Alexander Dempsey (1852–1920)

President of the Ulster Medical Society 1890–91

Presidential Opening Address
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My first duty is to thank you for the honour you have done me in electing me to fill the Presidential Chair of our Society for the coming year. I appreciate the honour very highly, especially when I contrast my own unworthiness with the eminence of former Presidents whose portraits adorn these walls; and when I consider there are still in the background, in reserve, no doubt, for honours, other men of our Society of higher standing in the profession, of larger experience, and of superior attainments, upon anyone of whom your choice of a President might more judiciously have fallen. However, it is not for me to grumble at, or find fault with, the choice you have made, but only to promise that I will discharge to the best of my ability the duties of the responsible position in which you have been good enough to place me, relying on your kind indulgence if I fail to realise your expectations. However, I cannot help feeling and saying that it is no easy task to take the place of my immediate predecessor in office. I venture to say that this Society has never had a President who was more generally respected. Notable among his many excellent qualities are his kindness and geniality of disposition and eminently practical cast of mind. In fact, it is a characteristic of Ulstermen in general, and of Belfast men in particular, that they are disposed to take a practical view of every question. Not that they eschew theory or under-rate its importance, but they are disposed to estimate its value by practical results. This characteristic of her citizens has, no doubt, contributed largely to the rapid growth and development of Belfast as a great manufacturing and commercial centre. Gentlemen, it is a privilege to belong to a community which, has won for the city of Belfast a reputation for energy, industry, and enterprise, which many larger and more ancient cities might well envy. Belfast is universally acknowledged to be in the forefront of commercial and industrial activity, and in the great work of education in all its branches, and especially in the matter of medical training she has given a good account of herself.

The Belfast Medical School holds a high place among the teaching institutions of the country. Its students are scattered over the world, and are generally to be found in positions of the highest trust, honour, and responsibility. Belfast enjoys, too, the great advantage of having toiling in her midst as capable and as well-informed a body of medical practitioners as can be found in any town or city in the United Kingdom. Nor are the practitioners of Belfast anywhere surpassed in the devotion and zeal with which they attend to the interests of their patients. But it appears to me the public expects, and has a right to expect, from us more than due attention to our private practice. It expects that we shall not allow our practice to engross our time and attention so far as to make us lose sight of the higher interests of the public health – the health of the general community. Our City Councillors and Town Commissioners are, for the most part, ordinary business men, who are not supposed to be thoroughly conversant with the details of sanitary science. Whether such knowledge should be looked for in our municipal representatives

is a question which, I think, is open to discussion, seeing that the aggregation of large communities is constantly generating sundry elements of disease, and that sanitary authorities should know how to dispose of these elements so as to render them harmless. Certainly the local rulers of our towns and cities have no weightier responsibility cast upon them than by wise sanitary laws and appliances to safeguard the health and lives of the people. At all events, I think that medical men, both individually in their intercourse with the people, and collectively at their meetings, should endeavour to create a sound public opinion with regard to all matters affecting the health of the community, so that those responsible for the public health may be spurred on to a proper and intelligent fulfilment of the important trust confided to them. I take it, therefore, that, the sanitary condition of a town must depend largely upon the medical profession practising in it. If its condition is bad and remediable, and if the death-rate is high, the Corporation, of course, as the sanitary authority, is to blame in the first instance, but indirectly the profession are responsible too, if through neglect or indifference on their part their views as authorities in sanitary science have failed to reach and influence the public mind.

