Public health in European capitals : Berlin, Paris, Brussels, Christiania, Stockholm, and Copenhagen / by Thomas Morison Legge.

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PUBLIC HEALTH IN EUROPEAN CAPITALS

BERLIN, PARIS, BRUSSELS, CHRISTIANIA, STOCKHOLM, AND COPENHAGEN

BY

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TO

ARTHUR NEWSHOLME, M.D., M.R.C.P.

MEDICAL OFFICER OF HEALTH OF BRIGHTON

AND HON. EDITOR OF "PUBLIC HEALTH"

THIS BOOK

IS GRATEFULLY INSCRIBED

BY THE AUTHOR

PREFACE

THE following pages, it is hoped, will give an idea of how public health questions are dealt with in some of the most important capitals on the Continent. The book, however, does not profess to do more than record my own observations made in them during visits paid at various times within the last two and a half years. The only merit, therefore, that I can claim for it is the fact that nothing is described in the book which I have not actually seen.

Any attempt to compare the various capitals, one with another, has been intentionally avoided, in the belief that no good end could be served by such a comparison, as the conditions prevailing in them are so different. But since Paris and Berlin stand, owing to their size, on a totally different footing from the others, the chapters concerning them have been placed side by side. It would have been interesting to add London to the list of capitals described; but this would have increased the size of the book beyond my intention; and moreover, to have treated of it, would probably have been superfluous for those to whom this book chiefly appeals.

In dealing in so small a compass with many different subjects, which necessitated reference to books and official documents in several different languages, it is, I fear, impossible but that some errors may have crept in.

Every effort, however, has been made that they should be as few as possible.

It is with pleasure that I record the invariable courtesy with which I was treated by the many officials connected with the public health service, whom I met when abroad; and I take this opportunity of expressing to them, one and all, my thanks.

I am indebted to the Editors of *The Medical Magazine*, and *Public Health*, for permission to utilise material contributed to their pages; and especially to the Editors of the *The Lancet*. Indeed, the chapters on the Scandinavian capitals (together with the diagrams illustrating them), are reprinted almost as they were written by me for the last named journal, while acting as one of their Special Commissioners.

I have to thank Dr. Weyl, of Berlin, for permission to use Figs. 1, 2, 3, and 4; and my publishers for 8, 12, and 18. Those illustrating the housing of the working classes in Berlin are taken from the publications of the *Centralstelle für Arbeiterwohlfahrtseinrichtungen*, and Fig. 17 from M. Cacheux' book on *État des Maisons Ouvrières à la fin du xix. Siècle.*

Lastly, I have to thank my friend Dr. Young, Assistant Medical Officer of Health to the London County Council, for many useful suggestions.

T. M. L.

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PUBLIC HEALTH IN EUROPEAN CAPITALS

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Development of the Public Health service.

It has been said that panic is the parent of legislation, and assuredly in no department has the truth of the statement been more clearly shown than in that relating to public health. The first expression of an interest in sanitary matters in Germany dates from 1426, when, owing to the ravages of the plague, the Emperor Sigismund ordered that all important cities of the empire should appoint special physicians to advise as to the steps necessary for combating the prevailing epidemics.[1] With the exception of Nuremburg, few cities seem to have profited much from these appointments.

[1] *Handbuch der Hygiene*, edited by Dr. Theodor Weyl; article *Geschichtliche Entwickelung und Organisation*, by Professor Finkelnburg, vol. i.

But as the plague and other epidemic diseases continued to break out at times with alarming virulence in the succeeding centuries, Prussia, at the beginning of the seventeenth century, began to organize that bureaucratic system of medical supervision which exists to-day, and which has been the model for other German states to copy. A "collegium sanitatis," long popularly known as the "pest collegium," was formed, with medical officers of health as the local agents for carrying out the necessary measures against plagues and pestilences amongst men and cattle. In 1762 a superior College of Health was established, with a District Council under its control, in each province. At the beginning of this century, unfortunately, the care of the public health in Germany became more and more closely incorporated with the functions of the police office. Those charged with the supervision of sanitary matters were not allowed to take any action on their own initiative, but were confined to reporting on what they might find to the police, by whom alone could executive measures be taken. In general, it may be said that the independent position of the health service which is found in Great Britain does not exist to anything like the same extent in Germany or France, nor are the laws dealing with public health matters so complete or so well arranged. In Germany, for instance, there is no general Public Health Act, the subject being dealt with by a multiplicity of police regulations, orders, and decrees, some of which date back to almost pre-historic times.

Rapid growth of the city in recent years.

Berlin has increased so rapidly within recent years, since the victorious wars waged by Germany against Denmark, Austria, and France, that for all intents and purposes it may be regarded as essentially a modern city. In 1786 the population numbered 145,000; in 1860 it had increased to about 500,000. Since then the population has more than trebled,

having been, at the end of 1892, 1,657,034, and it continues to increase at the rate of about 40,000 a year. Having grown to its present size at a time when the public mind was alive to the requirements demanded by hygiene, Berlin may be said (with the exception of proper provision for the housing of the working classes) to have grappled successfully with the various problems that beset a rapidly growing city. It has been fortunate in possessing among its servants men of the widest experience and technical knowledge, whose advice has been of the greatest service. To no one does it owe so much as to Professor Virchow, whose influence is markedly apparent throughout the whole of the departments relating to the public health of the city. In 1860 it was as unsanitary a city, from all accounts, as could well be found, having open drains running through the principal streets, and a sewage-polluted river, owing to the discharge of the contents of these drains into the stream in its course through the town. The city set itself resolutely to the task of furnishing a pure water supply, completing the network of sewers and purifying the Spree, the results of which have been to transform its condition. And it is interesting to note that the Town Council makes itself responsible for all this work, so that as a study in Municipal Government, Berlin is unequalled.

