

CHAPTER VII.

STUDIES IN EPIDEMIOLOGY.

(1) *Special Methods of dealing with Infectious Diseases and their results.*

IN "Evolution" a chronological parallel was established between the introduction of special methods devised to combat particular diseases, and the results which followed.

Typhus Fever had yielded before the combined assaults of hospital isolation of the sick and supervision of the contacts, but most of all to a rigorous application of the power of ticketing small houses and thereby preventing excessive overcrowding.

This disease being well under control by the early 70's, the administration was free to devote its attention to the Infectious Diseases of Children. From 1874 removal to hospital was vigorously pursued, and the control of Infectious Diseases became systematised. In the same year co-operation with the School Board for the purpose of securing early information of absenteeism due to infectious disease was invited and agreed upon. Leaflets were also prepared and issued to every household where infectious disease was occurring, which presented in a popular form the law as then existing for the control of these diseases and a summary of the more obvious methods by which they were spread. With the concurrence of the Registrar-General, a leaflet on the management of children was given to every parent or guardian when registering the birth of a child; and every death registered was made the subject of a special inquiry. Out of the latter there grew a pathological register, in which each death was recorded against the street and number of the tenement in which it occurred.

The cholera experiences of former years had shown that water might, under circumstances of excremental pollution,

become a carrier of specific infection, and in 1858 the theory had been applied to the distribution of Enteric Fever in Penrith by milk (Wm. Taylor).¹ Further support to the suggestion was afforded by the Islington outbreak of 1870 (Ballard), and the Leeds cases in 1872 (Robinson), while in 1870 Professor Bell had related a similar association with Scarlet Fever in St. Andrews.

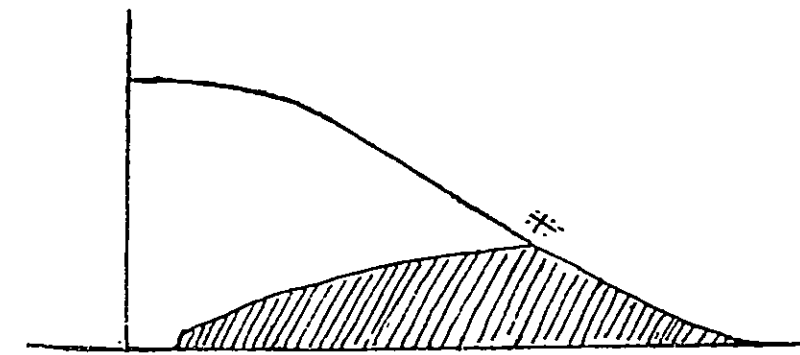
In 1873 an outbreak of Enteric Fever in Parkhead afforded an opportunity of tracing the infection to precedent cases in the dairyman's family, and subsequent outbreaks,² referred to in the text (p. 336), were used to show the necessity for reforming the condition of dairy farms in rural districts. The main conclusions were afterwards embodied in a paper on the "Sanitation of Dairy Farms," and helped to mould subsequent legislation for the control of infection by milk.

To the extracts from "Evolution" which follow there have been added :

- (1) The History of an Outbreak of Febrile Disease at St. Mary's Roman Catholic Industrial School for Boys, 1888;
- (2) The Memorandum on the "Sanitation of Dairy Farms," just referred to; and
- (3) A paper on the occurrence of Anthrax among the Workers in a Hair Factory in 1878.—(Ed.)

CRITERION OF SUCCESS IN USE IN HOSPITALS.

In 1883 in a Memorandum on the Hospital Accommodation for Infectious Diseases in Glasgow, which was an attempt to



forecast the requirements of Glasgow in hospitals and beds, I said—"Prevention is the aim and the *raison d'être* of hospitals

¹See "Paper on the Dissemination of Zymotic Diseases by Milk," by Dr. John Dougall, *Glasgow Med. Jour.*, Vol. v. (N.S.) 1872-73.

²Lack of space, unfortunately, forbids the reproduction of the reports on these outbreaks, but their titles are included in the list of papers appended to the biographical notes, and copies are to be found in library of the Faculty of Physicians and Surgeons, Glasgow.

and sanitary organization; and the evidence of the success of prevention, in so far as isolation is concerned, is and may be formulated as an increasing proportion isolated of a diminishing total quantity of disease existing." Supposing all cases of any infectious disease to be known, then the curve of perfection as regards hospital treatment would be this, in which the proportion removed to hospital is shaded. (See p. 325.)

At the point marked the curve of isolation coincides with the curve of existing disease. They become one; the maximum of bed accommodation is reached. Thenceforth the amount of the disease and the accommodation needed fall together and perfection is reached by the contemporary extinction of both.

SPECIAL METHODS AND RESULTS IN DEALING WITH INFECTIOUS DISEASES.

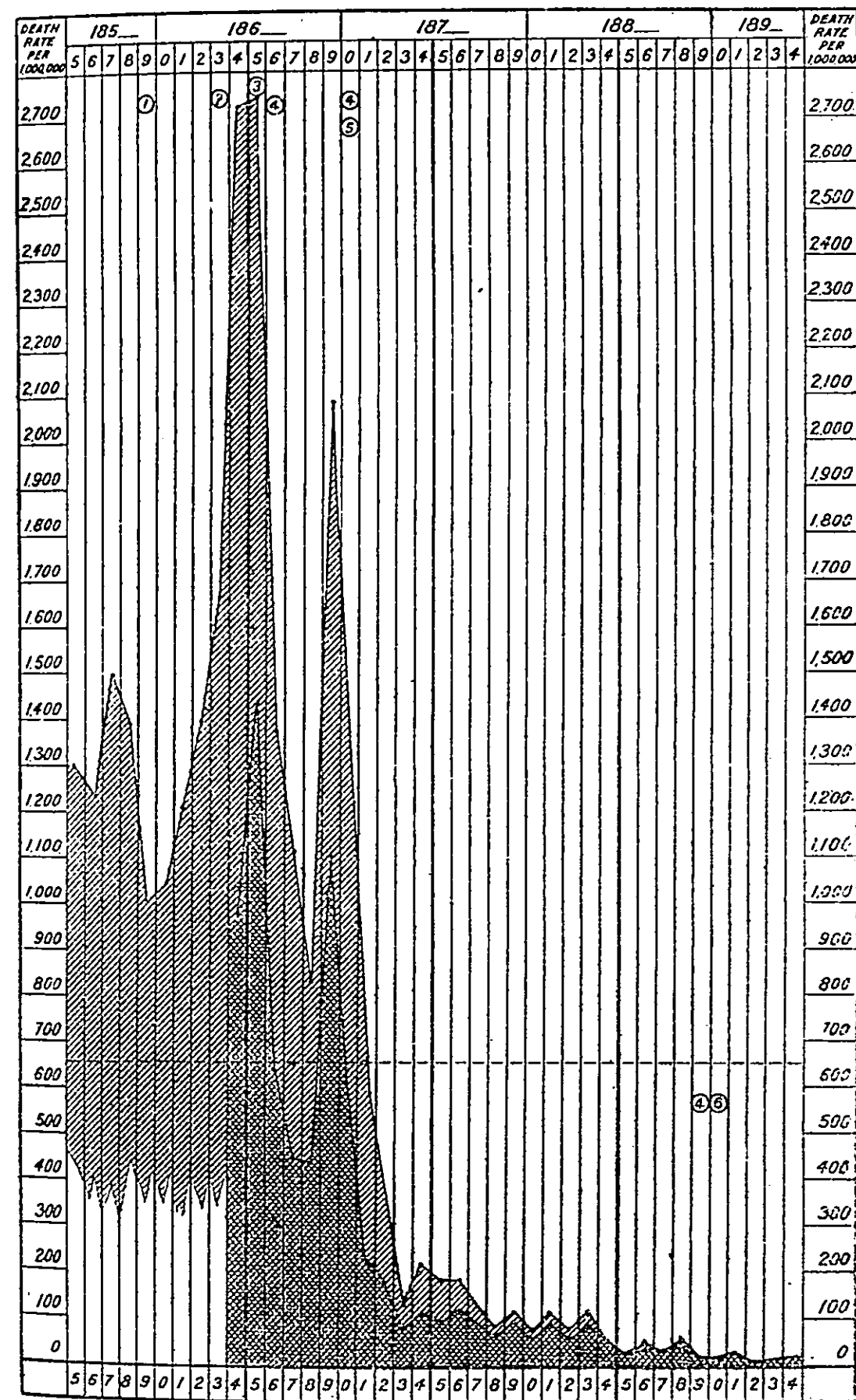
I propose now to consider the chief infectious diseases individually, to bring out any peculiarity in the method of dealing with each and to distinguish in the general bulk of success in prevention the special degree attaching to the treatment of each.

TYPHUS.—Hospital accommodation was originally provided by the Glasgow municipality solely for the treatment of Typhus. In fact, all the sanitary energy which now-a-days we expend upon the whole fraternity of infectious diseases was 30 years ago concentrated in a death-or-life struggle with this one disease. A "Fever-Hospital" or a "Fever-shed" meant a place for Typhus and nothing else. The following Table shows the progress of the struggle in quinquennial stages:

| Period. | Total Number of Deaths. | No. of Deaths in Hospital. | Death-rate per Million. | Percentage of Total Deaths in Hospital. |
|---------|-------------------------|----------------------------|-------------------------|---|
| 1855-59 | 2333 | ... | 1265 | ... |
| 1860-64 | 3225 | ... | 1576 | ... |
| 1865-69 | 3607 | 1795 | 1623 | 50 |
| 1870-74 | 1191 | 583 | 492 | 49 |
| 1875-79 | 352 | 242 | 140 | 69 |
| 1880-84 | 194 | 149 | 75 | 77 |
| 1885-89 | 97 | 77 | 36 | 80 |
| 1890-94 | 70 | 66 | 23 | 94 |

We have only casual opportunities of knowing the proportion of cases treated in Hospital in the earlier pre-registration times.

II. GLASGOW.—DEATH-RATE PER MILLION FROM TYPHUS FOR 40 YEARS (1855-94), SHOWING SINCE 1864 THE PROPORTION OF TOTAL DEATHS WHICH TOOK PLACE IN HOSPITAL,



MEAN DEATH-RATE THUS -----

DIAGRAM NO. II.—HISTORICAL REFERENCES.

- (1) Loch Katrine Water turned on. (2) First Medical Officer of Health appointed. Suppression of Overcrowding by ticketing, etc., begun. (3) First Municipal Fever Hospital opened. (4) City Improvements Act passed. Clearances, 1870-77. Re-construction, 1889. (5) Sanitary Department organised. (6) Notification Act adopted.

Dr. Richard Miller,¹ in stating the number of cases which occurred in the 5 years 1827-32 adds that "only about a fourth were sent to any hospital," which is the same proportion as that given by Dr. Cowan for the 5 years 1835-39. We have not attempted to ascertain the proportion of deaths in hospital in the first decade of registration because the duplicate set of Registrar's books in the Sanitary Department only begins in 1865. Still in the figures as given we have a perfect realization of the "curve of perfection" in isolation treatment (see diagram). We begin with 3607 deaths from Typhus in 5 years, of which 50 per cent. took place in hospital, we end with 70 in 5 years of which 94 per cent. took place in hospital. In other words, whereas in 1865, 610 beds were kept full of Typhus and yet more than one half of the total cases were allowed to run their pernicious course at home, for many years now two Wards of 15 beds each or 30 beds in all have sufficed to receive all the cases known to exist in Glasgow. In fact they are often empty for weeks and they are never full. This is an example of the attainment of theoretical perfection in isolation—"the largest proportion isolated of the smallest quantity of disease existing."

This result is not wholly due to the persistent enforcement of isolation. Typhus is peculiar in that its infectivity may, by change of environment, be weakened almost to extinction. Cleanliness and fresh air make it comparatively harmless. Small-pox and Scarlet Fever are not so influenced. Susceptible persons must keep away from them. The deadliest blow struck at Typhus in Glasgow was the suppression of overcrowding. The 1862 Act regulated the occupation not only of Common Lodging-houses but of small private houses. It fixed a minimum size of house which might be inhabited, which led to the closure of hundreds of undersized houses, and it fixed a standard of 300 cubic feet per adult in all houses of a less capacity than 2000 cubic feet.² These powers took effect in May, 1863, and Dr. Gairdner at once applied them, beginning with "Binnie's Court" 281 Argyle Street, which was ablaze with Typhus. In this way he followed the Fever about until he had brought all its haunts under night-inspection. Structural alterations to ventilate the lobbies and staircases which penetrated those buildings like tunnels were effected. Very soon he was able to point to notorious tenements remaining free of Fever while elsewhere it prevailed; and in 1866 when

¹ "Clinical Lectures on the Contagious Typhus Epidemic in Glasgow and the vicinity during the years 1831 and 1832."

² By the 1890 Act, the standard was raised to 400 cubic feet and made applicable to all houses, although "ticketing" and night inspection are still restricted to small houses. [In 1904 the power to ticket was extended to all houses not exceeding 2,600 cubic feet.—Ed.]

Typhus seemed to be reviving Dr. Gairdner proved by district statistics that its local incidence was in direct proportion to the local overcrowding as shown by the results of the night-inspections. Another thing which is inimical to Typhus is personal and domestic cleanliness. In a Typhus district there will always be more cutaneous excretions on the surface of the skin of the inhabitants and stored in their body and bed clothing than in a district where Typhus is unknown. A Reception House for the well is almost as essential as a hospital for the sick in an infected house. Every inmate of such a house is a magazine of infection, and removal to a temporary refuge is even more necessary for thorough disinfection of clothing than for observation. A Reception House was acquired in 1872, another in 1892. In the case of Typhus the period of detention is 17 days. The practice of free washing of clothes wherever dirt is found in presence of any infectious disease and the steady enforcement of household cleanliness at all times, as well as the facilities afforded by an ample water-supply and baths and wash-houses have raised the standard of domestic cleanliness in the poorest parts of Glasgow to an extent which only those who remember their former state can appreciate.

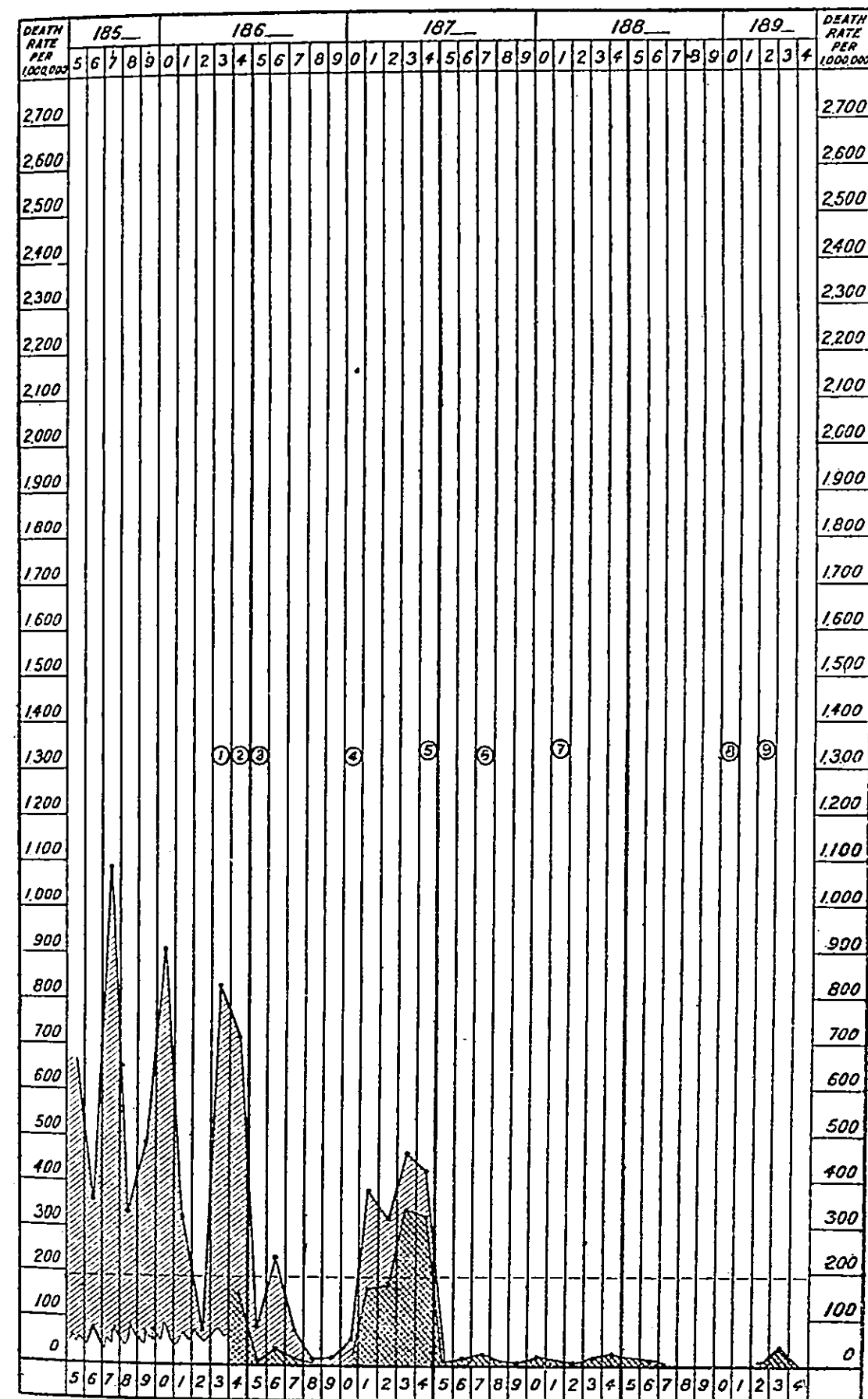
SMALL-POX.—Small-pox differs from every other infectious disease in relation to hospital treatment. The Hospital must itself be isolated, and even when this seems to have been effected a Small-pox Hospital may in a manner not yet satisfactorily explained become a centre of epidemic influence. There is no doubt that ignorance of these peculiarities had at one time a deal to do with the propagation of this disease in Glasgow. Indeed, the arrangements at the Royal Infirmary indicated not merely ignorance of this comparatively recondite property of aggregations of Small-pox even when isolated in an entirely separate establishment, but carelessness of the ordinary precautions which every private practitioner would now-a-days think essential to the isolation of a single case. The Small-pox Wards were in the Fever-house, opening off the common stair, in direct structural and unrestricted personal communication with the general hospital, not isolated as to medical attendance, nursing, or management, using the common washing-house, laundry, mortuary, &c., served from the common provision stores, kitchen and dispensary. In such circumstances it need scarcely be said that to send a case of Small-pox to the Royal Infirmary was to plant the disease on wider lines of communication, so that instead of merely spreading in a particular close or wynd, it would spread in a general hospital and be taken out over the city. Hence the exclusion of Small-pox from the Infirmary in 1871 may be regarded as an

important step in its prevention; but the treatment of it in Parliamentary Road Hospital was only a partial success although a distinct improvement. Suspicion was soon roused in the mind of the District Medical Officer. In the Spring of 1872 Dr. Gairdner and the Physician-Superintendent after careful inquiry could only report a verdict of "not proven." In the Spring of 1873 Dr. Gairdner's successor reported—"while I am not prepared to say *how* the hospital acts, I am afraid it must be admitted that it does act in propagating the disease in the Northern District." Steps were at once taken to provide a hospital at Belvidere, and it cannot be said that Glasgow ever had the full benefit of isolation in the prevention of Small-pox until 1877 when this hospital was opened. It will now be understood how with reference to the prevention of Small-pox the date of the shutting of a hospital may be as noteworthy as the date of the opening of a hospital with reference to the prevention of Typhus!

The part of Reception Houses in the preventive treatment of Small-pox is quite as important as in the case of Typhus, though somewhat different. Personal uncleanness has no essential relation to Small-pox. Still it is necessary where wardrobes are unknown to get the clothing actually on the bodies of the healthy washed. But the greatest service rendered by a house of temporary refuge arises from the opportunity it gives for the discovery of modified eruptions. Suppose a case of well-marked Small-pox is found in a workman's family—a young person of 20 or 25. There may be from eight to a dozen brothers and sisters graduated in age and all vaccinated more or less successfully. As to existing disease it is impossible to make sure that there is not among them a case or two of Small-pox, modified to the vanishing point of one to a dozen papules, or their remains, unless these persons are stripped and examined by an instructed *official* eye. As to prospective disease, for the same reason, such modified cases springing up under daily official surveillance are sure to be detected, whereas, under ordinary circumstances, they would be concealed even if suspected. Young people naturally kick against confinement in a hospital when in perfect vigour, not to speak of loss of work. For these reasons a Reception House is an indispensable aid in the campaign against Small-pox. Even such limited outbreaks as we are accustomed to in Glasgow tax the accommodation of our two houses, which is ample for all other needs. In Reception Houses as in Hospitals, the motto of Small-pox is *Noli me tangere*. Refugees from Small-pox cannot be put under the same roof as those from any other disease. Typhus is not so touchy.

These results are sufficiently striking without reference to a

III. GLASGOW.—DEATH-RATE PER MILLION FROM SMALL-POX FOR 40 YEARS (1855-94), SHOWING SINCE 1864 THE PROPORTION OF TOTAL DEATHS WHICH TOOK PLACE IN HOSPITAL.



MEAN DEATH-RATE THUS -----

DIAGRAM NO. III.—HISTORICAL REFERENCES.

- (1) First Medical Officer of Health appointed. (2) Vaccination Act came into force. (3) First Municipal Fever Hospital. (4) Sanitary Department organized. (5) Revaccination by Epidemic Inspectors begun. (6) Permanent Small-pox Hospital opened. (7) Special Enquiry after Vaccination Defaulters begun. (8) Notification Act adopted. (9) Practitioners authorized to re-vaccinate at public expense persons unable to pay a fee.

standard population. In the 10 pre-sanitation years there were 2197 deaths from Small-pox; in the 30 sanitation years 1060. In the 10 years of imperfect isolation in hospital there were 971 deaths, in the 20 years of perfect isolation 89. There were normally 250 beds in Parliamentary Road Hospital. In March, 1874, we had 258 patients. In the Small-pox Hospital,

| Period. | Total Number of Deaths. | No. of Deaths in Hospital. | Death-rate per Million. | Percentage of Total Deaths in Hospital. |
|---------|-------------------------|----------------------------|-------------------------|---|
| 1855-59 | 1043 | ... | 565 | ... |
| 1860-64 | 1154 | ... | 568 | ... |
| 1865-69 | 167 | 25 | 76 | 15 |
| 1870-74 | 804 | 518 | 324 | 65 |
| 1875-79 | 22 | 16 | 10 | 73 |
| 1880-84 | 22 | 18 | 8 | 82 |
| 1885-89 | 8 | 8 | 3 | 100 |
| 1890-94 | 37 | 34 | 11 | 89 |

Belvidere, we have only 150 beds. For the last 18 years the wards there have chiefly been used as a Scarlet Fever annexe to the Fever Hospital, and there have never been more than 106 cases of Small-pox under treatment at one time (in April, 1893).

Apart from their possibly sinister influence hospitals can at best play only the part of an auxiliary in the campaign against Small-pox. The first line of defence is primary vaccination. Nowhere has advantage been more fully taken of Jenner's great discovery than in Glasgow. So early as 1801 gratuitous vaccination was begun by the Faculty of Physicians and Surgeons, and is to this day continued. In 1857 the Managers of the Royal Infirmary instituted gratuitous vaccination at their dispensary. On 1st January, 1864, the Compulsory Vaccination (Scotland) Act came into force. In 1873 the Local Authority opened their vaccination station. Between these and other stations there is a very large proportion of the primary vaccination of Glasgow carried out officially and therefore in a superior manner. In Scotland the Parochial Boards were until 1894 the authorities who enforced the Vaccination Act. The Parish Councils then inherited the function, but it is very obvious that it ought to be transferred to the authorities under the Public Health Act. In 1876 arrangements were made with the City Parish to have lists of defaulters passed on to the Medical Officer after the Parochial officials had dealt with them. It was found that the epidemic inspectors were able to discover 26 per cent. and procure the

vaccination of 6 per cent. of these defaulters, the remaining 20 per cent. being actually vaccinated, although not certified. In 1881 all the City Registrars were asked to return from week to week the names and addresses of all children who were still unvaccinated a fortnight after the issue of the notice served by the Registrar on the guardians in accordance with the 17th Section of the Act. These were distributed among the Sanitary Staff, with the result that whereas previous to 1876 the proportion of children born in Glasgow who were not accounted for either by vaccination, death, or postponement, varied between 3 and 4 per cent., in the first year of limited inquiry by the Sanitary Department it fell to 2.8 per cent., and in the first year of complete inquiry to 2 per cent.

Having secured as far as possible a primarily vaccinated population, the next line of defence against Small-pox is still vaccination,—vaccination reapplied as a system to every person of 10 years or upwards, and as a special process to all persons within the infected area which surrounds every case of Small-pox. Systematic revaccination can only in this country be promoted by promulgating the opinion of the local authority that the practice is commendable, by announcing that practitioners are authorised to perform the operation gratuitously (*i.e.* at the cost of the local authority) in cases where persons cannot afford a fee, and by giving this advice and these facilities special publicity when Small-pox is present. All this is done in Glasgow. Special means are also adopted to get at sections of the community who are likely to encounter and import Small-pox. Of these the criminal population, so largely interfused with the tramp element, causes most solicitude. An arrangement is made under the sanction of the Prison Board, with Prison Surgeons to offer revaccination on behalf of the local authority to every person committed for more than ten days; and to vaccinate every unvaccinated prisoner. Through Reformatories, Church-missions, employers, &c., &c., and through the propaganda of the staff, a constant pressure is maintained towards the same end.

The best method of carrying out re-vaccination as a special preventive process in the face of existing Small-pox was only worked out after careful consideration of the results of several methods. In 1863 the District Medical Officers went to the infected localities in their districts. After the reconstruction of the Department in 1870, district vaccinating stations were opened for primary vaccination and re-vaccination, each in charge of a medical man. Experience proved (1) that of those who gave their names to the epidemic inspector as willing to be revaccinated a large proportion, before the visit of the District Surgeon or other medical man to whom the list was

sent, had thought better of it and refused to be touched, (2) that those who said they would go along to the station never went, (3) that the epidemic inspector frequently found visitors in the infected house who either gave wrong addresses or otherwise managed to escape revaccination, (4) that the number of children brought to the *district* stations was insufficient to keep up a lymph supply. Looked at with an open mind it was clear that the man to carry out revaccination was the epidemic inspector, who was first on the spot, who was known to the people, who probably was there before the removal of the case and gave his advice in presence of the "awful example." Vaccination is a purely mechanical operation, a bit of handicraft. The selection of the lymph is a matter of medical responsibility. If the lymph is selected and put into the hands of a man who has acquired this handicraft, no other conditions are necessary to justify the operation. In December, 1873, this system was adopted. The Medical Superintendent of Vaccination who attends at the vaccinating station attached to the Central Chambers, collected the lymph and taught each inspector the handicraft. Every inspector carries a supply of lymph (now calf-lymph), he revaccinates wherever necessary at the first visit, returning at meal-hours or in the evening to pick up all the stragglers. He is forbidden to vaccinate infants primarily but he sends their names to the medical superintendent or has the child brought to the station. If the parties prefer their own doctor he calls upon him, informs him of the circumstances, supplies him with the lymph if he requires it, calls next day to see if the operation has been done, and does not lose sight of the business until it is ended satisfactorily. All this is done under the close supervision of the Medical Officer to whom everything is reported in detail. Where general revaccination in a close or court, or lodging-house, or anywhere on a large scale is required, the inspectors are sent out at night in pairs or in squads. When Small-pox is increasing and the work growing a young medical man is appointed to take subordinate charge. The success of the system is shown by the fact that whereas in the last three years (1871-3) of the old system the number of persons revaccinated at their residence per case of Small-pox was barely 2, in the last three years (1892-4) under the new the number was 15.

The fear of losing work from sore arms is a natural and serious obstacle to revaccination in the case of working people. If any *bona fide* case of hardship occurs, the arm is dressed and a small daily allowance is paid during disability. The most serious local inflammation arises from drink, rough usage and dirt. Cases in this category are sent to one of our

reception-houses where they get free lodgings and food and are kept in bed and sober. In dealing with the Model Lodging-houses belonging to the Improvement Trust a bribe of a week's free lodgings sufficed to induce the inmates to accept revaccination after all argument had failed. The same principle was applied to the still larger private "Models," by a pecuniary arrangement with the proprietors. In short it may be said that the local authority of Glasgow has always extended to their medical adviser perfect freedom of action to do anything and everything to promote the prophylactic use of vaccine lymph.

Lastly, a word may be said as to the special demands of Small-pox upon the intelligence, tact, and discretion of the epidemic inspector. To be efficient against Small-pox he must combine the keen scent of the pointer, the wisdom of the serpent, and the common-sense of human-kind. A great part of the difficulty of suppressing Small-pox arises from the extremely modified cases which form the germinating margin of every epidemic. It is in the scenting out and marking down of these for his medical officer that the inspector may show his keenness of observation, while his tact in adapting himself to the character and ways of the people will appear in the success of his offers of revaccination.

ENTERIC FEVER.

| Period. | Total Deaths. | No. of Deaths in Hospital. | Death-rate per Million. | Percentage of Deaths in Hospital to total Deaths. |
|---------|---------------|----------------------------|-------------------------|---|
| 1855-59 | ... | ... | ... | ... |
| 1860-64 | ... | ... | ... | ... |
| 1865-69 | 1140 | 79 | 510 | 7 |
| 1870-74 | 1111 | 179 | 453 | 16 |
| 1875-79 | 1097 | 264 | 436 | 25 |
| 1880-84 | 1032 | 379 | 399 | 37 |
| 1885-89 | 497 | 210 | 182 | 42 |
| 1890-94 | 641 | 421 | 205 | 66 |

We can refer to no statistics regarding Enteric Fever for the first 10 years of Registration. The Registrar-General did not classify it apart until 1865. To the deaths thus classified we have added those from "Remittent Fever" which are no doubt, especially in young persons, all attributable to Enteric Fever. Indeed since 1877 the Registrar-General has embraced "Infantile Remittent" (previously classified apart) under Enteric Fever.

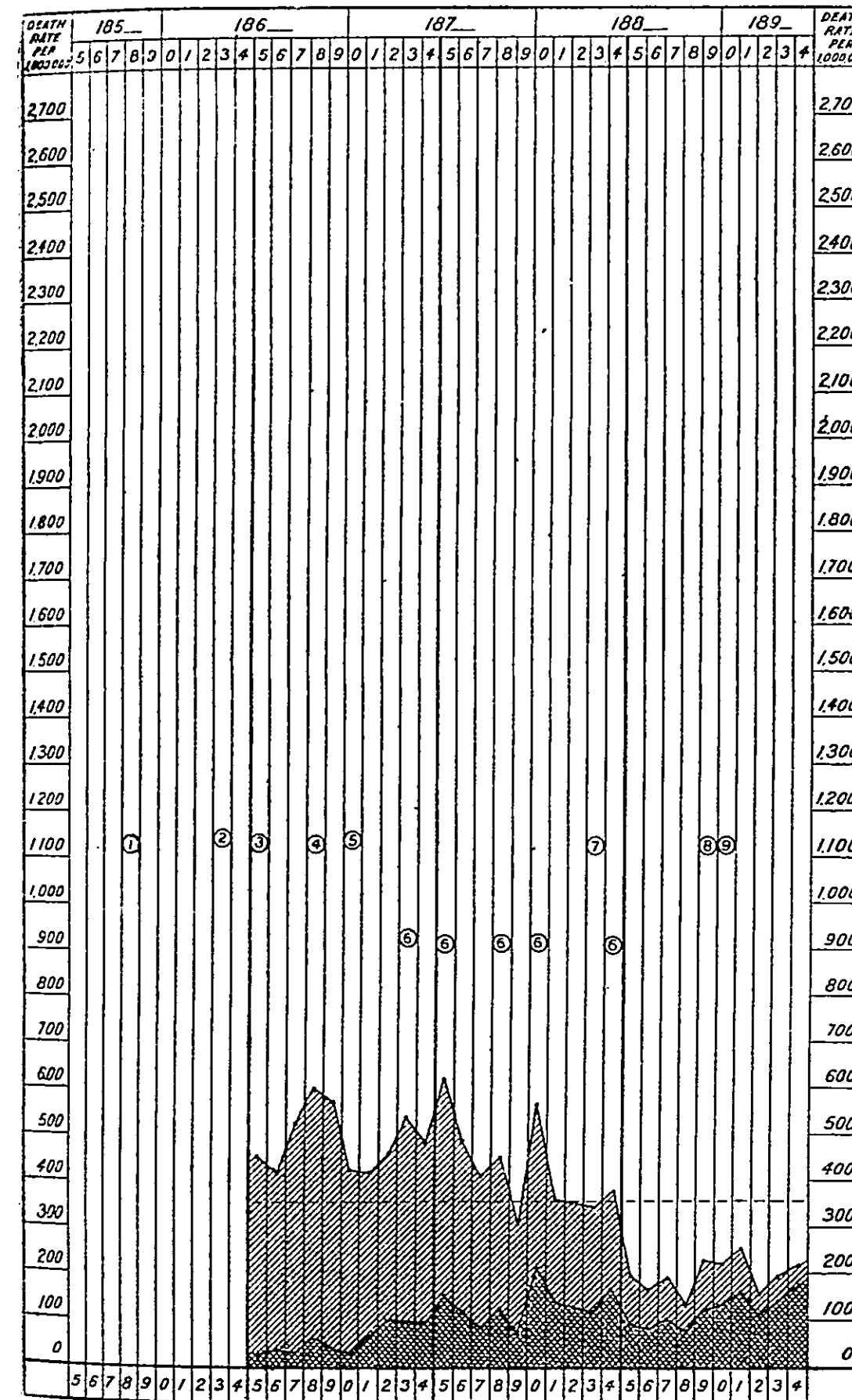
It is apparent that there has been a great and progressive

diminution in the fatality of Enteric Fever in Glasgow since 1865. If we divide the statistics into periods of five years the diminution has been unbroken except by a minute increase in the last over the preceding period. In periods of ten years the decrease in the death-rate per million is thus graded 481, 417, 193. The improvement is practically concentrated in the last decade. What is the cause of it?

No doubt the progressive influence of hospital isolation as shown by the growing proportion of the total deaths which took place in hospital (rising from 7 per cent. in the first 5 years to 66 per cent. in the last, and in 1894 to 77 per cent.) has had an important preventive effect. But if we consider the history of Enteric Fever in detail we observe that every occurrence of anything like an epidemic prevalence has been caused by the distribution of infected milk; and that these epidemics have been recorded in every decade but the last. This matter may best be understood by reference to the diagram in which the annual death-rate is laid down to scale. The milk epidemics are these (1) 1873 Parkhead, (2) 1875 Washington Street, Pollokshaws Road, and Kingston, (3) 1878 West End, (4) 1880 Northern and Central Districts, (5) 1884 Hospitals. If we note the peaks in the curve it will be seen that they fall on the years 1873-75-78-80-84, and these include every year which represents such a peak, viz.—a projection upwards confined to one year. In 1867-8-9 and in 1889-90-91 there are mounds or round-headed elevations spread over three years which were not traced to milk-infection. The history of Enteric Fever in Glasgow therefore leads to those notable conclusions, (1) that her epidemics have all been milk-borne; and since in the first alone was the infection acquired locally (from the milking of the cows in a city byre by a mother nursing children who had Enteric Fever) and in all the others demonstrably from defective water-supply, bad drainage and other defects at the source of supply in the country, (2) that the status of Enteric Fever in Glasgow mainly depends upon rural sanitary administration. It is the case that during the last 10 years of comparative immunity there have been no milk epidemics of enteric fever.

