THE PREVENTION OF DISEASE.*

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THERE is now, I suppose, hardly any subject of wide scope connected with public health which has not already been made the text of such addresses, and, while writing, one is haunted by the depressing feeling that one's effort is only a poor expression of what has probably been previously much better said by others. Perforce, therefore, one has to be content to tramp over some well-beaten field of thought, happy if in doing so one can flush a new idea, or, by putting up once again ideas which have not received due attention, enable some public health sportsman, within range of whom they may not previously have come, to add them to his bag. The field which I propose to beat to-day is that called "Prevention of Disease," in which it would seem that there can be nothing fresh left. But is this so? Have we exhausted all means for dealing with disease? and have we no fresh ones left? or have we used to the full those already known to us? The general public certainly has but an imperfect conception of what "prevention" means. A long struggle with an epidemic of some infectious disease, such as small-pox or diphtheria, the end of which is more or less complete success in checking its ravages, is regarded by them as the acme of preventive medicine, and is accordingly applauded. Should, however, a case, for instance, of small-pox be introduced into a district and extension from it be prevented by removal to hospital, re-vaccination, etc., their criticism is generally—"That is nothing; there was no disease to deal with; only one case!" Of real prevention—that is, removal or avoidance of primary causes of disease—the public has practically no conception; and, unfortunately, science itself has as yet given us little that is definite on which we may act to this end. Yet we are acquiring, gradually, certain more definite knowledge as to the causes and modes of spread of some of the infectious preventible diseases; and it behoves us not only to use that knowledge ourselves, but to endeavour to impress the importance of action towards prevention along these lines both on the lay, and also on the medical public. This seems an almost hopeless task when one considers the apathy with which public health matters are generally regarded,

* Presidential address delivered before the West of England and South Wales Branch of the Incorporated Society of Medical Officers of Health, October 31st, 1901.

and the comfortable, but false, sense of security engendered by drainage, a good water-supply, a fair amount of cleanliness, the avoidance of overcrowding, and, in a word, what is colloquially known as "sanitation." The substitution of such improved conditions, over those previously obtaining, was a distinct gain to the public health, and, in some instances, has tended to prevent infectious disease as in the case of typhus.

The doctrine of the "Danger of Dirt," preached by the first sanitary reformers, was not, however, the be-all and the end-all of preventive medicine; there are more things in hygiene than were dreamt of in their philosophy. I do not for one moment wish to belittle the value of their crusade, knowledge since obtained was not theirs; that which they had they used to the full, preaching to the best of their ability and doing a great and good work. So well did they preach that at last the public grasped, to some extent, their doctrine, and have now arrived at the idea of the necessity of drainage and cleanliness. Here, alas, they seem to have at present stopped, and can only exceptionally conceive any other causes of disease than faulty drains or uncleanness, the removal of which conditions is regarded by them as sufficient to meet all cases. From this apathy they require to be roused, and it becomes our duty, I think, to as energetically preach the "Doctrine of Prevention and Rational Dealing with Disease" as the pioneers of sanitary reform did that of the "Danger of Dirt."

The call to the nations to rise to a higher conception of the meaning of prevention was recently made by Dr. Koch in his address before the International Congress on Tuberculosis. One passage in that address so clearly and forcibly expresses the point at issue as regards prevention that I venture to quote it here, although it is probably well known to you all: "The most important lesson we have learned from the said experiences is that it is a great blunder to treat pestilences uniformly. This was done in former times; no matter whether the pestilence in question was cholera, plague, or leprosy, isolation, quarantine, useless disinfection were always resorted to. But now we know that every disease must be treated according to its own special individuality, and that the measures to be taken against it must be most accurately adapted to its special nature, to its etiology. We are entitled to hope for success . . . only if we keep this lesson constantly in view." Surely this expression of the principles of prevention is clear and common-sense enough for the public mind to grasp; and when backed up by his statements as to the control