[Existing sanitary organization.

The Magistrate and Town Council, by means of various committees on drainage, buildings, hospitals, etc., exercise a control over the administration of the Poor Law, the city hospitals, asylums, convalescent homes, workhouses, night refuges, orphan children, abattoirs, markets, matters connected with school hygiene, the waterworks, drainage, and sewage farms. It will thus be seen that, in regard to public health matters, the Berlin Corporation charges itself with much that at home falls under a separate administration.

To enter a little more minutely into the sanitary organization of Berlin, which cannot be said to be distinguished by its simplicity, we find that the conduct of public health affairs devolves upon two divisions in the office of the President of Police.[1] In the first of these there is a State Medical Councillor (*Regierungs und Medicinalrath*) who, with his assistants, amongst whom is the *Stadtphysikus*, or chief Medical Officer of Health, supervises the registration of all medical men, veterinary surgeons, and midwives, who intend to settle in the city, with the object of preventing such persons practising as have not the necessary qualifications. He supervises the examination of midwives and apothecary assistants, sees that all chemists' shops are inspected once every three years, prosecutes in cases of illegal practice, and examines all private lunatic asylums every two years. Further, in this department are prepared the various notices and regulations as to the measures necessary for protecting the public from the adulteration of food-stuffs, and as to the special dangers which may threaten the public health from various sources.

The second division of police, by means of the members of the police force and special experts on certain points, is charged with the execution of these various measures. It is the practical side, and undertakes the examination and control of water supplies, unhealthy dwellings, the sanitary condition of factories, common lodging-houses, cattle diseases, poisons, and supervises the women who take in children to nurse, permission only being granted them after a due examination into their character and the condition of their homes has been made.

Berlin is divided into ten districts, in each of which is a district physician (*Bezirksphysikus*), who carries out some

[1] *Sechster Gesammt bericht über das Sanitäts=und Medicinalwesen in der Stadt Berlin*, by Drs. Wernich and Wehmer, p. 4, 1893.

of the duties of a medical officer of health at home with, in addition, some of those of a police surgeon. But the same demands cannot be made on his time as is the case with a medical officer of health in this country, as he is paid only £45 a year.

In addition, four medical experts are charged with matters included under the term "medical jurisprudence," such as the making of post-mortems in cases of death raising suspicions of foul play, etc. In other parts of Prussia the *Kreisphysikus* (the name given to the Medical Officer of Health in country districts) combines this with his other duties.

A sanitary commission, which forms, for all practical purposes, a part of the first division of police, is occupied with the investigation of the death returns and the notifications of infectious disease.

Although questions of public health, therefore, enter very largely into the consideration of the city authorities, the machinery for carrying out the various measures seems exceedingly complicated, but as far as one can judge it appears to work smoothly enough.

Municipal Hospitals.

There can be few more finely situated town hospitals than those of Moabit, Friedrichshain, and Urban, all of which have been built since 1870 by the Corporation, and are under its management. The first consists of thirty pavilions, with a total of 900 beds, standing in about twenty acres of nicely laid out gardens; the second of thirteen solidly built brick pavilions, with 700 beds, standing in twenty-three acres of ground; and the third, opened as recently as 1890, with 600 beds. The cost of building the last named was nearly £150,000. The erection of another similar town hospital, to be situated in the northern part of the city, is under consideration. In the wards everywhere there are as few dust and dirt collect-

ing surfaces as possible; iron and glass replace wood wherever possible; the walls are covered with smooth cement or glazed porcelain tiles of various colours; steam is supplied to every room for heating and sterilizing purposes, and at the end of each ward is a balcony where the convalescents can sun themselves. It must be admitted that the lines of the sick in Berlin are cast in pleasant places. Each hospital has a steam disinfecting apparatus, and a laboratory for scientific work by the staff and their assistants. A remarkable feature about the hospitals is the elaborate detail that has been expended on the operating theatres in the way of abolishing everything that might harbour dust or dirt. In the three hospitals in 1892, 22,963 persons were treated, the average length of their stay in hospital being twenty-nine days. In the same year in the various policlinics, which may be compared to the out-patient department attached to our own hospitals, over 200,000 persons were treated. The expenditure of the three hospitals is about £92,000 a year. Such persons as can are allowed to pay for their treatment; and, chiefly from this source, in 1892, £34,500 was obtained, leaving a sum of about £58,000 to be paid from the city exchequer. The daily cost per patient is about *2s. 7d.*

Other Hospitals.

There are, of course, a large number of other hospitals both general and special, which serve the needs of the capital, as, for instance, the Charité, the largest of all, with 1,800 beds; Bethanien with 354, etc. A very beautiful and complete children's hospital, designed to take in both medical and surgical cases, with isolation pavilions for scarlet fever, measles, whooping-cough, and diphtheria, named the Kaiser und Kaiserin Friedrich Kinderkrankenhaus, was opened in 1890, the city helping to build it by large grants of money. In addition to the three hospitals described above, the Corporation have built

and control the magnificent asylums of Dalldorf and Lichtenberg, each intended to receive 1,000 insane and 500 epileptic patients; and the Infirmary, a very striking building recently built in the Prenzlauer Allée, with accommodation for 500 aged and infirm persons, and a hospital with 250 beds adjoining.

Municipal Night Shelter.