There were three methods of working for the protection of the City upon the indications of these experiences—by legislation, by education, through the commercial relations of buyer and seller. The publication of the facts of these epidemics impressed the public mind very acutely and the local agitation not only initiated local reform in the dairy-trade, but coupled with the action of the authorities had no small share in producing the Dairies and Milkshops Order (1879). Clauses drafted in Glasgow in 1878 for an amended Police Act with

IV. GLASGOW.—DEATH-RATE PER MILLION FROM ENTERIC FEVER FOR 30 YEARS (1865-94), SHOWING THE PROPORTION OF TOTAL DEATHS WHICH TOOK PLACE IN HOSPITAL.



MEAN DEATH-RATE THUS -----

DIAGRAM No. IV.—HISTORICAL REFERENCES.

- (1) Loch Katrine Water turned on. (2) First Medical Officer of Health appointed. (3) First Municipal Fever Hospital. (4) Cleansing Department organised. (5) Sanitary Department organised. (6) Milk Epidemic. (7) Systematic Drain-testing and special Summer cleansing begun. (8) Privy system condemned. (9) Notification Act adopted.

the intention of facilitating the investigation of these milk epidemics and even authorising inspection of the suspected farms and the exclusion of their product were adopted in the ill-fated Burgh Police Bill and thence in substance in various English local Acts and ultimately in the Infectious Diseases Prevention Act (1890) applicable to England only. This history led to the remarkable result that Glasgow herself only got the benefit of these clauses in 1890 in the Glasgow Police (Amendment) Act. However, much was done by education and the use of the commercial lever. In 1888 a pamphlet was drawn up entitled "The Sanitary Requirements of a Dairy Farm" and distributed by the Local Authority to every farmer within the area of the Glasgow milk-supply and to every milk-agent, to farmers' and dairymen's associations, to rural authorities and others. The plan of campaign was this. The citizens are infected and the business of the milk agent who distributes the infection ruined. The causes are obvious sanitary defects and the actual existence of disease at the farm-steadings from which the milk comes. The local authority points out the main requirements of a dairy farm. They advise all milk agents to visit the farms before making contracts and as one of the conditions of the contract to insist upon the immediate stoppage of the supply and report of the occurrence, when infectious disease appears at the farm. A form of contract on these lines was at once adopted by the Dairymen's Association. The authorities are themselves purchasers of milk in very large quantities for their hospitals. A very stringent special form of contract was adopted requiring every milk agent who made an offer to specify his farms. These were all inspected by special inspectors, reported upon with plans to scale, and a short list of farms finally inspected by the Medical Officer before the list of those found eligible was reported to the Committee on Contracts. The Directors of the Western Infirmary adopted exactly the same system. In the course of these inquiries and in the investigation from year to year of milk epidemics or circumstances suggesting suspicion of the milk-supply, hundreds of farms were inspected, the reports with relative plans registered, indexed and preserved in the Sanitary Office. Complaints were made to rural authorities and to the Board of Supervision. The hand of the customer in Glasgow was laid upon the factor, the landlord, and the authority; sanitation came to be associated in their minds with self-interest. The money of the town pays the rent in the country, and it was not to be forthcoming except on certain conditions. No doubt the position of the buyer is omnipotent, provided he is intelligent enough to see it and to think it out to its ultimate issues. Milk from a pure

source comes in the long run to be a matter of money—a better bargain for the man with a well-ordered steading, a better rent for his landlord, a higher contract-price to the milk-agent, a dearer article to the consumer. The dairymen of Glasgow are a peculiarly well-informed class as to the health aspects of their trade. Everyone of them who conducts his business as advised by the local authority is an effective apostle of sanitation to the rural districts. Of course there are people in all businesses, not excepting those of landlord, farmer and milk agent, who deliberately choose a low standard. The one makes the existence of the other possible. The ultimate sufferer is the poor, thoughtless, helpless customer of the town. It is for the suppression of the former and the protection of the latter that legislation is required.

While we ascribe so large a share in the reduced fatality of Enteric Fever to the prevention of milk epidemics these are after all what may be designated acute events arising from passing causes. The chronic causes of Enteric Fever, those which sustain it as an endemic, are the daily crop of "nuisances" essentially related to excrement-removal which springs up within and about the house, which it is a great part of the business of the nuisance inspector to abolish from day to day; and defects in the cleansing and scavenging of ashpits, courts, and closes for which the Cleansing Department is responsible. The plodding work of the Sanitary Department and the intelligently-developed system of cleansing which has already been commended therefore deserve their share in the allocation of merit. The epidemic peaks rise upon a falling base and this is the work of the hospitals and those departments.

RELAPSING FEVER.—In March, 1870, the first cases of this disease were recognized in the Municipal Hospital. It had been first detected in this country in the London Fever Hospital in July, 1868, having apparently been introduced by Polish immigrants to Whitechapel. In January, 1870, it appeared in Manchester, in February in Edinburgh, whence it was carried by a tramp to Glasgow. The disease developed slowly until the autumn, when it outran the hospital accommodation. From the middle of October, 1870, until the beginning of January, 1871, an increasing proportion of the known cases was treated at home and the fever spread like wild-fire. The authorities took prompt action. On 11th November they purchased the Belvidere estate. Wooden sheds were run up and filled as soon as finished, the first being occupied on 19th December. By the end of January the epidemic was obviously checked and in February it was on the

decline. In the following autumn there was a vigorous rally, but in face of the ample hospital accommodation the disease made no headway, and it disappeared in the summer of 1872. The following is the result of the epidemic so far as concerns deaths:—

| | Total Deaths. | Deaths in Hospital. | |
|---------------|---------------|---------------------|----------------------|
| | | No. | Percentage of Total. |
| 1870, - - - - | 121 | 24 | 20 |
| 1871, - - - - | 241 | 91 | 38 |
| 1872, - - - - | 34 | 7 | 21 |

It is very obvious from these figures that Relapsing Fever not only overwhelmed the hospitals but the whole executive. Out of 396 deaths 122, or only 31 per cent., took place in hospital. The new department was not in a position to discover more than a fraction of the existing cases, or to insist upon isolation without careful selection according to urgency. Still, over-crowding was now under control, lodging-houses were regulated, scavenging and cleansing were fairly in hand and disinfection was applied, in all which respects the circumstances were very different from those now to be contrasted.

Relapsing Fever had been epidemic in Glasgow in 1843. It is a disease which produces a low direct mortality—between 2 and 3 per cent., although it very rapidly involves a large area of the population, so that the mass of disease existing at one time is enormous. Probably encouraged by this consideration, the parochial authorities resolved to treat the poor at home. Relapsing Fever almost wholly runs along the lines of poverty so that the great majority of its victims could not get access to the Infirmary excepting at a cost to the parishes of 15s. each. To save this sum the district surgeons were requested to treat cases and allowed to give a few shillings in the way of relief. Otherwise, of course, nothing was done in the way of prevention. The result was that in 8 months 12 per cent. of the population had been attacked. In District 11, between the New Vennel, the Molindinar and Duke Street, the proportion was 27 per cent. If we take the mortality at 3 per cent., then 396 deaths in 1870-72 represents 13,200 cases in Glasgow in 3 years in a population of 492,000, whereas in 1843 there were 32,000 cases in 8 months in a population of 275,000.¹ It is, however, only fair to say that there was great destitution in the city in 1848 but not in 1870-72.

INFECTIOUS DISEASES OF CHILDREN.

The epidemic history of the pre-sanitation age suggests the same sort of questions as Hume's History of England and Disraeli's novels. Was there anybody but Kings and Emperors

¹The parishes of City, Barony, and Gorbals.

alive in those days? Is society entirely made up of Dukes and Duchesses? Were there no epidemic diseases in the first half of the 19th century, but Typhus, Small-pox, and Cholera? It is easier to explain why we hear of none but those grand diseases than why historian or novelist should so write. So soon as Registration enables us to ascertain the full facts we find epidemics of Scarlet Fever, Measles, and Whooping-cough mixed up with those of the major infectious diseases, competing closely with them in their contributions to the tale of deaths, and no doubt rivalling them in the bulk of disease existing at one time. In the 20 years 1855 to 1874, the number of deaths from *Scarlet Fever* was 11,377, from Typhus 10,356. In those 20 years the death-rate from Scarlet Fever on four occasions exceeded 2000 per million; on only three occasions in the case of Typhus. The highest death-rate attained by Typhus was 2749 per million in 1865, whereas the maxima of Scarlet Fever were 2906 in 1863 and 3358 in 1874. Compared with Small-pox, Scarlet Fever had in 11 of these 20 years shown a mortality exceeding three figures per million, Small-pox in only one. *Measles* had carried off 7495 persons in the 20 years, and in 1871 reached a death-rate of 1898 per million, which had only three times been exceeded by Typhus. *Whooping-cough* was then what it is now, the most destructive of all our epidemic diseases, not because of its periodic outbreaks but its steady persistency. In the 20 years it caused 12,722 deaths, and in only three of these years failed to raise its annual tribute to four figures per million. As it was in those 20 years, there is every reason to believe it was in the first half of the century. The classification of the burial-records as to the causes of death was founded upon very dubious data, but there is less dubiety about the ascription of deaths to infectious than to other diseases. In 1813, Whooping-cough was of sufficient importance in Glasgow to lead Dr. Robert Watt, a distinguished physician of the day, to write a special "Treatise on the History, Nature, and Treatment of Chin-cough," now best known on account of the appendix:—"An inquiry into the relative mortality of the Principal Diseases of Children and the number who have died under 10 years of age in Glasgow during the last thirty years." He tells us that "next to the Small-pox formerly, and the Measles now, Chin-cough is the most fatal disease to which children are liable," (p. 25) and that the greatest number of deaths attributed to this disease in Glasgow during the 30 years was in 1809 when they amounted to "something more than 11½ per cent. of the whole deaths in the year." In the 40 years of registration the deaths from Whooping-cough have never quite reached the proportion of 9 per cent., and in the

last 15 years never 7 per cent. Dr. Alexander Watt reports¹ that in the 5 years 1835-39 the death-rate per million from "Fever" was 3780, Measles 1960, Small-pox 1730, Whooping-cough 1720, Scarlet Fever 830. It is evident therefore that even in the heroic age of epidemics, if the infectious diseases of children excited no popular remark and led to no organized interference it was not because they did not exist, or, though existing, were not deadly. They were *diseases of children*. That was the reason and a sufficient one. Typhus slew the bread-winners, the house-mothers. It prostrated those who represented the vigour of the community and paralyzed its activities. The same instinct which prompted to revolt against Typhus said—let the others alone, our hands are full.

When the dust and smoke of the main battle have cleared away it is possible to discover positions which are held in strength by unbroken detachments of the enemy and to turn the forces to their attack. Every figure given above to prove that the epidemics of those (so-called) minor diseases were frequent and deadly, though overshadowed by the major epidemics, became an argument for attacking them when the latter were broken up. The last epidemic of Typhus occurred in 1869. The epidemic of Relapsing Fever which swept down upon the city like an Asiatic horde in 1870-71 overwhelmed the infant sanitary organization and compelled it to reinforce its hospital strength and extend its washing and disinfecting arrangements. When this vast outburst passed away all the added resources were left free for fresh enterprises. In 1871 the most severe epidemic of Measles on record broke out. The feasibility of dealing with children's diseases had frequently been discussed but always with a sense of hopelessness in view of the inherent difficulties. The district medical staff was instructed to endeavour to get cases of Measles into Hospital by offering to admit mothers with children. In 1873 the medical officer gave instructions to use every means to procure the removal of the first cases in tenements. In that year Scarlet Fever became unusually aggressive, the prelude to an epidemic outburst which culminated in 1874 and was by far the most destructive of any on record. In September the medical officer proposed "to enforce removal to hospital of cases of Scarlet Fever wherever it can with propriety be done, more particularly in those parts of the city where epidemics of all kinds spread rapidly." He was authorized to do so, and a fortnight after he reported that of 122 cases known to exist 34 had been removed "in most cases under warrant." Henceforth the hospital treatment of Scarlet Fever was quietly but

¹ Remarks on Mortality Bills of 1839.

firmly pressed, with the result that in place of 28 per cent. of cases of which the officers became aware because of the very fact that they existed in small houses being removed "in most cases under warrant," we now remove above 80 per cent. of all existing cases without having to ask for a warrant once a year.¹ The secret is to have a well-managed hospital with a good reputation for the kindly treatment of the children, to manifest human sympathy with parents in their desire to cling to their children, but to be firm and let it be evident that the firmness is the firmness of reason and not of mere despotism. The same principle of course applies to all forms of infectious disease in children. The preventive utility of hospital isolation in the case of Measles and Whooping-cough is limited by various circumstances. The advantage as regards the individual life is undoubted in the majority of the cases treated in Glasgow—the children of tramps and denizens of lodging-houses. The extension of isolation to the infectious diseases of children included the application of all the other means of prevention, general sanitary supervision and washing and disinfection.

The passing of the Scotch Education Act in 1872 had a most important relation to the infectious diseases of children in various ways, not the least of which was by centralizing the control of schools, and so facilitating general regulation. In 1874 negotiations were opened between the Local Authority and the Glasgow School Board with a view to co-operation in an endeavour to prevent the spread of those diseases through schools. It was agreed that no child coming from an infected house or itself infected should be permitted to attend school until a certificate of immunity had been received from the Medical Officer. To secure this, a system of notices of infectious disease where there were children attending school, from the Medical Officer to the Head Teachers and from the Head Teachers and the Board to the Medical Officer was instituted. This scheme of co-operation began in September, 1874, and has worked admirably ever since. When begun it had no legal sanction but this was obtained in 1890. The sending to school or receiving at school of a child from an infected house without a certificate is penalized. At the commencement of each session hand-bills containing extracts from the Act are distributed to the children through the Head-teachers. In 1874 also two popular pamphlets were issued by the Local Authority—"The Management of Scarlet Fever" and "The Law about Infectious Diseases." These have been re-edited from time to time. A copy of the former is left at every house where Scarlet Fever exists and of the latter

¹ In October, 1895, we are removing 89 per cent. of the cases notified.

wherever a case of any infectious disease exists. Altogether it may be said that 1875 is the first year of a new epoch in the history of the infectious diseases of children in Glasgow, for by that time all the preventive armament hitherto used only against Typhus, Small-pox, &c., had been turned upon these diseases, and other procedures specially adapted to their characteristics fairly initiated.

SCARLET FEVER.—The following table shows the movements of Scarlet Fever in quinquennial periods. The first three quinquennials show what Scarlet Fever is when left absolutely to itself. At the end of the fourth period (1870-74), as we have seen, a beginning was made. Compulsory removal was begun in the autumn of 1873, but after all only $4\frac{1}{2}$ per cent. of the deaths that year took place in hospital. In the severe epidemic of 1874 the proportion increased to nearly 10 per cent. In each of the next four periods in which hospital treatment and all the general methods of prevention as well as some

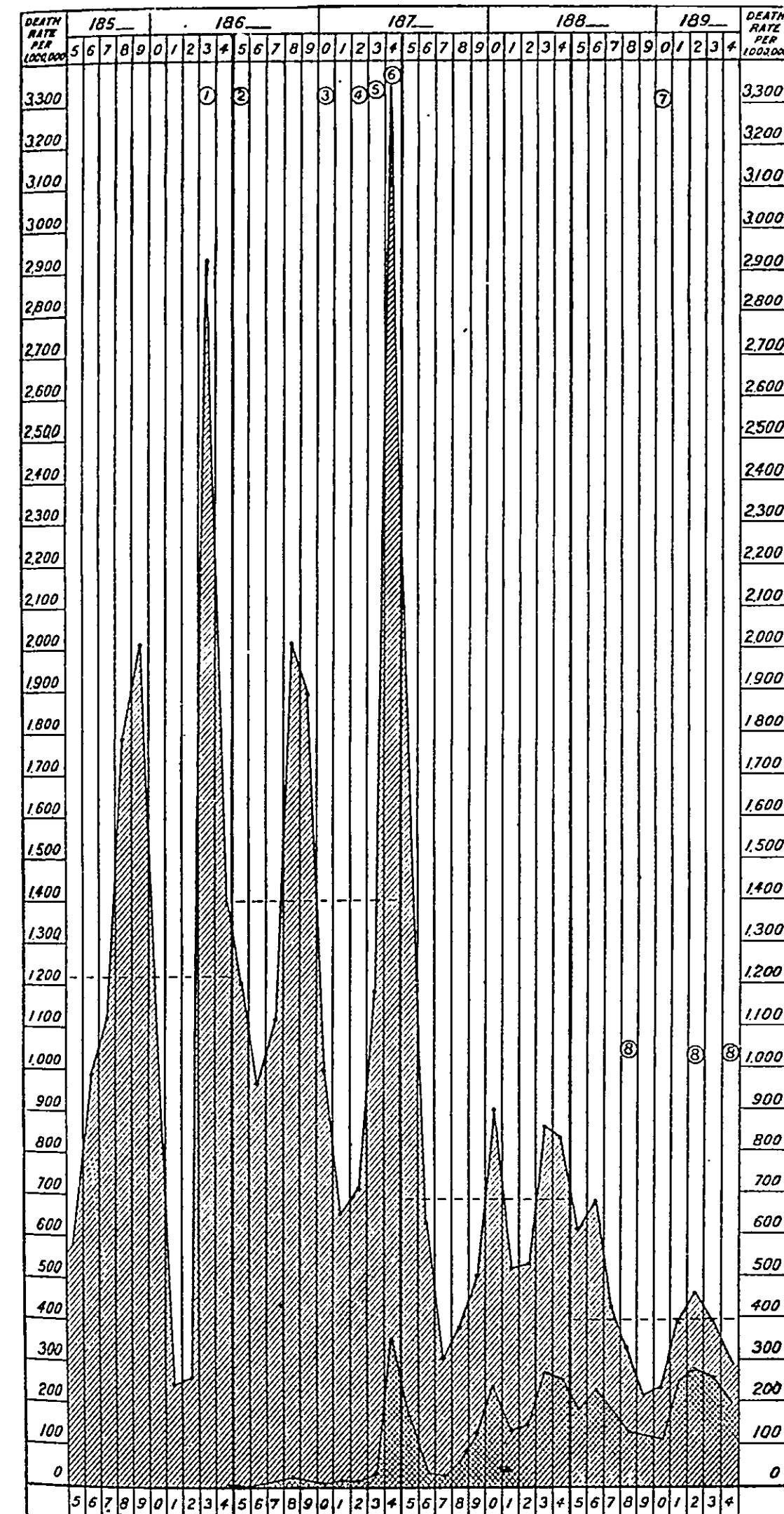
| Period. | Total Number of Deaths. | No. of Deaths in Hospital. | Death-rate per Million. | Percentage of Total Deaths in Hospital. |
|---------|-------------------------|----------------------------|-------------------------|---|
| 1855-59 | 2427 | ... | 1301 | ... |
| 1860-64 | 2343 | ... | 1141 | ... |
| 1865-69 | 3210 | 25 | 1429 | 1 |
| 1870-74 | 3397 | 209 | 1379 | 6 |
| 1875-79 | 1622 | 214 | 645 | 13 |
| 1880-84 | 1862 | 508 | 725 | 27 |
| 1885-89 | 1161 | 482 | 435 | 42 |
| 1890-94 | 1108 | 729 | 347 | 66 |

special were systematically applied, the proportion of deaths in hospital rose, and the death-rate fell steadily, so that in the last five years it was exactly one-fourth of the rate which prevailed in the five years 1870-74. This result is specially gratifying and encouraging, because it must be confessed that the constant strain upon the whole resources of the Department caused by the growing proportion of patients requiring accommodation

DIAGRAM NO. V.—HISTORICAL REFERENCES.

(1) First Medical Officer of Health appointed. (2) First Municipal Fever Hospital. (3) Sanitary Department organised. (4) Scotch Education Act. (5) (September) Resolve to enforce Isolation. (6) Co-operation with School Board. Distribution of popular Instructions as to Scarlet Fever begun. (7) Notification Act adopted. (8) Milk Epidemics.

V. GLASGOW.—DEATH-RATE PER MILLION FROM SCARLET FEVER FOR 40 YEARS (1855-94), SHOWING SINCE 1864 THE PROPORTION OF THE TOTAL DEATHS WHICH TOOK PLACE IN HOSPITAL.



MEAN DEATH-RATE THUS -----

and the large demands upon beds made by a disease every case of which occupies a bed for two months or thereby, were producing a sense of despair.

There is nothing special to note about Scarlet Fever excepting its occasional spread by milk-infection, the peculiarity of which is that the infection may in some cases originate in the cow. There have been four milk epidemics of Scarlet Fever detected in Glasgow, two associated with human infection in 1888 and 1893-4, and two with bovine in 1888 and in 1892. The practical lesson is of the same nature in both cases, that no person who suffers from a throat affection of any kind or degree, ulcerative or congestive, with or without eruption, ought to approach dairy cows or intermeddle with milk in any capacity, and that the milk of every cow with a lesion of the teats ought to be isolated and either destroyed or sterilized. These lessons have been carefully impressed upon dairymen and farmers.

MEASLES.

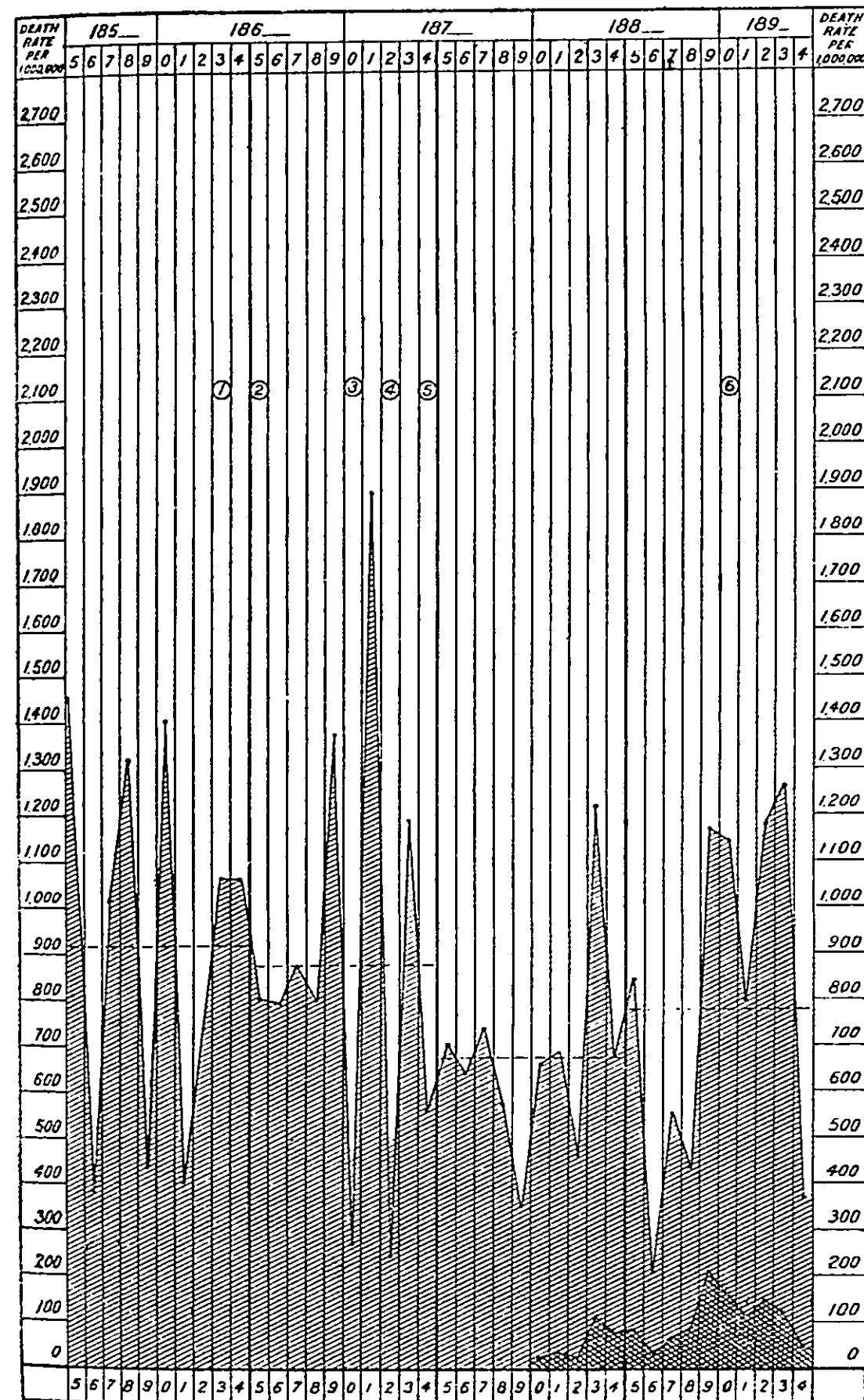
| Period. | Total Number of Deaths. | Number of Deaths in Hospital. | Death-rate per Million. | Percentage of Total Deaths in Hospital. |
|---------|-------------------------|-------------------------------|-------------------------|---|
| 1855-59 | 1657 | ... | 901 | ... |
| 1860-64 | 1817 | ... | 896 | ... |
| 1865-69 | 2020 | ... | 901 | ... |
| 1870-74 | 2001 | ... | 813 | ... |
| 1875-79 | 1449 | ... | 577 | ... |
| 1880-84 | 1880 | 114 | 725 | 6 |
| 1885-89 | 1677 | 222 | 614 | 13 |
| 1890-94 | 2965 | 353 | 841 | 12 |

It is obvious from this table that if any reduction has taken place in the mortality from Measles it is not brought out by the contrast of quinquennial periods. The following extends the periods to four of 10 years and two of 20 years.

| | Death-rate per million. | |
|----------|-------------------------|-----------|
| | 10 Years. | 20 Years. |
| 1855-64, | 898 | 877 |
| 1865-74, | 857 | |
| 1875-84, | 651 | 714 |
| 1885-94, | 777 | |

We thus ascertain that the mortality from Measles has declined, but not much and not steadily. It was higher during the last decade than during the preceding, but lower in both than in either of the two decades preceeding that again. We may say that whatever has been gained is to the credit of the

VI. GLASGOW.—DEATH-RATE PER MILLION FROM MEASLES FOR 40 YEARS (1855-94), SHOWING SINCE 1880 THE PROPORTION OF TOTAL DEATHS WHICH TOOK PLACE IN HOSPITAL.



MEAN DEATH-RATE THUS -----

DIAGRAM NO. VI.—HISTORICAL REFERENCES.

- (1) First Medical Officer of Health appointed.
- (2) First Municipal Fever Hospital.
- (3) Sanitary Department organized.
- (4) Scotch Education Act.
- (5) Co-operation with School Board.
- (6) Police (Amendment) Act—School Attendance Clauses.

last 20 years. The death-rate was 71.4 per million as against 877 in the previous 20 years. It may be argued that this is nothing more than might well arise from the general improvement in the public health which no doubt would cause the same quantity of existing disease of whatever kind to produce less death; but the decrease in the death-rate from Measles amounts to 19 per cent. whereas the decrease in the same period in the death-rate from miscellaneous general disease was only 8 per cent. It may also be recalled that we have gained nothing in diseases of the lungs. Whatever may be the conditions which favour acute diseases of the lungs they must promote the fatality of Measles. Something therefore may be put to the credit of special repressive measures. Of these, hospital treatment does not count for much. The requirements of Scarlet Fever leave little room for Measles. The largest proportion of the total deaths which occurred in hospital was 17 per cent. in 1889, when Scarlet Fever was at the lowest ebb ever seen. But I believe the preventive results of the isolation of Measles in hospital are in any case small. The acute stage of the infectivity is over before the acute stage of the disease is fully established. Before the case is removed the most of the damage is done. The same remark applies to the ordinary washings and disinfections which are so important in dealing with the major infectious diseases. The stability of the Measles contagium is feeble and its energy through the medium of clothing, etc., small. Speaking generally, the hospital treatment of Measles gives more satisfaction from the humanitarian than the preventive point of view. The cases treated are either the children of the abject poor, those who live in lodgings or sleep on stairs, &c., or they are removed from public institutions. In many ways from the preventive aspect Measles resembles Relapsing Fever and Influenza. They all develop with such rapidity that their mere mass overwhelms ordinary organization and tactics. No infectious disease now-a-days produces such *short-time* death-rates as Measles; yet it cannot compete with either Scarlet Fever or Whooping-cough in *annual* death-rates. The reason is that although it has a low case-rate of mortality, its season is short and it rapidly covers a large area. Hospitals could not contain the cases or any considerable proportion of them although all other infectious diseases were excluded. Even with a temporarily enlarged staff and without compulsory notification, it is impossible to visit and register the cases of Measles known to exist. The washing and disinfecting establishments working day and night can barely keep abreast of their work. Yet Measles is an "infectious disease" and the law draws no distinctions but forbids with the same emphasis the same

things in Measles as in Small-pox and is equally imperative as to the duties which may be exacted of local authorities.

The exclusion from school of children likely to be incubating the disease seems the most effectual preventive measure which can be adopted, if not indeed the only one. This can be accomplished only by excluding children belonging to infected families. Though this is done under one general enactment, the nature of the risk is not the same in all diseases. In Measles it is not the risk of a healthy child conveying infection on its clothes, but of a child apparently healthy being really in the most infectious stage of the disease. Therefore, even though a healthy child is removed to another house it cannot safely go to school for a fortnight. In spite of every effort to exclude the incubating child the disease will from time to time be implanted in schools. Then the only useful measure is to close the department of the school in which the disease has appeared. This will almost invariably be the Infant Department. The object still is to separate the incubating from the healthy, and this can best be done by scattering the class and so removing the compulsory intercourse of attendance at the same school. It is not necessary to close the whole school because Measles exists in one section. The method of extension is generally this. One child is seized; in 10 days or a fortnight, two or three more in new families; and so at intervals, each brood rapidly increasing in numbers. This is perfectly certain to happen in the Infant Department. The lesson is to close the department whenever the first brood, the group of two or three, appears.

WHOOPING-COUGH.

| Period. | Total Number of Deaths. | No. of Deaths in Hospital. | Death-rate per Million. | Percentage of Total Deaths in Hospital. |
|---------|-------------------------|----------------------------|-------------------------|---|
| 1855-59 | 3163 | ... | 1707 | ... |
| 1860-64 | 3214 | ... | 1588 | ... |
| 1865-69 | 3262 | ... | 1462 | ... |
| 1870-74 | 3083 | ... | 1257 | ... |
| 1875-79 | 3362 | ... | 1333 | ... |
| 1880-84 | 3437 | 109 | 1324 | 3 |
| 1885-89 | 3144 | 233 | 1153 | 8 |
| 1890-94 | 3079 | 288 | 979 | 10 |

Estimated simply by the number of its victims Whooping-cough is by a long way the most formidable infectious disease known to Glasgow. We might probably generalize and say the

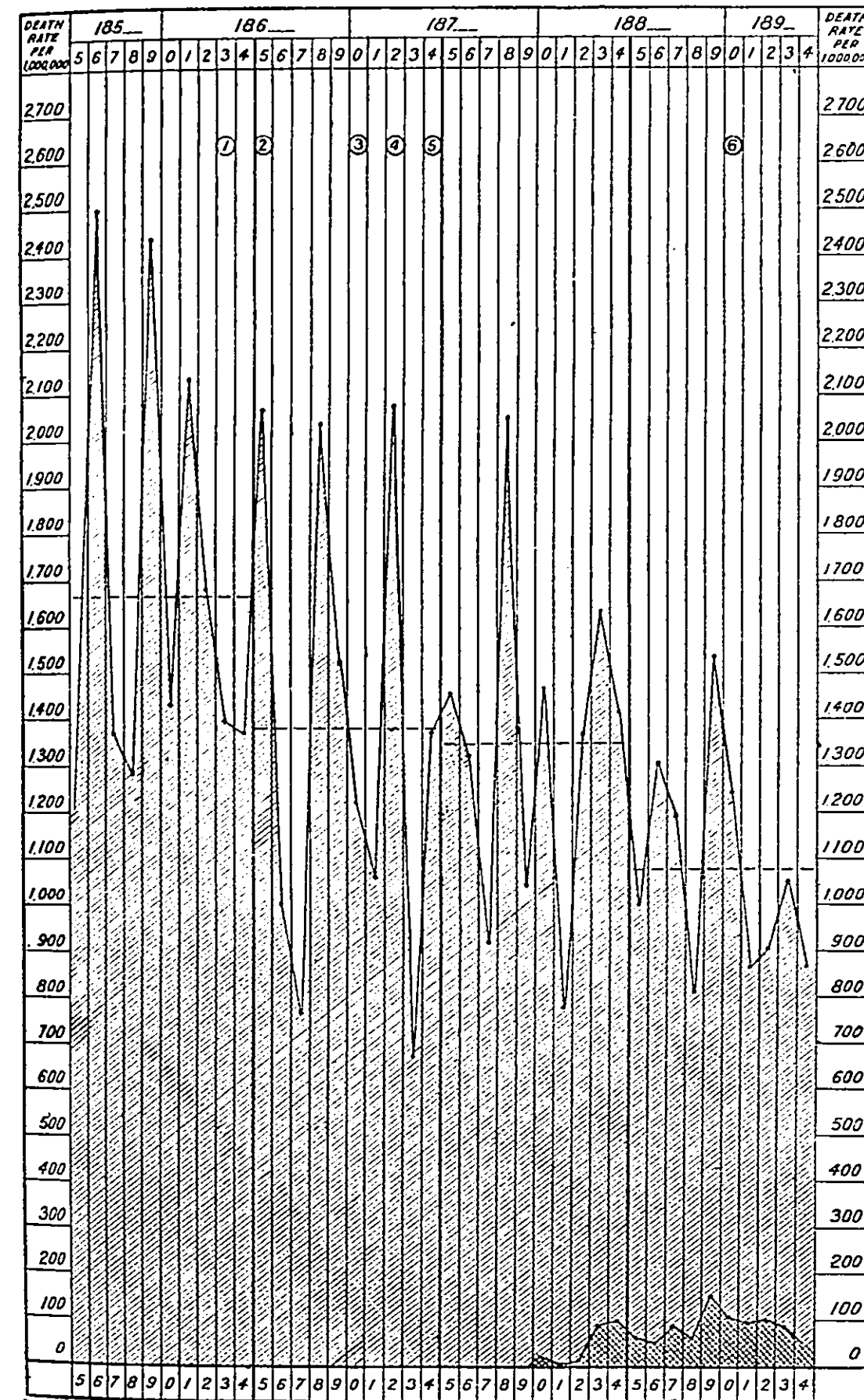
most formidable infectious disease of industrial cities. It shoots up into an epidemic at intervals of two to five years. In the height to which its mortality may rise in those years it is considerably excelled by Scarlet Fever alone. In the 40 years of Registration Typhus caused a somewhat higher mortality only once (in 1865), although in the great epidemics of pre-historic times it must have frequently and more decidedly exceeded. But Whooping-cough never subsides to a low level. Its line of mean prevalence is high. Hence even in the palmy days of Typhus in *quinquennial* averages Whooping-cough scores the highest death-rate (Whooping-cough, 1707 in 1855-59; Typhus, 1623 in 1865-69). On the average of 40 years it returns by far the highest death-rate, viz.—1350, no other single disease reaching four figures. Taking the last five years, after sanitation has done its best, Whooping-cough is still left in the position of most fatal disease, with a mortality of 979, but now very closely followed by Measles, 941. The following Table shows most of the figures from which these generalizations are made :—

| | Death-rate per Million. | | Highest Death-rate per Million in 40 years. | |
|--------------------|-------------------------|------------------|---|-------------|
| | 40 Years 1855-94. | 5 Years 1890-94. | | |
| Whooping-cough | 1350 | 979 | Scarlet Fever | 3358 (1874) |
| "Fevers" | 985 | 233 | Typhus | 2749 (1865) |
| Scarlet Fever | 925 | 347 | Whooping-cough | 2484 (1856) |
| Diarrhoea | 805 | 498 | Diarrhoea | 2215 (1857) |
| Measles | 796 | 941 | Measles | 1898 (1871) |
| Diphtheria & Croup | 541 | 401 | Diphtheria & Croup | 1188 (1863) |

It is so far satisfactory that a disease which is so formidable a factor in the mortality of the city, although still retaining its relative position has not resisted all ameliorative influences. This is clear from the *quinquennial* Table, which opens with a death-rate of 1707 per million and closes with one of 979; being respectively the highest and lowest of the 8 periods in the 40 years. Between the two extremes there is a decided though not quite unbroken gradation. The following Table exhibits these figures in four periods of 10 years and two of 20 :—

| | Death-rate per Million. | |
|---------|-------------------------|-----------|
| | 10 years. | 20 years. |
| 1855-64 | 1647 | 1503 |
| 1865-74 | 1359 | |
| 1875-84 | 1328 | 1197 |
| 1885-94 | 1066 | |

VII. GLASGOW.—DEATH-RATE PER MILLION FROM WHOOPING-COUGH FOR 40 YEARS (1855-94), SHOWING SINCE 1880 THE PROPORTION OF TOTAL DEATHS WHICH TOOK PLACE IN HOSPITAL.