exercised over certain diseases by acting on these principles—over cholera by attention to the water-supply, over hydrophobia by muzzling, over leprosy by isolation—and the failure to control the spread of plague, owing to mistaken ideas as to its mode of transmission and consequent failure to adopt the proper preventive measures, its correctness becomes convincing. This view of preventive method has no doubt been present in the minds of most, if not of all, medical men who have made public health their special study, but I do not think it has been continuously or forcibly enough pressed upon the public notice. It becomes incumbent on us, therefore, to gain recognition for the need of action on these lines, both by consistently proclaiming its necessity and by ourselves dealing with diseases in accordance with the knowledge of the special characters of each which we at present possess.

Dr. Koch mentioned certain diseases in dealing with which special measures had been attended with success. Are there any others of the nature of which we have sufficient knowledge to enable us to deal with them on similar principles?

PLAGUE.

Small-pox is, of course, controlled by vaccination. What of plague, inability to prevent the spread of which has hitherto been so marked? Koch in his address put his finger on the spot of failure, and brought to the public notice the fact, already recognised by medical officers of health, that plague only exceptionally spreads from person to person, but is really propagated through rats. Here, then, is justification for the endeavours of our own society, and that of the Port Medical Officers of Health, to obtain Government recognition of the necessity for preventing the introduction of plague by means of these rodents. The best methods for dealing with rat introduction have yet to be devised, but measures for confining rats on suspected vessels to those vessels—measures which I have myself strongly supported—are not to be compared with the policy advocated by Dr. Davies of Bristol—that of rat-free ships. This policy, initiated by Australia, can, of course, only be carried out by international agreement. Governments are proverbially hard to move, and are apt to scorn what they may term impracticable councils of perfection; still, if convinced of the reasonableness of such a policy the difficulties in the way of international action would not be insuperable. One great obstacle to this policy is, no doubt, the governmental fear of interference with commerce, and the endeavour to obtain recognition of its necessity by commercial men, so that they themselves would be willing to submit to certain restrictions, or even to urge their adoption, becomes important.

That such a state of the commercial mind is not too much to hope for is shown by the fact that at the annual meeting of the Chambers of Commerce this year at Nottingham the following resolution was proposed by the Bristol Chamber, seconded by Greenock, supported by Halifax and Southampton, and carried by an overwhelming majority: "That as it appears desirable in the interest of the public health to minimize opportunities for the introduction and dissemination of diseases by ship-borne rats, it is important that regulations made for this purpose should be so framed as not injuriously to affect the trade and commerce of the country. This association therefore recommends that the captains of vessels loading at plague-infected ports should be ordered to destroy rats on board ship before loading cargo, and to take precautions to prevent rats getting on board during the time cargo is being loaded, and that British Consular certificates should be issued to captains obeying such orders. The association further resolves that a copy of this resolution be sent to the Board of Trade and the Shipowners' Association." Neither the Government nor the public must be allowed to shelve this rat question, which should be pressed upon their notice again and again.

DIPHTHERIA.

There is another disease which for some years has been increasingly prevalent, about which much has been thought, much written, but in the control of which little has been effected—I mean, of course, diphtheria. What has been the cause of this failure? Should we not seek the answer to this question by inquiring whether we are endeavouring, in accordance with the principles enunciated by Koch, to control its spread by measures adapted to its special nature? It is universally admitted that diphtheria is an infectious disease caused by, or at least associated with, the presence of a particular bacillus; the discovery of this bacillus, therefore, in material from any surface of, or in any discharge from, the human body argues the infectious nature of such material or discharge. That the bacillus may be found in many other parts of the body besides the throat, which itself may be unaffected, and that the symptoms it may cause vary from practically none up to those of the most malignant type of the disease, does not, however, seem to be at all generally recognised by the profession. The ordinary text-book descriptions of diphtheria speak of it as affecting the throat or windpipe, or, exceptionally, the nose, conjunctiva, middle ear, vagina, or a wound; as being accompanied by a well-marked membrane, and all, or some, of a series of definite symptoms. When affecting the nose it is generally described as spreading

thither from the throat, or exceptionally commencing in the nose and thence passing downwards to the throat, but in either case as being well marked and a serious condition often arguing a fatal result.