Close by the Infirmary is the Night Shelter, one of the most remarkable buildings belonging to the city. The main block, four stories high, consisting of a central portion and four large wings, is intended for the reception of whole families, who, for some reason or other, whether it be from bad times or what not, are without any home, provided they have a recommendation from the President of Police or from the Relieving Officer. At the time of my visit there were 282 families located there, representing probably about 800 persons. The rooms were large, light, and airy, the floors of perfectly smooth woodwork, and the whole was warmed throughout by hot water pipes. The dormitories were well arranged, containing each 20 beds, and a large schoolroom with 20 benches was provided for the children. All the belongings of these families, bed linen, furniture, etc., are stored at the shelter, and everything is subjected to disinfection, the bed-linen, etc., to steam under pressure, the furniture, etc., to a dilute solution of carbolic acid. In 1892–3, 2,678 families, or about 10,650 persons, were housed, and the cost to the city per head per day was about 5*d*.

The casual wards, for single individuals who are homeless, number 40, and each contains some 70 beds. Every person on entering must have a bath, and while they are having this their clothes are removed and passed through a steam disinfector. The casual wards are warmed by hot water pipes. There is sleeping accommodation here for some 3,000 persons, and in the winter this number is

often reached. In 1892–3 some 335,436 persons frequented the shelter. It will be readily seen that the work of the city shelter, especially in its work of disinfection, is a powerful agent in checking the spread of infectious diseases, as experience has shown very forcibly in this country and in France that smallpox and typhus are especially prone to spread through the agency of those whose habit it is to pass the night in such shelters.

There are private shelters in Berlin, mainly charitable, but the accommodation and general sanitary arrangements of these, as far as I could see, left a good deal to be desired.

Administration of the Poor Law.

For the purposes of the administration of the Poor Law the city is divided up into 234 districts, each under the control of a committee. These committees consist of from four to twelve members, who inquire personally into the claims of the applicants. The administration gives relief to the necessitous poor, assists mothers in the bringing up of their children until their fourteenth year, provides medical assistance and nursing in the city and other hospitals and convalescent homes, affords free burial in the city graveyards, takes charge of children who are idiotic, blind, deaf and dumb, or have been abandoned, in special institutions, and provides work for habitual offenders, and those under the supervision of the police. The house of correction, to which the last named class of persons is removed, is situated at Rummelsburg, a few miles out of Berlin, and consists of a number of buildings where those vagabonds whom the judge considers would be benefited (after they have finished their term of imprisonment), by a sojourn of some weeks or months before being again let loose on society, are set to various kinds of work. Others of them are drafted off to work on sewage farms. Altogether there is room for about 1,800 such persons.

Care of Orphan Children.

Close by the *Arbeitshaus* at Rummelsburg is the Institution where such orphan children as are not put out to nurse or boarded out in Berlin, or the country, are educated. In 1892 there were 5,420 of these children under the control of the authorities in Berlin, but it must be remembered that the class includes, besides orphans, children who have been abandoned by their parents, children who have been removed from their parents because of ill-treatment, and children who, with us, would be sent to industrial or reformatory schools. Naturally the orphans form by far the larger proportion of the children. Of the 5,420, 1816 were boarded out in Berlin, 2,525 in the country, and 509 were in the Foundling Hospital at Rummelsburg. It was built as long ago as 1859, and consists of ten isolated houses, each with room for fifty children, in the midst of very pleasant gardens. The greatest attention is paid to the health of the children, and the spacious gardens give them plenty of opportunity for outdoor work. A children's hospital here serves for the reception, not only of the sick children in the institution, but also for any of the others who belong to the category of orphan children.

Public Markets.

The public markets under the control of the city number thirteen, and are so distributed as to be readily accessible to all persons. They allow of a strict control being exercised over the foodstuffs, and guarantee, therefore, that the poor obtain articles of good quality.

People's Kitchens.

Mention should be made of the development of the *Volks Küchen* (people's kitchens) in Berlin.[1] It was indeed here that such institutions were first originated by Frau Morgenstern in 1866. There are now fifteen of them in various parts of the city, and substantial

[1] *Festschrift zum 25-jährigen Jubiläum des Vereins der Berliner Volks Küchen.* By Lina Morgenstern.

dinners, consisting of one litre of vegetables with three pieces of meat or fish, representing together 100 grams in weight, can be had for twenty-five pfennige (about 3*d.*), or four-fifths of a litre of vegetables with one piece of meat or fish for fifteen pfennige. From personal experience I can vouch for the excellence of the food that is provided for the poor at these *Volks Küchen*. In 1891, the twenty-fifth year since the first was opened, no less than 2,187,000 dinners were provided.

Expenditure on public health works.

Between the years 1871 and 1892, the sum of money that the Corporation of Berlin has expended on buildings connected with the public health, including the waterworks, drainage, sewage farms, hospitals, asylums, abattoirs, disinfecting stations, night shelter, infirmary, and public baths, amounted to nearly £9,500,000, or on an average about £450,000 a year for twenty-one years. The only department in which the receipts, in the year 1891–2, exceeded the expenditure, was the waterworks, which yielded a balance of nearly £10,000. The deficit upon the others amounted to nearly £450,000.

