

the majority of such cases a medical man both assumes a very serious responsibility and shows practical sympathy with persons whose position merits nothing but reprobation and exposure, when from an external examination and on an *ex parte* statement he ventures to certify, *on the form drawn up for the use of a regular medical attendant*, to the cause of death of the deceased, especially if a child. In the case of a child whose death brings a few pounds to its guardian, and who during life receives no medical attention, so that there is a difficulty in reaping the advantages of its death, all our sympathies ought to go with the child; and for the sake of other children no one ought to interfere to remove this difficulty. At the best the conditions of the Friendly Societies' Act interpose but a frail barrier between the cupidity of the beneficiary and the life of the child. The facility with which post-mortem certificates can be obtained goes far to remove this barrier entirely.

"On the other hand, in the civil aspects of the Registration Act a certificate so granted contributes worse than nothing to our knowledge of the cause of death. The question of criminality may be settled by the wide and safe verdict of a 'natural cause,' but in the majority of cases, when a medical man sets himself, without a *sectio cadaveris*, and without a particle of knowledge from personal observation of the symptoms during life, to certify to the precise 'natural cause' which issued in death, he might as well determine his opinion by writing a few names on bits of paper and drawing one out at random. In a case which recently fell under my notice of the death of a child aged 6 months, *without medical attendance*, the cause of death was registered as 'debility,' subsequently altered to '*Tabes mesenterica*' as the opinion of the Registrar, based on the statement of the parents. For certain reasons I reported the death to the Sheriff's Fiscal. To prevent the necessity of a *post-mortem*, the parents referred to one practitioner who was prepared to certify that the cause of death was 'convulsions,' and produced a certificate from another to the effect that the child died from 'acute pneumonia.' The Sheriff, however, issued his warrant for a post-mortem examination, the result of which was to prove that the precise cause of death was 'tubercular meningitis!'"

## CHAPTER X.

### ON THE PREVENTION OF TUBERCULOSIS.<sup>1</sup>

#### INTRODUCTORY.

In December, 1891, the Medico-Chirurgical Society of Glasgow, after a discussion, came to the following resolution: "That a Memorial be presented to the Town Council of Glasgow calling their attention to the fact that tuberculosis is now fully recognised as an infectious disease, and asking them to take the matter into their serious consideration, with a view to the protection of the community from the infection." A Memorial<sup>2</sup> was accordingly drawn up and submitted to the Committee on Health in January, 1892. It was remitted to me for consideration and report.

The signatures appended to this Memorial are sufficient to secure for it respectful consideration. They guarantee that whatever it contains of positive statement as to the nature of tuberculosis is accurate, and that whatever of suggestion it makes as to practical measures is judicious. Still, the attitude of the administrative mind towards the contributions of science to the stock of knowledge and towards their executive application and effect is different. We receive implicitly and with gratitude the results of the laboratory and the study; we apply our own judgment to executive proposals. We are bound to consider their bearing on general policy, and to determine their expediency from a forecast of the advantages and disadvantages likely to follow their adoption. This distinction was clearly present to the minds of the Memorialists. No representation relative to the duties of the Local authority could have been made with greater tact and discretion. It is a distinction which is very well illustrated in the history of the subject of the Memorial. Koch's paper on "The Etiology of

<sup>1</sup> A Report issued October, 1895.

<sup>2</sup> See p. 568.

Tuberculosis." published in 1884, contains practically all the scientific facts necessary for the guidance of preventive administration. No essential statement made by Koch has been impugned, and nothing of importance has been added.<sup>1</sup> It is otherwise with the detailed application of his facts. This has been gradually developed by remarkable investigations specially directed to that end; by the discussions of such bodies as the Congress on Tuberculosis, held in Paris in 1888, 1891, and 1893, the French Academy of Medicine in 1889-90; by successive International Hygienic and Medical Congresses, &c.; by specialists engaged in administration, such as the German Public Health Association in 1889, and the Incorporated Society of Medical Officers of Health of England in 1893; by reports on special references made by these bodies to experts; and by numerous State and Municipal Authorities in various parts of the world, who have from time to time actually taken administrative action. There has, therefore, been an obvious advantage in delay. In the enthusiasm naturally inspired by a new discovery, there is always an element of danger. When the issues concern interference with human conduct, and involve the personal liberty of a considerable section of the community, even on the plea of the safety of the remainder, we are bound to ask if the game is worth the candle. The first disciples of a new doctrine must be enthusiasts. The regimen dictated from the laboratory is gradually moderated by the expediency of the administrative bureau. The practical methods of dealing with the infection are now better understood, and have, in consequence, been greatly simplified. Their importance in relation to general hygiene is now seen in more just proportion. I have, in the interval since this Memorial was remitted to me, followed closely all these discussions and investigations, and have collected everything in the shape of reports and documents which serves to show what is the general attitude of the administrative mind to this important subject, more especially in the country to which we owe the knowledge of the facts which we are told call for administrative action.

#### TUBERCULOSIS IN GENERAL.

##### WHAT IS TUBERCULOSIS?

The word tuberculosis, or tuberculous disease, is associated in the popular mind almost exclusively with Phthisis or Con-

<sup>1</sup> It is not meant that everything relative to the infectivity of tuberculosis in Koch's "Etiology" is new. Cohnheim, in his pamphlet, "Tuberculosis as an Infectious Disease" (1880), reasons out with as much clearness as was possible before the actual discovery of the infecting bacillus (Koch, 1882) many facts as to infection and its methods, especially inside the body. He first popularized the idea of infection as regards tuberculosis.

sumption of the Lungs. This is by far the most frequent and most deadly form of tuberculosis; but every organ and every tissue of the body may be the seat of tuberculous disease. Hydrocephalus is tubercle in the membranes of the brain; Tabes Mesenterica is tubercle in the lymphatic glands of the abdomen; Scrofula, in the popular sense, is tubercle in the superficial lymphatic glands, most familiar in the neck; Lupus is tubercle in the skin; there is tubercle of the joints and of the bones, giving rise to suppurations in all sorts of places, and occasioning surgical operations almost as various in their nature as in their locality.

Tuberculosis is a disease, not only of man, but of the lower animals. No warm-blooded animals are insusceptible when artificially tested, but it occurs naturally with great frequency in those which are domesticated or confined, as the cow, the pig, the rabbit, in fowls, in monkeys, &c.

The only cause of tuberculosis is the tubercle-bacillus. Without the bacillus there can be no tuberculous disease. Therefore, to prevent tuberculosis, we must stamp out the bacillus. From our point of view, tuberculosis is a disease. From the point of view of the bacillus, it is a natural life-process. The bacillus has a plan of life laid down for it, providing, as usual, for the maintenance of the individual and the propagation of its kind. Clearly, it is necessary that we should understand this plan before we can hope to disconcert it. The prevention of tuberculosis rests upon the biology of the bacillus.

#### THE BIOLOGY OF THE BACILLUS.

The bacillus is not inherited. As regards Pulmonary Consumption, this statement may be taken as absolutely true. The bacillus *may* pass from a tuberculous parent into the body of the foetus, and be born with it; and thus the offspring may carry into independent life a tuberculous process, but this fact has merely an academic interest. Tuberculosis has been actually seen in the foetus with just sufficient frequency and certainty to prove that the inheritance of the bacillus is not impossible. For all practical purposes, the hygienic administrator is bound to regard *every* case of tuberculosis as caused by infection which has taken place so to speak in the open—within the sphere of his control.

The tubercle-bacillus not being inherited, but passing into the body from the outside, how does it get there? Under what conditions does it exist there? Under what conditions does it pass from the outside to the inside of the body? Under what conditions does it live and propagate there? It is impossible to demarcate the answers to these questions as clearly as the

questions themselves. In nature the facts are interlaced, but, at any rate, the questions so stated will promote clear thinking.

The bacillus multiplies by subdivision and by the production of spores. As compared with other disease-producing organisms, it grows very slowly even under the most favourable circumstances. To be effective, therefore, these circumstances must be maintained for weeks continuously. At a temperature of 86 deg. F. growth is much enfeebled, and it entirely ceases below 82.4 deg. F. It cannot grow at a temperature above 107.6 deg. F. It flourishes at the natural deep temperature of the human body, viz. 99 deg. to 100 deg. F.<sup>1</sup> Moisture is absolutely essential to growth, with a limited supply of air and an absence of light. Obviously, we have here an aggregate of conditions which, in this country at any rate, can only be found in nature *inside the animal body*. The tubercle-bacillus cannot multiply outside the animal body; it can merely live, and live only under certain conditions, and under any conditions only for a limited time.<sup>2</sup>

When the bacillus obtains access to the body of a warm-blooded animal, which it almost solely does by the great main entrance, the mouth, passing thence into one or other of the diverging channels, the windpipe and the gullet, it is not yet in a physiological sense inside the body. It must break through the mucous surface of these passages. This is a most important stage in the career of the bacillus from a preventive aspect, which must be dealt with at large further on. Meanwhile, let us assume that the bacillus has broken through, still it has enemies in the tissues and fluids of the body. These also have a supreme interest for us, but these also we shall meanwhile pass by. If every circumstance has proved favourable, the bacillus proceeds slowly to multiply, and in doing so to invade and break down the natural tissue around. It may be borne along the stream of lymph or blood, or be carried by wandering cells to other parts of the body. However it may be effected, in all movement the bacillus is passive. Wherever it establishes tuberculosis, the process has products—irritated and disorganised tissue, pus, &c. These products have the relation of foreign bodies to the healthy tissues, and have therefore an eccentric or centrifugal bias. They may, however, be imprisoned and retained, sometimes changed in nature. If the process lies on the line of the great channels by which the bacillus gained entrance, then it has an equally patent exit—in consumption, by the expectoration, or by the fæces, if the expectoration is swallowed. If the process is in the bowel or

<sup>1</sup> The tubercle-bacillus of fowls has a somewhat wider range of temperature.

<sup>2</sup> The bacteriologist produces those conditions artificially, and finds it a very difficult task.

the kidney, or any organ having a natural exit for its products, then the morbid matter passes out thus. If the process is in bone or in lymphatic glands, or in any locality from which the nearest way outwards is through the skin, then we may have abscesses and a discharge of matter therefrom. To us this is a feature of disease. To the bacillus it is a phase in the cycle of its life. These discharges carry out bacilli and their spores; and these bacilli and their spores maintain the stock of infecting material outside the animal body upon which the continuance of the tubercle-bacillus as an individual and of tuberculosis as a disease depends.

What are the conditions which favour the continued vitality of the bacillus, and preserve the potential activity of its spores outside the animal body?<sup>1</sup> Although the bacillus will not grow, excepting under the conditions of heat and moisture described, it is not killed either by natural cold or heat, or by drying. It is, indeed, one of the hardiest of all disease-producing germs. Freezing has no effect. It resists putrefaction for weeks, and endures in the dry state for months. The greater stability in resisting natural agents and conditions to which other germs speedily succumb is, no doubt, compensatory for the characteristics of parasitism and slow growth. If the bacillus, being unable to grow anywhere but inside a warm-blooded animal, were also unable to survive outside, it would be exterminated. On the other hand, from the animal's point of view, the extremely sluggish growth of the bacillus, and its inability to grow outside, in a measure countervails its tenacity of life, otherwise the animal would be exterminated. Still, in spite of this tenacity of life, the combination of hostile conditions outside the animal body ultimately proves fatal to the bacillus. Direct sunlight will kill the bacillus in a few minutes, and ordinary daylight in a few days, whether it be exposed naked in cultures, or in sputum or in dust, and in each case free flowing air makes the light more active. The converse of these conditions—darkness and stagnant air—favour the bacillus.

#### TUBERCULOSIS IN MAN.

Hitherto we have dealt with tuberculosis in its general sense, without reference to the species of the animal in which it is found, or the locality of the body where it is seated. In harmony with the general law of life, the bacillus is varied by the soil in which it grows, and the disease to which it gives rise derives characteristics both as to locality and nature from

<sup>1</sup> It is impossible to speak separately of the bacilli and their spores. Observations and experiments really refer to the loss or the retention of the property of infectivity.

the physiological idiosyncrasies of the species. For these reasons, and since it is in man that we are *directly* interested, we shall now consider specially *tuberculosis in man*.