In Allbutt's "System of Medicine," however, there is a description of "Latent Nasal Diphtheria"—(1) primary; (2) secondary. In the primary form there is said to be discharge from one or both nostrils, deemed at first to be a simple coryza, which, if lasting several weeks, is supposed to be due to syphilis, disease of the turbinated bones, or of the antrum, and surgical proceedings may be recommended. But the debility of the patient is noticed to be greater than the disease warrants, or the urine is found albuminous, or paralytic symptoms occur, and thus the true nature of the disease becomes apparent. The secondary form is consequent on a manifest faucial attack. This is certainly an advance upon the usual descriptions, but does not cover all the varieties of nasal diphtheria, nor from a public health point of view one of the most important.

In the "Twentieth Century Practice of Medicine" the usual secondary nasal form is described. The primary nasal variety is said to be of frequent occurrence, and is described as severe: "There is no more dangerous form of diphtheria than that of the nares." Further, it is stated that "when nasal diphtheria is diagnosed in any of its forms, or even strongly suspected, danger should be assumed to exist"; and this statement is apparently intended to apply not only to danger for the patient, but also to danger for others.

The point with regard to nasal diphtheria which I am most desirous of forcing upon the attention of medical officers of health and medical men generally is contained in the following extract from a paper read by me before the Incorporated Society of Medical Officers of Health as long ago as 1896: "I wish to emphasize the fact that cases undoubtedly occur which are really diphtheritic and capable of spreading diphtheria, but in which there is no membrane apparent, *and no symptoms whatever* save some slight nasal discharge."

Experience gained since this was written, and specially during some examinations of school-children which I have had to make during the past year, shows that the bacillus may be found in the noses of children who have been exposed to infection under very various naked-eye appearances. There may be simply some reddening, with perhaps a glazy look of the nasal mucous membrane; more usually there is redness with a certain

amount of discharge, which may vary from a thin, irritating, watery fluid, through every grade of mucous, up to purulent or sanious; often there is crustiness or scabbiness about the lower part of the nasal fossæ. The alæ themselves may be quite normal in appearance, or the skin may be slightly puckered, or they may be excoriated or bloody. But the children have been perfectly well in themselves, attending school; there certainly has not been such debility as to raise any suspicion, or to prevent their mixing freely with others. Yet cultures from several of these children were reported by Dr. Klein to be virulent to guinea-pigs.

Ever since 1895, when the cases occurred on which the paper above quoted was founded, we have in Bristol been alive to their importance, the number of such cases recognised has rapidly accumulated, and instances where they have almost certainly been the cause of faucial diphtheria in others have been found fairly common.

Frequency of Nasal Diphtheria without Obvious Symptoms.—As bearing on the frequency with which such cases may be found among contacts, I may instance the result of an examination of children in a school in Bristol which I made this spring in consequence of several cases of diphtheria, some fatal, which were occurring among the scholars, chiefly those of a certain class. The whole class of 92 was examined, and 16 of the children were selected. Bacteriologically 8 of these were found to have diphtheria in the nose, 5 in the throat, 1 in both nose and throat, and 4 were free. Two other children in another class, a sister of whom had died of diphtheria, were found to have slight nasal discharge which showed free growth of diphtheria bacilli, as was the case also in a third child whose sister had just been notified. Altogether the visits and examinations made in connection with this school resulted in the discovery of 15 cases, 11 of which were nasal without constitutional symptoms, unrecognised and able to go about and spread disease freely. I may state that exclusion of these scholars from the school was shortly followed by closure for the Easter holidays; after thorough disinfection it was reopened, but diphtheria has not reappeared.