MEAN DEATH-RATE THUS -----

DIAGRAM NO. VII.—HISTORICAL REFERENCES.

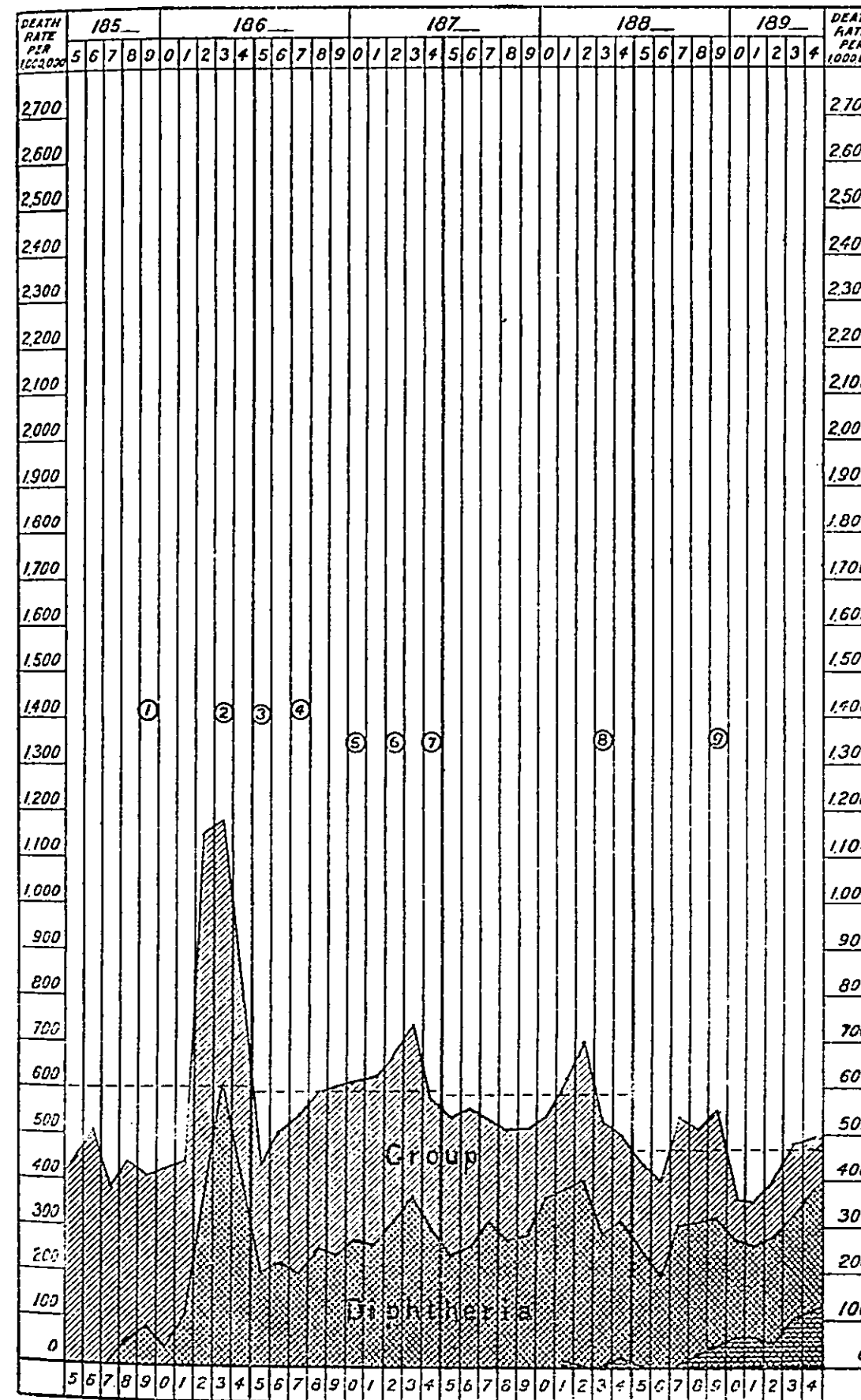
- (1) First Medical Officer of Health appointed.
- (2) First Municipal Fever Hospital.
- (3) Sanitary Department organized.
- (4) Scotch Education Act.
- (5) Co-operation with School Board.
- (6) Police (Amendment) Act—School Attendance Clauses.

The decrease in the last period of 20 years as compared with the first is 306 per million or 20 per cent. The decrease in Measles it will be remembered was in the same period 19 per cent. As in the case of Measles we cannot credit hospital isolation with much influence. The highest proportion of the total deaths which took place in hospital was 12 per cent. in 1892. The preventive effect of isolating the class of cases admitted to hospital must be considerable in Whooping-cough though doubtful in Measles. They are all peripatetic cases carried or trotted about by the parents. Still the aggregate result of the isolation must be small. The proportion of cases isolated must be much less than of deaths taking place in isolation. The exclusion from school of children from infected families and the application of general preventive measures to Whooping-cough, apart from any direct effect, must have tended to procure from parents, guardians and others a more respectful position for Whooping-cough than that popularly assigned to it. Perhaps the fact of greatest present-day interest in the 330 pages of Dr. Watt's Treatise on Chincough is recorded in the history of the case of his little boy aged 6. About the middle of December he showed "symptoms of a common cold." By Christmas "it appeared pretty obvious that he had got the Chincough. By the New Year this was certain." The "kinks" were fully formed and generally ended in vomiting. Dr. Watt proceeds:—"We were now disposed to take him from school but from a fear of being left behind by his companions, he was exceeding averse to the measure and therefore *continued to attend regularly* till Friday the 8th January." He was then so much worse that he "consented to leave off going to school until he was better," which, poor boy, he was never destined to be. He died on the following Thursday. This is very characteristic of the sort of paralysis of mental assimilation with reference to infectivity which now seems to us unaccountable but which was until comparatively recent times manifest in many ways. Even in Dr. Watt's mind the belief that Whooping-cough is infectious lay inert like a stone in the earth, barren of practical suggestion.

DIPHTHERIA AND CROUP.

The answer to the question, whether Diphtheria is increasing or diminishing in Glasgow, depends somewhat upon how we deal with the deaths returned as attributable to Croup. If we run our eye down the columns of quinquennial death-rates in the above Table we see, speaking generally, that "Diphtheria and Croup" are diminishing. The matter is one of so much importance that we give the annual death-rates under those heads during the 40 years of registration.

VIII. GLASGOW.—DEATH-RATE PER MILLION FROM DIPHTHERIA AND CROUP FOR 40 YEARS (1855-94), SHOWING SINCE 1881 THE PROPORTION OF THE TOTAL DEATHS WHICH TOOK PLACE IN HOSPITAL.



MEAN DEATH-RATE THUS -----

DIAGRAM No. VIII.—HISTORICAL REFERENCES.

- (1) Loch Katrine Water turned on. (2) First Medical Officer of Health appointed. (3) First Municipal Fever Hospital opened. (4) Cleansing Department organized. (5) Sanitary Department organized. (6) Scotch Education Act. (7) Co-operation with School Board. (8) Systematic Drain-testing and special Summer cleansing begun. (9) Notification Act adopted. Police (Amendment) Act—School Attendance Clauses.

DIPHTHERIA AND CROUP.

| Period. | Deaths. | | | Diphtheria Deaths in Hospital. | Death-rate per Million. | | | % of Diphtheria Deaths in Hospital. |
|---------|-------------|--------|-----------------------|--------------------------------|-------------------------|--------|-----------------------|-------------------------------------|
| | Diphtheria. | Croup. | Diphtheria and Croup. | | Diphtheria. | Croup. | Diphtheria and Croup. | |
| 1855-59 | 45 | 712 | 757 | ... | 24 | 386 | 410 | ... |
| 1860-64 | 558 | 1012 | 1570 | ... | 271 | 498 | 769 | ... |
| 1865-69 | 431 | 723 | 1154 | ... | 192 | 323 | 515 | ... |
| 1870-74 | 674 | 883 | 1557 | ... | 275 | 360 | 635 | ... |
| 1875-79 | 641 | 747 | 1388 | ... | 254 | 296 | 550 | ... |
| 1880-84 | 811 | 664 | 1475 | 21 | 313 | 256 | 569 | 3 |
| 1885-89 | 707 | 595 | 1302 | 48 | 259 | 218 | 477 | 7 |
| 1890-94 | 882 | 397 | 1279 | 244 | 276 | 125 | 401 | 28 |

DEATH-RATES PER MILLION.

| Year. | Diphtheria. | Croup. | Diphtheria and Croup. | Year. | Diphtheria. | Croup. | Diphtheria and Croup. |
|-------|-------------|--------|-----------------------|-------|-------------|--------|-----------------------|
| 1855 | ... | 407 | 407 | 1875 | 218 | 321 | 539 |
| 1856 | ... | 491 | 491 | 1876 | 243 | 306 | 549 |
| 1857 | 8 | 344 | 352 | 1877 | 303 | 353 | 656 |
| 1858 | 48 | 372 | 420 | 1878 | 247 | 254 | 501 |
| 1859 | 63 | 318 | 381 | 1879 | 260 | 248 | 508 |
| 1860 | 31 | 372 | 403 | 1880 | 316 | 218 | 534 |
| 1861 | 86 | 342 | 428 | 1881 | 344 | 269 | 613 |
| 1862 | 342 | 806 | 1148 | 1882 | 374 | 317 | 691 |
| 1863 | 589 | 599 | 1188 | 1883 | 248 | 270 | 518 |
| 1864 | 306 | 371 | 677 | 1884 | 284 | 208 | 492 |
| 1865 | 161 | 257 | 418 | 1885 | 214 | 206 | 420 |
| 1866 | 190 | 290 | 480 | 1886 | 176 | 215 | 391 |
| 1867 | 168 | 357 | 525 | 1887 | 283 | 253 | 536 |
| 1868 | 233 | 327 | 560 | 1888 | 305 | 195 | 500 |
| 1869 | 211 | 383 | 594 | 1889 | 317 | 223 | 540 |
| 1870 | 248 | 359 | 607 | 1890 | 244 | 119 | 363 |
| 1871 | 236 | 382 | 618 | 1891 | 229 | 115 | 344 |
| 1872 | 285 | 372 | 657 | 1892 | 242 | 130 | 372 |
| 1873 | 334 | 400 | 734 | 1893 | 307 | 152 | 459 |
| 1874 | 271 | 289 | 560 | 1894 | 357 | 109 | 466 |

We have here the whole history of Diphtheria. It was not recognized and was not classified apart until 1857. "Croup"

always had a place in the nosology of death. We find it in the Mortality Bills regularly, but "Diphtheria" was then and until 1857 unknown. If we look at the parallel course of the diseases as shown by their respective death-rates we must be struck with remarkable signs of relationship. In 1862-3-4 Diphtheria burst out into an epidemic, and Croup shows a synchronous epidemic development. The figures for these epidemic years with the years preceding and following them are—

| | | | | | | | | | | |
|-------------|---|----|---|-----|---|-----|---|-----|---|-----|
| Diphtheria, | - | 86 | : | 342 | : | 589 | : | 306 | : | 161 |
| Croup, | - | - | : | 342 | : | 806 | : | 599 | : | 371 |
| | | | | | | | | | | 257 |

There can be but one inference drawn from this parallel movement, viz.—that the same cause produced two forms of disease so different in their symptoms, as to lead men to call them by two distinct names, while they were in reality one disease. If we follow the subsequent course of the two diseases we observe the general tendency of the death-rate from Diphtheria is to rise and synchronously of that from Croup to fall. The mean death-rate in 40 years of the former is 233, of the latter 308. We find that in the first 20 years the death-rate from Diphtheria was *below* the mean in 11 years, and from Croup *above* the mean in 17 years; while in the last 20 years the death-rate from Diphtheria was *above* the mean in 16 years, and from Croup *below* the mean in 17 years. There is here a clear suggestion of transference by improved diagnosis and deeper vision into the character of the disease hitherto called Croup. The diagram showing the combined movements of the two diseases year by year conveys this interpretation of the apparent increase of Diphtheria more unmistakably and convincingly than any purely statistical exposition of the case. The further question arises—Is not "Croup," which in the first epidemic outburst of Diphtheria when the criteria by which that disease is distinguished were imperfectly known became so very much more fatal and which as those criteria become known is gradually being displaced by Diphtheria, in the main really Diphtheria? Of course, this involves the further question—Was Diphtheria after all a new disease? With this, however, we have nothing now to do. What we do maintain on the evidence of these facts is that we get a much more accurate gauge of the fatality of Diphtheria from year to year by including Croup than by omitting it. There may be a small residuum in Croup which is *not* Diphtheritic. Time will show. The influence of the Infectious Disease (Notification) Act has been remarkable. It requires notification of Diphtheria and Membranous Croup. The effect upon Croup was immediate. In each one of the five years during which the Act has been in force the death-rate from Croup has been less than in any one

of the preceding 35 years, and in the last year it is the lowest on record.

That threatened permanent, endemic rise of Diphtheria which is being observed in London and elsewhere with so much anxiety is not yet apparent in Glasgow. This may be most quickly appreciated by looking at the diagram which shows nothing but the characteristic ebbs and flows of an epidemic disease. During the last four years it has slowly increased, but still the average of the last five years is lower than that of each of the three preceding periods of five years. As this covers the whole of the period of compulsory education it is clear either that in Glasgow the influence attributed elsewhere to schools has not been exercised or has been neutralized by some counteracting agency. The system of co-operation with the School Boards which has already been described may have had some influence. It has practically covered the whole period of compulsory education. The special pains expended in securing the soundness of the house-drains and soil-pipes of Glasgow and the improved system of scavenging and cleansing the precincts of the house as well as the general sanitary work have all helped. The hospital isolation of Diphtheria has a high preventive value, and the serum treatment now gives it also a direct return in life-saving. Notification led at once to a great increase in hospital treatment as indicated by the proportion of deaths. In the five years preceding notification 7 per cent. of the deaths from Diphtheria registered as such took place in hospital; in the five years of notification 28 per cent.; in the last year (1894) 36 per cent. As a fact 19 per cent. of the cases notified as Diphtheria and Membranous Croup were removed to Hospital. It is worth adding that we have hitherto not had in our hospitals that post-scarlatinal Diphtheria which is so serious a feature of the hospital treatment of Scarlet Fever in London.

DIARRHOEAL DISEASES (*Diarrhoea, Dysentery, Cholera*).—These have an interest not only in themselves as contributing no inconsiderable share to the general mortality but because of their relationship to Cholera and Enteric Fever in a common cause—organic, mainly excremental impurity. The degree of chronic prevalence of Diarrhoea gives a fair measurement of the probability of Cholera becoming epidemic in a locality and indicates the soil whence a chronic crop of Enteric Fever is likely to spring. Given an impure water supply, then you have a steady and severe drain on the population from Diarrhoea, violent explosions of Cholera as often as the specific contagium is cast into their midst and a chronic prevalence, with periodic epidemics, of Enteric Fever. Given a pure water supply,

then you have a drain moderated in proportion to the character and efficiency of the local system of excrement collection and disposal, to the scavenging and the infinite variety in family cleanliness in this regard which in cities especially tells heavily for or against the young. Cholera will obtain but a passing foothold, should it happen to alight, and Enteric Fever, unless distributed in the milk supply, will only occur in scattered cases.

No better illustration of these facts could be cited than is afforded by the history of Glasgow. There have been three stages in the quality of the water supply. The wholly polluted stage, when Clyde water was supplied, up to 1848; the partially polluted stage, from 1848 (February) when the Gorbals gravitation water was introduced on the south of the Clyde; the wholly pure stage from 1859, when Loch Katrine water was distributed to the north of the Clyde. In the *wholly polluted stage* "Bowel Complaints" bulk very largely in the rude nosology of the Mortality Bills. On the average of the 7 years 1838-44, they caused an annual death-rate of 3360 per million and constituted 12 per cent. of the total deaths. The *partially polluted stage* reaches within the period of registration, when the highest death-rate recorded from diarrhoeal diseases was 2215 per million or 7 per cent. of the total deaths in 1857. In the *wholly pure stage* the highest recorded death-rate was 1114 in 1866 or scarcely 4 per cent. of the total deaths. The history of Cholera is exactly such as those facts would lead us to anticipate. It is shown in the following Table prepared by the Rivers Pollution Commission.¹

MORTALITY FROM CHOLERA IN GLASGOW.

| | Polluted Water Period. | | | Pure Water Period. |
|---|------------------------|-------------|-------------|--------------------|
| | Wholly. | Partially. | | |
| Year of Cholera Epidemic, | 1832 | 1849 | 1854 | 1866 |
| Total Mortality in Glasgow, Mortality per 10,000 of population | 2842 140 | 3772 106 | 3886 119 | 68 1.6 |

In 1866 there were 19 cases treated in Hospital of which 13 died. The first was a seaman from a Highland smack in the

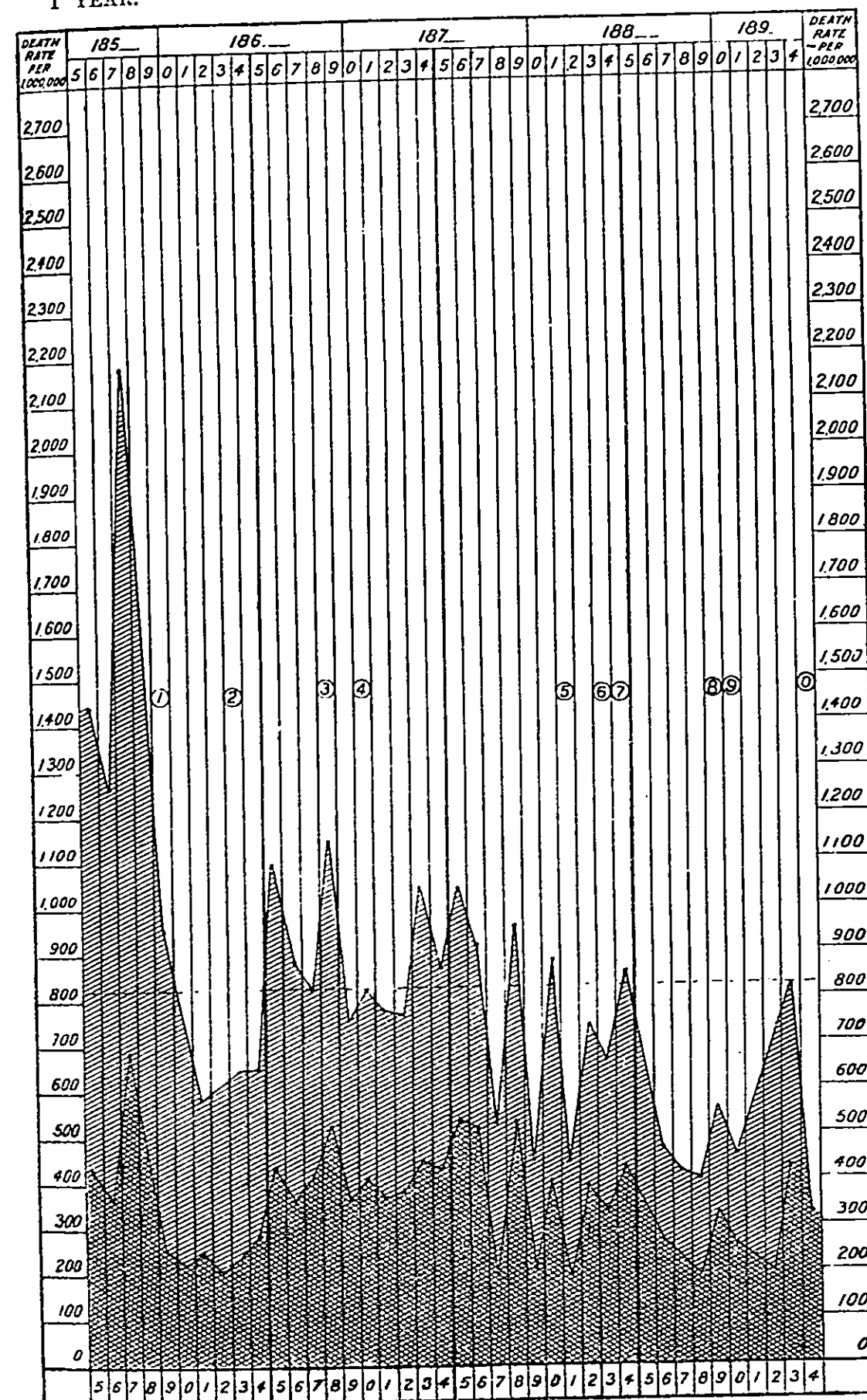
¹6th Report—Water Supply, p. 153. The words "wholly" and "partially" are not in the original Table, but attention is pointedly directed to the gradation in the text of the Report.

harbour. This case had no known antecedent or consequent. The first native cases arose in the New Vennel and there alone was an epidemic tendency shown. The circumstances so well illustrate the only sources of risk in Glasgow now that the water-supply is pure that a note of a visit made to the spot with Dr. Gairdner may be quoted,—“At 51 New Vennel, from which the first two cases came, we found the body of a son lying on a heap of loose straw from which the old father had just been removed to die in the hospital. Saving the body and the straw, and a little precocious girl keeping an unconcerned watch over her dead brother, there was nothing else in that miserable hovel—far inferior to the burrow of a Bosjesman. The front land was soaking in unmentionable filth from basement to attics; and a kindly remonstrance from Dr. Gairdner to a female whom we chanced to encounter, elicited only angry abuse from her and a friendly advice from a workman hard by, to hold our tongue and take ourselves off as quickly as possible.¹ Isolated cases arose in similar spots in all parts of the city. It was not any change in the general sanitation of Glasgow in 1866 which saved it from the fate of 1854. There was no essential difference between the places to which the Cholera led us in 1866 and those to which it led Dr. Sutherland in 1849; excepting that pure water abounded in the Wynds and Vennels. The New Vennel no longer exists. It is doubtful if the abode of one of the Cholera cases of 1866 could now be identified. The condition of the city has been revolutionized both structurally and as to the daily service of cleansing. Watch and ward for the advent of cholera from the continent has been maintained every summer and autumn since 1883, when under the name of “Special Cholera Precautions” extra measures were adopted to render the courts and closes and precincts of the tenement houses *clean* during the diarrhoea season. These have been renewed annually. They consist very largely in the free use of water in washing out the courts, &c., with hose. It is a mistake to limit our estimate of the health value of a generous supply of water to its use as a beverage. The unstinted supply of water for such purposes of public cleansing is of great importance and could not have been enjoyed had it been purveyed by a private enterprise.

The only cases of Cholera seen since 1866 have been in the persons of two emigrants on their way to America in August, 1892. The current record of the result of progressive efforts to secure cleanliness in Glasgow as to excremental nuisances has been partially exhibited with reference to Enteric Fever. The diagram shows the history of diarrhoeal diseases, a synopsis of

¹ Report on the City of Glasgow Fever Hospital for the year 1866-67.

IX. GLASGOW.—DEATH-RATE PER MILLION FROM DIARRHOEAL DISEASES FOR 40 YEARS (1855-94), SHOWING PERCENTAGE UNDER 1 YEAR.



MEAN DEATH-RATE THUS -----
DIAGRAM NO. IX.—HISTORICAL REFERENCES.

(1) Loch Katrine Water turned on. (2) First Medical Officer of Health appointed. (3) Cleansing taken over by Municipality. (4) Sanitary Department organized. (5) First Refuse Despatch Work. (6) Annual Cholera Precautions begun. (7) Second Refuse Despatch Work. (8) Resolution condemning Privy System. (9) Third Refuse Despatch Work. (10) First Sewage Purification work opened.

which is contained in the following Quinquennial Table:—

| Peri. d. | Deaths. | | | Death-rate per Million living. | | | Percent- age of Deaths under 5 Years. |
|----------|-------------------|-----------------------|--------------|--------------------------------|-----------------------|--------------|---|
| | Under 5 Years. | 5 Years & Upwards. | All Ages. | Under 5 Years. | 5 Years & Upwards. | All Ages. | |
| 1855-59 | 1614 | 1105 | 2719 | 6255 | 695 | 1475 | 60 |
| 1860-64 | 876 | 454 | 1330 | 3092 | 260 | 656 | 66 |
| 1865-69 | 1435 | 618 | 2053 | 4684 | 321 | 922 | 70 |
| 1870-74 | 1561 | 531 | 2092 | 4638 | 251 | 853 | 75 |
| 1875-79 | 1510 | 458 | 1968 | 4374 | 210 | 781 | 77 |
| 1880-84 | 1389 | 496 | 1885 | 3915 | 221 | 727 | 74 |
| 1885-89 | 1101 | 339 | 1440 | 3155 | 143 | 529 | 76 |
| 1890-94 | 1244 | 350 | 1594 | 3090 | 127 | 502 | 78 |

The first thing that strikes one is that the Diarrhoeal death-rate was higher in the first 4 years of the forty than it has ever been since. The death-rates per million of the 5 individual years of the first quinquennium are—

| | | | | | |
|------|---|------|------|-----|------|
| 1855 | - | 1445 | 1857 | - | 2215 |
| 1856 | - | 1263 | 1858 | - | 1507 |
| | | 1859 | - | 493 | |

It was in October, 1859, that Loch Katrine was substituted for Clyde water. Although it is obvious from the subsequent course of the death-rate from year to year as well as from the quinquennial averages that there are other factors in the causation of diarrhoea, and that we cannot ascribe to this event all the coincident improvement, yet it permanently lowered the mean line of diarrhoeal fatality. The mean death-rate of the 35 years of pure water is 710 as compared with 1475 in the five years of impure. All the subsequent peaks in the curve rise from a lower basis. The factor in the production of diarrhoea which is constant and beyond influence is high temperature (probably the temperature of the earth) but pure water, pure air, pure earth, cripple its noxious influence. Between the death-rate of the first five years and the last there is a decrease of 66 per cent. A remarkable feature of this decrease is the inequality of its age distribution. This appears from the proportion of the deaths under 5 years, which increases from 60 per cent. in the first or impure water period to 78 per cent. in the most recent 5 years. Two conclusions are apparent on the face of the successive figures. The immediate effect of the change to pure water was to lower the general death-rate to less than half, but to raise the proportion of deaths of children under 5 years from 60 per cent. to 66. Therefore diarrhoea in children does not depend so intimately

upon the water-supply as diarrhoea in adults. Further, the other measures which have promoted the reduction of the diarrhoea death-rate have failed to benefit children even more conspicuously than the introduction of pure water. This is proved by the fact that the proportion of child-deaths increased in spite of all those measures from 66 to 78 per cent. The actual state of the matter is that the death-rate under 5 years is now (1890-94) exactly what it was 30 years ago (1860-64) while the death-rate at 5 years and upwards is less by more than half. In the following Table this disconcerting fact seems to be brought nearer to an explanation:—

| Period. | Deaths. | | Death- rate under 1 Year per 10,000 born. | Birth- rate per 1000. | In every 10 Deaths from Diarrhoea. | | |
|---------|------------------|---------------|--|--------------------------------|---------------------------------------|---------------|-----------------------|
| | Under 1 Year. | 1-4 Years. | | | Under 1 Year. | 1-4 Years. | 5 Years & Upwards. |
| 1855-59 | 833 | 781 | 110 | 41 | 31 | 29 | 40 |
| 1860-64 | 500 | 376 | 60 | 41 | 38 | 28 | 34 |
| 1865-69 | 937 | 498 | 102 | 41 | 46 | 24 | 30 |
| 1870-74 | 1017 | 544 | 104 | 40 | 49 | 26 | 25 |
| 1875-79 | 1038 | 472 | 101 | 41 | 53 | 24 | 23 |
| 1880-84 | 915 | 474 | 93 | 38 | 49 | 25 | 26 |
| 1885-89 | 754 | 347 | 77 | 36 | 52 | 24 | 24 |
| 1890-93 | 738 | 326 | 87 | 35 | 55 | 24 | 21 |

The effect of the introduction of pure water was to diminish the number of diarrhoeal deaths under 1 year 40 per cent.; from 1 to 4 years, 52 per cent.; and from 5 years upwards, 59 per cent. The unequal incidence of the advantages of pure water raised the proportion of infantile deaths from 31 per cent. to 38 per cent. and lowered the proportion of deaths of older children from 29 to 28 per cent., and of all aged 5 and upwards from 40 to 34 per cent. This inequality has not been redressed by general sanitary measures, but in spite of them from year to year an increasing proportion of the fatal diarrhoea has been contributed by the infant population until we have now this very startling contrast between the age composition of 100 deaths at the beginning and at the end of the 40 years.—

| | | |
|---------------|-----|--------------|
| Under 1 Year. | 1-4 | 5 & upwards. |
| 31 | 29 | 40 |
| 55 | 24 | 21 |

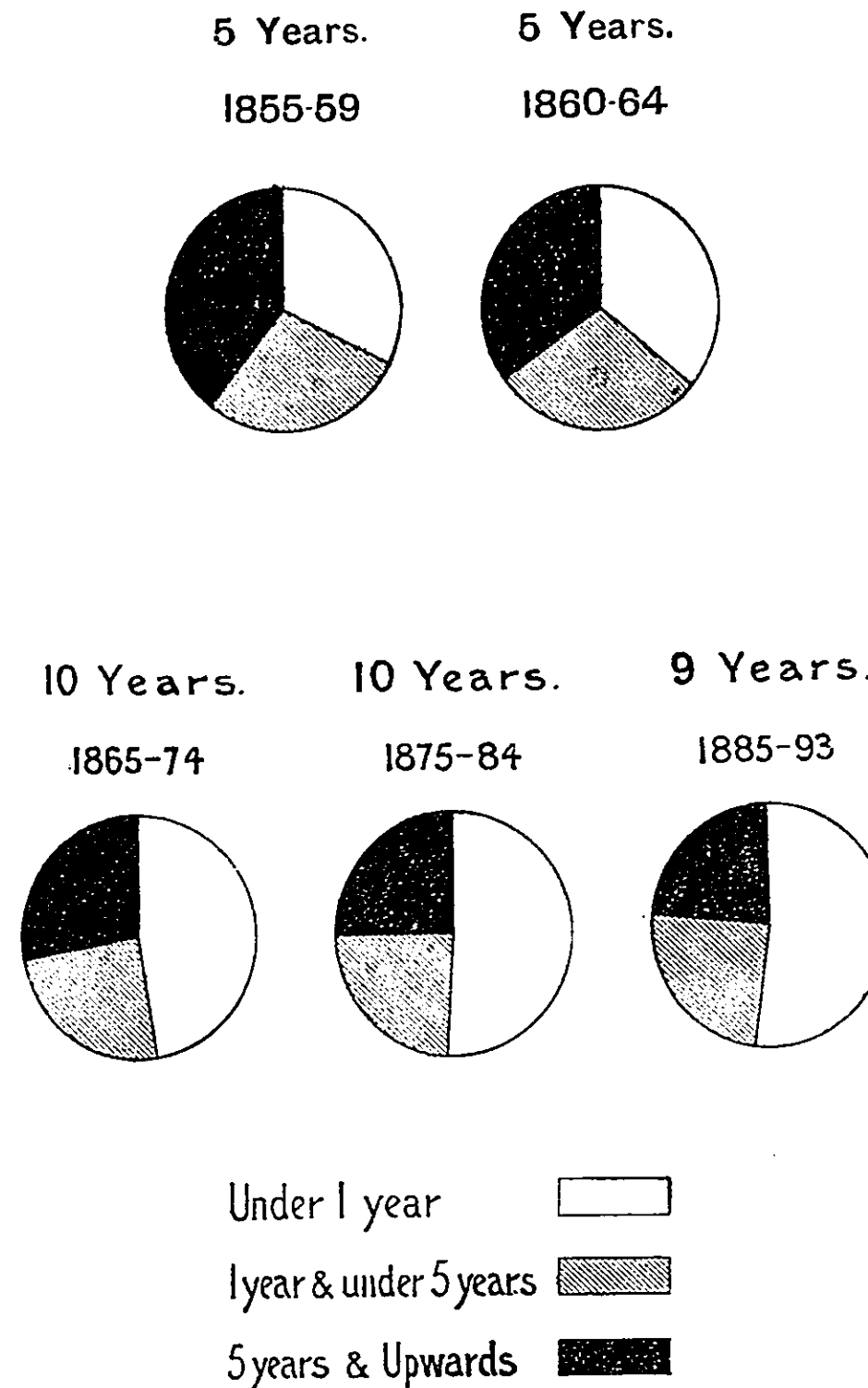
This result is made still more remarkable when we note that the birth-rate has in the interval fallen from 41 to 35, so that the increased proportion of deaths has been derived from a

diminished number at risk. The absolute state of the case is shown by the diarrhoeal death-rate under 1 year calculated per 10,000 births; and it is this. In the 34 years of pure water the infantile death-rate has always been below the mean of the five years of impure water, but from 1865 to 1879 there was a period of high mortality which almost wiped out the improvement. In the last 14 years, with a falling birth-rate, there has been a slow diminution in the diarrhoeal death-rate, but it is still considerably above the point to which it dropped in 1860-64. This is brought out by throwing the last 30 years into longer periods, thus—

| | | | | | | |
|----------|---|---|---|---------|---|-----|
| 5 years | - | - | - | 1855-59 | - | 110 |
| do. | - | - | - | 1860-64 | - | 60 |
| 10 years | - | - | - | 1865-74 | - | 103 |
| do. | - | - | - | 1875-84 | - | 97 |
| 9 do. | - | - | - | 1885-93 | - | 82 |

What were the measures which may be held to have told mainly against the causes of diarrhoea? They were the taking into its own hands by the municipality of the cleansing of the city (1868); the organization of nuisance inspection and removal (1870); the gradual revolution in the efficiency of filth removal, the stages of which are marked by the erection of the Refuse Despatch Works in 1881, 1884, and 1891; the adoption of special summer and autumn cleansing in the tenement districts (1883); and the commencement of the abolition of the privy system (1889). It would seem that such cleanliness as is within public control does not so intimately reach the environment of the child as of the adult. In short, it is domestic cleanliness, which is under parental and especially maternal control which largely determines the purity of the surroundings—the bed-clothes, the house-air, the person—of the child and of the food. No doubt the cleansing of the court benefits the older children because it is their playground, and the substitution of water-closets for privies discourages the retention of filth in the confined house-space and so advantages all children, but the mother is after all the domestic sanitary inspector. The authorities can only give her every facility to be clean. The Female Inspectors added to the staff in 1870 were specially intended to instruct and stimulate mothers in these respects. They encourage them to go to the public washing-houses with their clothing and bedding, and give to the poorer house-wives orders for material and the loan of brushes wherewith to white-wash, &c., their houses. In 1874 a simple tract on the Management of Children was drawn up by the Medical Officer and arrangements made by permission of the Registrar-General, that every person registering a birth should receive a copy from the registrar.