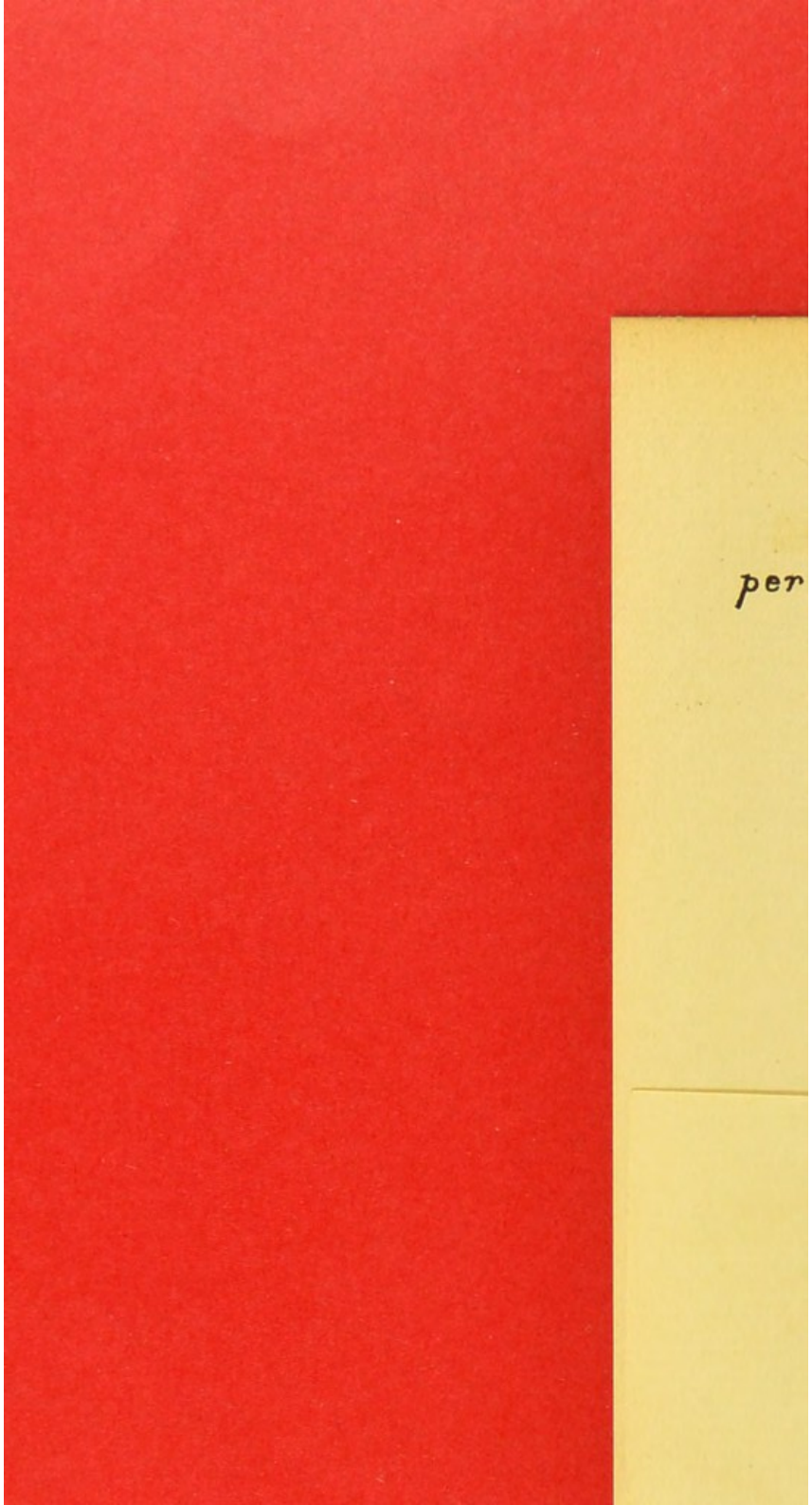
Effect of the improvements on the health of the town.

It is interesting to note what effect all these various improvements, and the expenditure of such vast sums of money, have had on the health of the city, and to see on what diseases in particular its beneficial effect is most noticeable.

Since 1876, the total death-rate has very steadily diminished. In that year it was 29·32 per 1,000; in previous years it had varied between 25 and 35 per 1,000. In 1892 it was lower than it had ever been before, 20·89 per 1000.

Very careful statistical inquiries by Dr. Weyl [1] show that the mortality at all age periods, and especially the mortality

[1] *Die Einwirkung hygienischer Werke auf die Gesundheit der Städte mit besonderer Rücksicht auf Berlin.* By Dr. Th. Weyl. Jena, 1893.



between 0–5 years, has diminished since 1875. He brings out clearly the fact that the effect of the introduction of the water supply in lowering the death-rate is not nearly so noticeable as the effect of the drainage operations which were commenced in 1876. The diseases which have diminished most markedly are tetanus, dysentery, phthisis, pyæmia, puerperal fever, small-pox, typhus, and typhoid fever. Such variations have been observed in the incidence of diphtheria, measles, scarlet fever, whooping cough, and diarrhœa, that no definite statement can be pronounced. It is evident that the diminution in some of these—as, for instance, pyæmia and puerperal fever—is due to the adoption in hospitals of aseptic methods in the treatment of wounds, while small-pox is held in check by vaccination and re-vaccination, both of which are compulsory in Germany. Typhoid fever, on the other hand, is a disease which more than any other is a test of sanitary improvements, and especially of those connected with an improved water supply and drainage. It is interesting, therefore, to examine into the incidence of this disease a little more closely. Thus the mortality from typhoid fever during the ten years 1871–80, was 23·05 per 1,000 of the total deaths, whereas for 1881–90 it was only 7·13 per 1,000; and if only the last five years of the latter period be regarded, 5·7. This diminution is shown for all age periods, and it is impossible not to ascribe it largely to the improved drainage of the city.

Death rate from Typhoid Fever.

Dr. Weyl was further able to show that in two of the city districts, which corresponded exactly with two of the radial systems of drainage, the mortality markedly fell soon after the work of drainage had been begun, and that the mortality remained high for a longer period in those districts where the drainage was commenced late than it did in those in which it was commenced early.