Again, owing to an almost endemic prevalence of diphtheria in a certain district in Bristol, I this year visited both the district school and the houses where notified cases occurred between March 8th and April 24th. In one infant class 10 cultures were taken, of which 1 throat and 6 noses were found affected. The inspections altogether brought to light 15 unsuspected nose cases, 5 throat cases, and 2 in which both nose and throat were affected.

Thirty persons in all, coming under suspicion, were examined, and of these 22 gave positive results.

In my own district there has recently been an outbreak of diphtheria in a certain village. Four cases were notified within thirty-six hours, and I at once visited the affected houses and the school. The class to which the cases belonged was examined, and 13 out of the 37 scholars were selected for bacteriological examination of the throat or nose; 2 other scholars from different classes were also reserved for like examination. The results of examination showed the presence of diphtheria in 12 out of these 15 children as follows: Nose only affected, 7; throat only affected, 3; throat and nose affected, 2. All these children, save one throat case, were apparently in good health. Following this inspection, which was supplemented by the usual measures of prevention, there was an interval of nearly two months without a case in this village, save one, probably a return case. Then three cases were notified in quick succession from an isolated portion of the village and the school, and affected houses were again visited. Eleven contacts were thus examined, of whom 10 were found to have nasal diphtheria. All but two of these were attending school; and two of the most marked cases were a brother and sister in a family which came to this place about eight days before the first case—the next-door neighbour's child—was notified, and who had, on their arrival, the same nasal soreness and discharge as when they were found to be harbouring the bacillus. There seems fair ground for assuming that this was a fresh outbreak due to importation of infection by the nasal cases just mentioned.

The above proves, I think, that this clinically undiscoverable form of diphtheria is extremely common.

Nasal Diphtheria without Symptoms as a Source of Infection.—Two nasal cases occurred in my own family and were after two months' treatment apparently bacteriologically free, yet three months later their mother had a sharp attack of faucial diphtheria. The children's noses were then found to have "a suspicious, crusty appearance," and to give almost pure cultures of diphtheria bacilli. The nature of these bacilli, including virulence to guinea-pigs, was on each occasion confirmed by Dr. Klein. The children had been in robust health the whole time.

In the autumn of 1895, in Bristol, "a case of obstinate nasal discharge preceded two cases of true faucial diphtheria, and another of nasal discharge in the same family, from all of which cultures of Loeffler bacilli were obtained—from the first nasal case almost a pure culture. The nature of the first case was not sus-

pected, as there were no symptoms except local, till diphtheria followed in the others."

In 1897, in spite of changing wards, four children and two nurses in the children's ward of a public institution in Bristol sickened sequentially. Examination of the throat and nose of each remaining inmate of the ward was made, and while all the throats were found clear, the noses of two children suffering from a nasal discharge of apparently no significance were found to contain free growth of the diphtheria bacillus. Isolation of these children was followed by cessation of the recurring outbreaks in the ward.

In the same year cases of diphtheria kept arising from time to time among the children in a ward of another institution, and ten cultures from throat and nose were consequently examined. Diphtheria bacilli were found in one nose only. Isolation of this nose case was followed, as before, by prompt cessation of cases.

