the co-operation of medical men of all nations, and it may well be said that our predecessors have made most extensive conquests, not by destroying but by promoting the health and happiness of the human race. In this and many other kindred struggles the profession of medicine has known no territorial boundaries, and at the present juncture, when we are sharply separated in many matters from some of our Continental colleagues, we do well to remember this. The information that has so far reached us as to the care bestowed on our sick and wounded in hospital by German medical men, in contradistinction to the general treatment of English prisoners in Germany, encourages us in the belief that in spite of this War of Nations a Commonwealth of Medicine may yet survive.

OBITUARY.

We regret to announce the death of DR. JOSEPH HARWOOD WILSON, which took place on April 8th. He was medical officer of health to the Wigan Rural District Council, and of the Standish Section of the Wigan Union. Dr. Wilson was Surgeon to the Standish Branch of the British Red Cross Society, having charge of the Woodlands No. 3 Hospital, and was a Fellow of the Society of Medical Officers of Health.

We regret to announce the death from pneumonia of NATHAN HANNAH, L.R.C.P., Edin., L.R.F.P.S., Glasgow, which took place at Rock House, Ashton-in-Makerfield, Lancs., on April 6th. Dr. Hannah had been medical officer of health of Ashton U.D. for 40 years and was also for many years a Fellow of the Society of Medical Officers of Health.

We regret to announce the death of Dr. BERTRAM LEEDS THOMAS BARNETT, formerly medical officer of health and school medical officer of the Administrative County of the Isle of Ely.

Shortly after the outbreak of war, Dr. Barnett was appointed Captain in the Army Service Corps, but he was compelled to relinquish his duties on account of varicose veins. He re-joined his Corps after undergoing an operation, but a recurrence of his previous condition took place, and he was advised that there was no prospect of improvement. The fact that he would be incapacitated from serving with his Corps seriously affected his mind with the result that he took his own life on April 18th. Dr. Barnett's qualifications included M.A., M.B., B.C. (Camb.), M.R.C.S., L.R.C.P. (Lond.), D.P.H., and he also qualified as a solicitor. He was a Fellow of the Society of Medical Officers of Health.

SOME NOTES ON A SERIES OF CASES OF DIPHTHERIA.*

By W. G. WILLOUGHBY, M.D., Lond., D.P.H., Camb.

Medical Officer of Health and School Medical Officer of the County Borough of Eastbourne.

THERE are not many diseases that have had more written about them than diphtheria, but there are still important points in connection with the disease that are not settled.

I do not pretend that I can give any additional facts that will settle these points, but one or two special circumstances in connection with my duties as regards diphtheria are the cause of my again bringing the subject before you. One is the personal experience over more than twenty years of a long series of over 1,600 cases where I have had to look after the patients, and attend to the circumstances of the cases personally in the triple rôle of medical officer of health, medical attendant on the patients, and bacteriologist. (By the last I mean a mere worker in crude morphological bacteriology).

Another peculiar circumstance is that the soil of the district in which my cases have occurred is of very varied geological formation, so that to some extent I can give comparisons of incidence of diphtheria on similar classes of people on different soils.

The connection of the incidence of diphtheria with special soils on which houses are built has been a very much discussed subject, and the variety of soil on which my cases have occurred with equality of conditions in other respects, makes comparisons in these cases less open to objection than usual. I consider that the nature of the soil and the condition that soil is in are important factors in relation to the prevalence of diphtheria. Before discussing this I wish to refer shortly to the immediate cause of the disease.

Loeffler's discovery of the specific bacillus of diphtheria enabled him to claim in 1884 that he had satisfied the three postulates of Koch with reference to the relation of a micro-organism to a disease, *i.e.*, the organism had been always found arranged in a characteristic manner in the affected part; the organism had been isolated and obtained in pure culture, and the disease had been reproduced by the inoculation of pure cultures.

The fact remains, however, that as in other diseases, though we cannot have the disease

* Read at a Meeting of the Society of Medical Officers of Health on March 12th, 1915.

without the bacillus, many individuals harbour the bacillus without suffering from the specific disease, and until we know what other condition (or conditions) besides the bacillus of diphtheria is (or are) necessary for the production of the disease, or what causes the bacillus to become pathogenetic, we are not going to stamp out the disease.

