REVIEW OF THE PROGRESS OF HYGIENE, 1906.

By Lieutenant-Colonel A. M. Davies.

Royal Army Medical Corps.

I.—AIR AND VENTILATION.

Bacterial Tests for Air Contamination.—Dr. M. H. Gordon has added to his former valuable contributions on this subject. In a previous Report he had shown that the fact that certain streptococci are normally present in the saliva (10,000,000 per c.c.) was applicable to the detection of droplets of saliva in air, in much the same way that Bacillus coli is used for the detection of faecal matter in water, air pollution (and possible access of morbific virus) being thus capable of measurement as well as water pollution. Subsequently Dr. Gordon investigated the characters of certain staphylococci with a view of ascertaining if it would be possible to detect the presence of particles derived from the skin as well as droplets of saliva. In the latest Report of the Medical Officer to the Local Government Board (for 1904-05, Appendix B. 5), this investigation has been continued. It appears that although a variety of staphylococci occur on the skin, one sort, having easily distinguishable characters, is found much more frequently than any other. "This frequents the epidermis of the hand, cheek, scalp and forearm with such persistency that it may be considered characteristic thereof in much the same way that B. coli is characteristic of the large intestine, and Streptococcus brevis of the mouth." This organism is the one named by Welch Staphylococcus epidermidis albus. Nine differential tests are available, viz.: Liquefaction of gelatine, 12 per cent. (a week at 22° C.); clotting of milk (a week at 37° C.); nitrate reduced to nitrite (3 days at 37°); neutral red changed (2 days anaerobically at 37°); acid production in slightly alkaline leuco litmus broth with 1 per cent. maltose (a week anaerobically at 37°); ditto with lactose, and with glycerine. Acid formation does not occur with mannite, nor is milk peptonised by this staphylococcus. Another form, reducing nitrate and acidifying mannite, but negative in regard to the other tests, was found frequently in the scurf of the scalp.

1 Report of Medical Officer to Local Government Board, 1902-3, App. B. 2.
Gordon obtained fifteen kinds of staphylococci from the open air, but none presenting the characters of the two just mentioned. In indoor air, on the other hand, as of a barber’s shop and of an operating theatre, on each of three occasions this particular staphylococcus was recovered, showing that it is applicable as a test for particles of integument in the air.

In a Parliamentary Blue Book (Appendix to Report of Committee on Ventilation of the House of Commons, 1906), Gordon details some elaborate experiments showing the presence and distribution of impurities (i.e., micro-organisms), derived from the mouth, throat and air passages, in the air of a chamber when speaking is in progress. The test was the identification in various situations of *Streptococcus brevis*, which is constantly found in, and can reveal the presence of even one ten-millionth of a cubic centimetre of, saliva. Droplets of saliva are to be found in the air of all rooms when speaking is going on, and are wafted about by air currents to considerable distances. The chief particulate pollution detected in the air passing out of the debating chamber was found to consist of such droplets, extremely minute, but apparently constantly present in the air during debates, and not found therein when the debating chamber is empty. To determine to what distance, and in what directions, salivary droplets are propagated during speaking, *B. prodigiosus* was used, the mouth of the person speaking being infected with this easily recognisable organism just before commencing. Portions of "King Henry V." and "Julius Caesar" were then recited in a loud voice. By this test it was fairly well shown that, even when the ventilation arrangements were at work, the air of the chamber became generally infected, especially in the galleries, with salivary droplets from the mouth and respiratory passages of the person speaking. The ventilation dispersed, but did not carry off, the particulate matter derived from the breath; for of a number of agar plates exposed in various situations, 25 per cent. were found to be infected on the benches on the floor of the house, and 50 per cent. of those exposed in the galleries.

The mode of spread of infectious diseases, such as influenza, tubercle, &c., in crowded places, especially when talking is going on, has thus been demonstrated, in confirmation and amplification of the observations of Koch and Flugge, and especially of Heymann (1901). It remains to be seen whether any ventilation measures that are practically available will afford adequate protection.
II.—Water and Water Supply.

Bacteriological Examination of Water.—Dr. Houston contributes another of his very valuable reports to the Supplement, containing the Report of the Medical Officer to the Local Government Board (1904-05, Appendix B. 2). In this he deals with the examination (1) of deep well waters at Tunbridge Wells; (2) waters in two Highland lochs.

(1) The Tunbridge Wells water is derived from the Ashdown Sands by a series of bore wells sunk to a depth of 350 feet; the sands are overlaid by the Wadhurst Clay, the depth of which is about 200 feet. This water, as might be expected, is of a high degree of bacteriological purity. Of 49 samples examined none contained typical B. coli in 100 cc.; of 27 of these samples as large a quantity as 1,000 cc. was tested, and in 26 no typical B. coli was found. Of 81 samples, none contained gas-forming coli-like microbes of any kind in 100 cc.; of 25 samples, in which 1,000 cc. were examined, 20 contained no coliform microbes of any kind. Deep well water properly protected is, therefore, practically free from typical B. coli, and, as a rule, from atypical coliform bacilli. None of the samples yielded B. enteritidis sporogenes in 10 cc.

(2) Two large Highland lochs, in parts very deep, were examined. Both contain trout in large numbers, and are liable to some degree of animal excretal pollution. Loch Laggan is exposed also to some degree of human excretal pollution from the Pattack stream, which also receives the drainage of manured land. Still, the volume of water in each loch is so enormous that it was anticipated that the bacteriological tests would be satisfactory. Loch Laggan is about nine, and Loch Ericht about fifteen, miles long; the breadth of each is half a mile or more.

Twenty-six samples from the burns feeding Loch Laggan were examined: B. coli or coliform bacilli were found in all samples; in 2 it was found in as little as 0·1 cc., in 14 others in 1 cc., in the remaining 10 samples it was found in 10 cc. or 100 cc. B. e. sporogenes was found in 3 out of the 26 samples in 10 cc. Of the Loch Laggan water itself 85 samples were examined: in 1 sample coliform bacilli were found in as little as 1 cc., in 28 samples they were found in 10 cc., and in 42 samples in 100 cc., while in 14 samples none were detected even in 100 cc.; of these coli-like organisms 82 per cent. gave the “flaginac” reactions. B. e. sporogenes was found, or suspected, in 4 only of the 85 samples. Houston considers that the B. coli found in the burn and loch
samples were largely not of human origin, but were derived from the drainage of manured land and from animal excreta.