Infantile mortality. The infantile mortality in Berlin, and in fact in most German towns, is very high. In Berlin in 1890 it was 321 per 1,000 infants born; in Hamburg 250, while in London and Paris it was but 141 per 1,000 in 1889. The causes of this are to be found probably in the great overcrowding that exists amongst the poor, and especially in the nature of the feeding. When the nature of the food is considered in relation to the deaths from

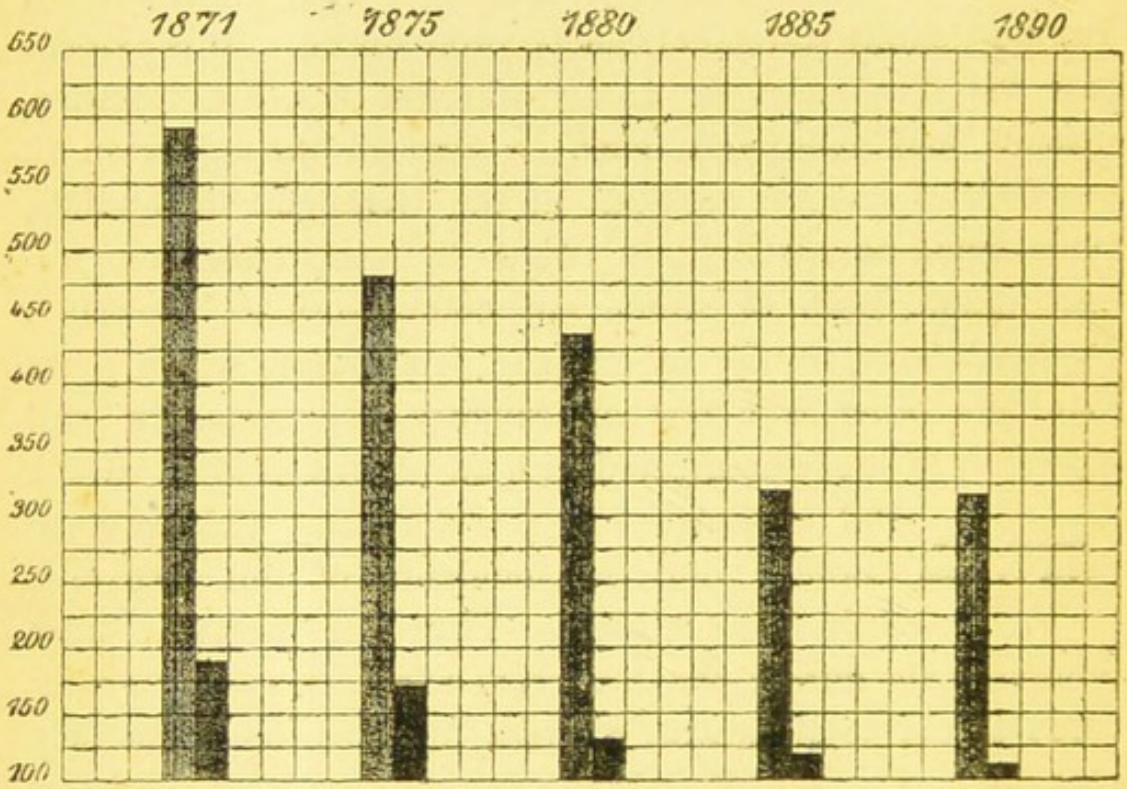


FIG. 2.—Mortality in Age Period 0–1 (light shading), and of Age Period 0–5 (dark shading) at Berlin in the years 1871, 1875, 1880, 1885, and 1890, per 1000 living.

vomiting and diarrhœa, and inflammation of the bowels, the close relation there is between the two is seen. In 1891, for instance, in Berlin the percentage of deaths of those infants fed with human milk was 18·46, with animal milk 47·77, and with a mixed diet 52·37, showing that those fed on human milk have nearly three times as good a chance of living as those fed on a mixed diet.

But, still, the accompanying table, which is taken from Dr. Weyl's work referred to before, brings out the fact that, although overcrowding and bad feeding are responsible to a great extent for a high infantile mortality, yet other insanitary conditions have some share in producing it, and that when they are removed a marked diminution in the infantile mortality may be expected. It shows that between 1871 and 1891 there was a difference in mortality per 1,000 of those in the first year of life of 268·86, and of those between 0–5 years of 81·63.

CHAPTER II

SANITARY ADMINISTRATION OF PARIS

Sanitary Services divided between the Prefecture of the Seine and Prefecture of Police—Inconvenience of this arrangement especially as regards House Sanitation—Municipal Laboratory— The Assistance Publique which has charge of the Hospitals, the Infirmaries, the Relief of the Poor, the Orphans and Abandoned Children — Recent Legislation as regards Children under two years of age—Present Sanitary condition of Paris.

Dual control in Sanitary matters.

THE most noticeable feature in the sanitary organization of Paris is the fact that this is not centralized in the hands of one department, but is divided between two, the Prefecture of the Police and the Prefecture of the Seine.[1] Their functions so dove-tail into one another in public health affairs, that it becomes a matter of the greatest difficulty to know at times where one begins and the other ends. It is a well recognized fact that in public health administration the absence of unity is fatal to its success, and there are not wanting signs to show that this fact is beginning to be realized in Paris. Still there are certain branches in which the difference between the two departments is clearly enough marked. For instance, the Prefecture of the Seine has the management of the waterworks, the drainage, the hospitals, and the administration of the Poor Law (by means of the special department of the Assistance Publique), the construction and main-

[1] *Les Services Sanitaires de la Ville de Paris.* By A. Joltrain, 1893.

tenance of the main thoroughfares, the Statistical Office, the Observatory at Montsouris, and the cemeteries.