Putting aside, as of no practical importance, the very rare case of inheritance of the bacillus, man, like other animals, suffers from tuberculosis only when he receives the bacillus from without. Putting also aside, as of no great practical importance from a sanitary aspect, cases which arise from direct inoculation by wounds or through scratches and other ruptures of the integrity of the skin, it may be said that the bacillus always enters by the mouth, that it is either inhaled or swallowed, that it is conveyed either in the air or the food, that it enters either by the lungs or the alimentary canal, or stops short in the structures in and adjacent to the mouth.

Every bacillus and spore thus inhaled or swallowed must have been produced in an animal, not merely derived from or descended from a bacillus or spore produced in an animal, but must itself have passed out from a diseased animal or been included in the flesh derived from a diseased animal.

Tuberculosis in man is therefore caused by infection either (1) through the excretions or discharges from infected animals, including man himself, or (2) the milk of infected animals, including his own species, or (3) the flesh of infected animals.

#### INFECTION BY SPUTUM AND OTHER DISCHARGES.

There is a remarkable consensus of opinion that persons suffering from Phthisis or Consumption of the Lungs are the largest contributors to the stock of what the Memorialists very aptly call the "floating infection" which exists in the environs of men. Physicians, bacteriologists, and pathologists, each reasoning on the line of the facts best known to them, concentrate upon this opinion. The hygienist sees no reason to dispute it. Nearly three-fourths of the deaths ascribed to tuberculosis are caused by Consumption.<sup>1</sup> Though the bacillus may reach the lungs by other paths than by the air, still the infection which establishes tuberculosis in the lungs and air passages is generally air-borne. Phthisis is the most frequent cause of Phthisis. It is a sufficient cause. Phthisical persons are to be found in every place and in every condition and position in which healthy persons are to be found. Everywhere, therefore, tubercle-bacilli may be distributed. For this reason, while all that has been said as to the discharge of bacilli in tuberculosis generally is correct, Phthisis has been regarded by all authorities who have taken special steps for the prevention of tuberculosis as either pre-eminently or alone among all

<sup>1</sup>In Glasgow, 1890-94, exactly 73 per cent.

its forms demanding precautionary measures. It is necessary, therefore, to inquire how exactly the bacillus is discharged and distributed from a case of Phthisis? in what sense Phthisis is and in what sense it is not infectious?—for a knowledge of the latter is of as much importance as of the former. If we understand how Phthisis becomes dangerous, we shall also understand the nature of the risks arising from tuberculosis generally.

Koch, in that section of his work entitled "The Relations of the Tubercle Bacillus to the Etiology of Tuberculosis," by the exercise of that imagination, combined with close reasoning, which enables the man of science to follow his discoveries to the verge of their consequences, describes the whole phenomena of infection in Phthisis. His conclusions have been very ably established upon a firm basis of experiment by Dr. George Cornet,<sup>1</sup> whose paper is a remarkable example of lucid experimental reasoning, and has been everywhere, with or without acknowledgment, followed in the instructions for popular distribution issued by health authorities, and in their general preventive measures. Professor Heller's report upon the whole subject and recommendations, endorsed by the German Public Health Association, has been followed by the administration of Berlin.<sup>2</sup>

The tubercle bacillus is not "ubiquitous." It haunts the vicinity of the consumptive. It is not in the expired air. It is not in the cutaneous exhalations. It abounds in the sputum. It abounds in the dust of the apartment. It is a well-known physical law that fluid or moist surfaces will not part with solid particles by evaporation or to a current of air. Hence the absence of bacilli in the expired air, and hence they are likewise imprisoned in the sputum. Even particles of sputum sprayed into the air by the violence of coughing, being gross, subside at once, and could only infect if coughed into the face of some one, and mixed with the actually in-going air. In order to be air-borne, the sputum must be dried and broken up into dust. If discharged into a handkerchief, it speedily dries, especially if it is put into the pocket or beneath the pillow. In the last stages of consumption the patient becomes weak, the sputum is expelled imperfectly, pillows, sheets,

<sup>1</sup>Two papers published in the *Zeitschrift für Hygiene*, November, 1888, and April, 1889, and issued, with additions, under the title, "Ueber Tuberculose—die Verbreitung der Tuberkel-bacillen ausserhalb des Körpers, &c.," 1890. Cornet's experiments constitute his entire claim to merit. His master, Koch, had outlined his whole doctrine, and even the details of his prophylaxis are anticipated in a singularly lucid and practical paper by Dr. Richard, "De la Transmission de la Tuberculose par les objet de literie, tapis, tentures, &c."—*Revue d'Hygiene*, 1886, p. 305.

<sup>2</sup>*Deutsche Vierteljahrschrift für öffentliche Gesundheitspflege*, 1890.

handkerchiefs are soiled. If a male, the beard or moustache is smeared. Even in the hands of the cleanly, without special precautions, such circumstances all tend to the production around the patient of a halo of infected dust maintained by every process of bedmaking, or of cleaning which includes the pernicious process happily described as "dusting." In the hands of the careless and the dirty, the infectivity is, of course, greatly aggravated. It attains its maximum of intensity where the filthy habit of spitting on the floor prevails, especially if it is carpeted.

The remedy is simply to spit into a spittoon containing a little water; and when a handkerchief must be used, to see that it never dries. Immerse it in water, and ultimately boil it. Better still, use a piece of cloth or paper, and burn it at once. Cornet found that where the spittoon was used, and cleanly habits prevailed, there were no bacilli in the dust; where handkerchiefs were used, even though there was no spitting on the floor, there the dust was infective.

This is the golden rule in dealing not only with sputum but with *all* forms of tuberculous discharge, with the *faeces* when they are infected, the pus from tuberculous sores and abscesses, &c. *Keep them moist.* Especially do not allow any soiled linen or dressings to lie about and dry. Make it impossible for the discharges to pass into the condition of dust.

It is not merely the dried substance of the discharge which determines the bulk of the danger. All dust must be regarded as suspicious in the neighbourhood of consumptives. If there is any infection at all about, it is there. The ordinary constituents of dust—the fibres of linen and cotton, the shreds of wool—all act as rafts on which the infective germs are borne about, and with which they rise when disturbed.

The infected dust in apartments occupied or frequented without precautions by consumptives will subside indiscriminately upon any exposed surface, and may thus ultimately be swallowed, *e.g.* upon plates, cups, glasses, basins, &c., viands of all kinds and fluids, such as milk or water. The latter are the most dangerous. They present more or less moist surfaces. No dust which falls on them can be blown away again, nor can they be cleaned.

The first person to suffer from carelessness with reference to sputum is the patient. He breathes an infected atmosphere, and in the struggle which is going on between his tissues and the bacillus, the latter is constantly reinforced, fresh territory is invaded, and the chance of recovery is destroyed. Auto-infection is one of the unavoidable risks of Phthisis. The chances of this occurring ought not to be knowingly increased. The use or misuse of handkerchiefs, and swallowing the

sputum, are both likely occasions. These facts bring the precautions necessary in the public interest within the scope of the duties of the private physician in the treatment of a case of Phthisis.

#### INFECTION BY MILK AND FLESH.

The other sources from which man may derive the infecting bacillus are the milk and the flesh of diseased animals. That infection through the stomach is possible, we know from the observed effect upon consumptives of swallowing their sputum, and from experiments with animals. The process of cooking tends to diminish the risk; but in the case of milk, there is no such safeguard interposed, owing to the habit of the country to consume it raw. The primary seat of tuberculosis in children is so frequently in the bowels and their related glands, and milk forms so large and essential an element in the food of children, that we cannot avoid the conclusion that it is to them a frequent source of infection. Indeed, no less an authority than Dr. Sims Woodhead has recently very forcibly protested against the tendency to lose sight of infection by food, and especially milk, in the prominence given to infection through the lungs. He points out not merely the frequency of primary abdominal infection, but the occurrence of pulmonary infection, which is secondary to and derived from an abdominal infection, or which may even be coincident with that infection. In children, more especially, even pulmonary Phthisis does not necessarily mean inhaled infection.<sup>1</sup> In the recent report of the Royal Commission "On the Effect of Food derived from Tuberculous Animals on Human Health," we are told that, when the udder of the cow is infected, "the milk possesses a virulence which can only be described as extraordinary"; that "the spread of tubercle in the udder goes on with most alarming rapidity," so much so, that in the intervals of a fortnightly inspection it may develop; that when occasion has arisen to slaughter all the milch cows in town dairies, under the Contagious Diseases (Animals) Act, 40 per cent. have been found to be tuberculous, and that the statistics of slaughter-houses show that a very large percentage of all cows sent there are tuberculous.<sup>2</sup> There is ample room for public interference to prevent the spread of tuberculosis by meat and milk, but, above all, by milk.

<sup>1</sup>"Channels of Infection in Tuberculosis."—*Lancet*, 27th October, 1894.

<sup>2</sup>In *The Veterinarian* for August, 1895, it is stated that in a herd of 95 dairy cows tested with tuberculin, 71 were found to be tuberculous. They were sent to market and sold!

## THE CONDITIONS WHICH CONTROL INFECTION.

Although without the bacillus there can be no tuberculosis, we cannot call it the sole cause of the infection in the individual case. The theory of infection has a profound influence upon the practical aspects of prevention. So long as we believe that infection is guided from person to person by supernatural agency, without regard to physical laws, we can do nothing. When we advance to the conception that the infecting element is material, and subject to physical laws, we have taken a great stride towards precision, both in preventing and curing the disease. As we ascertain that the element is solid, then that it is organic, we become more precise, until with the knowledge that infection passes with the body of a microbe, a minute living being, we are ushered into the study of those complicated conditions which surround the maintenance and development of life.

We have already learned something of the restrictions imposed upon the tubercle-bacillus by some of those conditions. It can grow only within warm-blooded animals. It retains *vitality* with considerable tenacity outside the body, especially when dried, but sunlight, free air, and other natural agents, which first kill and then disintegrate, wage steady war against it. In the long run, therefore, only a fraction of the total quantity of infecting material survives until it has the opportunity to infect.

When at last the bacillus reaches its natural habitat, disease is not necessarily caused thereby. In other words, but a small proportion of all who are exposed to infection, who actually inhale or swallow the bacillus, are infected. Every breath we inhale is loaded with particles of all kinds, organic and inorganic, dead or possessing the potency of life. A large proportion of this microscopic dust is caught in the nasal passages in the case of nose-breathers. Tubercle-bacilli have been found in the discharge from the noses of the attendants in wards occupied by consumptives. The moist lining of the air-passages catches the dust which passes the nose. The breath we exhale is optically pure. There are arrangements for expelling such particles—for scavenging the air-passages. If there were not, our windpipes would get choked as surely as unswept chimneys. What may be called local health is more important as a protection from the tubercle-bacillus than any other of the species of disease-germs, especially the integrity and vigour of the organs by which it enters the body. The bacillus is slow to develop, therefore there is a longer interval for its expulsion; but any catarrh, however local, anything which interposes a mechanical obstruction, or weakens the expelling

power, or hampers the movements of the lungs, or provides crevices as resting-places, interferes with the expulsion of the bacillus, as of every other sort of foreign matter. In like manner, any impairment of the functions or integrity of the stomach or bowels favours infection; but inasmuch as the business of the stomach is to resolve and break up, and its acid juice is inimical, while in the bowels there are swarms of competing microbes, and the struggle for life is keen, the bacillus is more likely to perish in these regions. Still, anything of the nature of indigestion or local irritation may give the microbe a chance.

