An address on the position of the state in respect to modern bacteriological research : delivered before a General Meeting of the XIth International Medical Congress, held in Rome, 1894 / by V. Babes ; abstracted and translated by F. Parkes Weber.

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AN ADDRESS
ON
THE POSITION OF THE STATE IN RESPECT TO MODERN BACTERIOLOGICAL RESEARCH.

Delivered before a General Meeting of the XIth International Medical Congress, held in Rome, 1894.

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[ABSTRACTED AND TRANSLATED BY F. PARKES WEBER, M.D.]

THE health of the community is under the care of the Department for Internal Administration of the State; and inasmuch as health is essential to the happiness of the individual and the development of human energy, it appears, for most important economic reasons, to have a first claim on the Government. Those learned in such matters are, however, of opinion that, in spite of its immense importance, of all the different departments of internal administration, that of hygiene has remained the least developed in Europe. I will at first attempt to throw light on this sad circumstance, affecting as it does the most valuable of human possessions—one that gives value to other possessions—and then I will search for means to obtain for sanitation its proper position amongst State institutions.

I.—HISTORICAL SURVEY.

The care of public health does not necessarily advance hand in hand with education; a lively and practical public spirit and a great vitality in the people cause a place to be yielded to the demands of State sanitation. The oldest civilised peoples regarded it as a public duty to protect the health of the individuals. With a view to this, the laws of Sparta, of the ancient Egyptians, and of the Israelites had more hold than modern legislation on the life of individuals. Still, their rules were not founded on any sure basis, but rested entirely on old traditions and experiences, which the spirit of the period clothed in religious or political dress.

In the laws of these old nations matters were regulated, which, according to our modern feelings are now left to the care of the individual, and sexual disease was more rigorously opposed than it is at present. Leprosy, from which the first civilised nations ran great danger, was opposed by more

rational laws than it is thought can be opposed to the just as dangerous or more harmful diseases of to-day. The good results of the working of the Mosaic laws can still be seen even in our days when State sanitation can derive so much aid from modern sanitary science. The Mosaic laws owing to their religious form took deep root in the domestic life of the people, and the vitality of the Jews of to-day bears witness to their wisdom. The Jews thrive where the native population, in spite of special legal protection, is decimated by infant mortality and infectious diseases. The hardening of the constitution, the dress and baths of the people are neglected by modern legislation for the reason, though expressed in various ways, "that the State has only to look after the health of individuals so far as the health of individuals affects the community."

When one contrasts this vaunted principle of individual liberty with the limitation of this liberty which is effected in the interest of religion, of the ruling classes, and even of traditions and conventional ideas, one cannot repress a thought that this magnanimous permission of the State allowing each individual to make himself ill if he likes, to treat himself as he thinks best, and spread his illness, is not merely dependent on the principle of individual liberty.

But also in another direction did the civilised nations of antiquity set us a good example—namely, in the repression of general causes of disease. Aqueducts and canals were made at great expense, marshes were drained; during the plague of Athens great fires were made and excreta burned, dead bodies were cremated, and the principles of public hygiene were also popularised by lectures. In spite of the much greater State incomes and the technical facilities of modern times, most modern States cannot nearly rival those of ancient times in the proportion of their sanitary undertakings to the number of their population.

In respect of public health, Rome advanced still further than Eastern civilisation. Aqueducts and canals were undertaken in early times; owing to the number of public baths in Rome, probably each citizen could have a free bath daily, and similar establishments existed in the smaller towns of the Roman empire. The irruption of barbarian hordes on the Roman empire disturbed the whole organisation of public health, and Christianity to some extent helped in producing this disturbance, especially by its ascetic disregard for corporal welfare, and by the absolute separation, which it enjoined, of religion from all matters of bodily health.

Epidemics raged and exercised a wholesome influence, in part by reducing the population, and by directing attention to the infectious nature of diseases. People began to notice that contagion was carried about by men and clothing, with the result that quarantine and sanitary police were introduced by some towns of upper Italy. Venice was particularly active in these matters of hygiene, but the unsettled political state of Italy long prevented the proper development of State sanitation. After the unification of Italy this development soon began to show itself, and the law of 1866, and particularly that of 1888 ("Sulla tutela della igiena e della sanita publica"), were framed, the latter of which might serve as a model to other States of Europe, with the exception perhaps of England. By this law the authorities on hygiene take that position which, as competent authorities, is due to them.