In a village in my district, where there had been no case of diphtheria for some years, a case was notified in 1898. The medical attendant, having had to deal with nasal cases before, mentioned the fact that a sister of the patient who attended a large school in Bristol and came home shortly before, in practically good health, had a nasal discharge. Examination of this nose showed the presence of diphtheria bacilli. This imported infection gave rise to four other cases in the same family; among them being a second in which the nose only was affected, and in which there were no symptoms of illness save some slight nasal discharge. Numerous other instances of family groups which have come under observation might be given, but I will only mention one or two as examples: The family H. developed three cases of diphtheria—the mother, aged thirty, a girl, and a boy. Inquiry showed that a child of one and a half years had returned home from an institution where diphtheria was prevalent, a few days before the others sickened, having a nasal discharge. This nose yielded good cultures of diphtheria bacilli. On July 10th of this year a culture from the nose of B. A. showed some very slightly suspicious forms which were decided not to be diphtheria, but on July 23rd cultures were examined from the throat of the same child, and the nose of H. L., living in the same house; both showed presence of diphtheria. Two days later the mother of H. L. showed faucial diphtheria. They were all removed to hospital and the house was free. Had B. A. diphtheria in the nose on July 10th, which subsequently extended to the throat and infected H. L. and Mrs. L.? If so, the compliment was returned later on, for a few days after the return of these patients from hospital (negative bacteriological results

having been previously obtained) a sister of B. A. developed throat diphtheria. Thereupon the three convalescents were bacteriologically examined once more, and the only one who gave a positive result was H. L., whose nose was found to again contain the bacilli. The comparative frequency of groups of cases such as I have mentioned above, together with similar observations made in America, seem to me to form fairly strong ground for assuming that these apparently harmless nose cases may, and not infrequently do, give rise to serious diphtheria. Not only so, but several instances of chronic ear discharge containing diphtheria bacilli for months—and one, at least, of which proved virulent to the guinea-pig—have been observed in Bristol, and in two instances were associated with subsequent cases of faucial diphtheria in the same house.

What, then, is the position? We have to face the facts (1) that diphtheria is capable of assuming every grade of severity, just as scarlet fever is; (2) that, just as in scarlet fever, it is the mild unrecognised cases which are chiefly responsible for spread of the disease; (3) that it is not by any means only in the throat that unrecognised cases occur. May we not, to a large extent, attribute the increase of this disease in towns, and failure to control its spread, to the non-recognition of the above facts? Does not the well-known relation between compulsory education and increase of diphtheria become more clear in view, as I pointed out in 1896, of these “ambulatory nose cases”? Apparently the bacillus can and does grow in the nose harmlessly to the host, yet in a virulent condition; or, if not virulent, still, after transplantation and single, or perhaps successive, culture on human media, capable of asserting itself in a virulent form. I know that here one touches on the very debatable ground of virulence, attenuation, and non-virulence, and the possibility of converting a non-virulent, or pseudo, into a virulent bacillus. This is too large a question to be entered on by me to-day. I would only say that, until the contrary is definitely proved, it is at least reasonable, and probably a good deal safer, to assume that so-called pseudo-bacilli found in the throats and noses of contacts, or of other persons when diphtheria is prevalent, are merely attenuated forms capable of resuming virulence under favourable conditions. In this connection I would mention that in at least one case of prolonged nasal discharge, which has from the first shown only a short Hofmann-like bacillus, a culture was found by Dr. Klein to be virulent.

Whether there has been any change in the type of the disease, whereby mild cases are more common, and whether such change in type may be due to improved “sanitary” conditions, which, while

leading to lessened severity of individual attacks, yet tends to increase their total number owing to mild cases, nose or other, acting as carriers, are points which might be considered. It is certainly curious that it is often in the newer parts of towns, or in places becoming urban and adopting more fully better "sanitary" conditions, that diphtheria seems to find a congenial home, and to become endemic. In view of this fact—of the fact that the disease attacks equally sanitary and insanitary towns—and also that the diphtheria bacillus has not yet been found, so far as I am aware, in sewage, sewer air, or in refuse matter of any kind, save in infected articles or rooms, it is high time that the drain theory of diphtheria causation should be abandoned, and that of causation by personal infection (the true theory) be substituted and acted upon. Yet how fondly the drain notion is still clung to in text-books, in annual and other reports, and by the public. The idea will die hard, for it is so easy and comforting, when one fails to trace a personal source of infection and when asked, "What is the cause of this, doctor? Do you think it is the drains?" to take refuge behind that shelter for the baffled inquirer—a trivial drain defect. What balm there is in that blessed word "drain"! Of course, the fact that a mucous membrane rendered unhealthy by inhalation of sewer air or other noxious odours, or by bad air and dust from overcrowding, is more likely to afford a favourable field for the growth of the diphtheria bacillus, when implanted, is undoubted; and to this extent faulty drains, etc., are *contributory* causes, precisely as a dusty occupation is to phthisis; but they do not produce the disease. Every drain may be made perfect, yet diphtheria will not cease. This the public, lay and medical, must be made to recognise, for I am convinced that if diphtheria is to be satisfactorily dealt with it must be on the assumption that it is a personal disease personally spread.