The very able address on National health delivered by Sir Spencer Wells at Manchester, and published in the *British Medical Journal* of October 4th, is worthy of the most attentive perusal and study by all who are interested in this question. In that address he has directed attention to the disparity in the death-rate of the principal large towns of England, and he appears to fix the responsibility in the case of those having a high death-rate upon their respective corporations. If the higher death-rates could be pulled down to equality with the lowest, certainly a most wonderful annual saving of human life would be the result. Though the death-rate of Belfast is not by any means so high as that of some of the large towns of England, yet it is much in excess of that of many of them, as, for example – Nottingham, Huddersfield, London, Birmingham, Wolverhampton, Bradford, Oldham, Leeds, Preston, Liverpool, and Sunderland, whose death-rates range in the order mentioned from 14 to 22 per thousand inhabitants. Let us see how the case stands between Belfast and Birmingham, which occupies a middle place among the towns mentioned. The population of Birmingham is nearly double that of Belfast, and the average death-rate of Birmingham is 19 per thousand, while that of Belfast is 25½ per thousand. Hence the saving of human life effected by reducing the death-rate of Belfast to that of Birmingham would amount to 1514 persons annually. That is 1514 people fall victims every year to the unsanitary and probably remediable conditions of their surroundings. These figures, if realised, are very alarming. The loss to the community of 1500 valuable lives a year surely calls for an explanation. It may partly be accounted for by the unhealthy occupations of the working classes. The whole question being of the greatest importance deserves to be fully investigated. Credit must be given to the sanitary authorities of Belfast for a reduction of 3 per thousand in the death-rate of the last 15 years. Let us hope that the mortality will be still further diminished by the works now in progress for the better drainage of the city.

The light which all recent scientific investigation is throwing upon the causation of disease, while simplifying the study of pathological processes, is also bringing disease more and more under the control of sanitary reformers. It has been proved beyond the possibility of doubt that a number of diseases owe their origin to the operation of certain specific vegetable microorganisms. In the case of some other diseases the circumstantial evidence of a like origin is all but conclusive, whilst in that class of infectious fevers known as the exanthemata – typhus fever included – though no specific micro-organism has for so far been discovered, yet there is every reason to hope that further investigations, conducted perhaps on improved methods, will fully establish their parasitic origin. The knowledge obtained regarding the action of living organisms in generating disease has been turned to good account in operative surgery, with the result that there is an immense saving of human life, and much suffering is prevented. Not only that, but operations which had hitherto been regarded as impracticable on account of their fatal results are now not only feasible, but highly successful.

The recent pronouncement of Koch at the Berlin International Medical Congress that he had discovered a means of arresting the tuberculous process in animals is full of promise for the successful treatment of one of the most hopeless diseases we have to deal with. If this treatment can be applied with like results to human tuberculosis – and the latest reports are to this effect – we are on the eve of an era in the history of medicine without a parallel. A most destructive disease which had hitherto been more than a match for medical art will have been dealt a deadly blow. Besides the lines will have been laid for the arrest of other diseases of parasitic origin, which at present run a pretty definite course in

defiance of treatment. One thing at all events appears to be clear.– The greatest hope for the successful treatment and prevention of parasitic diseases depends on a correct knowledge of the conduct of these microorganisms both inside and outside the body. We require to know how they get into the living body, how they increase and multiply there, the pathological processes they initiate, and how they come to die. On the other hand, all intelligent sanitation must be based upon a knowledge of the manner in which these micro-organisms escape from the bodies of animals and men and reach the outer world, the laws affecting their preservation and growth there, how they may be transported from one place to another, how they may perish for ever or again obtain admittance into the living body there to begin a new existence. At the same time we require to know something regarding the predisposition to or immunity of patients to their infective influences. For the solution of these important and vital questions we must look mainly to the scientists of France and Germany, in consequence of the restrictions placed upon the vivisection of animals in this country. That such absurd sentimentalism regarding the suffering of animals, in experiments so essential to the health and lives of human beings, should have been found to weigh with the Legislature of this country, is a matter greatly to be deplored. There is abundant evidence that the following diseases are caused by the action of micro-organisms peculiar to each disease, viz.:– Anthrax, Tuberculosis, Erysipelas, and Tetanus. Anatomical and microscopical investigation of these diseases has demonstrated in each the presence of a specific micro-organism which is capable of cultivation outside the body, and which has never been found in any other disease. Inoculation experiments performed upon healthy animals from pure cultivations of these specific-organisms produced diseases exactly similar in every particular to those from which the cultivations were originally taken, and infective material taken in turn from these animals begot the same disease in other healthy animals. So that the causal dependence of these diseases upon specific pathogenic bacteria peculiar to each has by these experiments been fully and clearly established.