These are all obstacles to entrance within the substance of the tissues, for, as has already been said, the tubercle-bacillus is no more inside the body after it has passed the portal of the mouth than when it is floating in the dust of the air or in the milk of a tuberculous cow. It is nearer, but *there has been no infection*. When it has effected a lodgment in the tissues, the production of disease depends upon the defeat of the antagonistic forces which surround it. These amount to nothing more than constitutional vigour—tissue-health. A condition of perfect health is one of insusceptibility. In this condition the juices of the tissues are poisonous to microbic life, and their cells active agents of destruction. Depression of vital resistance by disease, debauchery, fatigue, want, even by mental causes, induces susceptibility. Susceptibility may be constitutional, and may be so great and so marked as to amount to a predisposition. This it is which passes by inheritance, and, until the discovery of the bacillus, was regarded as hereditary tuberculosis. It is not the disease which is inherited. It is the pre-disposition—the feeble constitution, the low vitality, the *tout ensemble* of conditions, some of which are recondite and imperfectly understood, some obvious and capable of specification and comprehension. The outcome is a soil so congenial as to accept a delicate infection, from which the majority of mankind emerges absolutely scatheless; a soil which sustains and propagates the bacillus so vigorously that to popular observation the disease seems to be inherited. In such a person a blow or a sprain, a cold or sore throat, determines the local incidence. Nothing shows the reality of the antagonistic forces with which healthy animal tissues are endowed more strikingly than the numerous recoveries which take place, especially from pulmonary infection. In such cases there has been some temporary local susceptibility; but the vital forces have rallied, have invested the detachments of invaders, have cut off their convoys and scouts, and ultimately starved them out. The fact is undoubted. There is nothing in the world to accomplish this result but the native forces of

the tissues. The phrase sounds rather mystical and metaphorical; but the forces are real, and may very confidently be trusted as most important allies in any general campaign against tuberculosis.

In such a contest as that which we have depicted, and alike in both stages, the number of bacilli engaged must obviously have an important relation to the result. It is impossible to express oneself without appealing to the analogies of warfare. In the stage of endeavour to obtain a footing, numbers must tell as effectively as in storming a breach; in the stage of maintaining a footing, as effectively as in the resistance of a garrison or the progress of an invasion. This introduces the all-important preventive doctrine of dilution. Infection is fifty times more likely to occur if there are fifty bacilli in each breath of air or pint of milk than if there is but one. Disease is ten times more likely to occur if the tissues are successfully invaded by ten bacilli at once than if by only one. Apart, therefore, altogether from the wholesomeness of ventilation and the vital energy imparted thereby, the merely mechanical effect of diluting or reducing the concentration of infective germs in air has an important protective and preventive power.

So much for infection in the light of the habits of the bacillus, but what we see is a diseased person—a case of consumption, for example. What has been the result of clinical observation as to the evidence of infection? A disease may be so obviously infectious that no one doubts it. No specific organism may ever have been discovered, yet the universal testimony may concur, as, for example, in the case of Typhus. In Southern Europe, Consumption has always been regarded as infectious. In the Western Highlands a similar belief prevails, but it does not extend to ordinary social intercourse. Sleeping in the same bed or wearing the clothes of consumptives are avoided.<sup>1</sup> Detached observations of what were regarded as actual instances of infection have been recorded, but their very paucity is an evidence that, if there be infection, it must be effective under very special and extraordinary conditions. Yet it is astonishing how seldom one finds any satisfactory account of the conditions which predominate over all others—the hygienic. One records a case of marital infection, another a case of marital non-infection. We wish to know (1) whether the parties slept in the same bed, or in same room, or entirely apart; (2) whether they slept in a "box-bed," whether the bedroom measured 10 ft. by 10 ft. by 8 ft. or 20 ft. by 20 ft. by 12 ft., or what; (3) about its insolation and its ventilation. We may have a positive

<sup>1</sup> Dr. Roger M'Neil, M.O.H. for Argyllshire is my authority.

statement on the first point, but not always. As to the other and similar hygienic factors, rarely is a word said; and if there is, it is a mere general impression or vague allusion. Perhaps the most systematic attempt ever made to collect clinical evidence of infection from Phthisis was that of the Collective Investigation Committee of the British Medical Association in 1883. Circulars were issued to the profession. Only 1078 replies were received, and of these 673 contained a simple negative, and only 261 were affirmative. Unfortunately, the circular issued specifically asked for information about almost everything but the hygienic circumstances. The interest and importance of such an inquiry centre in the conditions surrounding both positive and negative observations. No one doubts that Consumption is communicable—or infectious, if you will—but it is obvious it can only be under very peculiar conditions. The very paucity and uncertainty of the replies to this appeal to the medical profession are an evidence of that. Still, a considerable number of the observers refer to ventilation, and we get such replies as the following:—A practitioner (166) who had noted five cases of apparent infection adds, "In all the above cases the patients lived in small, confined houses, and slept in the 'box-beds' in use in Scotland. During 25 years I have not seen one case of contagion in the airy houses of the well-to-do." Another (168) records case of brother, sister, mother, father dying in this order, but he adds, "Family well-to-do, but they displayed great ignorance of ventilation. Children slept in an attic with an immovable skylight, and no fire-place or other means of ventilation. So morbid was the fear of draughts that the windows were hardly ever opened, and the atmosphere inside the whole house was most oppressive and stifling." We note such remarks as these in other cases—(169) "There was, no doubt, overcrowding in this house"; (172) "A. W. slept with his brother in a concealed bed in a badly-ventilated room for several months after his brother took ill"; (176) "in two other cases the houses were very badly ventilated"; (193) "living in same ill-ventilated room"; (194) "the house, consisting of two rooms and an attic, and lying under the brow of a hill on its northern aspect, was ill ventilated and worse lighted"; (201) "her daughter who slept in the same close, badly-ventilated room." An army surgeon gives the following sagacious answer:—(304) "I have no recollection of any particular case caught by contagion at present. Phthisical diseases have, during the course of my service as military surgeon, much diminished in barracks at home since increased cubic space, ventilation, and light were given to barrack rooms." In the great majority of the cases of apparent infection quoted, the parties were either husband and

wife,<sup>1</sup> or in relationship so far similar as to occupy the same bed or room. In the occurrence of consecutive illness, even in such highly-favourable circumstances, the determining influence of conditions is apparent. On the one hand, many practitioners state that they have never seen marital infection; on the other, among the cases quoted by those who have, although, as we have already said, no special remarks had been asked on that head, we get such glimpses of the hygienic conditions as these—(6) "The bedroom was small, low, and miserable, about 12 ft. by 8"; (9) "their rooms were very close and warm"; (33) "the room in which they lived was badly ventilated"; (41) "it is only right to mention that the room in which the young couple lived was on the ground floor and damp"; (43) "this is but one instance out of several in which I was much impressed with the apparent communicability of phthisis as from person to person. They were all cases among cottagers where the rooms were small, the ventilation bad, the food scanty, and the soil clay—conditions conducive to the development of phthisis under any circumstances"; (53) "the house they lived in was very small, ill-ventilated, and in a close, poor neighbourhood"; (54) "the wives were exposed to bad hygienic conditions, and took no due precautionary measures, seldom breathing pure air"; (81) "slept in the same bed in a small, unventilated room"; (100) "communicated from husband to wife—latter nursed former almost constantly in small, overheated, badly-ventilated room"; (153) "I have for the last 20 years held that tubercular phthisis is infective as from husband to wife when sleeping together in ill-aired rooms." The conclusion of the Committee which reported upon the whole inquiry was this—"One fact these returns seem to establish beyond any question, and that is, that if phthisis is a communicable disease, it is so only under circumstances and conditions of extremely close personal intimacy, such as persons sharing the same bed or the same room, or shut up together in numbers in close, ill-ventilated apartments."<sup>2</sup> Appended to Dr. Heron's book, "Evidences of the Communicability of Consumption" (1890), are references to 77 papers, &c., chiefly foreign, recording cases of apparent communication of tuberculosis, but the great majority are cases of accidental inoculation with tuberculous material—sputum, pus, crude tubercle, received by cuts or punctures in *post-mortem* dissections, in operations, &c. The interest of such

<sup>1</sup> 192 out of the 261 cases of a positive nature. Martin (*Revue d'Hygiene*, Vol. VIII., p. 282) states that of 213 cases of apparent infection collected by him, about half were marital.

<sup>2</sup> *The Collective Investigation Record*, edited by Professor Humphrey and Dr. Mahomed, July, 1883, p. 41.

events to local authorities is very slight. No one questions the existence of infectivity in such material, or the possibility of introducing it into the body by cuts or pricks, or by direct application to existing breaches in the skin. To the cases of apparent infection by the lungs, the same remarks apply as to the other series. They nearly all took place under the special condition of sleeping together, and nothing is ever said about the hygienic surroundings. We have no reason to challenge Dr. Heron's summing up—"The whole history of those cases which make up the evidence favouring the view that consumption is a communicable disease goes to show that the essence of the conditions under which infection, not due to inoculation, may take place, is close and prolonged association of a healthy person with a consumptive. There is also good cause for the belief that faulty ventilation is one of the most powerful helpers, if, indeed, it be not the chief helper, in spreading consumption among those who come into close and prolonged contact with tuberculosis" (p. 73). But I entirely deny that one of the "logical consequences" of this evidence is "that every man, woman, and child who is tubercular should at once be removed from all possibility of contact, direct and indirect, with the healthy community" (p. 125).

#### WHAT OUGHT THE LOCAL AUTHORITY TO DO?

In the knowledge of all these facts, what ought the Local Authority to do? The object of the Memorialists is action for "the protection of the community from the infection." Let us first consider infection from man. The suggestions made are very practical. "If the public were authoritatively informed of the harmful nature of all discharges from tuberculous persons, and more particularly from consumption of the lungs, and if they were encouraged to have these discharges rendered innocuous, and also to submit their houses and clothing to disinfection at intervals during the currency of the disease, and again at its close, it is believed that much good would result."

#### IS TUBERCULOSIS AN INFECTIOUS DISEASE?

Now that we have come to the practical issue of this inquiry, it is well at once to raise the question—Is tuberculosis an "infectious disease?" The answer is—Yes and No. It must be apparent from what precedes that, while in the *academic* sense tuberculosis is infectious, in the popular sense it is not. Even in the language of the schools, where words are weighed and meanings are qualified to a nicety, hydrocephalus, although it is tuberculous, cannot in any sense be said to be infectious.



Neither can many forms of tuberculosis of glands, bones, and joints. Until a discharge is established, they cannot be infectious. Indeed, it is doubtful if even those cases of miliary tuberculosis of the lungs which have ended in recovery, in which every deposit has become a gritty particle, ever were infectious, and it is certain that no case of Phthisis is infectious until the expectoration becomes specific. Tuberculosis, therefore, even in an academic sense, is a disease which, though in all cases caused by infection, is not in all cases infectious. There is no other infectious disease of which this can be said. The fact that it is not infectious in the popular sense is of much more importance for our present purpose. The popular idea of an infectious disease is one from which there is no safety save in keeping away from it. Proclaim a disease to be "infectious, and the people will pay no attention to qualifications. It is very natural—don't go near the person, and the conditions of safety need give no trouble! Education makes no difference. The West-end fear of infection is indiscriminating even to absurdity. Enteric Fever, Scarlet Fever, Whooping-cough, Small-pox, all entail the same social ostracism. Belief in the protective influence of revaccination is found to be nothing more than a pious opinion when put to the test of personal conduct in reference to Small-pox. There is already evidence of mischief being done by the indiscriminate attachment of the idea of infection to Phthisis. We have heard of a consulting physician being referred to by a clerk in one of our large warehouses, at the instance of his employers, for an opinion as to the safety of his being permitted to continue in his employment. A distinguished English physician, an authority on Consumption, protesting against the unguarded application of the word "infectious," states that "the result of such teaching is already becoming apparent in many directions. Persons affected with almost any chest disease find it difficult to obtain places as domestic servants. The close ties of family affection are not always strong enough to induce relatives of consumptives to undertake, what is considered to be, the dangerous duty of nursing them. The sites for Consumption hospitals are becoming as difficult to find as those for Fever, and utterly unfounded reports as to the spread of the disease by such institutions are recklessly made, even by medical officers of health."<sup>1</sup> Another practitioner states that he has received from a consumptive patient a note in these words—"Can you tell me whether my disease is infectious to my friends with whom I live? They have been told that it is, and directly I leave one room for another, all the

<sup>1</sup>"On the Limits of Infection by Phthisis," paper by Arthur Ransome, M.D., F.R.S.—*Public Health*, January, 1895.

windows are opened, and such a fumigation goes on that I am beginning to feel myself a terrible nuisance."<sup>1</sup>

There is a substantial excuse for the popular notion of an infectious disease in the fact that the law does not discriminate between one infectious disease and another. The words have a technical meaning, and every disease in the category is within the scope of every provision of the law applicable to infectious disease—compulsory isolation of the living and of the dead, compulsory disinfection, penalties for the use of public vehicles, for appearance in public places, whether streets or buildings, &c., &c. It may be said that the application of these laws is left to the discretion of authorities, which is true; but one has only to study the opinions advanced by some medical officers of health to be convinced that, before placing tuberculosis officially among "infectious diseases," it is necessary to understand quite definitely what is to follow. There is not a single power of interference with the liberty of persons suffering from Small-pox, the application of which to consumptives has not been advocated. Indeed, one cannot avoid contrasting the studied caution and expressed solicitude to protect the consumptive from prejudice, which characterises the application by the original German investigators of their discoveries to prevention, with the rash utterances of many of those who seek to interpret those discoveries elsewhere. Koch himself showed the example in the closing words of his famous treatise, "It seems to me the time has now come to adopt prophylactic measures against tuberculosis. But, owing to the wide distribution of the disease all steps taken against it have to deal with social relations, and it must therefore be carefully considered in what way, and how far, we may proceed without neutralising, by unavoidable disturbances and other disadvantages, the benefit obtained."

