuberculous, there is strong presumptive evidence that this cause at work is the consumption of milk. Further, the argument is strengthened when the experimental evidence is adduced which was carried out on lower animals, such as guinea-pigs, for the Royal Commission of 1890. When guinea-pigs were fed on food designedly contaminated with tuberculous matter, only a few of them developed the disease, but when they were fed on milk from tuberculous udders they all became affected. Indeed, so markedly so was this the case that the experimenter (Dr. Martin) could only describe the action of such milk as ‘virulent.’

The general conclusion from this is, therefore, that too much attention has been paid to the meat from tuberculous animals by local authorities, and too little to the subject of milk.

There can be no doubt that in the past a great quantity of meat has been destroyed by the officers of local authorities which might very well have been consumed, because it has been found that only rarely does the tubercle bacillus lodge in the muscular substance itself, and, provided the organs containing the tuberculous deposits are destroyed, the meat itself may be sound.

While, therefore, it will be necessary to make it a penal offence to sell the milk of animals affected with tuberculous disease of the udder, this will not mean a great loss to the agriculturist, because the flesh of the majority of such animals will still be quite suitable as food.

It must be to the interest of the farmer, if, as he maintains,

the disease involves him in severe loss by reason of its prevalence among his herd, to try and get rid of it. The means to this end are now placed in his hands, not, it is true, without requiring some degree of effort and sacrifice on his part to bring about a successful issue, but still, at the same time, not demanding great expense or much readjustment of buildings.

The use of the tuberculin test affords now to the farmer an infallible guide to the animals in his herd which are tuberculous. It has been urged against its use that it draws no distinction between an animal that is markedly affected and another that is merely touched. This is true; but the fact that by its means an animal in the very earliest stages of the disease can be recognised, before its power for evil can be great, far outweighs any demerits it may possess.

The fact that the majority of the animals so tested have only latent tuberculosis, and show no outward visible sign of the disease, does not demand any drastic remedy, such as slaughter or the withdrawal of the milk, but only the isolation of those that have reacted from those that are sound by means of a movable partition erected in the sheds.

This done, it is to the interest of the farmer gradually to eliminate the reacting animals by selling them for the meat market. In this way, which is the method that has been adopted with so much success in Denmark, a farmer can in the course of a few years succeed in replacing a herd which may have been seriously affected with tuberculosis by a sound one.

The butcher, however, will naturally resist the attempt of the farmer to sell to him apparently healthy animals which may after slaughter prove to be so tuberculous as to necessitate total seizure. This may be the case in a few instances, but it is probable that the great majority of such animals will, under the new conditions prescribed for the seizure of carcasses affected with tuberculosis, be passed as fit for food.

To protect himself against loss two courses are open to the butcher. It might be considered that there was a third, namely, compensation either from Imperial funds or from the local rates. This course, however equitable it may seem, is not likely to be adopted; and it is a question whether, if it were

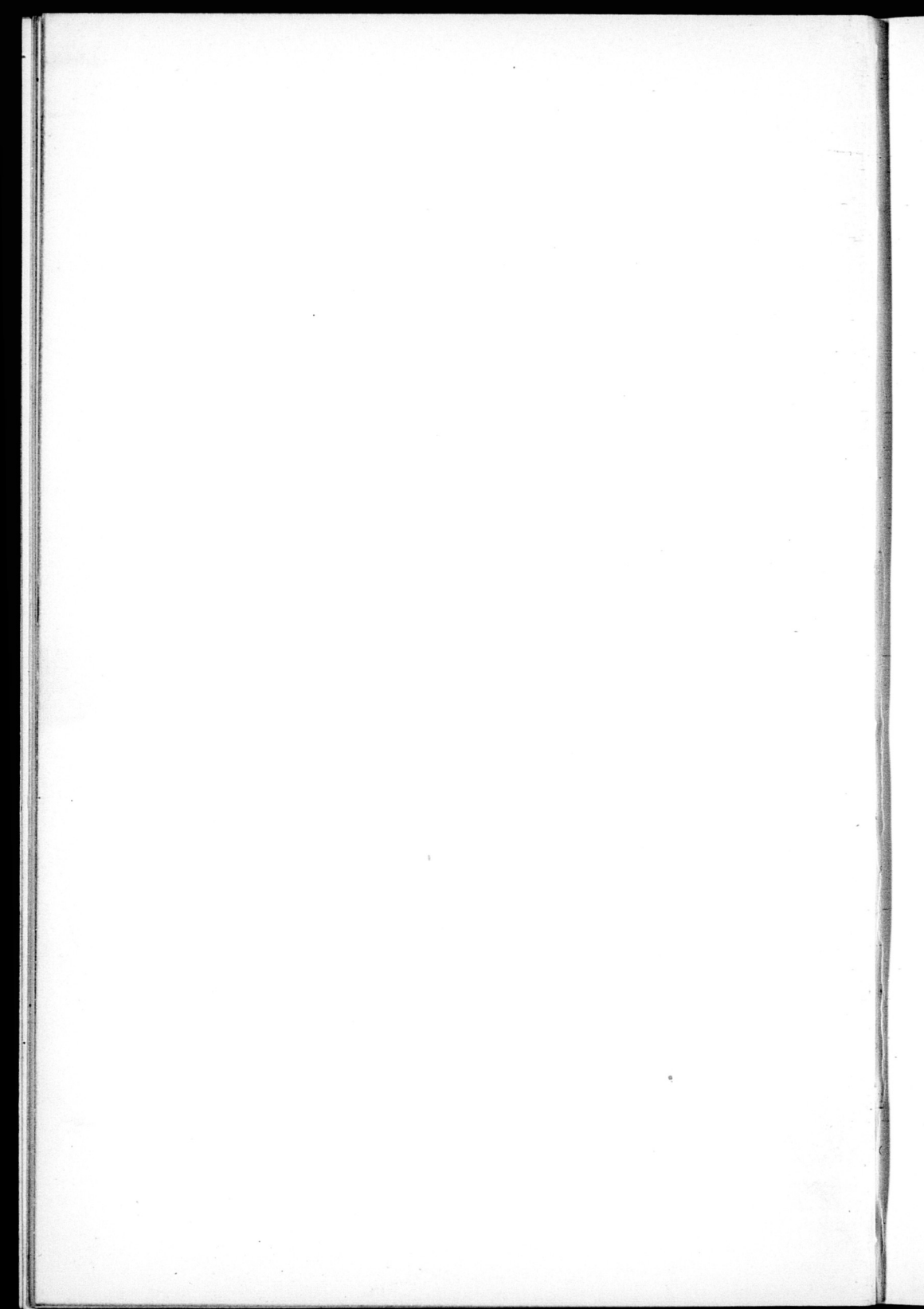
adopted, it would not tend to perpetuate the disease, by inducing a certain class of cattle-dealers to keep animals under conditions likely to foster tuberculosis for the sake of obtaining the compensation.

The two courses are: The obtaining of a warranty by the butcher from the farmer that the animals shall pass the meat inspector; and, secondly, the formation of an insurance fund, either among the butchers alone or jointly among the butchers and farmers, which would be preferable, to cover the losses that might ensue from seizure. In Germany, where inspection of meat has been carried out for years by veterinary surgeons under regulations affecting a much greater uniformity of practice than has been the case in this country, butchers and farmers have availed themselves almost entirely of the method of insurance.

This plan has been adopted with some success in certain towns in the United Kingdom, and there seems no reason why the benefits that have accrued from its adoption in a few places should not be extended so as to be universally applicable throughout the country.

It is hoped that the following pages will furnish reliable information on the points alluded to, and thus serve as a guide to the farmer, the butcher and the meat inspector.

NOTE.—The proof-sheets of Chapter VI. were kindly revised by Mr. King, M.R.C.V.S., Veterinary Inspector of the City of Manchester.



CHAPTER I.

CAUSE OF THE DISEASE.

ALTHOUGH tuberculosis has only been recognised among agriculturists as a specific disease during the last few years, dairy farmers have seen and recognised its ravages in their herds for a long time, but have not been able to appreciate its cause. Animals suffering from tuberculosis were supposed to be affected with various distinct diseases, and many local names, such as grape disease, pearl disease, wasters, piners, snorters, have been given, according as the lungs, bowels, or glands of the throat were attacked. Many cases of so-called wens or clivers, and of hard swellings in the udder setting up mammitis, were attributed to different causes, but, according to present knowledge, they should all be included under this one heading of tuberculosis.

In pigs it is generally called 'wasting,' from the very prominent symptom which it produces. Frequently it has been mistaken for swine fever or a cold, and in hundreds of cases pigs have died from it without any attempt having been made to ascertain the cause of death.

While cattle and pigs contract the disease easily, horses and sheep are only occasionally affected with it. Dogs and cats contract the disease, and probably more are affected than is commonly supposed; while birds and wild animals when kept in confinement are all subject to its ravages.

It is, however, chiefly among cattle that are used for dairy purposes, and which are housed for a considerable portion of the year, that tuberculosis exists. The symptoms which are observed in cattle vary to a certain extent, according to the portion of the body where the disease exists. In many cases an animal may be extensively affected with tuberculosis without showing

external symptoms of the disease. In other cases, a very rapid loss of flesh is observed, quickly resulting in death.

From observations and experiments that have been made, there seems little doubt that tuberculosis is not frequently met with among those breeds of cattle which are usually kept out of doors, while, on the other hand, those breeds which have been kept indoors in warm cow-sheds, and which have been forced for the production of milk, are affected with the disease to a very great extent. The Shorthorns, Ayrshires, Jerseys and Guernseys are the breeds of cattle in which the disease is most prevalent. No doubt, if any other breed of cattle was placed under the same conditions which have prevailed for the last few years in the management of the Shorthorns, Ayrshires, Jerseys and Guernseys, it would become quite as badly affected with tuberculosis as those already mentioned. Amongst dairy cattle at the present time it has been estimated that at least 25 per cent. are more or less diseased. This estimation has been made as the result of post-mortem examinations of herds of cattle which have been slaughtered under the pleuro-pneumonia regulations, and as the result of observations made at public slaughter-houses. Where the tuberculin test has been used, to which reference is made later, the percentage of animals affected is considerably higher.

Dr. Robert Koch in 1883 discovered that tuberculosis was due to the presence of a very small germ, or fungus, which invaded the animal tissues, and in the tissues in which the fungus developed little round nodules, or tubercles, were formed. He found that a number of these germs, or bacteria, as they are called, would only grow under certain definite conditions, and that in the main they were very much like plants of a larger growth with which we are more familiar. The germs of the disease, or, to speak more correctly, the tubercle bacilli, belong to the lowest form of plant-life. When viewed under the microscope, the bacillus has the appearance of a little rod (see Frontispiece). As soon as it had been found that these bacilli were present in all the tubercles, it became necessary to ascertain whether they were the actual cause of the disease, or only happened to grow after the disease had become established. To determine this point, some of these bacilli were sown in little glass tubes containing a mixture of gelatine and broth, and were kept in

them at a regular temperature of about 99° F. for some weeks. On this nutrient medium the bacilli grew, and after a time the appearance they presented was that of a grey membrane extending over the surface. Some of them were then taken from these glass tubes and planted in other glass tubes and grown under similar conditions. This was repeated a number of times, so that there was no possibility of any other bacilli being present in the last tubes. A crop of bacilli from one of the last tubes was then taken and introduced into the body of a healthy animal; in some cases they were injected under the skin, in other cases into the abdomen, and in others, again, they were mixed with the food given to the animals. The result was that in the course of a short period the animals thus inoculated became affected with tuberculosis, and when they were killed, and a post-mortem examination made, tubercles were found to have developed in various parts of their bodies containing the same sort of bacilli which had been first taken from another animal's body some months, or even longer, before.

These experiments established the fact that the bacilli are the cause of tuberculosis. They further show that the disease is of a contagious nature; that wherever these bacilli are planted, if the conditions be suitable, they will take root, grow, multiply, and cause disease.

Following up this argument, it will be readily seen that it is quite possible for an animal affected with tuberculosis of the lungs to cough out the bacilli over its own or some other animal's food, and the food when swallowed will carry the bacilli into the digestive organs and infect the bowels or mesentery. An analogy may help to explain the meaning of the greater susceptibility to tuberculosis of one class of animal than of another. Everyone knows that both Indian corn and wheat are grown in England. Wheat, as is known, readily matures and produces heavy crops. It is also known that acres of Indian corn may be grown, and it will reach a height of 6 feet and more; but it is only in exceptional years that in England it is possible to count upon getting a crop of maize. The climate is such that it does not ripen quickly or easily. At the same time, occasionally some very fine heads of Indian corn may be obtained, and the reason for the difference in the results

is that there is something in the habit of growth of the two corns which enables the one to produce a crop where the other cannot. But if the Indian corn is grown in America, it finds there a congenial climate, which assists it in producing abundant and heavy crops of the ripened corn. Much the same thing is found with regard to the tubercle bacilli. The bacillus is the seed, and the animal body the soil. But the seed and soil alone are insufficient to produce crops. There must be warmth, moisture, and general suitability. These agents are spoken of as accessory causes, and in the development of tuberculosis they are of the very greatest importance. For instance, animals of a hardy constitution which live out of doors may take in a considerable number of the tubercle bacilli without being affected by them. The condition of the tissues of their bodies is such that it is uncongenial to the growth of the bacilli. The following are among the chief accessory causes :

Heredity.—Until very recently it was generally asserted that the principal influence or cause was heredity. At the present day it is quite as strongly asserted that heredity has little or nothing to do with the spread of the disease. Although heredity cannot be said to be the actual cause of the disease, yet it is impossible to doubt that it exerts an important influence on its propagation. There are some families of animals the tissues of which form a very favourable seed-ground for tuberculosis, and if any of the bacilli effect an entrance they will grow quickly and luxuriantly, the animal having little or no protective power in its own body. On the other hand, there are members of other families, exposed to the same infection and under the same conditions, which are able to resist the disease to a very marked extent (see Table II.).

Sire.—In heredity, the question arises what influence the sire possesses, and what influence the dam. If the sire is tubercular, is there a likely prospect of his communicating the disease either to the dam or to the offspring? A careful examination of the evidence on this point leads to the conclusion that there is very little danger, if any, of the disease being communicated by the sire to either the dam or the offspring. A tubercular bull might when in contact with a cow infect her, but practical experience shows that such an event is highly improbable, and is not an

important factor. It is even less likely that a bull could infect a calf at the period of service. The influence a sire has on the disease is that derived from the power he has to perpetuate and to reproduce the particular form, colour, shape, and peculiarities of tissues which his individuality may possess.

Dam.—It also seems probable that there is very little danger of the disease being communicated from the cow to the calf before birth; and although it is quite conceivable that where a cow is the subject of generalized and progressive tuberculosis the foetus may become infected before birth, it must be at some period after the development of the ovum has commenced, and in any case it is an extremely rare occurrence.

The part which heredity plays in the propagation of this disease seems to consist in the perpetuation of constitutions favourable to the growth of this particular bacillus when introduced.

Climatic Influence.—Climate undoubtedly has a direct influence, and the purer the air is, the less chance is there for the development of the tubercle bacilli; indeed, in mild cases of tuberculosis there are particular districts where the air exerts a curative effect on the disease, such, for example, as the climate of the High Alps and the Highlands of South Africa. But in no climate, so far as is known, can the disease originate spontaneously.

Geological Conditions.—It has been asserted that tuberculosis is due to a large extent to the soil. This does not seem to be the case, as the disease is found equally prevalent on primary, secondary, and tertiary formations. It is found alike on clay, gravel, or sandstone.

Influence of Food.—As an accessory cause or favouring circumstance food plays a large part, and animals fed on stimulating or forcing food, particularly such foods as brewers' grains, are rendered more susceptible to all diseases, including tuberculosis.

Housing.—What statistics there are show very clearly that animals kept in houses are more liable to tuberculosis than those living an open-air life, and this is very much more the case when the animals are kept in small, dark, badly ventilated sheds. In dark sheds the tubercle bacilli will live for weeks or months, perhaps even longer, and they are carried about in the dust ready to cause disease. Exposed to the sunlight for a few hours, the bacilli are killed and rendered harmless. Badly ventilated sheds

cause a great accumulation of foul gases, given off from the animal's body and lungs, which are necessarily rebreathed many times, and cause a lowered vitality of the tissues. The air must be continually changed, so that an animal can at every breath take in pure air, and not air plus injurious gases. In order to change the air constantly, and yet prevent a continuous rush that would cause a draught, it is necessary for the buildings to have sufficient air space.

The exact amount of air space that is beneficial must vary a little according to the size of the animal, the position and structure of the building, and the amount of ventilation. A safe guide to take in cases where the sheds are isolated and free from other buildings is a minimum air space corresponding to 1 cubic foot for each pound weight of the animal's body, but in towns or places where the sheds are shut in by other buildings a minimum air space of not less than 800 cubic feet should be given.

Where tuberculous cattle have been tied up in one stall for a number of years, the woodwork, the mangers, and the walls become so thoroughly infected with the tubercle bacilli that healthy animals tied up in the same place months afterwards will contract the disease.

Contagion.—The great, in fact the only, means by which tuberculosis is spread is contagion, principally from the dust contained in the air inhaled, or from the food which is eaten. And it must be remembered that it is not necessary for animals to be in direct contact to communicate the disease.

Another means which has been advanced as propagating the disease is contact with human beings, and there is no doubt that some of the men who are employed in stalls in which cows are kept all the year round, and in which the ventilation is defective, are themselves tubercular. It is only reasonable to suppose that in some cases these men can infect animals. But it is improbable that this is so to any large extent.

CHAPTER II.

SYMPTOMS OF THE DISEASE.