As well as a competent upper board of health there are provincial boards of health, all of which of their own initiative, can move proposals on hygienic questions, and must be consulted on sanitary ordinances. These boards of health are not dependent on the administrative officers, and all urgent measures recommended by them must be immediately carried out by the prefects.

In England a practical public spirit early developed itself. What was accomplished in hygiene began from below, and took deep root in the customs of the people, before developing into institutions of the State; this insured its usefulness and recognition. The practical independency of the parishes, as well as the Parliamentary system of this country, showed to advantage in this matter; there were water supply committees, and the parishes left to the sanitary authorities the choice of their own methods. As in other countries, infectious diseases first gave occasion for thorough trial of sanitary arrangements. Committees were formed for statistical inquiry into mortality with regard to soil, overcrowding, with regard to the pollution of air, water, etc., and the activity of these committees led to important conclusions regarding the artisan population, which had attained so great an importance owing to the growth of the manufacturing towns.

The Public Health Act of 1848 was formed in accordance with the then existing state of scientific knowledge on a statistical basis, a testimony to the public spirit of the country. Local bodies, under the guidance of a doctor, had executive power, and could levy rates to cover the expense of water supply, canalisation, etc. Unfortunately, as usually happens in such cases, when a better hygienic condition was reached, the means by which it had been obtained were neglected. The Board of Health was abolished, but, on the other hand, the Local Boards gained in power. In 1871-72 a Board was instituted for seeing to the poor, sanitary matters, and Local Government, the whole country being divided up for this purpose into sanitary districts. Each of these districts possesses a well paid medical officer of health, a sanitary inspector, and a public analyst. These officers work in connection with each other, and with the central officers, and possess the power of taking measures to oppose epidemics.

In Prussia the sanitary arrangements have a bureaucratic aspect. There was a College of Medicine and a special College of Hygiene, to which the doctors of towns and districts were subservient. In 1862 officers were appointed to the different provinces, but their power was limited by the central bureau.

In Austria, since 1870, there has been a chief sanitary officer working with the junior ones, who, at all events, have the power to take first steps.

In Roumania, by the law of 1873, the sanitary administration is placed in active communication with the doctors of towns and districts, and controls them by yearly inspection. The latter are, in the same way as the hospital doctors, recommended by the special sanitary adviser to the central administration.

In France, although the medical schools are distinguished, public health is not sufficiently cared for, because the learned scientific bodies have hardly any voice in its administration.

The prefêt and the maire do all the administrative, and an authority on hygiene is only consulted when the prefêt thinks fit.

Of late years attempts have been made to include institutions for the furtherance of scientific medicine within the State organisations for hygiene. We shall see that just the most rational hygienic measures are opposed and partly abolished on the plea of their being inconvenient to commerce and intercourse, and to the influential Government administrators. International arrangements, also, for protection against epidemics have lately several times been neglected for the sake of the commerce and intercourse of the great nations, and partly at the sacrifice of smaller nations with less complete sanitary arrangements.

II.—The Position of Doctors towards the State.

The medical profession in many countries is not permitted to exercise any executive right to protect the country against epidemics. It must be allowed that there is a tendency for the scientific men employed in some State institutions of hygiene to separate themselves from the statesmen who founded these institutions. It must appear to us doctors unintelligible that, though statesmen recognise the immence importance of public health, they will not surrender the executive power of sanitary administration into the hands of those who have made it their special study. Doctors constitute a hard-worked class, possessing neither the time nor the authority to make their claim felt, and it is to be regretted that so few members of the upper classes of society devote themselves to medicine, which offers them such a field for useful work.

Doctors are not much attracted towards State matters of hygiene, because of the smallness of the pay allowed to those who enter the service of public hygiene. The State should pay its sanitary advisers better, since it expects of them a special professional education, and should at the same time forbid them to exercise the practise of ordinary or legal medicine. Doctors would then be able to devote themselves to finding out and remedying the causes injurious to public health, just as they would those injurious to the health of a family. Finally, every facility should be given them of making themselves familiar with the science of government, especially legislation, political economy, and statistics.

III.—Government Sanitary Institutions.

The best measure for raising the quality of the doctors is for the State to afford doctors the means of attaining the highest essential education. This necessitates State institutions specially designed for the purpose. An attempt of this kind was made in 1876 in Germany, but want of understanding and money caused the institution to fall short of the mark. The Imperial Board of Health at present does not possess, as it was at first intended, the superintendence either of medical and veterinary measures or of medical instruction, neither are the laboratories sufficiently endowed to meet the requirements of proper sanitary research. Nevertheless, with the exception of Roumania, no other country possesses a similar institution, though they possess institu-

tions, privately erected, for the study of infectious diseases, which act more or less in harmony with the State administration.