X. GLASGOW.—AGE-DISTRIBUTION OF 100 DIARRHOEAL DEATHS.



ERYSIPELAS.—In Glasgow we have always been in the habit of occasionally treating cases of Erysipelas in Hospital for humanitarian reasons. The disease is one with which it is within the powers of the Local Authority to deal, and when a destitute person came to the Office the quickest and most satisfactory course to adopt was to send the case to Belvidere. The Infectious Disease (Notification) Act changed all that. The mention of Erysipelas in the same category as Small-pox, Typhus, &c., and the compulsory notification to the Medical Officer of all alike brought with it the implication of similar responsibilities resting upon the authorities. Medical men began to recommend removal to hospital, and above all the Inspectors of Poor referred paupers suffering from Erysipelas to the Sanitary Department. The result has been that of the 1446 persons treated in the municipal hospitals in 24 years, 926 have been treated in the 5 years of the Notification Act, and only 520 in the prior 19 years, or 185 per annum in place of 27. Erysipelas follows Scarlet Fever, though with a long interval, in the number notified, which was 5756, of which 16 per cent. were removed to hospital. This is a very troublesome result of placing Erysipelas as an infectious disease in the same category as those in the prevention of which the hospital occupies a foremost and essential place. Our experience of Erysipelas as notified is that it is either some slight condition of tumefaction and redness, frequently in the vicinity of the nose, which sits so lightly on the individual that when the inspector calls he is out, or it is a complication of some serious surgical condition, a blush on the surface of an abscess or over a periostitis, or the disease involves the deep cellular tissue and ends in a serious surgical condition. The former class of cases is the subject of jocular remark among the staff who notice that they are most frequent in the notifications of Monday mornings. The latter leads to remonstrance from the hospital where the men find themselves burdened with the care of surgical cases which require free expenditure of time in dressing and which occupy beds for months on end. Ample as the resources of Glasgow are Erysipelas is as regards hospital treatment a great nuisance. We find it impossible in times of epidemic Scarlet Fever to deal with it, and require to get assistance from the general hospitals and to appeal to the parishes to accommodate their paupers. At all times we are without the satisfaction of belief in the preventive necessity or utility of the work. The following is the record of the mortality from Erysipelas in 4 decennial periods:—

| | Deaths. | Death-rate per Million. |
|---------|---------|-------------------------|
| 1855-64 | 449 | 115 |
| 1865-74 | 517 | 110 |
| 1875-84 | 539 | 105 |
| 1885-94 | 531 | 90 |

There has been a steady diminution in the death-rate from Erysipelas amounting to 22 per cent. in the last decennium as compared with the first. Antiseptic surgery, and the refined conception of cleanliness which has extended therefrom into all forms of surgical procedure and into hospital management, probably have had more to do with the prevention of fatal Erysipelas than anything else.

PUERPERAL FEVER.—Much that has been said as to Erysipelas applies equally to Puerperal Fever. We have always from humanitarian motives admitted casual cases to hospital. Since the adoption of the Notification Act 361 cases have been certified and 51 of these have been removed. The enormous mortality both in hospital and in private (47 per cent. and 65 per cent.) proves that nothing can be said on the score of triviality by way of objection to the notification of such a disease. But what is "Puerperal Fever"? We find the following in the Nomenclature of Diseases drawn up by a Joint Committee appointed by The Royal College of Physicians of London:—

"Septicæmia. Puerperal Fever.—The term 'Puerperal Fever' should no longer be used. Pyæmia, Septicæmia, and Erysipelas occurring in puerperal women should be described as 'Puerperal Pyæmia,' 'Puerperal Septicæmia,' and 'Puerperal Erysipelas,' respectively. The other conditions included under the term 'Puerperal Fever' should be returned according to No. 513, p. 117, under Diseases of Parturition, the word 'Puerperal' being in all cases prefixed to the word denoting the local process."

It is very unfortunate that in the face of such an expression of opinion, which is founded on a sound pathology, anything should have been made notifiable under the name of "Puerperal Fever." The fact will doubtless establish and give currency to the name. The requirement raises many conscientious questionings in the minds of practitioners. The results of certifying are serious. An officer calls to enter the case and deal with it as an "infectious disease." This may not have any untoward result where the patient is lying in the far recesses of a large house and only hears what she is told, but in tenements, where the main door opens into the one-room house, or if there is more than one room, still every word spoken to a caller is audible in the lying-in room and probably a mother opens the door, the whisper of "Puerperal Fever" may have a very grave effect. After all, what is the good of notifying "Puerperal Fever," whatever it is, to the authorities? There is not a single preventive step which can be taken in consequence unless in the case of midwives, and experience

shows that this is the rarest of occasions for usefulness afforded. Medical men ought to be left to be their own medical officers of health in relation to all puerperal conditions. The following are the statistics of "Puerperal Fever" under the various designations of "Metria," "Puerperal Fever (Metria)," and "Puerperal Fever" under which it has been registered in Scotland for 40 years. The maternal death-rate is calculated on the births. There is an astonishing uniformity of mortality during each of the four decennia. It is especially noteworthy that in the last 10 years, notwithstanding antiseptic midwifery, the mortality has been higher than in any previous period.

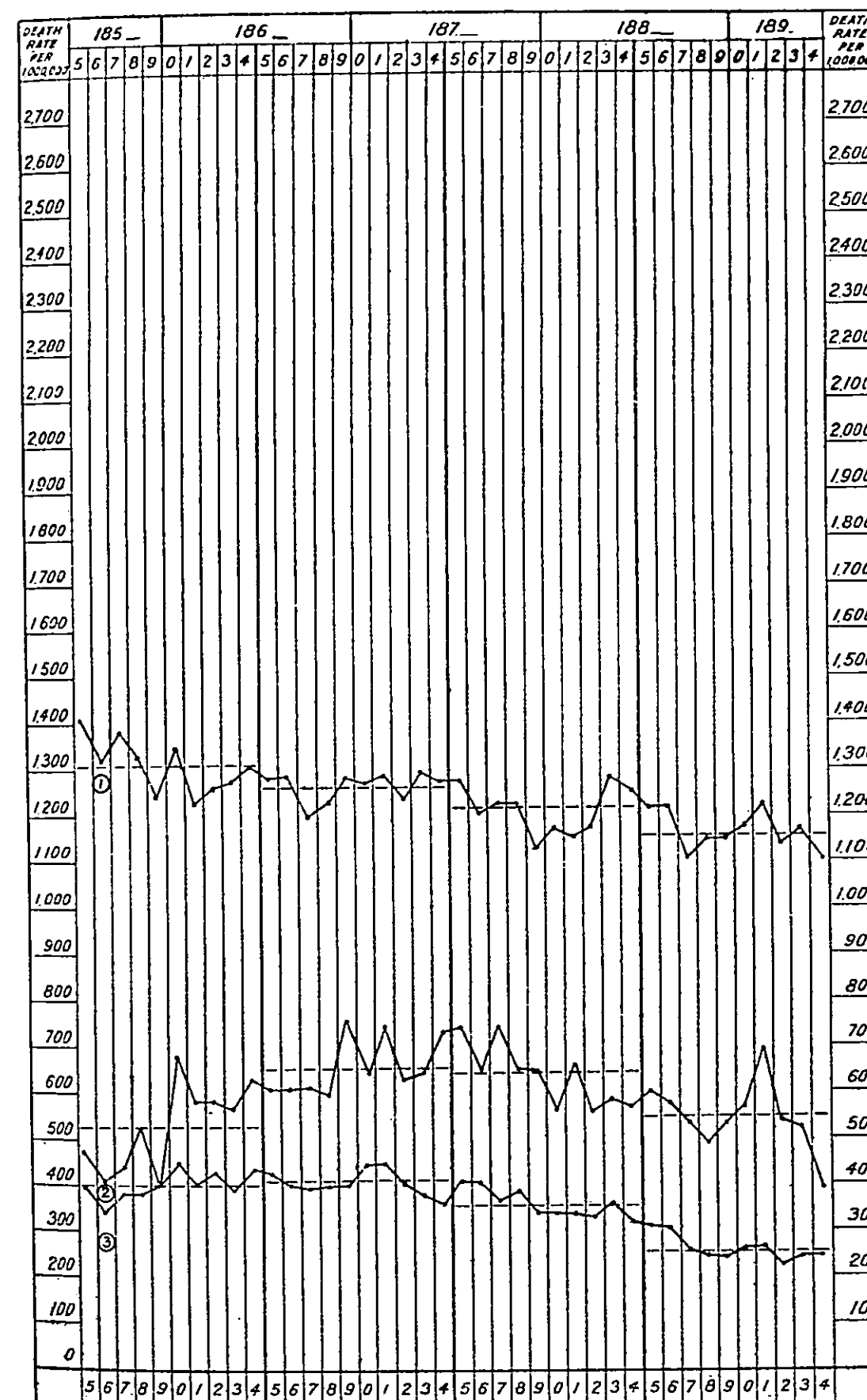
| | Births. | Maternal Deaths. | Rate per 10,000 Births. |
|---------|---------|------------------|-------------------------|
| 1855-64 | 159,231 | 302 | 19 |
| 1865-74 | 189,599 | 359 | 19 |
| 1875-84 | 201,524 | 389 | 19 |
| 1885-94 | 205,634 | 463 | 23 |

CHICKEN-POX—INFLUENZA.—These diseases may merely be mentioned. *Chicken-pox* is but rarely sent in to hospital as Small-pox, from the freedom with which practitioners ask consultations with the Medical Officer of Health as to diagnosis before committing themselves to removal. The majority is admitted as Chicken-pox, the children of tramps or persons in lodgings, brought to the Sanitary Office by their mothers. Tramps and waifs of all kinds drift to this Office in their extremity. Humanity makes one glad when an excuse can be found in their disease to send them to hospital. *Influenza* is another such excuse, and it figures among the miscellaneous infectious diseases which for the good of the individual rather than of the community have been isolated in the municipal hospitals.

PHTHISIS AND DISEASES OF THE LUNGS.

Typhus bears the same relation to diseases of the lungs as Cholera and Enteric Fever do to diarrhoeal diseases. Typhus points to measures which directly tend to remove the *domestic* conditions which favour the prevalence of pulmonary diseases—the prevention of overcrowding, the improvement of ventilation and of natural lighting inside the dwelling and in the stairs and lobbies by which it is approached; the free circulation of the general air and the distribution of sunlight in the precincts of the dwelling by the regulation of building and the proportioning of free space to height; the promotion of cleanliness in the home, in its accesses and environs. The chief *public* measures antagonistic to diseases of the lungs are—the provision of playgrounds convenient to the tenement houses which are the nurseries of the people, of parks arranged for the

XI. GLASGOW.—DEATH-RATES PER MILLION FROM MISCELLANEOUS UNCLASSIFIED DISEASES, PHTHISIS AND DISEASES OF THE LUNGS FOR 40 YEARS (1855-94).



- I. Miscellaneous Unclassified Diseases.
- II. Acute Diseases of Lungs.
- III. Phthisis.

MEAN DEATH-RATE THUS -----

recreation of the youth and the adult, and above all the protection of the general atmosphere from unnecessary contamination. All of these with one very important exception Glasgow may be said to have adopted. We imbibe the purest water and inhale the impurest air purveyed to any city in the Kingdom. The position of the authorities as to the common air-supply is very much the same as if they had continued to distribute Clyde water and compelled every proprietor to provide filters and every tenant to keep the domestic stock of reserve water in special vessels. They have compelled proprietors to adopt every means to admit air in and about the dwelling and tenants to keep the air clean, but they distribute air which is, to begin with, impure. They insist upon wide streets to diminish the breadth of shadow and they allow the sunshine to be cut off from the whole city by a canopy of smoke. With wise forethought they purchase suburban estates covered with stately trees which they desire in the interest of the future to rescue from the axe of the speculative builder. Yet the bushes of the Green and the very contrast between the name and the fact of Kelvingrove predict that the next generation will never sit under the shadow of these trees if nothing is done to check the spreading blight of the city smoke.

PHTHISIS.—It is in harmony with the nature of the diseases that the effect of preventive measures upon the prevalence of Diarrhoeal diseases should be prompt, while upon diseases of the lungs, especially upon Phthisis, it should be slow—effect loitering considerably behind cause. The annual movement of Phthisis may be traced in the diagram. The following Table shows the death-rate in quinquennial and decennial periods:—

| Period. | No. of Deaths. | Death-rate per Million. | |
|---------|----------------|-------------------------|-----------|
| | | 5 years. | 10 years. |
| 1855-59 | 6913 | 3742 | 3918 |
| 1860-64 | 8298 | 4094 | |
| 1865-69 | 8859 | 3972 | 3940 |
| 1870-74 | 9566 | 3908 | |
| 1875-79 | 9186 | 3644 | 3396 |
| 1880-84 | 8159 | 3149 | |
| 1885-89 | 7074 | 2601 | 2458 |
| 1890-94 | 7287 | 2315 | |

The story of these figures is a short one. During the 20 years 1855-74 the mortality from Phthisis was stationary,

during the 20 years 1875-94 it has steadily fallen. Between the five years 1870-74 and the five years 1890-94, there was a decrease of 41 per cent. in the death-rate. If we start from the maximum period of fatality (1860-64) the decrease amounts to 44 per cent. The acceptance of the doctrine that every case of Phthisis is the result of a specific infection, that consequently no one is foredoomed to have Phthisis or any other form of tuberculous diseases, gives great precision to our ideas of prevention. The existence and distribution of the tubercle bacillus is the first condition of infection. Since this was discovered in 1882, the knowledge has not only passed gradually into the minds of medical practitioners and so influenced the management of cases of tubercle in man, and dictated certain public measures to medical officers of health, but it has deeply penetrated the general mind. Hence the diffused effects of this doctrine in the direction of controlling the distribution of the infecting element, although impossible to estimate in amount, have been great and growing during the last ten years. In Glasgow there has been since 1889 greater stringency in excluding tuberculous meat from use as food, and since 1890 something has been done by the inspection of dairy-cows to prevent the use of the still more dangerous tuberculous milk. Greater precision and determination have also been given to administrative efforts everywhere to remove conditions known to be favourable to the distribution of the tubercle bacillus both among men and among animals:—ventilation, especially of houses and byres; the removal of dampness by subsoil-drainage and precautions adapted to the foundations and walls of houses; the abolition of dark spaces and enclosures, the dissemination of direct sunlight. The application of the power to close uninhabitable houses contained in the 1890 Act (Section 32) has been chiefly directed against damp and dark houses. But wherever we have to do with a seed we have an almost unlimited means of controlling the propagation of its kind by dealing with the soil, by making it congenial and friendly or incongenial and hostile. It is eminently true of Phthisis that the number of persons infected is but a fraction of those who are exposed to infection; and that the higher the standard of public health and especially the sounder the lungs of the population, the fewer will succumb. Indeed theoretically it is possible to conceive of such perfect health, constitutional and local, as to confer entire immunity. Hence we may without much hesitation ascribe the greater part of the gratifying diminution in the fatality of Phthisis in Glasgow to the gradual improvement in the vital resistance of the population; and a very large share in this improvement must be credited to the limitation of infectious disease. For every youth who

dies of Enteric Fever and every child who dies of Scarlet Fever a score are so debilitated as to furnish a friendly host for the bacillus of tubercle. Measles and Whooping-cough not only shatter the general health but irritate the lungs and induce the bacillus to settle there by whatever channel it has gained access to the system. One of the most powerful predisposing causes of Phthisis and one which we have not yet done much to diminish is the universal catarrh of the lungs which is provoked by our damp smoke-laden atmosphere. Lungs in such a condition are like the field ploughed and pulverized for the seed scattered by the hand of the husbandman.

OTHER DISEASES OF THE LUNGS. This includes everything classified by the Registrar-General under "Diseases of the Respiratory System" except Croup. The diagram shows their movement from year to year and this Table the death-rate in quinquennial and decennial periods.

| Period. | No. of Deaths. | Death-rate per Million. | |
|---------|----------------|-------------------------|-----------|
| | | 5 years. | 10 years. |
| 1855-59 | 8,042 | 4,355 | 5,170 |
| 1860-64 | 12,127 | 5,984 | |
| 1865-69 | 14,137 | 6,323 | 6,522 |
| 1870-74 | 16,483 | 6,721 | |
| 1875-79 | 17,085 | 6,777 | 6,322 |
| 1880-84 | 15,196 | 5,866 | |
| 1885-89 | 14,585 | 5,360 | 5,329 |
| 1890-94 | 16,543 | 5,298 | |

The fatality of Diseases of the Lungs increased steadily during the 25 years 1855-79 and fell very slowly in the last 15 years, 1880-94, but still remains considerably above the rate of 35 years ago. If we take periods of 5 years, the death-rate is 18 per cent. higher in the last than in the first. If we take 10 years it is 3 per cent. higher in the last than in the first. On the mean of 40 years pulmonary diseases caused a death-rate of 5.8 per 1000 and contributed 22 per cent. of the total deaths. But they exhibit from year to year all the variations of an epidemic disease as is well shown in the diagram. Thus in 1859 the death-rate was 3.9 per 1000 or 14 per cent. of the total; in the following year it was 6.8 per 1000 or 21 per cent. of the total. The following are years of phenomenal mortality.

| Year. | Death-rate per 1000. | Percentage of Total. |
|-------|----------------------|----------------------|
| 1860 | 6.8 | 21 |
| 1869 | 7.7 | 23 |
| 1871 | 7.6 | 23 |
| 1875 | 7.4 | 24 |
| 1877 | 7.5 | 27 |
| 1891 | 6.8 | 27 |

If we consider the incidence of the fatality from diseases of the lungs within these years we find that it is seasonal, usually in winter, occasionally in spring, and associated with prolonged frost as in 1860, 1875, and 1877 or with a cold spring with east winds encroaching on the summer as in 1869. Frost in Glasgow is always accompanied with more or less fog which is no doubt the most deadly ingredient of our winters. There seems to be no limit to the possible mortality so long as the cold and fog continue. The most remarkable winter on record for the duration of these conditions was that of 1874-5 when in the seventh week of their continuance the death-rate rose to 67 per 1000, *half of which was contributed by diseases of the lungs.* The fog in this case was more remarkable for density than the frost for intensity. The high pulmonary mortality of 1891 is associated with Influenza. Indeed the taint of this mysterious disease pervades the whole of the last quinquennium—a fact which affords the only crumb of comfort in our review of the movements of this section of Glasgow mortality. If we have lost nothing even under this heavy handicap may we not hope to gain very decidedly when running without weight? The following is a quarterly note of the deaths attributed to Influenza during each of the last 5 years. The gravity of the figures lies not in their amount but in the fact that they are a mere index of the associated addition to the mortality from pulmonary and also from miscellaneous diseases.

| | 1890 | 1891 | 1892 | 1893 | 1894 |
|-------------|------|------|------|------|------|
| 1st Quarter | 15 | 16 | 77 | 12 | 35 |
| 2nd do. | 6 | 28 | 17 | 9 | 12 |
| 3rd do. | 4 | 13 | 4 | 4 | 4 |
| 4th do. | 2 | 115 | 9 | 59 | 12 |
| Total | 27 | 172 | 107 | 84 | 63 |

The proverbial "bolt from the blue" is unknown in sanitary matters. The epidemic springs from the ever-present ever-active violation of the laws of health. We are a catarrhal, coughing, expectorating people, because we live in a huge

industrial city, situated at the seaward end of the trough of a valley, which from one end to the other is covered with smoke, drifting in wreaths and clouds with the wind or in calm filling up the trough so that nothing is to be seen between the higher ground on either side but a sea of smoke. Living thus we live constantly on the edge of a catastrophe. Whenever the scavenging of the air is interrupted by calms so that the smoke product accumulates the atmosphere of our streets thickens and the daylight becomes twilight. If a slight wind shifts so as to fold over and double the coverlid of smoke, then at mid-day we have midnight. Smoke not only loads fog with impurity but tends to produce fog as Mr. Aitken has shown. When therefore in the winter we happen upon a low temperature, a high barometer, and a dead calm we have an Arctic night with a mephitic, irrespirable atmosphere, in which we move about choking, our eyes irritated, our faces grimy—"a purblind race of miserable men." It is then that our pulmonary mortality is run up and the death-rate of the year determined. Now-a-days the undulations of mortality depend more upon our artificial local climate than upon the rise and fall of zymotic epidemics. In the middle of the catastrophe we are helpless; as helpless as people who persist in living on the skirts of Vesuvius are when the eruption begins. If we had no winters, no fogs, no interruption of aerial scavenging, then we might continue our profligate production of smoke and suffer no great inconvenience or injury; but we must anticipate anticyclonic conditions and we ought as reasonable beings to live at all times so that it may be possible to survive them. Glasgow Fair gives us an annual objection-lesson. If it fell on a time of winter-fog we should find our streets full of a thin mist no more irrespirable than the mist on the mountain side. It may be too much to hope for such entire freedom from smoke, but in that direction lies the future reduction of our death-rate. We are approaching a point when advance will be impossible in any other direction. If we must have smoke it is well there should be no misunderstanding as to what it will cost us. How is smoke prevention to be gone about? Firstly by making up our minds that it is possible; secondly by making up our minds that it shall be done, and thirdly by resolute pegging away at the doing. Smoke is a nuisance and nuisances are all alike in this—they can only be suppressed in detail by never-ceasing vigilance and effort. As to domestic smoke, the encouragement of the use of gas in place of coal will probably go as far to mitigate it as any single measure which can be mentioned. There are a host of miscellaneous comparatively paltry sources of low-level smoke which ought to be summarily suppressed. It is quite a mistake to tolerate any

smoke-production at a low-level in a city, however trifling. Smoke-suppression is a matter of detail. As to industrial smoke, still smoke-suppression is a matter of detail. Each case ought to be dealt with on its merits, but smoke there must not be.

There is so much analogy between smoke and the condition of the Clyde as questions of health that the one suggests the other in the consideration of atmospheric impurity as a cause of disease. The practical importance of smoke in deteriorating the physical conditions of health is limited to certain times and seasons, so also is that of the Clyde. When the temperature is low, when rain is falling and the volume of water is constantly high and floods are frequent, when there is wind, especially easterly, then the discharge of crude sewage into the Clyde though slovenly can scarcely be called culpable from our present standpoint. But when we fall upon seasons of prolonged drought, high temperature and calm or gentle airs, especially westerly, which are as usual concomitants of summer and autumn as the conditions of fog are of winter, then the Clyde becomes a serious ingredient in the complex influences which depreciate the health of Glasgow. In such circumstances the peculiar odour of the river is perceptible even in the Bridgegate, while in the normally purer air of the regions West of the Kelvin it is obtrusive even in Great Western Road and Dowanhill and befouls the air of Partick and Whiteinch. The question in what direction to look for the effects of the Clyde cannot be precisely answered. The fact that septic poisoning is now recognized as a cause of certain grave inflammations of the lungs warns us against dogmatism as to the category of disease to which air laden with the products of decomposition is likely to contribute. Popular bias would point to diarrhoeal diseases as more likely. In either case it is perfectly impossible to isolate statistically or otherwise the part played by an ingredient distributed in the universal air in the production of diseases which have so many possible causes as either pulmonary or diarrhoeal disease. There is no doubt that in the pollution of the Clyde we have a condition which in certain combinations of circumstances which may arise within the six months from May to October of any year may manifest a quite unmistakable potency for mischief. If we cannot be guided by general principles in dealing with the Clyde then general principles are of no use whatever in sanitary practice.

MISCELLANEOUS UNCLASSIFIED DISEASES.—This contains the large remainder of disease which does not fall within the category of Zymotics or Diseases of the Lungs and Phthisis.

For the most part it is open to the influence of sanitary operations only through the measures directed against the specified diseases, partly because these measures cover the whole area of the physical conditions of health, but partly also because into this miscellany of disease fall what may be called the pathological debris of infectious and pulmonary disease. The basement of the general diagram shows this residual portion of the death-rate from year to year. In the following Table it is given for periods of 5 years and 10 years:—

| Period. | Deaths. | Death-rate per Million. | |
|---------|---------|-------------------------|-----------|
| | | 5 Years. | 10 Years. |
| 1855-59 | 24,777 | 13,425 | 13,121 |
| 1860-64 | 25,989 | 12,817 | |
| 1865-69 | 28,106 | 12,597 | 12,692 |
| 1870-74 | 31,346 | 12,787 | |
| 1875-79 | 30,684 | 12,170 | 12,113 |
| 1880-84 | 31,253 | 12,055 | |
| 1885-89 | 31,551 | 11,588 | 11,566 |
| 1890-94 | 36,409 | 11,544 | |

There has been an extremely gradual movement downwards in the fatality of miscellaneous diseases throughout the 40 years, so gradual that the difference between the first 5 years and the last is only 14 per cent. and between the first 10 years and the last only 12 per cent. The highest death-rate is that of the first year of the 40, viz.—14.1 per 1000; the lowest is that of the last year of the 40, viz.—11 per 1000, a range of variation which is much less than that of any of the special classes of disease previously discussed. Relatively to these classes of disease, the miscellaneous diseases contribute an increasing proportion of the total deaths—50 per cent. in the last decade in place of 43 per cent. in the first. Two deductions lie on the surface of these facts. (1) That in the miscellaneous diseases we find the great substantial mass of our mortality and (2) that while absolutely this mass is contracting, relatively to the total mortality it is increasing. This is the necessary result of the interaction of two factors, one of which tends to take from, the other to add to, the deaths from miscellaneous causes. Towards these gravitate many of the lives maimed by Zymotic disease and in larger numbers those in whom pulmonary diseases becomes chronic, so that any mitigation in the prevalence of these diseases necessarily diminishes the number of deaths attributed to diseases which are ultimately classified as "Miscellaneous." On the other hand, as death is the

inevitable end of all, any relief of the infant, the youth and the adult from the ravages of diseases which lay violent hands upon the mechanism of life must add to the number of those who pass into old age and finally drop from the effects of ordinary wear and tear upon that mechanism. In these circumstances it is satisfactory to record even an absolute diminution in the death-rate from miscellaneous diseases. We must look within this category for a considerable proportion of the fatal results of our prevalent pulmonary disease, so that the sum of the effects of the causes which we have so pointedly referred to in discussing diseases of the lungs will be greatly underestimated if we take account only of deaths directly ascribed to those diseases. Very little pathology is necessary to make this clear. In the cycle of organs through which the blood circulates, and which must co-operate otherwise a strain will come upon one or other, there is none more important than the lungs. The heart feels resistance there at once and the effort to overcome the resistance leads to disease in that organ. Then may follow disease in any member of the cycle of coadjutors, or in any organ of the body. Out of our pulmonary catarrh spring diseases of the heart, liver, kidneys, brain, &c., all of which go to swell the mortality from miscellaneous diseases. Not only so, but while extreme cold is the natural enemy of the enfeebled whether from age or disease, and inevitably in the winter they die in increased numbers, to all such and to many more who have weakened hearts, diseased blood-vessels and other organic flaws and who with fair-play would see more years, the city fog is like sand thrown into a piece of machinery, it increases the friction and the wheels of life stop. The truth of all this is written large upon the sympathetic movements of the death-rate from Diseases of the Lungs and from Miscellaneous Diseases. I have pointed out the exacerbations in the pulmonary mortality in 1860-69-71-75-77 and 1891, and it will be found that in every one of these years there is a coincident rise in the mortality from miscellaneous diseases. All those facts go to make broader the grounds of my statement that it is mainly from diseases of the lungs that future reductions of the death-rate of Glasgow must be sought.

(2) *The History and Circumstances of a Peculiar Outbreak of Febrile Disease in St. Mary's Roman Catholic Industrial School for Boys, Glasgow, March, 1888.*

On the evening of Friday, 2nd March, a boy, aged 15, an inmate of St. Mary's Roman Catholic Industrial School for

Boys, Abercromby Street, Glasgow, complained of headache, and was sent to bed in his dormitory. Next morning he rose with the other boys and made his bed, but being observed to be very unsteady on his legs was sent to the sick-room, where he died at 8 a.m. On 3rd March another boy, aged 14, complained of headache, and was sent to the sick-room, and put under treatment. On the 5th, at 1 a.m. he became very delirious, and had to be held down in his bed. He was chloroformed and an enema of 20 grains of bromide of potassium administered. At 3 a.m. the convulsive movements ceased, and he seemed to fall into a natural sleep, but sunk and died at 4 a.m. At 5 p.m. on the 7th another boy, aged 11, reported himself ill, having vomited shortly before, and was sent to bed in his dormitory. The Superintendent's wife found him asleep about 6 p.m. A boy sent with tea could not rouse him, and he died comatose at 8 p.m. On the morning of the 8th, when the occupants of the middle dormitory were being awakened, a fourth boy, aged 14, was found to be unconscious, and by a quarter-past 6 he was dead. Only the second of these four boys had been seen by the Medical Officer of the Institution. These mysterious events, and the fact that 19 other inmates were more or less ill, led him to report the outbreak at the Sanitary Office on the morning of the 8th March; and 12 of the more serious cases were in the afternoon transferred to a separate ward in the Fever Hospital, Belvidere. On the 9th, 14 new cases occurred; on the 10th, 5; 11th, 8; 13th, 2 boys and 2 girls. These were the only inmates of the Girls' Department who were seized. They were employed in the kitchen in which the food for both departments was prepared. Further reference will subsequently be made to their case in discussing the causation of the outbreak, in which the immunity of the Female Institution is a cardinal point. After an interval of two days, 1 boy became ill on the 16th March; on the 17th, 2; 18th, 2; 19th, 1. There was then a clear interval of two days, followed on the 22nd, 23rd, 24th, and 25th by 1 case each day. On the 26th, 2 fell ill; on the 27th, 1; and on the 29th, 1. This makes a total of 66 boys and 2 girls, the number of inmates being 207 boys and 194 girls. Of these 29 boys and 2 girls were removed to Belvidere, and 37 (including the 4 fatal cases) were allowed to remain in the Institution.

Before proceeding to give a short statement of the chief clinical and pathological features of this disease, it is only right to remark that the difficulties in the way of obtaining the facts were great, and were but partially overcome. The arrangements for treating the sick are very defective. No records are kept of the history, symptoms, and treatment of patients. The meagre facts given as to the four cases of sudden death were

got from casual observers, only in one case supplemented by medical observation. The children are very dull and stupid, and practically contributed nothing to the subjective information. On the afternoon of the 8th March two trained nurses were got from the Glasgow Sick Poor and Private Nursing Association, one or other of whom was always on duty and took temperatures and made short notes of symptoms. The 19 children who are said to have sickened on the 8th means more probably all who took ill along with the fatal cases, and were at that date found ill. The numbers given afterwards are however correctly assigned. The more severe cases, in which the temperature was above 100 deg. at the outset, including 12 of those found ill when the outbreak was reported, were transferred to Belvidere, where careful notes were taken by Dr. W. W. Christie. As he intends to make these the subject of a paper, I shall only make such use of them as is necessary to present the main general diagnostic features. Of the mild cases retained at the Institution, I have the nurses' notes, supplemented by my own observations, which more or less embraced all the cases. I shall therefore give separately a short account (1) of the post-mortem appearances in two of the fatal cases; (2) of the symptoms in the 31 severe cases treated at Belvidere; (3) of the symptoms in the 33 mild cases kept at the Institution.

1. *Post-mortem Appearances.*—The bodies of the first two fatal cases were interred without examination. This is specially to be regretted in the second case, in which the illness lasted two days, and there was therefore time for the development of more marked lesions. The examination of the other two bodies was made by Dr. Joseph Coats, Pathologist to the Western Infirmary, on 8th March. The following are his reports:—

"Dennis M'Guire, aged 11 years; died 7th March, at 8 p.m., after 3 hours of acknowledged illness. Rigor mortis well developed. Arms, lateral aspects of chest and neck present a livid colour, very deep on left ear; very little lividity of lower limbs.

Brain shows a certain dryness of the surface, but there is no hyperaemia of membranes and no exudation. The ventricles are not distended, and the brain substance is of normal consistence.

Heart.—The blood in heart and body generally is perfectly fluid. The heart itself is normal.

Right Lung.—Firmly adherent, and there are some old condensations at apex; at root of lung some enlarged and slightly caseous glands.

Left Lung.—Non-adherent and otherwise normal. There is no condensation in either lung.

Right Kidney.—Extremely hyperaemic.

Left Kidney.—Similar.

The Bladder is greatly distended with urine, fundus reaching above umbilicus.

The *Liver* presents nothing remarkable.

The *Spleen* is considerably enlarged and hyperaemic. The Malpighian bodies are remarkably prominent.

In the lower part of *small intestine* there is a distinct but not very considerable enlargement of solitary follicles and Peyer's Patches. There is no special hyperaemia of them.

Mesenteric glands are distinctly enlarged and slightly red. No degeneration or sign of tubercular lesion.

Bernard M'Kenna, aged 14 years; died at 6.15 a.m. on the 8th, having gone to bed apparently well and been found dying when the boys were being awaked half-an-hour previously. Rigor mortis well developed. Bluish colour over entire posterior aspect of body and on right lateral aspect of trunk and lower limb. There is also a blue mottling over the lateral aspects of trunk and neck.

Brain.—Membranes present a moderate degree of injection, but there is no exudation, and the brain in general is normal in appearance.

Heart.—The blood in heart is partly coagulated; heart normal.

Both *Lungs* are somewhat adherent, but otherwise normal in appearance.

Spleen is somewhat enlarged, but not markedly hyperaemic. The Malpighian bodies are unduly prominent, but not so markedly as in other case.

The *Kidneys* are moderately hyperaemic, right more so than left, but neither so much as in other case.

Mesenteric glands are much enlarged, but not generally red.

They present no degeneration or sign of tubercular lesion. In the *small intestine* there is a general enlargement of the solitary follicles and Peyer's Patches, but it is not so great as in the other case.

Microscopic Examination.—Portions of the spleen, mesenteric glands, intestine, and brain were removed from both cases and prepared for microscopic examination. Nothing special was revealed by this examination, and, in particular, no micro-organisms were discovered.¹

¹ Dr. Maylard made culture experiments with the blood of seven of the Belvidere patients, but with negative results. Micrococci were found in four cases, but different in all, and probably of external origin. In the remaining three cases nothing was found.

2. *Symptoms, &c., in 31 Cases treated at Belvidere.*—(1) Invasion sudden. Headache was invariable and in many violent, frequently with nausea or vomiting; in a few cases rigor; in 3 sore throat. Pain in one or both sides was general. Occasionally there was drowsiness approaching to stupor. There was delirium in 2 cases; the face was flushed and signs of vascular excitement more or less obvious. Temperature taken on first declaration of illness always increased, in many cases as high as 103 deg., 104 deg., or even 105 deg. In one case it rose from 102.6 deg. to 105.8 deg. in the first 2½ hours; in another from 101 deg. to 105.2 deg. in 3 hours; in another from 102 deg. to 104.5 deg. in 4 hours; in another from 102.8 deg. to 104.2 deg. in 1 hour. (2) There was more or less cough at some time during the course of the illness in all cases but 1, in which, although the temperature ran up to 104 deg., there were absolutely no chest symptoms. Pneumonia was distinct in 17 cases, in all but 1 unilateral; doubtful in 8 cases—always limited in area. There was distinct catarrh of the air passages in 4 cases. (3) Herpes was present in 13 cases, sometimes appearing at the very outset. (4) The spleen was enlarged in 5 cases. (5) Chlorides in urine were slightly diminished in 9 cases. (6) Eruptions on body. Urticaria in 1 case. "Dusky spots and mottling on thighs" in 1 case. "Eruption probably due to irritation of flannel" in 1 case. "Taches bleuâtres" in 1 case. Purpuric spots on legs during convalescence in 2 cases. (7) All the cases recovered. There were no deaths excepting the 4 in the Institution at the outset. The highest temperatures noted were 106 deg., 106.2 deg., and in 2 cases 106.4 deg. In all, the temperature rose at one time or another above 100.6 deg.; in the greater majority above 103 deg. Pain in the joints, in 1 case with effusion, occurred in convalescence, in 5 cases. Recovery always perfect, and, when there was no lesion of the lungs, rapid, in view of the high fever and prostration. The average duration of febrile temperatures was 7 days; the average residence in hospital of the 17 distinctly pneumonic cases was 35½ days; of the 8 doubtfully pneumonic cases, 34 days; and of the 6 uncomplicated cases 26 days.