Push aside the proposal to extend such demands to everything that can be designated "tuberculosis" as condemned in the utterance. Consider them as applied to Consumption alone. Recall all the representatives of that pale multitude one has known who bore the burden of their infirmity for years, few or many, who did good work in the world, earned honest wages, supported themselves, supported others; all those one has heard of who lived more in the world's eye, who have instructed or entertained mankind, consumptives who have enriched our book-shelves, given us paintings for our walls, and satisfied our ears with music—Keats, with all his golden store of verse; Chopin, tuneful throughout his long decline; Green, heroically toiling over his brilliant histories; Addington Symonds, man

<sup>1</sup>"The Necessity for placing Tubercular Phthisis under control, from another point of view."—Dr. Goodhart, *Medical Magazine*, Vol. I., p. 1099.

of letters to the last; Sir Thomas Watson's nameless "statesman, who served his country well and strenuously" in a life-long illness<sup>1</sup>; the frail, but fruitful, life of Stevenson; all the phthisical patients to whom Sir Andrew Clark preached from his favourite text—" *Labor Vitae rita est*—Work is the life of life," with himself as the example, born of parents who both died of phthisis, and sent to Madeira at 21 to die.<sup>2</sup> They all suffer from an "infectious disease." They are all to be notified by the first physician who sees them. Each is to be "furnished with a card bearing the date of notification," which they are "required to produce on application for disinfectants, &c." and which medical men, wherever they may have to consult a doctor, are to ask for, so that they may not cause unnecessary expense by being reported again, for economy must not be lost sight of.<sup>3</sup> The announcement of the sad diagnosis is to be signalled and proclaimed to the world by a domestic ceremony of purification, conducted by the high priests of the sanitary department, to wipe out all the infection which has followed the unfortunate's pestiferous steps while the taint was yet unrecognised. To put an end to this he must "be thenceforward confined to certain parts of the house," in which the ceremony of purification is to be carried out every two months. They are now known to all men as "consumptive people," and are in future to live up to a code. They must abjure pocket-handkerchiefs; when "attending a workshop, assembly, or church," they must "spit into a hand-glass spittoon," which "may be conveniently attached to the person"; their "eating utensils . . . should be kept separate from all eating utensils of other persons"; their "clothing must be washed separately"; their "bowel discharges should be disinfected."<sup>4</sup> Even this is a compromise to which the sanitary puritan reconciles himself by the prospect of an ideal such as this:—"In the wake of compulsory notification would follow a number of regulations all aiming at stamping out Phthisis [surely a misprint for Phthisics!] These subsequent regulations fall easily into three classes—(1) Prevention of patients with actual Phthisis, or, indeed, with strong hereditary predisposition, from marrying. (2) Prohibition of patients

<sup>1</sup> "Lectures on the Principles and Practice of Physic," 5th Edition, Vol. II. p. 236. The names we specify are those not merely of persons who died of consumption, but who were consumptives all their working lives. They are a mere sample which occurs on the moment.

<sup>2</sup> "The Treatment of Fibroid Lung Disease": a Clinical Lecture.—*Lancet*, 6th January, 1894.

<sup>3</sup> Dr. Niven "On the Prevention of Phthisis."—*Lancet*, 10th August, 1895.

<sup>4</sup> Memorandum of the N. W. Branch of the Society of Medical Officers of Health as to the Prevention of Phthisis or Consumption; also Dr. Niven's Manchester leaflet.

with actual Phthisis from frequenting churches, theatres, railway carriages, tram-cars, or any public places. (3) Disinfection of sputa, habitations, and all things coming in contact with phthisical patients. Isolation of the consumptive."<sup>1</sup>

Let us rapidly run over the various administrative procedures usually applied to infectious diseases, and consider them as applicable to tuberculosis.

#### COMPULSORY NOTIFICATION?

Although this has been frequently recommended in expert reports, and was voted by the Parisian Congress in 1888, and again in 1893, as necessary in reference to tuberculosis in general, the fact is chiefly noteworthy as a warning of the direction in which science, without practical discrimination, is moving. This would cover an enlarged cervical gland, a lupus, a white-swelling, a hydrocephalus, a "cold abscess," every form of local tubercle, as well as a case of Phthisis. The question has in reality, as a rule, resolved itself into a discussion of the propriety of requiring the notification of Consumption. Suffice it to say, that I am not aware of any country or place where this has yet been done. I am not aware of any resolution in favour of compulsory notification having been passed by any body of medical practitioners. On the contrary, the subject has been discussed by the French Academy of Medicine, the College of Physicians of Philadelphia, and the Medical Society of Oldham, with an adverse result. Even the Incorporated Society of Medical Officers of Health of England, when asked to resolve that "tuberculosis should be made a notifiable disease, notifiable under the same Acts, and under similar conditions to such diseases as Scarlet Fever," passed instead a resolution to the effect that they, "while accepting the view that Phthisis is an infective disease, in the prevention of which active hygienic measures should be taken, think it premature to recommend the compulsory notification of a *chronic disease like Phthisis*." At the same time a rider was added encouraging voluntary notification and disinfection.<sup>2</sup>

#### ISOLATION?

Here again it may be mentioned the extremists have proposed that sanitary authorities should provide hospital accommodation for Tuberculosis, but practically the question

<sup>1</sup> "The Necessity for placing Tubercular Phthisis under Control"—Article by Arnold Chaplin, M.B., in the *Medical Magazine*, Vol. I., p. 1022. Exactly the same regimen is strenuously advocated in an article in the *Forum* for February, 1894.

<sup>2</sup> *Public Health*, September, 1893.

is one of providing for Consumption. We must carefully distinguish between the humanitarian and the sanitarian aspect of this question. The conditions which determine infection from Phthisis are, as we have seen, very narrow. With proper precautions, they are obviated merely by sleeping alone. In Small-pox and in Typhus they are so wide as to include almost every case; in Scarlet Fever they are sufficiently wide to make removal to hospital advisable in three-fourths of the cases; and in Enteric Fever in about the same proportion. From the present point of view, the essentially dangerous case of Phthisis is the one which is in the last stage, confined to the house or bed-ridden. When a person in this condition cannot have a bed alone, especially if young children must share it, when the material accessories of the special precautions necessary are wanting, when the conditions are hygienically bad, then removal would, from a preventive aspect, be useful. But this is a task different from any hitherto undertaken by local authorities, and one not to be lightly assumed—to provide, not a hospital for curative purposes, but a shelter for incurables, a "Friendensheim," or "home of peace," a place in which to die without endangering the living. Consumption hospitals, in the ordinary sense, are not open to such cases. I confess to considerable sympathy with the opinion of Dr. Squire,<sup>1</sup> referring to this limited class of cases—"A sanitary district should provide a home for its own advanced consumptives, where the sufferers should be received, without thereby incurring the brand of pauperism; these invalids would thus be prevented from being unwilling dangers to others." At all events, any provision which exists for the treatment of Consumption ought to be patronised by the authorities. These doctrines give them a special interest in consumptives.

#### DISINFECTION?

We already, when asked by medical practitioners, wash and disinfect after fatal cases of Phthisis, but we seldom are asked. The circumstances which require precautions in carrying out the washings of consumptives or other persons having tuberculous discharges are restricted very much in comparison with the ordinary infectious diseases. Indeed, we must avoid creating the impression that the bedding and clothing are necessarily infected. It is not so. They seldom are infected. It is the helplessness or carelessness of the patient which leads to infection of his garments, &c. Here again the advanced case, the fatal case, is the dangerous one; so that it would be well that washing and disinfection should, *always after death*,

<sup>1</sup> "The Hygienic Prevention of Consumption," 1893, p. 141

be undertaken by the authorities. If people possess the means of washing properly the clothing of the healthy members of their household, they can also wash the ordinary linen of a consumptive. I see no reason for interference even in the use of a common washing-house. If, however, people have not the requisite accommodation and appliances, if they are untidy and cannot be trusted to carry out any process of washing at all, then it might be carried out by the authorities, each case being considered in view of the circumstances. Whatever danger there is in any case emerges not from mere neighbourhood to or mere touching of articles, or from the act of washing, but from the disturbance of dust when they are dry. The moment they are wet the risk is gone.

#### POPULAR INSTRUCTION?

In Glasgow, for the last twenty years, the Local Authority has caused a paper, couched in simple language, entitled "Hints about the Prevention of Scarlet Fever," to be left at every house in which a case is known to exist. While it would be well to take similar means for the instruction of the people regarding tuberculosis, the dissemination of the knowledge of the facts we have been considering through the mass of the public must depend chiefly upon the medical profession. No doubt, every case of consumption will be made the occasion of some detailed instructions as to the nature of the risks entailed upon the family, and the method of obviating them. But there is room and use for popular instructions applicable to the special risks of consumption and of strumous sores. These might be supplied to public dispensaries, and given there to the appropriate patients; and, no doubt, many practitioners would welcome such papers for the more speedy and certain information of private patients. What ought to be in such pamphlets? We certainly do not wish any exposition of the whole etiology of tuberculosis. We do not wish to call names, and to run the risk of false impressions therefrom. We would meet the occasion of a case of consumption or a case of open tuberculous sores, and state as plainly as might be under what conditions the patients may live in the family, and follow the ordinary intercourses of life, without causing risk to anybody. We would preach the gospel of cleanliness, fresh air, and sunshine, from a new text.

The publication of Cornet's papers on "The Distribution of Tubercle Bacilli outside the Body," in 1888, and "On the Mortality among Nurses and its Causes," in 1889,<sup>1</sup> gave an impetus to preventive measures against tuberculosis, which

<sup>1</sup> *Zeitschrift für Hygiene*, November, 1888; February, 1889.

practically meant against Phthisis. In Prussia instructions were at once issued applicable to all state institutions—hospital, asylums, prisons, &c., and to military hospitals. These official instructions, and others issued by local authorities, especially of continental health resorts, such as San Remo, Meran, &c., were published, so far as then issued, as an appendix to Cornet's reprinted papers in 1890. In America these papers immediately attracted the attention of health authorities. A translation of the most important passages appeared in the Annual Report of the Board of Health of the State of Maine for 1888. At their first session in 1888, the Congress for the Study of Tuberculosis held in Paris resolved that it was expedient to distribute popular instructions as to the sources of infection and the means of combating them. These were drawn up and submitted to the Royal Academy of Medicine, who referred the draft to a commission. In the interval Cornet's first paper appeared, the influence of which was very manifest in the revised draft of next year. In 1889, at the instance of Dr. Niven, Medical Officer of Health of Oldham, a handbill of "Precautions against the Communication of Consumption" was distributed to the inhabitants of that town. Thus, almost at once and simultaneously, Cornet's investigations and eminently practical conclusions led to preventive measures, a part of which always was the instruction of those in charge of consumptive patients. The nature of Cornet's conclusions was such that this was essential. Besides the various documents and the draft codes referred to above, I have before me other leaflets and pamphlets for popular information. A list, with notes on their contents, will be found in the Appendix.<sup>1</sup>

One of the most interesting and instructive incidents in the application of the modern doctrines to the prevention of tuberculosis was the discussion just referred to, which was started before the Academy of Medicine by the code of popular instructions which Verneuil and Villemin had drafted for the Tuberculosis Congress. These gentlemen hoped to obtain for their code the authority of the Academy, but so much diversity of opinion emerged that the draft was remitted to a commission of five, including its authors. A revised code was duly submitted, and, after being discussed at nine several meetings, at which the greatest suspicion was manifested of every phrase which might lead to exaggerated or ill-defined fear of consumptives, the Academy could only be got to agree upon the following simple propositions, in place of the elaborate paper submitted by their commission in five principal and eleven subordinate paragraphs!—

<sup>1</sup> Not reproduced.