In the case of Typhoid Fever, Relapsing Fever, Diphtheria, Asiatic Cholera, Leprosy, and, perhaps, Pneumonia, the constant and exclusive presence of a special microbe in each disease has been fully proved; but, owing to the fact that animals are not susceptible, or only slightly so, to the infection of these diseases, inoculation experiments have not been quite satisfactory, and the proof of the casual relationship is so far incomplete. There is, therefore, already a pretty long list of diseases, whose dependence upon a specific parasitic micro-organism cannot be doubted. If to this list were added those diseases principally surgical, which are due to the operation of specifically undefined germs, and which have been classed as the traumatic infective diseases, puerperal fever included, and also the exanthemata, such as scarlatina, small-pox, measles, &c., it is manifest that the physician and sanatarian have in this department of medicine a wide field for observation and study – a field rich in tempting inducements to scientific research and teeming with prospects of the most valuable results. Except in the direction of prevention, the discoveries so far made have not very materially helped or improved our methods of treatment. No agents that we have yet become acquainted with can be administered in such a manner and with such effect upon the natural course of any one of these parasitic diseases as to entitle it to be classed as a germicide. There are of course many chemical substances even in very diluted solutions which are capable of destroying bacteria outside the body, but the dosage required of these weak solutions would be either poisonous or inert when administered as a medicine to man. Besides, in treatment, more has to be considered than the life of the infecting micro-organism. It is not simply the immense multiplication within the body of these living germs, the pathological processes which they initiate, the devouring attacks which they make upon the living cells of the body, the nutriment which they consume, the destruction of healthy and vital tissues which they produce; but more particularly and mainly, the poisonous products of their own tissue waste which are absorbed and enter the blood stream, and which act as a most virulent intoxicant. In certain diseases, even before a single germ has penetrated within the blood vessels, and almost before any very marked necrotic change has been effected in the tissues, the patient may die from absorption of these waste products of bacterial growth. This is so in many of the most rapidly fatal cases of cholera. Post-mortem examination discovers nothing further than swelling and congestion with loss of transparency of the superficial layers of the mucous membrane of the small intestine, but the microscope shows the small intestine to be swarming with the comma bacilli which are also found crowding into the tubular glands and partly thrusting themselves between the epithelium and the basement membrane. Koch, who has done more to elucidate the

etiology of this disease than any other investigator, was unable by the most careful examination to discover the comma bacilli in the blood or in any other organ of the body, not even in the mesenteric glands. He does not consider the local lesions, especially in rapidly fatal cases, sufficient of themselves to account for death, but explains the cholera process as being the result of a poison produced by the comma bacilli, which acts partly locally on the intestine, and partly after absorption on the entire organism and especially on the circulatory system, which is brought to a state of paralysis.

