

**'On the prevalence of certain zymotic diseases in the army in 1887', by Sir Thomas Crawford, being the inaugural address delivered before the Epidemiological Society of London, session 1889-90**

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ON  
THE PREVALENCE  
OF  
CERTAIN ZYMOTIC DISEASES  
IN THE ARMY IN 1887.

BEING THE  
*INAUGURAL ADDRESS DELIVERED BEFORE THE EPIDEMIOLOGICAL  
SOCIETY OF LONDON, SESSION 1889-90.*

BY  
SIR THOMAS CRAWFORD, K.C.B., M.D., LL.D.,

HONORARY SURGEON TO THE QUEEN; FELLOW, HON. CAUSA, OF THE KING AND  
QUEEN'S COLLEGE OF PHYSICIANS, AND ROYAL COLLEGE OF SURGEONS,  
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DIRECTOR-GENERAL ARMY MEDICAL DEPARTMENT, RETIRED;  
AND PRESIDENT OF THE EPIDEMIOLOGICAL SOCIETY.

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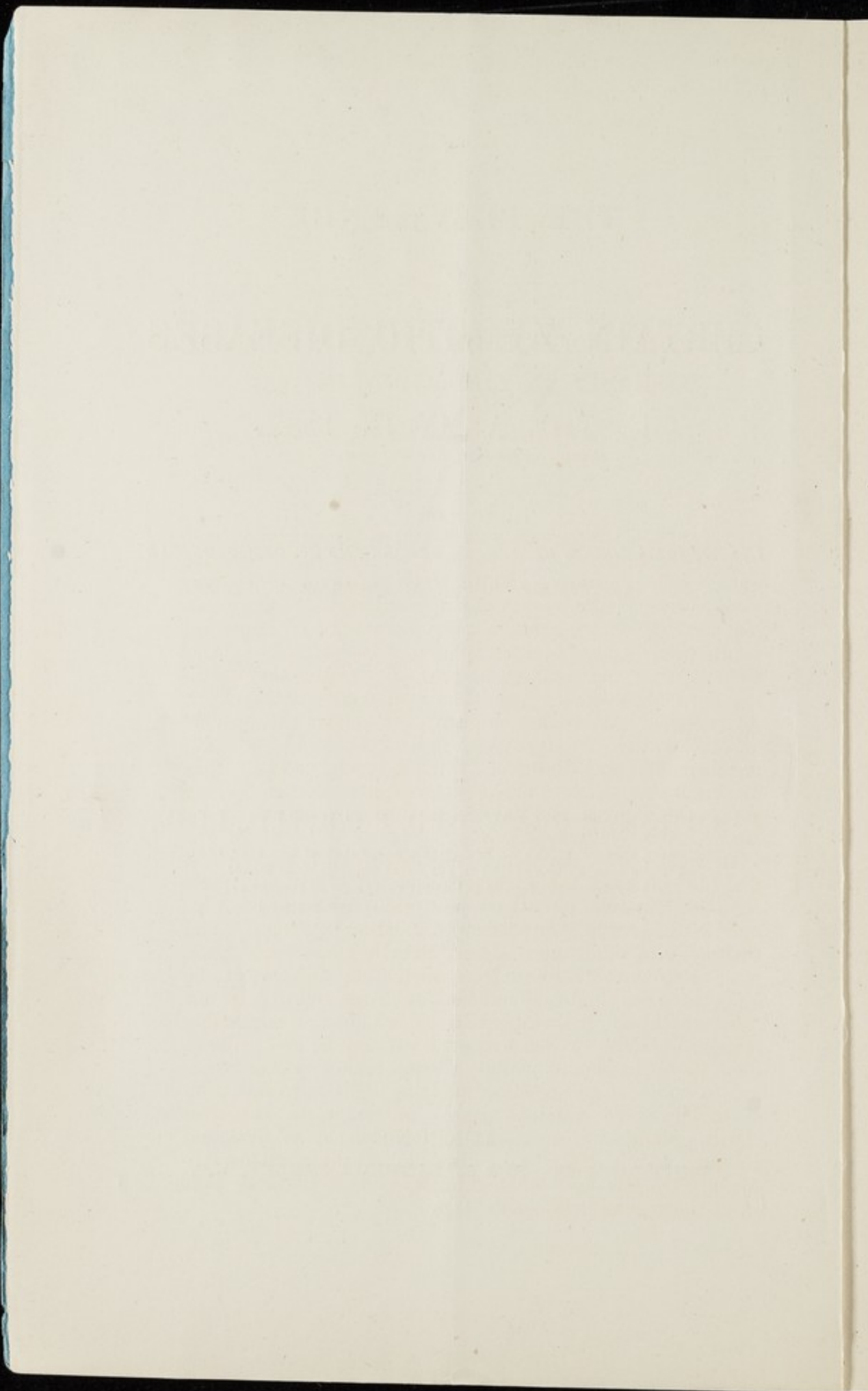
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*Being the Inaugural Address delivered before the Epidemiological  
Society of London, Nov. 13, 1889.*

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GENTLEMEN,—My first duty on taking this chair is to thank you for the honour you have conferred upon me by electing me as your President. During the quarter of a century covered by my membership, the Society has done some excellent work in educating public opinion on many most important points bearing on the health and happiness of the people, as well as upon the commercial prosperity of the nation, still too much hampered by so-called sanitary restrictions upon international intercourse. Originating in a superstitious dread of "the pestilence that walketh in darkness", and maintaining their hold upon the public through ignorance of the conditions under which epidemic diseases arise, the laws which govern their spread, and the best methods of prevention, they are not easily eradicated.

In looking over the earlier volumes of our *Transactions*, I find the objects of the Society thus stated:—"To institute a rigid examination into the causes and conditions which influence the origin, propagation, mitigation, prevention, and treatment of epidemic diseases; to collect and promulgate, with relation to these subjects, such facts as appear to be established on sound and sufficient evidence, and to point out those methods of investigation by which the misleading influence of false or deficient evidence may be best avoided. Such inquiries should include all that relates to overcrowding, to errors of construction affecting light and ventilation of buildings, to deficient supply of water, to imperfect cleansing and drainage, and to insufficiency of food and clothing. To investigate the diseases prevailing extensively among domestic and other animals, as well as those that affect the vegetable kingdom."