A few words, therefore, may be said on this institution of Roumania. As Roumania stands on the boundary between east and west, it was peculiarly exposed to infectious diseases, not to mention several imperfectly known diseases of the country itself. In 1887, epidemics amongst the cattle and widespread hydrophobia rendered it advisable to establish such an institution in Roumania; moreover, no sort of institution for pathological anatomy, pathology, or bacteriology existed there at that time. The institution is well endowed, and adapted to meet the requirements of scientific investigation and instruction, but unfortunately possesses no administrative authority.

In the veterinary department light was thrown on the nature of Roumanian endemic diseases (infectious hæmoglotiomia, endemic disease of sheep, horse typhus), and methods for the diagnosis and cure of other diseases (morvin) were found; the connection of *rouget du porc* with the pneumoenteritis bacilli was studied, as well as the etiology of horse typhus and pigeon diphtheria; the heredity of the sequelæ of the latter disease was determined.

In the department for curative and protective vaccinations the mortality of hydrophobia in man was reduced by the vaccination method from ½ per cent. to a minimum, and already (in 1889) the protective power of the blood of highly immunised animals was demonstrated; the method of conveyance and working of the hydrophobic poison was investigated, as well as the characteristic lesions it produces in the brain. The influence of normal nerve substance in certain nervous diseases was established, and the extraordinary reaction of lepers to tuberculin was described.

In the bacteriological department investigations were carried out on the existence and distribution of leprosy, the Roumanian forms of malaria, the nature of bilious infections, of hepatic abscess, of peculiar intestinal affections and forms of pemphigus. The researches into influenza and its bacillus yielded important results, notably the "bacterial associations," which play a real part in bronchitis. The microbes of hæmorrhagic infections, of scurvy, of noma, etc., were established, and specific means of disinfection against infectious diseases (diphtheria) were found). We could discover the so important "bacterial associations" in nearly all infectious diseases.

In the chemical department the sterilisation of water, especially by the precipitation method, was investigated, as well as the subject of bacterial products.

In the pathological department the systematic examination of all corpses from the hospitals showed the unexpected extent of bacterial associations and of bacterial invasion in non-infectious diseases; important results were moreover arrived at regarding the varieties and extent of variation in microbes, those of septicæmias, pneumonias, scarlatina, enterica, and hæmorrhagic infections being especially studied. All these investigations demonstrated the vastness of the problems which must be studied. Work was also done in the pathological section on the pathology of nervous diseases, on the pathological histology of nerve endings in muscles, on the origin of tumours and various diseases.

This short account is sufficient to show in what way a State institution of this nature may, even in spite of special difficulties, render service to hygiene and science. It may be remarked that Roumania presented to some extent a "virgin soil" for such undertakings, untrammelled by prejudices, and it was remarkable how rapidly the people realised the great use of such an institution. Not only did medical men benefit by its teaching, but the educated classes are beginning to understand the ordinary principles of hygiene as they concern the homes and habits and daily work of the people. The universities and most institutions of other countries are hardly in sympathy with the general wants of the people and hygienic administration; such institutions are generally few in number, and with their attention concentrated on special researches. Their chief shortcoming is, however, to be found in the fact that their directors, partly through their own fault but chiefly through that of the administrative authorities, are not called on to step out across the university walls, and to examine into the actual life of the people. Even measures founded not on absolutely certain knowledge but on great probability, should be carried out and tried by their result in place of old measures which rest on no scientific basis at all. However much trouble this may give to some, the gaol to be aimed at is worth the labour spent in reaching it. We may see how Koch's sphere of work—at first very limited—gradually enlarged, until the richly-endowed institution was gained of which he was appointed the head.

Such an institute should always be in connection with a hospital for infectious diseases, and the institute itself should be divided into five or six closely-connected parts: (1) For clinical treatment and experimentation; (2) for pathological anatomy, bacteriology, and experimental pathology; (3) for infectious diseases of animals; (4) for chemistry; (5) for statistics, superintendence, and the library; (6) for lecture rooms, museum, and management.

The building should consist of a chief edifice and several pavilions. The chief edifice must be for laboratories, and, if outside the town, there must be a dwelling house close by for the director, staff, and servants. There must be a completely isolated pavilion for inoculation of men and about three others for examination of animals, and there must be several places for breeding animals.