Loch Ericht is very deep; it appears to be practically free from any source of pollution of human origin: 100 samples were examined, in 1 sample only was a coliform organism found in 10 cc., in 19 it was found in 100 cc., the remaining 80 contained none; even in 100 cc. Only 6 out of 21 specimens (28.6 per cent.) were "flaginac" B. coli. One sample only yielded B. e. sporogenes in 10 cc. As 80 per cent. of the Loch Ericht samples contained no B. coli or coliform bacilli even in 100 cc., although trout were very numerous in this loch, it does not appear that the presence of fish is likely to interfere to any appreciable extent with the significance or utility of the B. coli test, as regards undesirable (i.e., human) pollution.

These researches are interesting and important, as establishing the purity of deep well and unpolluted lake waters from a bacteriological standpoint; they show that coliform bacilli are not omnipresent, and they provide a justification for somewhat stricter standards of purity for drinking water than are by some authorities considered sufficient.

III.—FOOD AND DIETING.

Recent Work on Dietetics.—Some allusion was made last year in this Journal (vol. vi., p. 226) to the recent experimental work of Chittenden, of the Yale University, on minimum proteid requirements for healthy men. During the past twelve months considerable attention has been given to this subject, and Chittenden's results, or rather the deductions that he drew from them, have been severely criticised. What may be termed the orthodox, or accepted, standards of alimentation for average individuals doing ordinary work, have been stated as follows:—

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<tr>
<th></th>
<th>Proteins</th>
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<th>Carbohydrates</th>
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<td>Rubner</td>
<td>127</td>
<td>52</td>
<td>509</td>
<td>3,092</td>
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<tr>
<td>Atwater</td>
<td>125</td>
<td>125</td>
<td>400</td>
<td>3,815</td>
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It is admitted that figures such as these (except Atwater's) have been arrived at empirically, by experience or observation as to what amounts of food large bodies of persons under different conditions of life have been in the habit of taking. It has been assumed that the generalisation was sufficiently extended to warrant the opinion that the quantities of the different food principles that were actually taken were those that were really required physiologically,
not merely such as were to the mass of the population agreeable. Chittenden, distrusting this argument, set himself first of all to find what was his own proteid requirement; he determined this to be from 36 to 40 grammes daily while doing ordinary work, i.e., considerably less than half the usually accepted amount of proteid. The metabolised nitrogen was 5.7 grammes, or 0.1 gramme per kilo. body weight daily.

He then proceeded to determine the proteid requirements of three groups of individuals successively. The first group consisted of five professional men—University professors—who maintained a condition of good health for six to nine months on a dietary with an average metabolism of from 34 to 56 grammes proteid per day, being at the rate of 0.1 gramme nitrogen per kilo. body-weight daily, or but little in excess of this. The second group consisted of eleven soldiers of the United States Army: for five months a metabolism of less than 50 grammes proteid per day was found to be sufficient to keep them in good health, the metabolised nitrogen varying between 0.1 and 0.15 gramme per kilo. body-weight. A third group of eight University athletes subsisted for five months in health, and taking active exercise, with an average daily metabolism of 55 grammes proteid, the metabolised nitrogen being at the rate of 0.1 to 0.13 gramme per kilo. body-weight daily.

These observations are remarkably harmonious; they were continued for many months; in practically every case the individuals living on this greatly-reduced nitrogenous diet not only maintained, but improved, their health and capacity for work, as also their feeling of \textit{bien être} and freedom from fatigue. It is not to be wondered at that this research was received as a most weighty contribution to the study of dietetics, as, indeed, it was the most laborious, long-continued and exact of any investigations of the kind hitherto made.

At the Toronto meeting of the British Medical Association last August Chittenden’s results were somewhat adversely criticised by Halliburton and R. Hutchison, the former urging the danger of living too near a minimum, and the latter suggesting that it might be well to have some excess of proteid in the circulation as affording a higher power of resistance to disease; pointing out also that Nature provides two lungs and two kidneys, though life may be maintained with only one; the two can hardly be superfluous, and emergencies ought to be provided for. Folin admitted the soundness of Chittenden’s conclusions as to the minimum amount of proteid that was necessary, though regarding the optimum require-
ments as probably lying somewhere between the orthodox figure and that put forward by Chittenden.

The most detailed criticism of Chittenden's position has been that of Professor Benedict, of the Wesleyan University, Connecticut (American Journal of Physiology, August, 1906). Having collected the dietaries actually in use from a large number of sources (chiefly American), he maintains that they show two things: (1) everywhere people, who can obtain such food as they desire, use liberal rather than small quantities; (2) the more severe the work done, the larger the quantity of food eaten. Having regard principally to the nitrogenous constituents, he finds that persons doing light work take 100 grammes proteid daily; those doing ordinary work take 115 grammes; while those engaged in very active muscular exertion take 175 grammes daily. It is now commonly agreed that increased muscular work does not materially increase the disintegration of muscular tissue. Why, then, is there always found an increased proteid consumption with increased muscular exercise? And why do people in general consume more proteid than is required to repair waste tissue? It is very significant that this is quite universal, as far as statistics afford evidence: England, France, Germany, Italy and Russia, as well as (contrary to popular impression) Japanese\(^1\) and Chinese dietaries, show an agreement in respect to a liberal quantity of proteid demanded, in spite of variation in nationality, climate, geographical conditions and dietetic habits.

Benedict admits, of course, the accuracy of Chittenden's observations; but doubts if he has incontrovertibly proved that the restricted nitrogen diet can be maintained permanently; the improvement in health that occurred in all the subjects may, he thinks, have been due to the simple, regulated mode of life, not necessarily to the small amount of proteid consumed. He points out a peculiarity in regard to the digestive phenomena of the group of eleven soldiers. These men all consumed practically identical quantities of food, during three periods of six, seven and five days; one would expect that with eleven normal alimentary tracts the quantities digested would be very much alike, and the quantities of nitrogen excreted through the faeces also almost the same. This had indeed been the case in some experiments he had himself conducted on cheese digestion (at the Wesleyan University) with

\(^1\) The present dietary of the Japanese Navy supplies 155 grammes protein, which, considering the body-weight, is above the average.
twenty-five or thirty men: of 40 grammes nitrogen ingested during a three-day experiment, 4.7 grammes were on an average recovered in the feces, with but two or three decigrammes variation. But in Chittenden's series, with a total nitrogen ingestion of 49.4 grammes, the nitrogen in the feces ranged between 4.45 and 12.10 grammes, with marked variations from the average (8.46 grammes) in a majority of the cases. Similar large variations were found during the other two experimental periods. These large variations in digestibility of the same diet are much more marked than in the ordinary healthy individual; it may have been that there was some disturbance of the alimentary tract, affecting its power of absorbing either the protein of the food, or the nitrogenous materials from which the so-called metabolic products are derived—a disturbance due to the abnormally low protein intake.