"1. Tuberculosis is a parasitic and contagious disease. The microbe, which is the medium of infection, resides especially in the dust produced by the expectoration of consumptives and the pus from tuberculous sores, when dried. Therefore the most certain method of preventing contagion is to destroy the expectoration and pus by boiling water or fire before they become dry.

"2. The parasite is also sometimes found in the milk of tuberculous cows, so that it is prudent not to use milk until it has been boiled, especially if it is for the use of children. The Academy calls the attention of the authorities concerned to the risks imposed by tuberculous persons on communities under their charge, such as schools, barracks, large establishments, and state workshops."<sup>1</sup>

I have already remarked upon the tendency of the disciples of Koch, Cornet, and Heller, especially in this country, to out-Herod Herod in the application of their doctrines. One naturally looks to Cornet himself and to the city where he resides, where, in fact, the bacillus was discovered, and whence nearly all we know of it has been announced to the world, for guidance as to what it is expedient to teach the people as to Consumption, and what it is necessary to require of consumptives by way of precaution for the safety of others. Here are (1) a leaflet which Cornet is in the habit of giving to his patients; (2) a leaflet issued by the Municipal Authorities of Berlin:—

#### I.—CORNET.

##### PROTECTION FROM CONSUMPTION.<sup>2</sup>

"The most destructive disease of the human race is Consumption (Tuberculosis). It carries off a seventh of the population (*sic*). In Germany alone there die yearly of Consumption well nigh 150,000 people.

"It has now been discovered that this disease is caused by the inhalation of a germ, a so-called bacillus. It is infectious, that is, it can be given by any person to another. But neither the breath nor the perspiration of the patient is at all dangerous, as used to be supposed. Infection generally takes place through the spit, and, according to the latest enquiries, especially when the spit is discharged by the consumptive upon the floor or in a handkerchief, where it dries and becomes dust, and some of the swarm of germs contained therein are inhaled by healthy people.

"Many other diseases, such as Diphtheria, Pneumonia, and various forms of Catarrh, may be communicated in a similar way.

<sup>1</sup> *Revue d'Hygiene*, 1890, p. 176. There is a very full *precis* of these discussions in the volumes for 1889 and 1890, which is well worth reading. The draft code may be found at p. 44 of the vol. for 1890.

<sup>2</sup> "Ueber Tuberculose," &c., &c., von Dr. George Cornet, Leipzig, 1890, p. 145.

"Consumptives endanger not only those about them, but themselves, through the drying of their spit, because they again inhale the discharged and dried bacilli, and thus infect hitherto sound parts of their lungs.

"Such infection may be avoided if consumptives, and, indeed, all who have a chronic cough with expectoration, keep this expectoration always moist; if they give up spitting on the floor or into a handkerchief, and always use a spittoon which is emptied down the water-closet.

"Spittoons must be placed wherever it appears necessary, in every enclosed space frequented by men. They ought not to be filled with sand or sawdust, but either left entirely empty or supplied with a very little water. They ought to be at hand in sufficient numbers in every apartment of houses, in workshops and factories, in counting-houses, schools, offices, public places, in corridors and on stairs, so as to give every one a convenient opportunity of observing these injunctions.

"In this way healthy people who have to remain within the same room as consumptives will be almost entirely protected from infection.

"Posters ought to be put up in factories, workplaces, etc., forbidding most strictly spitting upon the floor or into a handkerchief.

"On the street, where spitting can scarcely be prevented, certain other circumstances diminish the risk of infection.

"Let every man, even though suffering from an ordinary cough, discharge his spit, not on the ground, not in a pocket-handkerchief, but always in a spittoon.

"Milk ought, as far as possible, to be used only after boiling, especially by children, invalids, and convalescents.

"By the strict observance of these injunctions, consumptives are made almost harmless to those about them; and all the more that the bacilli can live outside the body only for about six months, it may be hoped that, if these rules are followed out by the sick, Consumption in general will diminish."

## II.—BERLIN.

### MEASURES AGAINST THE SPREAD OF CONSUMPTION.

"Pulmonary and Laryngeal Consumption (Tuberculosis) is communicated to the healthy by means of the tubercle-bacilli contained in the expectoration of the sick, when the spit dries, becomes dust, and is thus inhaled. The discharges from the bowels of such persons may in like manner act injuriously.

"If those matters are rendered harmless, the spread of Consumption is prevented; the healthy are protected from the sick.

"In order to prevent drying and the production of dust, the consumptive, indeed every person who has a cough (people with a cough are often not aware that they are actually coughing up tubercle-bacilli), ought to spit in vessels containing a little water (spittoons of earthenware or glass). No person ought ever to spit upon the floor or into a pocket-handkerchief. For the reception of sputum, spittoons should be placed in the dwellings of all who are ill with a cough, and, indeed, in all houses, on the stair landings, but especially in such buildings and

rooms as are used by the public (hotels, restaurants, places of amusement, meeting-places of all kinds, schools, etc.). These spittoons should be 8 to 10 inches in diameter, 2 inches in height, with smooth slightly inverted edges, made of strong smooth glass, porcelain, earthenware, or enamelled iron, containing water to the depth of half-an-inch or thereby. In places of public resort there should be a clearly legible inscription on the wall—'Spittoon for the use of persons troubled with cough.' The water must be renewed as it evaporates; the spittoons to be emptied down the water-closet, and washed daily with boiling water.

"Cleanliness of all places is the first condition of a successful public health administration; consumptives ought especially to study cleanliness.

"The sitting and sleeping rooms of consumptives ought to be provided with washable curtains, table covers, etc., with no carpets on the floors, or woollen runners on the stairs, and contain as little furniture as possible, with washable, easily removable covers (dusters). Elastic iron garden seats, with washable covers or movable cushions, are the most suitable furniture, and facilitate cleaning and disinfection of the room and its contents. Bedmats should be made of washable jute material.

"Wipe the whole floor of every room over with a damp cloth daily to remove the dust, and even in winter ventilate thoroughly for at least an hour. The room should be thoroughly cleaned weekly, and every three months be disinfected, according to the directions of the Code of 7th February, 1887, prescribing the process of disinfection in epidemic disease. The fulfilment of these instructions, especially the harmless removal of the expectoration, enables the intercourse of the healthy with consumptives to be carried on without scruple, and prevents the spread of this most destructive disease.

"May everybody, according to his circumstances, co-operate to this end."

It is characteristic of all official action in Germany in relation to the person of the consumptive to concentrate attention upon his expectoration. Every detail of injunction, as well as express statement, has the effect of liberating the consumptive from all social disability, so long as he is able to go about, provided he is careful to follow the simplest precautions as to expectoration; and when he is weak and bedridden, provided his attendants take up the rôle as to expectoration and are cleanly as to his other discharges. It is the same in France. Out of the periodic "Congress for the Study of Tuberculosis" sprang a "League for the Prevention of Pulmonary Phthisis and other forms of Tuberculosis," the primary object of which was to educate the people of France by the circulation of popular literature, each member acting as a distributing centre in his own locality. Their first issue was the code of instructions which received such drastic treatment at the hands of the Royal Academy. This was included in a pamphlet of 12 pages, which has been scattered broadcast over France. The code

itself is prefaced by some facts to show the gravity of Phthisis as a cause of ill health and death, and by an exposition of the modern doctrine, in the course of which this sentence is printed in emphatic type :—

“We know further that the consumptive is not in the least dangerous by contact or proximity, that it is neither his body nor his breath which is hurtful, and that we can chat with him for hours, live with him for years, and even sleep in his room and give him the most constant care, without running any serious risk, *provided we take certain precautions*, the chief of which is to collect his expectoration, and not to delay the destruction of his spittle until it becomes dry, and is disseminated as dust into the atmosphere.”

This position is logical and unassailable. If you accept the doctrine as sound, the practice must be conceded as sufficient. Let there be spittoons handy for everybody; don't put your spit of the way of drying and becoming dust; don't anywhere stir up the dust in enclosed places. The remedy is so commonplace that, after reading all that has been written and spoken, and proclaimed and enjoined, when we look at our notes and find nothing but sputum, spittoons, and dust, we are apt to show a little temper, like Naaman when he expected the prophet to hold a solemn function over his leprosy, and he merely told him to go and wash himself. No doubt, the very simplicity of the prescription will constitute the greatest difficulty in the way of its acceptance and observance. To the vulgar a “spittle” is symbolic of all that is insignificant and contemptible. To base a cardinal matter of sanitary practice and regulation upon the how, and the when, and the where, people are to spit, requires some moral courage. Only a clear apprehension of, and firm belief in, the doctrine that practically Consumption is communicable through dried expectoration, and nothing else, will save the practice from ridicule.

How far it is to be explained by the fear of this—how far by the imposition of modern doctrines upon the top of the conception of a vague infection, instead of entirely substituting the one for the other—we cannot say; but the fact remains that in this country the advocates of the modern doctrines never seem to regard the consumptive with any more equanimity. They expound the *modus operandi* of infection; they prescribe spittoons and proscribe dust, just as is done on the Continent; but in place of manifesting confidence in the consumptive thus reformed in his habits, as they most expressly do abroad, the tendency here is to exhibit suspicion of him in all his ways. They would surround him with restrictions, and cover him with differential marks, which must make him almost as

conspicuous in society as if he were clad in the grey gown and sounded the clapper of a mediæval leper—

“They curse him in eating, they curse him in drinking,  
They curse him in coughing, in sneezing, in winking.”

The jackdaw of Rheims was not “a penny the worse,” but it would be far otherwise with the poor consumptive. Well may one say, “Show us your faith by your works”; but it is not the logical inconsistency, it is the cruelty, the inexpediency of these restrictions which moves our criticism. They are cruel and inexpedient, because unnecessary. They deprive the consumptive of the very advantage of the modern doctrine to which Cornet never tires of adverting, “The consumptive in himself is almost absolutely harmless, and only becomes harmful through bad habits” (p. 130). Setting out from this proposition, he says, Prophylaxis is therefore simple. No more demands for legislative prohibition of marriage and other absurdities of restriction, which would consign consumptives to an island in the solitary ocean. No more demands for the separation of children from tuberculous parents, for their accommodation in institutions, for abstinence from kissing them,<sup>1</sup> for avoidance of intercourse with consumptives, for exclusion of consumptive workmen from workshops, &c. Cornet thinks such prescriptions about the furnishing of rooms for consumptives as those in the Berlin leaflet, and as to special disinfection of sputum are futile for private houses; the hygienist must endeavour to make his demands consistent with the comforts and habits of civilised life, otherwise his voice will be as that of one crying in the wilderness. This is now possible. Prophylaxis had of late come to a standstill because of its impracticable demands. Koch's discovery, the most fruitful in medicine, seemed to exhaust itself in staining bacilli.<sup>2</sup> In short, Cornet has proved by experimental induction, if ever anything has been proved, that the sputum is practically the only source of infection in Phthisis; that where there is no sputum there is no infection; that the sputum is not infectious unless it dries; that it cannot dry excepting under certain conditions, perfectly easy to be avoided; that if these conditions are avoided, a consumptive is not a source of danger to any one in the ordinary intercourse of society and the home. If this is so, we must say so; and we must not act, or make others act, as if we did not believe it.