It is easy to state generally that, as regards this disease and others, some individuals are immune, but the question is how are they immune. It is by no means proved that the individuals who are found quite well with bacilli in the mucous membranes are immune in the same particular way as a recovered patient is immune. Only a few of these instances are cases of immunity through a previous unnoticed attack.

It is true that Abel and Wasserman (quoted in the comprehensive work on diphtheria of Nuttall and Graham Smith) found that the blood of many healthy individuals, who had not *recently* suffered from diphtheria, was capable of protecting the guinea-pig against fatal doses of diphtheria bacilli or diphtheria poison. The protection by an attack of diphtheria from a second attack in the same individual, however, we know lasts a very long time, and in most cases permanently, and there are we know many mild unnoticed cases, so that unless the blood was taken from persons absolutely known not to have had an attack at all, this experiment does not seem to help very much.

In any case such an experiment would not explain the fact that there is much more apparent immunity in some districts than others, and that in spite of isolated cases some districts remain free from endemic diphtheria. There appears to me to be more genuine immunity of districts than of individuals.

The theory has been suggested that the bacillus has a saprophytic as well as parasitic existence, and in its former condition does not produce the disease, but in school epidemics I have found, as most of you have, that in children in the same class and under what seem to be identical conditions apparently similar bacilli exist, in some cases doing no harm to the child, and in others causing more or less serious clinical diphtheria. This occurrence one has also found in individuals in the same affected house.

It is difficult to imagine that in these outbreaks in a school or house the bacilli are amongst themselves different as regards their

pathogenetic power in the different children at the moment they are deposited on the throats.

Though in individual cases previous sore throat or cold has not infrequently been described, observation of school and house outbreaks do not show that ailing children are exclusively liable to attack; apparently healthy children also suffer. There has been no indication that in such cases the determining factor of the pathogenetic character of the diphtheria bacillus has been previous ill-health.

There is clearly in clinical diphtheria a selection of individuals in a district as well as a selection of districts, and in connection with this I consider it important that very few cultures of micro-organisms from the throats of persons affected with diphtheria are composed of Klebs-Loeffler bacilli only. It is probable that the presence of secondary pathogenetic bacteria or their products have an important bearing on the course of action of the specific bacilli or of the poison produced by them.

I have noticed frequently that the cultures from an infected throat where the patient has no symptoms, or very trifling symptoms, are more free from secondary bacteria than the cultures from a severe case. I have also noticed that in cultures from cases waiting for discharge from hospital where the patient has been clinically well for some time, but where the bacilli are persistent, I obtain the cultures most free from other organisms and most perfect as specimens of diphtheria bacilli morphologically. I should be interested to learn if that is the experience of others. I have had no time or opportunity to experiment with the sundry bacteria found. They are mainly streptococci and staphylococci.

Of the three theories to which I have referred viz, a possible real immunity of individuals (not including ex-patients), variation of pathogenetic and saprophytic existence of the bacillus, and mixed infections, as determining clinical from merely bacteriological diphtheria, the last seems to me specially important as being least hypothetical and more in accordance with direct observation. This has an important bearing on treatment. There is no time as a rule to obtain autogenous remedies but polyvalent sera should be tried with the anti-diphtheritic serum. Though this theory is not proved, it is my opinion that we shall not exterminate diphtheria if we are content to look upon the discovery of the specific bacillus,

most important as it was, as the end of necessary bacteriological research.

I may mention here another item I have noticed in the morphological bacteriology of the disease, viz., that in school outbreaks there are practically always cases at the same time, showing diphtheroid and "Hoffman" bacilli, and in some cases during recovery from diphtheria after the typical bacillus has ceased to appear, these bacilli are found instead.