The staff should consist of director, about four superintendents of departments, eight assistants, officials in charge of statistics, a librarian, intendant, and about eight or ten servants. The total cost of the undertaking would reach about 1,000,000 francs.

The director and his staff should give lectures, etc., with special regard to hygienic administration in its widest sense —for doctors in the public service, for candidates desirous of obtaining medical offices, for architects, engineers, administrative officials, and students. The institute for pathology and bacteriology might be under the control of a "home office" or a "health office," but must have the right of preparing hygienic laws for the State authorities.

Besides this great institution there should be well endowed professional schools for lower officers of health, and the elements of hygiene should be taught by capable teachers in all schools. No public buildings, aqueducts, or canals should be constructed by persons who have not received proper instruction in hygiene.

Institutions of this kind could systematically investigate the most important hygienic and medical questions. In times of peace the fight should be for the people's health, and only a scheme of this kind will enable hygiene to secure her place, as the most important part of statesmanship.

IV.—The Attitude of Statesmen towards the Claims of Hygiene.

The chief reasons alleged why statesmen refuse to give very great power to the hygiene authorities, may be enumerated as follows: That the necessary means are wanting to enable the State to undertake the task demanded; that the personal liberty of the individual would be endangered; that the scientific basis is still not sufficiently sure; that the demands of science are very often hard to carry out; and, lastly, that if they were carried out, other equally necessary State duties might have thereby to be neglected, or the consequences might be injurious to the State (Löhning).

(*a*) *Liberty of the Individual.*—Different countries and schools are not agreed on its proper bounds. One opinion is that the State has not the right to exercise restraint on a man, provided that he hurts himself only. Stein, on the other hand, considers that the health of the individual affects the community just as much as it does the individual himself; and indeed so many diseases have turned out to be more or less of infectious nature that the ground is now removed on which the former opinion was founded. Some hold up as their model English principles of individual liberty, whereas it is exactly in England that the sanitary authorities have most control over this individual liberty. It is obviously not logical to argue that because it is not right to compel a man to undergo an ordinary amputation, therefore one should have no power over a man when he has an infectious disease. Again, if the State is compelled to control the liberty of a criminal, why should it not also control that of persons affected with syphilis or tuberculosis, who may spread their maladies and harm others? Another reason (less frequently mentioned) against the right of restricting individual liberty is that this power might be misused for the sake of party politics, etc. This affords an additional argument in favour of having a sanitary administration quite independent of party politics.

(*b*) *The Diposal of State Means.*—A more difficult question is whether the State possesses money enough at her disposal both for looking after public health and the health of individuals. Emergency measures adopted during epidemics such as cholera can often not be carried out owing to want of previous organisation in the hygienic department. A bureaucratic paper regiment is nowhere as unpractical as in battle against the powers of Nature. The administrations for war and religion in most big nations are best endowed, whilst the condition of the other administrations depends much on the energy and influence of the Minister at the time, and since hygiene is usually included in the department of the Minister for the Interior, who is no professional man, but often influenced by party interests, the look-out in this direction is not very hopeful. An independent Ministry of Hygiene with a professional man at its head could do much more.

Under the present state of "armed peace" in Europe, the maintenance of such large armies is very costly to the different Governments. Part of the army might possibly be made use of for sanitary purposes without impairing its power in case of war. But besides the army, other departments (religion and law) are richly supplied in comparison with hygiene. On the whole, it seems that hygiene is neglected because the State means are employed for other and less necessary purposes.

(c) *The Importance of Hygienic in Comparison to other State Expenses.*—It must be allowed that quarantine is hurtful to commerce, but modern quarantine methods are much less so than the older ones. Quarantine is also a hindrance to intercourse, but in this respect affects the ruling and wealthy classes rather than the lower ones, to which latter, on the other hand, epidemics are more baneful. If the money gained by neglecting quarantine arrangements were spent for other sanitary purposes or for the lower classes, one could not object so strongly, but it is spent on the army, and therefore against the direct interests of the lower classes.

It is objected that quarantine is unpractical. I cannot enter on that question here, but perhaps the failure of quarantine measures on the frontier depends not so much on the nature of the infectious disease as on insufficient knowledge or want of exactness in carrying out the measures. At any rate no international arrangement has the right to withdraw rational quarantine from a State which has hitherto been protected by it and whose internal arrangements are not sufficiently organised to suppress an epidemic should one arise. The Hamburg cholera epidemic was more injurious to the town than a rational quarantine would have been. However important school instruction may be to the State, schools should be closed immediately on the outbreak of an epidemic. The danger in institutions for small children is especially great on account of their peculiar susceptibility to disease and mortality from it.