This poisonous effect of the growth of bacteria is better exemplified in the case of diphtheria. In a paper recently published by Roux and Yersin in the annals of the Pasteur Institute, it is demonstrated that the active symptoms of diphtheria are produced not directly by the specific bacilli which are present on the false membrane of the throat, but indirectly by the poisonous products of their growth being absorbed into the blood. A specific chemical substance was discovered in pure cultivations of the diphtheritic bacilli, which, when completely freed from bacilli and injected, even in most minute quantities, under the skin of healthy animals, caused their death after giving rise to nearly all the symptoms and lesions of diphtheria, with the exception of the formation of false membrane at the site of inoculation. This proof of the toxic effects caused by the absorption of the products of bacterial growth is strengthened by the fact that pure cultivations of the diphtheria bacilli inoculated on the excoriated mucous membranes of rabbits, guinea pigs, and pigeons, give rise to characteristic false membranes and the other symptoms of diphtheria, and in such cases the bacillus is only found at the point of inoculation, and not in any other part of the body, and during the later stages of the disease it may disappear also from the point of inoculation. So that the conclusion drawn by these investigators is that the infection is not produced by the invasion of the tissues by a microbe, but by the diffusion through the organism of a toxic substance prepared on the surface of a mucous membrane which might be regarded as altogether outside the body. It is clear, therefore, that in the treatment of these diseases not only must the microorganisms causing the disease and the pathological processes which they initiate be dealt with, but also the poisonous products of their growth. And hence arises the necessity of having a correct knowledge of the exact chemical composition of these poisonous products. As already mentioned, a number of considerations must be taken into account in the prevention of the various infective diseases. We require to know the ordinary paths of infection in each disease, the usual dwellings of the pathogenic organisms outside the body, and the means by which they reach them, their powers of resistance to external agencies when there, their usual means of transport, the laws affecting their destruction, as well as the susceptibility and predisposition of patients to their infective influences. Our information on several of these points is fairly complete. We know that the earliest, most distinct, and, perhaps, the only pathological lesions occur, for instance in the case of diphtheria, in the throat; in the case of cholera and typhoid fever, mainly in the intestine; in the case of tuberculosis, generally in the lungs and intestines; and in the case of erysipelas, in the skin, and so on.

It has been found by experiments on animals that the infective material, generally speaking, must be brought in contact with that part of the body at which these lesions usually are found before infection can occur. The bacilli of typhoid fever, of cholera, or the micrococci of erysipelas may be injected into the blood without producing any infection; but if any of these different species of bacteria are introduced where the lesions usually are found to be associated with their presence, infection of a kind will occur corresponding with the site of inoculation and the specific micro-organisms employed. This is partly explained by the fact, as demonstrated by Wyssokowitsch, that the bacteria circulating in the blood are not excreted through certain surfaces of the body. They cannot enter the lumen of the intestine, for instance, except where hemorrhages occur from the mucous membrane. Typhoid and cholera bacilli, therefore, even when present in the blood, do not always reach their proper seat of action, which is on the surface of the mucous membrane of the intestine. Consequently infection occurs in many diseases by the primary establishment and development of the infective agents at those parts of the body in which the specific process begins, so that the seat of alterations characteristic of the infective disease in question coincides with the specific seat of invasion. Cholera and typhoid fever, according to the most recent investigations, arise chiefly, if not entirely, from food or water containing the infective agents. The germs must be swallowed in order to produce the disease. They may reach the mouth in many ways and be afterwards swallowed with the food, but that infection can occur through the organs of respiration, more especially in the case of cholera, seems now to be entirely disproved. The case is different with the exanthemata. In them it is probable

that infection may take place both through the skin and the mucous membranes of the air passages, and this assumption is supported by the rapid spread of these diseases in time of epidemics. The origin of infection in the case of cholera and typhoid fever has been shown to be contained in the dejecta of patients. The bacilli of both diseases have been always found, especially in the early stages of the illness, in the intestinal contents. It is by these they reach the outer world and become the source of infection to others. It is only rarely in the case of cholera, according to Koch, that the vomited matters of cholera patients contain the infective agents of the disease.