With regard to the eight athletes, Benedict considers it significant that the reduced diet had not apparently been persevered with, although one would suppose that if the improved bodily condition had continued, the dietetic alterations would have been eagerly adopted in the efforts towards increased athletic success.

Referring to the experiments on animals, Benedict notes that (1) for carnivora, Munk, Rosenheim and Jagerroos have shown how in dogs a low protein diet resulted in loss of absorptive power in the intestinal tract, due apparently to change in condition of the epithelial cells and diminished secretion of digestive fluids; (2) for omnivora, Shutt, of Ottawa, and afterwards Skinner, of Indiana, have recorded that in hogs fed on low protein diet the muscular tissue becomes of very poor quality, being known as "soft" pork; improvement taking place when nitrogenous material is added to the food; (3) for herbivora, Haecker, in Minnesota, fed two groups of cows, one on normal protein diet, the other on a much lower amount; after two years both groups appeared to be in the same condition, but during the third winter the cows on the low protein began to fail, and this constituent had to be increased. This slowness in the appearance of deterioration is very significant. It may also be the case in man.

Benedict concludes, therefore, (1) that from the experiments on soldiers it is seen that abnormally low protein may affect nitrogenous absorption in the alimentary tract; (2) animals fed on low protein do not thrive so well as on liberal quantities; (3) dietary studies all over the world show that in communities where productive power, enterprise and civilisation are at their highest, man has instinctively and independently selected liberal rather than
small quantities of protein. He particularly instances the immense improvement that takes place, both in physique and morale, in the negro and poor white of the Southern States, and in the Italian labourer of Southern Italy, when fed on a higher protein dietary.

It must be allowed that there are two sides to this question, and that there is much to be said on each. Of the practical importance of the matter there can be no doubt. The current ideas as to what constitutes a minimum adequate allowance of food are generally derived from the older, or orthodox, standards which, *inter alia*, lay down 100 or 130 grammes of proteid as a daily necessity for an individual doing ordinary work. Mr. Seebohm Rowntree, indeed, in his study of *Poverty*, adopting the estimates of Atwater, took 125 grammes proteid and 3,500 calories as the minimum daily requirement; and based his conclusions (as to prevalence of poverty) on the cost of a ration yielding 137 grammes proteid and 3,560 calories daily. But if it be true that 50 or 60 grammes of proteid are sufficient, then the cost of the dietary necessary for a man doing ordinary work will be very considerably reduced, and consequently there will not be such a large number of persons unable to purchase the minimum dietary required; in other words, the amount of poverty existing in our population will be less than Mr. Rowntree estimated. The amount of ignorance as to food values prevailing amongst our poorer classes is, however, so great, that probably very large numbers are suffering from semi-starvation owing to want of knowledge, rather than want of means.

*Tinned Meat.*—Much interest was excited, not only amongst those concerned with the public health, but throughout the community generally, by the publication in the early part of 1906 of Mr. Upton Sinclair's book, "The Jungle," which, under the guise of a novel of incident, purported to disclose a state of things obtaining in the vast food industry of the United States (especially at Chicago) that caused uncomfortable feelings in both hemispheres. The matter could not be dismissed as a tale, full of sound and fury, signifying nothing; for the President of the United States, in a message to Congress on June 4 (accompanying a report by the Government Commissioners on the slaughter-houses and packing establishments of Chicago), stated that it was urgently necessary to provide immediately drastic and thorough-going inspection of all stock-yards, packing-houses, and their products, so far as these last enter into inter-State or foreign commerce. There appears to be no doubt that the conditions under which animals were slaughtered, and tinned or canned foods prepared, were in many cases filthy and
Review of the Progress of Hygiene, 1906

disgusting, and that grave danger to health must necessarily result to the consumers of such foods. This danger would exist owing to (1) possibility of food poisoning from the filthy conditions under which the canning has been in many cases carried on; and (2) possibility of transmission of disease, owing to the use of the flesh of diseased animals (e.g., tuberculosis).

It has been doubted whether the insanitary enormities that were reported referred to food intended for consumption in the United States only, or whether food exported to this country might also be reasonably suspected. The opinion of an experienced provision merchant of Liverpool, well acquainted with the conditions of the trade, and with personal knowledge as to the state of things at Chicago, was quoted in the Times (June 1st, 1906), to the effect that the sanitary state of the packing houses was most disgusting; that, though bacon and hams and tongues were fairly innocent, any foods in the shape of brawn, or potted meats, were prepared under conditions that were indescribable, and that the alleged food inspection was of no effect.

The consumption of these foods is so extensive in this country, and their use for ourselves is so widespread under Field Service conditions, that the matter is one of great interest and importance to the Army Medical Officer. Although a very great quantity of tinned meat was condemned as unfit for food during the South African War, it is certain that the greater part became unfit owing to the tins suffering damage by rough usage or exposure, and that the meat itself had been of apparently good quality when put up in the tins. The general opinion will certainly be that the tinned meat that is ordinarily purchased or consumed in this country, even though of Chicago origin, is not obviously of bad quality. It is none the less necessary to guard against possible disease transmission (as of tubercle, or of animal parasites), and possible food poisoning (through ptomaines or toxins). There seems to be some doubt whether the American Pure Food Law, passed in February, 1906, or the subsequent legislation of that year will afford sufficient protection. Very rigorous inspection at our ports of entry is required, and is now being carried out. Public authorities are exercising increased vigilance in this matter throughout the country.

Dr. George Newman has emphasised the importance of inspection at the time of manufacture as being the only effective method (Public Health, November, 1906). This is, no doubt, the case as far as regards food prepared within our own shores, but in the case
of imported foods we must rely on inspection at the port of entry, and when the article is exposed for sale. Dr. Newman's requirements are: (1) the manufacturer's name and place and date of canning to be impressed on the can; (2) food intended for canning to be inspected at the factory, and to be derived from animals that have already been inspected; (3) premises and apparatus used in preparation processes, or for storage, to be regularly inspected, and kept in good sanitary condition; (4) imported canned goods should have a certificate that they have been produced and prepared under administrative control and inspection; (5) the "detective" system of inspection, as now practised, should be much more thorough.