3. *Symptoms, &c., in 33 Cases retained at the Institution.*—Invasion sudden. Headache and sickness almost always the first cause of complaint, usually with more or less pain chiefly referred to right side. Distinct drowsiness in 8 cases. In 7 cases temperature slightly above 100 deg., in 1 as high as 104.8 deg. for a few hours; in remainder never above normal, or only some fractions of a degree between 98.4 deg. and 100 deg. In short periods, from a few hours to two or three days, health was perfectly restored, frequently after deep sleep and per-

spiration. In 1 case there was diarrhoea. In some cases, especially after the alarmingly sudden deaths, fear might account for the condition of the boys, but, as a rule, the general aspect of these mild cases suggested a striking family resemblance to the severe cases, and a common origin or affinity. To one accustomed to see the *whole area* of epidemic outbursts, those retained at home as well as those sent to hospital, those who did not think it necessary to have medical aid as well as those who did, the aspect of this outbreak was exactly the same. There was the black centre of fatality, shading off outwards through the severe cases into the mild cases, and ending in a region of slight deviation from health which, dissociated from the central events, would have been misnamed or have escaped notice. Nothing was more striking with regard to these mild cases than the suddenness with which the patient plunged from perfect health into the disease and emerged with equal suddenness into health again. The uncomplicated cases in hospital presented the same characteristic. A boy would take a hearty meal; become sick within an hour thereafter; his temperature taken at once might be up to 103 deg.; and his aspect one of utter prostration; within the next twenty-four hours it might reach 105 deg.; within a few hours more return to normal; and forty-eight or sixty hours from seizure he might be at the dinner table again!

The key to the discovery of the cause or explanation of this outbreak of disease is the limitation of it to the inmates of one of two kindred Institutions occupying different and structurally separate buildings placed side by side, one a little north of the other, viz., the Boys' Industrial School. The disease began there on the 2nd March, and had run two-thirds of its course there, when on 13th March, two girls were seized, the first and only cases on the female side. The two Institutions are worked together like one family. All the washing is done by the girls in one washing-house—all the cooking in one kitchen. There is a common larder, a common dietary, and a common dining-hall, into which the boys are marched to eat the meals cooked and set out by the girls, who clear away the dishes and set the table again for themselves. In this way there is an amount of intercommunication, which in the case of an infectious disease, such as typhus, scarlet fever, or smallpox appearing in one Institution, soon gives practical demonstration of reality. In all my dealings with St. Mary's Industrial Schools this has been a source of anxiety, as it was on the present occasion. These two girls were both employed in the kitchen. One of them a sister of one of the 19 boys found lying ill on 8th March. Their mother had visited her son in the boys' sick-room, and on two occasions was allowed to see her daughter

immediately afterwards. As regards the other girl there was no element suggestive of infection, excepting employment in the kitchen. Both had pneumonia—the one unilateral, the other bilateral—and, in fact, but for the association would have been regarded as cases of inflammation of the lungs, due to exposure to alternations of heat and cold incident to their employment, at a time when the wind was due E. and the mean daily temperature averaged 32.5 deg. As already stated, no other cases of sickness appeared among the girls. These two cases therefore remain on record as cases of pneumonia, which may either be regarded as isolated in causation or associated by infection with the outbreak among the boys. In either case, what we endeavour to explain is an outbreak of disease confined to the boys.

The circumstances described as to the internal economy of these Institutions at once exclude anything connected with food from the possible causes. In material, preparation, and distribution, everything was common to both. Nevertheless inquiry was made as to the source of the milk supply, especially as to pleuro-pneumonia among the dairy stock; but, both as to quality and possible contamination, the milk as well as all other articles of food supply were found to be unimpeachable. The food seemed to be well cooked and the dietary sufficient.

Was the disease confined to any section of the inmates of the Boys' Institution, as to age, employment, or dormitory?
 (1) *Age*—The average age of the 33 boys who were retained in the Institution (excluding the fatal cases) was 12 years; of the 29 removed to Belvidere, 11.8 years; of the 4 fatal cases 13.5 years; of the remaining 141 boys who were not affected, 12.4 years. Contrasting those who were attacked with those who were not attacked, the average age of the former was 12 years; of the latter 12.4 years. Classified as to gravity, the average of the severe cases (*i.e.* the 4 fatal cases and the 29 sent to Belvidere) was 12 years; of the mild cases, 12 years. The only indication given by these figures is that those who escaped were the oldest, but of those attacked the oldest died.
 (2) *Habits*—The fact that the first and fatal cases were among the older boys (*viz.* 15, 14, 14, 11) gave support and currency to the opinion entertained by all the officials of the Institution that tobacco-chewing was the cause of the whole affair. It is stated that these lads were all tobacco-chewers. The other fact, that those who escaped were older on the average than those who were seized, bears in the opposite direction; but the tobacco theory must be rejected for much stronger reasons. A narcotic could never give rise to a febrile disease. Even the officials could not assert that every boy attacked was a tobacco-chewer, and when put to the boys individually some who admitted their

personal failing supported others in their assertion that they did not chew. In any case this practice, which undoubtedly to some extent prevails among the boys and is unknown among the girls, takes its place among other more important differences, tending to a lower standard of health among the boys, to which we shall afterwards allude.

(3) *Employment in the Institution.*—Both Institutions are conducted on the half-time system, i.e. the one-half of the inmates is in school while the other half is in the workshop, sewing-room, washing-house, &c., and the half in the school-room in the forenoon is in the workshop, &c., in the afternoon, and *vice versa*. The bearing of this method is that any insanitary condition within the Institution affecting the school-room or playground is common to all inmates of each Institution apart, just as the dining-hall and food are common to all inmates of both Institutions together. (4) *Workshops, &c., and Dormitories*—Here there is a rigid division, so that any insanitary condition in a workshop or dormitory might tell on one section of the boys. The following Table shows the distribution of the boys as to employment and dormitory:—

| | Trade. | | | | | | Dormitory. | | |
|-------------------------|-----------|-------------------|-----------|--------------|-----------|----------------|------------|-----------|-----------|
| | Firewood. | Paper-bag Making. | Tailor. | Shoe-making. | Nothing. | Miscellaneous. | Top. | Middle. | Low. |
| Died, - - - - - | 1 | ... | ... | 2 | 1 | ... | 1 | 1 | 2 |
| Removed to Belvidere, | 11 | 5 | 3 | 4 | 6 | ... | 9 | 4 | 16 |
| Treated at Institution, | 9 | 5 | 6 | 1 | 11 | 1 ¹ | 12 | 13 | 8 |
| Not attacked, - - - | 63 | 16 | 20 | 12 | 25 | 5 ² | 47 | 51 | 43 |
| TOTAL, - - - | 84 | 26 | 29 | 19 | 43 | 6 | 69 | 69 | 69 |
| Percentage attacked, - | 25 | 38 | 31 | 37 | 42 | 17 | 32 | 26 | 38 |

¹ Van-boy. ² 2 Door-keepers, 2 Engine-boys, 1 Infirmary boy.

No set of boys was exempt; though all did not suffer in the same proportion. Those employed in the manufacture of fire-lighters were most exempt, but those who had no special employment suffered most. Those sleeping in the middle dormitory were most exempt. Still we may conclude that, whatever the noxious influence was, all in the Institution were exposed to it. There may have been some subordinate

modifying circumstances connected with the conditions under consideration, but it is equally possible that the different results in those sections of the boys were accidental.

The site of these Institutions is one which is utterly unsuited for the residence and upbringing of children, especially children who have inherited impaired constitutions and are the waifs of a large city. It is in the centre of a populous working-class district—within a block, surrounded by four-storey tenements and workshops, in the midst of which is a graveyard, which was opened in 1839. Its extent is 5333 square yards. In a printed Report on the Burial Grounds of Glasgow by the late Sanitary Inspector, dated 1875, he says:—"Notwithstanding its recent erection, this cemetery is greatly overcrowded with bodies, and kept in a state of rank disorder. Orders for 390 interments were granted during the past six years. The common ground, containing the remains of many who died of cholera (in 1848), has been covered with earth to a depth of six feet, for the purpose of forming accommodation for new interments, some of which had been made before the sheriff's restriction." This refers to the fact that the graveyard was closed by order of the Sheriff, at the instance of the Local Authority, along with other intramural burying-grounds, in 1870. Permission has, however, since been granted by the Local Authority to inter near relatives of lairholders in this as in the other cemeteries. Up to 1875, as stated above, the number of interments thus made amounted to 390, and since to the following number in each year, viz. :—1875, 39; 1876, 26; 1877, 19; 1878, 23; 1879, 17; 1880, 15; 1881, 7; 1882, 3; 1883, 9; 1884, 7; 1885, 5; 1886, 10; 1887, 4; up to date of outbreak, 3; a total of 187 bodies. On the western verge of this graveyard a Convent was erected, which was in 1862 transformed into an Industrial School. In 1868 a separate school for boys was built to the north. They are therefore shut up with this graveyard inside a barrier of dwelling-houses in flats, and public works, which extend continuously round the W., N., and E. sides, the south-side being partially closed in by a large Roman Catholic Chapel and Day Schools. The situation of these Institutions has been repeatedly condemned in official Reports by H.M. Inspector of Industrial Schools and Reformatories.

Such being the insanitary conditions which surround both Institutions alike, let us compare their internal arrangements, especially as to area and capacity. The number of inmates is of course a cardinal datum for comparison. The boys' division is licensed for 200; the girls' for 190,¹ but there were

¹ Recently increased from 175 on the extraordinary plea that a play-shed had been provided!

207 boys and 194 girls at the time to which this inquiry refers. It is obvious that these numbers are frequently exceeded, especially on the boys' side. Thus, the Government Reports give the average number of inmates in 1878, 247 boys and 204 girls; in 1879, 241 boys and 214 girls; in 1880, 246 boys and 212 girls; in 1881, 242 boys and 208 girls; in 1882, 240 boys and 202 girls; in 1883, 231 boys and 189 girls. I shall take the number of beds in the main dormitories of each at this time as a fair standard, viz., 210 for boys and 190 for girls, excluding the sick-room beds in each case.

Superficial Area.—The Master of Works informs me that the entire area occupied by the Boys' Institution is 1470 square yards; by the Girls', 1960 square yards. This gives 7 square yards per head for the boys and 10.3 square yards for the girls. He also states that of this there is open space, available for play-ground, 600 square yards for the boys and 800 for the girls, or nearly 3 square yards per boy and 4.2 square yards per girl. But while the boys have no covered play-space for wet weather, the girls have a cloister, which can be shut in entirely, with an area of 240 square yards. This raises the available play-space for the girls to nearly 5.5 square yards per head, against 3 for the boys. In winter, in the evening, before going to bed, and on Sundays, in bad weather, all the boys are put into the school-room, where they have 108 cubic feet and an area of 9 square feet per head, encumbered with forms and desks.

Cubic Space.—I have had the cubic contents of every apartment used by the inmates of each Institution measured. The details will be found in the Appendix (Table 1.). I do not include the Dining Hall, which is in the Female Institution, because it is used by both sides. The *Boys* have an aggregate of 125,312 cubic feet, the *Girls* of 135,295 cubic feet, or 597 and 712 cubic feet per head respectively. In each of the three Male Dormitories there are 70 beds, which gives 385, 372, and 367 cubic feet per head in the low, middle, and top dormitories respectively, or an average of 375 cubic feet.

The *Female Dormitories* are four in number, among which the 190 beds are thus distributed: 60 with 374 cubic feet each; 48 with 275 cubic feet each; 41 with 259 cubic feet each; 41 with 288 cubic feet; the average being 306 cubic feet. This is the only part of the accommodation in which the boys have more space than the girls. In the *Boys' School-room*, used by half the inmates at one time (105), the space per head is 216 cubic feet; in the *Girls' (95)*, it is 254 cubic feet. The *Boys' Sick-room* is a small bedroom, containing 2694 cubic feet, in which 4 beds are placed usually, but as many more are added on occasion as the floor will hold. The *Girls' Sick-room*

measures 5044 cubic feet with 5 beds. This gives 673 cubic feet or less to the sick *Boys'*, and 1008 cubic feet to the sick *Girls*. The *Girls' Sick-room* is also much better suited for the purpose, having 3 windows as compared with 1. In neither Institution is there a *mortuary*. The bodies on which the post-mortem was made on the 8th March were placed in what seemed to be a bedroom used by attendants, on the same landing as one of the dormitories. I have since attended a post-mortem on the girls' side, and the body was in a closet next to the sick-room, used as a drug-store, and lighted only by a skylight! It certainly seems remarkable that such arrangements as those described for the sick and the dead should be tolerated in Institutions under Government Inspection.

General Sanitary Conditions.—At the time of the outbreak all the wall surfaces in the *Boys' Institution* were conspicuously dingy and in want of renewal, while on the *Girls' side* they were fresh and clean. The *Privy* in the *Boys' courtyard* is an iron trough privy in which the faeces accumulate, and were flushed out every second day and removed by the Cleansing Department. I ordered this to be done every day. The *Privy* in the *Girls' courtyard* is also a trough privy, but it is flushed out at least three times a day into the drains by the attendants. It is consequently much more cleanly and wholesome.

The difference between the *lavatory arrangements* in the two Institutions is also important. The boys' lavatory is a cold, damp, uncomfortable-looking place, without hot water at the taps, situated in the courtyard. To turn lads of low vitality with weak chests, out of their warm dormitories to perform their ablutions there at 6 o'clock on a winter morning must be dangerous. The girls have washing places convenient to their dormitories on the same landing, where they are not exposed to chills.

The *drains and soil-pipes* of the girls' school were thoroughly overhauled and rectified under the supervision of this Department in the Spring of 1886, after an outbreak of Typhus Fever. In March last, after the present outbreak, the whole drainage system of the *Boys' Institution* was tested and inspected, and the following is Mr. Fyfe's report of the result:—

“13th March, 1888.

“The drainage system of the boys' workshops, school, and dormitories was smoke-tested to-day.

“The following are the defects which were noted:—Smoke issued in the W.C. attached to the dormitory in the top flat, and from the joint at the top of the window outside: also in the W.C. apartment attached to the dormitory immediately beneath this, apparently from defective fittings at the jawbox.

It also came up in considerable volume in the small private washing-house on the opposite side of the court.

"The sink in the closet attached to the lowest dormitory is connected to the soil-pipe below the seal, and the ventilation of the soil-pipe is insufficient. Inside of the seat of this W.C. filth and dirt were found in considerable quantity. Below this W.C. and bath apartment is the boys' lavatory, a long chamber having iron basins ranged along side. There are six bell traps in this chamber. Two were lifted, and both were found to be choked with dirt, and consequently inoperative. An old disused waste pipe, four inches diameter, was found connected to the main drain, running out to the south of the dormitories. It was built about two feet into the wall, and was quite open. *The main drain was thus being partially vented into the stones and mortar of the gable at the south end of the school-room.* At this end of the building, just at the stairs leading towards the south, the ground was opened. The soil and sand turned up were teeming with large white worms, which were crawling about in every direction. I understand that coffins containing human remains were found some time ago in the court attached to the girls' portion of the school when a portion of it was being dug up to lay the drains.

"The steam pipes which heat each of the three dormitories are connected to the drains, so that hot water and steam are discharged therein during heating time. This, of course, ought to be discontinued.

"I got a portion of the floor of the centre dormitory opened. The deafening is composed of ashes and builders' refuse, viz. lime stones, sticks, &c. Cobwebs were formed among portions of it; but no offensive smell could be felt. No ventilation is provided underneath the flooring of any of the dormitories.

"The main soil pipe from the water-closet attached to the dormitories is connected to the back gutter, and takes off the rain water. This soil pipe should be carried up full bore three feet above the roof, and a separate rain conductor ought to be erected in order to take off the roof water. The main drains are very deep, and quite inaccessible.

(Signed) PETER FYFE,
"Sanitary Inspector."

Addenda, 14th June, 1888.

"Drain pipes in cellar under boys' lavatory were open at the joints, and all the bell traps in lavatory choked; also, soil pipe of W.C. (on left of passage leading through the main building to back court) was defective.

"All the defects in the drainage are now made good.

"The steam and hot water from the heating pipes are still discharged into the drains, which will assist in the rapid decomposition of the sewage, and the quick formation within the purlieus of the buildings of offensive gases.

"Nothing has been done to warm the boys' lavatory, which must be a chilling spot in the winter time.

"P. F."

The health record of these Institutions is bad. In the Annual Reports of the Government Inspector of the Certified Reformatory and Industrial Schools of Great Britain, the first of which appeared in 1858 for the year 1857, we find evidence of this fact and of its association in the opinion of the Inspector with the radical defect of situation. The Convent, which ultimately became the Girls' School, is first referred to in 1862, and the Boys' School in 1868. The following are a few notes and extracts from the Inspector's remarks from year to year:—

1868. Referring to both Institutions.—"The premises were clean and in good order. The chief drawbacks to them are that the space and opportunity for active exercise are very limited, and that they are so close to a large burial ground still occasionally used." (p. 91.)

1870. *Boys.*—"There was little illness in the house at the date of inspection, but since that time there has been a very serious outbreak of *Smallpox.*" (p. 146.)

Girls.—"They looked healthy, bright, and cheerful, but there has been serious sickness in the year. . . . The girls require more air, exercise, and freedom for moral and physical health and growth." (p. 146.)

1872. *Boys.*—"The exercise ground is but small. The children should be taken out for change of air and exercise as often as possible." (p. 160.)

Girls.—"The girls' school was visited by *typhus fever* in the early part of the year. No less than 100 girls stricken at once. Two deaths resulted, and two from consumption. . . . The girls want more air and lively exercise. The situation of the school is not conducive to health. It should be removed to a greater distance from the town." (p. 161.)

1873. *Boys.*—"I found the boys in fair condition of health, though not very robust. They should be taken out for change of air and exercise as often as possible. One death in the year only. A few cases of *smallpox* had occurred without fatal effects among the boys, but the Superintendent's son did not survive the attack." (p. 168.)

Girls.—"The school maintains its internal efficiency. It is not healthy in point of situation. The young children require

purser air and a greater amount of exercise and freedom." (p. 169.)

1874. *Boys.*—"Health and general condition—Generally very fair. There had been a serious attack of *fever* in the preceding autumn, and 5 deaths had occurred in the present year, chiefly from lung disease." (p. 196.)

1875. *Girls.*—"Health and general Condition—The situation is not a healthy one for children; the girls have rarely enjoyed an average share of good health for any length of time. In the early part of the year there was an outbreak of typhoid (*typhus*) *fever*, affecting 20 girls. These were sent to the Fever Hospital and treated there; this was followed by an attack of measles, 14 or 15 girls were affected. I found the general health restored on the day of my visit, but the physical state of the girls was not quite satisfactory. They want more fresh air and free exercise." (p. 181.)

1880. *Boys.*—"Health and general condition—The children are received in a very feeble condition; the constitution is very indifferent. It is difficult to build them up in strength and vigour. There were 5 deaths in the year. The children suffered a good deal from the cold in the early part of the year, and the deaths resulted chiefly from lung diseases and consumption; 1 from heart disease. The boys looked bright and well on the day of inspection. The medical report was favourable." (p. 236.)

Girls.—"Health and general condition—The health of the children had been much tried since the last inspection. There had been 10 cases of *scarlet fever* and 2 of *measles*. Two deaths in 1880; 1 from consumption. The children on their arrival are very feeble and with constitutions much impoverished. At the time of inspection all the children were well, and very many of them looked blooming and vigorous. A large majority very young." (p. 237.)

1881. *Boys.*—"Health and general condition—The children are very feeble on admission, and in the early part of the year there was a very serious mortality among those recently admitted; they seemed to be too weak to struggle against the severe weather of the early part of 1881. I came to the conclusion that the large dormitories were greatly at fault, and that in the winter it would be necessary to introduce some artificial heat. Ten boys died in 1881. This excessive death-rate demands the most serious attention on the part of the managers. Such a mortality is altogether abnormal, and can be prevented by ordinary precautions, by merely supplying warm clothing, plenty of food, and warm apartments, accompanied with individual care and attention." (p. 239.)

Girls.—"Health and general condition—The girls had a

healthy appearance. Several of them suffered from the extremely trying weather of the early part of 1881 from attacks of bronchitis and pulmonary disorders. Only two deaths in 1881; a few cases of ophthalmia. No sick cases on day of visit. Children thriving physically." (p. 240.)

1882. *Boys.*—"Health and general condition—A better medical report this year. Only one death in 1882, against ten in 1881. The winter happily was very mild. Cold is the deadliest enemy of the poor, enfeebled children received. Keep them warm by night and by day, and you may preserve their lives." (p. 256.)

Girls.—"Health and general condition—Very fair. Most of the children looked remarkably well. Two deaths in 1882. A few cases of ophthalmia; some acute cases of bronchitis and congestion of lungs; a little rheumatism also; one case of *enteric fever*. A good many bronchial attacks in the early part of the year." (p. 256.)

1883. *Boys.*—"Health and general condition—A great deal of special attention is now paid to the delicate and the failing. The Medical Officer calls daily. Three deaths in 1883 from lung disease; two suffering from pneumonia at the date of my visit. Many very feeble on admission. A few cases of weak eyes; one from hip-joint disease. Boys generally doing well, bright and active, and with plenty of spirit. Food and clothing apparently sufficient." (p. 270.)

Girls.—"Health and general condition—Many of the girls very young, and when admitted very feeble, and without any constitutional strength. Three deaths in year from lung disease. Children very subject to pulmonary complaints. Children carefully nurtured and very kindly treated. A large number looked healthy and vigorous, well fed and clothed, and of good physical appearance. Very little sickness. Medical report, except as to delicate children, satisfactory." (p. 271.)

1884. *Boys.*—"Medical Report favourable on whole. . . . Several cases of pneumonia, the most fatal in its effects here." (p. 262.)

1885. The Chief Inspector refers to "a very serious outbreak of *typhus fever* at an Industrial School in Abercromby Street, Glasgow, for the reception of Roman Catholic girls." After detailing the circumstances, which are given in quotations below, from Mr. Rogers' Report, he adds—"The situation of the School is not good, being in a low and crowded part of the town, and some of the sanitary arrangements of the building are open to objection." (p. 12.)

Boys.—"Health and general condition—The school is very subject to epidemics. In July, 1884, there was a severe attack of *smallpox*—11 cases. All the boys were vaccinated or re-

vaccinated after the attack. In November, 1884, 11 boys were suffering from *measles*. Several cases of lung disease, a most fatal complaint in this school; several cases of ophthalmia. Boys very feeble on admission, with no constitutional strength; these younger boys need a separate establishment and female care. Four deaths in 1885—a large mortality. No sickness in the house; boys looked fairly bright and active, many very young." (p. 273.)

Girls.—"State of premises—Premises in very good order and repair. One or two of the dormitories open to objection; some alterations required on sanitary grounds. Good laundry and drying-room. Capital play-shed. Yard newly pitched. Much has been done of late to place the school on a satisfactory footing, but the situation is an unhealthy one, and contagious or infectious disease is constantly at its doors."

"Health and general condition."—Several cases of ophthalmia and two cases of rheumatism; several of bronchitis and pneumonia. In November and December, 1884, six cases of *measles*. In the early part of 1885 several cases of bronchitis and pneumonia. In October, November and December, 1885, the school suffered from a prolonged attack of *typhus fever*; there were 65 cases in all. Happily it was of a mild type, but two girls died, and one of the attendants, a Sister of Charity, also succumbed. The outbreak was the subject of special investigation and inquiry. It was probably introduced into the school, but was allowed to get strength before it was fairly grappled with. The premises have been carefully examined, the sanitary arrangements looked into, and measures of prevention adopted. But the school is badly situated, and should be removed into the country. There were five deaths in the year." (p. 274.)

1896. *Boys.*—"Health and general condition—I cannot say that the situation of the school is a healthy one. The boys are constitutionally feeble on admission, and require female care and superintendence up to a certain age. They are very subject to pulmonary complaints, and very often succumb to such attacks. There were two deaths in 1886; one with diseased bone of foot, which he was obliged to lose; several cases of pneumonia and bronchitis, in the early part of the year. Boys are properly cared for, and looked bright and cheerful. I saw no indications of neglect; on the contrary, the children are treated with much kindness and attention." (p. 287.)

Girls.—"State of premises—I found that, in consequence of the alarming outbreak of typhoid (*Typhus*) fever in the school, in November, 1885, the sanitary condition of the house had been much improved. The whole house had been renovated, the drainage carefully examined, and everything objectionable

removed. The dormitories were clean and sweet, new bedding supplied, and the whole house purified and cleansed as far as possible.

"Health and general condition.—The health of the children since the serious outbreak of 1885-6 had been good. One death in the year. The sick-room was unoccupied on the day of my visit. There had been a few rheumatic cases, and some cases of ophthalmia and bronchitis. The children had a healthy appearance generally." (p. 289.)

The burden of all these official reports is the unhealthiness of these schools, their unwholesome position, their repeated invasion by infectious disease which always spreads. This shows want of sufficient air-space both within and without. Pneumonia and other lung diseases are chronically prevalent from the same cause, and especially severe among the boys. Ample testimony is borne to the care bestowed upon the inmates, and to the numerous alterations and rectifications of drainage and other internal improvements, but these do not touch the radical defect of these Institutions, and there has been no real elevation of the general standard of health.

Death-rate in St. Mary's.—In the Appendix¹ will be found a statement compiled from Tables in the Government Inspector's Annual Reports, showing the average number of inmates and the number of deaths in each Institution for the 10 years, 1878-87 inclusive. I have chosen the last 10 years so as to give the Institutions the benefit of all that has been done to improve their condition. The result is that in the Boys' School there have been 36 deaths (*i.e.* 3.6 in an average population of 226.7) or a mean annual death-rate of 15.9 per 1000 inmates; in the Girls' School 25 deaths (*i.e.* 2.5 in an average population of 190) or a mean annual death-rate of 13 per 1000 inmates. For comparison I have also compiled a similar statement from the same source for the Mossbank Industrial School for Boys and the Rottenrow Industrial School for Girls, which was transferred in June, 1881, to Maryhill. These Institutions receive the same class of boys and girls from the same city, the only difference which determines the allocation of these children being one of religion. The result is that in Mossbank Boys' School there had been 42 deaths in an average population of 385, or a mean annual death-rate of 11 per 1000 inmates; in Rottenrow (now Maryhill) Girls' School 12 deaths in an average population of 211.5, or a mean annual death-rate of 5.7 per 1000 inmates. This comparison requires no comment. The extreme unhealthiness of the St. Mary's Institution may be illustrated by another comparison. Taking the Boys and Girls together we find that there have been 61 deaths (*i.e.* 6.1

¹ None of these Tables are reproduced.—[Ed.]

in an average population of 416.7), or a mean annual death-rate of 14.6 per 1000 inmates. In the worst district of Glasgow, viz., Bridgegate and Wynds, in the 3 years, 1880-1-2, the death-rate per 1000 of the population between 5 and 20 years of age was 12.5, or 2 per 1000 less than this Institutional death-rate of a population aged between 5 and 15 years. The data at my disposal do not admit of stating the mortality for exactly the same period of age, but the inclusion of the five years, 15 to 20, tends to raise the district death-rate quoted, so that the comparison as it stands is favourable to these Institutions, yet this is the astounding result. Taking Mossbank and Maryhill Schools, we find that there have been 54 deaths (*i.e.* 5.4 in an average population of 596.5), or a mean annual death-rate of only 9 per 1000 inmates; which is 3.5 per 1000 less than the district death-rate and 5.6 less than the St. Mary's death-rate.

The Most Fatal Diseases in St. Mary's.—In the Appendix (Table III.¹) will be found in detail the registered cause of each death in each Institution in the last 10 years, with the duration of illness and age of patient, all extracted from the Registrar's books. Out of a total of 36 deaths among the boys there were 16 from Phthisis, 6 from Pneumonia and Pleuro-pneumonia, 4 from Congestion of the Lungs, and 1 from Bronchitis. Out of a total of 25 deaths among the girls there were 10 from Phthisis, 3 from Bronchitis, 2 from Congestion of the Lungs, and 1 from Pneumonia. Therefore 75 per cent. of all the deaths among the boys was caused by various diseases of the Lungs, and 64 per cent. of all the deaths among the girls. Combining the two sexes, 70.5 per cent. of all the deaths was caused by Pulmonary Diseases. Again, turning to the most unhealthy district of Glasgow, viz., Bridgegate and Wynds, for comparison, I find that in the three years 1880-1-2, 41 per cent. of the total deaths between 5 and 20 years of age were caused by diseases of the Lungs. Separating Phthisis from Acute Diseases of the Lungs, I find that the comparison stands thus:—

| | Institutions. | Worst City District. |
|------------------------------|----------------|----------------------|
| Phthisis, - - - - - | 42.6 per cent. | 21.7 per cent. |
| Acute Diseases of the Lungs, | 28 do. | 19.3 do. |

The rapidity with which some of these diseases proved fatal to the children, especially the boys, is remarkable, *e.g.* Congestion of the Lungs was fatal to a boy of 11 years in 1 day, and Pleuro-pneumonia to boys of 9 years and 10 years in 4 days.

Frequency of Epidemics in St. Mary's.—The quotations from the Inspector's annual reports show that both Institutions

¹ None of these Tables are reproduced.—[Ed.]

have been repeatedly invaded by various epidemics. *Small-pox*—In 1870, in 1873, and in 1884, there were outbreaks of smallpox, on each occasion among the boys. *Typhus*—There have been 3 severe epidemics of typhus, all among the girls. In 1872 "no less than 100 girls were stricken at once," and 2 died. In 1875 there were 19 cases. On that occasion I reported as follows to the Local Authority—"I have had the dormitories in this Institution measured, and find that in all there is a minimum of cubic space, and in one, indeed, positive overcrowding—there being little more than 200 cubic feet per bed. I have addressed myself to the Superintendent of the schools on the subject, and have seen the local agent of the Inspector of Reformatory and Industrial Schools." In 1885 there were 70 cases; 2 girls died and 1 of the Sisters of Charity. *Scarlet fever* invaded the boys in 1873 and the girls in 1880. *Measles* invaded the boys in 1877 and 1884, and the girls in 1875 and 1884. Free intercourse with friends and relatives, and the absence of a probationary ward in which new admissions could spend a period of quarantine before joining the others, make the occasional importation of infection inevitable. Still, if there was no overcrowding and if proper sick-room accommodation existed, the disease thus imported would not spread as it always does. Those epidemics of typhus, which have thrice occurred in the girls' school, are sufficient of themselves to bring discredit upon the Institution.

Meteorology.—A table showing daily progress of disease, with meteorological data, will be found in Appendix (Table IV.¹). This outbreak occurred in the spring. The first and fatal cases, on 2nd and 3rd March, were preceded by a period of cold, dry, sunless weather, with east and north-east winds; the mean daily temperature averaging about 36 deg. F. The next fatal cases, on 7th March, occurred after two days of west wind, with rain and mean temperatures of 44 deg. to 45 deg. F. This change continued for the three following days, which produced the bulk of the cases. Then occurred three weeks of east and north-east winds with occasional rain and more sunshine on the whole, but with low mean temperatures, considerably below or but little above freezing and very variable, during which cases occurred, 1 or at most 2 per day, with intervals of immunity. Probably all that can be inferred from these facts is that the weather was trying for weakly children and well calculated to chill the surface and produce internal congestions.

Health of the Neighbourhood.—In the tenements of flatted dwelling-houses surrounding the block containing St. Mary's Institutions, there are 158 dwellings, viz. 38 of 1 apartment;

¹ None of these Tables are reproduced.—[Ed.]

85 of 2 apartments; 27 of 3 apartments; 7 of 4 apartments; and the residence of the clergy, 14 apartments; the number of inhabitants being between 700 and 800. In the months of February and March, and April of this year there were *only two deaths* registered in this population, viz., a female, aged 65 years, on 16th April, of pneumonia, after an illness of 10 days; and a male aged 52 years, of phthisis pulmonalis, on 17th April, after an illness of 3½ years. There is therefore no evidence of any coincident disease of the St. Mary's type among those living within a few yards of the Institutions.

Health of the City.—The Registrar-General returns the weekly death-rate and the number of deaths from Bronchitis, Pneumonia, and Pleurisy, in the City, for the six weeks covered by the Meteorological Table in the Appendix, thus:—

| Week ending | Death-rate. | Pulmonary Deaths. |
|----------------|-------------|-------------------|
| 25th February, | 26.9 | 69 |
| Do. 3rd March, | 27.5 | 76 |
| Do. 10th do. | 29.4 | 94 |
| Do. 17th do. | 26.9 | 72 |
| Do. 24th do. | 27.2 | 71 |
| Do. 31st do. | 27.4 | 77 |

The week ending 10th March, which was the centre of the St. Mary's outbreak, was, therefore, marked by a sudden and solitary increase in fatality of acute diseases of the lungs, over the whole City.

Summing up the results of this investigation, we find that the St. Mary's Industrial Schools are situated in a densely populated district of the City; that they are enclosed by surrounding tenements and other large buildings, along with a graveyard which was in 1875 described as "greatly overcrowded with bodies, and kept in a state of rank disorder," and in which have since been interred 577 bodies; that the free space attached to both, and available for exercise, is small; that the internal air-space in both is deficient; that the inmates are children between 5 and 15 years of age, who are the waifs of a large city, weak in constitution, tainted with a proclivity to scrofulous diseases, and generally of low vitality; that the death-rate is in both higher than that of other Industrial Schools which receive the same class of Glasgow children, and higher than that of children of the same age living in the lowest district of Glasgow; that the proportion of the total deaths caused by pulmonary diseases is enormous, and higher than among children of the same age in the worst district of Glasgow; that, in the words of the Government Inspector, "contagious or infectious disease is constantly at their doors," and especially that there have been repeated epidemics of Typhus Fever, a certain indication of, and attendant upon,

overcrowding. This is the sanitary status, and the vital results associated therewith, as regards both institutions; but comparing one institution with the other, we find a marked difference to the disadvantage of the boys' school—a difference of such a kind as to suggest a probable explanation of the event for the cause of which we are in search. The overcrowding is much greater in the boys' than in the girls' school, *i.e.* the external free space is much less, the internal air space is much less per head; the internal arrangements are more defective, the accommodation and general sanitary condition of the building inferior; the general mortality among the boys is higher; the proportion of the total deaths caused by pulmonary diseases, and especially by acute diseases of the lungs, is considerably higher. The outbreak of March was in its nature a febrile disease, tending to implication of the lungs, and especially to pneumonia. It seems identical with a disease which has been observed in other similar institutions, more or less detailed accounts of which will be found at the end of this report, in all of which the observers had a difficulty in assigning it a place in nosology, but in all of which it was associated with insanitary conditions of the nature of aerial contamination. It suggests a specific poison, from family resemblance in explosive character, local limitation, and clinical features, to other well-known typical diseases of the epidemic and infectious class. No specific micro-organism was discovered in this, or has been, so far as is known, in any other like outbreak. The rapid fatality in the fatal cases shows that this poison, though in the cases in which life was not at once extinguished, it tended to expend itself upon the organs of respiration, was the cause of the disease. The local disease was the result of a constitutional infection, which was capable of killing without the local disease. The *post-mortem* appearances pointed to a specific poison allied to that of enteric fever. Such as they were, they were distinctly lesions of the mesenteric glands, and of the glandular system of the small intestines. The experiences of the Fever Hospital is strongly suggestive of a casual affinity between certain forms of pneumonia and enteric fever. The two diseases are frequently confused, both in their diagnosis and local incidence. This observation, as well as the present epidemic raises a strong suspicion that we must enlarge our conceptions of the morbid manifestations which are to be regarded as proof of the influence of air contaminated with organic effluvia. If so, we can no longer hold that the absence of enteric fever warrants us in concluding that known impurity of the air from sewage emanations, for example, is innocuous. The prevalence of acute pulmonary diseases may be the result. The presence of "Pythogenic Pneumonia" and

"Epidemic Pneumonia" in nosology, and the circumstances of the well-known outbreak in the East Sheen Boys' School, and other similar recorded outbreaks, give this observation support and established recognition.