HAVING admitted, then, that a large number of animals are affected, and that the disease is one which is practically only spread through contagion, though influenced by heredity, food, housing, and climate, the next point to consider is whether any practical means can be devised for eliminating the disease, or, at any rate, for keeping it within much smaller limits than is the case at present.

The first step in the problem is to diagnose the disease correctly.

Physical Symptoms.—In only a small proportion of the animals that are actually affected with tuberculosis is it possible, by a physical examination, to diagnose the disease correctly, and this has been the great stumbling-block hitherto in the way of dealing with the disease. There are no absolutely diagnostic symptoms which are usually found present in the various forms assumed by the disease, for nearly all the symptoms may arise from some other cause, and it is necessary from circumstantial evidence to balance between the most likely probabilities. In cattle there are acute and chronic forms of the disease which may merge or change into each other. In the acute form the symptoms will vary with the organ or organs that are chiefly attacked; but one symptom always present is a high temperature, 105 to 107 F., with quick respirations and accelerated pulse-beat. If the lungs are involved auscultation will reveal it. They quickly become congested, and air is prevented from passing to the smaller bronchi and air vesicles. The abdominal respiratory movements are shallow, quick, and often twice as rapid as usual, while the elbows are markedly turned out. There is glistening and brilliancy of the

eye, a dry nose, and disinclination for food. Death is the usual sequel within the course of a few weeks. In the chronic form there are frequently no physical manifestations of the disease, and considerable portions of various organs may be affected for months or years without apparent inconvenience to the animal. In some chronic cases it is frequently noticed that other illnesses, such as difficulties during parturition or colds, are materially aggravated, and are more difficult to treat. In others a gradual manifestation of symptoms is observed, dependent on a disturbance of the functions of the body, brought about by the tubercular growths. When the mesenteric glands are affected, nutrition is impaired, and in spite of the best food and nursing the animal gradually wastes away until it dies.

Where the lungs are involved, shortness of breath and a chronic cough are generally leading features. It is, however, a curious fact, which has been repeatedly noticed, that although large portions of the lungs may have become completely solidified through the disease, and enormous tubercular nodules be present on the pleura, the animal has remained in a nearly fat condition for years, and the existence of the disease only been discovered after slaughter in the ordinary trade way for human food. It must not be assumed that because this is the case in some individual animals the chronic form of the disease is not serious. In most cases the disease progresses, and though it may do so slowly, there usually comes a time when physical symptoms are manifested and the animal depreciates in value. There is also the danger that the disease may be communicated to other animals and set up the disease in an acute form.

In young stock the glands of the throat are sometimes the seat of the disease, showing its presence by hard, deep-seated swellings at the junction of the head and neck. After a time the swelling forms an abscess, but still remains hard, and does not yield to treatment.

When the udder is affected, the swelling generally appears as a small marble-like nodule in one quarter, which gradually extends until the whole quarter is involved, and useless for milk secretion. The other quarters may also become affected. In some cases there is no disturbance of the general health of the cow; in others the attack may be acute, showing itself by feverish symptoms.

In pigs the symptoms manifested are a markedly unthrifty condition, often accompanied by an erratic appetite. There is almost invariably a cough and a tendency to diarrhoea. Many of the outbreaks occur on dairy farms, and often large numbers of pigs are attacked. It spreads easily from one pig to another, and the sties become so contaminated with the disease that it is unsafe to put healthy pigs into them until they have been thoroughly disinfected. Pigs are generally affected in the lungs, spleen, and liver, but brood sows which are diseased become affected in the udder, and some give the disease to their offspring. Unfortunately, so few people know that pigs are affected in this way that often large herds are decimated, while the survivors are sold off as being 'an unthrifty lot,' to spread disease among neighbouring herds. A case is reported where a brood sow from an infected herd was sold to a neighbouring farm, with the result that within a few months seventy pigs on that farm had become diseased.

By constant practice these symptoms become valuable aids to diagnosis, but there is not sufficient evidence in them to make the diagnosis certain.

Recently a new substance has been discovered which promises very material aid in dealing with the disease. It is made by growing large numbers of the tubercle bacilli in an incubator, and from them preparing a very powerful substance called tuberculin. When a correct dose of tuberculin is injected into the body of a tuberculous animal, it causes a good deal of feverish disturbance, and if the temperature of the animal be taken during the twenty-four hours succeeding the injection of tuberculin, it will be found to have risen several degrees (see Tables I., II.). If, on the other hand, the animal is healthy, the injection of tuberculin causes no appreciable effect. At first it was hoped that the repeated injection of tuberculin might cure the disease, but at present this has not proved to be the case. Possibly some modification in the preparation of tuberculin may be discovered which will have that desired result. Tuberculin must be regarded merely as a means of diagnosing the disease, and it therefore becomes a serious matter to ascertain to what extent the test is a reliable and practicable one.

Recently one of us has had the opportunity of testing three

herds of about 150 cows. The tuberculin was obtained from the Pasteur Institute in Paris in one consignment, the same syringe was used, the same thermometers, and the cows were injected on succeeding nights. In one herd about 40 per cent. of the animals were found to react to the test; in the other two no animal gave a reaction. In the first herd tuberculosis was known to have existed in the sheds almost, if not quite, from the time that they were built. The animals were kept in day and night, there was very little ventilation, and on entering the cowsheds after the workmen had left of an evening they were exceedingly hot, close, and had a strong smell. In the other herds, the ventilation was good, the sheds roomy, and the cattle had lived open-air lives. So far as could be ascertained, tuberculosis had not been previously found among the stock. There is no way of explaining the action of the tuberculin in these cases, except by accepting the results as a correct diagnosis. In addition to these testings, hundreds of others have been carried out with similar results. Particular attention should be paid, however, to those carried out by Professor Dewar on the Castle Craig herd of Sir T. D. Gibson-Carmichael, the results of which we have been allowed to append (see Table II. at the end of the book.) It will be seen that those cattle that reacted to the tuberculin test did so on each subsequent occasion that they were tested, and Sir T. D. Gibson-Carmichael has found that the post-mortem examinations made on his herd have proved the test to be reliable.

Professor McFadyean's views, expressing reliance on the tuberculin test, are set out in the minutes of evidence of the Royal Commission on Tuberculosis, 1896. A reference to the many results published in Europe and America with regard to its use leaves no doubt that tuberculin, when properly prepared, is absolutely reliable.

The foregoing remarks therefore show that tuberculosis is a contagious disease communicable from one animal to another. It has also been proved to exist to a considerable extent among dairy stock, and the best means of diagnosing it is by the tuberculin test.

CHAPTER III.

MEASURES OF PREVENTION.

EXPERIMENTS made for the Royal Commission (1890), and observations since published, show that the milk of a cow only contains tubercle bacilli when the udder is affected, and it has been proved (McFadyean, Bang, Carmichael) that healthy calves can be reared by cows that have tuberculosis, but the udders of which are free from disease. The percentage of cows that have tuberculous udders is fortunately comparatively small, but the virulence of the milk is so great that animals taking it readily become infected with the disease. It has been found that not more than from 1 to 2 per cent. of tuberculous cows have the udder affected. Such cows are dangerous, and ought on no pretext whatever to be kept in a dairy.

The danger that children run by drinking raw milk from farms where the cows are not kept under the best conditions, with the probability that one or two have tuberculous udders, cannot be overestimated. When the milk from several cows is mixed the danger is lessened, as, if one animal is thus affected in the udder, the individual dose is diluted. The practice of keeping a particular cow for nursery-milk should only be allowed under strict veterinary supervision, and it is wisest to let children have the mixed milk, unless it is quite certain that the cow is absolutely healthy. It cannot be too strongly insisted on that milk is a variable article, produced under very different conditions, and because the price of milk is lower in one dairy than in another, it does not follow that it is in reality a cheaper article. The richness of the milk depends upon the way in which the animals are fed and looked after. The colour is no criterion of its quality, as there is very little, if any, milk sold in the large towns that is

not coloured artificially before it reaches the consumer. Boiling kills the tubercle bacilli, and this simple expedient should always be resorted to, unless it is known that the cows are perfectly healthy.

It is probable that in the future there will be a great extension of the principle of the application of heat to milk prior to its sale, for the purpose of destroying the pathogenic micro-organisms which in one way or another may gain access to it. Outbreaks of typhoid fever, scarlet fever, and diphtheria have repeatedly been traced to milk-supplies, and the very high diarrhoeal death-rate in children is largely due to the presence of putrefactive organisms in stale milk.

In the application of heat in addition to simple boiling or scalding, the two methods employed are Pasteurization and sterilization. By Pasteurized milk is meant milk that has been raised to a temperature of about 167° F. for half an hour. This temperature is sufficient to destroy the germs of tuberculosis, scarlet fever, etc. Although it is thus sufficient to destroy the pathogenic germs, it is not sufficient to destroy highly resistant bacteria or spores, so that the keeping property of the milk is only slightly increased above that of ordinary milk. The taste of milk thus treated is only slightly altered, and in some cities, as, for instance, Copenhagen and Paris, there is a large demand for this Pasteurized milk, which is sold in glass bottles.

By sterilized milk is meant milk that is raised to such a temperature that all organisms and their spores are destroyed, so that, when hermetically sealed, the milk keeps perfectly well for an indefinite time. To render milk thus sterile it is usually placed in bottles in a steam sterilizer (an apparatus not unlike that used in steam disinfection), where the temperature can be kept at rather over 212° F for some time.

In this country hitherto local authorities have had no powers for controlling the danger to man from the sale of milk of tuberculous cattle, even when the udder is diseased. The Dairies, Cowsheds, and Milkshops Order, 1885, prescribes and regulates the lighting, ventilation, cleansing, drainage, and water-supply of dairies and cowsheds, and states that if at any time disease exists among the cattle the milk shall not be used for human food. Unfortunately, this cannot be stretched so as to cover tubercu-

losis, since that disease was not included in the Contagious Diseases (Animals) Act, 1878, under which the Order was instituted. Nor has it been found possible to make use, as regards tuberculosis, of the section in the Infectious Disease Prevention Act, authorizing the Medical Officer of Health to stop the sale of milk from a dairy from which he believes infectious disease is being spread. In one or two local Acts, however, such as the Glasgow Police Amendment Act, steps have been taken directly with the view of preventing the sale of tuberculous milk, and hence the Royal Commission recommends an extension of such powers in the direction of systematic inspection of the cows in dairies and cowsheds by the officers of the local sanitary authorities within whose districts the premises are situated; inspection, when desired, of the cows in any dairy or cowshed, wherever situated, by the authorized officers of local authorities within whose districts milk from the premises in question is supplied; power for a Medical Officer of Health to suspend the supply of milk from any suspected cow for a limited period pending veterinary inspection; power to prohibit the sale of milk from any cow certified by a veterinary surgeon to be suffering from such disease of the udder as in his opinion renders the animal unfit for the supply of milk, or exhibiting clinical symptoms of tuberculosis; and the provision of a penalty for supplying milk for sale from any cow having obvious udder disease without the possession by the owner of a certificate to the effect that such disease is not tubercular. They further recommend that notification of every disease in the udder shall be made compulsory, under penalty, on the owners of all cows, whether in private dairies or those in which the milk is offered for sale. The reason it is advisable that all diseases of the udder should be notified is that notification of tubercular disease of that organ alone would fail of the object in view, as expert knowledge is required for its diagnosis. Notification of cows showing symptoms of the disease is required, because when once an animal is recognised as tuberculous there is no knowing when the tubercular process may not invade the udder. Dr. Sims Woodhead, in his investigations for the Royal Commission (1890), was impressed with the fact that the spread of tubercle in the udder goes on with most alarming rapidity, and he noticed that on several

occasions the disease had become distinctly developed between fortnightly inspections carried on along with a veterinary surgeon.

The disease being recognised as contagious, common-sense indicates that it is necessary to separate the healthy from those that are diseased, and as soon as the disease is recognised there is no longer any excuse for allowing the healthy and unhealthy to stand side by side.

In Denmark much has already been done by separation and isolation of the diseased animals, and a reference to the legislation of foreign countries may indicate what is likely to be done here.

Many countries have, through the Veterinary Department of the Government, issued instructions on the employment of tuberculin as a diagnostic agent for the use of farmers and stock-owners generally, and one or two have passed laws with regard to its employment.

Although it was first employed on an extensive scale by Professor Bang in Denmark, the conditions under which it was tried there were voluntary, and Belgium may be said to have been the first country to take legal steps with regard to its employment, in 1895.

It is interesting to note that the Belgian Government was led to legislate on the subject by the knowledge gained as to the extent of the disease in the country by the thorough system of meat inspection instituted in 1890. As regards this first measure, which was admittedly an experiment, it was found to be too drastic, as the test was made almost compulsory on all cattle in consequence of the fact that, if tuberculosis was found post-mortem in an animal, none of the animals which had occupied the same shed were allowed to be sold, except for the meat market, unless they failed to react to the test.

The first law, therefore, was replaced by a less stringent one, which was passed in August, 1897.

By this regulation the use of tuberculin is only permitted under a special authorization of the Minister of Agriculture, in order to prevent frauds which might easily be committed were anyone to be allowed to use it. The tuberculin is supplied gratuitously to the veterinary surgeons, and those animals only which show symptoms of tuberculosis are tested. If they react, they must

be slaughtered within a week. In cases where tuberculosis is found in animals slaughtered for the meat market, the owner is required to notify within five days the place from which the animal came, and a veterinary inspection may be made of all the animals in the herd, except such as are being fattened, for the purpose of dealing with any that show suspicious symptoms. Any stock-owner may have his herd tested on condition that he does not sell, except for the meat market, the reacting animals, and that he isolates those that fail to react from those that do. The farmer can, however, continue to make use of the reacting animals so long as they show no clinical signs of the disease, provided he removes the calves from their mothers soon after birth, and submits all newly-purchased animals to the test before allowing them to mix with the other animals.

Provision is made for testing, when necessary, any animal that is imported into Belgium from any neighbouring county.

Compensation is given in certain cases, a distinction being drawn between the animals found tuberculous after slaughter in the ordinary course for the meat market, and those slaughtered by order of the authorities as being clinically affected. In the first case, 50 per cent. of the value of the flesh and organs is given when the carcase is totally condemned, and in the second, when it is a question of breeding cattle, 70 per cent. of the value of the animals estimated as perfectly healthy if the flesh is totally condemned as unfit for food. But in no case can the compensation exceed £17. When the flesh of the animal can be sold as fit for food, 25 per cent. of the same value is given. When it is not a question of breeding cattle, the conditions are very similar to those prevailing for animals intended for the meat market.

The compensation is safeguarded by requiring: (1) A veterinary surgeon's certificate, stating whether the flesh was or was not fit for food; (2) a statement from the local authority as to what was done with the flesh; and (3) proof that the animal had been in the country for six months.

In France a decree was passed in March, 1896, requiring that all cattle, except such as are intended for the meat market, imported into the country should be submitted to the tuberculin test, and placed under observation on the frontier for forty-eight hours.

Reacting animals are to be sent back to the country from which they came, after having been marked, unless the importer consents to their immediate slaughter.

This action on the part of the French authorities is likely to have the effect of inducing the owners of pedigree stock in this country to have their herds tested, as it has already led to the slaughter of some such animals imported for breeding purposes into France.

In Germany, so far as is known, there has been no definite legislation on the subject, but most of the States have made arrangements for the preparation of tuberculin in the veterinary colleges, and have circulated information to farmers and agricultural societies as to the means of applying the test, and the interpretation to be put upon the results obtained.

In Denmark nearly £6,000 is allocated in the annual budget for the purpose of assisting owners to make use of tuberculin.

Only those cattle-owners, however, can benefit from the gift of tuberculin, and the services of a veterinary surgeon free of cost, who will undertake to keep the healthy animals isolated from those that react, by means of a partition erected in the shed. The work is under the superintendence of Professor Bang, one of the greatest authorities on bovine tuberculosis, and in April, 1897, there had been tested in the whole of Denmark 5,306 herds, numbering 144,800 cattle. The results are eminently satisfactory, and anyone who has had the opportunity of seeing the work carried out there cannot but be struck by the simplicity and slight cost of the arrangements necessary to bring about success.

In Switzerland and Norway action has been taken to supply tuberculin gratuitously to such stockholders as wish for it.

In some of the United States of America very active measures have been taken to combat bovine tuberculosis by means of tuberculin. For instance, the following are the main provisions of a General Order as regards the importation of cattle into the State of Massachusetts issued by the Board of Cattle Commissioners in July, 1895.

All owners desirous of introducing neat cattle into the State must produce a certificate based on a tuberculin test, carried out by a veterinary surgeon, that such cattle are free from tuber-

culosis, and stating the quantity injected and the temperature resulting from such injection. On their arrival the animals are quarantined until they have been inspected by an officer of the Board. Animals imported without a certificate of soundness will be quarantined and submitted to a tuberculin test after the lapse of six days at the owner's expense. Should they react, they are condemned and killed.

Compensation up to the full value is given for the slaughter of animals by reason of tuberculosis, provided the animal has been in the State for six months, and there has been no contributory neglect on the part of the owner.

Numerous experiments have been carried out at the Agricultural College of the various States on the use of tuberculin, and pamphlets, in all cases recommending the use of tuberculin, have been issued.

From this very brief summary of the legislation that has been enacted by other countries, it is apparent that tuberculosis is considered a contagious disease, a dangerous disease, and a disease that can be eliminated, or at least controlled.

The means which a farmer can adopt under present conditions will go far to check and lessen the disease, and the means which the State can adopt will help still further to eliminate the disease.

In getting rid of the disease, a farmer must be prepared to give the subject a little thought and attention, and be ready to rearrange his herd, and in some cases to alter his cowsheds. This course, it is certain, will amply repay him by the general improvement in the health and hardihood of the animals, and will prove of lasting benefit.