<sup>1</sup> He means kissing on the cheek or brow, which he advises in place of osculation.

<sup>2</sup> “Ueber Tuberculose, &c.,” 1890, pp. 130 *et seq.* He recurs to the same subject in his paper, “Die Prophylaxis der Tuberculose, &c.”—*Berliner klin. Woch.*, May, 1895.

## TUBERCULOUS MEAT AND MILK.

The recent Royal Commission on "The Effect of Food derived from Tuberculous Animals on Human Health," as is stated in the Report, was not instructed to inquire into or report on "administrative procedures available for reducing the amount of tuberculous material in the food supplied by animals to man," and consequently authorities must deliberate upon the Report, and come to their own conclusions as to their action. In Glasgow the interest in the Report is rather different. In 1889 we took up a position, and successfully asserted it in Court, regarding tuberculous carcasses. In the Glasgow Police (Amendment) Act, 1890, Sections 26 and 27, we took up a position with reference to tuberculous cows and their milk. Does the Royal Commission support these positions? Owing to the omission in their instructions, the answer can only be reached by argument upon the facts which they report. In my opinion the Report amply confirms our position, both with reference to meat and milk. Unfortunately, the aspect of the meat question put before the Commission was too purely academic. This probably arose from their being precluded from considering administrative issues. A carcass is an article of commerce. If any superficial tubercle is perceptible to the naked eye of the Inspector, he cannot proceed to cut up the carcass into sections to ascertain how far the disease extends into the lymphatics, bones, &c. Every unusual incision depreciates its value. No person would defend the sale of a single visible tubercle as a part of the weight of a pound of meat purchased for human food; but is the butcher to be trusted to carefully dissect out a tuberculous gland if he even cuts it across in helping his customer? He can't do more, for the same reason which prevents the Inspector cutting up a carcass. Hence arise rough rules of practice, which, to begin with, assume that the Inspector sees the viscera *in situ*. They all affect to remove visible tubercles, and assume that there are no invisible deep-seated tubercles. When no viscera are produced, the guess at the general condition of the carcass must be still wilder. All this is exclusive of the more subtle question of localized *v.* generalized tuberculosis (not tubercle), *i.e.* of tuberculosis which consists wholly in fixed nests of bacilli which may be excised, and tuberculosis in which the bacilli are careering through the tissues in the blood and lymph-streams. These practical aspects of the conditions of meat inspection deprive such a statement as this of all weight or importance.

"82. Provided every part that is the seat of tuberculous matter be avoided and destroyed, and provided care be taken to save from

contamination by such matter the actual meat substance of a tuberculous animal, a great deal of meat from animals affected by tuberculosis may be eaten without risk to the consumer."

We turn to the body of the Report, and we find—

"38. We have now to point out the very great difference in one and another part of a tuberculous animal in the amount of tuberculous matter contained in the meat. This matter is found principally in the organs of the animals; as a rule, most abundantly in the lungs, lymphatic glands, serous membranes, but often in the liver, spleen, kidneys, intestines, and other structures. These organs are usually removed by the butcher in 'dressing' the carcass, though some of them may, intentionally or not, be left. To a practised eye it is hardly possible that tuberculous matter in these organs can escape detection, and the importance of its presence there will soon be apparent;

"39. For, in the tissues which go to form the butcher's 'joint,' the material of tubercle is not often found, even where the organs exhibit very advanced or generalized tuberculosis; indeed, in muscle and muscle juice it is very seldom that tubercle-bacilli are to be met with; perhaps they are somewhat more often to be discovered in bone, or in some small lymphatic gland imbedded in inter-muscular fat. *Yet there is always a difficulty in making sure of the absence of tuberculous matter from any part of a carcass that shows evidence of tubercle elsewhere.*"

The practical outcome of all this is, that for experimental purposes you can dissect from a "joint" of a tuberculous animal a bit of "muscular tissue" which contains no crude tubercle, and not even a bacillus; but if the Inspector sees crude tubercle anywhere, he never can be sure where it is not, buried out of sight or smeared by the knife over apparently healthy flesh. The former I call the academic, the latter the practical view of the matter. It is all very well to demonstrate that fragments of meat might be safely salvaged from tuberculous carcasses and restored to the food-resources of the community. Nothing will satisfy the butcher but passing those carcasses on into the market, whole or in normal segments, so that these shall fetch the same price as corresponding portions of a healthy carcass. He objects to the source of this meat being known. To ask him to "exercise sufficient discrimination and care in taking meat from tuberculous cattle" is not business from his point of view, nor, in fact, from any point of view. This must be done by officials, if it is done at all.

There is no need for argument in reference to the milk of tuberculous cows. The facts are so universally accepted and so grave, that the administrative effect shines through them. It is precisely the Glasgow position—that a tuberculous cow must not be retained in a dairy byre (par. 63). There is a

remarkable consensus of opinion as to the influence of milk in disseminating tuberculosis, especially amongst the young. The pathologist finds "that of the total deaths under 10 years of age amongst the mass of the people, about a third are due to tuberculosis,"<sup>1</sup> and that the usual seat of the disease at that age points to food as the medium of infection. The prevalence of tuberculosis among dairy cows is notorious. Experiment shows that when the udder is affected the milk is virulent. Every authority on the prophylaxis of tuberculosis places the supervision of the milk supply next to the regulation of the expectoration of consumptives in importance. I am inclined to think that it is at least of equivalent importance. It certainly is much more practicable as a matter of sanitary administration. If we remember the habits of the tubercle-bacillus, we cannot imagine a more favourable nurture-ground than the typical byre—a dark or badly lighted space, with insufficient ventilating apertures, which are unhesitatingly closed when necessary to maintain a temperature of 60 deg. to 70 deg. F. by the heat of the animals; the air consequently loaded with carbonic acid, with organic impurities and moisture, full of the dust of dried dung, never penetrated by a direct ray of sunlight, in winter never vacated either in country or town for weeks, and in cities never vacated at all.<sup>2</sup> Well may Professor Brown, of the Agricultural Department of the Privy Council, say—"Nothing worse than the insanitary conditions of the life of the average dairy cow can be imagined." The natural result is that dairy stock is ravaged with tuberculosis. Yet we never hear a farmer or a dairyman speak of tuberculosis without speaking of compensation. When he puts windows in his byre, and floods it with light, ventilates it, and ceases to use his cow as a heating apparatus, it will be time enough to speak of compensation. Meanwhile the children of the town are being infected wholesale, and it behoves the authorities, not only to take every means to eliminate tuberculous cows from dairy byres, but to enforce sanitary reform in the construction, use, and condition of byres. Bye-laws as to cubic space, ventilation, lighting, cleanliness, obtain from tuberculosis a direct interest to all men. But yet more is required. The Glasgow Police (Amendment) Act, 1890, contains powers which, if efficiently worked, would weed out tuberculous cows, not only from Glasgow byres, but from any byre from which

<sup>1</sup> "Tuberculosis viewed as an Infectious Disease; its Prevalence and the Frequency of Recovery from it."—Professor Joseph Coats, *Sanitary Journal*, 23rd November, 1891.

<sup>2</sup> See valuable paper by J. MacMillan, M.B., D.Sc., Edinburgh.—"An Investigation into the Condition of the Atmosphere of Cowhouses and Stables in Edinburgh, Leith, and the County of Midlothian."—*Journal of Comparative Pathology and Therapeutics*, 1892.

milk is sent to the city. In Glasgow there are some 1600 cows, of which 40 per cent. are never outside their byres. In 1892-3-4 there were 23, 9, 7 tuberculous cows detected and eliminated by the inspectors; but the method of inspection is thoroughly inefficient. A competent veterinary inspector ought to be at once appointed, who could test with tuberculin the accuracy of the suspicions suggested by his skilled general examination. In this way only can we hope to detect and abolish, as milk-producers, animals which are, no doubt, at this moment contaminating the milk supply of Glasgow. At present our powers are lying dormant. After putting our own house in order, an occasional inspection of the cattle at dairy farms, chosen at random in various parts of the country, would have a most wholesome effect, not limited to the detection of a few unsound animals, but leading up to more stringent bye-laws and better sanitation in country byres. County officials require a little help from the powerful commercial lever which the purchaser of country produce can apply whenever he chooses.

#### GENERAL HYGIENE IN THE PREVENTION OF TUBERCULOSIS.

##### STATISTICS.

In May of this year Cornet read a paper to the Berlin Medical Society on "The Prophylaxis of Tuberculosis and its Results," in which he adduces statistics to prove that a great reduction in the mortality from tuberculosis had followed the adoption of precautions on the lines of his investigations. The new regulations came into force in the spring of 1889 in prisons, lunatic asylums, and hospitals. The paper contains detailed tables, the effect of which may be summarised. In prisons there has been a fall of 54 per cent., in lunatic asylums of 15 per cent., and among the nursing orders of 36 per cent. In the case of the prisons the last year given is 1893, in the case of asylums 1891, and of nurses 1894, so that all this improvement was effected in from 2 to 5 years. Cornet also gives statistics from which we may select two illustrations. In Prussia the mortality from tuberculosis in 1879-83 was 31.5 per 10,000. In 1889-93 it was 26.6, a fall of 16 per cent. in five years. In Saxony the mortality from Consumption in 1879-83 was 24.7. In 1889-93 it was 22.4, a fall of 10 per cent. in five years. In the subsequent discussion, Professor Virchow, while thoroughly supporting Cornet's system, expressed, amid audible signs of approval, his doubts as to the statistics. Regarded as results, these seemed to him essentially too great. Dr. Baer, medical officer to one of the largest penitentiaries, stated that,



coincidentally with the special prophylaxis, great improvements in the general hygienic condition, including increased cubic space and a more liberal dietary, had been introduced. He said, "However powerful prophylaxis may be against the spread of tuberculosis, the diminished mortality from Phthisis in prisons of late years cannot be ascribed to it. Other essentially different hygienic measures of the highest importance have effected that which Dr. Cornet wished to ascribe solely to prophylaxis." Although this drew from him the remark that "salvation was not to be found in the spittoon alone," no other impression could be received from the paper than that which his audience evidently did receive.<sup>1</sup> Yet it is well-known that long before bacilli were heard of, or any idea of attacking Phthisis on the lines of infection had been promulgated, it has yielded extraordinary results to simple hygienic measures: results excelled in the case only of Cholera, Typhus, and Small-pox, even with the help of all the special methods applicable to those diseases, and not equalled in the case of any other infectious disease. The accurate and scrupulous Parkes, in considering the causes of a Phthisis mortality among British troops of 7.86 per 1000 in the 17 years ending in 1846, in contrast with 2.6 in the 22 years ending 1880, says, "There is only one condition which seems capable of explaining it, viz. overcrowding. . . . It is the only condition which has undergone a very decided change both at home and abroad."<sup>2</sup> By giving our soldiers more cubic space and better ventilation, we have reduced the death-rate from Consumption 67 per cent. In 1865 Simon brought into prominence a list of 15 towns in which sanitary works, more particularly the drying of the soil by the laying down of main sewers, had reduced the mortality from Phthisis within periods of time ranging from 3 to 11 years by from 11 to 49 per cent. This was the result of investigations carried out by Buchanan, the gist of which was formulated in the law that "dampness of soil is an important cause of Phthisis to the population living upon the soil."<sup>3</sup> Dr. Janssens, who has made Brussels the centre of light and leading

<sup>1</sup>See paper and discussion in *Berliner Klin. Woch.*, 20th May, 1895. With reference to the exaggerated estimates occasionally made of the number of persons in the community suffering at any one time from Phthisis, it may be well to mention that in this paper Cornet deals with the correct method of estimation in a very satisfactory manner on the basis of the average duration of illness. "The tuberculous person is not so all his life; only the years of his illness are important in relation to infection." He calculates that in Prussia, in 1891-92, one male in 128.5, and one female in 153.3, was tuberculous. Applying these figures to Glasgow in 1894, gives in round numbers 5000 persons suffering from Phthisis. As this disease is distinctly more fatal in Prussia than in Glasgow, this is certainly not an under-estimate.