On the other hand, matters requiring the appointment of inspectors usually, but by no means always, fall to the charge of the Prefect of Police ; as, for example, the care of the abattoirs, the markets, and the inspection of meat and food generally, the inspection of animals according to the terms of the Contagious Diseases (Animals) Act, the municipal laboratory, and the detection of the adulteration of food-stuffs, the inspection of dangerous or unhealthy trades, the inspection of infants boarded out, and of children working in factories and workshops, the regulation of prostitution, the Morgue, the ambulance stations for street or river accidents, the inspection of lodging-houses, and of private roads and courts, and the suppression of illegal practice in medicine and pharmacy. Further, in 1892, the various services for obtaining information as to the deaths from infectious diseases, and carrying out the necessary measures of disinfection, were centralized under a permanent Committee at the Prefecture of Police.

Where the two departments seem to clash is in matters connected with house sanitation, where, above all others, it is least desirable. Both have, for instance, powers as to the disinfection of premises ; the one, the Prefecture of the Seine, has elaborated its equipment by the provision of ambulances and of steam disinfecting ovens, etc., to a remarkable extent, while the other still continues to do nothing more than fumigate the room with sulphur. This has led to much friction in the past, only having disappeared of late owing to its being recognized how much more efficacious the methods of the former were.

It has been said above that the inspection of lodging-houses (*hôtels garnis*) falls under the Prefecture of Police, but the committee charged with the inquiries into unhealthy

dwellings is appointed by the Prefecture of the Seine. Unfortunately, the powers placed in the hands of this committee have been so hopelessly inadequate that next to nothing could be done by it. No initiative action could be taken; it was limited entirely to reporting on the sanitary defects found, and suggesting what should be done to improve them. Moreover, the sanitary defects, of which alone cognisance could be taken, had to be inherent in the building itself, or due to default on the part of the landlord, and not of the tenant. In this way such elementary causes of insalubrity as overcrowding could not be touched.

Central office for House Sanitation and Disinfection.

Perhaps the greatest reform in this respect in Paris had been the formation of a central office three years ago for dealing with house sanitation and allied subjects (*Service central d'assainissement et de salubrité de l'habitation*), under the direction of a permanent committee consisting of the most eminent medical, scientific, and administrative experts in the city. The inspector-in-chief to this department is Dr. A. J. Martin, who has long been identified with public health work in Paris, and his functions somewhat correspond with those of a medical officer of health in this country. For instance, his duties are to investigate the causes of insalubrity, to notify to the several technical departments the various insanitary conditions found and the measures necessary for their removal. He is furnished with all the available sources of information, such as the death returns, notification returns, and the cases taken into hospital. He controls the entire work of disinfection as carried out by the *Étuves municipales*, and all building plans must be examined by him to see if the hygienic provisions in them are sufficient. He is placed in relation with the chemical and bacteriological laboratories of the observatory of Montsouris for such scientific work as, for example, the detection

of typhoid or cholera bacilli in water, etc., as he thinks necessary. Such questions, too, as the sanitary condition of crêches and the prevention of school epidemics, come under his care.

Council of Public Health.

The powers of the Prefect of Police in sanitary matters date from the time of the Revolution, and under him in each arrondissement is the mayor, to see to the particular needs of the district. It is only natural that in France, where there is no specially trained staff of sanitary inspectors, such as is the case in this country, the police servants should be the persons from whom information as to sanitary defects can be most easily obtained. The Prefect of Police has, for the purpose of advising him on all matters relating to public health and sanitation, a council (*Conseil d'hygiène publique et de salubrité du département de la Seine*), which meets twice a month and consists of thirty-eight members, amongst whom are the Dean and Professors of Hygiene and Medical Jurisprudence of the Faculty of Medicine of Paris, the Chief Engineer of Roads and Bridges, and others chosen for the recognized position they hold as experts on various subjects. In each arrondissement a committee of hygiene is appointed, chosen by the Prefect on the recommendation of the mayor, consisting of nine members. Of these, two must be doctors of medicine, one a veterinary surgeon, one an architect, one an engineer, and one a chemist. The members of these committees inspect their districts personally, and endeavour, as far as they can by persuasion, to get sanitary defects remedied.

Municipal Laboratory.

The Municipal Laboratory under the Prefect of Police, founded in 1879, has done much to prevent the adulteration of food-stuffs in Paris. Two kinds of analyses are made, qualitative and quantitative. The former is made gratuitously of any article of food, no matter

by whom it is presented, and merely gives the information whether it is good, bad, or adulterated; the latter, for which payment has to be made, naturally gives information as to the matters found in the analysis. For the poor to be able to know authoritatively whether the articles they buy are of good quality, and to have the information without charge, is a great boon. No prosecution is made as a result of the information obtained from such an analysis, but it gives the chemist a clue as to where adulteration is practised, and if, on a second analysis of a sample taken by the agents of the laboratory, adulteration is detected, a prosecution follows. Some thirty chemists are constantly at work in the laboratory, and the use that is made of their services increases every year.

The Assistance Publique.