This field has been fairly covered by the labours of the members, in so far as some of the more striking forms of epidemic disease are concerned; but the sphere of useful observation and research has been by no means exhausted, although the self-imposed task of the Epidemiological Society has been, of late years, largely shared by other societies having the advancement of sanitary science specially in view.

The volumes of our *Transactions*, and the admirable reports published from time to time by the Medical Officers of the Local Government Board, most of whom have been in the past, and are in the present, members of our Society, have made the public familiar with the history of the great epidemics which have visited this and other countries during the century now drawing to a close. The medical officers of the public services have taken a prominent part in similar investigations, and as their labours have been carefully recorded, in regard to the army at least, it may not be amiss to lay before you some of the results, in so far as these bear upon epidemiology, and upon the stamping out of the diseases held to be altogether preventable. These results are in the main satisfactory, although much still remains to be done, and must, it is to be feared, so remain till the people realise the fact that on their own and on their neighbours' shoulders must rest the responsibility for injury to health, the pecuniary loss which sickness entails, especially on the working-classes, and the sacrifice of useful lives daily occurring in our great centres of population, and in a less degree throughout the country at large. This responsibility men are prone to lay upon Providence rather than upon their own possibly ignorant violations of laws which Providence has ordained for their guidance, and which sanitary science is daily endeavouring to make clear to them, although with less satisfactory results than many regard as practicable, and all admit to be desirable.

It may be well, perhaps, to remark here that there are many terms in common use in regard to epidemic diseases which require definition. Prominent among these may be mentioned epidemic prevalence, epidemic constitution, epidemic influence, epidemic wave, epidemic laws, etc. These terms spring out of our want of clear knowledge regarding the nature of the diseases in question, and will, no doubt, receive some modification, or possibly disappear altogether, under the clearer views of etiology and pathology dawning upon us through bacteriological and chemical discoveries, which modern research is daily bringing to light. Under the first of these terms it is not uncommon to find diseases men-

tioned for no other reason, apparently, than that they have been of unusually frequent occurrence among a given community, although they may not be dependent upon any cause capable of producing a true epidemic. Again, when any zymotic disease has become prevalent, we are apt to assume the existence of an epidemic constitution or influence favouring the development and spread of the disease, or of undue susceptibility on the part of those affected, while, in reality, the cause is a physical and demonstrable one, lying within easy reach, and admitting of prompt removal.

In the army we have a more accurate record of the sickness and mortality from zymotic diseases than it is possible to obtain regarding the great mass of the people. I select from this source Sub-group I of General Diseases for remark, because, in the words of Sir William Jenner when writing of zymotic diseases generally, "the diseases constituting it, dissimilar as they are in their pathology, are so intimately connected in their etiology that the removal of the causes of one of the group would certainly and greatly diminish the mortality from all." This is especially true of those causes which contribute to the epidemic prevalence of these diseases.

The average strength of the army for 1887, excluding local corps recruited from natives of our Colonial and Indian settlements, was 195,932, scattered over the various military stations in the United Kingdom, Channel Islands, Gibraltar, Malta, Cyprus, Egypt, Canada, Bermuda, West Indies, South Africa, Mauritius, Ceylon, China, Straits Settlements, India, and on board ships in transit from one part of the Queen's dominions to another. This distribution of Her Majesty's troops covers vast tracts of the world's surface over which great epidemics have often prevailed, and will, it may be feared, again do so. Moreover, they garrison many points along the great routes of human intercourse by which epidemic diseases are usually held to be propagated. At all events, they are as fully and freely exposed to every pandemic and epidemic influence as others, and if equally susceptible and unguarded, would no doubt suffer equally with them.

Following the nomenclature of diseases recently issued by the Royal College of Physicians of London, and approved for use in Her Majesty's public services, and taking Sub-group I of general diseases, which includes: 1, small-pox; 2, cow-pox; 3, chicken-pox; 4, measles; 5, epidemic rose rash; 6, scarlet fever; 7, dengue; 8, typhus fever; 9, plague; 10, relapsing fever; 11, influenza; 12, whooping-cough; 13, mumps; 14, diphtheria; 15, cerebro-spinal fever;



16, simple continued fever; 17, enteric fever; 18, yellow fever; 19, cholera; 20, sporadic cholera; 21, epidemic diarrhoea; 22, dysentery; the army tables give the following results.

In order to avoid verbal repetitions, the ratios of admissions, deaths, and constantly sick are in all cases calculated on 1,000 of strength.

*England*—Strength, 72,329; ratio of admissions, 17.2; of deaths, 0.40; constantly sick, 0.99. *Scotland*—Strength, 3,635; ratio of admissions, 13.2; of deaths, 0.27; constantly sick, 0.57. *Ireland*—Strength, 25,150; ratio of admissions, 20.2; of deaths, 0.48; constantly sick, 1.09. Of the admissions under this head in the United Kingdom 137 were from enteric fever, of whom twenty-eight died, being just two-thirds of the deaths from all diseases included in the sub-group. Sixty-one, with sixteen deaths, occurred in England and Wales; three, with one death, in Scotland; and seventy-three, with nine deaths, in Ireland. All the military districts in England were affected to some extent, with the exception of Chatham, which had also had an immunity from this disease for the previous three years. London yielded ten cases, with two deaths. Three of the cases are said to have been imported from Dublin; one is ascribed to defective drainage, and one occurred in the person of a recruit just joined; for the others no cause has been assigned. Aldershot contributes six cases, some of which were supposed to be due to a defective condition of the subventilation of the huts. Shoeburyness returns five cases, of which four proved fatal. These are ascribed to a sewer from the village opening on the foreshore near the huts. At Parkhurst there were four cases and two deaths, probably due to water-impurity. There were also four cases and one death at Portsmouth, due to defective drainage. Hounslow contributes three cases, said to have been imported; Manchester three, Dover three, of which two are attributed to defective drainage, but for the third no cause could be traced. There were two cases at Great Yarmouth, two at Pembroke Dock, all probably due to impure water; two at Guernsey, said to have been contracted in the town; two at Woolwich, believed to have originated elsewhere; one at Cardiff, and one at Alderney, ascribed to impure water; one each at Guildford, Leeds, Liverpool, Newcastle-on-Tyne, York, Harwich, Winchester, Netley, Sandown, and Devonport, for which no cause could be discovered.