How long parasitic bacteria may live outside the body depends upon a number of circumstances. It depends, in the first place, on whether they are capable of forming spores which have been shown to be very resistant to external influences. Koch says that spores of bacteria have a power of resistance to high temperatures and to chemical agents, which, compared to other living things, is without parallel. It also depends upon the soil or medium in which they are placed, as regards nutriment, temperature, light, moisture, or dryness. The bacilli of cholera do not form spores, and are therefore less resistant than the bacilli of typhoid fever and tubercle. Again, a soil too rich in nutriment is not favourable to the lengthened existence of pathogenic bacteria, because they quickly get outgrown by non-pathogenic bacteria, which multiply with enormous rapidity and not only use up the nutriment necessary for their existence, but also poison them with products of their tissue change. A certain amount of moisture appears to be favourable to the preservation of nearly all kinds of bacteria. Cholera bacilli can remain in the moist state for lengthened periods, and under suitable conditions can grow outside the living body. They were found alive in the harbour water of Marseilles up to 81 days, in pure spring water they were found to exist 30 days, in sewer water six to seven days, in cesspool water they were no longer alive after twenty-four hours, and they were found by Koch to be dead after being exposed to a process of drying for three hours, so that active putrefaction and drying quickly destroy the infective agents of cholera. The infection of cholera, therefore, cannot be conveyed by the atmosphere, because the drying necessary to float the cholera germs into the atmosphere would cause their death. The bacilli of anthrax, typhoid fever, and tubercle, which form spores, can exist in the dry state for lengthened periods. The spores of typhoid bacilli have been found by Gaffky to retain their vitality for three months in the dry state, and it is, therefore, possible they may be lifted in the dust and carried from place to place by the winds. This power of existence in the dry state possessed by the bacilli of typhoid may explain the occurrence of typhoid in localities where all other possible causes seem to be non-existent. I also offer it as an explanation of the outbreak of typhoid in the immediate vicinity of open gratings in the main sewers of the street at elevated districts of the city. This is an occurrence which I have several times observed. In one locality which I need not specify, a number of cases of typhoid occurred last autumn in some houses facing one of these ventilators. The houses had only been a few years built, and there was no reason to suspect any defect in their drainage. The water used was the ordinary town water, and there did not appear to be anything uncommon in the supply of provisions or milk which would have left room for suspicion in that direction. The smell arising from this open grating was most offensive at times, and the people believed firmly it was the cause of their illness. After full inquiry I came to that conclusion myself, and this is my explanation of how the infection probably occurred.

I regard a main sewer with a steep gradient in the light of a chimney or ventilating shaft. During the rainy weather and when the sewers are full their sides and roofs are moist, but in the continuous dry weather of summer and autumn there is a fall in all the sewers, and the deposits that have taken place on the sides or roofs, containing perhaps the bacilli of typhoid, become dried up by the ventilating current of air passing through them. This process of drying continues until the deposit is converted into dust, which is carried by the draft from the lower portions of the town to the higher, emerges out of the open ventilating grates, is wafted by the wind through the open windows, settles upon the food at table, and is swallowed along with it and gives rise to the disease. From what we know of the vitality of the spores of typhoid bacilli in the moist state, and their power of surviving for even three months in the dry state. I consider this explanation quite reasonable, and the conclusion I would draw from it is that these ventilating gratings are a source of great danger to those residing in their immediate vicinity. In connection with this power of life which the infective agents of other diseases as well as typhoid possess in their dry state, and notably those of tubercle, which retain their vitality for six months, I should like to refer to a recent order of the City Council compelling those constructing new dwellings to have the ashpits roofed so as to preserve the contents in a dry

condition. What will be the effect of this order ? All the refuse of the house, the dustings of rooms occupied by the sick, perhaps in some instances the dejecta will be thrown into this dry heap, which will supply all the conditions most favourable for the preservation of all kinds of pathogenic bacteria. Each time these ashpits are emptied the dry dust containing perhaps infectious agents will be wafted about by the winds, and may enter the dwellings and become the source of new disease. Pathogenic bacteria are very sensitive and fastidious as to their nutriment, and are liable in our ordinary surroundings to be outgrown and starved by the enormous number of saprophytes which are always present wherever animal or vegetable decaying matter exists. These microscopic saprophytes are, therefore, in this respect the greatest friends of humanity. This new bye-law would seem to be aimed at the destruction of these not only harmless but salutary and friendly germs, which multiply most rapidly in presence of moisture and active putrefaction in the open air, in order that our invisible foes the pathogenic bacteria may have undisturbed existence and repose until an opportunity again offers of waging a deadly war against human life. Besides, it has been shown that moisture has the effect of fixing bacteria so that their entrance into the atmosphere is not likely to occur. The adoption of a regular system of inspection and frequent cleansing of these ashpits, which I have reason to believe is very much required in this city, would have the test of practical experience to commend it as the best means of counteracting the deleterious influences which all accumulations of the kind have upon the public health.