In the course of the outbreak the patients at Belvidere were seen by several eminent professional friends at my request. Professor Gairdner was inclined to regard them as cases of "Influenza of a malignant type"; Dr. Finlayson had no doubt that they were examples of what has been called "Epidemic or Infectious Pneumonia." Dr. Samson Gemmell had the advantage of seeing all the cases, having accompanied me repeatedly in my visits to the School as well as to the Hospital, and seen the cases at all stages, within an hour or two of seizure as well as subsequently. I have therefore asked him to give me in writing his general impression, which he has done in the following short memorandum:—

NOTE ON THE CLINICAL ASPECT OF THE DISEASE. BY
PROF. GEMMELL, ANDERSON'S COLLEGE.

"It seems to me evident that in the recent epidemic in St. Mary's School we had to deal with a disease allied to the acute specific fevers. The sudden onset with headache, sickness, shivering, and other signs of profound constitutional implication point decidedly in this direction. Moreover, the speedy issue in the four fatal cases (three of them dying after a few hours' illness), finds its closest analogue in the so-called malignant forms of epidemic disease, which terminate in some instances so rapidly that they would baffle diagnosis were it not for clear association with cases having more ordinary manifestations. The two *post-mortem* examinations revealed no specific lesions, but the extremely fluid character of the blood in one case, and the general tendency to enlargement of the spleen and mesenteric and intestinal glands in both, are quite in keeping with the idea of acute specific poisoning, although the microscopic examination of the blood and organs revealed no micro-organisms.

"In view of the frequent occurrence of inflammation of the lungs among the patients, the question of the disease being 'infectious,' or 'epidemic' pneumonia early suggested itself. This is a disease apt to arise under insanitary circumstances, such as overcrowding, deficient ventilation, and other hygienic errors apt to induce infectious diseases in general. And no doubt in this School the sanitary conditions, especially with regard to air-space, as indicated both by the Government Inspector and Dr. Russell, are defective; and pneumonia, not, however, as an epidemic, has been a frequent visitant in recent years. But it must be borne in mind that out of the 66 cases

comprised in the epidemic only 17 had decided pneumonia. Other 8 were doubtful cases (some of them very doubtful, the temperature being the only suggestive fact), but the majority of the patients presented no traces of pneumonia at all. No doubt in many of these the disease was of short duration and unattended by high fever, but the general symptoms otherwise were such as to reveal clearly a close aetiological affinity, if not absolute identity, with the more severe cases. They seemed all the victims of the same poison, although in some, owing probably to personal idiosyncrasy aided by favourable atmospheric conditions, it issued in pneumonia.

It is to be remarked also that the clinical features of the pneumonic cases do not strengthen the idea of the disease being 'Epidemic' pneumonia arising from insanitary surroundings. There was no prodromal stage; the local lesion revealed itself early; the disease was unassociated with typhoid phenomena; terminated in crisis, in every instance, within a week; the convalescence being rapid, and the restoration of the lung speedy and complete. In no instance did death occur. Such are not the characters of the infective type of pneumonia; and, indeed, apart from their epidemic association, any of the cases might have been selected as exhibiting most of the typical characters of acute pneumonia as it occurs sporadically.

"It is impossible with our present light to dogmatise regarding the exact nature or genesis of the disease. The question as to whether it might not be an anomalous manifestation of enteric or typhus fever was suggested, but nothing transpired to encourage such an idea. The circumstances pointed clearly, of course, to a local origin of the disease, and it is no matter for wonder that it told with such severity among boys of low constitutional vigour living under unwholesome circumstances."

What ought to be done?—The important question which is the natural outcome of the melancholy history of the St. Mary's Schools is this:—What ought to be done to improve their sanitary condition?

(a) *Removal of the Institutions to the Suburbs.*—This is the only radical cure. This step has been from the time of their establishment on their present site urged by the Government Inspector, but they remain. The reason is that referred to in his Report for 1863—"They have to contend with the usual difficulty of institutions of this kind for Catholic children in England and Scotland, viz., very scanty pecuniary resources." (p. 69.)

(b) It is surely obvious, nevertheless, that something must be done. (1) The only control which Government can exercise is by *reducing the number of inmates for which they are licensed.* Some sacrifice must be made. The children suffer

from air-hunger. If they cannot be transferred to the country, then an endeavour must be made to reduce their number, and thereby raise the proportion of such air-space as the site affords. At present they are exactly in the position of the inmates of an overcrowded house, in which, while there is every condition which induces disease, there is no possibility of separating the diseased from the healthy when in life, or even the dead from the living.

(2) Such a high death-rate necessarily means an equally high sick-rate. Yet there is practically no accommodation for the sick in the Boys' School, and inadequate accommodation in the Girls' School. The number of inmates should be so reduced that space for a *large hospital ward* may be obtained. Skilled attendance ought to be provided by night and by day for those under treatment there, so that such a thing as a child dying unseen should be impossible; not to speak of the inevitable inference that if children die unseen those who survive must be neglected. In the light of medical opinion now-a-days as to the communicability of Phthisis, the prevalence and fatality of this disease in those Schools, taken along with the want of commodious apartments for their treatment, raises the gravest suspicion that Phthisis is not only induced by the prevailing air-hunger, but is propagated by infection. Care is prescribed as to the disposal of Phthisical expectoration by medical attendants in their private practice, and wherever it is possible isolation in bed and living arrangements is thought to be an ordinary precaution.

(3) A *Mortuary* outside the main building, away from the sleeping and living apartments, must also be provided. It is bad enough that in the small houses of Glasgow the dead should be laid out beside the living; but it is intolerable that in a public Institution corpses should be stored away in drug-stores and bedrooms.

(4) A *Probationary Ward* is also wanted in both schools. Children when admitted may bring with them the seeds of infectious disease, and should be kept apart for three weeks under observation.

(5) The boys require a *Play-room* for winter and wet weather. Anything more unnatural and unwholesome than the present practice of penning those children up on such occasions in the school-room can scarcely be imagined.

(6) Hot water ought to be introduced to the taps in boys' lavatory, and heating pipes, so as to have the place warmed in winter before the children leave their warm dormitories to wash.

(7) Every child, both male and female, ought to have flannel underclothing during winter and spring. At present

only the delicate ones are said to have flannels, but all are delicate. When they become so specially delicate as to attract attention it is too late to begin to clothe them warmly.

(8) Another step, which it is within the power of the Local Authority to take, and which ought to be taken at once, is *absolutely to close St. Mary's Cemetery*, and to make arrangements for putting the ground in decent order. It is now, as in 1875, "in a state of rank disorder," and is used occasionally as an exercise ground for the children!

SIMILAR OUTBREAKS IN SIMILAR INSTITUTIONS.

The allusions to the extraordinary occurrence at St. Mary's, published in the Medical Journals, brought me two very interesting communications of apparently similar outbreaks in similar Institutions, and my attention was also called to another published account, all which I append.

1. *Roman Catholic Reformatory for Boys, Westhorn, Glasgow.*

While the St. Mary's disease was in progress, Dr. Scott, of Tollcross, examined the patients at Belvidere, and addressed a letter, under date 16th March, to Dr. Gairdner, who had also seen those cases, and was inclined to regard their disease as "Influenza" of a malignant type. I am permitted to publish the following extracts:—

"I have been Medical Officer of Health to the Roman Catholic Reformatory for Boys at Westhorn for the last twelve years, and have been much interested in the outbreak of this so-called 'fever' in Abercromby Street. I called at Belvidere to-day, and in Dr. Allan's presence I carefully examined several of the older patients, and have come to the conclusion that they are suffering from a form of disease which is exactly analogous to one with which I have had to deal among our own boys.

"About ten years ago, at this very season of the year, when the weather was intensely cold, 10 or 11 of the boys were brought into the Hospital with what I thought at the moment incipient symptoms of typhoid fever. The history of that attack was something like this:—On this cold morning the boys rose and breakfasted in their usual good health. After having been sent out to their work in their various divisions, one after another was noticed to be suffering from cold, and was sent in by their respective masters to the sick-room. Within three hours thereafter these boys gradually assumed a semi-comatose condition, and one of them especially became affected with a low muttering delirium during the time I was even making an examination of his fellows. They complained of no pain,

wanted to be left alone, and their temperatures ranged from 104 deg. to 105 deg. Only one had diarrhoea, and he succumbed in 9 hours from the onset of the disease. The boy to whom I have already referred as unconscious died within a few hours. With the others the temperature remained at pretty nearly 105 deg. (its highest stage) for three or four days, during which time there was no appearance of diarrhoea, spots, rash or spit, except in one case in which there was a little pulmonary congestion. At the end of that time the temperature fell to nearly its normal condition, and the boys in two or three days thereafter regained perfect health.

"Since then another epidemic took place about two years ago, in which all affected made a good recovery. On several occasions we have had sporadic cases. One terminated fatally after four hours' illness. In every case the onset of the disease could be traced to—not a rigor—but a chill which was long continuous and depressing. During intensely cold weather these boys have to be watched with extreme care. Many of them are constitutionally unhealthy, and from the state of their health and condition of their blood, they seem to be quite unable to stand severe cold. Since our first serious outbreak we are specially careful that the delicate boys are clad with flannel and are not suddenly exposed to extreme cold. Our treatment with regard to these has been warm baths, warm diluent drinks, and some stimulant, and experience has shown that if the capillary circulation of the skin be not restored within the first 3 or 4 days of the onset of the attack, the patient dies of apparent blood poisoning.

"In my opinion the disease is caused by defective capillary circulation and consequent hyperæmia of lungs, liver, spleen, and intestines. I am not satisfied that the disease is infectious, nor can I consider it as pyogenic pneumonia, and I am inclined to think from the cause of the disease and the condition of the patients that it is somewhat like influenza, and that the septic poisoning is auto-innoculative.

"The mention of the old graveyard in connection with Abercromby Street School leads to the consideration of the septic influence of Dalbeth graveyard. But why should these germs be most virulent during the coldest part of the year, and be entirely innocent during the hot summer months when our boys are working and playing in its immediate neighbourhood, and that too with large open pits for graves?

"Among those affected in our school only one showed symptoms of pneumonia."

2. *Birkdale Roman Catholic Reformatory, Southport.*

"50 Liverpool Road, Birkdale,
"Southport, March, 23, 1888.

"Dear Sir,—Excuse delay, but I could not reply earlier to your letter.

"As you suggest, we have had at the Birkdale Reformatory a series of cases evidently of the same kind as those you report upon at the Glasgow Industrial School. Since Jan. 3rd of last year we have had 3 deaths.

"1. The first case occurred on Jan. 3rd, '87, and I was with the boy for an hour and a half before death. From notes taken at the time I extract the following:—

"I arrived at 10.20 a.m. and found the boy in a state of profound coma, the breathing being slow and stertorous, the pupils dilated and absolutely insensitive to light, flushed face, bounding pulse, 80; temp. 101 deg. The chest full of loud, coarse mucous rales, which increased progressively to the time of death. The breathing became slower, the face more flushed, and at 11.45 the boy died asphyxiated, the face finally becoming purple and the heart beating strongly and regularly up to the last. (About 11 o'clock he vomited bile and mucus.) No inquest or post-mortem.

"This boy commenced vomiting in the dormitory about 2 or 3 a.m., having previously been in good health and eating well. A master saw him about 7 a.m., and found him 'languid, with a weak slow pulse.' He said he had no pain, but when he got up he could only walk with the assistance of another boy. At 7.20 he was seen again. He was in the infirmary lying on his bed, and was with some difficulty roused. However, he stood up, and was undressed and put to bed. At 8 a.m. 'he appeared to be in a nice comfortable sleep.'

"2. *The Second Fatal Case.*—I did not see this boy before death. He took ill in the afternoon with vomiting and heaviness, and at 11 p.m. temp. was 104 deg. About 2 a.m. he was found dying, and was dead when I arrived.

"*Post-mortem.*—Brain and membranes congested. The lateral ventricles nearly full of pink serum; lungs intensely congested (recent); no consolidation; stomach contained 1½ pints of mucus and bile, as certified by county analyst. Bowels empty; kidneys healthy.

"3. *Case 3 died recently.*—I saw him the evening before his death—11 p.m. Temp. 100 deg.; pulse 96; resp. 24. There seemed very little the matter with him beyond a simple feverish attack. At 4 a.m. he vomited mucus and bile, and shortly afterwards was found dead.

" *Post-mortem.*—Brain congested; lateral ventricle on left side half full of pink serum; lungs, stomach, liver, kidneys, congested; right heart gorged; stomach empty; bowels rather constipated.

" I now give a case which I saw recover, and reproduce my notes verbatim :—

" *J.M., 17 years.*—First saw him at 9.15 p.m.; pain in head; perfectly conscious, but dazed; pupils rather dilated; sluggish; pulse 84, strong regular; temp. 101.8 deg.; vomited mucus and bile. Rapidly became less conscious, and at 10 p.m. pulse 100, weaker, irregular; temp. 100.4 deg.

" 10.10.—Perfectly unconscious; corneae insensitive; pulse 92; temp. 100.2 deg.; breathing stertorous. Turpentine enema; 5 grains, and again 4 grains calomel; cloth wrung out of boiling water applied to nape of neck with friction, and then blistering fluid, mustard to calves.

" 10.30.—Pulse 72; temp. 99.6 deg.

" 11.15—Temp. 100 deg.; becoming more conscious; corneae sensitive. Made a good recovery.

" 4. In addition to these cases we have had, since January, 1887, 23 cases falling ill singly, *i.e.* no two or more boys took ill on the same day, but at varying intervals, such as one, two, three days a week, or two weeks, and in the last case five months. There were two types of this epidemic, *viz.* the chest type and the head type. The former began as usual with vomiting, headache (not very severe and lasting), and developed a broncho-pneumonia pleurisy or simple bronchitis, which cleared away in two or three days. In the broncho-pneumonic cases immense expectoration of frothy bloody sputa. The head cases were more obstinate and lasted longer. The headache was very severe, and generally was all over the head. One case displayed nothing but a badly-congested throat with yellow mucous patches, and a temp. of 104 deg., which was followed by a peculiarly copious desquamation.

" By careful examination at the hands of experts we have excluded from the possible causes water, drains, food (meat, milk, bread).

" Ventilation is *said* to be good, but I think we are too well ventilated in the dormitories, and too badly in the school-room, which is also used as a play-room. We have about 200 boys, and these boys spend a couple of hours in the school-room before going to bed (in winter). The room then becomes stifling hot, stuffy, and fetid. In sheer despair I have been driven to imagine that this condition of things may amount practically to overcrowding, and that the production of some bacterial poison similar to Typhus may result. We still require a certain and unknown condition of body.

" *Disjointed Facts.*—There is *no* evidence of contagion in these cases. All the deaths have occurred in cold (very cold) weather during a north-east wind. Our series of cases last year finished in August, but earlier on we observed that a warm spell of weather following a cold one put a stop to the series. When the weather became colder they began again. Some slight ones, however, did occur in the warm months.

" I have thus put together in haste such information as, I think, may interest you, but I can, if you wish, furnish you with more or less copious notes of every case we have had. My time is at present very limited, and I trust, therefore, that you will excuse my very imperfect account. I have some reason for thinking that these cases are more common in Reformatory and Industrial Schools than is generally believed. On referring to the Journals of the Birkdale Reformatory, I find an account of a small epidemic (eight cases, with one death) of the same kind about 12 years ago.

" I should be glad of any further communication on the subject.—I am, Dear Sir, faithfully yours,

" (Signed) FRANCIS NEWSHAM,

" M.R.C.S.E., V.C.

" Dr. Russell,

" Medical Officer, Glasgow."

Under date 14th June, in giving permission to publish his letter, Dr. Newsham states that the tobacco theory is also in favour among the Birkdale officials. The vice is general there, but he remarks that " the Clarence Reformatory Ship has never experienced a similar visitation, and I am told that the boys there are undoubtedly more given over to the habit of chewing than the Birkdale boys." He then adds—" One omission of some importance I made in my last letter to you, and that was, that at Birkdale they are not in connection with any system of sewage, but use dry earth system, and collect the liquid refuse in tanks, from which it is pumped on to the farm. The soil, also, after being collected in a heap, at some considerable distance from any of the buildings, is mixed with other materials, and spread upon the land. Now we have not suitable soil for the dry earth system, as the Reformatory was built on pure sand, and the cultivated soil, even now, is in appearance nothing but sand. To remedy this fine ashes are used. But against all inferences under this head, we have the fact that the deaths and worst cases are nearly all among the Shoemakers, and scarcely any cases at all, and no deaths, among the farm lads."

3. Roman Catholic Poor Boys' School or Orphanage.

In a paper entitled "Clinical Notes on a Febrile Epidemic Illness at a School," read by Dr. Edward Seaton, 23rd October, 1885, before the Clinical Society of London, and published in volume xix. of the Society's *Transactions*, he gives a careful history of an outbreak of peculiar disease in a "Roman Catholic Poor Boys' School or Orphanage, situate in the country near London." There are 665 inmates, of whom 157 were attacked and 7 died, in June, July, August, and September, 1885. The disease was strictly confined to this school, and did not affect attendants, &c. In five cases there were second attacks after considerable intervals of perfect health. The following is Dr. Seaton's summary of the symptoms:—

"The group of symptoms which characterises this epidemic clinically is as follows:—Suddenness of attack without any premonitory symptoms. Attack commencing with rigors and severe frontal headache, followed in a few hours by pyrexia, vomiting (often severe) without diarrhoea, the acute stage being further marked by scantiness of urine and almost complete absence of chlorides. Rapid development of the crisis, the fatal cases terminating in twenty-four hours, and (in the uncomplicated cases) defervescence commencing in two or three days in the slight cases, and in four or five days in severe cases. The fall of temperature being generally simultaneous with the appearance of a herpetic eruption on the upper lip, and perspiration, but no marked sweating. Earache frequently occurring towards the end of the fever, and sometimes being followed by otorrhoea. Absence of any other local pains except those due to the straining of the muscles in vomiting. The duration of illness generally short and not exceeding four or five days, unless complicated with pneumonia. Surely a disease accompanied by so well-defined a group and train of symptoms requires a distinctive name as much as typhus fever or ague!"

He appends a clinical history of a typical case ending in recovery, which might be that of one of the St. Mary's boys, uncomplicated with pneumonia. He gives another history of a case which proved fatal in twelve hours, which also closely resembles a St. Mary's fatal case. Of the 7 fatal cases, 6 terminated within twenty-four hours. The frequency of rigors, the greater persistency of vomiting, the more general suppression of chlorides in the urine, the association of the herpetic eruption with defervescence more than with the pyrexial stage, and the occurrence of earache and otorrhoea are the only points in which Dr. Seaton's disease deviates somewhat from the St. Mary's.

As to nosology, Dr. Seaton says it "may be called 'synoque' (Devasse), 'ephemeral fever,' or 'herpetic fever,' names which have been used to designate a variety of continued fever, characterised by symptoms similar to those of the disease which in this case assumed an epidemic form." As to causation, it will be observed that this outbreak occurred during summer, not as in St. Mary's, Westhorn, and Birkdale, during cold weather. In the discussion which followed the reading of Dr. Seaton's paper, Dr. Bridges, Medical Inspector of the Local Government Board, attributed the disease to "exhalations from the sewage charged soil," earth-closets being used in the institution, and their contents carelessly distributed over the attached ground. A similar system was in use at Birkdale.

EPIDEMIC NEAR LEICESTER.

In the *Edinburgh Medical Journal* for June, 1886, there is a paper entitled "History of an Epidemic," by W. B. Garvin, L.R.C.P. & S. Ed. It refers to a febrile outbreak in the village of Ansty, near Leicester. The history is very meagre, but it seems to have resembled these outbreaks in many points. There were over 100 cases, chiefly among the young, 2 fatal within 24 hours, the rest recovering in a few days. Dr. Garvin has the same difficulty in naming his disease, but concludes: "It is clear to me that this epidemic was caused by the filth of Ansty. Of filth as the origin I am positively convinced. In the absence of a diagnosis I shall content myself by calling it sewage fever."

(3) On the Sanitary Requirements of a Dairy Farm.¹

1. THE FARM-STEADING AS REGARDS THE HEALTH OF THE INMATES.

A farm-house should, like every other house, be wholesome in structure and furnished with all the usual requisites of health. That this should be so is more vital to the interests of the residents than of any other people; but the remote consequences of disease in the farmer's household may spread so far through the milk which he produces that their health and the conditions which affect it assume direct importance to every consumer of milk. Therefore, though there may be here and there a farmer who is indifferent to the welfare of his family,

¹ Drawn up at the request of and issued by the Local Authority of Glasgow for the information of persons engaged in the milk supply of their district, 1888.

he cannot be left alone, because the health of himself and his family, and the health of his distant customers, are bound up together.

A farm-house, including servants' quarters, should be so constructed as to be in all parts dry, well-ventilated, and well-lighted. It ought to have a good water supply, sufficient for man and beast all the year round, brought from some point distant from the area of the steading, from a gathering ground, which is not arable; or, if that is not possible, from such a depth, as to exclude surface drainage. The house-drainage ought to be conveyed below ground through vitrified pipes jointed with cement. There ought always to be at least one privy, and where there are male and female servants, one for each sex, built of stone or brick, placed with regard to decency, and apart from the byres; lime-washed inside and out periodically, and kept scrupulously clean always.

2. THE FARM-STEADING IN RELATION TO THE BUSINESS OF MILK PRODUCTION.

A farm-house may be in all respects wholesome as a residence, and yet be badly planned as regards the business of a dairy farm. All the arrangements of the structure and the habits of life ought to have in view one cardinal principle—the separation, so far as possible, of the domestic life from the milk, in its production, manipulation, storage, and despatch. The reasons of this are two—(1) that milk is prone to contamination from exposure to disease in the persons of those working among it; (2) the risk of contamination by disease is just in proportion to the closeness of the relation between the ordinary domestic life of the farm-house and the structure and arrangements necessary to the business of the dairy. If the bedrooms, the washing-house, the conveniences, &c., are mixed up with the milk-house, the boiler-house, the byres, &c., then whenever disease appears in the family or household mischief is certain to follow. If these various parts of the steading are separated, then the chances are that before the nature of the disease is recognised, no harm will have been done, and after a few precautions will enable the farmer to carry on his business without interruption. The main points to be attended to in the arrangement of structure are these:—

1. A domestic washing-house placed as remote as possible from the milk-house, boiler-house, scullery, and byres is indispensable. No farm-house which is without a separate washing-house can be a safe source of milk supply; yet the almost universal habit is at most to use for boiling clothes a separate boiler beside the boiler used for scalding milk vessels;

and to wash in any convenient place, it may be in some passage opposite the door of the milk-house, or in the scullery.

In health this may be only convenient, but the moment infectious disease invades the family the results are disastrous and unavoidable. Explosions of enteric fever and scarlet fever have been traced to the washing day, when the soiled clothing has been brought to the boiler-house, or washed opposite the milk-house door.

2. The milk-house ought always to have its door opening into the free air. It ought to have no other apartment above it, especially no bedrooms. It ought to be well-ventilated, have no internal communication with drains, be entirely free from damp, and so placed that the air which reaches it shall be pure, not near the dung-pit. It will be observed that the usual practice of having the milk-house incorporated with the dwelling-house, opening off the lobby, or kitchen, or scullery, is condemned.

3. The dung-pit ought to be placed as far as possible from the house, especially from the milk-house. It ought not to be a mere hole in the earth, but have retaining walls, an impervious bottom, and over it a light roof, raised on pillars, so as to permit free ventilation and yet keep the rain out, and so preserve the strength of the manure, and avoid the foul drainage which usually streams from a dungstead.

3. THE FARM-STEADING AS REGARDS THE HEALTH OF THE COWS.

It seems unnecessary to expend words in proving the statement that only healthy cows can produce wholesome milk. The health of cows depends upon the same general conditions as the health of human beings—fresh warm air, cleanliness, pure water, proper food. The cowhouse or byre ought to be well lighted and ventilated, evenly paved, not overcrowded, kept clean by regular removal of filth, and by periodic lime-washing of the walls. The influence of warmth on the flow of milk is so great that in the absence of any source of heat but the bodies of the cattle, the temperature is generally maintained by preventing the access of fresh air. This has the same effect on stalled cattle as the same practice in the houses of the poor has upon the inmates—it promotes disease of the lungs, especially consumption. Without artificial heat it is impossible to maintain the temperature of a byre in a normal winter in this country; but this assistance is unknown in our dairy-farms, and hence the truth of the statement recently made by Professor Brown of the Agricultural Department, Privy Council Office, that "nothing worse than the insanitary

conditions of the life of the average dairy-cow can be imagined." All that can be said is that in cold weather, without heat from steam or hot-water pipes led through the byre, a comfortable temperature can only be maintained by shutting out the fresh air and storing up the animal heat, and that this is necessarily unwholesome.

4. DISEASES IN MAN IN RELATION TO MILK.

By the Dairies, Cowsheds, and Milkshops' Order it is declared to be unlawful for "any person suffering from a dangerous infectious disorder, or having recently been in contact with a person so suffering" to milk cows or otherwise engage in the business of milk production or distribution. "Contact" ought to be regarded as meaning any sort of communication, direct or indirect, with infectious disease, *e.g.* it would be obviously dangerous for any one who had been in the sick-room, or who had washed an infected washing, to proceed at once to milk cows, &c.

The only safe rule for a farmer to follow is to let no one who is not in perfect health handle his milk. Infectious diseases taper off into slight forms, only recognizable when associated with well-marked cases. Scarlet fever, especially in adults, may produce merely a sore throat, or a blush on the skin which may never be observed. Enteric fever may lurk in what seems to be a simple diarrhoea or "weed." It is not ill-health which has continued for some time, so much as the sudden indisposition which overtakes a previously robust and healthy person, which has to be suspected.

5. DISEASE IN THE COW IN RELATION TO MILK.

By the Dairies, Cowsheds, and Milkshops' Order, the milk of a diseased cow is forbidden to be mixed with other milk, or sold or used for human food, or given to other animals, unless and until it has been boiled. But this enactment refers only to cattle-plague, pleuro-pneumonia, and foot-and-mouth disease. These are acute diseases which soon stop the flow of milk. Tuberculosis is a more insidious disease, which does not do so until it enters on the last stages. Yet the milk is unquestionably unwholesome, and may convey tubercle (the cause of "consumption") to man. Therefore any animal having rapid breathing, a short cough, or emaciation should be examined by a veterinary surgeon; and the milk of no animal showing signs either of local or constitutional disease should be given to man.

A grave suspicion has recently arisen in the minds both of medical men and veterinary surgeons that certain eruptive

diseases affecting the teats and udder of the cow are associated with the propagation of scarlet fever among the consumers of the milk. It is not necessary to accept this as more than possible to justify the advice that careful inspection of the cattle as to the existence of any affection of the teats and udder is demanded, and *careful exclusion of the milk of any animal so affected from human consumption is absolutely necessary.* The teats are liable to different kinds of injury or disease. They may in cold weather be chapped or hacked just as the hands of men and women are chapped or hacked by the influence of cold air upon them, especially when wet.

This leads to occasional bleeding in the act of milking, and, although no actual influence on health may follow the use of such milk, it is disagreeable to think of using it. But there are also eruptions, probably of different distinct kinds, of the nature of vesicles or pustules which, through the friction of milking, are broken and give rise to scabs and ulcers. These are well known to be infectious from cow to cow through the milker. Whether or not it be the case that one or other of these eruptive diseases in the cow may produce scarlet fever in man, it certainly is not pleasant to think of the consumption of milk contaminated with blood and matter, and therefore for this reason alone the milk of cows so diseased should not be distributed with the general produce of the dairy. It is a question of sacrificing the milk of one cow or of running the risk of poisoning the milk of a whole dairy.

6. CLEANLINESS IN GENERAL IN RELATION TO MILK.

As a rule nothing could be desired more than is generally practised by the Scotch farmer, or rather by his wife, as regards the careful scalding and cleaning of milk vessels. It is impossible to be too scrupulously careful in this respect. It is unfortunate that in Scotland a barrel is the sort of vessel in use for the conveyance of milk. Wood is porous, and difficult to cleanse in any circumstances, but the structure of the barrel, the inside of which cannot be reached and cannot even be seen, is the worst which could be devised. Only live steam has any chance of making it sweet. Some form of tin vessel, to all the internal surface of which the hand can reach, and which is open to inspection, such as is in common use in England, would be much preferable.¹

A little advice, also, as to the cleanliness of the udder and teats of the cows, and of the hands of the milkers, is not unnecessary. Attention to the bedding of the cow, and the

¹The objection on the score of the effects of sun heat, which, of course, tells more upon metal than upon wood, is not beyond being obviated by a little ingenuity.

removal of droppings from the place where the animal lies, will prevent the soiling of the udder.

If soiled, the teats ought to be washed before milking. As to the hands, no instrument requires such careful washing as the human hand, considering the variety of offices to which it is applied, before it is engaged in the work of the dairy. Every drop of milk may be said to have passed through the hands of a milker, and before milking every milker's hands ought to have been carefully washed. Convenience for the comfortable and efficient use of soap and warm water is an indispensable requisite of every dairy.

Dairy farmers and dealers in milk, however sceptical as to the argument in favour of these precautions on the ground of the likelihood of disease being conveyed by milk, ought not to forget the commercial aspect of failure to be careful and cleanly in every detail of their business. In the first place, if by any chance even suspicion arises in the public mind as to the milk of any farmer or dairyman, his business is for the time ruined. Naturally, the first effort at self-protection is to change the source of milk-supply. But apart from this, the milk which is produced from the healthiest cow, in the cleanest byre, handled by the cleanest milkers, collected in the cleanest vessels, and stored in the cleanest milk house, keeps the longest. In hot weather this means money. A thoughtful customer at once infers, and is right in inferring, that if one man's milk keeps longer than another man's it is to be preferred. It is not merely because of the loss implied by the "turning" of the milk, but because it is some want of cleanliness which causes the "turning."

In conclusion, the attention of farmers is requested to the following extract from a Report to the Veterinary Department of the Privy Council "On Eruptive Diseases of the Teats and Udders of Cows, in Relation to Scarlet Fever in Man," by Professor Brown, from which a sentence has already been quoted. Not being the words of a medical man, but of a distinguished veterinarian, they are free from the suspicion which attaches to merely medical opinion in the eyes of those who are engaged in farming and dairy-keeping:—

"Milk is often collected, both in country and town, with contemptuous disregard of the most elementary sanitary precautions, amidst surroundings which can only be characterised as filthy.

"Dirty premises, diseased and dirty udders and teats, to say nothing of the state of milkers' hands, are stern realities which may be seen by anyone who is curious in such matters, and they must inevitably lead to contamination of milk with septic bacteria, and often with infective matter, not only from

consumptive cows, but also from the attendants, who are subject to little or no supervision.

"It is true that in some model dairies a contrast to the above description is exhibited, where absolute and scrupulous cleanliness is insisted on. The health of the attendants is strictly watched, and any temptation to conceal a trifling ailment is counteracted by the arrangement which allows the milkers full pay during absence from illness. The slightest sign of udder disease or other disease in any of the cows is accepted, as it certainly should be, as a sufficient reason for excluding the animal's milk from the common stock. Under such conditions milk may be collected as free as possible from specific or common micro-organisms. This degree of care has not yet been generally taken, nor will be until the authorities interpose and insist that the cleanliness and perfect sanitary arrangements, which are now exhibited in a few dairy establishments, must be the only conditions under which the trade of a dairy man can be permitted to continue."

SUMMARY.

1. A farm-house ought to be wholesome in structure, and the steading well supplied with pure water, drained by vitrified pipes, and with privy accommodation for both sexes.
2. The house ought to stand apart from the premises used for dairy purposes. A distinct domestic washing-house is indispensable. The milk-house ought to open into the free air, and be at a sufficient distance from the dung-pit. The dung-pit ought to have retaining walls, an impervious bottom, and a light roof borne on pillars.
3. The byre ought to be well lighted, ventilated and paved, and regularly cleaned.
4. No person who suffers from infectious, or any recent indefinite illness, or who has been in any way in communication with an infected person or thing, should engage in the milk business.
5. The milk of no animal which seems to be ill, or which has any sore about udder or teats, ought to be sold for human consumption.
6. The udders and teats, if soiled, ought to be washed before milking. Soap, warm water, and towels ought to be at hand, and every milker ought to wash hands before beginning.
7. Healthy cattle, healthy servants, cleanliness in every detail of the business of the dairy farm, mean money to the producer and retailer of the milk.

(4) *Report on certain Cases of Sickness and Death occurring among the Workers of Adelphi Horsehair Factory, Glasgow, in March and April, 1878, with Remarks upon the Communication of Animal Poisons by Means of Horsehair.*¹

In order to account for the defects which will be apparent in the details of the cases of sickness and death among horsehair-workers, which form the basis of the following report, it is in the first place necessary to give the history of the circumstances under which they were investigated.

On 7th March 1878, I received a letter marked "Private," directing my attention to a report current on the south side of the river Clyde, that several sudden and mysterious deaths had taken place among the workers in the Adelphi Hair Factory (Messrs. John Fraser and Sons), Govan Street, Glasgow.

I at once instructed an inspector of the Department to make inquiries into the facts, and in the afternoon he reported that he had traced three cases of death after short illness, one on 1st March, and two on the 6th, all being females employed in this hair factory. The bodies of two had been already interred. That of the third I saw about 4 p.m. of the same day, and in order to secure a post-mortem examination and full investigation, I reported the death to the police. Next day I also made a personal statement to the Procurator-Fiscal for the county of Lanark. He ordered a post-mortem examination, which was made by Dr. Samuel J. Moore, one of the Medico-legal examiners for the Sheriff of Lanarkshire, on the afternoon of the 8th. The following statement of the symptoms, &c., in those and in other cases of illness subsequently discovered is compiled from notes made by myself at the residences of the parties, and comprises also all the information which could be obtained from every available source, as to circumstances bearing upon the cases.

1. A. M. L., aged 16, hair-spinner, residing at 32 Silverfir Street, came home from her work at the dinner hour (2 p.m.), 26th February, feeling very ill. She was seized just before leaving off. She said, "I am very bad. My head and my heart!" and laid her hand over her stomach. Vomited everything and constantly called for water. Did not sleep during the first night. Bowels moved twice on 26th, and motions were natural. Continued very restless throughout, constantly covered with a cold sweat, and could not be kept in heat. No

¹ Appendix No. 7 to Report by Medical Officer of L. G. B. of England for year 1878.

convulsions. Became "Blue like Magenta" before her death on 1st March. Was seen by Dr. Menzies about an hour after death. Red blood oozed from the nose and mouth soon after death, but no blood was observed in stools or expectoration during life. No broken skin or local swelling was observed by those who laid out the body. The death was registered as from an "unknown" cause, and the body was interred on the 5th March.