Of the three cases in Scotland two occurred in Glasgow and one at Piershill, near Edinburgh, no cause being mentioned.

The number of stations in Ireland at which cases of enteric fever occurred was thirty-nine. Fifty cases, with four deaths, are reported from Dublin, namely, twenty-three from the Royal barracks, nine from Pigeon-House fort, a small barracks on the end of the pier at the mouth of the harbour; five from Ship Street barracks, located in a densely populated district close to the Castle; four from Arbour Hill hospital, all Hospital Corps men, of whom two had been attendants on cases of this disease. Beggars' Bush barracks contributed three cases; Richmond barracks, two; Linen Hall barracks, one. One case was admitted from lodgings, one from furlough, and one from another station. The history of enteric fever among the troops in Dublin is most perplexing. There is much in the structural and sanitary arrangements of the barracks to which exception may be taken, and for the removal of which remedial measures have been suggested, and are now in the course of being carried out; but whether the results will be altogether satisfactory is open to doubt. Sound sanitary principles must be vigorously applied to the city as a whole before satisfactory progress in stamping out this disease can be hoped for. An improved system of drainage, which will free the Liffey, and secure an uninterrupted flow of all sewage to a safe distance, is a first and most pressing need, without which other measures can only be regarded as palliatives.

Belfast contributes six cases, four of which were admitted from Hollywood Camp, and were reasonably attributed to a contaminated water-supply. Five cases are reported from the Curragh; Enniskillen and Kilkenny contribute two each, no cause being given; while a like number occurred at Dundalk, one of which is said to have come from Dublin. Two cases at Limerick, said to have been contracted outside the barracks, and one case each at Tipperary, Galway, Haulbowlin, and Fermoy, account for the whole of the admissions in Ireland.

There were 745 admissions under the head of eruptive fevers, including seven with one death from small-pox, and 185 with eight deaths from scarlet-fever; measles, rose rash, chicken-pox, and cow-pox account for the remainder. There were also 689 cases of continued fever, ninety-six cases of dysentery with one death, and 134 cases of other diseases with one death, included in the sub-group under review; but none of these diseases, except scarlet-fever, could be said to have assumed an epidemic form in any of the home stations during the year.

Before attempting to draw any inferences from these facts,

it may be well to trace the history of this group of diseases through the other commands of the Empire, and this I shall do as briefly as possible, dealing with the various garrisons in the order in which I have already enumerated them; and first of—

*Gibraltar.*—Average strength, 4,614; ratio of admissions, 31.4; of deaths, 1.95; constantly sick, 4.28; the whole of the admissions are grouped under three classes of diseases, viz., eruptive fevers, five cases, no deaths; enteric fever, thirty-five cases, nine deaths; other continued fevers, 105 cases, no deaths. The columns for other diseases of this subgroup are blank. The medical officer in charge reports that the cases of enteric fever were all severe; convalescence was very protracted, and relapses were frequent. With regard to the cases of continued fever which occurred during the same period, he was of opinion that "it is not a climatic fever, but depends upon local sanitary defects, and is more prevalent in hot and dry months, because the water-traps of drains then often become dry, and are no longer effective. In almost every instance where severe cases of fever have occurred in barracks, blocked drains, defective traps, rat-holes communicating with sewers, or unknown and disused drains, have been discovered under floors, and when these defects have been remedied no further cases have occurred." The same officer goes on to remark: "There is a close connection between simple continued fever and enteric fever; they are both admitted from the same barrack at the same time, and when a sanitary defect is discovered and removed both fevers cease to occur." Buena Vista barracks, which suffered severely from fever in 1886, were comparatively free from it in 1887, while Europa barracks, which in the former year gave no cases, in the latter gave several. On turning to the report for 1886 I find, under the head of enteric fever, the following:—"The disease prevailed in an epidemic form in June, July, and August, in the Royal West Kent Regiment, the Royal Engineers, and the South Staffordshire Regiment. Those troops occupied barracks far apart from one another, and no connection was traced between the outbreaks in each barracks. The rest of the garrison was remarkably free from fever during these three months. The Royal West Kent Regiment arrived from Egypt on the 16th June, and was quartered in the Casemate barracks. Cases of enteric fever were admitted daily from all companies of this regiment up to the middle of July, when the outbreak ceased. The disease in this corps was evidently contracted in Egypt; and it is believed that very few, if any, cases

originated in the garrison. The outbreak of the disease among the troops quartered in the Town range, Hargraves, and Buena Vista barracks was, in the opinion of the medical officer in charge, sufficiently accounted for by certain serious sanitary defects which existed in them, which is borne out by the fact that the disease ceased when the barracks were vacated, and when they were reoccupied after the defects had been remedied there was no recurrence of the disease." The theory of importation from Egypt, in the case of the South Staffordshire Regiment, seems to require some qualification, for a little further on Dr. Warren adds: "With regard to the cases which occurred at Buena Vista, it is stated that nearly all came from a stone two-storied building, occupied by two-and-a-half companies of the South Staffordshire Regiment, and that three companies of the same regiment, which arrived from Ramleh at the same time, and were quartered at Windmill Hill, did not furnish a single case of the fever." If the disease was of Egyptian origin the whole regiment would presumably have suffered, and the cases would have occurred soon after the arrival of the corps, as was the case in the Royal West Kent Regiment.

*Malta.*—Strength, 5,499; ratio of admissions, 110.7; of deaths, 2.72; constantly sick, 10.66. The diseases yielding these results were small-pox, two; measles, one; enteric fever, fourteen, with five deaths; other continued fevers, 570, with seven deaths; cholera, one case, fatal; dysentery, nineteen, with two deaths; other diseases, two. The fevers alone account for nearly the whole of the sickness and mortality under this head; and were the admitted difficulties of diagnosis fully met, and the classification of cases thus rendered perfectly accurate, we might possibly be able to add that enteric fever alone is accountable for nearly the whole of the mortality.

Of the origin of this disease the medical officer in charge at Cottonera remarks: "The cause remains obscure; but most probably the insanitary conditions of the wine-shops and other houses frequented by the men were in fault." It is difficult to reconcile this theory with the fact recorded in the report, that the Malta Fencibles, who are natives of the island, and presumably in closer social intercourse with the inhabitants, were entirely free from the disease.