The entire charge of all the hospitals, of the medical attendance on the sick poor in their homes, and the relief of the poor, is in the hands of what is called the Assistance Publique.[1] Prior to 1789, the hospitals were not under a single administration, but either managed their own affairs or were grouped together. In the time of the Revolution, however, the management of all the hospitals and charitable institutions was placed under a General Council, presided over by the Prefect of the Seine, and in 1849 the organization assumed its present definite form and became known as the Assistance Publique. At the head of this organization is a director (at the present time M. Peyron), who exercises an almost absolute control over all its affairs. He is made responsible to a council consisting of the two Prefects, two members of the Municipal Council, and sixteen other persons chosen for their special knowledge of the work. The representation of the Municipal Council is fully justified by the large sums of money which it votes annually in aid

[1] *Encyclopédie d' Hygiène et de Médecine Publique*, vol. v., p. 71.

of the work. The expenses in 1891–2 amounted to nearly £2,000,000. A substantial source of income is that which is derived from various performances in the theatres, music halls, and casinos of Paris, which is known as the *droit des pauvres.*

The Administration has under it fourteen general hospitals, six special hospitals, five children's hospitals, five infirmaries for the aged and incurable, three almshouses (*maisons de retraite*), where persons of slender means are received on part payment of their board, and eleven institutions built by donations or legacies handed over to the Assistance Publique by charitable persons. At the Central Office at the Hôtel Dieu, the applicants for admission to the hospitals are examined, and should their condition not be urgent, they are sent home with advice and medicine. Here too the aged and infirm come who seek admission to the infirmaries and are given the certificates as to the conditions of admission. In the hospitals there are nearly 12,000 beds, and in the infirmaries and other foundations over 10,000. Only such as are without means are taken into the hospitals; but of the total deaths in Paris more than a quarter take place in them, whereas in London and New York the proportion is barely one-sixth.[1]

A population of about 32,000 persons, including nurses and attendants, lives in the various establishments of the Administration, and to supply its needs the Assistance Publique has its own bakehouse, its own slaughterhouse at the abattoir, its own cave for wine at the Halles aux Vins, its own provision shop, its own pharmacy, and distributes every day with its own carriages the various things required.

The Hospitals.

As regards the hospitals, not a few of them, as might be expected in so old a city, such as

[1] *Dictionnaire Encyclopédique des sciences médicales*: article, Paris, by Léon Colin, p. 31.

Necker, Cochin, Saint Antoine, Laennec, Trousseau, Enfants Malades, date from times when hygienic requirements in hospitals were not understood, and consequently they are neither in the style of their construction nor in the arrangement of the wards altogether suitable for the reception of the sick. Most of them, however, stand in delightful grounds, and much has been done to try and bring them into line with modern requirements. The more recently constructed hospitals, such as the Hôtel Dieu, with 550 beds, erected at a cost of £2,400,000; Lariboisière, with 676 beds, costing £400,000; and Tenon, with 805 beds, costing nearly £300,000, are very monumental in style and construction; while the two new pavilions and operating theatre in the Hôpital Cochin, named after Pasteur and Lister respectively, and intended for the reception of surgical cases only, are as perfect as they can be from a structural point of view. But it is in the arrangements that are made for the isolation of cases of infectious diseases, reference to which is made in the chapter on Disinfection, that the hospitals of Paris are most open to criticism.

The Relief of the Poor. In each of the twenty arrondissements into which Paris is divided there is a *Bureau de Bienfaisance*, or charity organization office for the relief of the poor. Attached to the central office are the dispensaries, where such of the sick as are not visited in their homes by the physicians, of whom no less than 180 are engaged in the work, are attended to. Each office is directed by a Committee composed of the Mayor and 12–18 members, nominated by the Prefect of the Seine on the recommendation of the Director of the Assistance Publique. The persons relieved are divided into two classes: the *indigent*, who figure permanently on the books of the administration and receive monthly or annual sums, and the *necessitous*, who receive temporary relief only. Of

the former, there were in 1892, 65,705, and of the latter, 72,139, making in all 137,844 relieved in the year. Such persons are entitled to relief as are: (1) affected with chronic diseases; (2) over 54 years of age; and (3) orphans under 13 years of age. The necessary funds, excepting what the bureaux themselves collect in their districts, come from the Assistance Publique.

Care of Foundlings and Orphans.

One of the most interesting branches of the work confided to the Assistance Publique is the care it exercises over foundlings, orphans, and abandoned children, known as the *Service des Enfants Assistés*. The stationary condition of the population in France imposes the duty on the Government of doing all it can to protect the children who are born. The diminution that has taken place in the birth rate in France is greater than in any other country. The excess of births over deaths in the five years, 1881–1886, was only 1·37 per 1,000, whereas, during the same time in England it was 13 per 1,000, and in Germany 10 per 1,000. The total population of France had only increased by a little over half a million between 1881–1886.[1]

During the Revolution the duty of the State in looking after neglected children was recognised, and in 1811, the system at present in vogue was inaugurated. The number of the "Enfants Assistés," aged from 1 day to 21 years, was for Paris in 1892, 33,545, and for the whole of France, 124,917.[2] Strict regulations for the inspection of the children were made in 1887. For the Department of the Seine the inspectors are to be chosen from doctors of medicine of ten years standing at least, and from the principal clerks in the Bureaux of the Minister of the Interior, the Prefecture of the Seine, and the Assistance

[1] Jules Rochard: *Traité d'Hygiène Sociale.* Paris, 1888.

[2] *Annuaire Statistique de la Ville de Paris*, 1892.

Publique. Female inspectors are chosen from among those who have had at least eight years experience of teaching.

The Foundling Hospital.