I know that the consensus of opinion is that there is no degeneration or regeneration from one to the other, especially in the case of the Hoffman bacillus, and I have not sufficient experience to do more than say that it has happened sufficiently often in my cases to make me notice it. In dealing with an outbreak in a private school, I should certainly not certify the school as absolutely free while there were any instances of the presence of diphtheroid or of Hoffman bacilli.

I have already mentioned that one of the peculiarities of the district where my cases have occurred is that it presents wide varieties of soil on which the houses are built. In this connection I propose to give some figures.

Statistics are dangerous in discussing any disease, and in diphtheria seem almost worse than in any other. At Blackpool in July last Dr. Snell gave us a careful compilation of figures showing that apparently those districts were better off, both as to prevalence and fatality, that did not take diphtheria cases into hospitals.

I think that the true explanation of his figures is district immunity, and that diphtheria is of such varied incidence according to locality that one district cannot be fairly compared with another. Whatever was left undone in a non-diphtheria district there would be less diphtheria than in a district where diphtheria is endemic, in our present state of knowledge.

In a district where diphtheria is endemic the prevalence and fatality would easily be still worse without hospitals, and in a non-diphtheria district the prevalence and fatality would be probably even less if isolation and hospital treatment were provided, unless one takes the view that proper care of any disease is useless.

As instances of the failure of isolated statistics in diphtheria I may mention the following :—

My own figures show that I only began to get "return" cases from diphtheria when I

adopted the system of discharging patients from hospital after they were bacteriologically free. Here an explanation is probably that the numbers are too small to eliminate accident. A return case of diphtheria is, in my experience, a rarity. I had none whatever for years before bacteriological examination of patients became a routine. I must in those years have sent out many ex-patients with diphtheria bacilli, and the absence of return cases tends to confirm my theory that diphtheria bacilli, as a rule, will not alone cause clinical diphtheria.

In spite of the drawbacks to statistics, however, I propose to give some, but they will not be many, for the possible sources of fallacies to be eliminated have proved to be so many that I had to abandon certain figures I had prepared. Those I have given I shall be glad to have criticised.

The district geological map which I have hung on the wall shows the nature of the soils of the area on which the houses are built to be in strips of varying width. From the west-eastward we have areas on chalk, valley gravel on chalk, alluvium, and beach.

Groups of houses of approximately the same class are to be found on the chalk, on alluvium, and on the beach, so that approximate comparisons as to diphtheria in persons living on these soils can be made.

The characteristics of the three soils are as follows :—

The Alluvium is persistently wet with much organic matter. The water is within a few feet of the surface, and special bye-laws as to concreting, iron drains and height above O.D. have been passed to ensure safer building.

The Beach, as its name implies, is wet at a certain depth, but from its nature well-drained and the ground porous. Its retained organic matter has a chance of removal.

The Chalk, though good as regards subsoil drainage, when it is much puddled approaches a clayey consistence on the surface, and surface drainage is sometimes not good. It does not, however, have much organic matter in it; what is on or near the surface in the clay-like portion cannot get away easily.

In the district described, the first two are low-lying areas, the last averages about 70 feet above sea-level.

The subjoined table shows the numbers of houses on each class of soil that can fairly be compared through the social position of the inhabitants being approximately equal, the number of cases of diphtheria occurring in these houses, and the percentage attack rate.

The second table shows the numbers and percentage-rate of the fatal cases.

The attempt to associate diphtheria with districts was dealt with many years ago by Dr. Longstaffe. For the 26 years up to 1880 the counties with most diphtheria were Norfolk, Lincoln, Sussex, and North Riding; but, on the other hand, the mountainous Welsh counties were next in order. In those early days diphtheria was a disease of sparse districts, and has gradually since become relatively more frequent in populous districts. Somerset, with much low-lying marsh district, was one of the least affected counties. I have not been able to obtain similar figures for a series of years since.

CASES						
1162 CASES ON THE THREE SITES TAKEN						
Series of 20 Years						
	Houses	Per-centage	Actual Cases	Per-centage	How the Cases should have theoretically occurred to House Percentage	Excess
(1) Alluvium	2859	46	655	56	534	+121
(2) Beach	1532	24	242	21	349	-107
(3) Chalk	1776	30	265	23	279	+14
Totals	6167	100	1162	100	1162	

NOTE.—Population per house about the same. Somewhat largest houses on Chalk, smallest on Beach. Epidemics do not affect the above figures. Social position almost exactly equal on the first two, a little better than either of these on the third.