In commenting upon these cases, Surgeon-General Sinclair remarks: "There were no cases of this disease on the Valetta side, which speaks volumes for the water-supply, this being the only district where aqueduct-water was in general use throughout the year." It is interesting to note here that,

though there was an epidemic of cholera prevailing among the civil community in the months of August, September, and October, the history of which has been already laid before the Society, there was but one case among the British troops and one among the Malta Fencibles.

*Cyprus*.—Strength, 472; ratio of admissions, 70.0; of deaths, 2.12; of constantly sick, 4.70. There were three cases of enteric fever, with one death. The remaining cases were twenty of simple continued fever and eleven of dysentery, all mild.

*Canada*.—Strength, 1,282; ratio of admissions, 4.7; of deaths, 0.0; constantly sick, 0.29. The admissions were five cases of measles and one of enteric fever.

*Bermuda*.—Strength, 1,183; ratio of admissions, 86.2; of deaths, 6.76; of constantly sick, 8.07. The whole of the admissions, with the exception of one case of dysentery, range themselves under enteric fever and common continued fever in equal proportions, all the deaths having been caused by the former. This outbreak was, with reasonable probability, attributed to impure water.

*West Indies*, includes Barbadoes, Jamaica, Trinidad, Demerara, Honduras, Bahamas. Strength, 1,121; ratio of admission, 161.5; of deaths, 6.25; of constantly sick, 5.72. Fourteen of the admissions and the whole of the deaths were from enteric fever. Eleven occurred in Jamaica, one at Up-park Camp, which proved fatal, and ten, with five deaths, at Newcastle. Frequenting rum-shops, and contaminated water, are stated to have been the probable causes of the outbreak at Newcastle. The black troops in the West Indies have not suffered from enteric fever, although by no means exempt from other forms of continued fevers. The other diseases of this sub-group occurring among the troops in these islands do not call for special notice, no deaths having occurred from any of them.

*Cape and St. Helena*.—Strength, 3,490; ratio of admissions, 21.5; of deaths, 0.86; of constantly sick, 1.73. There were five cases of enteric fever, two admissions, with one death, at Cape Town, and three admissions, with one death, at Pietermaritzburg. There were also forty-four cases of continued fever of a mild type, and twenty-three cases of dysentery, with one death, but neither of these diseases can be said to have assumed an epidemic form.

*Mauritius*.—Strength, 400; ratio of admissions, 82.5; of deaths, 10.0; of constantly sick, 5.37. There were thirty-three admissions and four deaths in all, one from enteric

fever, seven from other continued fevers, with three deaths, and twenty-five from dysentery, with one death. The fevers are described as typho-malarial, the case returned as enteric being of a doubtful character. No doubt they were all of the same type.

*Ceylon.*—Strength, 1,077; ratio of admissions, 85.4; of deaths, 7.43; of constantly sick, 4.50. Here, as in Bermuda, the whole of the admissions range themselves under three heads—enteric fever, ten, with seven deaths; other continued fevers, sixty-seven, no deaths; dysentery, fifteen, with one death. Four of the cases of enteric with three deaths occurred at Colombo, and six with four deaths at Galle. The disease is said to be endemic at both places, and the towns riddled with cess-pits.

*China and the Straits Settlements.*—Strength, 2,266; ratio of admissions, 55.2; of deaths, 1.77; of constantly sick, 2.98. Of the admissions, five with three deaths were from enteric fever. Nine cases occurred at Hong Kong, but in no instance did two cases come from the same barrack. Nothing could be discovered within the precincts of the barracks to account for their occurrence. The remaining three cases were, one from board ship, disembarked two days prior to admission, one from Kowloon, and one from McGregor barracks, the origin of which could not be traced. Of the six cases in the Straits Settlements, three occurred at Tanglin and three at Penang. Several cases are said to have occurred among the crews of the ship, in which two of these men had recently arrived from the Cape. There were also forty-five cases of simple continued fever, and twenty-four cases of dysentery with one death, but these diseases did not assume an epidemic form, and being mild in type, and below the average in numbers, do not call for further notice here.

*India* furnishes some very interesting facts regarding the group of diseases under review. I shall give the details by Presidencies; and first of—

*Bengal.*—Strength, 40,921; ratio of admissions, 131.5; of deaths, 7.04; of constantly sick, 6.53. There were 538 cases of enteric fever, of whom 166 died. These cases were distributed over fifty-five stations, in numbers varying from one each at ten stations, two each at four, three each at three, four each at two, five each at two, six each at five, seven each at six, eight each at two, nine each at two, ten at one, eleven each at two, twelve each at two, fourteen at one, eighteen at one, nineteen at one, twenty at Roorkee, twenty at Ranikhet, twenty-one at Sialkhot, twenty-two at Allahabad, twenty-three

at Chaubuttia, a like number at Fyzabad, twenty-eight at Meerut, twenty-nine at Rawal Pindee, to seventy-nine at Lucknow. Calcutta escaped altogether.

Having regard to the relative strength of these several garrisons, it cannot be said that the disease was epidemic in any of the stations, with the exception perhaps of the last. The admissions at Lucknow are, however, lower by twenty-five than in the previous year. The reporting officer says: "In no case was the disease satisfactorily accounted for, and it seems almost impossible to imagine that insanitation in the barracks or lines could have originated any of the attacks." Of the numerous cases occurring at Fyzabad another officer writes: "Some were extremely severe, and all, with one exception, were in young soldiers between twenty and twenty-three years of age, whose average service in India was a year and three months. The disease could not be traced directly to any local insanitary condition, nor to faults in food or milk, and the fact of the rareness of attacks among women and children, as also noticed last year, would seem to exclude milk as a possible cause."

There were thirty cases of small-pox with two deaths, 143 cases of other eruptive fevers, chiefly dengue. The majority of these cases occurred at Umballa, where the fever is said to be endemic, and of a malarial type. There were 3,483 cases of continued fever with five deaths, being below the average of previous years. There were 135 cases of cholera with ninety-two deaths, being considerably in excess of the average ratios of the previous five years. Eleven cases with ten deaths occurred on the line of march, ten with five deaths at Lucknow, twelve with seven deaths at Ranikhet, thirteen with ten deaths at Meerut, seven cases with four deaths at Meean Meer, twenty-three cases with ten deaths at Peshawur. The disease was generally prevalent among the civil population. There were 984 cases of dysentery with twenty-two deaths, but the disease was not so prevalent as in 1886.