The first thing to do is to test the herds of cattle. Experience in testing a number of herds has shown that it is only necessary to test breeding animals; consequently the matter resolves itself into testing cows, heifers and bulls. Cattle must have been at least a week in their homes, under normal conditions, before the test can be properly applied. Cattle that have been driven long distances, or have come by boat or rail, cannot be tested until the effect of the journey has passed off. Should this be done prematurely, the results obtained are unreliable. While being tested, the cattle must be kept tied up in their regular stalls for a period of eighteen hours, and fed on their usual food.

The results will not be satisfactory if the cattle are taken in from the fields, or even from a strawyard, and tested the same day. They must be kept tied up at least twenty-four hours before they are tested, and great care is necessary to see that their temperatures are normal. Cattle out at grass during the day and housed at night, may be tested by keeping them in for a day. Even in this case it will be found that the excitement consequent on their not being allowed to go out as usual may increase the temperature of one or two of the cows to the extent of a degree or more.

The cattle should be injected either last thing at night or early in the morning, so that the temperatures can be taken during the daytime.

The following directions are issued from the Research Laboratory, Royal Veterinary College, London, by Professor McFadyean, for using tuberculin :

Directions for using Tuberculin.

'1. While under the tuberculin test cattle ought to be kept in the house, fed on their usual food, and protected from draughts.

'2. The dose of tuberculin for a medium-sized cow is 3 cubic centimetres, or 50 minims, and it may be varied a little above or below that, according to the size of the animal.

'3. It ought to be injected under the skin with a clean hypodermic syringe. The most convenient points are in front of the shoulder, or on the chest wall behind the point of the elbow. The best form of syringe is one with an asbestos piston, as the whole instrument may be sterilized by boiling it in water for five minutes before use.

'4. The tuberculin must be injected into the subcutaneous connective tissue, and care must be taken that the whole dose is introduced.

'5. The temperature must be taken at the time of injection, and at the sixth, ninth, twelfth, and fifteenth hours afterwards.

'6. Animals in which the temperature, during the fifteen hours following the injection, rises gradually to 104° F., or more, may be classed as tuberculous, and those in which it remains under 103° F. as not tuberculous. When the maximum temperature attained is under 104° F., but over 103° F., the case must be considered doubtful, and the animal may be retested after a month.

'7. The test is not reliable in the case of animals in the last stage of the disease, or in those in which the temperature is over 103° F. before injection.

'8. The tuberculin should be kept in a cool place, and protected from light. Should it become turbid or cloudy, it must not be used.

'9. The tuberculin test does not render the milk in any way injurious.'

In herds containing many suspected animals which have been tested for the first time, it is often observed that the diseased animals are, or have been, in groups in contact with each other.

After having found out those animals which are affected, it becomes necessary to separate them from the sound animals. If there are two cowhouses on the farm, or the owner has two farms, the cattle can be easily divided and kept apart. Where there is only one shed it is more difficult, but the two lots of cows should be put at separate ends, and a cheap boarded or canvas partition erected to separate them, which should be thoroughly limewashed and cleansed every six months.

Many cows that have reacted will be found to be only slightly affected, and if they have been kept in a hot, close, badly-ventilated stall, there is no doubt that by a change to an open-air life, particularly in bracing hilly districts, a number will recover. This is seen by a reference to the following table :

TABLE III.

Showing the possibility of Recovery where slight cases are placed under favourable Conditions.

No.	1897. <i>February 3.</i>		1897. <i>February 4.</i>			1898. <i>Mar. 1.</i>		1898. <i>Mar. 2.</i>		1898. <i>March 3.</i>	
	11 a.m.	10 p.m.	6 a.m.	9 a.m.	12 noon.	3 p.m.	10.30 a.m.	8 p.m.	5.30 a.m.	10 a.m.	2 p.m.
II.	101.8	101	101.3	101.5	102.2	103.6	101.4	101.2	101	101.2	101.8
VIII.	101.2	101.4	100.8	101	101.3	101.4	101.4	101.2	101	101.6	101.2
IX.	102.1	102.5	103.3	106.5	107.6	105.3	101.2	101.2	102	103.6	104.6
X.	102	102	102.2	104.1	105.4	105.5	101.2	101.4	101.4	101.6	102.2
XIII.	101.5	100.8	104.6	105	104.1	103.4	101.4	101.2	100.6	101.4	101.6
XVI.	101.8	102	102.2	102.8	105.2	106	101.4	101	101.2	101.6	101.8
XVII.	101.3	101.8	101.4	102.2	105.5	105.7	101.4	101.2	101	101.6	101.2
XIX.	101.3	101.4	100.6	100	101.1	101.2	101.4	101.2	101	101.6	101.2
XXV.	102	101.8	102.6	106	107.4	105.4	101	100.6	101	102	101.8
XXVIII.	101.5	100.5	101.4	102.9	106	105.3	102.2	101.2	101.4	101.2	101.4
XXXIII.	102.4	101.1	101	101.3	101.4	101.3	101.2	101.2	102	103.6	102.2
XXXIV.	102	101.8	101.6	102.6	106.1	104.4	101.2	101.2	101	101.2	101.4

In 1896 these cows had been tested and found free from disease; they were then placed in the same stall with others that were affected, and the shed in which they were kept had contained tuberculous cows for some years.

The shed is a good one, airy, well built, and with means of ventilation. During the winter the temperature rarely, if ever, exceeded 50° F. During the autumn after the 1896 testing the cows were kept in the same shed, but, owing to the prejudice of a cowman, the windows and ventilators were rarely opened, and the temperature of the shed was continually at 60° F. and over. It was hot, close, and after the shed was shut up the air quickly became so foul that it was most unpleasant to enter it. In the spring of 1897 this condition of things was changed. The cows were turned out on some hill-pastures, where the air is particularly bracing, and when they came into the sheds at night, windows and ventilators were kept open. As the result of this, during the past winter the shed has always been perfectly sweet and clean.

The very different results obtained in 1897 and 1898 go far to show that recently-affected cows may recover. They also emphasize once again the most important fact that large air space and ventilation are requisite, not only for the well-being of men, but also for all animals.

Cattle that react should, therefore, be given every chance of recovery; but it is wise to get such animals fat as soon as possible, and killed, as the disease may not be arrested, and they are under certain conditions a constant menace to the health of other animals. Tuberculosis rarely spreads from one animal to another when they are at pasture, because cows do not, as a rule, eat over the same particular piece of ground as another cow does during the same day, and the sunlight has such a powerful germicidal action that the tubercle bacilli are soon killed. If it is practicable, it is wisest to keep the cattle in separate fields.

The great majority of cowsheds are much smaller than they should be, and though this defect is being gradually remedied, still, the condition of very many leaves much to be desired. In the course of a number of observations collected during February, 1898, it was found that the inside temperature depended very greatly on whether the owner took advantage of the

means of ventilation or not. Those sheds that had the greatest air space were the least draughty and sweetest.

TABLE IV.

No.	Number of Cows.	Breed.	Cubic Feet Air Space.	Outside Temperature.	Inside Temperature.	Condition of Shed.
I.	25	Jersey	500	33° F.	42° F.	Very sweet.
II.	28	"	421	39° F.	45° F.	"
III.	24	Shorthorn	600	33° F.	52° F.	Fairly sweet.
IV.	24	"	520	33° F.	52° F.	"
V.	9	"	414	33° F.	52° F.	"
VI.	28	"	450	33° F.	60° F.	Very close and foul.
VII.	25	"	888	40°-45° F.	40°-45° F.	Very sweet.
VII.	20	"	888	38°-58° F.	38°-58° F.	"
VIII.	36	Jersey	544	30° F.	60° F.	Unstated.

It is clear that for the production of milk warmth is beneficial, but where the warmth is obtained by keeping the animal in foul air, more harm than good is done, and no cowshed, even at midnight, should smell hot and unpleasant. When tuberculosis exists in a shed, the stall should be kept scrupulously clean, and scrubbed down weekly with an ounce of carbolic acid in every pailful of hot water used.

The prevention of tuberculosis can be aided largely by the State.

In future all new buildings should be larger, more airy, and better paved and drained than is the case in the existing ones. Sufficient light should be insisted upon, so as to obviate dark corners. In summer the windows can have sacks hung over them, if necessary. The ventilation should be so ample that when the stalls are full of cows the air inside the shed should be as sweet to breathe as it is outside.

Tuberculin should be supplied direct from the Government, and no other kind should be used. It should be supplied only to the County Veterinary Inspector, and he should be empowered to supply it to veterinary surgeons free of charge, a return on a schedule being made by him of the place and time it was used and the results obtained.

All cattle tested should have a tag put in the ear. Where a herd has been tested, the Inspector should see that the animals

are kept apart, and if the cows' milk is being used, particular care should be exercised as to the condition of the udders. To sell milk from a cow with a diseased udder, or to drive an animal along a highway when it shows symptoms of the disease, should be made a penal offence.

The Royal Commission on Tuberculosis (1896), in their report, recommend that notification of every disease in the udder should be made compulsory on all owners of cows; that local authorities should have power to exclude from their districts the milk of cows thus affected, or which show clinical symptoms of the disease; that powers be given to local authorities to take samples and make analyses of the milk produced or sold in their districts (including that coming from foreign countries), and that milk-vendors should be required to supply sufficient information as to the sources from which their milk is derived.

As regards cowsheds in urban districts, the recommendations are, that in future no cowshed shall be permitted within 100 feet of any dwelling-house; and that the discontinuance of any one already existing shall be ordered on the certificate either of the Medical Officer of Health that it is injurious to the health of human beings residing near it, or of the veterinary inspector that it is not a place wherein cows ought to be kept for the purpose of milk supply, and that it is incapable of being made so.

The conditions they recommend for new cowsheds are:

1. An impervious floor.
2. A sufficient water-supply for flushing.
3. Proper drainage.
4. A depôt for the manure at a sufficient distance from the byres.
5. A minimum cubic contents of from 600 to 800 feet for each adult beast, varying according to the average weight of the animal.
6. A minimum floor space of 50 feet for each adult beast.
7. Sufficient light and ventilation.

The Commissioners think that the above conditions should also hold in the case of cowsheds in rural districts, except in so far as cubic contents per cow are concerned. As regards these cubic contents, such space per cow should be provided as would, in view of the surrounding circumstances, secure reasonable ventilation without draught.

For the elimination of bovine tuberculosis the recommendations are that the Board of Agriculture should manufacture tuberculin and offer it gratuitously, together with the services of a veterinary surgeon, to stockowners, on condition :

1. That the test be applied by a veterinary surgeon.
2. That tuberculin be supplied only to such owners as will undertake to isolate reacting animals from healthy ones.
3. That the stock to be tested shall be kept under satisfactory sanitary conditions.

In Manchester the following regulation is in force :

‘ For prescribing and regulating the Lighting, Ventilation, Cleansing, Drainage, and Water-supply of Dairies and Cowsheds in the Occupation of Persons following the Trade of Cowkeepers or Dairymen.

‘ A person following the trade of a cowkeeper or dairyman shall observe the following regulations with respect to every cowshed in his occupation, viz. :

‘ 1. He shall provide for the effectual lighting thereof in all parts.

‘ 2. He shall cause every cowshed in his occupation to be provided with adequate means of ventilation, and to be properly ventilated at all times when such cowshed is in use.

‘ 3. He shall cause every cowshed in his occupation to be maintained at all times in a thorough state of cleanliness, and so that no offensive matter is allowed to sink into the floor.

‘ 4. He shall cause every cowshed in his occupation to be effectually drained, and in such a manner as not to allow of direct communication by means of any drain between the interior of such cowshed and any sewer or cesspool into which such drain may enter.

‘ 5. He shall cause the cowshed to contain for each animal proposed to be kept therein a space of at least 600 cubic feet, any portion at a height exceeding 14 feet not being taken into account in reckoning such space.

‘ 6. He shall provide an adequate supply of wholesome water, either constant or stored in a metal or slate cistern, which he shall provide with a proper cover and maintain in a thoroughly clean condition.

'7. He shall cause the floor to be thoroughly cleansed twice a day at appropriate times, and shall at the same time remove all dung from the cowshed.

'8. He shall cause every cowshed in his occupation to be thoroughly cleansed from time to time, as often as may be necessary to keep the same in a clean and wholesome condition.

'9. Where any part of the inner surface of the walls of the cowshed is covered with a hard, impervious material, he shall cause such part to be so cleansed at least once in each week.

'10. He shall cause the roof and the walls, except so much thereof as may be painted or covered with materials such as to render limewashing unsuitable, and as may be properly cleansed, to be limewashed at least twice in each year—viz., in the months of March and October—and at such other times as may be necessary.'

The Urban Sanitary Authority of Ruskington have the following regulations :

' In Respect of Cowsheds.

' Lighting.—The occupier of a cowshed shall provide windows or openings in its walls, doors or roofs, so placed as to ensure its being well lighted in every part of its interior. He shall cause the aggregate area of such windows or openings to be not less than one-thirtieth of the floor area of such cowshed.

' Ventilation.—The occupier of a cowshed shall provide in its external walls, doors or roof, permanent openings, so placed and kept as to insure an effectual change of air therein, and having an aggregate area for inlet of not less than 54 square inches for each animal actually in such shed, and the same for outlet.

' Cleansing.—The occupier of a cowshed shall at all times keep it in a properly clean condition, and free from any accumulation of offensive matter. He shall cause its floor and mangers to be thoroughly cleansed at least once in each day it is occupied. He shall cause the inner surface of its walls, doors, and ceiling or roof, to be limewashed at least once in each year, viz., in the month of September, and at such other times as the local authority may require by notice given in writing under the hand of their clerk.

' Provided that when the structure of any part of the internal

surface of a cowshed is of a nature to render limewashing inexpedient, the local authority may prescribe, in place thereof, other suitable means of cleansing the whole or a part of such internal surface. The occupier of a cowshed shall cause a grain-pit, or other fixed receptacle used for containing grains or other fodder, when situated within such cowshed, at all times, when such cowshed is occupied, to be cleansed sufficiently often to prevent it from being in a foul condition.

‘Drainage.—The occupier of a cowshed shall provide it with such proper means of drainage as will effectually carry away from it all urine and liquid filth, and he shall cause such liquid drainage to be discharged outside it in such a manner that no inundations from any drain, sewer, or cesspool, can gain entrance to it.

‘Provided that a fixed trap or gully may be placed within a cowshed, if it be made to discharge into a drain on which there is a complete air disconnection outside such cowshed, before such drain enters any sewer or cesspool. The afore-mentioned air disconnection shall be formed by a suitable trap in the drain, with not less than one untrapped opening, one of which shall be placed at or near the level of the surface of the ground adjoining such opening, and communicating with the drain by means of a suitable pipe, shaft, or disconnecting chamber of a sectional area, not less than that of the drain, with which such pipe, shaft, or disconnecting chamber may communicate, and situated as near as may be practicable to the trap, and on that side of it which is nearer to the cowshed than the sewer, or other means of drainage with which such drain may lawfully communicate. A grating or cover to the afore-mentioned opening shall be so constructed and fitted as to secure the free passage of air through it by means of a sufficient number of apertures, of which the aggregate extent shall be not less than the sectional area of the pipe or drain to which such grating or cover may be fitted. In no case shall any but a fixed trap or gully be situated within a cowshed.

‘Water-Supply.—The occupier of a cowshed shall provide it with a sufficient supply of pure and wholesome water. He shall not permit soakage from a privy, drain, sewer, cesspool, pigsty, or accumulation of manure or other foul matter, to percolate into a well or other source of water supplying such cowshed.

‘The occupier of a cowshed shall not permit a water-cistern, supplying such cowshed, to be situated within a building in which any animal is kept, or in any place or situation where it would be liable to be exposed to any foul or injurious inundations. He shall cause such cistern to be properly covered, and to be cleansed as often as may be necessary to keep it in a clean condition and free from any deposit. He shall not allow a pipe from such cistern to communicate with a water-closet, soil-pipe, drain, sewer, cesspool or privy. He shall cause any overflow pipe from it to discharge into the open air.

‘The occupier of a cowshed shall cause a water-trough in such cowshed to be cleansed as often as may be necessary to keep it in a clean condition, and free from any deposit. The occupier of a cowshed shall permit the Medical Officer of Health or the Inspector of Nuisances of the local authority to take and carry away some of the water supplied to such cowsheds, sufficient for the purpose of examination or analysis, whenever he may deem it necessary so to do.

‘**Alterations.**—The occupier of a cowshed shall not make, or permit to be made, an alteration in the lighting, ventilation, drainage or water-supply of such cowshed, without forthwith giving notice thereof, in writing, to the clerk of the local authority. Provided that such notice shall not be required for the execution of necessary repairs.’

To attempt to get rid of tuberculosis without regulating the conditions under which cows are kept, where they are forced for milk production, will fail of its purpose. The way in which tuberculosis is and has been largely spread is through the sale and turning out to grass of cows which have been stall-fed for some years, and are badly affected with tuberculosis. After a time they improve again, and at their next calving are re-sold into another dairy herd, carrying the contagion with them. This can only be prevented by regulating the sale of such animals.

CHAPTER IV.

CONDITIONS AFFECTING MEAT INSPECTION IN GREAT BRITAIN AND ABROAD.

IN a review of the conditions affecting meat inspection in this country, as compared with those prevailing abroad, it should be remembered that there are conspicuous differences between the two. In the first place, abattoirs are much more common on the Continent than in the United Kingdom. Whereas in England and Wales their number is about 80, in Prussia it is 321, and in the other States which form the German Empire there must be at least another 300, making a total of over 600 altogether. In Würtemberg and Baden, most of the little towns with a population of 3,000 possess abattoirs; but it has been estimated that, not to mention smaller districts, there are in Germany over 350 districts with more than 5,000 inhabitants that are as yet unprovided with public slaughter-houses. It would be a mistake, therefore, to say that their use is universal, and, indeed, it is considered in Prussia that, while as regards towns meat inspection is satisfactory, in many rural districts the condition of things in this respect leaves much to be desired.