It is impossible in an address like this to go into all the means of transport of the infective bacteria and of their behaviour in the soil. It will suffice to say that investigations conducted towards clearing up this question of bacterial life in the soil go to prove that bacterial existence is only found in the superficial strata of the earth, and the pollution of wells is usually, if not always, caused by surface water.

I pass over those diseases which occur as epidemics after lengthened intervals, such as cholera, and whose infective agents have been proved to have a very limited existence outside the living body, by saying that Koch has supplied a full and ample explanation of the manner of their outbreak. Predisposition and susceptibility play an important role in the determination of all disease processes, including, of course, the infectious diseases. The factors which influence this predisposition of the body are partly in the body itself, in the constitution of its cells and secretions, and partly they come from external agents, which render the body abnormally susceptible to attack. There may be natural protective arrangements of the body which render difficult the access of certain infective agents to the specific points of invasion. Thus the gastric juice can, according to its degree of acidity, and also its quantity, injure or destroy those infective agents, which must develop in the intestine. The action of the gastric juice on the bacilli of cholera and typhoid fever explains, in conjunction with other conditions, the immunity enjoyed by some people who have been fully exposed to their infective influence. As regards those infective agents which have their seat of invasion in the lungs, the more or less narrow and convoluted entrance of the respiratory tract, the ciliated epithelium, and the sensitive mucous membrane form protective arrangements of varying efficacy, and according to the development and perfection of these arrangements one individual will have an advantage over another in his power of resisting the entrance of parasitic bacteria into the lungs. The degree of delicacy of the epithelium of the mucous membrane and its susceptibility or proneness to injury are different in different individuals and have an important bearing upon this question of predisposition. It has also been shown that the endotheleal cells of the capillaries and of the lymphoid tissue in some organs have the power of destroying bacteria which have gained an entrance, On the vital energy of these cells, which have been called phagocytes, will depend the issue of the battle against the invading enemy. Any influence, therefore, that would lower the cell energy would most probably turn the tide in favour of the infective agents. Minute injuries of the mucous membrane, as I have already mentioned, give an opportunity of the bacteria to obtain an entrance within the tissues. It is just possible that such injuries are essential in all diseases to the infective process. They may be caused in many ways. In the intestines the multiplication of non-pathogenic bacteria and the production of ptomaines consequent upon their growth, may cause the injury necessary for the entrance of the true infective bacteria. The presence of animal parasites in the intestines and constituents of food with sharp and pointed edges may so injure the mucous membrane as to afford predisposition to infection.

The occurrence of typhoid fever in its greatest prevalence in the autumn season may in part be due to the greater consumption of fruit containing seeds which are not masticated or rejected. That a great many do swallow the seeds of grapes, pears, and

apples is unquestionable. I was very much struck with this probable cause of injury to the intestinal mucous membrane in the case of a patient who had an abdominal section performed for malignant stricture of the intestine. After the operation a great number of large seeds of grapes escaped with the liquid contents of the intestine. They appeared particularly irritating, and it is quite easy to conceive that they would be capable of causing minute injury to the mucous membrane. In no disease is the influence of predisposition more palpable than in tuberculous. So much stress is laid upon this question of predisposition in phthisis that no attempt is made to destroy the infective agents, as is done in the case of other infective diseases, but all attention is given to the improvement of the general nutrition and correcting any respiratory deficiencies that may exist. I think the time has come when phthisical patients should be dealt with in a manner similar to those suffering from other infective diseases. Our knowledge of the cause of phthisis is so complete, and the proof of its dependence upon a specific bacillus so conclusive that measures ought to be adopted to reduce the mortality from this disease. The bacilli of tubercle were invariably found by Koch in all the tuberculous organs of both animals and man microscopically examined by him and were absent in all non tuberculous organs. They were found to precede, both in time and place, the pathological changes peculiar to tuberculosis, and to be so closely connected with the course of the disease that nothing more was required than experimental proof of their infectiousness to demonstrate, with absolute certainty, their casual relationship to tuberculous. Such proof has been furnished in the fullest manner by inoculation and inhalation experiments performed on animals with pure cultivations of the bacilli. With such information at hand, some more stringent measures to abate the ravages of this disease than the maintenance of the general health of those predisposed must be taken. The only attempt made towards prevention, which appears to be based on a knowledge of the cause, is that by some of our public bodies in condemning the sale of the milk and confiscating the flesh of tuberculous animals. While the step must be regarded as one in the right direction it leaves untouched multitudinous sources of infection to which little or no attention is paid. Besides the hardship which this order inflicts upon a respectable and frequently struggling body of traders, it is scarcely warranted by a study of the question in all its bearings.