Occurrence of diphtheria in different districts is not easy to tabulate. The Registrar-General in his report for 1912 states that the figures show mortality for diphtheria greatest in the north, and the prevalence, as indicated by notifications, at its lowest in the north.

This may be explained by the existence of a severer type, by the children being less resistant or by more careful notifications in the south; for, as the Registrar-General, says:—"Diphtheria is a disease found to a considerable extent in the degree in which it is looked for." The fatality varied from 76 per 1,000 in the south to 125 in the north.

Though my figures do not show a very great difference, they point in the direction of the view of the late Sir R. Thorne Thorne, who said: "Where a surface soil is by reason of its physical constitution and topographical relations such as to facilitate the retention of moisture and organic refuse, and where a site of this character is in addition exposed to the

influence of cold wet winds, there you have the conditions which do tend to the fostering and fatality of diphtheria, and which also go to determine the specific quality of local sore throat."

Apart from figures, we locally expect cases of diphtheria on the low-lying alluvium after rainfall (and in the old days, before the completion of a comprehensive drainage scheme, after the flooding on the alluvium that accompanied it) and we are not disappointed as a rule.

In one long street on the alluvium, a marked improvement on house incidence followed re-sewerage with iron drains lessening organic contamination. The improvement has lasted sufficiently long to eliminate the explanation that the pabulum (susceptible persons) was exhausted.

As regards rainfall and diphtheria, for 20 years December, November, October, February and January have been the months

DEATHS			
Series of 20 Years			
	CASES	DEATHS	FATALITY PER CENT.
Alluvium	655	46	7.0
Beach	242	15	6.2
Chalk	265	20	7.5
TOTAL	1162	81	6.9
Remaining Houses	531	25	4.7
TOTAL	1693	106	6.2

NOTE.—Practically 100% of all cases are treated at the Borough Hospital, so that the treatment is the same in each case. This table indicates approximately the severity of the cases in each district.

with most cases in order, and September and June the best months; while in the same 20 years October, December, November, and January have been the wettest months. The theory has been advanced that a rising of the ground water has had something to do with the increase in number of cases, but I cannot find any satisfactory evidence of a causal connection in my district.

Diphtheria has been shown by Dr. News-holme to be connected with dryness, but my cases have occurred principally during the wet months, and not immediately after the close of the dry period. September, the close of the dry period, has been the month with least cases.

I do not propose to review the other etiological factors of diphtheria, for as regards age, sex, etc., they have been much the same in my cases as described in text books.

In spite of the large number of cases referred to (1693), and although cases must have

occurred in workers handling milk, there have been no milk epidemics.

In the last ten years, in a population with the sexes approximately equal in the chiefly affected age group, the proportion of cases according to sex has been five males to six females, and the fatality five males to seven females. Approximately two-thirds of the patients were in the age group 5-15.

Personal infection must be the chief means of spread. I have frequently been able to trace cases from persons to persons in different parts of my area, particularly from the alluvium to the chalk area. It is very seldom one gets a second case from the same house after the first case is removed.

I have noticed that the cases come largely from the artizan class; the well-to-do rarely suffer, and only lightly as regards severity. The second table shows this to some extent. The poorest and worst-kept houses, however, proportionally provide less diphtheria than scarlet fever. The diphtheria cases are often from very clean houses and in well-kept children.

The sanitary condition of the house, in fact, seems a somewhat secondary consideration, except in so far as general ill-health may predispose to diphtheria. New houses supply decidedly more than their proportion of cases, especially on the alluvium. I look upon a damp house on a damp organically contaminated soil as a most definite predisposing cause, in some way tending to make a harmless bacteriological diphtheria become a clinical case of diphtheria.