In France, Belgium, and Austria it is probable that all towns of any magnitude are provided with public abattoirs.

In Prussia their use has been largely brought about by a law passed in 1865 to compel all slaughtering to be carried out in a public abattoir, as soon as one has been erected in the district. Power was further given to the local authority to draw up regulations requiring all cattle to be examined by an expert before and after slaughter.

The owners of private slaughter-houses were compensated to the extent of the real loss sustained by them in the withdrawal from their original purpose of the buildings and fittings. No compensation was given for mere disturbance of business.

All the slaughter-houses are self-supporting, the charges that are imposed on the butchers being so calculated as to cover working expenses and to defray interest on capital and sinking fund. They vary from 2s. to 5s. for the slaughter of cattle, 1s. for calves and sheep, and 1s. to 2s. for pigs. In addition to this, there is a charge for the expert examination amounting to 1s. to 2s. for cows, 6d. for sheep, and 1s. for pigs, which includes a microscopical examination of the flesh for trichinosis.

The advantages of public slaughter-houses over private are many. A greater uniformity of inspection is obtained, because efficient inspection of meat in private slaughter-houses, when scattered about a town, can only be secured at great cost. Better provision can be made in them for the housing of the animals, pending their slaughter. When the cattle market is adjacent to the public slaughter-house, as it always should be, and both are in direct communication with the main railway lines, the driving of cattle through the main thoroughfares is done away with. In connection with slaughtering, many trade processes for the utilization of the waste products are carried on, such as bone-boiling, gut-scraping, the extraction of albumin from the blood, and fat-melting, which, if not carried out with care, are productive of grave nuisance, and it is highly desirable that they should be centralized in a public slaughter-house as much as possible.

If any attempt is to be made in this country to utilize by sterilization or cooking the flesh of animals affected to a certain extent with tuberculosis, or to utilize profitably, for trade purposes, carcasses so badly affected with tuberculosis or other disease that they must be wholly condemned, the plant necessary for carrying this out must be centralized in the public slaughter-house. To show what can be done by these methods, when efficiently supervised, the authorities in Stolp, in Prussia, recovered 30 per cent. of the full value of the condemned carcasses.

Lastly, the knowledge gained in them as regards the nature of and extent to which diseases prevail among animals used for

food can be tabulated, and such knowledge must prove useful in many ways.

Public slaughter-houses should be built and controlled by the local authorities themselves. In not a few instances abroad they are in the hands of butchers' associations, but this course is not to be recommended.

It is probable that the objections raised by butchers in England to the erection of public slaughter-houses, on the ground of the inconvenience to the trade and the belief that their erection would lead to a falling-off in the killing of home-fed cattle and an increase in the importation of dead meat from the colonies, would disappear when once they were established. At any rate, in Scotland the butchers prefer public to private slaughter-houses, for the simple reason that they have tried them and been made sensible of their advantages. The general public, it is certain, would prefer to have meat from public slaughter-houses, where it is known that the inspection is adequate.

The second point in which there is a marked difference between the conditions at home and on the Continent as regards meat-inspection is the far larger consumption in England of imported meat than is the case in any country on the Continent.

A distinction must be drawn between animals that are imported from over sea and killed at the port of entry, and the animals killed in the distant countries and imported in a frozen, or chilled, condition.

Although it must be admitted that hitherto there has not been the same stringency of inspection of the carcasses of animals slaughtered at the port of landing in this country as compared with native cattle, there is no reason whatever why this should be so. In some places, for instance, the offal are not kept close to the slaughtered animal, as is the case with home-fed animals, so that the carcass to which they belong cannot be identified with certainty. But it requires only a slight organization or increase of staff to subject both to identical conditions of inspection. In Deptford, until a year or two ago, there was no inspection of the carcasses of the enormous number of animals, amounting in the case of large cattle in 1895 to 151,049. Now, however, one inspector is deputed to examine the carcasses, but a larger staff is imperatively required to do the work satisfactorily.

An important question arises : Is there less tuberculosis among these imported cattle than there is among the home-fed ?

The evidence given before the Royal Commission by those whose work brings them most into contact with such imported animals was that there was considerably less disease among them—a fact which was attributed to their open-air life on the prairies, the small number of cows among those sent over, and to the fact that they are selected animals.

Nor should it be forgotten that in some of the countries—as, for instance, the United States—the animals are all inspected. Some doubt has been cast on the value of this inspection ; and certainly, if the work is done thoroughly, it must require an enormous organization and entail great expense. From the report of the Chief of the Bureau of Animal Industry (Dr. D. E. Salmon) for 1895, it is evident that an organized attempt has been made in the United States to cope with the matter, and every credit should be given the Government there for it.

Whereas in 1892 in the abattoirs 3,800,000 head of cattle were inspected, in 1896 the number inspected amounted to 23,275,000, and in stockyards to 12,641,000. Of cattle alone 7,529,523 were examined before slaughter, and 23,356 were condemned. Post-mortem examination was made of 3,995,461 cattle, of which 8,757 were condemned. Since March 15, 1897, under an order of the United States Department of Agriculture, all meat which is transported to European ports must be accompanied by a certificate issued by an inspector of that department. It is unfair, therefore, to say that cattle imported into this country are subjected to no examination whatever.

The relation between the living animals (cattle and sheep) imported to be slaughtered at the port of entry, and the same class of animal imported as dead meat, is brought out in the accompanying table, taken from the Board of Trade returns for the year 1897.

Living Animals.

CATTLE.				1896.	1897.
				Number.	Number.
Channel Islands	...	...	...	1,719	1,633
Canada	...	...	...	101,591	126,495
United States	...	...	...	393,119	416,299
Argentine Republic	...	...	...	65,699	73,867
Other countries	...	...	...	425	42
				<u>562,553</u>	<u>618,336</u>
SHEEP.					
Canada	...	...	...	83,767	63,761
United States	...	...	...	266,760	186,755
Argentine Republic	...	...	...	339,381	345,217
Other countries	...	...	...	79,684	15,771
				<u>769,592</u>	<u>611,504</u>

Imported Dead Meat.

BEEF.				1896.	1897.
				Cwt.	Cwt.
<i>Fresh :</i>					
United States	...	...	...	2,074,644	2,242,063
Other countries	...	...	...	585,056	768,324
				<u>2,659,700</u>	<u>3,010,387</u>
<i>Salted :</i>					
United States	...	...	...	240,630	171,970
Other countries	...	...	...	6,906	3,266
				<u>247,536</u>	<u>175,236</u>
MUTTON.					
<i>Fresh :</i>					
Germany	...	...	...	3,610	2,321
Holland	...	...	...	229,283	266,842
Australasia	...	...	...	1,853,129	2,009,085
Argentine Republic	...	...	...	801,733	908,623
Other countries	...	...	...	7,403	6,405
				<u>2,895,158</u>	<u>3,193,276</u>

It will be seen that enormous quantities of both beef and mutton are imported as dead meat, and the only inspection they undergo is the cursory examination by the inspector while they are hung up in the chilling-rooms, or the still more casual inspection by the inspector when they are exposed for sale in the shop.

On the Continent, hardly any live animals or dead meat are imported from abroad, the home-fed animals sufficing for the

supply. But, naturally, into the large towns a good many carcasses of animals that have been killed in the country districts are brought, and in these towns regulations have been made for the careful examination by experts of such meat before it can be offered for sale. Special stations are appointed near the main railway-stations and roads, by which such meat is brought for its examination. The following are the main points of the regulations in force in Berlin as to the examination of this imported dead meat :

1. The stations are under the control of the director of the slaughter-house, and in each one a veterinary surgeon is placed in charge.

2. No less amount than whole quarters of an animal may be imported, and they must always be accompanied by the organs and head of the animal.

3. A certificate from a member of the police or from a veterinary surgeon must be brought, stating that the animal had been inspected before slaughter, and was not affected with contagious disease.

4. No meat can be removed from the station until it has been stamped as fit for food.

5. The charge for examination must be fixed, so as to cover the working expenses of the station.

6. A careful register must be kept of all the conditions leading to seizure of the meat.

Similar regulations are enforced by the municipal authorities of many large towns abroad. In Copenhagen, indeed, where all the meat, as is universally the case abroad, is stamped, two stamps of different colours are employed, one for first-class meat, and another for that which is, in the opinion of the inspector, of second-class quality, and this latter stamp is used largely in the case of imported dead meat.

CHAPTER V.

NATURE OF INSPECTION REQUIRED, AND QUALIFICATIONS OF MEAT INSPECTORS.

It is absolutely necessary that there should be meat inspection, first, to protect human health from the danger of eating meat that might prove injurious, and, secondly, to give an assurance to the public that what they buy is what it purports to be.

Butchers themselves quite recognise the importance and value of inspection, and would welcome it provided it were carried out by competent officials.

To be effective, meat inspection must extend to the animal both before and after slaughter, because, if inspection is deferred until after the organs are removed and only the carcass remains, the most valuable indications whereby the nature of the meat may be judged will have been destroyed.

Another advantage which may accrue from the inspection of meat, which has been almost entirely lost sight of hitherto in this country, is the knowledge which a careful compilation of the statistics of meat inspectors enables the authorities to gain of the extent to which various diseases affect domestic animals, and what organs become chiefly affected with the diseases.

In no disease has this knowledge been more wanted than in tuberculosis, but the reports of most medical officers of health may be searched in vain for information as to the relative proportion in which bullocks, heifers, bulls and cows, calves, and pigs, are affected with the disease. All the information usually given on the subject is that so many carcasses or so many pounds of meat were seized and destroyed as unfit for food.

On the Continent, especially in Germany, France, and Belgium, very great care is taken to tabulate, in the annual reports of the Director of the public slaughter-house, all information which would help the authorities in gaining a better knowledge of the diseases affecting domestic animals, and that the reader may see the form which this information takes, especially in relation to tuberculosis, the following examples are taken from the annual reports of the abattoirs in Leipzig and elsewhere :

LEIPZIG, 1897.

Kind of Animal.	Number Slaughtered.	Of which were Tuberculous.	
		Number.	Per cent.
Oxen	9,131	3,205	35.10
Bullocks and heifers ...	1,493	306	20.49
Cows	10,355	5,068	48.09
Bulls	6,212	1,320	21.24
Total cattle	27,191	9,899	36.40
Calves	67,961	139	0.20
Sheep	49,559	8	0.01
Goats	235	—	—
Pigs	132,062	3,679	2.78
Horses	1,530	8	0.52

Extent of the Tuberculous Process.

Kind of Animal.	Localized and Limited to				Generalized and Extending to					
	One Organ only.	Several Organs in the same Body Cavity.	Organs of both Body Cavities.	Total of Localized Cases.	Spleen.	Kidneys.	Udder.	Bones.	Glands of the Muscular Tissue.	Total of Generalized Cases.
Cattle	7,018	339	1,878	9,235	202	462	93	54	128	664
Calves	44	—	9	53	79	35	4	9	21	86
Sheep	5	—	1	6	2	—	1	—	—	2
Goats	—	—	—	—	—	—	—	—	—	—
Pigs...	851	8	1,343	2,202	1,368	496	140	161	173	1,477
Horses	4	—	2	6	2	2	—	—	—	2

CATTLE TUBERCULOSIS

47

STETTIN, 1895.

Kind of Animal.	Number Slaughtered.	Of which were Tuberculous.		Distribution of Tuberculosis.							
				Thorax.			Abdomen.				
		Generalized.	Localized.	Lungs.	Bronchial and Mediastinal Glands.	Serous Membranes.	Liver.	Kidneys.	Spleen.	Intestines.	Serous Membranes.
Cattle .	8,118	33	1,798	1,523	1,747	170	155	41	69	195	119
Calves .	11,498	—	71	52	68	11	22	—	17	30	1
Sheep .	21,913	—	23	22	42	—	7	—	1	2	—
Pigs ...	41,483	44	1,697	1,317	1,451	37	318	37	109	541	5
Horses	488	—	—	—	—	—	—	—	—	—	—
Total...	84,500	77	3,589	2,920	3,308	218	502	78	196	768	125

The following table shows clearly the increase that has taken place in the disease within the last few years. The comparison is probably unfair when made between the first and last years given, because there can be little doubt that inspection has been more rigorous in the latter period; but taking the two years 1895 and 1896 in Kiel, the probability is that inspection was about as rigorous in the one year as in the other, and yet the increase is enormous.

KIEL, 1895-96.

Percentage of Cattle and Calves affected with Tuberculosis.

Animals.	Number Slaughtered.	Single Organs Destroyed. Only flesh of full value.	Whole Carcasses Condemned.	Total Affected.	Percentages.			
					1895-96.	1894-95.	1893-94.	1892-93.
Oxen ...	610	204	1	205	33·61	29·74	16·56	13·15
Bulls ...	2,642	706	2	708	26·90	19·80	12·47	10·05
Cows ...	8,789	3,958	69	4,027	45·82	34·40	22·30	19·05
Calves ...	15,499	155	11	166	1·7	0·3	0·08	0·08
Pigs ...	26,670	1,615	56	1,671	6·27	4·36	3·72	
Total ...	54,210	6,638	139	6,777				

In the 321 abattoirs in Prussia in 1896, there were slaughtered 726,824 cattle, of which 14·2 per cent. were affected with tuberculosis. When this result is compared with similar statistics for the four preceding years, it is seen that the percentage of

tuberculous cattle has steadily increased: 8·6 in 1892, 8·9 in 1893, 10·09 in 1894, and 12·7 in 1895.

Another table is appended from Kiel, to show that the incidence of the disease is much more marked in animals over three years of age than in those under that age :

KIEL, 1895-96.

Age Periods of the Animals Affected with Tuberculosis.

	Under 6 Weeks.	From 6 Weeks to 1 Year.	1-3 Years.	3-6 Years.	Over 6 Years.
Of 83 whole animals condemned ...	8	3	1	23	48
Of 5,023 that were partially condemned ...	43	126	775	1,741	2,338
Total ...	51	129	776	1,764	2,386

A mere consideration of the foregoing tables will suffice to show the frightful extent to which the disease prevails abroad, and such exact reports as we possess of the condition of things in England and Wales show the disease to be equally widespread.

From the following table prepared by Mr. King, Veterinary Inspector of Manchester, it would appear that the percentage of animals found affected with tuberculosis there is almost identical with that in Leipzig.

The figures, however, relate only to a period of about three months.

A Table showing the Incidence of Abdominal Tuberculosis in Cattle of Different Ages slaughtered in the Manchester Water Street Abattoir, and not specially selected.

Number.	Number Tuberculous.	Condemned as Unfit for Food.	Number in which the Abdominal Organs only were affected.	Number in which both Abdominal and Thoracic Organs were affected.	Tuberculous Udders.
Cows ... 168	69 or 41%	11	19	23	2
Heifers... 124	27 or 22%	3	19	4	0
Bullocks 75	12 or 16%	0	8	2	0
Bulls ... 8	2 or 25%	0	0	2	0
Calves ... 23	(1 ?) or 4%	0	0	0	0

It should be remembered, too, that in all the instances given it is the inspection post-mortem merely that has revealed the presence of disease, and that doubtless the number would have been increased had the tuberculin test been used on the animals instead.

Meat inspection has been considered hitherto to be one of the duties of the Medical Officer of Health and Sanitary Inspector. The former relies on his pathological training on the human subject to help him with regard to the diseases of animals, while the latter can only have an empirical knowledge, aided in some cases by long practical experience of the work. The persons whose knowledge would seem to fit them best for the work—veterinary surgeons—have in only rare cases been employed. The reasons for this are, that to employ a veterinary surgeon would be too costly, and some have even believed that his knowledge would be in his way—that he would, in fact, know too much.

On the Continent, in Germany, France and Belgium, and, indeed, in most of the countries abroad, it has been held for years that veterinary surgeons alone ought to have the final decision as to what should and what should not be condemned for food, and it is owing to this fact that the views held abroad on the subject of tuberculous meat are so much in advance of those in this country. It is curious that the plea of expense should be raised in a rich country like Great Britain against the employment of veterinary surgeons as meat inspectors, when in a comparatively poor country such as Germany their employment is almost universal.

In Germany it is held that meat inspection is no insignificant branch of science, but that it requires for its complete mastery and proper exercise a varied knowledge and a thorough practical training. It is not, however, considered enough that a veterinary surgeon, to be competent for the work, should merely have passed his examinations for his diploma (of which the theory of meat inspection forms a part), but that he should in addition undergo a special training in a public slaughter-house.

In Belgium and France, also, the stringent laws that have been passed on the subject of meat inspection constitute members of the veterinary profession the final arbiters on questions of meat

inspection, and require that they shall be placed at the head of public slaughter-houses.

In Belgium, where the law requires that all meat should be inspected before consumption, it is not possible that veterinary surgeons should be able, unaided, to inspect the whole of the animals killed, and consequently there are placed under them inspectors of meat who have no veterinary qualification.

Their duty is, however, not to condemn, but to reserve any carcasses of animals which they suspect for the inspection of the veterinary surgeon. But to carry out this limited sphere they must pass an examination in the following subjects :

1. Knowledge of the laws and regulations dealing with meat inspection.
2. Description of the animals used for human food.
3. The names and situation of the different organs and regions of the body.
4. Signs of health and disease in animals used for food, both when alive and after slaughter.
5. The characters of fresh meat, organs, fat and blood, as well as of the different preparations made from them, as to the conditions rendering them fit or unfit for human consumption.
6. Knowledge of the abnormal conditions laid down in regulations, in regard to which he can act on his own responsibility, and of those in which he must summon the aid of a veterinary surgeon without delay.