Regarded from this point of view, we come back once more to the question, Do we adapt the means at our disposal for prevention to what we know of the nature and etiology of diphtheria, and do we use those means to the full?

For dealing with any infectious disease, notification is the first essential—this is now, happily, compulsory. Next, of course, comes isolation accommodation for all cases in which proper isolation cannot be secured at home. At present there can be no doubt that our hospital accommodation is far from adequate, and that even in many urban districts where hospitals exist more attention appears to be given to isolating scarlet fever than diphtheria; while in rural districts any accommodation is the exception. It

would be a distinct gain if the provision of hospitals were made compulsory, instead of being optional. Every district should have adequate accommodation either of its own or through a share in a joint building, and we should use every means in our power to secure such provision. We all know how hopeless it is to obtain anything like isolation in most country cottages, or in the working-class dwellings of towns; multiple cases in families can hardly be avoided under such conditions as there exist.

Equally important is proper means of disinfection, yet in how few districts, comparatively, especially rural districts, is it available. The fetish of sprinkling powders, or the futile endeavour to disinfect bedding, etc., by means of sulphur, are still prevalent to an enormous and disastrous extent. Efficient means of disinfection by steam should be available for every district.

What has been said above with regard to hospitals and disinfectors applies equally to all infectious diseases. There is, however, a special point with regard to disinfection after diphtheria which does not, I think, receive sufficient attention, and that is that its performance should depend upon the case being found bacteriologically free. It is not uncommon for disinfection to be applied for ten days or a fortnight after notification and the finding of the bacilli. Knowing, as we do, for what long periods, amounting in some cases to months, the bacilli may remain in throats or noses, it is unlikely that they will have disappeared in such a short time as fourteen days; as a matter of fact, I can only remember two cases which have been bacteriologically free under three weeks. It is always safest to have found no bacilli in at least two consecutive cultures before allowing cessation of isolation or disinfection.

It is impossible, too, to deal with diphtheria as it should be dealt with without the aid of bacteriology. This comparatively recent aid to diagnosis and control of the infective period, is, however, comparatively little used; yet it is only since we have had its assistance that we have been able to definitely decide that many cases of apparently simple sore throat are really diphtheria, and to recognise the infective nature of nasal cases without symptoms. The importance of being able to detect and deal with these ambulatory cases need hardly be pointed out, nor need the advantage of knowing when infection ceases; to these ends bacteriology is absolutely essential. Its use and importance are, unfortunately, not sufficiently recognised by corporate bodies, the public, nor by many medical men; and it behoves us to impress its usefulness upon them until every district has arranged for bacteriological

examination. In this connection the importance of competent inspection of the members of infected households or the scholars in schools where diphtheria occurs becomes evident. Bacteriological examination should be made of throats and noses which are in the slightest degree suspicious, as it is only by this means that ambulatory cases can be detected. Even if this does involve an immense amount of work and much expense it must be met, and proper assistance and facilities must be provided, if diphtheria is to be controlled. In many cases examined, no doubt the only bacillus found is that known as the Hofmann bacillus, which is usually considered harmless. That it is not always so, however, is shown by the following case: A girl was notified as nasal diphtheria on March 7th, and the only bacillus found was that of Hofmann; on April 24th the same bacillus was present in throat and nose; on July 19th it was still present in the nose, and, the patient having developed albuminuria, the culture of July 19th was forwarded to Dr. Klein, and found to be virulent to the guinea-pig. The question whether this bacillus is an attenuated form of the diphtheria bacillus is a disputed point; but its constant occurrence in the later stages of cases originally containing Loeffler bacilli is, at least, suggestive, as is also its frequent presence in the noses or throats of contacts, or of those who have been exposed to infection, or live in an infected district.