I am not able from my cases to give any comparative results regarding cases removed to hospital and those not so removed, for the simple reason that, practically, all the cases—I may say all but about half-a-dozen of the undoubted cases of the 1697—have been isolated and treated in hospital. Very few—indeed, not a dozen—of the 1697 cases have been associated with scarlet fever.

In conclusion, I should like to refer to the decreasing mortality from diphtheria of recent years, which is most satisfactory.

I think I am right in saying from my observations that most of the deaths that do still occur are preventable, however difficult of prevention the cases themselves may be. It is merely a matter of giving the specific anti-toxin soon enough. That this is so, is sufficient proof that the injury to the patient, even though the infection may be a mixed one, is due to the Klebs-Loeffler bacillus in the main.

Very occasionally a case occurs that within a few hours becomes so intense that anti-toxin has no apparent effect, and in these I have found by cultivations that the diphtheria bacillus is in scanty proportion to the various other organisms, mainly streptococci, found; but, as a rule, one may safely say that anti-toxin given on the first day of the illness would have saved the life of the patient, and every hour of delay the remedy became less useful.

Unfortunately, in spite of the free supply of anti-toxin at stations open day and night, practitioners have not even yet got into the habit of giving the specific cure while waiting for time to aid them in completing their diagnosis.

The fact, however, that sore throats being common ailments, the doctor is frequently not sent for in time, especially if the patients are in poor circumstances, is the main cause of diphtheria mortality now that we have such an antidote as diphtheria anti-toxin. I have found locally that police-stations—owing to someone being always in attendance there—make excellent anti-toxin distributing stations.

DISCUSSION.

The PRESIDENT said that the subject dealt with by Dr. Willoughby was specially suitable for discussion by a Society whose members were so closely concerned with the administration of public health, and he was sure that the discussion would be both useful and instructive.

DR. J. T. C. NASH (Norfolk County Council) said he had listened with peculiar interest to Dr. Willoughby's instructive paper. He had been particularly struck with many points in it which bore upon the question of the evolution of disease, a subject to which he had devoted much attention. The same factors noted in the causation of diphtheria were also found in other diseases, as, for instance, in pneumonia and typhoid fever, "carriers" of the pneumo-coccus and of the bacillus typhosus being numerous. In his own experience, when investigating some outbreaks of scarlet fever he had found among children at school some children who had had scarlet fever a year or two previously, but who at the moment showed nothing more than a slight nasal discharge. He believed that some of these children without the ordinary symptoms of scarlet fever were either "carriers" of the organism chiefly responsible for the development of scarlet fever, which had reacquired virulent properties for other children, or were themselves reinfected from other cases, but, being immune through a previous attack, they developed none of the classical signs of the disease beyond a slight nasal discharge, which, however, was capable

of infecting others. Such cases could easily be overlooked, and their responsibility for causing further outbreaks not realised. Evolution or recrudescence of infection, without ordinary symptoms in persons who had previously had scarlet fever, was he thought an explanation of why administrative measures had failed to stamp out the disease. He (Dr. Nash) was of opinion that there was a relationship between scarlet fever and diphtheria. As an instance of the evolution of diphtheria, he would instance an outbreak of sore throats in a girls' school some years ago. Swabbings from the first cases, cultured on blood serum, showed practically pure cultures of a long streptococcus. Next day swabbings from a further batch of three or four cases showed, in addition to long streptococci, a few diphtheroid organisms. Later swabbings showed in one or two cases typical beaded diphtheria bacilli of the Klebs-Loeffler type. The polymorphism of the diphtheria bacillus is well known as a diagnostic feature in film preparations from a pure culture. Occasionally virulent diphtheria is associated with a short non-beaded form of bacillus which would be returned by some laboratories as Hoffman's bacillus. This short form was recognised and described by Westbrook, whose work on the diphtheria bacillus was of immense importance. Streptococci are frequently found in the throats of scarlet fever patients; one form of streptococcus isolated and described by Klein as the streptococcus scarlatinae shows bacillary forms not unlike diphtheroid bacilli. Dr. Willoughby had referred to Norfolk as among the counties where diphtheria was prevalent. Active measures had very considerably reduced such prevalence of late years. As to return cases these would diminish if care was taken not to release patients from quarantine until nasal as well as throat swabs were reported clear. His own experience coincided with that of Dr. Willoughby as to the existence of diphtheria in new and comparatively damp houses. All practitioners should take to heart Dr. Willoughby's advice regarding the administration of antitoxin as early as possible; he agreed that the police office, which was open night and day, was a good place in which the antitoxin could be kept so as to be available for instant use.