V.—Position of Modern Bacteriology with Respect to its Usefulness to the State.

One reason given for the State neglecting the care of health is the belief that medical science and hygiene cannot on sure ground fight against and keep off disease. This cannot be altogether denied and must be discussed as regards the various diseases, but the belief arises in part from the means employed by the State against the diseases being insufficient and therefore failing to produce the required effect.

(a) *Precautions about Water and Soil.*—Modern science has demonstrated the important part played by drinking water in the production of some diseases. Cholera bacilli have been found in bad drinking water, so also saprogenic bacilli, which, according to my investigation, play an important *rôle* in infantile diarrhœa, enteric fever, and dysentery. The bacteria of suppuration have likewise been found in drinking water; and, according to my latest investigations, it appears that the parasites of malaria pass through one stage of their development in water. It is therefore clear that one urgent duty of the State is to provide good drinking water. This may be obtained from deep wells or from springs direct from the rocks, or (under careful management) by filtration through

sand. Our discovery that by small quantities of alum, water may not only be clarified, but also sterilised, may in time be made of some practical use. On the whole, one must doubt that water obtained by sand filtration is sufficiently good to be used as drinking water, and the various household filters must be rejected.

The soil must be purified by drainage, but the canalisation of towns is still an open question. The drains of a town can only be carried into a river when the river is of large size. In last year's cholera epidemic in Roumania I found that the water from the centre of the Danube was almost sterile at only a small distance below the infected towns, although the cholera bacillus could be repeatedly found in the water of the immediate neighbourhood of the towns. Therefore, although drinking water from the Danube in the immediate neighbourhood of the towns could undoubtedly be a cause of the spread of cholera, it seems to me very unlikely that a town can be infected from another town lying much higher up on the river.

(*b*) *Contamination of the Air; Hospitals.*—The air can only be rendered infective through dust, though different gases in impure air can produce other illnesses. Possibly the money spent on the complicated disinfection of hospitals could be better spent on more complete asepsy and antisepsy, and particularly on better isolation arrangements. In the medical wards of a modern hospital we find patients with tuberculosis, pneumonia, and bronchitis, grouped together with patients who, although their main disease is non-infectious, suffer from "bacterial associations." As regards these last, I could hardly find 50 amongst 350 patients with non-infectious diseases who did not suffer from "bacterial associations," and a great part of the patients with non-infectious diseases died in consequence of these "bacterial associations."

The commonest of these complications are septic or pyæmic, local or general infection, gangrene, pneumonia, and inflammation of serous membranes. The commonest causes of these complications are: (1) Putrefactive bacilli, which constitute a series from those like typhoid bacilli to the bacillus coli, and still more saprogenic bacilli; some forms are more pathogenic than the typhoid bacillus. (2) Streptococci and pneumococci. (3) Staphylococcus aureus. (4) Forms of proteus. (5) Pseudo-diphtheritic bacilli.

Probably these bacteria can spread by contact from one patient to another, just as the forms described by me, proteus septicus and bacillus transparens septicus, can produce endemics amongst the animals experimented on. My latest experiments have made it clear to me that at certain periods particular bacteria acquire a peculiar virulence and exert a bad influence on most diseases. So there may be a great mortality from influenza epidemics, and also from other "bacterial associations" at different times. There are months when all deaths in the hospital show "associations" with streptococci or with the staphylococcus aureus.

Such observations show how necessary it is for the directors of hospitals to have professional knowledge. It is sad to see how often the direction of hospitals is entrusted to non-medical persons.

(*c*) *Means to Counteract particulnr Diseases.*—Probably the most terrible and deepest rooted disease of our state of civilisation is tuberculosis. It is the duty of the State to oppose

this widespread and still extending disease; nevertheless the most competent hygiene authorities do not dare to propose radical measures, and seem themselves to believe that the disease can be exterminated by teaching the patients only to spit into spittoons. Even if we cannot quickly overcome the evil, even if two generations of consumptives become martyrs for the good of future generations, we ought to demand powerful State measures in this direction. I am convinced that we have at present no specific against phthisis, and the different methods we have tried have no greater effect than that of Koch. If we could introduce a thorough reform into social conditions, something after the model of England, only entering still more fully into the social misery of the working classes, we might in this way form a radical obstacle to tuberculosis, but it would take several generations to produce any appreciable result by this means.