Dr. Louis Cobbett states that "the bacillus of Hofmann was found quite as frequently among those who had never come into contact with cases of diphtheria as in those who had done so." Dr. William Hallock Park says that it is found in about 1 per cent. of normal throat and nasal secretions in New York City. Out of 96 bacteriological examinations of selected contacts, or those exposed to infection, made this year, the Hofmann bacillus was the sole suspicious organism found in 55 noses and 17 throats—that is, 72 were found affected out of 96, equalling 75 per cent. Either, then, this bacillus must be much more universally present in this country than in America, or it is more frequent in contacts than in the general population. Further, several of these cases were admitted to diphtheria wards, and in no instance did they contract diphtheria; this was also the case in Cambridge this year with five persons harbouring pseudo-diphtheria bacilli. It is quite probable that some, perhaps a considerable number, of these Hofmann or pseudo cases are harmless; and the question arises, How are we to distinguish the harmful ones, or, till such differentiation is possible, how are we to deal with them? The tests of Neisser's stain, the power of acid forma-

tion, the isolation of pure cultures, and injections into guinea-pigs, in order to distinguish true from so-called pseudo bacilli, take a considerable time, during which much mischief may be done; and a quick and ready method of detecting harmful cases is a desideratum. The provision of homes where suspects may be detained while determination of their virulence or non-virulence is being made, as was done in Cambridge this year, is a point deserving attention. For virulence of a culture must, I presume, at present be taken as the measure of the harmfulness of a case, though there is not, as far as I am aware, any certainty that a culture virulent to animals is necessarily so to man, nor *vice-versâ*. It is, however, manifestly impossible to secure isolation for all such cases, and the only thing to be done when isolation is impossible or is refused seems to be to endeavour personally to persuade the patients, or those in charge of them, to take reasonable precautions of treatment, and abstention from school and public assemblies; much may be affected in this way.

Another point with regard to the use of bacteriology is that in every suspected case both nose and throat should be examined, for the frequency with which the nose is latently affected is very great. Special care should be taken in this respect when declaring a patient free from infection, for it is not uncommon to find diphtheria lurking unsuspected in the untreated nose of a throat case. Recurrent outbreaks, or return cases, may well follow neglect of this precaution.

There is yet another means of prevention which can be, and has lately been, used in dealing with diphtheria, and which is peculiar to this disease—I allude to protective injections of antitoxic serum. It is true the immunity conferred is short, but it is sufficiently long to tide the injected over the period of danger previous to removal of the patient to hospital and performance of disinfection; while two injections would probably cover the infective period if a patient were nursed at home. It would be well, I think, if this safeguard were offered to the inmates of every infected house, where it is deemed advisable. Some sanitary authorities already supply antitoxin gratis for use in the case of poor patients, and there can be no reason, save that of expense, why the supply should not be extended to protective injection.

In order, then, to attack diphtheria with reasonable hope of success there must be available: (1) Notification; (2) proper isolation accommodation; (3) efficient means of disinfection; (4) the aid of bacteriology; (5) competent inspection of contacts (in the widest sense of the word); (6) the use of antitoxin curatively and preventively.