The conditions in which he can take action himself are limited to the flesh or organs when affected with abscesses, cysts, chronic changes in the visceral organs, and adhesions or growing together of organs naturally distinct. In all cases of tuberculosis he must summon a veterinary surgeon.

CHAPTER VI.

EXAMINATION OF TUBERCULOUS CARCASSES.

TUBERCULOSIS in cattle, as found by post-mortem examination, generally occurs in one of two forms: (1) where organs and their glands only are affected, (2) when there has been invasion of the serous membranes. The former is the more frequent form in cattle, and the latter is almost invariably secondary to disease of the organs.

Tuberculosis of the lining membranes of the chest and abdominal cavities shows itself by the formation of a number of small lumps, or 'tubercles,' from the appearance of which the familiar name of 'grapes' has been given. Sometimes these grow to an enormous size, so that they weigh several pounds; at others the appearance presented is that of a roughening or velvety appearance of the wall, owing to the coalescence of a large number of small tubercles. Of the organs, those most frequently affected are the lungs, then those of the digestive tract, and lastly the organs of generation. From a primary infection all the organs of the body can be secondarily infected.

The tubercles are formed by the life processes of the bacilli, which live upon and bring about changes in the tissues, and in all cases the bacilli can, if proper care is taken, be discovered. When the tubercles first appear they resemble little grey bodies, each of about the size of a millet-seed, or rather larger, and from this resemblance the name 'miliary' tuberculosis has arisen. They rapidly increase in size by the multiplication of the bacilli, and by the formation of secondary foci in the neighbourhood of the primary ones.

Under the microscope the appearance of a tubercle is very characteristic, from the alteration in the character of the cells of the tissue which is brought about.

They are, however, unprovided with bloodvessels, and consequently undergo fatty changes, or caseation, as it is called. Sometimes the broken-down tissue hardens by the deposition of lime salts, and the affected part gets shut off from the rest, and gradually heals. On the other hand, if the bacteria which cause pus gain an entrance, as is not unfrequently the case, then an abscess will be formed.

In meat inspection the point that it is of the utmost importance to decide is whether an animal is affected with localized or generalized tuberculosis. The term 'localized' is used when the disease is limited to one organ, or spreads to another organ by contiguity, or by the lymphatic channels, or through the portal circulation (*i.e.*, the circulation between the intestinal tract and the liver), but not by means of the general blood-stream of the body. As examples of it are tuberculosis of the retropharyngeal lymphatic glands with tuberculosis of the lungs and bronchial lymphatic glands, tuberculosis of the intestines and mesenteric lymphatic glands, tuberculosis of the lungs and pleura, tuberculosis of the intestines and liver.

By 'generalized' tuberculosis is meant the spread of the disease by the passage of tubercle bacilli into the main blood-stream or into the thoracic duct, and their conveyance thence to different organs and parts of the body, such as the lungs, liver, spleen, kidneys, bones, and muscular tissue. If the bacilli in this case enter in large numbers into the blood-stream, then acute miliary tuberculosis (galloping consumption) results; but it by no means follows that in generalized tuberculosis all the organs and tissues become equally infected. Some tissues offer a particular resisting power to the organisms. The lungs are always attacked, then come in order the abdominal organs, the serous membranes, the lymphatic glands of the muscular tissue, the udder, kidneys, and lastly the bones.

Seeing, then, the importance of determining in a tuberculous carcase whether the disease is generalized or not, it is necessary to make a systematic examination of the organs and chains of lymphatic glands, which give the best indications of the presence

of this condition. These are the lungs, liver, spleen, kidneys, the axillary glands, and the internal and external iliac glands.

In the case of dressed carcasses consigned without offal the condition of the lymphatic glands ought to be particularly noted.

Professor Ostertag of Berlin, the highest authority on the subject of meat inspection in Germany, considers that affections of the serous membranes, when it is a question of generalized tuberculosis, play a very much less important rôle than the organs named. So much so, indeed, is this the case, in his opinion, that in passing judgment on flesh their condition should be disregarded, because tuberculosis on them is a local condition. The one exception to this is when the disease starts from the uterus. The serous membranes may be most extensively affected without causing any infection of the lungs, liver, or spleen ; and, on the other hand, there may be extensive miliary tuberculosis of the lungs, etc., without any sign of disease on the pleura or peritoneum. Tuberculosis of the serous membranes only rarely leads to a generalization of the disease.

The examination of the important organs should be carried out by examining first the organs least likely to be affected, and not, as is usually the case, those which are most likely to be the seat of the tubercular process. The reason for this is that the knife will probably, if the latter method be adopted, carry infective material from a diseased to a healthy organ. That this is not a risk that may be neglected was proved by the feeding experiments carried out by Dr. Sidney Martin for the Royal Commission, 1890. Every unnecessary incision into tuberculous deposits should be avoided.

The following is the method of examination as carried out in Manchester. The points noted are :

1. The general condition of the carcass.
2. The outward appearance of the viscera without any handling or cutting.
3. The appearance of the serous membranes.
4. Examination of the lymphatic glands of the carcass.

This examination of the lymphatic glands is considered the most important, as the extent of the disease, without fear of contamination, can be readily ascertained. It is commenced by cutting into (1) the internal and external iliac and the sub-lumbar

glands if the abdominal viscera or lining membrane have been affected; (2) the dorsal, supra-sternal and pre-pectoral glands, if the disease is present in the thorax.

Should further examination be required, the carcase is quartered and cut up (in the usual way of trade) and the deep-seated glands are examined, such as the superficial and deep-seated inguinal glands, the popliteal in the hind-quarters, and the pre-scapular and the brachial in the fore-quarters. A butcher seldom objects to such a course, as his meat, if passed, is not reduced in value on account of the cutting up. In the examination of the carcase of cows the lymphatic glands of the udder should be observed. Tubercular disease of the udder can often be detected by its hardness, but it is better to incise the ampulla and examine the lining of the ducts for evidence of tuberculous deposit or ulceration.

The portal lymphatic glands often show more marked tubercular deposits than the liver itself, and the same is the case with the bronchial glands and the lungs.

In the lungs the tubercular changes are of two kinds—either large cavities or small nodules. The former are situated either at the apex or base; the latter are distributed throughout its substance.

An examination made in the manner described will enable the inspector to determine whether generalized tuberculosis is present or not—*i.e.*, whether or not the bacilli have been carried by the main bloodvessels from one organ to another.

It will also show the organs which must be destroyed if the flesh is to be passed as sound.

CHAPTER VII.

UTILIZATION OF TUBERCULOUS CARCASSES.

WHEN the interchangeability of human and bovine tuberculosis became an established fact, it was only natural that an extreme view should have been taken of the danger to man from the consumption of the meat of animals affected with tuberculosis. This view was advocated with great energy by M. Arloing, Director of the Veterinary College in Lyons, at the Congress on Tuberculosis held at Paris in 1888, and led to the adoption of a resolution that the flesh of animals affected with tuberculosis in any degree should be condemned. There can be little doubt that this resolution has formed the basis on which many meat inspectors have acted, but the enormous loss that the strict carrying out of the resolution would have entailed, and the result of numerous experiments on the infectivity of tuberculous meat made since then, have prevented, fortunately, its strict execution.

It would serve no useful end to detail the enormous number of experiments that have been made to arrive at a definite conclusion as to the infectivity of tuberculous meat, both in this country and abroad, within the last fifteen years.

It will suffice to say that they have been carried out in two ways: First, by the inoculation, that is, the introduction into the peritoneal cavity of an animal, such as a guinea-pig, of the meat in question; and secondly, the feeding of similar animals with portions of the meat. It is evident that the first method is by far the more delicate test, as the infective material is, as it were, sown on a very receptive soil, but it is one that has no analogy in everyday life. As was to be expected, positive results

have been obtained much more frequently by inoculation than by feeding experiments. And in feeding it is evident that a distinction must be drawn between food that is derived from cases of localized or generalized tuberculosis.

The general conclusion to be drawn from all these experiments is that the muscular tissue of tuberculous animals, as a rule, contains no bacilli, or, at least, not enough to cause disease in the animals experimented on. The flesh is only infectious in cases of a high degree of tuberculosis.

But from these experiments the following main conclusions may be drawn* :

1. In purely local tuberculosis the flesh is harmless. This includes cases where the tubercular deposits have undergone caseation or become calcified, and have not broken down into pus. It may also be extended to cases of limited generalization of the disease (chiefly of the organs), where the tubercles have become calcified, showing that the dissemination has not been recent.

2. On the other hand, the flesh must in all cases be regarded as injurious to health when the tubercles are generalized in the muscles, bones, and lymphatic glands.

3. When the local character of the tubercular process is doubtful, as in cases when abscesses have formed in the lungs or in the liver, the flesh must be viewed with suspicion, and treated as though it was injurious to health.

4. When the tuberculous animals are wasted, the flesh will be very poor in quality, without regard to the extent of the lesions.

Where the organs are affected, it is not sufficient to cut away the diseased portion. The whole organ must be totally destroyed, because the lymphatics ramify in all directions through the organs, and have probably set up tubercular changes which cannot be detected by the naked eye. Similarly, too, all the lymphatic glands connected with the organs in question must be destroyed. When the pleuræ or peritoneum are affected, the cutting away of the whole chest wall or abdominal wall is preferable to merely stripping them, as by careless manipulation tuberculous material may be left behind.

* Ostertag's 'Handbuch der Fleischbeschau,' p. 542.

But in Germany they have gone much further than merely saying that, as a rule, carcasses affected with localized tuberculosis are to be passed, and with generalized tuberculosis to be condemned. What makes the meat injurious is the dissemination in it of the tubercle bacilli, and if these are destroyed, then its harmful nature will have departed. A joint that has been roasted or boiled will certainly have all the tubercle bacilli on the outside, and to a certain depth in its substance, destroyed, and such outside pieces will therefore, in the process, have lost their harmful properties. Unfortunately, the temperature to which the interior of the meat may have been raised in the roasting will not be so great as on the outside, and may not have been sufficient to kill the bacilli.

If exposed to steam in a closed chamber, on the other hand, for a certain length of time, the steam will penetrate to every fibre and destroy every organism. The plan is, therefore, to cut up meat—affected with tuberculosis to such an extent that it would be dangerous to sell it in the raw condition, but yet which is not affected to such an extent as to require total destruction—into small pieces weighing 2 or 3 pounds. These are placed in a steam sterilizing apparatus on shelves. The doors are shut, and steam at a temperature of 212° F. is admitted into the apparatus, and allowed to remain in contact with the pieces of meat for about an hour, by which time the whole of the meat will have been sterilized. The penetration of the steam is assisted by allowing it to act intermittently by alternately shutting off and re-admitting it. When the door is opened, a quantity of the steam will be found to have condensed, and as this forms a rich broth, having dissolved some of the extractive matters out of the meat, it is sold with the pieces.

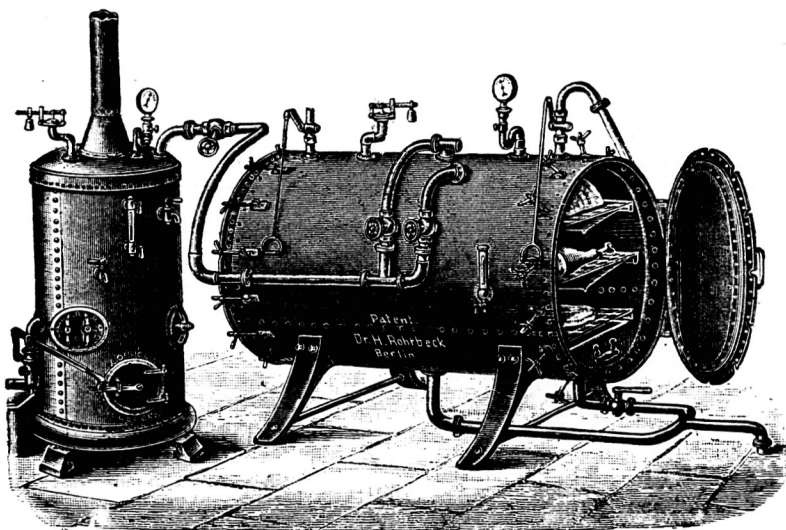
An illustration is given of one of these steam sterilizing apparatuses. It is in every essential exactly like a steam disinfecting machine, such as all properly-equipped sanitary authorities possess for disinfecting infected bedding and clothing.

Simple cooking, if carried out under proper supervision, is equally efficacious in sterilizing the pieces of meat, and in some places such cooking apparatuses are used.

Naturally, the method is applicable to many other conditions of diseased meat besides tuberculosis, but the apparatus was

designed in the first place to enable a quantity of tuberculous meat to be sold, which would otherwise have had to be condemned.

Such meat is then sold at a special stall, called a Freibank. This institution is peculiar, and requires a brief notice. It is intended for the sale of second-class meat—meat that is not unwholesome, but for which the purchaser should not have to pay the price of prime meat. Whether the sale takes place at



ROHRBECK'S STEAM STERILIZER.

the abattoir or at a shop in the city, a notice must be clearly written over the place as to the class of meat sold. Such meat must not be purchased by butchers or restaurant proprietors. It is intended for the very poor, who would probably have to dispense with meat altogether if they could not obtain it at a very cheap rate. At first the authorities were doubtful whether there would be any public which would be desirous of buying such meat, but experience has proved that there is, and now the demand is greater than the supply.

To show the utility of the Freibank, it may be stated that in

at least five-sixths of the abattoirs in Prussia they are to be found.

The following are the regulations, based on the views that have been described, which guide the inspectors in France, Prussia, and Saxony in the condemnation of tuberculous carcasses, and they can be compared with the recommendations of the Royal Commission on the same subject.

Seeing that in Great Britain the idea of sterilization or cooking of tuberculous meat has not been entertained, it will be noted that the recommendations formulated by the Royal Commission on this subject do not give quite the same latitude as do some of those already quoted; but they will, when generally adopted, remove much of the harshness complained of by butchers with regard to the action of medical officers of health in the past.

FRANCE.

Order of the Minister of Agriculture, dated Paris, September 28, 1896, prescribing the Procedure to be adopted in the Case of Carcasses affected with Tuberculosis.

The flesh of tuberculous animals is to be excluded, in whole or in part, from human consumption, according to the nature and extent of the lesions found, in accordance with the subjoined description.

They are to be seized and totally condemned—

1. When the tuberculous lesions, whatever their importance, are attended with wasting.
2. When there are tubercles in the muscles or in the glands in the muscular tissue.
3. When generalized tuberculosis is present with miliary deposits on all the organs, and notably on the spleen.
4. When important tuberculous lesions exist at the same time both on the organs of the chest and of the abdominal cavity.

They must be seized, and partially excluded from human consumption—

1. When the tuberculosis is localized either in the thoracic or abdominal cavity.
2. When the tuberculous lesions, even though they exist at the

same time both in the thoracic and abdominal cavities, are not extensive.

The seizure in this case only extends to portions of meat (costal or abdominal walls) which are directly in contact with the diseased portion of the pleura or peritoneum.

In every case the tuberculous organs must be destroyed, whatever the extent of the lesion.

In all cases meat that is fairly fat can be handed over to the owner, after being sterilized, for at least an hour, either in boiling water or in a steam sterilizer, but the sterilizing must be carried out in an abattoir, under the control of a veterinary surgeon.

The Prefects of the Departments are charged with the execution of the present order.

PRUSSIA.

The flesh of tuberculous cattle is, as a rule, to be regarded as injurious to health if the muscular tissue contains tubercles, or if the tuberculous animal, without the presence of tubercles in the muscular tissue, is wasted.

On the contrary, the flesh of a tuberculous animal is to be passed (as not injurious to health) if the animal is well nourished, and (1) the tubercles are confined exclusively to one organ; or (2) if two or more organs are affected, these organs lie in the same body cavity, and are connected directly with one another, either by lymph-channels or by such bloodvessels as do not belong to the systemic circulation, but to the pulmonary or portal circulation.

SAXONY.

1. When tuberculosis is present in a high degree and extensive, with pronounced wasting, and when the condition of the flesh differs markedly from that which is healthy.

2. If it is generalized, that is, if the extension of the tuberculous process in the body has taken place only through the blood-stream (with the exception of the portal system), and the animal is at the same time markedly wasted, or the flesh and the bone or lymphatic glands belonging to them are studded with tubercles.

3. If it appears in the form of an acute generalized (embolic) miliary tuberculosis, accompanied by fever.

The recommendations of the Royal Commission are :

- | | | |
|---|---|--|
| <ol style="list-style-type: none"> 1. When there is miliary tuberculosis of both lungs - - - - - 2. When tuberculous lesions are present on the pleura and peritoneum - - 3. When tuberculous lesions are present in the muscular system, or in the lymphatic glands embedded in or between the muscles - - - - - 4. When tuberculous lesions exist in any part of an emaciated carcase - - | } | <p>The entire carcase and all the organs may be seized.</p> |
| <ol style="list-style-type: none"> 1. When the lesions are confined to the lungs and the thoracic lymphatic glands - 2. When the lesions are confined to the liver 3. When the lesions are confined to the pharyngeal lymphatic glands - - 4. When the lesions are confined to any combination of the foregoing, but are collectively small in extent - - - | } | <p>The carcase, if otherwise healthy, shall not be condemned, but every part of it containing tuberculous lesions shall be seized.</p> |

In view of the greater tendency to generalization of tuberculosis in the pig, we consider that the presence of tubercular deposit in any degree should involve seizure of the whole carcase and of the organs.

In respect of foreign dead meat, seizure shall ensue in every case where the pleuræ have been 'stripped.'

In the following tables it will be seen how systematic the inspection is under these regulations abroad, and how much meat is saved from total condemnation by the provision of a Freibank.

CATTLE TUBERCULOSIS

63

HANOVER, 1895.

Treatment of Carcases affected with Tuberculosis in Various Degrees.