We are not justified in waiting, with our hands idle, for the discovery of some cure for tuberculosis, since we have already sure means at our disposal against this greatest enemy of our civilisation and of human happiness. I cannot here go over the whole plan of operation, but the beginning would have to be some arrangement of social conditions by which all classes of the people have at least the right to live and work assured to them. Instructions for the prevention of infection should be given in all families and schools, and the carrying out of the instructions should be superintended. State institutions for the reception, care, and isolation of the tuberculous should be erected. The suckling by tuberculous mothers and the care of children by the tuberculous should not be allowed, and children should not be permitted to stay with tuberculous families, neither should the tuberculous be allowed to marry. Tuberculous animals should be recognised, isolated, and only used for purposes where there is no chance of infection. Such measures might be modified from time to time, and examined by an international committee.

Energetic State measures against infectious sexual diseases appear to be just as much required, notably against syphilis. Although as yet we do not know what the virus of syphilis is, we know enough about the modes of its infection to get the better of it by the aid of a properly-instituted sanitary police, the notification of cases of syphilis, and prohibition of marriage to infected persons. Even if notification of the infectious diseases, tuberculosis and syphilis, were necessary merely for those applying for work, especially nurses, soldiers, factory labourers, etc., the danger of infection would be considerably lessened. The latter measures have been carried out with success in some German States. The difficulties in the way of carrying out the former measures can only be overcome when the mysterious prejudices against the "secret diseases" have been dispersed by broad-minded and wise teaching.

Other diseases against which the State should interfere are cholera, typhus, yellow fever, the plague, and small-pox.

Cholera is introduced by human intercourse, and epidemics are produced by the multiplication of the bacilli in water when it has been contaminated, especially by fæcal material from persons affected with cholera; owing to modern bacteriological research, it can be prevented and resisted. It is certainly not right to condemn modern rational quarantine me-

thods as "Asiatic" or "mediæval." When the community is convinced of the great importance of health, such measures will be reintroduced and not confined to the frontiers merely. Although with proper internal sanitary arrangements, with sufficient number of doctors and sufficient intelligence amongst the people it may be considered "Asiatic" to close the frontiers, it will be considered still more so if quarantine arrangements be neglected, although there be too few doctors and insufficiency of sanitary arrangements in the interior of the country.

I cannot understand how our best hygienists can believe that a sanitary inspection of travellers on the frontier is sufficient to shut out cholera, since we must also take into consideration the incubation period of the disease, and the articles which the travellers may be carrying with them, and which may remain infectious for several days. If there were a really thorough organisation, which might also have means for compensation at its disposal, the usefulness of measures taken on the frontier would be quite different; the travellers might be transferred to isolated huts, erected with all the necessaries of modern hygiene, and the less important ways across the frontier might be closed up with a strong military *cordon*. In countries where commerce is too great, and where at the same time the hygienic arrangements are good, such measures might be replaced by a rational internal organisation. Even in such countries quarantine arrangements may be of some service, as the measures regarding ship passengers in Germany have shown. Moreover, I fail to understand why hygienists have made so complete a difference in regard to quarantine by land and by sea. In badly arranged ship quarantines the water may easily become contaminated, and on land statistics show that hardly a one-thousandth part of travellers crossing the frontier will succeed in escaping the sanitary inspection.

For the proper prophylaxis of cholera, England, in conjunction with other great Powers, should watch over the nurseries of cholera, and take precautionary measures to prevent the spreading of these centres. With sufficient means and energy the disease could probably be nipped in the bud. Other places where cholera has become established should be found out and quickly brought into a sanitary condition. Commercial and political interests, however, form a great obstacle in the way of the proper organisation for such measures.

When cholera has once effected an entry it is absolutely necessary that the first cases should be diagnosed with certainty, and no private interests should prevent a doctor from notifying cases. In Roumania I convinced myself that it was possible soon to get the better of the epidemic by preventing the people from drinking the contaminated water, and in Bulgaria the limited epidemic was immediately suppressed when my advice was followed, namely, that no one should be allowed to take the infected water of the Danube.

The undoubted specificity of the cholera bacillus is a real help to us in adopting measures against cholera, whereas in enteric fever we have the close relation between the typhoid bacillus and the putrefactive and fæcal bacilli. To oppose enteric fever we must take all measures to prevent the entry of fæcal and decomposing materials into food and water used for drinking or general use.