As an instance of what may be done by action on these lines, I may perhaps be forgiven if I very briefly state the outlines of an outbreak in my own district this year: Between 1st and 10th July, 29 cases were notified, 17 by medical practitioners and 12 found by me among contacts; there was then an interval of eight days before the next case; four days later 2 cases arose in the same house, and a third on the following day; this was the last case, on July 27th. Considering that at the beginning of the outbreak cases were arising at the average rate of 3 per day for ten days, the sudden fall to an average rate of occurrence of 1 case every three days during the next seventeen days, and after that an absolute cessation of cases lasting for two months, seems a very satisfactory result.

I would also refer you to papers in the last two numbers of the *Journal of Hygiene* (Nos. 3 and 4, vol. i.) on "Diphtheria in Cambridge," by Dr. Louis Cobbett, as giving a most interesting account of effectual preventive action on the same lines. He was fortunate in having the necessary assistance provided and a fully equipped laboratory under his control. If I may venture to criticise, however, it seems strange that, as the first outbreak was apparently caused by a mild unrecognised nose case, no further attempt appears to have been made to detect like cases: throat cultures are alone alluded to. May not the recurrent outbreak in the King Street School, mentioned in the second paper, have been due to undetected nasal cases?

It seems, then, that we have a large amount of work before us in educating opinion as to diphtheria causation and prevention up to the required point. Still, large as it is, we should not shrink from it; if the toil be great so also should the reward be.

ENTERIC FEVER.

With regard to enteric fever, do we, for preventive purposes, fully use the knowledge we have of its special nature? This is, of course, a disease in coping with which "sanitation"—that is, attention to water-supply and avoidance of general filth conditions, sewage or other—plays an important part, and care is taken to disinfect or render harmless the stools of patients in which the bacillus is known to live. It is a fact, however, that in many cases the urine is also loaded with bacilli, sometimes to an enormous extent, yet it is to be feared that scant attention is paid to its disinfection. It is doubtful whether the fact of its infectivity is known to the bulk of the profession; and even in hospitals where such cases are treated, the attempt to render the urine harmless before discharge, by the use of urotropine or otherwise, is probably the exception and not the rule. I venture to suggest greater attention to this point

in prevention. In dealing with this disease also bacteriology is of immense value, for by the application of Widal's serum test it becomes possible to detect cases which could not be clinically diagnosed, or about which there might be much uncertainty, or which could not be recognised till a late stage in the disease. The importance of recognition of indefinite cases is manifest, and was aptly exemplified by the milk outbreak in Clifton in 1897. In this instance the true enteric nature of a series of cases which arose within a short time, and which were supposed to be influenza with abdominal symptoms, was established by Widal's test; the cause (milk) was then quickly discovered. Without this test the real nature of the outbreak would probably have remained unrecognised. Again, where cases are to be removed, the early certainty of their nature is an important matter, for the longer the delay in moving the greater the risk to the patient; in any case it is an advantage to the patient from the point of view of treatment. The employment of a bacteriological laboratory is, then, essential to the proper control of enteric fever.

As yet we have no such definite knowledge as to the nature of scarlet fever, measles, or whooping-cough as to enable us to act upon special lines of prevention in their case. In time, however, it is probable that bacteriology will furnish us with something definite on which to take action, but until that time arrives we must be content to deal with them upon routine lines.

I have endeavoured to indicate certain directions in which our mode of dealing with some infectious diseases may be rendered more efficient, and I would again state that all our energies should be devoted to disabusing the national mind of the idea that all diseases are due to "insanitary conditons," and that the removal of these will be followed by cessation of infectious disease. I wish distinctly not to be misunderstood on this point. It is not my intention to decry "sanitation," which is absolutely necessary for improvement of general health, and does exercise an influence over the spread of certain infectious diseases; but I do unhesitatingly affirm that, of itself, it will not prevent every infectious disease. By all means let us have all our surroundings as "sanitary" as possible; but even then we shall still have to deal with each of these diseases on its own special lines.

What is required for effecting any real good in this direction is a better appreciation of the necessity for, and the provision of, isolation accommodation, steam disinfection, personal control, and bacteriological aid. When, if ever, all these are generally available we may look for tangible results.