Animals.	Number Slaughtered.	Sold as of Full Value.					
		Muscular Substance and Bones.	With Emaciation.	Of One Organ only.	Of several Organs in same Body Cavity.	Of the Udder with Disease in Body Cavity.	Of Organs in both Body Cavities.
Cattle ...	12,721	—	—	525	26½	3	32
Calves ...	16,248	—	—	3	—	—	1
Swine ...	55,287	—	—	173	22	—	243
Sheep ...	15,124	—	—	1	—	—	—
Total ...	99,380	—	—	702	48½	3	276
Animals.	Number Slaughtered.	Sold when Sterilized.					
		Muscular Substance and Bones.	With Emaciation.	Of One Organ only.	Of several Organs in same Body Cavity.	Of the Udder with Disease in Body Cavity.	Of Organs in both Body Cavities.
Cattle ...	...	2½	—	—	—	1¼	12
Calves ...	...	—	—	—	—	—	—
Swine ...	...	1	—	—	—	—	49
Sheep ...	...	—	—	—	—	—	—
Total ...	...	3½	—	—	—	1¼	61
Animals.	Number Slaughtered.	Totally Condemned.					
		Muscular Substance and Bones.	With Emaciation.	Of One Organ only.	Of several Organs in same Body Cavity.	Of the Udder with Disease in Body Cavity.	Of Organs in both Body Cavities.
Cattle ...	...	4½	—	—	½	—	3
Calves ...	...	—	—	—	—	—	2
Swine ...	...	20	8	—	1	5	36
Sheep ...	...	—	1	—	—	—	—
Total ...	...	24½	9	—	1½	5	41

CARLSRUHE, 1895.

Prevalence of Tuberculosis among Cattle and Swine.

Animals.	Number Slaughtered.	Affected with Tuberculosis.	Per Cent.	Relegated to Freibank.	Per Cent.	Totally Condemned.	Per Cent.
Oxen ...	3,118	163	5·2	3	1·8	0	0
Cows ...	2,363	458	19·4	51	11·1	5	1·1
Heifers ...	2,056	160	7·8	6	3·8	0	0
Bullocks ...	1,959	202	10·3	4	2·0	1	0·5
Total ...	9,496	983	10·4	64	6·5	6	0·6
Swine ...	25,987	74	0·29	27	36·5	2	2·7

Comparison with Previous Years as regards Cattle.

1895	9,496	983	10·4	64	6·5	6	0·6
1894	10,237	874	8·5	53	5·6	1	0·1
1893	11,534	1,036	8·9	70	6·7	14	1·3
1892	10,055	610	6·0	79	12·9	28	4·5

CHAPTER VIII.

INSURANCE AGAINST LOSS FROM SEIZURE.

IN giving an account of the method of insurance by which the loss that must occasionally be suffered from the seizure of carcasses when affected to the degree mentioned in the preceding chapter may be best met, it will be convenient to commence by describing the systems already in vogue in the United Kingdom.

It appears that for some years such insurance systems have been at work at Newcastle, Carlisle, and West Hartlepool in England, at Paisley and Aberdeen in Scotland, and at Belfast in Ireland.

In Newcastle and Carlisle the method adopted is very similar. Both are associations formed by the butchers in the usual way, with a president, treasurer, secretary, and committee of management. Any butcher may become a member on paying a premium of one shilling for every bullock or heifer and one shilling and sixpence for every cow slaughtered, and, in the case of the Carlisle Insurance Association, an entrance fee. Compensation is given to the amount of three-fourths of the value of the beast, but none is given in the case where the animal cost less than £8, nor for one purchased otherwise than in perfect good faith. Compensation is given for other diseased conditions besides tuberculosis, or where the animal dies as the result of accident. Should the funds of the association at any time be unable to meet the compensation required, a levy is made on the owners of each beast slaughtered in that week to make up the deficiency.

In Carlisle, and, indeed, in most of the places named, the insurance association was avowedly started on account of the losses caused by seizure of tuberculous carcasses. In 1895 the

sum of money paid in compensation for sixteen claims was £94 15s. 6d., and in 1896, for thirty-two claims, £209 8s. 5d. After the close of the first year, so good was the state of the finances of the association that the height of the premium was reduced to one shilling in the case of cows, and to sixpence in that of bullocks and heifers. It became necessary, however, to re-establish the old premiums, owing to an increased number of seizures. Another interesting point brought out in connection with the Carlisle Association, in the evidence of Mr. Bell before the Royal Commission, is that such an association, consisting as it does of butchers, is the best agency for detecting cases of fraud on the part of its members. In Carlisle, as it was thought that one of the members was dealing in old cows for the sake of the compensation that he would get were they condemned, the £6 limit for compensation was raised to £8.

In Newcastle the insurance was commenced in 1892, and since that date 22,764 animals have been insured, of which only eight have been surrendered. The total amount paid in compensation has been £70, thus leaving no less a sum than £827 12s. 9d. (over 90 per cent. of the sums received) to be re-distributed among the forty members.

The explanation of the small number of seizures in this case is the fact that most of the animals insured were of a good class, and no compensation is given for an animal costing less than £8.

In West Hartlepool the insurance society was formed in 1891, with a membership of forty. The premium charged is one shilling for a cow and sixpence for a bullock. In the course of six years fifty-two claims have been paid, amounting to £440 9s., and the system has worked very satisfactorily, until of late some members who had had no seizures objected to paying money to compensate others who had. Two-thirds of the value of the beast is given in compensation for seizure. The number of seizures for tuberculosis (and the payment of compensation is limited to this disease) has been gradually increasing, the numbers being four in 1891 and 1892, eleven in 1893, ten in 1894, five in 1895, and fifteen in 1896.

In Paisley the premiums charged are threepence for a bullock or heifer, sixpence for a bull, and one shilling for a cow, but the

society has the power of raising these charges if the fund requires it. One half the value of the animals is given, but not unless the animal cost more than £8. This limit, however, is a variable one, subject to current market values. Since the society has been in operation fifty-one claims have been paid, amounting to about £300. Mr. Scarlett, the secretary, stated in his evidence before the Royal Commission that as far as its operations had gone they had been quite successful. It was, however, not taken advantage of by all the butchers, and its activity has been largely affected by a compulsory system of insurance on the part of the auctioneer.

The auctioneer charges on every cow put through his ring two shillings (one shilling from the buyer and one shilling from the seller), and one shilling on every bullock or heifer (sixpence from the buyer and seller respectively), and a somewhat similar arrangement has been employed in the auction markets at Aberdeen. The system has the advantage of compulsion, and it is improbable that the charge of sixpence for a bullock and one shilling for a cow would be appreciably felt by either the butcher or farmer, in view of the three-fourths compensation he would receive in case of total seizure.

It is evident, then, from a consideration of the above facts, that insurance in this country has not passed much beyond the experimental stage. All the weight of the National Federation of Butchers has been thrown against any extension of the scheme, on the ground that they would, by advocating it, be cutting the ground from under their feet as regards compensation from imperial or local funds. But if the losses are so considerable that they exert a crippling effect on dealers in home-fed beasts, seeing that the majority of the Royal Commission report unfavourably on the subject of compensation, insurance offers the best way out of the difficulty.

Passing from this country to Germany, it will be found that the subject is there fully worked out on an extensive scale, and is no longer experimental.

It must be premised that there, as a rule, the farmer, and not the butcher, suffers the loss from seizure, as payment is not made by the latter to the former until after the carcass has been passed by the inspector. The subject, further, is less difficult to deal

with in Germany, because public slaughter-houses are more the rule than in this country, and consequently the collection of premiums and means of checking fraud are easier to effect.

But the growth of these insurance societies has been necessarily brought about by increased uniformity of inspection, and by means of them the apparent hardships inflicted on owners by seizures have been almost entirely alleviated. The view of the matter taken in Germany is that if the State will not organize insurance or give compensation for tuberculosis, as in the case of animals affected with other contagious disease (and the State so far has shown no disposition to do so), then the interested parties must protect themselves as best they can. Unremitting efforts have been made to induce the various States to organize a system of insurance, but so far Bavaria and Baden alone have dealt with the matter. Agriculturists there maintain that unless the insurance is made compulsory it will be a failure, and they urge that the organization for the insurance of cattle should be as all-embracing as possible, in order to protect the small owners.

In Baden the law of 1890 led to the establishment of district insurance offices, but under the condition that when once started they should not be dissolved until after the lapse of seven years. It was considered desirable that the State should exercise a certain amount of control and supervision over these offices, because the loss of an animal to a farmer in poor circumstances might lead to a serious diminution in his capital, and to his borrowing at an exorbitant interest.

Every cow must be insured as soon as the office has been established, and any loss must be defrayed by the office. In the case where several district insurance offices agree to amalgamate, then the insurance office of the particular district bears one quarter of the loss, and the remaining three quarters is distributed among the others.

It is evident that the knowledge the officials of the insurance society would gain as to the prevalence of the disease in a particular district might be utilized very easily to bring about a better state of things. In most towns where there is a public slaughter-house, as, for example, in Leipzig, Berlin, Dresden, and Halle, there are insurance offices against loss by condemnation

of carcasses, managed either by the slaughter-house authorities themselves, or by the Butchers' Union, or by the farmers and butchers banding together.

As an instance, the chief rules of the Cattle Insurance Association, having its headquarters in Berlin, may be given :

1. The insurance of cattle destined for slaughter belonging to the cattle-dealers of Berlin has been founded to protect the owners of cattle, by the payment of a premium, from the great losses to which they are exposed, owing to the rigorous measures of the veterinary inspectors at the abattoir.

2. The association is not started for purposes of gain. The premium to be paid, therefore, is regulated every month, according to the number of seizures, and published on the first of each month in the abattoir.

In February, 1895, this was eight shillings for a cow, six shillings for a bull, and two shillings for a bullock or heifer.

3. No person is allowed to insure who does not promise in writing to insure the whole of his cattle coming to the slaughter-house.

4. Animals cannot be insured which have been injured during transit, or have been transferred as suspicious by the veterinary inspectors to the contagious disease isolation slaughter-house, or are markedly wasted or recognised as diseased by the veterinary inspectors.

5. The compensation paid is the full market price of the animal. If the carcass is not wholly condemned, then the price of the portions which are allowed for sale must be deducted.

6. The liability of the society ceases if the animal is not slaughtered within twenty days.

7. The director is justified in refusing the privileges of insurance to those whom he is convinced will cause damage to the office, or to those not acting in good faith.

Table of Premiums of Different Insurance Societies.

Place.	Cattle.	Amount of Compensation.	Nature of Insurance Office.
Dresden ...	Bulls } 3s. Oxen } Cows, 6s.	Full market price and slaughter-house charges	Butchers' Union.
Göttingen ...	Bulls } 4s. Oxen } Cows, 5s.	" "	Cattle Insurance Association.
Halle ...	For members, 3s. For non-members, 6s.	" "	Cattle Insurance Association, with limited liability.
Leipzig ...	Oxen } 7s. 6d. Bulls } Cows, 9s. 6d.	" "	Municipal Association for Insurance of Cattle.

It will be seen that the amount of the premiums varies considerably, being dependent, no doubt, on the character of the animals brought to the slaughter-house, and to the greater or less degree of stringency in inspection.

In Leipzig, for instance, by far the largest number of cattle brought to the abattoir are old cows and oxen, which are much more liable to be affected with tuberculosis than younger cattle.

The following figures, taken from the annual reports of the Dresden and Leipzig slaughter-houses, show the actual status of the associations :

Particulars extracted from the Annual Report of the Butchers' Union of Dresden for the Year 1895.

Number of Animals brought to the Market.

Oxen ...	...	12,251
Bulls ...	...	7,721
Cows and heifers	...	8,982
		28,954
Swine ...	...	134,579
Sheep ...	...	53,265
Calves ...	...	62,093
Goats ...	...	26
Total ...	...	<u>279,277</u>

Results of the Insurance Office for Cattle under the Combined Management of the Butchers' Union and a Commission of the Cattle-Dealers.

Place.					Number Insured.	Premiums Paid.
Oxen	...	...	...	...	10,172	£
Bulls	...	...	...	...	6,721	—
Cows and heifers	...	...	...	...	5,858	—
Total	...	...	...	...	22,751	£5,566

In addition, however, to these special insurance societies, quite a number of the public insurance offices undertake insurance against loss which may be sustained through the condemnation of cattle in the abattoirs. They have agents in the principal towns, and there seems no reason why live stock insurance societies in the United Kingdom should not extend their lines in the same direction; but it must be observed that private unions inaugurating an insurance fund can work much more economically than societies which carry on insurance as a business. In the former the expenses of management are small, because, with the exception of the veterinary surgeon and clerk, all the appointments are honorary. The larger the number of parties interested who can be induced to join, the lower will be the premiums that will have to be charged, and on this ground the plan is to be highly recommended of farmers, butchers, and cattle-dealers all uniting to form the insurance fund.

It should be clearly understood, if the insurance office is to be of real value, that (1) all animals, before being insured, must be examined by a veterinary surgeon, and only those be accepted which are without visible signs of disease; (2) that carcasses which are presented for examination of animals that have not been seen alive shall be excluded; (3) that there should be a Freibank or similar institution for the sale of second-class meat; and (4) that there should be arrangements for utilizing to the full for trade purposes carcasses totally excluded from human consumption.

In addition to these, over 3,500 cattle were insured; but as they were removed from the cattle market to be slaughtered elsewhere, the premiums, less 1 mark, were returned.

Compensation was paid in the following cases, owing to veterinary condemnation :

	Totally Destroyed.	Freibank.	Livers.	Tongues.	Lungs and Heart.	Spleens.	Udders.	Various.	Amount Paid.
Oxen ...	17	147	870	45	18	49	—	98	£ 4,418
Bulls ...	15	89	310	36	13	29	—	30	2,325
Cows and heifers }	31	248	649	21	21	49	32	160	4,451
Total ...	63	484	1,829	102	52	127	32	288	£11,194

£4,486 was, however, realized by the sale of meat on the Freibank, and by the utilization of the condemned carcasses, etc., so that the total amount of the claims paid out of the insurance fund was £6,608.

The heavy losses which the office suffered led, in addition to the expenditure of £650 from the reserve fund, to the lowering of the compensation for livers from 8 to 6 marks, and the raising of the premiums on oxen to 5 marks, bulls to 6 marks, cows and heifers to 8 marks, making the total loss to the office for the year 1895, £905.

The report for 1893 is in marked contrast to that for 1895. In 1893 the insurance charge for oxen and bulls was 3 marks, and for cattle and heifers 6 marks.

Insured were :

	Number Insured.	Premiums Paid.
Oxen	9,948	£ —
Bulls	5,276	—
Cows and heifers	3,464	—
Total	18,688	£3,951

In addition to these, over 5,000 cattle were insured ; but, as they were removed to be slaughtered elsewhere, the premiums, after deducting 1 mark, were returned.

Compensation was paid in the following cases :

	Totally Condemned.	Freibank.	Livers.	Tongues.	Lungs and Heart.	Spleens.	Udders.	Various.	Amount Paid.
Oxen ...	16	73	1,335	20	18	14	—	47	£ 2,178
Bulls ...	10	28	341	21	4	2	—	6	896
Cows ...	20	111	494	4	10	13	44½	15	1,942
Total ...	46	212	2,170	45	32	29	44½	68	£5,016

£2,299 was, however, realized by the sale of meat on the Freibank, etc., so that the total amount paid out of the insurance fund was £2,717.

The premiums paid amounted to £3,591, so that there was a balance in hand of £874.

LEIPZIG, 1895.

**Income and Expenditure of the Municipal Cattle Insurance
Society.**

Receipts.	Expenditure.
1. <i>Insurance pay, as follows :</i> 11,488 bulls and heifers at 7s. 6d. each ... 8,563 cows at 9s. 6d. each ... 97,848 native pigs at 1s. each ... 2,930 imported pigs at 1s. 6d. each ... } £ 13,487 2. <i>Proceeds from sale of animals on the Frei- bank :</i> 133 oxen ... 23 heifers ... 339 cows ... 58 bulls ... 924 pigs ... 8,800 lb. beef ... 334 lb. pork ... } 6,656 3. <i>Proceeds of sale from animals totally con- demned :</i> 32 oxen ... 8 heifers ... 56 cows ... 10 bulls ... 243 pigs ... Various ... } 482 Total ... £20,625	<i>Compensation paid for :</i> 165 oxen ... 31 heifers ... 395 cows ... 68 bulls ... 1,168 pigs ... Various organs and por- tions of meat ... } £ 18,719 Slaughter-house, etc., charges paid back ... 890 Insurance premiums paid back ... 286 Office and other expenses 252 Total ... £20,147 Total receipts ... 20,625 „ expenditure... 20,147 £ 20,625 20,147 In hand £478

TABLE I.

Showing Rise of Temperature in Cows affected with Tuberculosis,
and showing how Diseased Cows are grouped together.