*Madras.*—Strength, 11,783; ratio of admissions, 137.9; of deaths, 4.60; of constantly sick, 9.90. Here, also, as in Bengal, enteric fever is conspicuously present, accounting for thirty-five of the fifty-three deaths under this sub-group. The distribution of the disease was also very general, but, as in Bengal, the number of cases in the several stations bears no fixed proportion to the strength. Madras and Poonamallie escape altogether. Wellington, Belgaum, St. Thomas's Mount, show one admission each, Malliaporum and Rangoon two each, Kamptee six, Bellary eight, Bangalore thirty-one with eleven deaths, and Secunderabad ninety-one with sixteen

deaths. More than half the cases occurred at Secunderabad, the great majority of those attacked belonging to the 7th Hussars, recently from England, and largely composed of young men. It must be borne in mind, however, that the number attacked in 1886 was nearly as large, being seventy-six with twenty-five deaths, although age and recent arrival in the country could not be said to have exercised any marked effect on the prevalence of the disease. It is stated that the latrine arrangements were not altogether satisfactory; but no definite opinion regarding causation either here or at Bangalore is recorded.

There were seven cases of eruptive fevers other than small-pox, 708 cases of continued fever with one death, eight cases of cholera, all fatal; and diarrhœa was epidemic at Trimulgherry and Secunderabad in July and August, cholera being also prevalent in the villages round Secunderabad at the same time. There were 729 cases of dysentery with eleven deaths, the greatest prevalence being in the Hyderabad Subsidiary Force. The admissions in Secunderabad alone amounted to 309, or more than two-fifths of the total number, but no deaths occurred at that station. This speaks highly for the modern treatment of this formidable disease.

*Bombay.*—Strength, 11,238; ratio of admissions, 130.8; of deaths, 7.0; of constantly sick, 7.05. Here, too, enteric fever caused within a fraction of half the deaths from all diseases under this sub-group. The actual numbers are—small-pox, 1; other eruptive fevers, 4; enteric fever, 127 with 38 deaths; other continued fevers, 1,057 with 2 deaths; cholera, 39 with 28 deaths; dysentery, 244 with 9 deaths; other diseases, 2. The distribution of enteric fever was as follows:—Colaba 2, Deesa 6, Karachi 19, Hyderabad 1, Poona 7, Kirkee 3, Ahmednagar 12, Mhow 56, Nasirabad 21. The reports contain nothing definite regarding causation.

There were 1,057 cases of continued fever with two deaths, thirty-nine cases of cholera with twenty-eight deaths, and 224 cases of dysentery with nine deaths. The cases of fever were of the usual type and frequency, the highest ratio of prevalence being in the Bombay district. Cholera was epidemic at Neemuch, where twenty-three cases and seventeen deaths occurred. There were eight cases at Mhow with five deaths. Isolated cases occurred at six other stations, showing the presence of a so-called epidemic influence kept in check by judicious sanitary arrangements. Dysentery was not so prevalent as in Madras, but it was rather more fatal, although here, also, the results of treatment are satisfactory.

*Egypt.*—Strength, 5,272; ratio of admissions, 292.5; of



deaths, 8.72 ; of constantly sick, 16.17. Here, again, enteric fever accounts for thirty-seven of the forty-six deaths recorded under this head, the remaining fatal cases being small-pox four, dysentery five. Thirty-two cases of eruptive fevers other than small-pox, and 1,092 cases of fevers other than enteric, were treated without a single death. Enteric fever is attributed to local insanitary conditions. When the Nile was at its highest and began to fall, the greatest number of admissions occurred. "As the river rises it percolates the soil and disturbs the filth in the ground, and also the cess-pits with which Cairo abounds. The insanitary material is pressed to the surface, and under the hot sun poisonous emanations rise into the air." So writes the medical officer in charge, but with such sanitary, or rather insanitary, surroundings it is just possible that here also the water-supply may be contaminated. The admissions at Abassayeh were less by one-fourth than the previous year. The medical officer in charge does not attribute this to improvements in sanitation, but rather to the fact that the troops were for the most part resident, as it were, in Abassayeh during the year, and not, as in previous years, a garrison composed of a fluctuating population passing up and down the Nile. The decrease at Ramleh is similarly accounted for, the bulk of the force being seasoned troops, quartered in good barracks, more settled, and better fed.

The almost uninterrupted presence of small-pox in a virulent form subjects the troops in Egypt to a danger which, but for vaccination, would be a formidable one. Judging from the number of cases recorded—twenty-six admissions and four deaths—it is obvious the efficiency of our system of vaccination and revaccination has been severely tested. Possibly a careful scrutiny of individual cases might elicit evidence of want of thoroughness in the operation in some instances, but on the whole the results are by no means unsatisfactory.

The prevalence of continued fevers is ascribed to local insanitary conditions, largely influenced by the rise and fall of the Nile, a remark which is equally applicable to dysentery.

A comparison of the data that I have now laid before you, in what may possibly be considered unnecessarily minute detail, with the sickness and mortality in the army from this class of diseases thirty years ago, shews, I think conclusively, that a considerable advance has been made in lessening their prevalence in all parts of the Empire. They also seem to warrant the conclusion that the most successful

as well as the most practicable method of preventing these diseases is thoroughly efficient sanitary supervision of the men and their surroundings. Purity of air and water, wholesomeness and sufficiency of food and clothing carefully adjusted to the requirements of climate, and the nature of the duties demanded of the troops, are of course first essentials; with which should be included roomy, well-ventilated and lighted barracks, free from any approach to crowding, especially in dormitories, and the most scrupulous cleanliness in every detail of domestic economy. These are the principles which guide the medical officers who are charged with the sanitary supervision of the army, and, in so far as the means at their disposal admit of their application to the varying needs of the troops, they leave nothing to be desired. I do not of course overlook the great importance of isolation and disinfection in contagious diseases, and more especially in those depending upon a specific poison thrown off by some organ or part of the patient. In such cases the contagia should of course be intercepted and destroyed at their source, or as soon after their escape from the person of the sick as possible. Underlying these principles, however, there are others which must not be overlooked, and on which the facts laid before you seem to throw light.