DR. J. J. PATERSON (East Berks. U.S.D.) said that in his opinion there was a third factor besides the two mentioned by Dr. Willoughby, which came into operation to make a case clinically diphtheria. What that factor was he could not say, but the following experience would illustrate. In the course of swabbing a certain school he found two "carriers." Both were put under medical treatment, one cleared up in about a fortnight, but the other, a girl, carried the bacillus without any symptoms whatever from early in May to the end of June, in spite of local

treatment, and then membrane began to develop. His experience of the relation of soil to diphtheria was somewhat different to that of Dr. Willoughby. Until the last two or three years, diphtheria was very prevalent in his district, especially in the villages along the banks of the Thames, but on the other hand, in another part of the district (Sandhurst) there was a peculiar geological formation of gravel and sand; but it was not a dry gravel, for below the surface there was a pan which prevented the surface water from sinking through, and all through the winter the land was waterlogged. In some groups of houses if the floorboards were taken up they found several inches of water, and yet, curiously enough, these places had very little diphtheria. When a few cases occurred they did not seem to spread. The children at the schools, however, were frequently absent with sore throats. He should like to know if Dr. Willoughby could say anything as to the qualities or properties of the diphtheria germ. He had tried all sorts of tests, but had never come across anything which caused the clinical disease; although it was not infrequently difficult to identify the diphtheria bacillus.

DR. H. W. HARDING (Assist. S.M.O., Walthamstow) asked Dr. Willoughby whether he had noticed any alteration in the morphology of the bacillus during the last few years.

DR. VEITCH CLARK (Croydon C. B.) said that the actual cause of diphtheria had been the subject of innumerable papers. He could not agree with some of Dr. Willoughby's statements. He was certain that Hoffman's bacillus was quite a different organism from Klebs-Loeffler: there was no relationship between the two; Hoffman's bacillus is morphologically and culturally distinct and it is also non-pathogenic. He had had several years' intimate experience of infectious conditions in a certain set of orphanages. Diphtheria was several times introduced into these orphanages from without, but was always suppressed by swabbing of the children's throats and noses and isolation of those carrying true diphtheria germs. Hoffman's bacillus was paid no heed to and no evil results followed. With regard to the occurrence of acidosis in diphtheria, he considered it a common feature, as in a large number of cases acetone could be demonstrated in the urine, and was undoubtedly associated with fat metabolism and fatty degenerative changes. Two questions had to be considered in regard to this subject, firstly, actual personal infection without which the disease could not occur; secondly, the power of personal resistance to the disease. They were indebted to Dr. Willoughby for bringing before them the conditions which tended to govern the individual power of resistance, as, for instance, low vitality. His investigations had confirmed the opinion of those whose experience showed the greater

incidence of diphtheria on damp soils. Damp soils to a considerably greater extent than the harder and drier geological formations tended to produce a lower average vitality in individuals. In his opinion, however, diphtheria is a purely personal infection, and he doubted very much if there was any marked life of the infective organism outside the human body at all.

DR. B. C. STEVENS asked what Dr. Willoughby would do with carrier cases. Should these be isolated, or should the homes be isolated?

DR. SIDNEY C. LAWRENCE (Edmonton) said that he wished to put in a plea for the general practitioners who worked in poor districts, and were often unable to get payment for their visits. They had sometimes been held blameworthy for not giving antitoxin to every case of diphtheria. But a patient was usually safely bedded in the isolation hospital within two to four hours of the notification. His experience was that nearly all diphtheria return cases were due to sending out the children from the hospital with a *nasal* discharge. Swabs should be taken of every case, either scarlet fever or diphtheria, admitted, and the patients should never be discharged until at least two negative results had been obtained by cultivating swabs from throat and nose. There would be no return cases of diphtheria if that were the routine practice of the medical officer at the isolation hospital.