No.	FEBRUARY 3RD.		FEBRUARY 4TH.				
	11 a.m.	Injected 10 p.m.	6 a.m.	9 a.m.	12 a.m.	3 p.m.	
1		102	101	101·2	101·2	101·4	
2	101·8	101	101·3	101·5	102·2	103·6	
3	102	101	101·2	100·8	101	101·3	
4	101·1	101·2	101·5	102·4	104·3	103·7	Reacted.
5	101·6	103	102·5	104·5	106	105	"
6	102	101·8	101·3	102	104·3	105·4	"
7	101·1	101·6	101·4	101	101·4	101·7	
8	101·2	101·4	100·8	101	101·3	101·4	
9	102·1	102·5	103·3	106·5	107·6	105·3	Reacted.
10	102	102	102·2	104·1	105·4	105·5	"
11	100·6	101·6	104	106·3	105·9	105·8	"
12	102·2	101	101·6	102·4	105·9	106	"
13	101·5	100·8	104·6	105	104·1	103·4	"
14	102·5	102·2	102·4	103·9	106·3	105·7	"
15	103·8	103	103·4	105·9	105·5	106	"
16	101·8	102	102·2	102·8	105·2	106	"
17	101·3	101·8	101·4	102·2	105·5	105·7	"
18	102	102·3	104·6	104	103·3	103·5	"
19	101·3	101·4	100·6	100	101·1	101·2	
20	102	101·9	102	101·5	101·9	102·5	
21	102	102·7	102·7	103·5	101·9	103·4	
22	102·8	102·1	105	107·5	106·7	104·8	Reacted.
23	102·4	102·2	103·4	105·5	106·4	104·5	"
24	101·4	101·8	101·3	102·6	106·1	105·2	"
25	102	101·8	102·6	106	107·4	105·4	"
26	102·1	101·4	102·8	105·6	106·3	104·1	"
27	101·8	101·6	101·8	101·4	101·5	101·6	
28	101·5	100·5	101·4	102·9	106	105·3	Reacted.
29	101·8	101	101·2	101·5	101	101·6	
30	101·5	101·6	101	101·5	101·7	101	
31	100·8	101·1	101	101·2	101·3	101·2	
32	102·3	102	101·7	100·8	102·1	101·5	
33	102·4	101·1	101	101·3	101·4	101·3	
34	102	101·8	101·6	102·6	106·1	104·4	

(Extracted from 'The Use of Tuberculin,' by J. Wilson)

It will be noticed in examining this table that the numbers are grouped according to the cow's family

				TEMPERATURES, MARCH, 1895.						TEMPERATURES,					
				24 hours before inoculation.	At inocu- lation.	4½ hours after.	7½ hours after.	10½ hours after.	13½ hours after.	16½ hours after.	19½ hours after.	24 hours before inoculation.	At inocu- lation.	6 hours after.	9 h after.
1. Calved 1888	...	...	...	103·1	103·8	105·4	107·0	106·7	105·8	104·5	102·8	...	...	...	...
65. Calved 1894, daughter of 1	...	...	...	...	...	...	...	...	...	...	...	101·3	102·5	101·2	101·0
2. Calved 1887	...	...	...	102·0	102·0	102·9	104·5	107·0	106·4	104·8	104·4	...	...	...	...
3. Calved 1887	...	...	...	101·0	101·0	102·0	101·0	102·2	100·6	101·0	101·0	102·0	102·1	101·7	101·0
23. Calved 1893, daughter of 3	...	...	...	102·0	101·9	101·7	101·5	101·4	101·1	101·4	100·9	101·7	101·4	101·9	101·0
98. Calved 1895, son of 23	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
66. Calved 1894, daughter of 3	...	...	...	...	...	...	...	...	...	...	...	101·9	102·5	102·2	101·0
52. Calved 1895, son of 3	...	...	...	...	...	...	...	...	...	...	...	104·0	103·4	103·0	101·0
100. Calved 1896, son of 3	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
5. Calved 1878	...	...	...	100·6	100·2	101·3	101·6	104·7	106·9	104·5	102·8	101·3	102·8	102·2	101·0
11. Calved 1886, daughter of 5	...	...	...	101·4	101·5	100·8	100·8	103·7	106·1	105·6	103·4	102·0	101·9	105·3	101·0
*12. Calved 1893, daughter of 11...	...	...	...	102·5	102·8	102·8	102·8	102·7	102·3	101·6	101·6	101·7	102·8	101·9	101·0
42. Calved 1895, son of 11	...	...	...	...	...	...	...	...	...	...	...	103·0	103·1	102·8	101·0
118. Calved 1896, daughter of 11...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
41. Calved 1892, son of 5	...	...	...	...	101·8	101·6	101·4	101·6	101·0	101·2	100·8	...	...	...	...
63. Calved 1894, daughter of 5	...	...	...	...	...	...	...	...	...	...	...	102·7	102·6	103·3	101·0
47. Calved 1895, son of 5	...	...	...	...	...	...	...	...	...	...	...	102·5	103·1	103·4	101·0
6. Calved 1890	...	...	...	102·0	102·4	102·2	102·8	106·0	106·0	105·3	105·1	...	...	...	...
83. Calved 1895, daughter of 6	...	...	...	...	...	...	...	...	...	...	...	102·1	102·3	102·4	101·0
7. Calved 1892	...	...	...	101·4	101·6	101·7	101·8	105·5	105·8	104·2	103·3	...	...	...	...
50. Calved 1895, son of 7	...	...	...	...	...	...	...	...	...	...	...	103·0	102·3	102·1	101·0
8. Calved 1888	...	...	...	101·5	101·6	102·0	102·1	105·7	105·4	104·0	103·3	101·4	102·0	102·5	101·0
44. Calved 1895, son of 8	...	...	...	...	...	...	...	...	...	...	...	103·0	102·8	102·9	101·0
109. Calved 1896, son of 8	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
9. Calved 1892	...	...	...	102·0	102·1	101·1	101·9	101·6	101·1	101·5	101·3	102·5	101·2	101·6	101·0
77. Calved 1895, daughter of 9	...	...	...	...	...	...	...	...	...	...	...	102·3	102·0	101·4	101·0
105. Calved 1896, son of 9	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
10. Calved 1887	...	...	...	101·1	101·5	101·3	100·9	102·9	105·3	104·8	103·0	101·2	102·0	102·3	101·0
84. Calved 1895, daughter of 10	...	...	...	...	...	...	...	...	...	...	...	102·1	102·5	102·1	101·0
123. Calved 1896, daughter of 10	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
13. Calved 1891	...	...	...	101·7	102·4	103·6	107·4	106·1	105·6	105·9	104·8	...	...	...	...
49. Calved 1895, son of 13	...	...	...	...	...	...	...	...	...	...	...	105·1	102·2	102·9	101·0
14. Calved 1890	...	...	...	101·4	101·2	100·9	100·1	100·6	101·1	102·2	100·9	102·5	101·2	101·1	101·0
78. Calved 1895, daughter of 14	...	...	...	...	...	...	...	...	...	...	...	101·9	102·9	101·9	101·0
117. Calved 1896, daughter of 14	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
15. Calved 1881	...	...	...	101·0	101·0	100·4	100·2	101·0	103·6	105·1	104·0	102·8	102·3	102·3	102·0
4. Calved 1892, daughter of 15	...	...	...	101·0	101·3	101·2	101·0	100·7	100·7	101·1	100·7	102·1	102·2	102·6	102·0
91. Calved 1895, son of 4	...	...	...	...	...	...	...	...	...	...	...	104·5	102·2	102·3	102·0
115. Calved 1896, daughter of 4	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
43. Calved 1895, son of 15	...	...	...	...	...	...	...	...	...	...	...	102·9	102·1	103·0	102·0
116. Calved 1896, daughter of 15...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...

TEST ON THE CASTLECRAIG HERD.

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and that there are very few instances in which more than one member of a family has been affected.

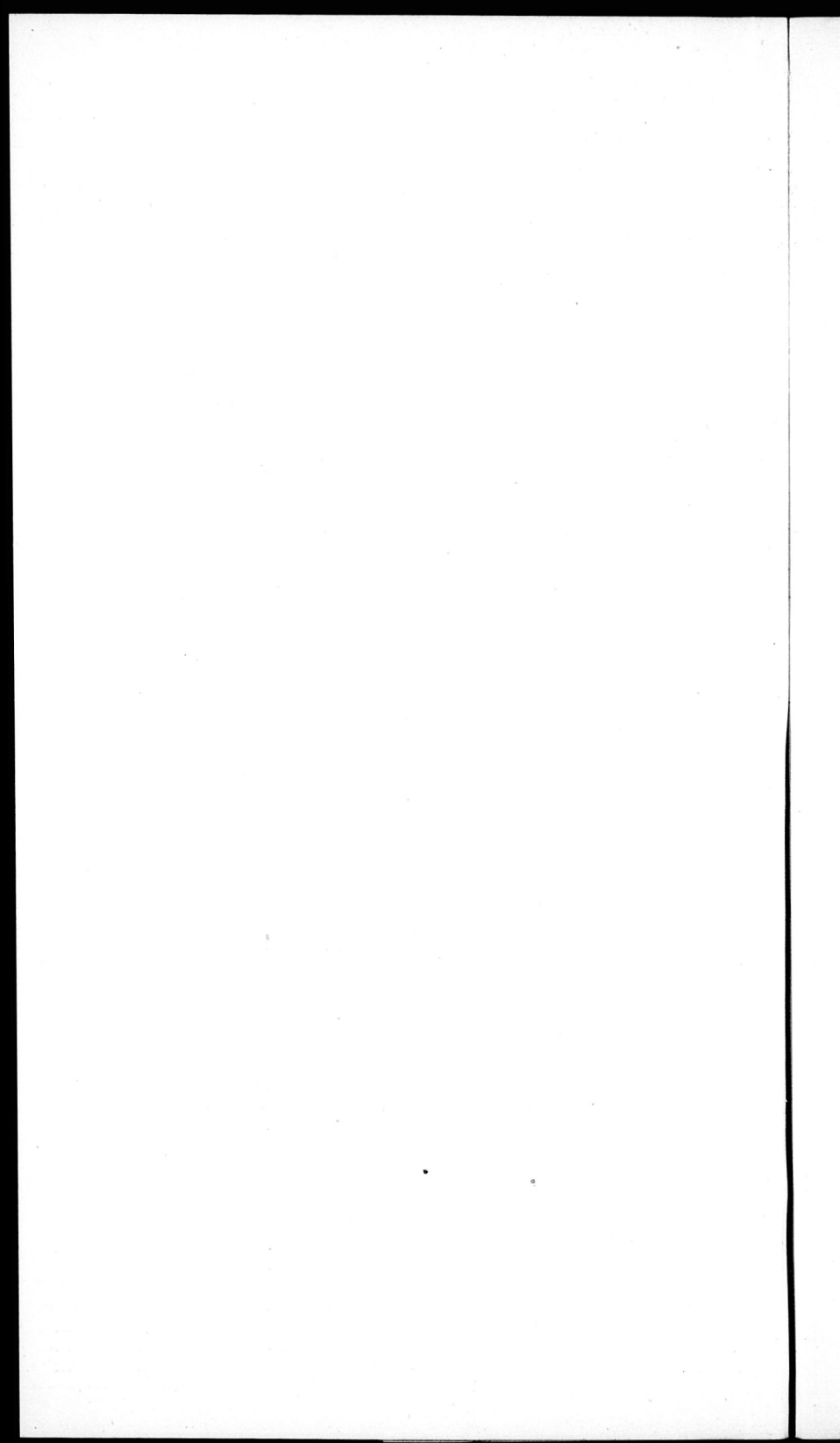
JANUARY, 1896.				TEMPERATURES, NOVEMBER, 1896.							
12 hours after.	15 hours after.	18 hours after.		24 hours before inoculation.	At inocu- lation.	6 hours after.	9 hours after.	12 hours after.	15 hours after.	18 hours after.	
...	...	...	...	...	...	...	...	...	...	...	1 had a living premature calf (No. 65) in 1894, had a dead premature calf in 1895, and was slaughtered a few days after being tested.
101·4	101·7	101·8	...	...	101·3	102·7	102·5	101·0	101·6	101·4	65 was bred at Castlecraig.
...	...	...	...	...	...	...	...	...	...	...	2 had a dead premature calf in 1895, and was slaughtered shortly after being tested.
100·8	101·1	100·9	101·8	101·8	101·3	100·9	101·0	100·9	101·0	101·0	23 was bred at Castlecraig.
101·7	101·7	101·7	101·9	101·9	102·2	102·1	101·3	101·5	101·3	101·3	98 was bred at Castlecraig.
...	...	...	102·5	102·5	103·1	102·7	102·2	102·0	101·7	101·5	66 was bred at Castlecraig.
101·7	101·7	101·0	102·5	102·5	102·3	102·2	102·2	101·9	102·0	102·2	52 was bred at Castlecraig ; sold in 1896.
103·7	104·2	103·2	...	...	...	...	...	...	...	...	100 was bred at Castlecraig.
...	...	...	102·6	102·6	102·4	101·8	102·2	101·7	102·8	...	
105·3	106·6	105·8	...	...	...	...	...	...	...	...	5 had a dead premature calf in 1896, and was slaughtered.
106·3	104·6	104·1	102·3	102·3	101·9	103·6	106·3	108·0	106·4	103·0	12 was sent to the butcher in 1896.
101·3	101·7	101·2	...	...	...	...	...	...	...	...	42 was bred at Castlecraig ; sold in 1896.
103·3	103·3	102·7	...	...	...	...	...	...	...	...	118 was bred at Castlecraig.
...	...	...	102·6	102·6	102·5	102·0	102·0	101·6	101·8	101·8	41 was sent to the butcher in 1895.
...	...	...	...	...	...	...	...	...	...	...	63 was bred at Castlecraig.
102·9	102·5	101·9	102·9	102·9	102·7	102·5	101·9	101·3	101·4	101·9	47 was bred at Castlecraig ; sold in 1896.
102·7	102·5	102·0	...	...	...	...	...	...	...	...	
...	...	...	...	...	...	...	...	...	...	...	
101·2	101·7	101·6	101·8	101·8	101·6	101·7	101·5	101·4	101·5	101·4	6 did not settle to the bull in 1895, and was slaughtered after her calf was weaned.
...	...	...	...	...	...	...	...	...	...	...	83 was bred at Castlecraig.
102·3	101·6	101·7	...	...	...	...	...	...	...	...	7 did not settle to the bull in 1895, and was slaughtered after her calf was weaned.
...	...	...	...	...	...	...	...	...	...	...	50 was bred at Castlecraig ; sold in 1896.
106·1	104·4	103·5	102·0	102·0	102·3	104·6	106·0	107·8	106·0	104·2	44 was bred at Castlecraig ; sold in 1896.
102·7	102·3	102·3	...	...	...	...	...	...	...	...	109 was bred at Castlecraig.
...	...	...	102·8	102·8	102·4	102·3	102·2	102·1	101·8	101·7	
102·0	101·7	101·6	101·7	101·7	102·5	100·5	101·0	101·0	101·3	101·4	77 was bred at Castlecraig.
100·8	101·0	100·8	101·8	101·8	101·0	101·3	101·0	100·4	100·7	100·4	105 was bred at Castlecraig.
...	...	...	103·6	103·6	103·4	102·9	102·4	102·6	102·0	102·5	
104·1	105·6	104·7	102·8	102·8	102·2	102·9	103·3	106·3	106·0	105·2	84 was bred at Castlecraig.
101·7	101·6	101·7	102·3	102·3	101·6	101·5	101·5	101·5	101·6	101·4	123 was bred at Castlecraig.
...	...	...	102·9	102·9	102·3	102·1	102·2	102·1	101·9	101·9	
...	...	...	...	...	...	...	...	...	...	...	
102·9	102·5	102·2	101·3	101·3	101·9	101·5	101·2	101·0	101·0	100·8	13 had a diseased udder in 1895. Her calf was taken from her and she was slaughtered.
...	...	...	...	...	...	...	...	...	...	...	49 was bred at Castlecraig.
101·8	101·8	101·7	102·7	102·7	102·6	102·9	103·4	102·9	103·0	102·1	14 was bred at Castlecraig.
101·7	101·2	101·7	101·9	101·9	101·3	101·6	102·0	101·3	101·0	100·9	78 was bred at Castlecraig.
...	...	...	102·4	102·4	102·1	101·4	101·6	101·9	101·7	101·5	117 was bred at Castlecraig.
103·9	105·9	105·8	[101·4	101·4	100·9	101·3	101·5	101·2	102·7	102·6]	
101·1	101·6	101·8	101·1	101·1	101·2	101·8	101·7	101·1	101·2	101·3	91 was bred at Castlecraig ; sold in 1896.
102·0	102·5	101·9	...	...	...	...	...	...	...	...	115 was bred at Castlecraig.
...	...	...	102·8	102·8	102·7	102·8	102·7	102·4	101·9	102·1	43 was bred at Castlecraig ; sold in 1896.
102·3	102·4	101·8	...	...	...	...	...	...	...	...	
...	...	...	102·6	102·6	101·8	102·1	101·1	101·5	101·6	101·7	116 was bred at Castlecraig.