Endemic dysentery probably depends on similar insanitary conditions, and our latest experiments show that it is only in part dependent on amœbæ, in part also on other microbes related to putrefactive bacilli and those of suppuration. The same causes are at work also in the production of the ulcerative intestinal inflammation of the East, which may be associated with hepatic abscess.

The common exanthemata constitute a different group, and attack children especially. Though we do not yet know their exact nature, experience has taught us important points concerning them. For instance, the vaccination against small-pox is of the greatest importance, and it is disgraceful that with the present state of sanitary organisation so many civilised countries should still suffer so much from this disease. Those authorities may well think of this, who look for all cure in a specific treatment of diseases, for,with our present deficiency in sanitary organisation, the rooting up of a disease by such methods is hardly to be expected; the German army, however, shows us that by careful and rational arrangements something may really be done in this direction.

In the treatment of diphtheria, the most terrible of children's diseases, some hints have certainly been derived from the discovery of the bacillus, but disinfection of the pharynx and "serum therapie" have as yet in the case of human beings not given sufficiently sure results. The protection afforded by serum injections, comparable to Roux's measures against tetanus, is, however, in some cases probably worth a trial. In the treatment of diphtheria, the presence in the mouth and pharynx of streptococci is a difficulty; I am sure that they cause septic infection in diphtheria, and believe that the term "pseudo-diphtheritic bacilli" includes a series of different bacilli, of which some play an actual part in the necrotic processes of mucous membranes, and one, under certain not exactly understood conditions, gives rise to diphtheria. It is not, indeed, certain that this bacillus may not in attenuated condition be present in healthy persons as a "pseudodiphtheritic bacillus."

Energetic isolation and disinfection is the duty of the State in regard to scarlatina, and especially typhus.

Although we cannot always prevent the spreading of scarlatina and measles, we ought to adopt measures against the "bacterial associations" found by us in these diseases, especially as possibly one of these bacteria may be causally related to the disease. Such bacteria are usually those which in attenuated form are found in the mouth and pharynx of children. I have found that the bronchitis of measles is usually due to streptococci, pneumococci, mucus-producing bacteria and staphylococci, whilst the pneumonia of measles and the pneumonia and nephritis of scarlatina are caused by streptococci or pneumococci; noma is caused by a proteus or by other bacteria, which I have lately described.

Much more surely can septic puerperal processes be avoided by proper antisepsis, and as in the laboratory we are constantly finding that more diseases belong to the septic group, it will not be too much to demand that neglect, leading to such complications, on the part of the doctor or other persons concerned in the treatment, should be punished. Just as a wound under improper careless treatment may give rise to suppuration, erysipelas, gangrene, sepsis or

tetanus, so we know that the same bacteria which cause these diseases may more commonly be predisposed to by constitutional causes, such as weakening of the body by disease or misery.

Even the most civilised States hesitate to effectually ensure the hygiene of the poor, for fear lest protection of the factory labourers should go far enough to damage the capitalist in respect of foreign competition. It is just as impractical to hope for specifics against diseases called into existence by social misery, as to expect to cure phthisis by some mixture or other.

The "trade diseases" are diminishing, but form only a part of the illnesses produced by social misery; the larger part of the latter are infectious diseases. Virchow long ago pointed out that the most rational method of opposing relapsing fever was to remedy the social misery, and we can say the same of infantile diarrhœa, tuberculosis, pellagra, leprosy, and scurvy. I have lately described the bacillus of scurvy, and it forms a good example of a disease in which an ordinary parasite, frequently present in the mouth, becomes pathogenic, owing to malnutrition of its host; and in all these diseases the cause is usually similar.

Some of the causes of a large group of diseases can be probably reached by State means; to this group belong varieties of bronchitis and pneumonia, as well as emphysema, meningitis, and peritonitis, and perhaps they are the commonest cause of death, in consequence of persons being rendered susceptible to them by other past infectious or neglected diseases. Their frequency can certainly be diminished by State care (especially afforded to those unable to care for themselves), and by the prevention of the predisposing diseases, such as tuberculosis, the exanthemata, etc. By such measures, even influenza (whose cause is probably the bacillus first discovered by me in 1890, and then cultivated by R. Pfeiffer) would be rendered less harmful, since it acquires its severity from earlier diseases of the respiratory system.