For Army Medical Officers the existing instructions as to examination of tinned or canned foods (Supply Handbook, p. 31) are practically sufficient. It will be found that the most convenient way of testing for presence of gas in the tin is to place a good sized drop of water on one end of the tin and to puncture the tin sharply through this drop; if there is a partial vacuum in the interior, the water will be sucked in; if there is formation of gas, bubbles will escape, forming a froth with the water.

Another practical point is this: if there is a faint suspicion of a tympanitic note on tapping a tin, a suspicion not strong enough to warrant condemnation, set aside the tin in a warm place for twenty-four hours, and test again by tapping; if gas formation is going on, the tympanitic note will be more marked. Many firms now date their tins, therefore this stamp should always be looked for.

"Non-bacterial blowing" of tins has been described by Pfuhl and Wintgen as due to insufficiency of the tin lining, the acid of the food material acting electrolytically on the iron case and producing gas, which consists partly of hydrogen, partly of atmospheric air. The same action has been described as occurring in tinned milk, by Dodge, of New York.

Food Preservatives.—Much activity has been shown by public authorities during the past year in various parts of the country as regards inspection of preserved foods, and many prosecutions have been undertaken when the amount of preservative added has been found to be excessive. The Metropolitan Branch of the Society of Medical Officers of Health went so far as to pass a resolution in July, that "the use of preservatives in canned food is unnecessary, and should under no circumstances be permitted." The Corporation of the City of London, in October, communicated to the Local Government Board their opinion that the time had now arrived
for adopting the recommendations of the Preservatives Committee appointed by the Board of Agriculture; these recommendations had been made in 1901, but have hitherto had no legislative sanction. In regard to milk the Local Government Board in July addressed a circular to local authorities, suggesting that they should take action under the Sale of Food and Drugs Act in instances where preservatives were reported to be present: in cases where the vendor makes a declaration, by label or otherwise (in reference to Section 6 of the Act of 1875), that he does not sell the "milk" as such, or that its quality in regard to preservatives is not guaranteed, or that it contains some added preservative, the Local Government Board consider that formalin 1 in 40,000 (= formic aldehyde, 1 in 100,000) parts, or boric acid 57 parts per 100,000, when found to be present in a milk sample (within three days of its collection) raises a strong presumption that the article has been rendered injurious to health and the purchaser prejudiced.

The preservative most largely in use for meat foods is probably boric acid, in accordance with the present taste for "mild cured" foods; this is added instead of the old-fashioned saltpetre; it appears that large quantities of foods, such as hams, are imported packed in boric acid for transit purposes, and that potted meats prepared from such hams, &c., may contain notable amounts of boric acid without any having been added by the manufacturers in this country; 0·25 per cent. (17½ grains per lb.) is said to be sufficient when used for packing; amounts that have been actually found are 145 and 163 grains per lb. (20·3 and 22·8 per cent.). In such cases prosecution might be undertaken effectively.

Food Poisoning.—There is still much to be learned as to the nature and exact causation of food poisoning by bacterial agency. Dr. W. G. Willoughby (Public Health, August, 1906), describes an outbreak at Eastbourne, affecting sixty persons, the symptoms being those of high fever and acute enteritis, but without any fatal result. The cause was distinctly traced to some brawn, which apparently had no peculiarity of taste or appearance; the severity of the symptoms varied with the quantity consumed; there was a short incubation period. The brawn came from Nottingham, and it was ascertained that similar cases of poisoning had occurred in that town at the same time, from the same consignment of brawn. It was evident, therefore, that the brawn became poisonous not at Eastbourne but before it left Nottingham. Chemical and bacteriological examinations were made by Mr. M. Wynter Blyth, who found coliform organisms of various kinds to be present, amongst
them being some true "B. coli"; the organisms were found to be far more numerous on the outside than in the interior. "B. sporogenes" was also found in one specimen. The conclusion was that the brawn had been prepared from sound meat, and had afterwards become infected, probably with intestinal organisms, on the surface, these bacteria subsequently growing inwards. Neither ptomaines nor poisonous albuminoids could be definitely demonstrated.

Levy and Fournet relate a small outbreak of food poisoning (Cf. Bakteriologie, Orig. xli.) following on the consumption of damaged food. Seven members of one family were attacked suddenly with vomiting, diarrhoea and fever; in four of these cases there was enlarged spleen, in one a characteristic typhoid roseola. The symptoms improved on the third or fourth day, except in one case, where they were like those of genuine typhoid fever, lasting eighteen days. Bacteriological examination showed the presence of paratyphoid bacillus B. in the excreta of all the persons; all their serums agglutinated with paratyphoid B.; from one case it was isolated and proved very virulent to a guinea-pig, and fatal to mice.

A somewhat similar outbreak was traced by Lobenau (ibid., xl.) to eating cutlets avariezés (damaged) at a large sanatorium; the symptoms were diarrhoea, vomiting, abdominal pain and headache, coming on eleven hours after eating; in some cases there was fever for two or three weeks. By exclusion, the cutlets were incriminated; a short spore-bearing bacillus was found, pathogenic to dogs, guinea-pigs and mice being refractory. The meat had been kept on ice, then boiled, then put on ice again,—in July.

IV.—REMOVAL AND DISPOSAL OF SEWAGE.

Biological Treatment of Sewage.—Some further evidence has been adduced in regard to the efficacy of fine-grain percolating filters by Dr. G. Reid. This relates in particular to the high degree of purification effected in the upper layers, and if found to hold good generally with the materials in ordinary use, a considerable increase in the adoption of this method may be looked for. Hitherto it has been considered that the greater the depth of the filter (within limits) the greater the degree of purification obtained. In the Hanley filters, however, it has been found that the effective purification takes place in the upper three feet.
Review of the Progress of Hygiene, 1906

<table>
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<th>Solids in suspension</th>
<th>Free ammonia</th>
<th>Albuminoid ammonia</th>
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<td>0·043</td>
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The quality of the filtrate at 3 feet is seen to be as good as, or better than, that at 4½ feet depth. The filtering medium is broken "saggers" (pottery chips), and the best results have been found to be given by a fine grade, ¼ inch fragments. The distribution is effected by travelling sprinklers, giving 200 gallons per day, in 200 doses of 1 gallon each, per square yard of filter surface. It is seen that the suspended solids are practically all retained in the top layer of the filter, where the organic matter is liquefied. The upper few inches may require to be removed and washed, but so far this has not been found to be necessary, after three years' working.