To begin with the difficulty of forming a correct opinion as to the soundness or unsoundness of a beast brought into market for sale must be very great. In the early stages of phthisis in man we know there is frequently great difficulty in making a positive diagnosis even with the help which the patient is able to give us. In more advanced cases too, under certain conditions, and when the history is withheld say for the fraudulent purpose of affecting an insurance, the difficulty of positive diagnosis, with all the most modern methods of examination at our disposal is sometimes considerable. It appears unfair then to require that the butcher, who has nothing to guide him but an experienced eye, should either have to reject a diseased animal, or suffer considerable pecuniary loss in case he commits an error of judgment. On the other band it is not so clear that the use of milk or flesh of animals, whose organs only are affected with tubercle, is capable of causing tuberculosis. In the case of the milk the most careful microscopical examination has failed to detect the presence of the bacilli, unless when the udder itself is tuberculous. Nor is it usual to find the flesh affected with tubercle. The disease is generally localised in the glands and internal organs. If these are destroyed the remaining carcase may be perfectly sound and wholesome food. Besides the process of cooking, as ordinarily carried out, ought to be sufficient to destroy bacilli if present. The gastric juice has been shown to have a most destructive effect under certain conditions upon all kinds of bacilli. This has been proved in the case of anthrax. The spores only can pass uninjured into the intestines. It is believed the same holds good regarding the bacillus of tubercle, and that, therefore, only the bacilli which contains spores can become infective. The spores, however, require some time to germinate before they can invade the mucous membrane of the intestine, but it is possible sufficient time may not be allowed to permit of this process. Besides, the intestines do not offer a favourable point of attack for the slowly growing tubercle bacillus. In further proof of this unusual mode of infection might be mentioned the fact that a large number of phthisical patients frequently and continuously swallow their own sputa, in which bacilli are always present, yet intestinal tuberculosis is a comparatively rare complication of phthisis. It is, therefore, extremely probable that the number of cases of tuberculosis caused by eating the flesh of tuberculous animals is extremely limited. We have not sufficient evidence that because a portion of the lung of an animal is diseased the flesh of that animal is also diseased and unfit for food. In view, therefore, of the difficulty of diagnosing tuberculosis

in animals in its early stage, and the doubt as to the infectivity of the flesh of such animals, I think the confiscation of the entire carcase is not justifiable, unless compensation be given to the owner. The same remark cannot be applied to dairymen, whose cows are known to be affected with tuberculosis. Though the tubercle bacilli have not been found in the milk of such cattle, except the udders were diseased, still the danger of such affection is ever present, and there is no reason why the public should be obliged to run any risk whatever.