In Edmonton antitoxin was kept at the Town Hall, but when this building was closed, a supply for emergency could be obtained from the fire-stations, which were open day and night and well-distributed over the area. Fire-stations were less objectionable than police-stations as houses of call for medical men who were not police-surgeons and valued their reputations as staid members of society.

DR. CHARLES SANDERS (West Ham C. B.) said he wished to add his quota to the pleasure with which the Society had heard this interesting paper from one of its most distinguished Fellows. It was very comforting to those of the old school to know that modern science had proved that diphtheria arose from damp polluted soils accompanied by wet, cold winds. With the extension of scientific knowledge it was found necessary to carry on the hygienic measures advocated by the pioneers of the Public Health Acts, and that they had to adopt, with regard to modern infectious diseases, the same treatment from an administrative point of view with which they had checked the spread of, and caused the reduction of other diseases. What Dr. Willoughby had absolutely shown was that public authorities in town and country had not yet succeeded in properly draining all damp soils. As to Dr. Stevens' query about the isolation of all cases of carriers, he (Dr.

Sanders) questioned whether, from a legal point of view, they had any right to isolate a carrier unless the child had the disease definitely.

DR. T. ORR (Shrewsbury M.B.) said he agreed with Dr. Willoughby that the influence of soil had a large effect in the production of diphtheria, and that dampness of the soil predisposed to low vitality and consequent sore throat. He himself did not believe that immunity had much to do with the non-prevalence of diphtheria; it was all a question of susceptibility. On the question of symbiosis there was no doubt that the presence of dead matter in the throat favoured the growth of other organisms, but these did not affect the character of the disease. He agreed that Hoffman's bacillus was quite a different organism from that of diphtheria. In his experience, where children with sore throats attending public schools were swabbed, the result was not striking, nor was it striking where contacts in private houses were swabbed. In the hospital, where cases were swabbed until negative results were obtained, they had no return cases.

DR. T. W. NAYLOR BARLOW, hon. sec., said he agreed with Dr. Orr that there were no return cases where negative results were obtained after frequent swabbing.

DR. A. M. ERSKINE (Goole), speaking from an experience of over 16 years, gave the instance of Goole, which has a population of 22,000, and a naturally wet subsoil of alluvial deposit. Contrasted with diphtheria, scarlet fever, although imported repeatedly, does not flourish in the town. Last year diphtheria, which has been endemic since 1899, suddenly took on an epidemic character during the early part of October. The cases were notified from all parts of the town, at the same time having no common connection, and although an extensive system of "swabbing" (both nose and throat) was instituted, in very few instances were positive results obtained, and where a positive result was obtained, the child was not isolated, but a very careful watch was exercised, and practically never could a second case be traced to this source. The notifications ceased just as suddenly in the beginning of February. As every one knows, the bright summer of last year was followed by continuous rain, which began in October and lasted on into the new year. The special features of the cases were:—Very little spread of the disease by personal infection, or at schools, or through the medium of milk, and the increased mortality. It is common knowledge that ordinary "sore throat" is a very common affection in districts with a damp subsoil and low lying, such as Goole. He gave it as his opinion that the Hoffman bacillus plays no part in the causation of the disease, but the subject was one for the bacteriologists to elucidate. *Prima-facie*

evidence suggested that there was a connection between diphtheria and the movements of the ground air. During the month of January the level of the subsoil water was two feet six inches from the surface, and this fell during February to three feet six inches. He offered the suggestion that, after a period of dry and warm weather followed by continuous rain, with the rise of the level of the ground water, cases of diphtheria occur, and if the rainfall be continued long enough and in sufficient quantity the time is reached when further activity of the disease is arrested. This accounts for his recent "Experience" of the disease, as well as similar ones in 1907 and in 1903, when he stated, "that with the rise of the ground water level more notifications were received." It is understood, of course, that he is not referring to the spread of the disease by means of personal infection, or by milk, etc., but only with its endemic causation.