2. M. M'C., aged 32, "yard-woman" in hair factory, residing at 63 Nicholson Street. Usually employed hanging up the hair-ropes in the stove after steaming, but had fed a hair-carding machine for a few days before her dismissal on 4th March for misconduct (drinking). Came home at breakfast hour saying she was not to get back to her work. About 5 p.m. went to bed, complaining of "lightness in the head" and pains in her chest and stomach. Had cold sweating that night. Throughout was very cold. Did not vomit but had great thirst and drank water copiously. Was always very restless, so that could scarcely be kept in bed. Skin became blue, and her whole aspect at the close of her life reminded her mother of people she had seen dying of cholera. Her bowels were moved by medicine. Never passed blood by stool or expectorated blood. Had often been observed to cough and spit up black stuff after coming from her work. Died 6th March at 8.30 a.m. Body seen by Dr. Barrie four hours after death. Blood began to ooze from nose and mouth very soon after death. The death was registered "sudden, supposed heart disease," and the interment took place on the 7th. No broken skin or local swelling was observed by those who laid out the body.

3. A. N., aged 26, "yard-woman" in hair factory, residing at 46 Rose Street, S. Employed in carrying hair-ropes from the spinning room to the steam-chest in yard. Came home at the breakfast hour on 4th March, saying she was very bad, pained all over, but especially in the head, back, and stomach. Slept well that night, but became very restless next day, vomiting frequently, and being very thirsty. On the morning of the 6th was greatly exhausted, still vomiting, but no diarrhoea, no blood in stools or expectoration. No convulsions or cramps. Was first seen by Dr. Mullan about 15 minutes before death, which took place at 3 p.m. on the 6th March. The body was seen by me at 4 p.m. on the 7th, when blood was oozing from nose and mouth so as to soak a towel and the pillow and bed-clothes. A post-mortem examination was made at 3 p.m. on the 8th, under warrant from the sheriff, by Dr. S. J. Moore and myself. No broken skin or local tumour was discovered. The body was enormously swollen from advanced putrefaction. A report was duly made to the Fiscal by Dr.

Moore, but owing to the state of the body the pathological appearances were entirely destroyed. In our opinion they pointed to some form of blood-poisoning as the cause of death.

Contemporaneously with those three fatal cases of illness there were four girls attacked with symptoms apparently the same in kind, although much milder in degree, and all ending in recovery, viz. :—

1. C. D., aged 24, hair-spinning machinist, residing at 37 Dale Street. Took ill on 1st March with severe pain and "lightness" in the head, also pain in stomach, right side of abdomen, and chest. Felt nausea, but vomited little. Had quite recovered, excepting a sense of weakness, on 9th.

2. M. H., aged 24, hair-spinning machinist, residing at 5 King Street, City. Seized with exactly the same symptoms on 1st March. Was seen by me on the 7th, when she was suffering from debility but recovering.

3. H. C., hair-spinning machinist, residing at 27 New Wynd. Seized at the same date, with the same symptoms. Seen by me on the 7th sitting up, and recovering, but weak.

4. B. R., aged 19, hair-spinning machinist, residing at 42 Thistle Street. Seized on 7th March with the same symptoms. Was seen by me at 4 p.m. on that day, when pulse was 96, and temp. 99 deg. F. Still nauseated. Vomiting throughout more urgent than in other cases. Was able to rise next day, and recovered.

Another contemporary case of illness is worthy of special notice from the presence of a local lesion, which was absent in all the other cases, viz. :—

5. S. F., aged 20, hair-carding machinist, residing at 41 Charles Street, N. On the evening of 1st March returned from work feeling ill, and was unable to turn out next morning. Observed a pimple on outer aspect of left upper arm. Not aware of having pricked herself or being otherwise injured there. On Monday 4th March went to work, but had to return home. On the 5th Dr. Walker saw her. Had headache, and arm was slightly swollen. Seen by me at 6 p.m. on the 7th. Her pulse was 120, the axillary temp. 101 deg. F. The tongue was coated with thin yellowish fur. Complained only of pain in left upper arm, the outer aspect of which was much swollen, the tissues, brawny, and the skin tense and red. At seat of pimple there was seen a *black* spot, as large as a threepenny piece. Arm being poulticed.

On the 8th at 11 a.m. her pulse was 96, and the temp. 99 deg. F. A crop of miliary pustules had appeared over the inflamed area surrounding the black spot, which was larger. Swelling more diffused round her arm, but pain was considerably less. On the 9th, I found the girl up, and dressed, but

looking very pale and faint. Her tongue was clean, the constitutional symptoms gone, and the local swelling less and the pain gone. She recovered gradually, the illness leaving great debility behind it.

On 1st April I received intimation of the death of another hand employed in the hair factory, but not in the hair department. The following is the history of the case :—

M. D., aged 20, fur-cutter in Adelphi Horsehair Factory, residing at 3 Saracen Lane. On 29th March was seized with slight shiverings and colicky pains in her bowels. Next day observed a swelling of left cheek. On the 31st this swelling had extended down over neck, and she consulted Dr. Meighan at his surgery, 219 Gallowgate. He has drawn up for me a full report of the case, which, after reciting the facts already given, proceeds :—"Patient said she felt slightly giddy, but had no distinct head-ache. The tongue was dry and furred, and brownish in the centre, the pulse was full and bounding, 90 in the minute. Skin of body generally was dry, but not hot to touch. The face showed a circumscribed flush on each cheek. The swelling covered chiefly the parotid region, extending downwards as far as the clavicle and spine of the scapula, backwards over the side and back part of the neck as far as the vertebral spine, and upwards by a narrow ridge over the zygomatic arch on to the temple and forehead. The swollen part had a firm brawny feel and pitted slightly on pressure. There was but slight redness and no pain or tingling. I noticed also a swelling about the size of a crown piece on the left side of the forehead. Its surface was glossy and had a livid hue, with a reddish elevated spot in the centre, and on inquiry, the patient stated that two or three days before, this had begun as a small pimple which became itchy, and the head of which had been broken off by scratching. She also stated most particularly that the appearance of this pimple had preceded the other symptoms, both local and constitutional. This swelling was firmer and more inflamed than the other swollen parts, and she complained of throbbing pain in it. I cauterized the pimple with acid nitrate of mercury, and prescribed carbolic acid internally. At 8 p.m. I again saw the patient. She was sitting up in bed, very restless and anxious. The swelling had increased considerably, and had now extended to two inches below the clavicle and spine of scapula on the left side, crossing to the right side of the neck in front. Her cheeks were more deeply flushed. The whole of the swollen part had now become of a deep red colour. The lividity on the forehead was also more marked. Patient complained much of thirst; she felt frequently inclined to vomit, and the bowels had been purged two or three times during the evening. She had also

colicky pains in the bowels at intervals. Pulse 120, soft, and irregular. Breathing was oppressed and laborious, and she complained of a choking sensation in her chest. There was marked foetor of the breath. I did not see the patient again, as she died at 4 a.m. on next day (1st April). I heard from her friends that she had vomited several times and had frequent desire to empty the bowels. She soon however became very prostrate, and was comatose for some time before death."

Dr. Meighan certified that the death of M. D. was caused by "malignant vesicle."

The case was reported to the Fiscal, and a post-mortem examination of the body was made under a sheriff's warrant on 2nd April in the mortuary of the Central Police Station, 36 hours after death, by Dr. Moore, in presence of Dr. Foulis, lecturer on pathology in the Royal Infirmary Medical School, and myself. The following is an extract from Dr. Moore's official report:—

"The body was well developed and bore no mark of violence. Rigor-mortis was partially present. A little froth exuded from the mouth and nostrils. A small discoloured patch was observed on the forehead as if produced by nitrate of silver, in the centre of which there was a scab. There were a few very small petechial spots over the sternum and breast. There was a swelling on the left side of the neck, and over the left shoulder. Post-mortem hypostasis well marked over the back. The brown mark on the forehead on being incised appeared to be quite superficial. There was no œdema at the part. On cutting into the swelling on the neck, the tissues were very œdematous, and on incising the part deeply, some cheesy glands were observed. The tissues on the left shoulder and over the upper part of the chest were also very œdematous.

"*Chest.*—The trachea contained some froth, but its lining membrane appeared normal. On removing the sternum the anterior mediastinum was found to be very œdematous. The right chambers of the heart and the large vessels leading thereto were filled with thin fluid blood of a dark red colour. The left chambers were contracted and empty. The lungs were bound to the parietes by old adhesions. At the lower and back parts they were much loaded with thin dark red blood which exuded freely from the cut surface. *Abdomen.*—Some parts of the mesentery, and of the peritoneum were œdematous. The falciform ligament of the liver was very œdematous, and the serous fluid infiltrating it had a turbid, almost milky, appearance. There was a considerable quantity of straw-coloured serous fluid in the abdominal cavity. The stomach contained some partially digested food and some fluid. A few spots of extravasation were observed in the mucous membrane. The

spleen was slightly enlarged and pulpy soft. The liver and kidneys seemed normal. Nothing further worthy of note was observed. The stomach and its contents were placed in a jar, sealed and labelled for further examination if considered necessary. Microscopic examination of some of the fluids was made as the dissection was conducted, and a portion of lung was retained for microscopic examination of the mucus in the air passages."

Dr. Foulis reports the results of his examinations:—"In the vicinity of the glands of the side of neck the cellular tissue was much swollen, and œdematous, and there was decided œdema in the anterior mediastinum down to the diaphragm. The fluid of those parts had a peculiar opalescent appearance, and on microscopic examination crowds of the *Bacillus Anthracis* were observed in a clear colourless fluid. Some of the blood from the œdematous regions of the neck was also examined and found to contain the same bacilli, though in less abundance. The same may be said of the blood from the heart. The red corpuscles did not tend to arrange themselves in rouleaux. The bacillus rods were motionless, of a dimly transparent pale aspect, and of the length of two or more diameters of the red blood corpuscles. The mucus in the air passages contained the usual products of catarrh of the mucous membrane, a very few bacilli, and no dust or portions of hair."

The first question is—what was the nature of the disease which attacked those hair-workers? As I am chiefly concerned with the circumstances under which the disease arose, and its relations to this special trade, I shall state at once, and without discussion of the symptoms, appearances, &c.,¹ that all these

¹To aid in the intelligent consideration of these cases, I give from Hirt (24) and Bollinger (23) the following compendious account of the chief symptoms and post-mortem appearances of *internal anthrax*. The *external* carbuncular form is easily recognised, and therefore need not be described:—

"Malignant anthrax œdema is distinguished from malignant pustule in this, that the vesicle and primary pustule are absent. There is no essential difference in their future course. The œdema, a pale yellow swelling, is observed at first only on the eyelids, but spreads later to other parts of the body. The intestinal mycosis arises from internal infection. Its symptoms have been carefully investigated only recently. The initial stage of this affection is scarcely to be distinguished from that of other acute diseases. Depression, faintness, headache, giddiness, and gastric disturbance ensue, and a painless, sometimes bloody diarrhoea sets in with increasing force, leading very frequently to speedy collapse. The patient is often tormented with violent headache, and colicky pains in the abdomen; the respiration is painful and frequent, the pulse quick, and sometimes there are epileptiform convulsions, opisthotonus, and dilatation of the pupils. Local lesions on the skin in the form of small carbuncles, and upon the mucous membrane in the form of hæmorrhagic effusions may frequently be found. A fatal termination has ensued in almost all hitherto observed cases, generally between the first and seventh day after the outset of the illness" (Hirt, p. 104).

The post-mortem appearances in *internal anthrax* are thus summarised by Bollinger:—"In the abdominal cavity there is generally a moderate serous or sero-hæmorrhagic effusion, and sub-peritoneal suggillations in moderate amount;

cases were in my opinion but various forms of the disease known as Anthrax, Charbon, Milzbrand, Splenic Fever, Malignant Pustule, &c., &c., which is primarily an affection of horses, horned cattle, and sheep, but which may be propagated among all warm-blooded animals, including man. The contagium is demonstrated to be the *Bacillus Anthracis*, a fungoid organism which infects the blood and tissues, which in its full development assumes a rod-like form and is very perishable, but which propagates by spores which are very tenacious of life, and in fact are, when dried, practically imperishable. These organisms were actually observed in the blood of M. D., when examined microscopically. From the general and local symptoms, we have seen that Dr. Meighan certified her death to be from "malignant vesicle." I may also add that Dr. Hector C. Cameron, surgeon to the Royal Infirmary, had no hesitation in agreeing with me that the girl S. F. had "malignant pustule," the whole aspect of the case reminding him of a patient, a hair-worker in the same factory, who died in 1876 from that disease, in whose blood also the bacillus was detected by Dr. Foulis. The particulars of this case will be given subsequently.

The variety in the nature of the disease in these cases has an interesting and important bearing upon their causation, and may, therefore, be more particularly discussed.

Anthrax assumes different aspects, apparently depending on the mode of access obtained by the infecting organism to the system, *i.e.* according as it is inhaled or swallowed, or enters locally by the hair-follicles or other natural or artificial openings in the skin. In the former case it is called charbon fever (*fièvre charbonneuse*), intestinal or internal anthrax, and mycosis intestinalis, the symptoms being from the outset constitutional. To this category the cases of A. M. L., M. M'C., and A. N. belong. In the latter case it is known as malignant pustule, charbon, or anthrax proper, the constitutional symptoms being preceded by, or at any rate advancing *pari passu* with certain characteristic local appearances of the nature of a carbuncle or pustule. To this class belongs the case of S. F.

The last fatal case, that of M.D., also belongs to this class, but to the most rapidly fatal form of local infection, or it may be to a combined local and constitutional infection, in which the specific contagium at once passes from its local nidus into

the retro-peritoneal and mesenteric connective tissue is infiltrated, jelly-like and of a yellowish and reddish colour" (p. 419).

In all cases the detection of *Bacillus Anthracis* in the extravascular fluids and blood is decisive of the nature of the disease. Rapid decomposition, with its external phenomena—swelling, discolouration, sanguineous exudations from the mouth and nose, etc., are always observed.

the surrounding tissues, and thence permeates the whole body. This has been styled œdematous charbon (*C. Œdemateuse*), malignant œdema (*Œdème Malin*), or malignant anthrax œdema (*Bösartige Anthrax Œdem*).

The general circumstances under which anthrax manifests itself in man are these: It is always observed in persons employed, either in the care of animals during life, in their slaughter, or in trades and manufactures connected with the utilisation of the various parts of animals. The localities in which outbreaks have been observed in man are therefore either anthrax districts, *i.e.* districts where anthrax is prevalent among animals, or places at a distance where it is unknown as an epizootic, but to which, in the course of commerce, the products of infected animals may be conveyed. As every single item of these products may be a carrier of infection, the ultimate place of manifestation of the disease is as varied and widely distributed from the original focus as the products and their destination. Hair, wool, bristles, hides, horns, hoofs, &c., being valuable articles of commerce and in wide request, those parts of animals have furnished the most startling demonstrations of the vitality and portability of the disease by its propagation to man. Hirt (24) thus enumerates the various classes of workpeople who have suffered:—"Tanners, makers of coarse hats, fellmongers, furriers, fur dyers, workers in horsehair, wool, and paper factories, and ropemakers who clean hair brought from abroad, *e.g.* from Russia" (p. 102). This reference to the special likelihood of Russian hair conveying the infection shows that anthrax may so constantly be present in certain countries as to mark out the spoils of their animals as specially likely to contain and convey the disease. We are told by several writers that there is no country where anthrax is more constantly present and severe in its ravages among horses and horned animals than in Russia, especially in Siberia. In Siberia horses are the chief victims. Naturally cases in man are also very frequent there, resulting in epizootic years in hundreds of deaths. This sufficiently accounts for the circumstance that "Russian hair" is very frequently mentioned in records of outbreaks of anthrax among hairworkers; and hair is more frequently associated with such outbreaks than any other animal product.

A few references will prove how thoroughly recognised by continental writers were those risks of the hair trade. The first also shows how very early Russian hair gained an unfortunate notoriety in this relation.

Heusinger (8) quotes from the "Memoirs de l'Académie de Med." so far back as 1777 the following passage:—"Malignant carbuncle in Paris as a rule only affects those engaged in two

trades, the tallow-chandlers, or those who work with mutton fat, and horsehair workers. The latter are most frequently affected; indeed it is seldom that they pursue this trade long without suffering from it, and many die. They have observed that the hair whose manufacture is most dangerous is that which is imported from Russia. This hair is usually in a bad condition; a part is sometimes transformed into grey dust, and has a disagreeable smell. The case of carbuncle which Paulet saw was that of a young woman who had opened a bale of this hair" (p. 403). In 1822 Patissier published a book (1) based upon Ramazzini's historic treatise "De Morbis Artificum" (Padua 1713), a section of which is entitled "Maladies des Criniers." He there states:—"Workmen who unpack bales of hair and who beat them are liable to contract malignant charbon and boils. The 'Gazette de Santé' (March, 1777) contains the history of some workmen who had been attacked with those diseases after having without sufficient precaution opened and sorted bales of hair imported from Russia" (p. 242). In 1860 Vernois, in his "Traité pratique d'Hygiène industrielle" (12), has an article "Crins (Préparation des), Appret et teinture" from which we learn that this trade was by the French Government in 1843 placed in the third class of dangerous employments as requiring police supervision. Among the "causes d'incommodité" he mentions:—"Dust in the beating and sorting rooms. Sometimes the occurrence of serious mishaps to the workers, through the hair being impregnated with the blood of animals dying of charbon or glanders." In Tardieu's "Dict. d'Hygiène" there is an article, "Criniers," in which those risks are mentioned as common, and certain precautions are recommended. Eulenberg (20) and Hirt (24) have similar references. This is enough to establish the statement that since the earliest systematic treatises on industrial hygiene, the dangers of the manufacture of hair as a medium for the conveyance of animal poisons to man have been recognised and amply discussed by foreign authors.

The fact that anthrax is enzootic in the pastoral districts of all the chief European countries excepting Great Britain, sufficiently accounts for the circumstance that all our precise knowledge of the disease, both in the lower animals and in man, is derived from the observations and investigations of foreign writers. It is, nevertheless, remarkable, considering our commercial relations with those countries, and the existence among us of old-established and extensive hair factories, that so far as I can discover only one casual record has been made of malignant pustule in connexion with an English hair factory.

Indeed in Thackrah's (4) small treatise on trade diseases,

published in 1831, the first work in the English language devoted to the systematic treatment of this department of hygiene, we find this passage, which proves that it was not want of knowledge or observation of the hair trade in its health aspect which caused the communication of specific infection to be overlooked:—"Preparers or dressers of hair—men, women, and boys—are in an atmosphere of dust and stench, especially when employed on the foreign article. The winnowers suffer most. The complexion is soon rendered pale, the appetite reduced, the head affected with pain, respiration impeded, cough and expectoration established, the body emaciated. I scarcely need add that life is sacrificed to a continuance of the employ. In most baneful arts and occupations the wages are high, but here we find with surprise that a winnower does not earn more than 4s. 6d. or 5s. a week. For what a pittance is health broken and life destroyed! But why should the winnowing be effected by hand at all? Why not employ machinery to turn the fan? Or why not collect the dust in a box and carry it off through a wooden chimney by the current from the fan? Few persons indeed are employed in the dressing of hair, and fewer are acquainted with their situation and suffering. This may palliate, but cannot excuse the neglect" (p. 69). Therefore "foreign" hair was then imported into England, but was known only as more productive of "dust and stench" than the home article. That specific infection was not observed even more recently becomes the more remarkable when we remember that Dr. William Budd read a paper before the British Medical Association in London in 1862, entitled, "Observations on the Occurrence of Malignant Pustule in England, illustrated by numerous fatal cases" (published in "British Medical Journal" for 1863). At that date he could not refer to a single case in association with a hair factory in this country (evidently not being aware of Mr. Lawrence's cases, which were published in 1847), but he quotes two continental examples. Yet with these suggestive incidents, so widely published, no similar mishap seems to have attracted attention in this country during the intervening 16 years. Additional facts made out in reference to the Glasgow Hair Factory, discovered and interpreted in the reflected light of the events above recorded, make it unfortunately too probable that we cannot infer from the absence of any record of such outbreaks of anthrax among British hair workers that no such outbreaks have occurred. The probability is that they have occurred from time to time, but being chiefly of the intestinal or internal variety, as in the present instance, they have not been recognised.

I have not been able to obtain full details of all the hair

outbreaks recorded, but it will be useful to collect such facts as I have alongside of the Glasgow cases, before considering the circumstances special to this trade, which originate and facilitate those accidents, preparatory to suggesting preventive measures.

Rayer (3), states:—"During the three years I was attached to the Hospital St. Antoine, I saw several cases which all came from the same manufactory, in which the business of cleansing and preparing hair, imported from Russia, was carried on" (p. 558). Budd refers to this statement and says that these cases were eight in number, and calls them "malignant pustule," but Willis' translation of the second edition (1835), to which alone, and to the original first edition (which contains no mention of the facts), I have had access, specifies no number.¹ In the translation one hair factory case is detailed, and three casually mentioned, all of date 1829, on the statement of one of those patients. Two are undoubted illustrations of the true external anthrax, the local tumor being on the face and neck in one and on the thigh in the second. All were fatal except this last. Rayer says: "According to the patient, weakness, prostration, and spitting of blood are symptoms of frequent occurrence among the workers in hair. His daughter had died after an illness of five days, with symptoms of this description, and one of his fellow labourers had sunk, some time previously, in two days" (p. 567). This rapidly fatal case is certainly suggestive of the internal form of the disease. Another fatal case of external facial anthrax is detailed, which occurred in a female "carder of mattresses." Proust (19), also refers to the liability of "mattress-workers" to charbon. Budd says, "I think it is the same writer (Rayer), who records the still more remarkable case of three persons who were attacked with the disease after cleaning some hair that had for many years served as the stuffing of an easy chair." I have not been able to verify that reference to Rayer, but such an occurrence is quite within the range of possibility. Given the contagium in a dry condition, and it seems to have no limit to its potential vitality.

There is a valuable special paper on the association of hair manufacture with charbon, by Dr. Ibrelisle (5), published in the "Annales d'Hygiène" (1845):—"Sur les Accidents qui peuvent resulter de la Manipulation des Crins." It is introduced by the following remarks on the general question by the editors:—"Experience has superabundantly proved that animal matters long accumulated yield a dust which is extremely injurious to persons who breathe it. This is especially

¹ There was a new edition of Rayer published in 1845, to which Budd no doubt refers, but which I have not seen.

true of hair. This material, charged with cutaneous secretions and blood, befouled by fecal matters which escape at the moment of slaughter or of natural death, is packed in bales to be exported from Brazil, Buenos Ayres, or Russia. It yields a dust from animal debris, fermented and changed in character, which will certainly prove poisonous if inhaled in great quantity. It is not necessary for the explanation of this poisonous property, to assume that the animals have died of contagious diseases" (p. 339).

The editors of the "Annales d'Hygiène" doubt the specificity of the effects of foul hair; and certainly Dr. Ibrelisle's cases of malignant anthrax are peculiar in this, that they were distinctly associated with other cases of boils or simple furuncle. They occurred among the male prisoners in the prison of Metz, and only among those who were employed in beating, picking, and teasing hair. In May, 1842, four were seized with boils, appearing in numbers on the back, the neck, the arms, and the thighs in each case; preceded by debility and gastric disturbance. These were followed by a fifth case having all the characteristics of "true charbon" on the right neck. In succession there were six similar cases, the anthrax postule being on the neck in four, on the cheek in one, and on the loins in another. Besides these characteristic cases there were five of an intermediate character, the local lesion being on the shoulders, neck, and thigh, and lastly, eleven cases of simple boils like the first four. Dr. Ibrelisle says that the employment was very dusty, and that the foreign hair produced a risk not only from the dust, but from contagious diseases; but he adds, "I attribute to a common cause the eczematous eruptions which I have observed, from 'le furuncle simple' to 'l'anthrax grave.'"¹ He bears distinct testimony to the fact that these risks were well known to attend all hair manufacture. "Medical men who have studied the diseases of artisans, regard work among hair as very dangerous to those who engage in it." One-third of all the prisoners engaged in this work were attacked, an excessive proportion, which he attributes to the small ill-ventilated cells in which it was carried on.

Trousseau's cases are quoted frequently (7). He states (Gaz. Med., January, 1847) that in two Parisian factories for working up horse-hair from Buenos Ayres, and in which only six or eight hands were employed, 20 persons died in the course of 10 years from malignant pustule. He himself treated three cases from the same factories, successfully by means of severe cauterization.

¹ These facts and opinions, especially the facts, are very interesting in view of the theory of the late Dr. Laycock that ordinary carbuncle arises from the imported poison of "epizootic carbuncle." See paper on "Contagious Furunculoid."—*Edinburgh Medical Journal*, June, 1857, Part I.

In the Second Annual Report of the State Board of Health of Massachusetts, U.S.A., for 1871 (19) there is a paper giving a very complete account of 26 cases which occurred between 1853 and 1870 among the workers in a hair factory in the town of Walpole in that State. This paper is all the more valuable to us that it views the subject from a preventive aspect.¹

The whole history is so analogous to what we shall subsequently see has been the history of the disease in the Glasgow Factory that I must give it in some detail. The first case occurred in 1853. A workman was taken suddenly ill and died in two days, a well marked characteristic vesicle having in the meanwhile appeared. The next case occurred in April, 1861, when "another man expired after an illness of 24 hours, having obscure symptoms of blood-poisoning, but without the appearance of any vesicle. Two months later this was followed by another case, accompanied by a vesicle upon the neck." *These isolated cases attracted little attention at the time.* "In March, 1866, another operative died, manifesting unmistakable symptoms of charbon, and from that time till July, 1869, the disease seems to have lurked about this same factory, indicating its presence at pretty regular intervals. During this period seven or eight cases have occurred each year, the average number of operatives employed being about eighty." The following table shows the total number of cases up to November, 1870, their nature and results:—

| | Cases. | Died. |
|---------------------------|--------|-------|
| Malignant vesicle - - - - | 15 | 5 |
| Internal lesions - - - - | 10 | 8 |
| Malignant Oedema - - - - | 1 | 1 |
| Total - - - - | 26 | 14 |

In the 15 cases of malignant vesicle the external lesion was situated in six cases on the neck, in five on the face, in one each upon the shoulder, nose, scalp, and arm. Of the eight fatal cases of internal anthrax five succumbed within 24 hours of the attack. Of the 26 cases, 24 were employed in manufacturing curled hair. Of the other two, "one was a carpenter, who a short time previous to his attack had worked about the buildings connected with the factory, and the other was seized shortly after having nursed her husband who had been ill with the same malady." As to the source of the hair which introduced the poison we are informed that it was "sheared from the necks and tails of living wild horses, and is imported in bales for the most part from Buenos Ayres, a small portion only being brought from Europe." This latter statement suggests the question whether the "small portion" was of Russian

¹ See also Dr. Stone's paper (16) for fuller medical details.

origin, but no further information is given. The process of manufacture was much the same as that pursued in the Glasgow Factory (of which an account will subsequently be given). "During all these processes the hands of the operatives are brought constantly in contact with the hair, while in the vicinity of the picking machine the air is loaded with minute particles of dried animal matter, so that there is every facility for absorbing the poison by both contact and inhalation." It is noted that some specimens of the hair were quite clean, while others were "often matted together with dirt and putrid animal matter." Repeated inoculation experiments were made upon rabbits with this animal matter, but "without producing any characteristic effects."¹ In other American towns there are larger factories than that in Walpole, supplied with hair from the same sources, and "the most careful inquiry has failed to discover a single instance of the disease, or anything resembling it in any other factory." The importers asserted that no similar accident had ever come to their knowledge. The bacillus anthracis was discovered by Drs. Stone (16) and Hodges (17) in two of the cases, one of external pustule, which, though very severe, ended in recovery, and one of the internal variety, which ended fatally.

In Mr. South's additional notes and observations, in his translation of Chelius's "System of Surgery," (6) published in 1847, I find the only record of cases of malignant pustule arising in an English hair factory. Three cases were communicated by Mr. Lawrence, who says, "In the other instances, both of which were persons employed in a horse-hair manufactory, the skin had sloughed before they came to the hospital. The affected portions were circular, the size of a shilling in one, on the front of the chest, that of a sixpence in the other, on the forearm. There were no other local symptoms nor the slightest constitutional disturbance." (Vol. I., p. 69.)

In a paper by Wagner (22) "Die intestinal Mycose und ihre Beziehung zum Milzbrand," there is a history of a series of cases observed in Leipzig with ample details of symptoms, pathological appearances, and microscopic examinations of the tissues and fluids. We shall confine ourselves to the facts bearing upon their ætiology. (1) A dyer of sable furs died in hospital two hours after admission, 25th November, 1872, his illness lasting about 24 hours, ending in epileptic convulsions, opisthotonos, and coma. (2) A hair rope spinner, aged 23, who had been engaged in the manufacture of Russian horse-hair, walked into hospital 31st March, 1873, complaining of diarrhœa, cramps confined to his left side, and colicky pains,

¹ Virchow (10) made similar experiments on dogs and guinea-pigs with the same unsuccessful results (p. 387).

his illness having begun 24 hours previously. He went to bed, and died almost immediately. (3) A clerk, aged 30, entered hospital 26th June, 1873, and died in 12 hours. Awoke feeling ill on 21st but worked till 24th. He was employed in the goods department of a railway. (4) A message-boy, aged 16, employed in a factory where Russian horse-hair was in hands; observed a vesicle at left angle of lower jaw on 30th August, and entered the hospital on 1st September collapsed and cyanotic. He died on the 3rd. These cases furnish the basis of the paper, but the following are collected and added:—(5) A hair rope spinner, aged 18, employed in the same work as (1) who had been carding Russian horse-hair which was intermixed with ox-hair, died a week after observing a vesicle under his chin, 20th February, 1870. (6) This case led to the discovery that "a workman in the same work had two months previously become suddenly ill, and died quite unexpectedly. A homeopathic practitioner regarded the case as pneumonia, although he thought it obscure, and could not account for the death." (p. 29.) (7) A hair rope spinner, aged 21, died 6th July, 1857, with symptoms of peritonitis after an obscure illness of about a week. (8) A bristle binder, aged 60, died 27th March, 1875, after a rapid illness of 24 hours, in which headache and vomiting were prominent symptoms. In cases 1, 2, 3, 4, 5, and 8, the *bacillus anthracis* was found in abundance, especially in the extravascular fluids, but also in the blood occasionally. Cases 6 and 7 are associated by Wagner with the others in the light of their ascertained nature, as being the same disease, but not recognised at the time. He also gives references to similar cases, not however in hair-workers, and quotes Neyding of Moscow, as saying that malignant pustule was observed by him most frequently in workers in hair and bristle factories. Münch also had examined in Moscow, within four years, no fewer than 28 bodies of persons who had died of this disease. In 15 there was external carbuncle, in two it was very small and insignificant, and in 11 there was no external lesion whatever. These cases mostly originated in works where horse-hair and similar products were manufactured.

Wagner adds that such cases were unknown in Leipzig, in works where Russian or Siberian horse-hair was not manufactured, and that workpeople employed in the same work which supplied the fatal cases of internal anthrax had been treated for external anthrax in the surgical department of the hospital. He states that this hair was extremely dirty, and thinks that the bacteria get access to the stomach with food, especially with breakfast and afternoon refreshments, which are taken during work in the workroom, the viands being

powdered with infected dust, or contaminated by the unwashed hands of the workers.

We see, therefore, that in Great Britain, France, Germany, and America, Russian hair has proved itself to be *par excellence* a dangerous material—the most dangerous hair in use; while not unnaturally in Russia itself the occurrence of anthrax infection in hair factories may be said to be frequent and deadly.

The Adelphi Hair Factory buildings are very extensive, as may be seen from the accompanying plan and this bird's-eye view.¹ The particular part of the trade allotted to each building is marked upon the plan, so that it can be readily made out where the processes to be described are carried on. It is not my intention to describe all the processes of all parts of the manufacture of the different sorts of hair, but principally to give an idea of those applied to the hair in question. The hair is received in bales, and is treated differently according to quality and destination. Some is first of all passed bit by bit through the hands of women, who with considerable nicety of touch tease out and assort the various colours and qualities, removing in the process the grosser impurities. This is mostly done in the basement flats on the extreme left, and at the end of the enclosure opposite the main entrance. Some hair, such as that which caused this outbreak, is not sorted but is first unpacked from the bale to be subjected to the process of "willowing," in machines which by violent rotation and disturbance remove all dust and animal debris. It next passes on to the "carding machines," which remove all the finer dust, and improve the gloss and elasticity of the material. These machines are ranged in a long shed open to the roof, and are constantly surrounded with an atmosphere of dust. Their whole work is effected by rapid movement and disturbance of a parched unadhesive material, charged with dry debris, which it immediately sends off in the form of dust. It is not, therefore, in the nature of things possible that the work of feeding and tending these machines can be prosecuted without filling the lungs, and powdering the exposed skin and garments of the workers with this dust. The hair is now ready for the spinning and curling machines. For this purpose it is conveyed up a broad open stair, from one end of the machine-shed to the second flat of the building on the extreme right, which is open from end to end, and from side to side, and is lofty, airy, and well-lighted and ventilated with numerous windows. The operation of spinning closely resembles that of ordinary rope making. The girls carry the loose hair in bags tied round

¹ Not reproduced here, but included with original report which forms Appendix No. 7 to Medical Officer's Supplement to Eighth Annual Report of Local Government Board (England).

their waist, retreating backwards, applying successive portions of hair therefrom to the revolving rope, so that any remanent dust or microscopic particles are thrown up just about the breathing level. The tightly twisted and coiled ropes are now carried down the stair *through the carding shed* to large steam chests in the yard, standing in the open air at the foot of the chimney stalk on the left, where they are boiled and steamed for 20 or 30 minutes. On being removed from these vats the ropes are hung up in stoveing chambers on the basement flat of the building on the extreme left to be dried. The object of this is to "set the curl" and give the necessary elasticity to the manufactured article.

The special hair which was in hand at the time of the recent outbreak of anthrax is known as "Raw Russian manes," and being required of its natural mixed colour in the manufactured state was not assorted, but passed at once into the "willowing" and "carding" machines. The "Russian manes" were on this occasion put in hand on 16th February and withdrawn upon 2nd March, when the news of the death of M. L. on 1st March came to the ears of the proprietors. The relation of the illness of the workers attacked to these dates, and the nature of their employment, &c., will be seen at a glance from the following tabular statement:—

| Name of Worker. | Nature of Work. | Date of | | Duration of Illness. | Form of Disease. |
|-----------------|-----------------|------------------|-------------------|----------------------|------------------|
| | | Sickening. | Death. | | |
| A. M. L. | Hair spinner | 26th Feb. 2 p.m. | 1st March | 3 days | Internal A. |
| M. McC. | Yard woman | 4th March 5 p.m. | 6th do. 8.30 a.m. | 39½ hours | Do. |
| A. N. | Do. | 4th do. 9 a.m. | 6th do. 3 p.m. | 54 hours | Do. |
| S. F. | Hair carding | 1st do. | - | Recovered | External A. |
| C. D. | Hair spinner | 1st do. | - | Do. | Internal A. |
| M. H. | Do. | 1st do. | - | Do. | Do. |
| H. C. | Do. | 1st do. | - | Do. | Do. |
| B. R. | Do. | 7th do. | - | Do. | Do. |
| M. D. | Fur Cutter | 29th do. | 1st April, 4 a.m. | 3 days | Mal. Œdema. |

The "yard women" were employed in the steaming of the hair ropes. A. N. took the ropes from the spinning flat and put them in the steam chest, necessarily passing through the carding flat in the transit. M. McC. hung up the ropes in the drying stove after boiling; but it will be remembered that for three or four days before her dismissal, she had fed one of the carding-machines. With these explanations a consideration of the nine cases of sickness yields the following results: Five cases sickened within the "Russian manes" period; two in two days thereafter, one in six days, and one in 27 days thereafter. Classified as to their departments, five were engaged

in hair spinning, and one went into the hair spinning flat to remove the ropes; two were engaged in hair carding or "willowing," and one was employed in a distinct department of the business, fur-cutting, *i.e.* tending a machine which shaved the fur off rabbit skins for the felt hat trade. As to the form of disease, there were seven cases of internal anthrax, of whom six were hair-spinners and one removed the ropes from the spinning flat; and two cases of external anthrax, of whom one was a carder, the other a fur-cutter.