The main source of phthisis lies in the sputa ejected by consumptive patients. These have been found to contain immense numbers of spore-bearing bacilli. Numerous experiments have shown that the inhalation of scattered particles of phthisical sputum causes tuberculosis with absolute certainty, not only in animals easily susceptible, but in those also which have much more power of resisting the disease. When one considers that every phthisical patient, for perhaps months and years, has been scattering about him any quantity of infective material, and when we consider the large number of people who suffer from phthisis, the contamination of the air must be very widespread and the infectious agents of tubercle ever present among us. The greatest carelessness is exhibited by phthisical patients as to the disposal of their expectorations. Among the sick poor spittoons are very seldom used, and it is quite a usual thing to find the floor of a room occupied by a phthisical patient literally covered with spits. Handkerchiefs and the blankets of the beds are frequently used for wiping and removing tenacious sputa from the mouth. As a general rule these latter coverings are very seldom changed and, consequently, the sputa becomes dried upon them, and with every arrangement of the bed virulent bacilli are thrown up into the aimosphere and afterwards settle down upon the floor, and may find their way beneath it, and be there beyond the reach of all attempts at disinfection. The danger of infection is, therefore, not only very great to those in immediate attendance on a phthisical patient, but also to those who may come to occupy the same room even for a considerable time after the patient has vacated it. Fischer and Schill found that sputum containing spore-bearing bacilli retained its virulence for six months, though kept moist, and putrefaction had occurred in it; but, when such sputum was dried at the ordinary temperature of the air it retained its virulence for 186 days, as was proved by its inoculation on guinea pigs. The popular opinion regarding the healthiness of rooms exposed to the sunshine is amply proved to be correct from experiments performed on pure cultures of the bacilli of tubercle. These when subjected in layers of considerable thickness to the action of the sunlight were found to be dead after a few minutes in some cases, but not longer than a few hours; and even when exposed to the daylight they were dead in less than seven days. The indication which this observation supplies to consumptives and those predisposed is of the highest value. Seeing that almost one-seventh of mankind is carried off by phthisis, this disease above all others gives hope of most promising results from the application of well directed sanitary laws. All efforts to check the spread of phthisis must of necessity be attended with great difficulties. The great prevalence of the disease, and the consequent wide-spread distribution of its infective agents, together with the predisposition which many exhibit to its infective influence, must render sanitary reform for a long time difficult and unsatisfactory.

If the Notification of Infectious Diseases Act is applied to Belfast, I would recommend that an educated and energetic staff of sub-sanitary officers should be appointed, who would be capable of carrying out effectively all the details of disinfection. Immediately on the notification of the occurrence of an infectious disease being received by the sanitary authorities, and when the patient is not to be removed from his home, printed directions should be sent to those in charge giving all the details necessary for preventing its spread. Supervision should be exercised as to the manner in which these directions are carried out. A most important defect exists at present in Belfast in the arrangements for disinfection. There is no means of disinfecting without injuring clothing and bedding which cannot be washed. Their destruction by burning is the practice amongst the poor when the articles are of very little value, but when they are of considerable value the expense to the city by such a method of disinfection is prohibitive. The consequence is that in private houses disinfection is never properly carried out. A steam sterilizer should be obtained for the city, and all articles of the description mentioned should be taken charge of by the sanitary officers and exposed in it to a thorough disinfection.

I have endeavoured very briefly, but I fear very imperfectly, owing to the magnitude of the subject, and the difficulties of condensation to focus our knowledge of bacteriology in its relation to disease, and to indicate some of the leading points in that knowledge which have been and might be still further practically applied towards the treatment, prevention, and spread of disease. It would be somewhat utopian

to expect that future investigations will give us a complete mastery over these invisible foes of the human race. But that they will supply us with the means of mitigating and restraining their evil influences upon mankind the experience of the last few years supply us with the greatest hope. To the general practitioner who has to deal with the practical application of these discoveries in medical science, the path is clear and the way straight. It is our duty to point out and enforce with all the influence we can command the adoption of those measures which science has incontestibly demonstrated to be conducive to the preservation of the health and lives of the people. With the conscientious discharge of that duty our responsibility to the public ends. We are not called upon to compete with censors of the vices and evil habits of the people, and to advocate in season and out of season the observance of those laws of sanitary science which we know to be beneficial and essential to public health. Our sole duty to the public is like finger posts to point the way to health, and to give warning of the dangers that cross its path. We have no power or authority, save to put forth our views and throw out suggestions on these matters of the highest moment; it is for those who have the power and on whom the responsibility rests to see that our views and suggestions are carried out.