<sup>2</sup>*Hygiene*, 6th Edition, 1883, p. 607.

<sup>3</sup>Simons' *Public Health Reports*, Vol. II., p. 337.

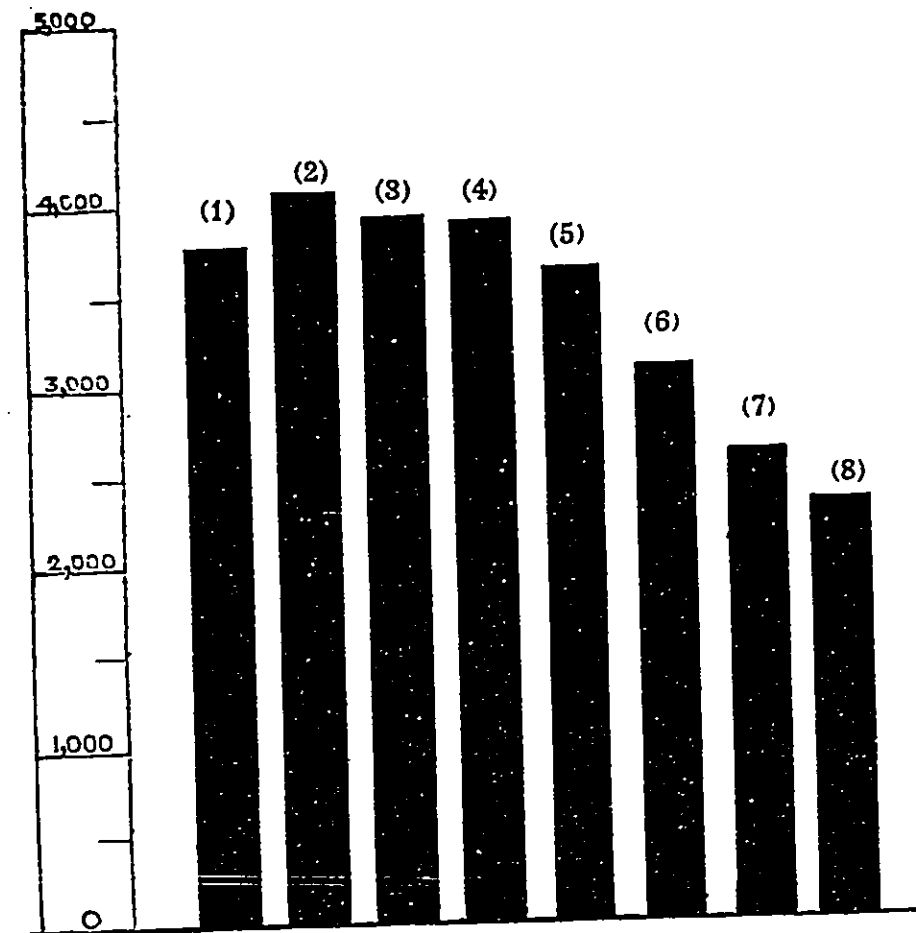
on the Continent as regards practical sanitation, thus introduces to his city the code of "Practical Instructions for the Prevention and Control of Tuberculosis," promulgated by the Belgian Central Council of Public Health this year:—"Doubtless the number of deaths caused by pulmonary tuberculosis is heart-breaking, but let us say at once we may derive from it facts calculated both to comfort us and to give us confidence as to the future, if we contrast separately the successive periods of the interval between 1864 and 1893. As a matter of fact, thanks to the sanitary measures which have revolutionised the hygienic circumstances of our city, and to the increase in the comforts enjoyed by our population during last quarter of a century; thanks also to the organisation of its sanitary department, and to the vigorous application of the hygienic principles on which now both the preventive and curative treatment of tuberculosis is based; thanks, finally, to the preventive treatment first applied by the city in 1874, from which about 3000 of its school children profit, the capital has had the satisfaction of seeing for the last twenty years a remarkable and progressive diminution in the annual mortality from Pulmonary Phthisis." He then states that in the three decennial periods—1864-73, 1874-83, and 1884-93—the death-rate from Consumption in Brussels was 46, 40, and 31 per 10,000. This represents a diminution of 33 per cent. in ten years from general hygienic measures alone.<sup>1</sup>

Glasgow itself affords another equally remarkable illustration of the influence of general hygienic measures upon tuberculosis, as is shown in the following diagram (see p. 562):—

In the period 1860-64 Phthisis reached its highest mortality, 4094 per million. In the period 1890-94 it was 2315, so that in 25 years Consumption has been reduced 44 per cent. in fatality without special treatment as an infectious disease. If we turn to "Zymotics" for the same periods, we find that the combined effect of special efforts and general hygienic measures has been to reduce their fatality 50 per cent. Enteric Fever, which we are told tuberculosis most resembles as an infectious disease, was reduced 60 per cent. The proportion of the total deaths which took place in isolation rose from 7 per cent. to 66, which serves as an index of the extent to which every known special method was pushed. The reduction in Phthisis is very notable even by the side of these figures. Unfortunately, Phthisis is the only form of tuberculosis which has been throughout consistently classified by the Registrar-General as a cause of death. Prior to 1883 there

<sup>1</sup>"Instructions pratiques pour prévenir et combattre la Tuberculose. Rapport par le Docteur E. Janssens, Inspecteur en Chef de la Division d'Hygiène de Bruxelles, 1895." See p. 80 for text of Instructions.

GLASGOW.—DEATH-RATE PER MILLION FROM PHTHISIS IN QUINQUENNIAL PERIODS FOR 40 YEARS, 1855-94.



(1)—1855-59. (2)—1860-64. (3)—1865-69. (4)—1870-74. (5)—1875-79.  
(6)—1880-84. (7)—1885-89. (8)—1890-94.

was a class "*Tubercular Diseases*," comprising "*Scrofula*," "*Tabes Mesenterica*," "*Phthisis*," and "*Hydrocephalus*," but in 1883 these were all transferred to "*Constitutional Diseases*," as "*Tabes Mesenterica*," "*Tubercular Meningitis (Acute Hydrocephalus)*," "*Phthisis*," and "*Other Forms of Tuberculosis, Scrofula*." A table is appended giving the returns for the 40 years as published, but the sequence of the figures shows that after 1882 "*Hydrocephalus*," at any rate, does not represent the same thing; and information confirms what the sequence suggests, viz., that "*Scrofula*" also is not the same. We are, therefore, shut up to the 12 years, 1883-94, for evidence of the movement of tuberculous diseases other than Phthisis. Dividing them into two periods of 6 years, we find that the death-rate from "*Phthisis*" has fallen from 2849 per million to 2316, and from "*Other Tubercular Diseases*" from 1090 per million to 884, in both cases 19 per cent.—a result which quite casts into the shade the improvement in Prussia and Saxony, quoted from Cornet, which he puts to the credit of

special prophylaxis. Clearly, then, we are warranted in asserting that among infectious diseases, tuberculosis is the most amenable of all to general hygienic measures; that, in fact, from these alone as good results are obtained as from hygienic measures plus isolation, disinfection, &c., &c., in the case of diseases popularly known as infectious. It is not implied that special measures directed against the infectivity might not have produced even better results; but in view of what has been accomplished, and in view of the difficulties in the way of special prophylaxis, it is contended that more is to be expected from general hygiene.

#### THE DWELLING AND CONSUMPTION.

We have already gone with some detail into the relation of local and general health to tuberculosis through their influence on the bacillus. Everything within the control of the individual which promotes and maintains soundness of body; everything within the control of the municipality or the State which improves the physical conditions beyond which the individual living in populous communities cannot go, which raises and maintains the standard of public health, comes within the scope of the prevention of tuberculosis. So that, to treat this aspect of prevention in its fulness, would be to write a treatise on private regimen and State medicine. Nevertheless, there are some of the elements of health which tuberculosis marks with special importance.

A copious supply of pure air and distribution of direct and diffused sunlight within and without the dwelling are not only wholesome to man, but are directly fatal to the bacilli distributed outside the animal body. Sunlight is the only disinfectant which sustains the man while it kills the microbe. Therefore, whatever withdraws from the air we breathe impurity of smoke, or dust, or foul exhalation, and from the sky above us that canopy of smoke which reduces our sunshine to twilight; every thing which promotes free motion of air without and within the house; every bye-law which regulates the width of streets, the height of houses, the arrangement of buildings, so as to offer no obstruction to the winds, and to secure as much light and as little shadow in the hours of daylight as possible, which promotes the access of the sun's rays to dwellings, and helps to make the sky visible from the floor of all inhabited rooms, which widens and brightens lobbies and staircases in tenements, which prevents dampness of foundations and walls; every regulation which checks overcrowding both in house and work place, which protects the artificer from irritating dust and fumes and secures to workers of every

degree and kind natural light and pure air in the place of their employment;—all are precautions against tuberculosis. Dr. Thorne Thorne has drawn out what may be called a specification for building a dwelling-house which will promote, and a dwelling-house which will prevent Consumption. Here they are in parallel columns:—

*“Conditions of Dwelling-house tending to the Promotion of Tuberculous Consumption.”*

“1. A soil either (a) naturally damp and cold, or (b) subject to the influence of the rise and fall of a subsoil water lying within a few feet of the surface.

“2. A dwelling-house of which either the foundations, the area they enclose, or the walls are, by reason of faulty construction or otherwise, liable to dampness.

“3. Such immediate surroundings of the dwelling-house as tend to prevent the free movement of air about it, and its ample exposure to the influence of sunlight.

“4. Such structural defects as would prevent the maintenance within all parts of the dwelling-house of ample movement of air by day and night, and free exposure of its habitable rooms to daylight.”

The lungs are like every other organ, their health is promoted by free and full use. Deep inhalation of pure air—especially the open air, the air which is moving freely in the great currents we call winds, which is clarified by sunshine—gives vigour to the lungs, and supplies the heart with well oxygenated blood to be sent throughout the body, increasing the insusceptibility of every tissue. Therefore, every public park, and the flowers and music which attract people thither, every open space and children’s playground, every cricket and football field, every gymnasium and drill-ground, is a precaution against Consumption.

It is remarkable with what unanimity those who have studied Consumption clinically testify that no diseases predispose to it

<sup>1</sup> “The Dwelling-house in Relation to Tuberculous Consumption.”—*The Practitioner*, vol. 46.

*“Conditions of Dwelling-house tending to the Prevention of Tuberculous Consumption.”*

“1. A soil which is dry (a) naturally, or (b) freed by artificial means from the injurious influence of dampness, and of the oscillations of the underlying subsoil water.

“2. A dwelling-house so constructed as to be protected against dampness of site, foundations, and walls.

“3. Such open space on at least two opposite sides of the dwelling-house as shall secure ample movement of air about it, together with its free exposure to the influence of sunlight.

“4. Such construction of the dwelling-house as will secure for its habitable rooms and throughout its interior free movement of air by day and by night, and the free access of daylight.”<sup>1</sup>

more frequently than Enteric Fever, Scarlet Fever, Measles, and Whooping-cough. Enteric Fever produces a profound and long-continued depression of the vitality, which favours the lodgment of the bacillus. If, perchance, tuberculous milk should be given to such patients, who are practically sustained for weeks on milk and nothing else, it certainly would infect. Scarlet Fever, in its severer forms, also reduces constitutional resistance. On the other hand, Measles and Whooping-cough create for the bacillus an opportunity chiefly by their influence on local health, producing debility in the lungs, to which Whooping-cough frequently adds great general exhaustion. It follows from these facts that all hygienic measures which tend to prevent Enteric Fever, and whatever is done to limit the spread and prevent the complications of the infectious diseases of children, are precautions against Consumption.