First and most conspicuous among these is the etiology—the true cause—of these diseases; and in discussing this point my remarks will be limited to enteric fever, the great importance of which is shewn by the destruction of valuable lives at an age when they are developing into the full vigour of manhood. Enteric fever is usually attributed to a specific morbid poison which is reproduced, multiplied, and given off by the stools alone during the course of the illness. The contagium is further stated upon high authority to be a specific typhoid bacillus. Bacteriology has made such rapid strides of late years in throwing light on obscure points of etiology and pathology that men are beginning to regard it as a likely means of solving many of our existing difficulties in regard to this subject of causation. But the admirable lectures on the relationship between chemical structure and physiological action, recently delivered before the Royal College of Physicians by Dr. Lauder Brunton, are calculated to make us hesitate to accept the microbe as the ultimate factor in the production of this disease. Possibly even the ptomaines may eventually be found to depend upon some perverted vital function, rather than upon the bacillus which may have found a temporary home within the system.

At all events, assuming that the cause is a specific one, and

that every case of enteric fever must, therefore, have had an antecedent one, how are the numerous instances which I have laid before you, in which single cases, or a very small group of cases, springing up among given bodies of men far separated from each other by distance, but of a common race and age, and following common pursuits, to be explained? In many instances no progenitor or successor could be traced, while in an equally large proportion of outbreaks no connecting link was discovered. Neither the specific poison theory, now much favoured, nor the pythogenic theory alone, seems capable of accounting for these isolated cases regarding which I still hold to the opinion expressed in my report of 1880, that there are facts encountered in practice, and especially in India, which it is difficult to reconcile with any of the theories favoured by European pathologists. The occurrence of cases of enteric fever among troops previously free from the disease, at posts and camps which were in all human probability occupied for the first time during the campaign in Afghanistan, is the most striking of these, and is hardly explicable on any theory short of origin *de novo*.

There is, no doubt, a great mass of evidence which points to the existence of a previous case, from which the poison may have been derived in certain outbreaks in civil life; but in the army, at least, such evidence is so often wanting as to create a doubt not easily satisfied. Dr. Broadbent seems to think that to admit the correctness of the pythogenic hypothesis, with which I would associate self-infection, involves the admission of the origin *de novo* of small-pox and all other contagious diseases. This seems to me to assume that enteric fever is contagious in the same sense that small-pox is so, and that other admittedly contagious diseases, such as typhus fever, diphtheria, etc., cannot spring up *de novo*, neither of which has, so far as I am aware, been quite conclusively established. At all events, whether the cause be a specific poison, a bacillus, or some product of putrescent organic matter existing in the body, or introduced from sources external to it, we may accept as probable at least that, in the case of enteric fever, the cause is nurtured and propagated by filth, the removal or destruction of which is fatal to its existence.

But the points in which this Society is more immediately interested are the causes which contribute to the epidemic prevalence of these diseases, and the best means of removing them. Putting aside for the moment climatic influences which are not under our control, these seem to be local and personal, and in the front rank I would place overcrowding

and filth. Overcrowding is of course a relative term depending largely for its injurious effects upon the quality and construction of the edifice, the sufficiency or otherwise of its ventilation and lighting, and the condition of the site on which it stands. Filth here indicated, on the other hand, is not merely "matter in a wrong place", as defined by Lord Palmerston, but animal and other organic matter in close proximity to individuals, or their dwellings, while undergoing those degenerative changes which eventually resolve it into its elements, or into other inert compounds. Where these conditions exist zymotic diseases readily assume epidemic intensity, while, local conditions and sanitary surroundings being satisfactory, the epidemic dies on its birthday.

While disposed to concur with those who view enteric fever as capable of being stamped out when it occurs, and of being prevented altogether by sanitary measures directed against filth, there are other members of this group which are apt to become epidemic under favourable circumstances, and for the prevention of which more vigorous measures are necessary. When and under what circumstances do the contagia of such diseases germinate, if they be organic entities depending on germination or some allied process for their existence, and what are the predisposing causes at work among communities in which they find a genial soil for their development? Is it clear that the specific causes, whatever they be, of the several diseases which are prone to assume an epidemic form, are self-existent entities always present with us, but impotent to assail us, so long as we enjoy a vigorous frame and a healthy environment? In other words, are the conditions, social and sanitary, under which we live, and the physical development they produce, elements in the complex questions of the origin and spread of disease, and therefore worthy of the attention of the epidemiologist? If physical differences in individuals are found to depend on varying physical conditions under which they grow up, may it not be possible—nay, probable—that these latter have also some influence in warding off, or predisposing to disease, the various communities among whom epidemic and endemic diseases prevail? At all events, it may be well to glance at such conditions as are known to influence development, and to see how far these are identical with those which are held to favour or check the spread of epidemics.

"If we inquire," writes Buckle, in his *History of Civilisation*, "what those physical agencies are by which the human race is most powerfully influenced, we shall find that they may be classed under four heads, namely climate, food, soil, and

general aspect of nature." After analysing the separate and combined influence of these agencies over the fortunes of man, Buckle proceeds to show the order in which the human race advances in civilisation, and in moral and intellectual development, "man modifying nature and nature modifying man, while out of these reciprocal modifications all events must necessarily spring." If this be so, may we not reasonably inquire whether man's proneness to suffer from epidemic and endemic diseases is not more intimately associated with the physical conditions by which he is surrounded, and which he has been an active agent in shaping, than is generally realised?

Whatever views may be held in regard to racial differences in the inhabitants of different countries, and even of districts of the same country, few will refuse to admit the influence of the agencies referred to on the physical development of the people in all countries. Climate and soil are essential to, and mainly instrumental in, the production of food; and this again, with what Buckle calls "the general aspect of nature", shapes to a great extent man's physical as well as his moral and intellectual development. "Racy of the soil" is perhaps less applicable to the inhabitants of these islands to-day than it was a century ago, when men for generations inhabited the same hills and valleys, and subsisted mainly on the products of their native soil. Now men aggregate in great cities, and subsist on the food-products of other countries to a much greater extent than they did even half a century ago, and the results are perceptible not only in modifications of the types of disease prevalent among them, but also to a still greater degree in a less robust physical development. It is only necessary to visit the centres of our manufacturing industries, and the slums of our great cities, to realise this, notwithstanding the great advances which have been made of late years in ameliorating unfavourable conditions as to health, still too commonly met with among the lower orders of our large towns. Free trade and cosmopolitan intercourse are rapidly placing the different races of men more nearly on a common platform as regards food at least; while the ever-widening sphere which improved means of human intercourse is daily opening up, offers attractions for the physically strong and mentally vigorous, who thus carry to other countries, and happily to our own colonies in the main, the flower of our youths, leaving the less vigorous, the halt, the maimed, and the blind, to struggle on and perpetuate the race at home.