The PRESIDENT said that there had emerged from the discussion the satisfactory conclusion that the more or less empirical work of public health pioneers was bearing fruit, and that the theories as to infection propounded in the last century had not been upset by the more exact observations of later years. For some years he had placed great reliance on the swabbing of the children in a diphtheria infected school as a means of lessening the incidence of the disease, but the results obtained were not always so satisfactory as could be wished.

DR. WILLOUGHBY, in reply, said that as regards isolating all carrier-contacts he had found it impracticable, but it was easy to treat persons who had bacteriological diphtheria in their homes, and all infected children could be kept from school until the throat was clear without much practical difficulty. He was quite ready to defer to the opinion that the Hoffman bacillus was in no way connected with the true diphtheria bacillus, he only pointed out that in a large number of his cases the Hoffman bacillus appeared at a late stage. In stating that in very bad cases there were many more foreign bacilli than in mild cases, he had allowed for the fact that there would, of course, be many extra bacteria naturally owing to the foul condition of the throat. There was no doubt in his mind that although it was contrary to scientific theory, no important result had accrued from the practice of taking swabs and examining them before discharging patients from hospital. He could only repeat that although he believed the practice ought to be continued, yet over a period of many years there was not a single return case in what must have been quite a thousand discharges without bacteriological examination. This helped to show that some other factor besides the Klebs-Loëffler

bacillus was necessary for clinical diphtheria. Dr. Willoughby said it would be impossible to go over the whole of the ground covered by the remarks of the various speakers owing to time, and he concluded by thanking the members for the kind way in which they had received his paper.

MEMORANDUM ON THE DESTRUCTION OF VERMIN.

Issued by the Society of Medical Officers of Health.

THE importance of a national effort to suppress all forms of vermin affecting bodies, clothing and households has been emphasised by the existing war conditions.

The Army authorities have efficiently dealt with the question of lice as affecting the soldier, and the hope of the Society is that similar instructions regarding these and other parasites may prove useful to local authorities.

BODY VERMIN (fleas, bugs and lice) are injurious to health in that—

1. They cause discomfort and loss of proper rest ;
2. They cause indirect injury to the skin, with consequent possibility of infective absorption ;
3. Under certain circumstances the vermin may directly transmit serious disease through their bites.

The destruction of the insect is easier than the destruction of the eggs.

The eggs of the flea develop in 2-5 days (adult insect in 10-18 days) ; of the bug in 7-10 days (adult insect much longer) ; of the louse in 10-15 days.

The value of frequent change of underclothing to remove undeveloped eggs and partially developed insects is thus strongly indicated.

Body vermin, particularly bugs, can live without food for long periods.

To suppress the Vermin—

1. *For the Body and Head.*—Ordinary hot baths with soap are sufficient, except in the case of head lice. For these and their eggs, paraffin or diluted acetic acid (hot vinegar) should be well rubbed in over night ; the head should be thoroughly cleansed with soft soap and water the following morning, and then combed with a small-toothed comb. This should be repeated every night until there are no more eggs or nits visible. It should be remembered that paraffin is very inflammable.

2. *For the Clothing.*—Heat at or above boiling point is the most efficient method of destruction of insects and their eggs. Every Authority should have a steam disinfectant available for vermin destruction. Paraffin or petrol, especially along the seams of clothing, is also useful.

3. *For the House.*—Continuous cleanliness is the best measure. This prevents the development of eggs. Neither gaseous disinfection nor liquid disinfectants are to be relied upon. Some insect powders, chloride of lime and powdered naphthalin, destroy vermin. In crevices oily substances may be used with good effect.

It is a matter of urgent importance in dealing with vermin that the body, the clothing, and the house should be dealt with at one and the same time to prevent re-infection from one to another ; further, for the same reason all infected persons living in the same house should be dealt with at the same time.

A mixture of oil, soap, and some disinfectant, such as naphthalin, spread over the body and clothing has been found efficacious in preventing as well as suppressing verminous conditions.