Now, assuming the Russian "manes" to have been the source of the contagion, there are two facts which demand explanation: (1) The sickening of four of these workers after this hair had been withdrawn from manufacture. (2) The seizure of the girl M. D. not merely 27 days after this withdrawal, but although she was employed in an entirely different department, and was not necessarily in direct contact with the hair at all. The questions involved in the former case refer to time, in the latter to place and time. What is the incubation period of anthrax and what are the laws which govern its diffusion? Nor are these questions distinct, *i.e.* there may be something in the physical condition and laws of diffusion of the contagium which makes the difficult question of incubation of comparatively little practical importance in certain circumstances. Such circumstances attended the Glasgow outbreak. The incubation period is said by Raimbert to be one to three days; by Bollinger to be sometimes very short, but usually to be three or four or at most five days, and by Virchow to be most usually a few days rarely longer than 11 to 12, but frequently only a few hours, or it may be entirely absent. We might, therefore, bring the actual date of infection of all those cases save one within the "Russian manes" period, since they sickened from two to five days from its cessation; but the exception goes quite beyond such a theory, *viz.*, the fur-cutter who tended a machine for shaving the fur from rabbit skins. She stood when so employed at the corner in the basement flat marked with a x in the plan, immediately opposite a window, in the middle of which was a ventilating pane of glass. Both hares and rabbits have been known to contract charbon in districts where it prevails among cattle, apparently from feeding on the same pastures. Indeed, at the very time of this occurrence in Glasgow, there was an outbreak of this disease among cows at Dalkeith near Edinburgh, and I learn from Principal Williams of the New Veterinary College, Edinburgh, that hares were frequently found dead in the locality, and were ascertained to have died of charbon. Raimbert (14) states that rabbit skins have been known to communicate the infection to man (p. 146). In the present case any such effect

would in all probability have manifested itself at a previous stage of the manufacture, viz., in the process of combing and cleaning to which the skins were subjected before reaching the fur-cutting departments; but I believe that it was not contagion proceeding from the fur, but from the "Russian manes" which originated the disease in M. D., as in the cases of the girls actually in contact with the hair.

This brings us to the general circumstances of the outbreak in relation to the well known characteristics of the contagium of this disease. Here, as in reference to the matter of diagnosis as based on the symptoms and pathological appearances, I shall not enter into a minute discussion of this contagium. It is so easily recognised and isolated that the *bacillus anthracis* has been the subject of most precise observation and experiment which have not only yielded a minute acquaintance with its own habits, but have thrown a flood of side light upon the phenomena of infection in general. Combining the results of those laboratory experiments with the observations so abundantly made as to the etiology of charbon, as seen in veterinary practice as well as in man, it has been ascertained that in the dry state, the contagium has scarcely any natural limit to its vitality, and is invulnerable by any artificial dry application or process. Moisture and the supervention of decomposition in the medium where it resides seem to bring the only natural termination to its organised existence, and infecting powers. Once let the medium in which the resting spores of the bacillus exist be dried, while yet fresh, whether that medium be some part of the animal, as bones, hides, horns, blood, &c., or some external fomites, as excrement, hay, straw, rags, hair, wool, which do not contain the poison in their structure, but include it in their bulk, and those substances become a perennial source of infection in fitting circumstances. Bollinger (23) states, "the customary medium of communication for anthrax poison is the air, whether the carriers of that poison (*anthrax bacteria*) come out of the soil or are derived from living animals. The digestive track holds the second place" (p. 384). "Small and light they [the spores] are wafted by the breeze and either directly breathed in by the animal, or they fall upon the fluid or solid food, and with it enter the body" (p. 393).

If now reference is made to the description of the manufacture in the course of which those cases of anthrax arose among the workers, this is what we find. Those "Russian manes" more or less are derived from infected animals, they are more or less loaded with dried fomites, excrement, fresh desiccated blood, &c. The whole object and result of the various processes of "willowing," carding, and spinning is violently to disturb, dislodge, and dispel in the shape of dust those infected

matters. The result was to create an infected atmosphere which not only pervaded the machine room and the spinning flat, but at the time of this accident must have extended outside, as the arrangements were devised so as to throw the greater part of the debris into the open air through shafts connected with the machines, and discharging on the roof of the machine shed. Hence, as seen from the window of the spinning-flat, there was a constant stream of dust pouring out of the ventilators and the roof of the shed, and even the vacant ground intervening between the two buildings was powdered thickly with this dust, and seeds of various kinds were here and there germinating. There can be no doubt that the more deadly seeds of anthrax were present in this debris, and from their lightness more plentifully suspended in and conveyed by the currents of air. We may, therefore, conceive the poison as not only in the general atmosphere of the yard, but as settling down in quantity on convenient surfaces in corners here and there, ready by a chance puff of wind to be blown again into dust, and so inhaled or deposited upon the skin or about the dress of any unfortunate worker in any department of the work who chanced to be near.¹ Once admit those physical conditions to be correctly described, and everyone of the cases is brought within the scope of their action. All the workers attacked were either engaged directly in the dust-producing processes, or indirectly brought within the sphere of their influence. The case of the fur-cutter is precisely analogous to that of the carpenter in the Walpole outbreak. "A short time previous to his attack he had worked about the buildings connected with the factory." Among Wagner's cases also we find a "message-boy" employed in a hair factory. Why these persons were infected and the many who had casually been exposed had not been infected is a question easily to be solved in perfect consistence with the general phenomena of all infection, which work themselves out in the presence of such controlling circumstances as the physical facts of the case create. The material germs of disease are unequally distributed in the medium which contains and conveys them, and the actual infection follows or not upon the sufficient or insufficient insemination of the individual exposed.

The type of disease communicated corresponds with the conditions under which the infection occurred. Of the nine Glasgow cases, seven were examples of internal anthrax. Of the 26 American cases 10 were internal. Wagner's cases are

¹It is worth noting that the month of March, 1878, was unusually warm and dry. There were only 11 days on which rain fell, and the total amount was but 1.6 inches. The fur-cutter sickened on the 29th, and during the previous 17 days there had been only on two occasions a trifling shower.

all internal. In Russian factories the majority are of this type. Hirt tells us:—"The fact has recently been established that internal infection may occur either through the inhalation of anthrax bacteria with the air, or by their introduction with food. The disease developed in consequence of this infection is identical with Milzbrand, and has been observed and described under the name of Mycosis Intestinalis by Waldeyer in a slaughter-house forage-master; by Neyding and Münch in workers in bristle factories; by E. Wagner in a fur dyer, three ropemakers, and a bristle binder" (p. 103). In all these occupations the material is dry and dusty and the process tends to infect the air, but in none on such a large scale or so necessarily and inevitably as in the manufacture of hair. In it the nature of the trade processes co-operates with the characteristics of the contagium to produce the most favourable circumstances possible for internal infection.

This tendency to internal infection in hair works has an important relation to the fact that so little has hitherto been observed of such occurrences in this country. I have already expressed the belief that this does not prove that the experiences of the continent are exceptional, but rather that here they have passed unnoticed. "In intestinal anthrax, which is much more rare, it is difficult to make a diagnosis from the symptoms and appearances alone. In consideration, however, of the rapid onset of the disease, its acute course, and violent manifestations (diarrhoea, vomiting, cyanosis, convulsions, collapse), and the business of the patient, an accurate diagnosis is possible." (Bollinger, p. 424.)

The proprietors of the Adelphi Hair Factory stated that in an experience of over 40 years, during which Russian hair had been largely manufactured, no such outbreak had occurred, or any mishap to direct their attention to the risks so generally recognised on the continent, though utterly unknown to them. But the narrative of the present outbreak makes it abundantly clear how readily even it might have escaped notice, not to speak of sporadic cases at long intervals such as preceded a similar alarming succession of cases in the Walpole Factory. The death of A. M. L. was registered as from an "unknown" cause; that of M. M'C. as "sudden, supposed heart disease"; that of A. N. as "unknown." Yet now that the facts are before us there can be no doubt whatever, that all three died from internal anthrax. There is therefore ground for suspicion that fatal cases may from time to time have been recorded on similar erroneous or imperfect information. This suspicion assumes the form of a certainty or a strong probability in reference to three deaths of workers in this same factory which took place in 1876-7. My attention was directed to them and

other deaths in connexion with another factory, by the statements of the workers in Adelphi Factory as to such events, the recollection of which was naturally revived at this time. There could be no doubt that in their minds at any rate "Russian hair" was associated with anticipated risks. The first case to which I shall allude was one of malignant pustule admitted under the care of Dr. Hector C. Cameron, into the wards of the Glasgow Royal Infirmary, on 10th October, 1876. The following history is compiled from copious notes made by Dr. Cameron at the time, and kindly communicated to me. I have not dwelt much on the local appearances, which are minutely described, as there could be no question of the diagnosis, which was confirmed by the detection of the bacillus anthracis in the blood.

C. H., aged 19, residing at 237 South Wellington Street, hair spinner. A pimple appeared on 6th October, 1876, on left angle of lower lip. It was black in the centre with a yellow ring outside the black, like a "shilf-corn" or a flea-bite. She made no complaint until 8 p.m. on the 7th, having gone to work that day. She then felt "out of sorts," and took some laxative medicine. The lip swelled up in the words of her mother, "as fast as a loaf in an oven." She was out of bed on the 8th, but on the 9th, felt very weak and was very restless. On the 10th, about mid-day, she entered the hospital, pulse 120, and the local appearances entirely typical of malignant pustule. Passed a very restless night, constantly endeavouring to get out of bed. On the 11th, her pulse was 140, temp. 104.4 deg. F., her respirations rapid and laboured; much moaning and restlessness. A plentiful crop of small vesicles and pustules had appeared over trunk and limbs, interspersed with numerous minute hæmorrhagic spots, permanent on pressure. On the 12th the patient was evidently sinking, pulse 140, respirations 50 per minute, and temp. 103 deg. F., in morning; passed everything in bed. The minute vesicles were more numerous. Died at 9.3 p.m., the temp. being 106 deg. F. an hour before death. On that day a sample of urine removed by catheter was examined. It was very red and turbid with amorphous urates; reaction highly acid. A precipitate of albumen was obtained, amounting, after subsidence for 12 hours, to two-thirds or more of the bulk operated upon. Under the microscope, besides a little scaly epithelium and amorphous urates, numerous tube-casts were seen, mostly filled with dark granular matter, but partly hyaline. No distinct blood corpuscles were detected, but a faint blue reaction with the Guaiac test was obtained.

A post-mortem examination was made on 13th October, 12 hours after death, by Dr. Foulis, whose report is as follows:—

Brain, 45 ozs.; right lung, 1 lb. 6 ozs.; left lung, 11 ozs.; liver, 3 lbs. 9 ozs.; heart, 9 ozs.; spleen, 8 ozs.; kidneys, 12 ozs. Body, examined 12 hours after death, shows rigor-mortis established. The under lip and chin are much swollen, the lip dry, caked, and brown; the chin and lower parts of the cheeks show numerous small purple spots, in the centre of which there is a minute excoriation. The whole body is dotted with minute purple spots, so small as to require close inspection to discover them, and there is also an eruption of pustules the great majority of which are of similarly minute size, while a few are rather larger. One in particular on the inside of the right knee is of the size of an ordinary small-pox vesicle. Chest—both pleuræ are the seat of acute pleurisy, with copious layers of soft lymph. In some of the lymph there has evidently been effusion of blood from the small vessels. The left lung is everywhere of a dark-red colour, and in places a little fluid (reddish) can be squeezed out from the cut surface; the whole tissues of this lung are non-crepitant, and though not devoid of flexibility, present a solid resistance. The right lung is also dark-red in colour, but subcrepitant everywhere. There are in this lung several small solid masses of triangular shape, and mottled red section, which are mostly near the surface; the size is that of walnuts. Heart, normal; no peri- or endocarditis. Liver, normal. Gall-bladder, normal. Kidneys, pale; the minute venous radicles on the surface injected. Capsule easily removed; here and there are small mottled red and white masses of size of split peas, of same character as those in lungs. Spleen is pulpy of light plum-colour. Stomach, normal. In the cellular tissue behind the gullet is a hæmorrhagic effusion; the minute lymphatics in the gullet are injected in small beaded lines. Intestines, normal; except near the ilio-cæcal valve, where there are in the mucous membrane of the ileum, numerous minute round, clear, raised dots, like enlarged solitary glands. Pelvic-organs, normal. The lip on being cut into creaks under the knife, and the whole of the veins in the tissue of the lips and chin are full of pus. The jugular veins do not show pus, nor are the lymphatic glands of the neck much enlarged, though rather congested. Brain is quite normal.

The following history of the illness and death of the foreman of the spinning department, in which C. L. was employed, and which was contemporary with her sickness, must be read in the light of her case. It was taken down by an officer of the Sanitary Department from the lips of a woman with whom he was cohabiting, and is of course necessarily defective.

W. C., aged 22, residing at 173 Mathieson Street, foreman of hair-spinning department. On 2nd October, 1876, com-

plained of a severe pain in his left side. During two following days became worse, but was able to go about. Called at the surgery of the late Dr. Martin, who told him that his stomach was disordered. On the night of the 4th October was very restless, scarcely sleeping any. Sweated heavily and had constant thirst. Got a dose of salts which he vomited. On the 5th was much worse. Bowels moved by castor oil. About 2 p.m. was seen by Dr. William Forrest, who injected morphia into his left side. About 4 p.m. fell out of bed in a convulsion fit, the contortions of his face and limbs being violent. Had to be held in bed by men. Died at 2 a.m. on the 6th. Soon after death his face and neck became black and swollen, and a discharge of blood came from his nose and mouth. Cause of death was certified by Dr. Forrest "delirium tremens."

In answer to my inquiries Dr. Forrest wrote (22nd March, 1878):—"I find from my note book that the man C. was seen by me twice on 5th October, 1876. I ordered him a mixture such as I was in the habit of giving in delirium tremens. My memory of the case, without notes of any kind to refer to (excepting the record of the visits and the medicine got), is necessarily vague, but so far as I can recall the circumstances, the case presented itself to me as one most probably of delirium tremens. I was told that the man had been drinking. The house looked quite like the home of a drunkard, bare and wretched, and there was nothing about the case to raise the suspicion of any other cause of illness. I remember that the man was in a state of violent delirium when I saw him on the second occasion, being held down in bed by some of his neighbours, and I remember also that I gave him a subcutaneous injection of morphia. On neither occasion was it possible for me to get a satisfactory examination made. Neither my brother nor I have seen any case of sickness of any kind so far as we are aware amongst hair workers, with, of course, the above exception."

It only remains to state that both these persons were engaged in the manufacture of Russian hair at the time of their seizure.

Another case of fatal illness occurred in 1877 among the workers in the same factory. The cause of death is thus registered: "Inflammation of Brain." Duration of illness, three days. No medical attendant. Russian hair was again the material in hand. The following is the statement made to one of my officers. In the absence of medical testimony no better information can be obtained. In this, as in other cases, I preferred accepting inquiries made by a layman, as all chance of leading questions was in this way avoided.

M. H., aged 15, hair-machine feeder, residing at 212 St. James Street, Kinning Park. Her mother, now residing at

154 Crookston Street, states that M. went to her work in her usual health on the morning of 29th May, 1877. She returned about 12 noon, sick, complaining of a severe pain in her head, and shivering. She went to bed and had a dose of castor oil which acted on her bowels once. Vomited constantly, and was very thirsty, perpetually asking for cold water. On the 30th and 31st these symptoms continued with increasing restlessness. On 1st June had three "convulsion fits." There was a pimple upon her left cheek which gave her great pain. It was blue in the centre, with redness round about. She died on that day, no doctor having seen her. Soon after death her body swelled, especially about the head and neck, and became discoloured. Blood oozed from her nose and mouth, and the smell was extremely offensive.

In the course of my inquiries into these deaths I heard of three cases of illness rapidly fatal which had taken place among the workers in another hair factory in the eastern district of the city. The attendant circumstances had evidently impressed the minds of the other hands in the same work, and reached the ears of those employed in the Adelphi Factory. Similar difficulties impair the value of the following narrative of these cases, but the facts were obtained as before through one of the district sanitary inspectors, who was not even aware of the history of the Adelphi cases, and consequently could not put leading questions.

1. M. B., aged 35, wife of a labourer, residing at 5 East Union Street, employed as a teaser in M'Rae's hair factory. From the statements of her husband and of a neighbour woman who had attended her in her last illness, it was ascertained that on 26th December, 1876, she complained of shivering and a severe pain in her side, with general soreness in her bones. She had previously been a strong healthy woman, but had not gone to work for a few days, though no record of complaint of illness can be discovered until the 26th. On the following day she stated she had been very sick, vomiting whatever she took. This sickness continued, the pain in her side getting more severe, accompanied by a dry hard cough and a feeling of great oppression. On 29th December she consented to sending for Dr. Young, of Parkhead, who said she had severe inflammation of the lungs, and ordered a linseed and mustard poultice and prescribed a mixture. He visited again next day, but the pain was much worse and never abated. She died early in the morning of 31st December. Both informants stated that very soon thereafter the face and neck became swollen and black, and blood oozed from nose and mouth. The cause of death was certified and registered "probable pneumonia." This history was read to Dr. Young, who stated

that it was correct, and that he regarded the case as doubtful, being so sudden in its termination.

2. H. J. O., aged 47, widow of a hawker, residing at 28 East Union Street, employed as a hair-teazer in M'Rae's factory.

The following statement was obtained from two female fellow-workers. She had been in the work for 18 months.

About a week before her death she complained of a severe pain in her side, but did not leave her work until the 26th November, 1877. On that morning she began work as usual, but in half an hour had to return home feeling very sick but unable to vomit, and having smart diarrhoea. Next night about 8 she was seen by Dr. Roy, Gallowgate. He said she was a done woman, and had heavy inflammation. He ordered poultices and prescribed. This treatment gave her no relief. The sickness continued, with a gradually increasing sense of oppression and smothering. She died on 28th November. Swelling and discolouration of the face and throat soon set in.

The cause of death was registered, but not certified, "Chronic bronchitis and pleurisy." This statement was read to Dr. Roy, who said that it was correct so far as he knew, and that the woman appeared to be done with bronchitis.

3. E. S., aged 49, widow of a labourer, residing at 28 East Union Street, a hair-teazer in M'Rae's factory.

The following statement was obtained from the same fellow-workers as in the preceding case. They had lodged with Mrs. S., who was apparently a very healthy woman, and had been employed about nine years in the same work. Heard no complaint whatever until between 4 and 5 on the morning of 4th February, 1878. She then said she had had a shivering and been seized with severe pain in her left side, so that she had to get upon her hands and knees in bed in order to breathe easily. About mid-day she managed to rise and dress, and go to the railway station in Queen Street to inquire for a parcel which she expected. In the evening she got home and went to bed. Next day she took a dose of salts and cream of tartar which operated once. On the 6th Dr. John Miller, Gallowgate, saw her about 2 p.m. He said there was severe inflammation of the left lung, and ordered poultices and prescribed. She was very much nauseated, but could not vomit. She was unable to bear the poulticing. On the 7th, about 3 p.m., the doctor stopped the mixture and ordered a tablespoonful of whisky in water every two hours. She was unable to take it, and complained much of a sense of smothering. She died about 8 o'clock that night. The following morning the body was much swelled and discoloured, especially about the face and throat. The cause of death was certified

and registered "Inflammation of left lung." This statement was read to Dr. Miller, who said it was correct; that he prescribed the whisky because the patient's face was pale and her lips blue, and said that now he was inclined to regard the case as one of blood-poisoning got from the hair.

I have seen the Messrs. M'Rae, in whose works these women were employed, and found them extremely anxious to give me the fullest information. "Raw Russian manes" were being manufactured at the time of each of these deaths. Although the women are designated teasers, they were put to the picking and sorting when necessary. M. B. and E. S. were certainly so engaged at the time of their seizure, and probably H. J. O. also. The importance of this change is obvious. The teaser is not brought into contact with the material until it has been spun into ropes and boiled, while the picker and sorter takes the hair in its raw condition, and shakes out the rougher impurities, while arranging it as to colour and quality. In this way every part of the bale is handled, the operator bending over it. The Messrs. M'Rae are disposed to regard the sickness and death of M. B. and E. S. as having "something to do with the hair." They were more particularly struck with the case of E. S., who was a very healthy, steady, well-behaved woman, a good worker, and one of their oldest hands. H. J. O., on the other hand, was a delicate woman, regarded as consumptive.

Immediately on the death of E. S., they determined to cease the use of Russian hair, which they say can without inconvenience be entirely dispensed with in the trade. There was a small quantity in stock which they boiled in bulk, before handling it, and then worked up without accident.

The factory is much smaller than the Adelphi work, and not well adapted for the purpose. The buildings are old and badly constructed. The machine shed especially is confined, and the arrangements for collecting the dust and preventing it from impregnating the general atmosphere are rude and insufficient.

Several of the writers quoted who refer to the risks of the manufacture of hair, touch upon the important question of prevention, but excepting in one instance very meagrely. The chief suggestions made are these: Patissier (1) advises that suspected bales should be spread out in the open air, and also treated with sulphur and other acid vapours. The workers who handle it must wash frequently with a mixture of vinegar and water. Ibrelisle (5) says that to purify the hair it ought before manufacture to be boiled with steam, but he very properly remarks that it is a trade question whether this process could be adopted without lowering its commercial value, by

impairing its properties of elasticity, &c. He points out that large airy well-ventilated apartments, designed primarily for the business, evidently diminish the risk, as shown by the immunity enjoyed by workers in the trade factories, as compared with the narrated experience of the prisoners who treated the hair in the cells of their prison. Vernois (12) repeats the recommendation to open bales of hair only in the open air, and to ventilate thoroughly the workshops where it is sorted and beaten. Again, under "Crins de Bœuf et de Cheval, soies de Cochon (Preparation des par la Fermentation)," he advises that the store where the bales are kept should have a special ventilating shaft, and that the hands and general cutaneous surface should be carefully inspected to detect the first indications of malignant pustule. Tardieu (13) remarks, that accidents occur much more rarely in workshops which are well ventilated than in those which are not. This, with avoidance of opening the bales in close spaces, and great attention to personal cleanliness on the part of the workers, will suffice to do away with the risk. Bollinger (23) goes to the fountain head of the mischief when he says that the prophylaxis consists essentially in the destruction of all parts of diseased animals, but he adds that the legal enactments prescribed in all civilized countries are very insufficiently enforced and practised. Suitable instruction as to the nature and properties of anthrax should be given to all handicraftsmen who are exposed, and as to the value of the early application of caustic (carbolic acid) to external lesions. The caustic should always be at hand in such works. Proust (25) refers to this matter of "cupidity and carelessness" leading to the clandestine preservation of parts of infected animals. He also states that the activity of the virus is destroyed by a temperature of 60 deg. C., by chlorine water, carbolic acid, and putrefaction. Hirt (24) explains the law of his country on the destruction of diseased animals, but says that all restrictions and attempts at disinfection in regard to foreign hair, &c., imported are worthless.

The report of the Massachusetts State Board of Health on the Walpole outbreak enters fully into the subject of prevention. After a discussion "on the value and application of disinfectants or antiseptics" in general, the writer states that the facts indicate very clearly the importance of resorting at once to energetic measures of disinfection whenever there is reason to suppose that any infected hair exists in a factory. He then summarizes his suggestions thus:

"I. All suspected hair should be thoroughly disinfected, either by boiling for one half hour or by wetting with a solution of carbolic acid in proportions of two ounces to one gallon of water.

"The former process is the one which has thus far been adopted by the proprietors of the Walpole Factory, from the belief that it would be more efficacious. It has been found, however, that boiling the hair extracts a large proportion of the animal oil contained in it, thereby destroying its elasticity, rendering it more difficult to pick and spin, and causing considerable diminution in the weight.

"It remains, therefore, to be decided whether on the whole the application of the acid is not less expensive and equally efficacious, since the weight of hair is not diminished by its use nor its quality impaired. Furthermore, as the hair is invariably boiled in the latter stages of its manufacture, all odour left by the acid must thereby be removed.

"II. The rooms to which the hair has been admitted should be thoroughly disinfected. The roofs and walls should be washed with lime. The floors and woodwork should be washed with water containing soda, and then sprinkled with a solution of carbolic acid. The clothing, boots, and shoes of the operatives also demand attention, as the seeds of the disease may have attached themselves to some of these articles.

"III. Those who are obliged to handle hair suspected of being infected, should previously anoint their hands with a mixture of carbolic acid and lard, in the proportion of one drachm to the ounce" (p. 107).

We are told that a supply of this ointment is kept constantly at hand in all the departments of Walpole Factory.

The reporter claims for these proceedings the credit of the fact that "since a thorough disinfecting process was adopted, but one mild case of the disease has taken place, although a period of sixteen months has now elapsed."

It is evident, on considering the conditions and circumstances surrounding the propagation of anthrax or charbon by hair in course of manufacture, that by any measure short of the exclusion of the contagium they are of a nature such as to render them extremely difficult if not impossible to be fully met by preventive measures. The dangers of dust as a mechanical irritant, varying in intensity according to its physical nature and properties, are well known, and the precautions to be adopted according to the trade or process in the course of which they arise have been well considered and ought to be observed in hair as in other factories and workshops. The general hygienic arrangements of hair factories ought to be as perfect as they can possibly be made. The apartments ought to be roomy and well ventilated. The dust ought to be prevented from mingling with the general atmosphere, and in the machine room, where the "willowing" and carding processes are carried out, the volatile debris ought, by extract-

ing shafts and fanners, to be collected, and finally destroyed by fire. But we have to cope with more than the mere mechanical properties of ordinary dust. The most dangerous part of hair-dust consists of organised particles, the contagium of a subtle animal poison which does not even require to be inhaled, but may by simple contact with the skin fatally affect the workers. It is almost impossible to imagine precautions sufficient to protect workpeople engaged amongst dust having such properties, still more amongst a material impregnated with particles so subtle and active as to be dangerous, apart altogether from visible dust. It seems evident therefore, that the only radical and absolutely trustworthy measures for the prevention of such outbreaks among hair-workers are these:—

1. The prevention of the utilization of the hair of infected animals. It is against the law in most countries, if not all, to utilize the carcasses of such animals or any part of them, but everyone knows how difficult it is to enforce such laws in the face of cupidity and ignorance, and they certainly can have little practical effect in such countries as Russia and South America. Nevertheless, the knowledge of such grave facts as those now collected and put upon record may enable the governments of this and other countries to make such representations and remonstrances as may lead to more strict supervision of the collection and exportation of hair, and general enforcement of the enactments as to the disposal of diseased animals and their various products or parts.

In view of the pre-eminence of Russian hair as an observed source of infection the question of entirely prohibiting its introduction is suggested. One result of these occurrences in Glasgow is that two at least of the manufacturers have resolved to have nothing more to do with it.

2. Failing such absolute safety as the exclusion of infected hair would provide, the only other radical precaution is to submit all hair in bulk to some process which would disinfect it, *i.e.* kill the virus which may exist therein, before the hair is disturbed or handled. As pointed out by Dr. Ibrelisle and in the Massachusetts report, this is really a trade question. The possibility of enforcing such a precaution entirely depends upon the effect which such a process would have upon the properties of the hair. At present this Russian hair after carding and spinning is boiled in steam vats for 20 minutes to half an hour, and if dyeing is necessary it is boiled in dyeing before carding, &c., but not before sorting. The question is, could it not all be boiled in bulk? If it could, then no risk would attend its subsequent manipulation. The Massachusetts experience is, however, it is to be feared, enough to decide the impracticability of the suggestion. The Glasgow manufacturers also

state that the boiling lowers the value of the hair, and is employed in fact to turn to account the physical effects of the process upon the hair for trade purposes, viz., "to set the curl." Therefore to employ it at a prior stage of the manufacture would introduce this physical change at a time when it would injure the hair, and probably make it useless for the purpose for which it is intended to adapt it.

We are therefore forced to consider what general precautionary measures can be suggested which would palliate a risk which apparently must attend the manufacture of hair. It is very doubtful, from the transient effects which the observations of Dougall have proved carbolic acid to exercise upon the vaccine contagium, whether its application in solution to the hair in bulk, as recommended in the Massachusetts report, would be efficacious. With the restoration of the hair to the dry condition, which must necessarily precede the stage of further manufacture, would come a renewal of the potential activity of the contagium. I am not aware of any other chemical agent which could be applied in sufficient strength to destroy the contagium without exercising its properties upon the organised structure of the hair, so as also to destroy it.

Apart then from any precautions directly operating upon the material, and always supposing the existence of generally good hygienic conditions in the work, and of special provision for the collection, expulsion, and destruction of the dusty debris from the machine room, the following palliative suggestions may be mentioned:—

1. To prevent poisoning by inhalation, respirators ought to be worn by the hands employed in the machine room, in the spinning room, also in the sorting department. It is, however, a matter of experience that workpeople will not use this simple precaution. The laying aside of respirators on every convenient opportunity, like the unlocking of Davy lamps, would undoubtedly be practised.

2. To prevent poisoning by external contact, bare arms should be prohibited, and close-fitting, high-necked, long-sleeved over-garments of some close texture should be enforced, possibly supplied, left in the works, and regularly cleansed. The application of carbolic lard to the necessarily exposed surfaces, *e.g.* of the hands and face, as suggested in the Massachusetts report, is to be recommended. But from the well-known drying and injurious effect of carbolic acid upon the skin, females would object to use it. Therefore simple lard or camphorated oil would be preferable. Above all things, strict personal cleanliness should be observed. The free use of soap and water applied to the face and arms at each meal hour and at the close of work would be eminently useful.

Ample facilities in the shape of lavatories supplied with all requisites ought to be provided in the work.

No person having any open sore on their person, or having fissures, or any other cutaneous lesion should be employed.

3. To prevent poisoning by deglutition, no eating or drinking within the work or keeping of food on the person or about the factory ought to be allowed. A room for this purpose should be provided, remote from the workrooms, and beyond the possibility of access of dust.

4. Every means ought to be adopted to inform the workers of the risks attendant upon their employment, and of the nature of the contagion to which they are exposed. Caustic in some convenient form ought always to be at hand, ready for immediate application to any suspicious pimple.

P.S.—Since writing the foregoing report, another instance of infection from hair, again of Russian origin, has come under my notice. Two cases of external anthrax on the left side of the neck, in the persons of girls employed in picking and sorting Russian manes in Govan hair works were admitted in July to the Western Infirmary, under the care of Dr. M'Call Anderson. A clinical description of these cases will be found in the "Glasgow Medical Journal" for September, 1879. It is there stated that a specimen of the blood was examined by Dr. Coats. In one case "At first nothing abnormal was observed on microscopical examination, but in the course of a day or two, numerous motionless rod-like bodies were found in the preserved specimen. In the second case, . . . nothing abnormal was observed, either when the blood was newly drawn, or four days after" (p. 215). Very probably, had the local extravascular fluids been examined, the *bacillus anthracis* would have been demonstrated at once. Two other girls, both employed in the spinning department, were contemporaneously attacked with severe vomiting and colicky pains in the bowels, but recovered speedily. The Govan hair works are of modern construction, and are airy and well ventilated. Judging from the raw manes which were being sorted at the time of my visit, the quality was very inferior. The material was a mixture of cow and horse hair, charged with impurities of various kinds, both animal and vegetable.

CHAPTER VIII.

CLINICAL STUDIES.

As has already been stated, the Reports which were issued from Parliamentary Road Hospital contain Clinical Studies of considerable interest, but few probably surpass in importance the observations made on the question of Stimulation in Fevers generally, but especially in Typhus Fever, and on the protective influence of vaccination in Small-pox.

At this period it was commonly held that alcohol served a double purpose in the treatment of fevers—it fed as well as stimulated the patient, and the first paper we have mentioned is a closely-reasoned appeal to the facts of clinical experience as showing that its function was one of stimulation only.

In the second paper the value of vaccination in Small-pox is considered in relation to severity of attack, and the theory is advanced and illustrated by a diagram which has formed the pattern for many subsequent illustrations that protection against the disease wanes with the length of the interval which elapses between vaccination and subsequent exposure to infection, and that the individual “drifts” towards recurring susceptibility to the disease in after years.—(ED.)

(1) *Stimulation in Typhus.*¹

I propose to make a study of stimulation as exhibited in 1538 cases of typhus fever treated in the City of Glasgow Fever Hospital between 25th April, 1865, and 1st May, 1867. My object is to show the method and results of a course of practice in which alcohol has been employed as a stimulant.

Everybody knows that alcohol in all its relations is surrounded with doubt, and fruitful of disputation. Is it purely stimulant, or partly food? How does it leave the system, or does it leave the system at all? are all questions concerning the answer to which there are differences of opinion, unfortunately

¹ *Glasgow Medical Journal*, 1867.

not unbiassed by social and moral considerations. I do not intend to discuss any of the chemical or physiological investigations to which those questions have given rise. It would not influence my practice in the least, although it could be demonstrated that every drop of alcohol is assimilated and detained in the tissues, or that none of it is assimilated and detained. All agree that alcohol is a stimulant, nay more, that its first and most evident action is that of a stimulant. It may or may not be food, but whatever may be the truth in that respect, if not stimulant it is nothing, if a food it is a highly stimulant food. It follows, therefore, that those who give alcohol as a stimulant have all the benefit of whatever nutritive value it may possess, if any, and avoid the evil of narcosis, or impairment of function into which stimulation soon passes, while those who give alcohol as a food are liable to all those evils. All food is stimulant in some degree, but not to a degree which makes this property the chief characteristic. Good beef-tea is decidedly stimulant, and were it so in the sense that alcohol is, then I should give it in fever with the same caution and under the same restrictions as alcohol. A sentence from the writings of Dr. Todd and of Dr. Gairdner will best show the bearing of opinion on this subject upon practice. “Alcohol,” says Dr. Todd, “possesses its stimulating property because it is a form of aliment appropriate to the direct nourishment of the nervous system, and to its preservation; and its special adaptation to this system gives it an immediate exciting power superior to any other kind of food.” . . .

Dr. Todd would rather over-stimulate than under-stimulate. “I am convinced that it is much better to err on the side of over-stimulation than not to give enough; for if we have over-stimulated a patient, it is very easy to pull him down again; there are plenty of appliances and means for this purpose; but if the patient sink too low nothing is more difficult than to restore him.”

Turning to the cases of continued fever detailed by Dr. Todd, the following seem to be peculiarities, but still, such as flow naturally from the preceding. First. There is but a very rude attempt at graduation in the exhibition of stimulants. If any stimulant is given it is almost invariably brandy, and the amount is increased and diminished by gigantic strides, and is always high. Thus; a common procedure is to rise by twelves up to forty-eight ounces of brandy, often to double the amount all at once, one day twenty-four, the next forty-eight ounces. Age, sex, habits, &c., though noted, make really very little difference. The same circumstances arising in a number of patients varying in all their characteristics would meet the