The history of the inhabitants of these islands is not want-

ing in illustrations of the differences in the susceptibilities to disease depending upon the nature of the staple articles of food, and the consequences which flow from their use. Scotland, with its oatmeal and pease-brose, the products of its own soil and climate, has nurtured races of men in the past, whose physical and mental development and power of enduring hardships and resisting disease, compare favourably with other European nations; while their Irish neighbours have shown a susceptibility to disease, and to typhus fever in particular, which is remarkable. Is this proclivity of the Irish to typhus attributable to the potato as a food, or to the concomitant fact, stated by Buckle, "that in a country where men live on potatoes the population will, if other things are tolerably equal, increase twice as fast as in a country where they live on wheat"? The overcrowding which this rapid increase of numbers produces, when not accompanied by an equally rapid increase of wealth, is probably a more potent factor in the prevalence of fever than the potato. Pestilence and famine, and the improved wages resulting from reduction of numbers through emigration, have done much to modify all this.

The conditions under which the English as a nation live, the rate of wages earned, and the sources from which they draw their food-supplies, are so different from the Scotch and Irish, as not to admit of any accurate comparison in these respects, at all events as regards the past; but here, too, changes in the staple articles of food, through free importation of foreign produce, and notably of meat sold to the consumer under novel conditions as to methods of preservation, may not be without their influence.

It may be well to glance here a little more minutely into the conditions under which man has placed himself in those great towns and cities of the Empire—man's modifications of his physical surroundings—and to estimate approximately, for we cannot do so accurately from the data available, the effect these have had on the physique of the people, and on their power of resisting epidemic outbreaks of zymotic disease. Time does not admit of an exhaustive examination of the conditions under which the lower orders in our large towns live, nor is this perhaps necessary, as it is a favourite subject of discussion in the press at the present time. Those who have turned over the pages of the Report of the last Royal Commission on the Housing of the Working Classes will readily admit that there are many parts of this city, and of other large towns, in which the condition of the dwellings of these classes are neither conducive to a healthy

development of mind and body, nor to a reasonable prospect of an average longevity. Of many districts of London, the late Lord Shaftesbury said, the progress made in the improvement of the dwellings of the poor was enormous as compared with thirty years ago; yet the evils of overcrowding, especially in London, were still a public scandal, and were becoming in certain localities more serious than they ever were. To take an illustration from St. Pancras—a Jews' quarter—in the words of the Rev. C. Billing, "overcrowding has not increased there simply because the district had become so full it could not grow more crowded . . . five families to six rooms will be found, in certain areas, to be under the mark rather than over it." In Lion Row there was a room, 12 feet by 6, and only 7 feet high, in which seven persons slept. At 3, Drury Street the first floor front room was 13 feet by 12, and 9 feet high, and was inhabited by a family of nine, who had only one bed. Many similar instances are given by the Commission. Bristol, Newcastle, Camborne (in Cornwall), Alnwick, and many other towns afford like examples of overcrowding.

Great overcrowding of houses in limited areas is also said to exist in many places, while the very objectionable principle of placing houses back to back, thus cutting off all possibility of thorough lighting and perflation, is a crying evil, to which Dr. Thorne Thorne and others have called public attention. Cellar-dwellings, jury-buildings, old houses rotten from age and neglect, new houses rotten from the first, are described, and the effect of the one-room system is declared to be morally and physically bad. No one has ventured to express an opinion that they are not most destructive to bodily health; but, to put this beyond doubt, the Commission give the rate of mortality in one locality as 70.1 per 1,000, adding the significant remark—No epidemic. In Wellington Square, the same year, the death-rate was 53.7 per 1,000, and in Drury Street it was 44.4 per 1,000.

One word touching the effects of such conditions on physical development. The Jews are in all countries dwellers in cities, and there is in this city a fair sample of the race of every social grade, from the tailors of Houndsditch to the barons of Piccadilly. Of this people Messrs. Spielman and Jacob have furnished many interesting particulars, which have been fully recorded in the journals of the Anthropological Institute. I quote the following in abstract:—There are two social facts of great importance in their bearing on vitality: the vast majority of Jews live in cities; Jews have a larger proportion of poor than the people among whom

they dwell. Their longevity and vitality, so far as it is founded on the low death-rate, is attributable rather to the greater care taken of children under five, which, after all, means that more weakly individuals are kept alive to carry on an unequal struggle for existence. In a recent number of the *Jewish Chronicle* it is stated, on the authority of these gentlemen, that the curves of measurements of West-end Jews are almost identical with Mr. Galton's measurements of all Englishmen; whereas those affecting the East-end Jews are invariably below them. The measurements for height of 13,000 Jews, given by Mr. Jacob, are remarkably close to the actual measurements taken by Mr. Spielman, the mean in the former being 63.47 inches, and in the latter 63.75 inches. It is added, with regard to sickness among this people, that the most widely spread of Jewish diseases—namely, insanity, blindness, and deaf-mutism—can be traced in part to their life in towns, their mental activity, and exciting occupations. I venture to think that the insanitary, but remediable, conditions under which the East-end Jews have been shown to reside, in London at least, are important factors in producing these results.