Another group of infectious diseases which the State can ward off is that which men derive from animals. Perhaps it is not sufficiently known how often different forms of glanders are met with in men. In order to make the diagnosis of glanders more easy we introduced a substance, "mallein," obtained from cultures in a similar way to tuberculin, and this substance has since been used for diagnostic purposes in Germany, France, and Russia. If tuberculin was largely used by the State for the diagnosis of tuberculosis in animals, much would be gained towards prevention of this disease.

Hydrophobia is the most terrible of the diseases which we get from animals. Only Germany, by stringent sanitary police measures, succeeded in overcoming it, whilst other States had to replace these rational measures by the more expensive and less useful method of Pasteur. In the latter direction we can note down considerable advances, and our experience has led us to a harmless method of protecting dogs against hydrophobia; ours were, indeed, the first attempts to battle with a natural disease by the help of blood serum from immunised animals. The State might also take measures against other diseases, as echinococcus disease, derived from dogs.

From these few examples it becomes manifest that a State, perfected in the way I have laid down, could by the means at our disposal already do much more for the health of its citizens than it does at present, and it is clear that the erection of proper institutions would help to this end. It is clear also that we are not justified in separating the public health from that of the individual, but just on this account the State work will be increased and a thorough reform of the sanitary administration appears necessary.

If we were to contrast the demands made here with those acknowledged by statesmen, we should see that the latter limit the rights of the State too much and do not take the universal importance of hygiene into due consideration. Although they profess to acknowledge the immense importance of hygiene, they place other State interests in the front, which prevent the carrying out of measures for the advantage of hygiene; they only recognise certain conditions under which the State can take care of the health of individuals, and they always dread the interference of the State with family life though in the interest of public health.

Against these objections science will be powerless until it can practically and clearly demonstrate the results of modern research; but on our part it will first be necessary to free ourselves of all non-scientific interests, and leave to others the interests of commerce, industry, politics, the army, and the family. There should be doctors who are not fettered by practice, but specially trained to make known to the ruling bodies—especially the Parliament—the advances and practical application of science, so as to obtain that position for the organisation of hygiene which belongs to it as being of the greatest importance for the happiness of the citizens.

The first result of this should be the erection of a richly-endowed institute of State hygiene, in which laboratory work may be turned to practical use, and which may serve as a high school for the statesmen in question, directors of hygiene and hospitals, and all Government officials, whether of the departments for instruction, medicine, or the useful arts, who occupy themselves with matters of hygiene.

An international and social reform should be obtained, because individual health cannot be separated from public health, because the health of one class is necessary to the health of other classes, and the health of the lower classes is of the highest economical value to the State. The health, however, of the lower classes is affected by an unjust want of the primary necessities of life and health, as well as by the insufficient care taken by the State for public and private health. A settling of the social question becomes, therefore, essential for public health.

Furthermore, there would have to be an international agreement by which the sanitary interests of the working classes are placed above the interests of capital and competition, and by which a part of the expensive State institutions—namely, the armies—are lent or given up for hygienic purposes.

The position of the sanitary officials should be raised, and all the strength of the sanitary department should be used to fill up lacunæ in professional knowledge. The sanitary administration should have equal power with the Ministry, but should be without the political instability of the latter, and, on urgent occasions, should have the free right of direc-

tion. Its organs should be more numerous, higher placed, well paid, and excluded from all other political or medical work.

Under such conditions sanitary questions can be thoroughly and scientifically considered, and the proper extent can be found to which the State shall enter on matters of individual and public health.

Although the free mental development of the individual is necessary for progress, the proper conditions for bodily development, which consist chiefly of the keeping off of harmful external influences, are more and more bouud to belong to the sphere of State work. The thus perfected State is justified and bound to interfere directly or indirectly in the freedom of individual life, and moreover to a much greater extent than before seemed justifiable, because modern research tells that this is in favour of the sanitary development of the community.

Although the sanitary administration of to-day, even in the best developed countries, is but poorly furnished with power, and in most civilised countries is absolutely powerless; nevertheless in some few countries rational measures could be carried into effect which would clearly show how beneficial the general adoption of such measures would be. As soon as a sanitary measure has been approved anywhere, as soon as some hygienic discovery has been made in the workshops of medical science, it should be the duty of the State to try it, to estimate its practical value, and to make it generally known.

It is only by such means that hygiene will become a science, that this science will become the most important part of statesmanship, and that the State will become, as it ought to, a healthy State.