If a similar successful result is obtained with fine grade material of different sorts, and with sewage of different characters, the reduction in depth necessary to produce satisfactory purification will be of great importance, especially in places where the available fall is limited.

V.—CAUSATION AND PREVENTION OF DISEASE.

Plague.—A Report on plague investigations has been issued by the Committee appointed by the Secretary of State for India, the Royal Society and the Lister Institute (Journal of Hygiene, September, 1906), in which the fact of transmission of the disease from animal to animal by means of fleas has been proved to demonstration.

(1) On thirty occasions it was found that a healthy rat contracted plague, after living in the neighbourhood of a plague-infected rat, but under circumstances which prevented the healthy animal from coming in contact with either the body or the excreta of the infected rat; fleas were abundant, and could pass freely between the two rats. (2) In twenty-one out of twenty-eight experiments, healthy rats living in flea-proof cages contracted plague after receiving fleas (P. cheopis) collected from rats dead or dying of plague in another cage. (3) By observations on guinea pigs it was found that close contact between infected and healthy animals, if fleas were excluded, did not give rise to an epizootic; this contact
included contact with the faces and urine of infected animals, and eating food contaminated by the same. Close contact of the young, even when suckled by plague-infected mothers, did not transmit the disease. (4) If fleas were present, the epizootic, once started, spread from animal to animal, the rate of progress being in direct proportion to the number of fleas present. (5) Guinea-pigs, allowed to run free in infected houses, acted as good traps for fleas, on an average twenty per room being obtained, mostly rat fleas; in 29 per cent. of the rooms tested guinea-pigs contracted plague. (6) In plague houses disinfected by the ordinary means, numbers of fleas were found to be still present; guinea-pigs allowed to run free became infected in 29 per cent. of these houses. (7) In forty-two experiments, two guinea-pigs, one protected from fleas by a wire gauze curtain, the other not so protected, were placed side by side in a plague house. Both animals were protected from soil infection and from contact with other animals, but were equally subject to aerial infection. None of the protected ones, but four of those unprotected, contracted plague. (8) Animals protected from fleas by a sufficiently broad layer of "tangle foot" (a sticky, resinous preparation used for catching flies) and placed in plague houses did not contract the disease, while several animals, similarly placed, but not so protected, did take plague.

Contrary to the experience of Hankin in 1898, the Commission found that in making passages of \( B. \) *pestis* from rat to rat, without intervening culture on artificial media, no diminution of virulence occurred; the time taken in this experiment was eighty-nine days.

With regard to the important point of the infectivity of the ground, floors of cowdung grossly contaminated with \( B. \) *pestis* were found to remain infective for forty-eight hours, when scrapings were rubbed into susceptible animals; and for twelve hours (not for twenty-four) to animals running about freely over them; chunam floors similarly contaminated remained infective for twenty-four hours by rubbing scrapings, and for six (but not for twelve) hours, to animals running over them.

**Diphtheria.**—The significance of the various pseudo-diphtheritic bacilli, especially of the Hoffman bacillus, continues to be discussed. Dr. Joseph Priestley (Public Health, February, 1906), has related in detail the circumstances of an outbreak of diphtheria and Vincent's angina, in connexion with which Klebs-Joeffler and Hoffman's bacilli and Vincent's organisms were found together. This occurred in July, 1905, in a Lambeth institution, the inmates of which con-
sisted of about 600 children and officers, and was characterised by
the extreme mildness of many of the cases, clinical symptoms
(except slight redness, with minute ulcerations of the nose or
fauces) being absent, and the diagnosis depending solely upon bac-
teriological examinations.

The outbreak was traced to two chief sources, the Infirmary
and the Receiving Ward; of the total number of sixty-four cases
the Infirmary was found to be responsible for the causation of
thirty-six. A child, J. J. T., was an inmate of the Infirmary from
April 13th to 28th, suffering from stomatitis and catarrh; he
occupied a bed next to another child, W. J., whose throat showed,
on examination, modified diphtheria bacilli, and a few doubtful
Vincent’s organisms; the rest of the J. family were traced (three
being at the institution and three at the workhouse), and four of
them were found to harbour modified diphtheria bacilli in their
throats, one had a pure cultivation of Klebs-Loeffler and one only
(the father) gave a negative result. The child, J. J. T., returned
from the infirmary to his own block on April 28th, having
his throat infected, but presenting no clinical symptoms of any
kind. Contrary to the standing recommendation of the medical
officer, the child was transferred direct from the infirmary to his
block without passing through a convalescent or probation ward.
Out of the sixty-six inmates of this block thirty in all were removed
to the Metropolitan Asylums Board Hospital suffering from actual
or potential diphtheria (complicated in five instances with Vincent’s
angina) as shown by the presence of Klebs-Loeffler and Vincent’s
organisms in their throats or noses; nine others showed Hoffman’s
bacilli in their throats or noses; and one other (the child J. J. T.
just mentioned) showed modified Klebs-Loeffler and pseudo-diph-
theria bacilli, together with a few doubtful Vincent’s organisms,
pointing to a recent attack of diphtheria complicated with ulcerative
stomatitis.

The Receiving Ward was responsible for seventeen cases. On
June 16 a child, B. A., was admitted to the Receiving Ward from
the Lambeth Workhouse, stated to be suffering from enlarged and
inflamed tonsils; the throat was examined, and a pure cultivation
of Klebs-Loeffler bacillus obtained. The child was next day
removed to the Metropolitan Asylums Board Hospital, but had
been twenty-four hours in contact with forty other children in the
same ward, whose throats were at the time infected with pure, or
modified, Hoffman bacilli and modified Klebs-Loeffler bacilli. The
result was an explosive outbreak, during the following four to
fourteen days, of pure diphtheria; nine children directly, followed by seven others indirectly; the child B. A. having been the match which caused the explosion. It was afterwards found that this child had also caused a localised outbreak of eleven cases at the workhouse. Of the total of sixty-four cases, fifty-three have been accounted for; of the remaining eleven the source of infection could not be so definitely traced.

The preventive measures adopted were, shortly, careful medical inspection of all contacts and suspects, including bacterial examinations of noses and throats, and followed by strict isolation of all persons showing the presence of either Klebs-Loeffler bacilli or Hoffman bacilli (pure or modified). No patient should be deemed free from infection until after three successive negative examinations of both nose and throat.