In combating tuberculosis in the lower animals, hygienic measures bear an equally important part. Indeed, the tuberculosis of animals is begotten of the domestication of animals by man, and the perversity of man in treating them as if fresh air and sunlight were less essential to their health than to his own. The fact is they are more essential. Tuberculosis prevails among the different species in proportion to the extent to which man has, for his purposes, made them denizens of closed spaces; and most of all in the cow, which he has entirely taken possession of, and which he treats as if foul air and darkness were conditions of its being. Dogs and cats also share in the risks of the society of consumptives who are careless in their habits. The improvement of the hygiene of the domestic animals is a precaution against Consumption in man.

#### SUMMARY OF SUGGESTIONS.

1. It is of supreme importance, first of all, to lay in the mind, both of the profession and the public, a broad foundation of positive knowledge. The direct and indirect practical issues of the doctrine of tuberculosis are very various, and can only be effectively worked out through the intelligence of the community. They touch the business of administrative bodies of every kind, not merely municipal, but parochial, charitable, corrective, educational, and others both of a public and private character. They affect the personal habits of a considerable proportion of the citizens, and the duties of those about them, and, in certain circumstances, responsible for them. They concern the health of all. I believe the preceding Report will be accepted by the Memorialists as a fair presentment of their case, and as suggesting a course of administrative action which is, in general, reasonable and adequate. In my opinion, there-

fore, the first thing to be done is to have this Report printed and considered by the Local Authority, who ought, thereafter, to come to some resolution regarding it, and, if the purport of that resolution is favourable *in general* to its contents, then, with this *imprimatur* the Report ought to be sent to every member of the medical profession practising in Glasgow, to the medical officers of all institutions, to all Boards responsible for the regimen of any part of the community (*e.g.*, parochial, school, hospital, reformatory, &c., &c.), and freely to all citizens who lead and guide.

2. The Local Authority ought to resolve that, in the interests of public health, it is necessary that washing and disinfection should be effectively carried out after every death from Pulmonary Consumption, and at the discretion of the Medical Officers in the course of illness from this or any other form of tuberculous disease.

3. In my own opinion, and, I believe, in that of the Memorialists, the importance of taking immediate action in the direction of eliminating tuberculous cows from the dairies, first of all in Glasgow, and next from those sending milk into Glasgow, can scarcely be exaggerated. It is at least equivalent in promise of beneficial results to any part of the special action recommended in this Report. Glasgow is in the unusual position of possessing ready to hand the legal powers to deal with this source of tuberculosis. We cannot take full advantage of these powers without a veterinary expert. Science has provided in tuberculin a test which overcomes that difficulty of diagnosis of tuberculous disease in the living animal which has hitherto made professional opinion uncertain or only equivalent to suspicion, and therefore insufficient to support decisive action. This test can be systematically applied only by a specially qualified veterinary surgeon.

4. These are the most urgent and important parts of the action which may be taken by the Local Authority consequent upon this Report. As regards *popular instruction*, the first step is taken by the wide dissemination of the Report itself. The further step of issuing popular leaflets to be systematically distributed from house to house, and otherwise put into the hands of those responsible for the care of the sick, may be remitted to the Medical Officers to be taken in due course. It will be judicious to delay for a few months, so as to derive from the general attitude of the medical profession and the public, some guidance as to the scope and general character which it may be expedient to give to those popular directions.

5. It is scarcely necessary to point out that many departments of municipal management ought to be inspired with renewed energy, and to receive increased precision of direction,

each in its own special work, from this doctrine of tuberculosis, *e.g.*—

*The Committee on Health*, in the application of general and local powers to the suppression of damp, dark dwelling-houses; to the dissemination of light and air within and around tenements and workplaces, whether factories, workshops, warehouses, counting-houses, or offices; in the enforcement of ventilation, light, and cleanliness in byres; in the provision of open spaces and play places convenient to tenements.

*The Magistrates Committee*, in the suppression of smoke, and the energetic application of the law in all cases relating to overcrowding, cleanliness of the house, and other matters of domestic police, which, if not associated in the judicial mind with some large principle, are apt to sink to the rank of petty details, rather vexatious than otherwise.

*The Parks and Galleries Committee*, in the support they derive for the conviction that their parks are only useful in proportion as they are used, and that therefore they must be made attractive, and that the same attractions will not draw every class in the community. Flowers are wanted for some, music for others, but always space for the young. The youthful instinct to play and sport is accessory to growth and development, and this Committee may, by providing suitable space for the gratification of that instinct, powerfully aid in building up strong resistant constitutions in the youth of Glasgow.

*The Committee on Sewage Works* will see more clearly a hygienic sanction for their function in the prospect of sweetening the air, and transforming the Clyde from an offensive, repulsive sewer into an attractive water-way, on which he that fares will find wholesome food for his lungs, and which will be a temptation to one of the most useful recreations for developing their capacity, and thus raising the vital standard of the whole body.

*The Committee on Tramways* may find moral courage to enforce their bye-laws against spitting "in or upon any car," which, in fact, means to compel the male sex to refrain, for hygienic reasons, from doing that which the female sex, from a sense of propriety, never does.

*The Dean of Guild Court* will recognise the profound importance of its functions in the rigid enforcement of every item of the provisions of the law which virtually determine the health of the future in so far as it depends upon a dry foundation and walls, and upon the distribution of light and the free movement of the air in and around the dwelling, and not only there, but wherever human beings are employed in earning their bread.

6. The practical issues of this doctrine of tuberculosis, as regards the individual and the family, in matters which can only be touched by private effort, actuated by the growth of intelligence, are many and various, and must be trusted to the evolution of thought in the process of time. How to deal with *domestic dust* is, perhaps, the most important of these issues. It is to be desired that women should understand the importance of dust in the causation of Consumption, and should devise methods of dealing with dust which will end in its collection and destruction, not merely in its disturbance and redistribution. Tuberculosis confers hitherto unimagined dignity on tea-leaves! Not merely as housewives, but as sick nurses, women ought to study these modern doctrines.

MEMORIAL PRESENTED BY THE MEDICO-CHIRURGICAL SOCIETY OF GLASGOW TO THE COMMITTEE ON HEALTH, 25TH JANUARY, 1892.

TO THE HONOURABLE THE LORD PROVOST, THE MAGISTRATES AND COUNCIL OF THE CITY AND ROYAL BURGH OF GLASGOW, AS THE POLICE COMMISSIONERS THEREOF.

#### INFECTIOUSNESS OF TUBERCULOSIS.

The Medico-Chirurgical Society of Glasgow, a body consisting of over two hundred members, mostly Practitioners in the West of Scotland, held a discussion, and arrived at the following Resolution, at a meeting on the 18th December, 1891:—

“That a Memorial be presented to the Town Council of Glasgow, calling their attention to the fact that tuberculosis is now fully recognised as an infectious disease, and asking them to take the matter into their serious consideration, with a view to the protection of the community from the infection.”

A Committee was afterwards appointed to frame such a Memorial as would serve to indicate with somewhat more of detail the views and objects aimed at in the Resolution. We beg, accordingly, to submit to your Lordship, and to the Magistrates and the Town Council, the following considerations:—

1. Tuberculosis is an infectious disease, in the sense that in all cases of this disease the one constant and necessary element in the causation is a microbe. This microbe grows and multiplies in the bodies of certain animals and of man when introduced from without, and in so doing it produces an intensely active poison, which is the more direct agent in bringing about the morbid changes in the living structures. There are, doubtless, other elements in the causation, such as inherited and

acquired susceptibility, but the microbe is the only essential and constant one, and there is evidence to show that, without any special susceptibility, it may produce the disease if introduced in sufficient quantity.

2. As the microbe will not grow except at a temperature almost identical with that of the body, the living bodies of men and animals affected are the great propagating places of it. They are the sources of the supply, and constitute the centres from which the infection is derived. But the microbe is not retained in the bodies of the persons affected. Most of the forms of tuberculosis are characterised by discharges of matter from the affected parts of the body, and these discharges contain the microbe—often in very large quantities. The most frequent form of tuberculosis is Consumption of the Lungs, and persons affected with this disease almost constantly spit up matter which is loaded with the infective microbe. The spit of such persons when dry is liable to be pulverised into fine dust, and this, in its dissemination, carries the still living microbe with it.

3. It is believed that tuberculosis is fairly to be compared, as regards its infectious quality, if not with Typhus and Small-pox, at least with Typhoid or Enteric Fever, although the mode and channel of the infection may be so different as to make it much less obviously dangerous to live in the same house or room with a case of Consumption than it would be in the case of one of the well-known contagious fevers. Tuberculosis, however, is much more disastrous in its results than all the other infectious diseases put together. According to the Annual Report of the Registrar-General for 1888, the deaths registered as due to tuberculosis in Glasgow numbered 1824, and those assigned to all other miasmatic, that is, infectious diseases, including Measles, Scarlet Fever, Whooping-cough, &c., were 1089. For reasons known to us, it seems certain that the mortality from tuberculosis considerably exceeds that which appears in the Registrar-General's returns, but even these figures are sufficiently striking. The deaths registered as tuberculous made up 15.5 per cent. of the total deaths in Glasgow in 1888. These facts imply a large amount of what may be called “floating infection” in our midst.

4. The Town Council, by its action in prohibiting the sale of tuberculous meat and milk has, in our opinion, very properly endeavoured to grapple with one source of the infection. It may be said that the great prevalence of tuberculosis in cattle, especially in milk cows kept in town byres, and therefore both more likely to be infected with tuberculosis, and to become, in turn, sources of infection through their milk, has justly been already considered by the authorities. We recognise the

wisdom of a policy having for its object the removal of this source of infection, which is dangerous for man as well as for animals. It should be possible, by rigid cleansing and disinfecting of byres, and by the condemnation of all carcasses or animals known to be tuberculous, to stop this source of infection.

5. It is not for us to prescribe the mode in which the infection should be dealt with in the case of man. The Council has skilled officials whom it can consult on the matter. But we venture to suggest that a beginning should be made with a definite attempt to stay the infection. If the public were authoritatively informed of the harmful nature of all discharges from tuberculous persons, and more particularly from cases of Consumption of the Lungs, and if they were encouraged to have these discharges rendered innocuous, and also to submit their houses and clothing to disinfection at intervals during the currency of the disease, and again at its close, it is believed that much good would result. With the splendid sanitary organisation which Glasgow possesses, it should be possible to do much to cleanse our city from some of the principal causes of the widespread prevalence of this, its greatest plague.

ON BEHALF OF THE SOCIETY,

JOSEPH COATS, M.D., *President.*  
 W. T. GAIRDNER, M.D.  
 HUGH THOMSON, M.D.  
 JOHN LINDSAY STEVEN, M.D.  
 CHARLES WORKMAN, M.D.  
 J. WALKER DOWNIE, M.D., *Secretary.*

## CHAPTER XI.

### ON DISINFECTION.<sup>1</sup>

GENTLEMEN,—First let me explain the scope of this paper. I have dropped from the title the subject of Infection, and confine myself to Disinfection, which affords material enough. I have read pretty well all that has been written about disinfection—both theoretical, or experimental, and practical. I am familiar with the various so-called disinfectants and disinfectors as placed in the market, and pressed by travellers and advertisements upon the public. I have had a large experience of the practical difficulties in the way of the effective use, even of genuine disinfectants, in detail, in private or on the largest scale in public operations. I do not pretend to treat my subject scientifically. I propose to submit merely a few general conclusions which, during the observation and direction of the practice of disinfection in an extensive field for a good many years, have grown up in my mind. They are only the formulated impressions left by the multitude of facts which pass under the eye of a busy man, whose first duty is to get through a vast amount of daily work, and who has no time for that precise record of data which is necessary to a scientific disquisition.

If we begin the study of disinfection in the laboratory, the problem before us seems very simple. We learn there that if we take a certain contagium, which is definitely associated with a certain disease, if to a determined quantity of that contagium we add a certain chemical agent in known proportion, and after admixture and the lapse of a certain time, we introduce a certain amount of the mixture into the body of some animal, we find that the specific morbid process is not established; or if we attempt to cultivate it in some suitable medium it will not grow. The contagium has thus been

<sup>1</sup>Read at a meeting of the West of Scotland Branch of the British Medical Association, held at Kilmarnock, 13th November, 1884.