These facts seem to be confirmatory of some deductions drawn from statistics of recruiting by me two years ago—viz., that the combined effects of emigration, which draws away the most physically fit of the working-classes to the colonies and America, and the migrations of large numbers of the same classes from rural to urban residences and pursuits, had a deteriorating effect on the lower orders from which our recruits are largely drawn. Although the subject is hardly within the scope of this address, it may interest the Society to learn that of 60,976 recruits examined in 1887, 27,571 were rejected as unfit to bear arms, giving a ratio per 1,000 of 452.16, and this, too, under a standard much below the mean of the healthy population of these islands—viz., height, 5 feet 4 inches; chest-girth, 33 inches; weight, 115 lbs. It is right to add that, of the rejections, 35.09 per 1,000 were under height, while the chest-girth for men of 5 feet 4 inches is in excess of a fair development, the correct proportion in an adult being half the height. Being anxious to ascertain whether the recruits drawn from the East-end of London were physically inferior to the average of the recruiting generally, I obtained a separate return for 1887 from the sub-district at the Tower, from which it appears that of 2,633 recruits examined, 1,316, or one half, were rejected. The chief causes of rejection were—weakness of intellect, 17; defective vision, 196; disease



of heart, 43; disease of veins (varix), 39; loss or decay of teeth, 21; hernia, 48; varicocele, 20; defects of lower extremities and flat feet, 33; disease of joints, 37; ulcers, wounds, cicatrices, and other affections of cutaneous system, 42; malformation of chest and spine, 38; under height, 93; under chest-girth, 398; under weight, 172; other disabilities, enumerated under twenty different heads, 119. Although recruited in the East-end, these men were not all natives of London. Of the total number examined, 2,505 were English, of whom 1,283 were rejected; 40 were Scotch, of whom 9 were rejected; 50 were Irish, of whom 11 were rejected; and 38 were colonials or foreigners, of whom 13 were rejected. I do not attach much value to these recruiting statistics, because the men had been already selected by recruiters who accept none but such as they think will pass; but, such as they are, they seem to me to favour the views I have elsewhere expressed regarding the relatively inferior physique of urban as contrasted with rural populations.

As I write, the School Board of London have under consideration, to quote *The Times* of 4th November, "how best to deal with the semi-starvation of a portion of the children who attend the schools, and whose capacity to receive and profit by instruction is seriously curtailed by the pains of hunger, as well as by the want of strength consequent upon insufficient feeding." *The Times'* article goes on to say: "The committee appointed by the School Board have issued a report, from which it appears that no less than 43,000 children, or more than twelve per cent., habitually come to school in want of food." Still further on it is stated: "The basis of a child's power to learn is in the physical structure of his brain, and this physical structure is built up and sustained by food." Under such circumstances, coupled with other conditions as to overcrowding already incidentally touched upon, it is hardly reasonable to expect that children so reared can develop into men of good physique and average stature, nor can we hope that when exposed to the causes of zymotic diseases they will be able to resist them, or have a fair chance of escape from fatal consequences when so attacked.

Turning to the exhaustive reports of the late Dr. Farr for an illustration of the death-rate of urban populations fifty years ago, I find, from calculations made with care, and based upon returns of deaths for the seven years 1838-44, and the census taken in 1841, "that the annual deaths in the town districts of Manchester to 1,000 males living are

thirty-seven; in the extra-metropolitan parts of Surrey, nineteen per 1,000. To take particular ages, the annual mortality of boys under five years of age is forty-eight in Surrey, 148 in Manchester, per 1,000 living; of men of the age of thirty-five and under forty-five the annual mortality is eleven in Surrey, twenty-one in Manchester, per 1,000 living." "It is found from the returns of the seven years 1838-44 that the mortality of Liverpool and Manchester, and the worst parts of other towns, is nearly double the mortality of tolerably salubrious districts." These, and other facts which might be cited, amply justified Dr. Price—quoted by Dr. Farr—in stating, "With how much truth great cities have been called the graves of mankind?" adding, "It is by no means strictly proper to consider our diseases as the original intention of Nature; they are, without doubt, in general our own creation." It is satisfactory to find, from the returns of the present time, that the death-rate in our large towns has greatly decreased during the last fifty years. During the quarter ending September 30th, 1889, the death-rate in London per 1,000 per annum was only a fraction over sixteen; in Liverpool, twenty-one; in Manchester, twenty-four. The death-rate from the principal zymotic diseases in these cities is also low. Still we have ample evidence that our large towns offer numerous instances of a death-rate far in excess of what it should be. In Plymouth, for example, the rate for the last quarter was 26.6, the deaths from the principal zymotic diseases being ten per 1,000. In Preston the death-rate was thirty-three per 1,000, 12.0 of which was attributable to zymotic disease; and in Newcastle-on-Tyne, 27.6 per 1,000, 5.3 of which was from zymotic disease.

The pressing need still existing for continuous effort on the part of this and other Societies having for their object the improvement of the sanitary condition of all classes, and the results already obtained in reducing the death-rate in certain large towns, encourage the hope that further energetic efforts in this direction will be abundantly rewarded. The death-rate is not a full measure of the injury inflicted upon the people by the presence in their midst of remediable causes of disease. Dr. Farr has pointed out that every death may be taken as representing two persons constantly sick, to which must be added the cost of subsistence and medical treatment while so disabled, before any estimate of the impoverishing effects of preventable disease can be formed. No stronger argument could be used in favour of the rigid enforcement of all laws having for their object the prevention of disease, and the physical well-being of the people.

Let me advert briefly to the Infectious Diseases Notification Act which has just come into force, and which places on the medical profession the responsibility of fixing the limits within which the law is to be enforced. No doubt the Act, judiciously administered, will contribute largely to the prevention of contagious diseases; but it is equally clear that its enforcement upon all classes, the poor especially, will be both onerous and difficult. It is of great importance, therefore, to determine with precision what diseases are really capable of communication to others by contact or personal intercourse only, and, therefore, demanding isolation for their prevention; and what are merely filth-diseases capable of being stamped out by cleanliness alone. I venture to repeat here what I stated on this subject some two years ago: "Do the so-called filth-diseases, many of which are said to be contagious, really require isolation; and are we justified in calling upon the State to insist upon due provision being made for such isolation? In my judgment it is the filth that should be isolated, and not the unfortunate sufferer from filthy environments. And here I see a pressing need for clearer views regarding causation. Let this point be once determined, and much of the difficulty of dealing with so-called contagious diseases will have vanished. In certain diseases depending upon known specific poison, the laws governing the multiplication of such poison, the conditions under which it can retain its infectivity, the pabulum, so to speak, on which it lives, and the vehicles by which it is distributed, all demand more attention than they have received. When all existing doubts have been removed, and when we are able to say unhesitatingly, here is a case in which neither disinfectants nor the utmost attention to cleanliness will safeguard the healthy if brought into contact with the sick, the consent of the people to enforced isolation will no longer be withheld; and I may add the number of cases requiring removal for purposes of isolation will be fewer than is generally supposed."

For these and other reasons which might be stated, it is obvious that this Society is performing a good work in keeping before the public the pressing need of the strictest investigation into the origin and spread of epidemic diseases.

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