Dr. Priestley draws attention to the following points: (1) Mildness and nature (nasal) of the type of diphtheria (latent forms); (2) importance of convalescents from infirmaries passing through a probation or convalescent ward; (3) the power that the true Klebs-Loeffler bacillus appears to have of losing its virulence, lying dormant, and afterwards regaining it under suitable environment; (4) variation in virulence and in morphology of diphtheria organisms; (5) the need for strictly isolating all "carrier" or potential cases, i.e., persons, especially children, who do not show any clinical symptoms, but who have in their throat or nose, or both, the germs of diphtheria. This is in accordance with previous experience at Colchester, Cambridge, and elsewhere, but is, of course, difficult and troublesome in practice. The clear, detailed account by Dr. Priestley demonstrates that the trouble must be taken and the difficulties overcome if the disease is to be combated with success.

In order that there may be no doubt as to the nature of the organisms found, their morphological and staining characteristics are here given:

1. **True Klebs-Loeffler Bacilli.**—Slender rods, 3 to 5 μ × 1 μ, non-motile, non-sporing, staining with methylene blue (segmental and polar), and typically by Gram and Neisser methods, having a tendency to arrange themselves in parallel groupings; giving acid reaction with glucose; virulent to animals. **Involuted or modified forms:** spindle- and club-shaped rods, staining irregularly with methylene blue, and only occasionally typically with Gram and Neisser; non-virulent to animals.

2. **Hoffman (pseudo-diphtheria) bacilli.**—Short even rods, 1 to 2 μ long, staining evenly with methylene blue, not at all typically with Gram
and Neisser, giving no acid with glucose, non-virulent to animals. The grouping of these bacilli at times seemed to point to a sort of connexion or correlation with the Klebs-Loeffler bacilli, antecedently or subsequently.

(3) Vincent's Organisms.—(a) Fusiform, elongated bacilli, 6 to 12 μ x 1 to 1.5 μ, vacuolated, motile or non-motile, not staining with Gram, staining irregularly with Ziehl's liquid, readily cultivated in ordinary broth or human serum; (b) fine long spirilla of varying lengths, sinuous and very motile, staining badly or not at all with the usual reagents, not cultivated in the ordinary well-known media. These organisms are found in Vincent's angina, an infectious disease, most frequent in children from 8 to 10 years, appearing rarely in a diphtheroid form, and commonly as a deep ulceration of the membranes of palate, tonsils, &c. Vincent holds that they may also cause ulcerative stomatitis.

Yellow Fever.—The main facts regarding the causation and prevention of this disease are now fairly well understood, though many points still await explanation. For practical purposes, however, prevention resolves itself into measures for the extermination of Stegomyia fasciata, and of protection both of the yellow fever patient and of the healthy population from its bite.

S. fasciata is a domestic mosquito, frequent in the crowded parts of cities, where it breeds in water cisterns and barrels, and in small collections of rain water, such as in gutters, empty tins, bottles, &c., also in cesspools. Professor R. Boyce summarises the preventive measures thus (Transactions of Epidemiological Society, xxv., 1906) :—(a) In connexion with the patient and infected mosquito: (1) Early notification; (2) isolation; (3) screening with wire gauze (18 meshes to the inch), the whole room being preferably so treated, and the entrance protected by double doors (air-lock); (4) fumigation of the whole house, except the patient's room, which is screened; effective agents are sulphur (2 lbs. to 1,000 cubic feet), pyrethrum (3 lbs. to 1,000 cubic feet), in each case the duration of the process being three hours; or camphor and crystallised carbolic acid fused into a liquid with gentle heat, 4 oz. to each 1,000 cubic feet, the duration being two hours. (b) In connexion with extermination of Stegomyia: (1) Survey of cisterns, &c., to discover the mosquito; (2) screening and controlling of the water supply (the form of water receptacle being prescribed, and barrels and all open receptacles being prohibited); this screening of water supply is to be especially borne in mind in connexion with wharves and shipping; (3) mosquito nets and screening of houses; (4) anti-mosquito propaganda. Stamping out has been achieved with brilliant success at New Orleans in 1905.
Marchoux and Simond have carried out important researches at Rio Janeiro (Annales Pasteur, xx., 1906). They have proved the transmission of hereditary virulence in Stegomyia: a female having bitten a yellow fever patient, deposited its eggs; two females from this brood were made to bite a healthy individual, who thereupon became infected with the disease. This subject had not come into contact with any other source of infection. He was subsequently bitten by several mosquitoes which had fed on a fatal case of yellow fever in the second day of the illness; no inconvenience ensued, indicating that this individual was immunised. The experiment was repeated with mosquitoes which had bitten a severe case of yellow fever on the first day of the disease, and again with a negative result. Marchoux and Simond, however, do not think that “hereditary virulence” of mosquitoes can extend through many generations, or is of much epidemiological importance; possibly passage through the egg of Stegomyia brings about attenuation. They have not succeeded in infecting S. fasciata from cadavers of infected mosquitoes; nor have they found the excreta of patients to be capable of infecting mosquitoes; moreover, the females avoid the regions of the skin that are soiled by the excretions of the patients. They did, however, infect the mosquito by pounding living infected mosquitoes with glucose and eau physiologique and administering the mixture to Stegomyia; sixteen days later three of these bit a man, who subsequently had a typical attack of yellow fever; thus showing that the virus can pass from one mosquito to another.

S. fasciata is the only mosquito that transmits the virus, so far as is known. Among most mosquitoes the fact that the death of the female occurs after the first laying of eggs is against the possibility of their becoming infective: S. fasciata is an exception to this rule; the female can furnish seven successive broods after one copulation, provided fresh blood is ingested after each laying; in the free state the average is three broods. It is to this biological peculiarity that this mosquito owes its power of transmitting the yellow fever virus; the ingestion of living blood is necessary to it for the development of its eggs. In its early life it appears to bite both by day and night, but after the first laying it ceases to bite during the day; hence yellow fever transmission occurs normally during the night. Marchoux and Simond have succeeded in keeping alive and rearing S. fasciata in France; during the summer the temperature of the interior of dwellings is suitable, and it can multiply, although in a less active fashion than in tropical climates. This is of epidemiological significance.
Malarial fevers.—The results of the preventive measures that have been undertaken in the malarious districts of Italy are most encouraging. Besides measures of drainage and agricultural improvement, there have been two chief lines of attack on the disease—prophylactic administration of quinine, and mechanical protection against mosquitoes.