TABLE II. (continued).—RESULT OF THE TUB

				TEMPERATURES, MARCH, 1895.						TEMPERATURES, APRIL, 1895.				
				24 hours before inoculation.	At inoculation.	4½ hours after.	7½ hours after.	10½ hours after.	13½ hours after.	16½ hours after.	19½ hours after.	24 hours before inoculation.	At inoculation.	6 hours after.
16.	Calved 1890	...	...	101.2	101.6	101.1	101.0	101.0	101.4	101.6	100.8	102.1	102.2	101.8
71.	Calved 1894, daughter of 16	...	...	...	...	...	...	...	...	...	...	102.3	102.7	101.8
89.	Calved 1895, daughter of 16	...	...	...	...	...	...	...	...	...	...	102.0	102.0	102.0
101.	Calved 1896, son of 16	...	...	...	...	...	...	...	...	...	...	...	...	...
17.	Calved 1892	...	...	101.1	101.9	101.0	102.4	105.1	105.8	104.6	103.1	...	...	...
18.	Calved 1891...	...	...	102.1	102.6	101.5	101.2	101.6	101.2	101.7	101.3	102.8	102.3	102.4
54.	Calved 1895, son of 18	...	...	...	...	...	...	...	...	...	...	103.1	102.5	103.0
104.	Calved 1896, son of 18	...	...	...	...	...	...	...	...	...	...	...	...	...
19.	Calved 1891	...	...	103.1	103.1	103.2	102.7	102.3	102.1	102.0	101.9	102.2	102.2	102.4
90.	Calved 1895, son of 19	...	...	...	...	...	...	...	...	...	...	102.4	102.4	102.7
112.	Calved 1896, daughter of 19	...	...	...	...	...	...	...	...	...	...	...	...	...
20.	Calved 1893	...	...	[102.5	102.8	102.4	102.1	104.3	104.7	103.2	102.1]	[101.4	102.0	101.5
114.	Calved 1896, daughter of 20	...	...	...	...	...	...	...	...	...	...	...	...	...
21.	Calved 1893	...	...	103.0	102.2	101.8	101.0	101.4	101.7	101.3	101.0	102.4	101.7	101.7
122.	Calved 1896, daughter of 21	...	...	...	...	...	...	...	...	...	...	...	...	...
*22.	Calved 1893	...	...	102.1	102.5	102.2	102.3	102.0	101.6	101.6	101.1	101.7	102.1	101.3
24.	Calved 1893	...	...	102.6	102.2	102.6	103.2	105.6	105.3	104.6	103.0	...	...	...
*25.	Calved 1893	...	...	102.2	102.4	102.1	101.0	101.3	101.3	101.0	101.2	102.9	101.6	101.4
26.	Calved 1893	...	...	102.2	103.0	102.2	102.6	104.0	105.2	104.7	103.7	...	...	...
27.	Calved 1893	...	...	102.4	102.4	102.0	102.0	101.7	101.4	101.6	101.4	102.7	102.2	102.0
124.	Calved 1896, daughter of 27	...	...	...	...	...	...	...	...	...	...	...	...	...
28.	Calved 1891	...	...	102.2	101.7	102.2	101.8	101.4	101.4	101.6	101.6	102.5	103.3	102.8
94.	Calved 1895, son of 28	...	...	...	...	...	...	...	...	...	...	104.7	102.5	101.9
113.	Calved 1896, daughter of 28	...	...	...	...	...	...	...	...	...	...	...	...	...
29.	Calved 1885	...	...	102.1	100.6	101.4	100.8	100.4	101.1	101.2	101.2	103.3	103.0	103.5
30.	Calved 1891, daughter of 29	...	...	102.3	101.6	101.5	101.4	101.1	101.7	102.2	101.5	102.6	103.2	102.0
76.	Calved 1895, daughter of 30	...	...	...	...	...	...	...	...	...	...	102.0	102.4	101.9
102.	Calved 1896, son of 30	...	...	...	...	...	...	...	...	...	...	...	...	...
75.	Calved 1895, daughter of 29	...	...	...	...	...	...	...	...	...	...	101.8	102.5	102.0
120.	Calved 1896, daughter of 29	...	...	...	...	...	...	...	...	...	...	...	...	...
31.	Calved 1891	...	...	102.2	101.6	101.8	101.6	101.6	101.4	102.0	101.8	102.4	102.6	103.3
60.	Calved 1894, daughter of 31	...	...	...	...	...	...	...	...	...	...	102.4	102.0	102.0
93.	Calved 1895, son of 31	...	...	...	...	...	...	...	...	...	...	105.1	102.5	102.8
119.	Calved 1896, daughter of 31	...	...	...	...	...	...	...	...	...	...	...	...	...
32.	Calved 1890	...	...	102.2	101.2	101.4	102.0	102.1	102.3	101.7	101.8	102.8	102.5	103.1
58.	Calved 1893, daughter of 32	...	...	...	...	...	...	...	...	...	...	103.2	102.2	102.3
61.	Calved 1894, daughter of 32	...	...	...	...	...	...	...	...	...	...	102.5	101.9	102.2
95.	Calved 1895, son of 32	...	...	...	...	...	...	...	...	...	...	105.1	102.5	102.7
110.	Calved 1896, son of 32	...	...	...	...	...	...	...	...	...	...	...	...	...
33.	Calved 1891	...	...	102.8	102.8	102.8	102.8	102.4	102.6	102.4	102.4	103.0	102.6	102.3
67.	Calved 1894, daughter of 33	...	...	...	...	...	...	...	...	...	...	101.9	102.7	101.4
96.	Calved 1895, son of 33	...	...	...	...	...	...	...	...	...	...	105.2	102.6	103.0
99.	Calved 1896, son of 33	...	...	...	...	...	...	...	...	...	...	...	...	...

BERCULIN TEST ON THE CASTLECRAIG HERD.

TESTS, JANUARY, 1896.				TEMPERATURES, NOVEMBER, 1896.							
9 hours after.	12 hours after.	15 hours after.	18 hours after.	24 hours before inoculation.	At inoculation.	6 hours after.	9 hours after.	12 hours after.	15 hours after.	18 hours after.	
101-8	101-2	101-5	102-2	102-2	102-5	101-7	101-7	102-4	101-7	101-4	71 was sold in 1896. 89 was bred at Castlecraig. 101 was bred at Castlecraig.
101-3	101-9	101-8	101-9	...	...	...	...	...	...	...	
101-4	101-2	101-7	101-6	102-1	101-6	101-3	101-7	101-4	101-3	100-9	
...	...	...	...	103-2	102-2	102-5	102-7	102-0	102-0	101-6	17 was injured in calving her first calf in 1895, and was slaughtered.
...	...	...	...	...	...	...	...	...	...	...	
...	...	...	...	...	...	...	...	...	...	...	
101-8	101-5	101-9	101-6	103-0	102-7	102-3	102-0	102-0	101-8	102-0	54 was bred at Castlecraig ; sold in 1896. 104 was bred at Castlecraig.
103-4	102-3	102-6	102-3	...	...	...	...	...	...	...	
...	...	...	...	103-5	103-0	102-8	102-7	102-4	102-0	102-0	
102-5	101-8	102-0	102-0	101-7	101-3	101-5	101-3	100-9	101-2	101-6	90 was bred at Castlecraig ; sold in 1896. 112 was bred at Castlecraig.
102-5	103-4	102-1	101-7	...	...	...	...	...	...	...	
...	...	...	...	103-3	102-0	102-8	101-9	103-6	102-2	101-8	
101-5	102-3	102-9	103-8]	102-9	102-6	102-4	102-3	103-3	107-0	106-2	114 was bred at Castlecraig.
...	...	...	...	102-3	101-9	102-8	102-2	102-3	101-6	101-3	
...	...	...	...	...	...	...	...	...	...	...	
105-5	106-6	105-5	106-3	102-9	102-7	103-6	104-3	106-4	106-4	105-0	122 was bred at Castlecraig.
...	...	...	...	102-7	102-6	102-1	102-1	102-0	101-8	101-5	
...	...	...	...	...	...	...	...	...	...	...	
101-7	101-5	101-3	101-2	102-5	102-5	102-5	102-3	101-8	101-6	101-5	24 was a heifer when tested, and was slaughtered shortly after.
...	...	...	...	...	...	...	...	...	...	...	
...	...	...	...	...	...	...	...	...	...	...	
100-9	101-1	101-7	101-2	101-9	101-6	101-9	101-9	100-6	101-2	101-3	26 was a heifer when tested, and was slaughtered shortly after.
...	...	...	...	...	...	...	...	...	...	...	
...	...	...	...	...	...	...	...	...	...	...	
102-1	100-7	101-6	101-1	101-9	101-9	101-3	100-9	100-9	100-8	101-1	124 was bred at Castlecraig.
...	...	...	...	103-3	102-6	103-0	102-7	102-7	102-4	102-2	
...	...	...	...	...	...	...	...	...	...	...	
103-2	102-8	102-3	102-7	102-5	102-5	103-0	101-9	102-1	101-3	101-9	94 was bred at Castlecraig ; sold in 1896. 113 was bred at Castlecraig.
102-2	101-9	101-9	101-7	...	...	...	...	...	...	...	
...	...	...	...	102-5	102-3	102-3	102-1	101-9	101-4	101-9	
103-9	106-1	106-0	103-6	...	...	...	...	...	...	...	29 had a dead premature calf in October, 1896, and has since been slaughtered.
101-4	101-1	101-6	102-0	101-5	102-2	101-0	100-7	101-0	101-4	100-8	
101-9	101-3	101-1	101-3	...	...	...	...	...	...	...	
...	...	...	...	103-3	102-9	103-0	102-9	102-9	101-7	102-8	76 was bred at Castlecraig ; sold in 1896. 102 was bred at Castlecraig. 75 was bred at Castlecraig ; sold in 1896. 120 was bred at Castlecraig.
101-5	101-2	101-3	100-9	...	...	...	...	...	...	...	
...	...	...	...	102-5	101-9	101-7	101-5	101-8	102-3	101-6	
102-8	101-8	101-8	102-5	101-5	101-0	101-3	101-3	101-3	100-8	101-7	31 was bred at Castlecraig. 60 was bred at Castlecraig ; sold in 1896. 93 was bred at Castlecraig ; sold in 1896.
101-9	101-4	101-4	101-2	...	...	...	...	...	...	...	
103-2	102-7	102-6	102-2	...	...	...	...	...	...	...	
...	...	...	...	102-5	102-1	101-7	102-5	101-8	101-0	101-2	119 was bred at Castlecraig. 32 was bred at Castlecraig. 58 was bred at Castlecraig. She is now a dairy cow. Her first calf (1896) died at birth.
102-6	101-8	102-3	101-9	101-6	102-0	101-0	101-4	101-1	101-7	101-4	
102-1	102-3	102-1	101-7	101-8	101-6	101-8	101-7	101-5	101-9	102-2	
101-5	101-1	101-2	100-5	...	...	...	...	...	...	...	61 was bred at Castlecraig. She was being fed for the butcher, and was not tested in Nov., 1896. 95 was bred at Castlecraig ; was sold in 1896. 110 was bred at Castlecraig.
102-4	102-0	102-2	102-1	...	...	...	...	...	...	...	
...	...	...	...	102-6	102-1	102-2	102-4	101-7	101-3	101-6	
101-7	102-3	101-5	102-5	101-7	102-0	101-0	101-4	101-4	101-4	101-0	33 was bred at Castlecraig. 67 was bred at Castlecraig. 96 was bred at Castlecraig ; sold in 1896. 99 was bred at Castlecraig.
101-3	101-6	101-3	101-5	102-2	102-3	101-9	101-6	101-6	101-4	101-4	
103-1	103-0	102-8	102-3	...	...	...	...	...	...	...	
...	...	...	...	103-8	102-7	102-9	103-0	102-7	102-6	103-7	



INDEX.

- A.
Air space, amount required, 18, 32, 33
Recommendations of Royal Commission as to, 34
- B.
Bang, Professor, Work of, in eliminating tuberculosis from herds in Denmark, 28
- C.
Carcases, Condemnation of, when disease is generalized but not when localized, 56
Examination of, for evidence of tubercle, 51-54
Regulations as to condemnation of, when tuberculous, in France, 59; in Prussia and Saxony, 60; recommendations of Royal Commission, 61
Treatment of, when tuberculous, in Leipzig, Hanover and Carlsruhe, 62, 63
Carlisle, System of insurance against loss from seizure, 54
Carlsruhe, Slaughterhouse returns of, 63
Cattle, Breeds of, most susceptible, 14
Conditions under which tuberculin test may be applied to, 29, 30
Increase of tuberculosis among, in recent years, 47
Number of, imported alive for food-supply, 43
Periodical inspection of, recommended by Royal Commission, 25
Proportion of tuberculous, 14, 46, 47, 48, 62, 63
Climate, Influence of, on disease, 16
Compensation demanded by farmers and butchers for cattle when condemned, 66; and given in Belgium and United States under certain restrictions, 27, 29
Contagion the main cause of tuberculosis, 18
Cowsheds, Conditions to be required of, 34
Regulations as to, in Manchester and Ruskington, 35-38
Unsatisfactory condition of, 32
Ventilation of, 17, 18, 32, 33
- D.
Dairy cows most subject to disease, 13
Dairies, Cowsheds, and Milkshops Order, 24
Denmark, Legislation as regards tuberculosis in, 26, 28
Dewar, Professor, Tuberculin inoculations by, 22
- F.
Fattening of reacting animals recommended, 32
Food, Influence of, on the disease, 17
France, Legislation as to tuberculosis in, 27
Regulations as to condemnation of tuberculous carcases, 59
- G.
Germany, Insurance systems against loss from seizure in, 66-73
Regulations as to condemnation of tuberculous carcases in, 60
Use of public slaughter-houses in, 39, 40
- H.
Hanover, Slaughterhouse returns of, 63
Heredity, Relation of, to tuberculosis, 16

Horses, Immunity of, 13
 Housing, Effect of, on spread of the disease, 13, 14, 17, 18

I.

Imported dead meat, Consumption of, in England, 40
 Inspection of, in Berlin and Copenhagen, 44
 Less stringent inspection of, 40
 Infectious Diseases Prevention Act, 25
 Insurance, Method of, adopted in Newcastle and Carlisle, 64, 65; in West Hartlepool, 65; in Paisley, 65, 66; and in Germany, 66, 67
 Premiums paid for, in English towns, 64, 65; and in Germany, 69
 Results of societies for, in Germany, 69-73
 Rules of Association for, in Berlin, 68
 Systems of, against loss from seizure, 64-73
 Isolation, Necessity for, in case of tuberculous cows, 26, 31

K.

Kiel Slaughter-house, Return of, 47

L.

Legislation as regards tuberculosis in England, 24, 25; in Denmark, 26, 28; in Belgium, 26; in France, 27, 28; in Germany, 28; in the United States, 28, 29
 Leipzig Slaughter-house, Returns of, 62
 Lymphatic system, Examination of, 53

M.

Manchester, Method of examining carcasses in, 53, 54
 Regulation as to cowsheds, 35
 Slaughter-house, Return of, 48
 Martin, Dr. S., Experiments of, for the Royal Commission on Tuberculosis, 1890, ix, 53
 McFadyean, Professor, Directions of, for using tuberculin, 30
 Meat, how dealt with in Leipzig when tuberculous, 62; and in Hanover and Carlisle, 63
 Infectivity of, when tuberculous, 55, 56
 Regulations as to, in France, 59; in Germany, 60
 Stamping of, 44

Meat to be condemned when disease is generalized, but not when localized, 56

Meat inspection, Advantages of public slaughter-houses in securing efficiency in, 40

Statistics as to, from Continental slaughter-houses, 46-48; in the United States, 42; and in Manchester, 53

Meat-inspectors, Qualifications of, in England, 49; in Germany, 49; in Belgium, 50

Veterinary surgeons would make the best, 49

Milk, Epidemics spread by, 24

Infectivity of, when udder tuberculous, 23

Pasteurization of, 24

Powers for controlling sale of, inadequate, 24, 25

Recommendations of Royal Commission as to control of, 25

Sterilization of, 24

Variable nature of, 23

N.

Newcastle, System of insurance against loss from seizure in, 64

Notification of disease of the udder and of clinical symptoms of tuberculosis recommended, 25, 34

P.

Paisley, System of insurance against loss from seizure in, 66

Pasteurization of milk, 24

Pigs, Prevalence of disease in, 46, 47, 62, 63

Symptoms of tuberculosis in, 13

R.

Rohrbeck, Steam sterilizer of, 58

Royal Commission on Tuberculosis, 1896, Recommendations of, as to control of milk-supplies, 25, 34; as to cowsheds, 34; as to elimination of tuberculosis, 35; as to condemnation of carcasses, 61

S.

Serous membranes, Relative importance of, when affected with tuberculosis, 53

Sheep, Immunity of, 13

Shorthorns, Prevalence of disease in, 14

Sire, Influence of, on disease, 16

- Slaughter, Advisability of, when animal tuberculous, 32
- Slaughter-houses, public, Advantages of, over private, 40
- Charges made in, 40
- Law enforcing use of, in Prussia, 39
- Number of, in Germany, 39
- Objections to, on part of butchers, 41
- Statistics from Continental, 46-48
- Sterilization of milk, 24
- of tuberculous meat, 57
- T.
- Tubercle bacillus, Appearance of growth of, 15
- Conditions for growth of, 14, 15, 17
- Interchangeability of, in man and animals, 55
- Tuberculin, Conditions under which test must be applied, 29, 30
- Directions for using, 30, 31
- Legislation as to, in Denmark, 26, 28; in Belgium, 26, 27; in France, 27, 28; in Germany, 28; in United States, 28, 29
- Number of animals which react to test, 22
- Recommendations of Royal Commission as to, 35
- Restrictions in use of, 33
- Use of, in Castlecraig herd, 22, Table II.
- Value of, as a means of diagnosis, 21
- Tuberculosis, Accurate knowledge of, in this country wanted, 45
- Contagious nature of, 15, 18
- Different names given to the disease, 13
- Difficulty of diagnosis of, 19
- Forms of, found post-mortem, 51
- Heredity in relation to, 16
- Tuberculosis, increase of, in recent years, 47
- Influence of food on, 17
- Influence of housing on, 17, 18
- Influence of sire and dam, 16, 17
- Localized and generalized, 52
- Most frequent in dairy cattle, 13
- Prevalence of, in Leipzig and elsewhere, 46-48, 62, 63
- Symptoms of, 13, 19-22
- U.
- Udder, Examination of, in a carcass, 54
- Number of cows with tuberculous, 23
- Recommendations of Royal Commission as to disease in, 25, 34
- Symptoms of tuberculous disease of, 20
- Virulence of milk from, when tuberculous, 23
- United States, Legislation as to tuberculosis in, 28, 29
- Meat-inspection in, 42
- V.
- Ventilation, Importance of, 17, 18, 32, 33
- Veterinary surgeons always appointed as meat-inspectors abroad, 49
- Inspection of cows by, recommended, 25
- would make best meat-inspectors, 49
- W.
- Warranty between farmer and butcher as to soundness of animal, xi
- West Hartlepool, System of insurance against loss from seizure in, 65
- Woodhead, G. Sims, investigations for Royal Commission, 1890, 25

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