(1) Quinine Prophylaxis.—In the notorious Campagna of Rome, in 1900, when no medicinal prophylaxis was carried out, malaria prevailed to such an extent that 31 per cent. of the population suffered from attacks of fever; in 1901 quinine commenced to be given systematically, and in this year 26 per cent. were attacked. The figures for the three years succeeding were 20, 11 and 10 per cent. respectively; and in 1905 only 5·1 per cent. of the population suffered. Celli, in his summing up of the experiences of 1904, concluded that quinine administration during the pre-epidemic period was of no use (it has now been abandoned). The continuous and daily treatment of relapses during the two most feverish months with 40 to 60 centigrammes of quinine gives good results. Out of a population of 70,000 persons, protected by routine quinine administration, only 8·08 per cent. suffered from malarial attacks; and this was in a bad fever year, and, of course, in malarious localities. In a particular district, in the lower valley of the Aniene and Tiber, amongst 578 persons treated regularly with quinine, there were 12·11 per cent. of cases; in 270 persons treated irregularly there were 50 per cent. of cases, and amongst the control population not treated at all, there were 46·52 per cent. of cases. Again, in 1905, in the same Aniene valley (which is notoriously feverish), out of 419 treated prophylactically, only 3·81 per cent. of cases occurred.

Celli, summing up for 1905, states that in North Italy malaria was not bad, but in the South it was very bad. The daily prophylaxis by 40 centigrammes of quinine, in 59,340 persons treated, resulted only in 5·8 per cent. suffering from malarial attacks, either relapses or fresh infections; even in the South the morbidity fell from between 35 and 80 per cent. to 18 per cent. (Bulletin Pasteur, 1906).

(2) Mechanical protection against mosquitoes has been continued and extended by the railway administrations; on the Adriatic system, of 10,000 persons so protected at malarious stations, 11·41 per cent. suffered from fever; this is but little more than the percentage of fever cases (10·39) occurring among 26,568 persons employed in non-malarious, or only slightly malarious stations, where no protection is afforded (or required); the result is therefore very favourable.
A. M. Davies

Celli considers that there is no longer any need to dwell on the value of this method of prophylaxis; it is thoroughly established. It is now applied in the rice fields of Lombardy, wirework sleeping places for the "pruners of rice" being provided in the summer. In Corsica and in Sardinia, where are some of the most feverish districts of the whole kingdom, a combination of mechanical plus quinine prophylaxis is said to have given in some places perfect results. On the east coast of Corsica the morbidity fell from 50 per cent. of the inhabitants to 11.5 per cent. (in 1905), the cases being mostly relapses (Laveran).

Some important generalisations are contained in the last Reports of the Italian Society for the study of malaria (1906).

(1) Spontaneous disappearance of paludism: this has taken place in the Agro Sarnese, one of the most fertile valleys in Southern Italy (in which lies Pompeii); here malaria is now only found in the commune of Sarno, and in two restricted zones. The improvement in the drainage has, however, been very rudimentary; the marshes are still there and with them Anopheles maculipennis and bifurcatus. There has been a great development of irrigation, with extension of the artichoke culture, and of rice fields after the Chinese fashion, by which the rice is transplanted, not sown (this is said to be the only example in Europe). The existence of anophelism without paludism has not yet been explained.

(2) Improvement in drainage should first be undertaken in a malarious locality; then improvement in agricultural methods, i.e., regular and careful cultivation; then should follow the new anti-paludic measures. (3) Economic result: in Sardinia the expenditure of 3,500 lire in quinine has resulted in a saving of more than 10,000 lire value in day's work; of course, no account is taken of any future good resulting from this diminution of fever, it merely refers to the net economic result of one year's operations.

It is impossible to study the accounts of the measures taken in various parts of Italy to exterminate, or at any rate alleviate, the effects of this scourge of malaria, without admiring the energy and determination with which the problem has been attacked, and rejoicing in the magnificent success that has in so many instances resulted therefrom. It may well be asked, What have we to show in comparison? in India? in West Africa? Are our resources less than those of Italy? or our knowledge of what ought to be done? or our energy in applying the knowledge we possess?

Tuberculosis.—The Royal Commission, of which the late Sir Michael Foster was chairman, have recently issued a second interim
Report (January, 1907). In their former report of 1904 they had shown that cattle fed on, or inoculated with, human tubercle bacilli from various sources, had become infected with tuberculosis; the disease set up in the animal by human, was compared with that set up by bovine, tuberculosis, and found to be identical. In the present report are related the results of experiments with the bacilli of bovine tuberculosis, which have been introduced into other animals by feeding, and by injection, both subcutaneous and intravenous, and in some instances intramammary. The animals experimented on have been calves, monkeys (rhesus, baboons and lemurs), and anthropoid apes (chimpanzees), also pigs and other animals. The effects have differed in degrees of severity, but progressive generalised tuberculosis was produced in each group of experiments (except in rats). The Commissioners summarise the results of their experiments thus:—"The bacillus of bovine tuberculosis is not so constituted as to act on bovine tissues only, for it can give rise to tuberculosis in many animals other than bovine; it is not even so constituted as to act on bovine tissues with a special energy, for it can give rise to tuberculosis in some other animals as readily as, or even more readily than, in bovine animals themselves. We call it the bacillus of bovine tuberculosis merely because we find it most frequently in the bovine body, it being the cause of bovine tuberculosis. The fact that the bacillus of bovine tuberculosis can readily, by feeding as well as by subcutaneous injection, give rise to generalised tuberculosis in the anthropoid apes—so nearly related to man—and, indeed, seems, so far as our few experiments go, to produce this result more readily than in the bovine body itself, has an importance so obvious that it need not be dwelt on." It can hardly be doubted that, if experiments could be made upon man, the results would be same; numerous instances of unintentional inoculation have been recorded in recent years, as amongst veterinary surgeons by Nocard.

The Commissioners have also experimented with the bacilli of human tuberculosis. They find two principal groups of viruses of human origin. The viruses of group 1, tested on calves, monkeys, and many other animals, were found to give results identical with those obtained from bovine bacilli: "We have failed to discover any essential differences between the one and the other; both are equally virulent, that is, equally able to set up tuberculosis in bovine and other animals." The viruses of group 2 were found to be much less pathogenic to bovines and other animals than those of group 1; generalised tuberculosis was not produced in most cases (except in
guinea-pigs, monkeys and the chimpanzee), but a limited retrogressive condition. A third group of viruses of human origin showed intermediate characters, the significance of which will be considered in a future report.

The Commissioners conclude by stating distinctly that "in a certain number of cases the tuberculosis occurring in the human subject, especially in children, is the direct result of the introduction into the human body of the bacillus of bovine tuberculosis; and there can also be no doubt that in the majority at least of these cases the bacillus is introduced through cows' milk. . . . Our results clearly point to the necessity of measures more stringent than those at present enforced being taken to prevent the sale or consumption of such milk."

Effects of Hunger and Fatigue on Bacterial Invasion of the Organism.—By preparing sections through the intestinal coats of newly-born rabbits Ficker¹ has shown that certain bacteria penetrate the walls and make their way into the blood and organs, this occurring especially in the upper part of the small intestine; in guinea-pigs this penetration appears to take place less freely.

Ficker submitted various animals to complete starvation, and after varying intervals fed them on the easily recognisable red bacillus of Kiel; the animals were then killed and cultures made from the blood and organs. In adult rabbits so treated after a fast of six or seven days, the bacteria were found disseminated through the blood and in the organs; this occurred also, but only in 35 per cent. of the cases, in rabbits fed on bacteria, but not starved. He then found that in rabbits, after a fast of some days, the normal bacteria of the intestine could be discovered in the blood and organs; in dogs this was found to occur after twelve or thirteen days' abstinence.

Subsequently Ficker studied the effects of fatigue in dogs, who were submitted to work in an electric mill; work of from one to three hours did not suffice, but after six hours it was found that B. coli had passed into the kidneys, liver and mesenteric glands, and after a longer time proteus was found in the organs and in the blood as well. With starvation and fatigue combined the red bacillus of Kiel passed through in three hours.

These researches throw light on the pathology of fatigue fever; and on fatigue as a factor in causation of infection, especially in

¹ Archiv. f. Hygiene, liv. and lvii.
conjunction with want of nourishment, also on the cases of poisoning following on ingestion of the flesh of over-driven animals.

Infectious Disease and School Closure. — The Local Government Board issued a Memorandum in 1904 in regard to the closing of schools for infectious disease, in which it was pointed out that whether an outbreak might be best combated by closing the school, or by excluding the children from infectious households, depended upon: (1) the completeness and promptness of the information received as to occurrence of cases; and (2) the opportunities for intercourse between children elsewhere than at school. If the cases are few and their origin known, and known promptly, probably the exclusion of children from infected households will suffice, but not otherwise. As to opportunities of intercourse between children in sparsely populated districts, where children rarely meet except at school, closure may effectually check spread of disease; it is less likely to be successful in a town or populous place.

The practice as regards school closure in the London County Council area has recently been considerably modified, chiefly through the measles enquiry at Woolwich, and bacteriological laboratory experience in regard to diphtheria. As to scarlet fever, Dr. Kerr believes that "the infectiousness of such cases before the child vomits or the rash appears is probably considerably over-rated. A child without other symptoms, but with the rash just appearing, is possibly not very infectious; where, however, there is any suspicion of scarlet fever, any child who vomits at school should be sent home at once, the room should be cleared of children for the day, the ejected matter promptly removed, and strong disinfectants used, as it is unsafe to regard this material as other than a source of contagion." "Peeling" is not looked on as particularly dangerous; the really dangerous "carrier" cases are convalescents with suppuration or catarrh of the ear or nose; some suppurring patch about the nasal sinuses or turbinated bones may keep up infectiousness for months. Such diffusion as occurs through school attendance is probably chiefly due to convalescents. In the case of diphtheria there is the same danger of convalescent "carriers"; the London school experience is "that for practical purposes the detection of the Klebs-Loeffer bacillus in the throat, nose, or ear of any school child, however well the child itself may appear, requires the exclusion of the child till it is free from the organism. . . . . 

1 See Army Medical Regulations, 1906, para. 147.
To other organisms than the Klebs-Loeffler bacillus we do not attach importance” (Report for 1906). After consultation with the Medical Officers of Health Society the London County Council resolved “to refuse, during the presence of diphtheria in any district, re-admission to school of children excluded on account of diphtheria or sore throat, until such children shall have obtained a medical certificate of freedom from infection based on a bacteriological examination.” The Council have also instructed teachers that no child who has been in an infectious diseases hospital should return to school for at least a fortnight after discharge. The Metropolitan Asylums’ Board recommend that this period should be three weeks.

In regard to the non-notifiable infectious diseases, there has been a modification in procedure in London and elsewhere. Measles is the most important of these complaints. It does not seem to spread unless between 30 and 40 per cent. of the children have not previously suffered; and it ceases to spread when only 15 to 20 per cent. remain unaffected. Under the conditions that obtain in London at present, it follows that this disease may be neglected in schools above the infant department.

The following are the present rules in force by the London County Council:—Children suffering from measles must be excluded from school for at least one month; from mumps, for one month; from chickenpox, for at least two weeks, or until every scab has fallen off the scalp or the body; from whooping-cough, as long as the cough continues, and not less than five weeks from the commencement of the whooping. Children coming from houses where these diseases exist must be excluded, if in infants’ schools; in other schools only those who have not had the disease need be excluded. The period of this exclusion will be, in measles (1) for infants’ schools, until the Monday following the expiration of fourteen days from occurrence of last case; (2) for other schools, until the Monday following the expiration of fourteen days from occurrence of first case; in mumps, for three weeks, or such time as medical attendant requires; in chickenpox and in whooping-cough, for two weeks.

If this exclusion could be carried out effectively, there would probably be little need for the extreme step of closing schools. One of the most important points of all is the early recognition of infectious cases; the school teachers have unequalled opportunities for observation of the children under their care, and it is necessary that they should be acquainted with the early signs and symptoms of these diseases, so that they may take immediate steps, referring, of course, to the medical officer in every case im-
mediately. (See "Manual of Hygiene for Teachers in Army Schools.") A regular inspection of schools by a medical officer in order to pick out the earliest cases of infection would be the best plan, better than closing schools after the attendance has fallen 30 or 40 per cent.; but this is not universally practicable, whereas it is practicable for teachers to be of the greatest service by taking the preliminary step of looking for and recognising early cases.

VI.—Legislation.

There is no sanitary legislation of great importance to be recorded during the past year. The Workmen's Compensation Act, 1906, makes provision for compensation for industrial diseases; those at present named are anthrax, ankylostomiasis, and poisoning by lead, mercury, phosphorus and arsenic. A Departmental Committee has been appointed to consider what diseases should be added to this schedule, and it may be expected that there will eventually result improvement in the health of the artisan population affected.