Since 1814 the head-quarters of this department of the Assistance Publique have been at the Hospice des Enfants Assistés in the Rue Denfert Rochereau, where there are some 750 beds.[1] Three classes of children are received: first, the foundlings, orphans, and abandoned children, who remain (unless they are ill) for only two or three days, before being drafted off to homes in the country; secondly, children in *depôt*, a term employed to signify those whose parents are either in prison or in hospital, or for some reason or other temporarily unable to look after them, and who may remain as inmates for a period not exceeding six months; and lastly, the Hospice has recently charged itself with looking after children *moralment abandonnés*, *i.e.*, children who have been ill-treated by their parents, and those who are in the position of first offenders, so as to avoid the necessity of their having to go to the Depôt of Police, and be exposed to the degrading influence of hardened criminals. All the children, legitimate and illegitimate, are admitted, no matter what their age. The majority are presented, however, before they are one month old. Abandoned children are usually presented by the mother, and in order to try and dissuade her from the step, it is pointed out, that once the child has entered the hospice, she will never be allowed to see her child again, nor even to know where it is, the only information given being the statement whether the child is alive or dead. Further liberal opportunity is offered the mother to avail herself of pecuniary assistance and other means to enable her to keep her child. In fact, in 1892 over 11,000 children were

Conditions of Admission.

[1] *Encyclopédie d'Hygiène*, vol. v., pp. 182–193.

assisted in some other way than that of being received into the hospice. Notwithstanding this, however, the admissions in 1892 numbered 4,897.

The children on admission are all medically examined. The sickly, or those afflicted with hereditary syphilis, are retained in the hospice and treated there. The healthy are sent off to homes in the country. Infants are handed over to wet nurses, who are recruited in the country by the various medical inspectors of the assisted children; each wet nurse must produce a certificate stating that she is married, free from disease, of honest mode of life, and not over forty, nor may she suckle any other child than that confided to her care. She only remains in Paris for the time necessary to receive her charge before returning to the country. Every infant put out to nurse in this way wears a necklace, which may not be detached until it is six years old. Until they are a year old the infants must be inspected once every month, and from 1–13 years every three months. During the first year the nurses receive 25 francs a month, during the second, 20 francs, during the third 15 francs, and from the fourth to the thirteenth year 13 francs.

On the completion of their sixth year children must attend the communal school. After they are twelve years old they either continue to remain with the families who have brought them up, or else they are apprenticed to some trade.

Of the total 4,407 children put out to nurse in Paris and the suburbs in 1892, 3,186 were legitimate, and 1,221 illegitimate. The mortality amongst those who were spoon fed (11·1 per cent.) was nearly twice that of those breast fed (5·9 per cent).

Protection of children under two years of age.

A very important law was passed in 1874, for protecting children under two years of age, the administration of which falls to the

charge of the Prefecture of Police.[1] Amongst its provisions are that every person who desires to place a child out to nurse, must make a declaration at the Mayor's office; and every nurse who wishes to take charge of one or more children, must obtain a certificate from the Mayor, and from a doctor, proving her fitness to undertake the work. If she receives a child she must announce the fact within three days at the Mayor's office. No one is allowed, without proper authorization to act as intermediary with regard to the placing of children out to nurse. Thirteen medical inspectors, five assistant inspectors, and eighteen female inspectors in the Department of the Seine, devote the whole of their time to visiting these children placed out to nurse, and inquiring into the condition of the homes where they are housed. It is they who give the medical certificate to the nurse desirous of taking charge of children, stating that she is free from infectious disease, has been vaccinated, etc.

A number of societies exist in Paris for watching over the children of the poor, for rendering assistance to the mothers, for encouraging them to suckle their children rather than to hand-feed them, and to do all in their power to keep the mothers from abandoning their children to the Hospice des Enfants Assistés. The principal of these are La Société de Charité Maternelle, La Société pour la Propagation de l'Allaitement maternelle, which has a membership of over 1,000, La Société Protectrice de l'Enfance, and La Société des Crèches. One or more crèches exist in each of the arrondissements of Paris. That which I saw in the Place Monge was, although small, accommodating only 24 infants, very clean and comfortable.

[1] *Encyclopédie d'Hygiène*, vol. v., p. 143.

Present Sanitary Condition of the city.

The total population of Paris at the census of 1891 was 2,386,232. From the report of Dr. Deschamps presented to the Municipal Council for the year 1894, it would appear that the health of the city had never been in so favourable a condition.[1] The total death-rate has fallen from 25·37 per 1000 in 1880 to 21·80 in 1893. The mortality from epidemic diseases has never been so low as during last year, and what has been especially noticeable about the outbreaks is that they have been of exceedingly short duration. The accompanying diagram, extracted from the above report, shows in a graphic manner the diminution that has taken place in the deaths per 100,000 of the population from the principal zymotic diseases during the last three years, as compared with the mean for the preceding twenty years.

Prevalence of Typhus Fever.

Still there are certain points about some of the infectious diseases which must occasion anxiety to persons interested in hygiene at Paris. For instance, in 1893, typhus fever broke out in Paris at the depôt of the Prefecture of Police, and almost immediately after in the prison of Nanterre. Indeed, cases of typhus fever, of which France generally has been remarkably free for years, occurred in 1893 in more than a dozen towns in the north-west of France. The epidemic did not assume large proportions in Paris, but small recrudescences appeared at times again last year. The close connection of this disease with over-crowding and filth makes it one specially dreaded in large cities. That the disease did not spread more widely must be attributed to the degree of efficiency attained in disinfection by the service of the Étuves Municipales.

Small-pox.

In the spring of 1893, too, small-pox broke out so virulently, that it looked as though it would

[1] *Rapport présenté par M. Deschamps sur les services de l'assainissement, etc.* Conseil Municipal de Paris, 1894.

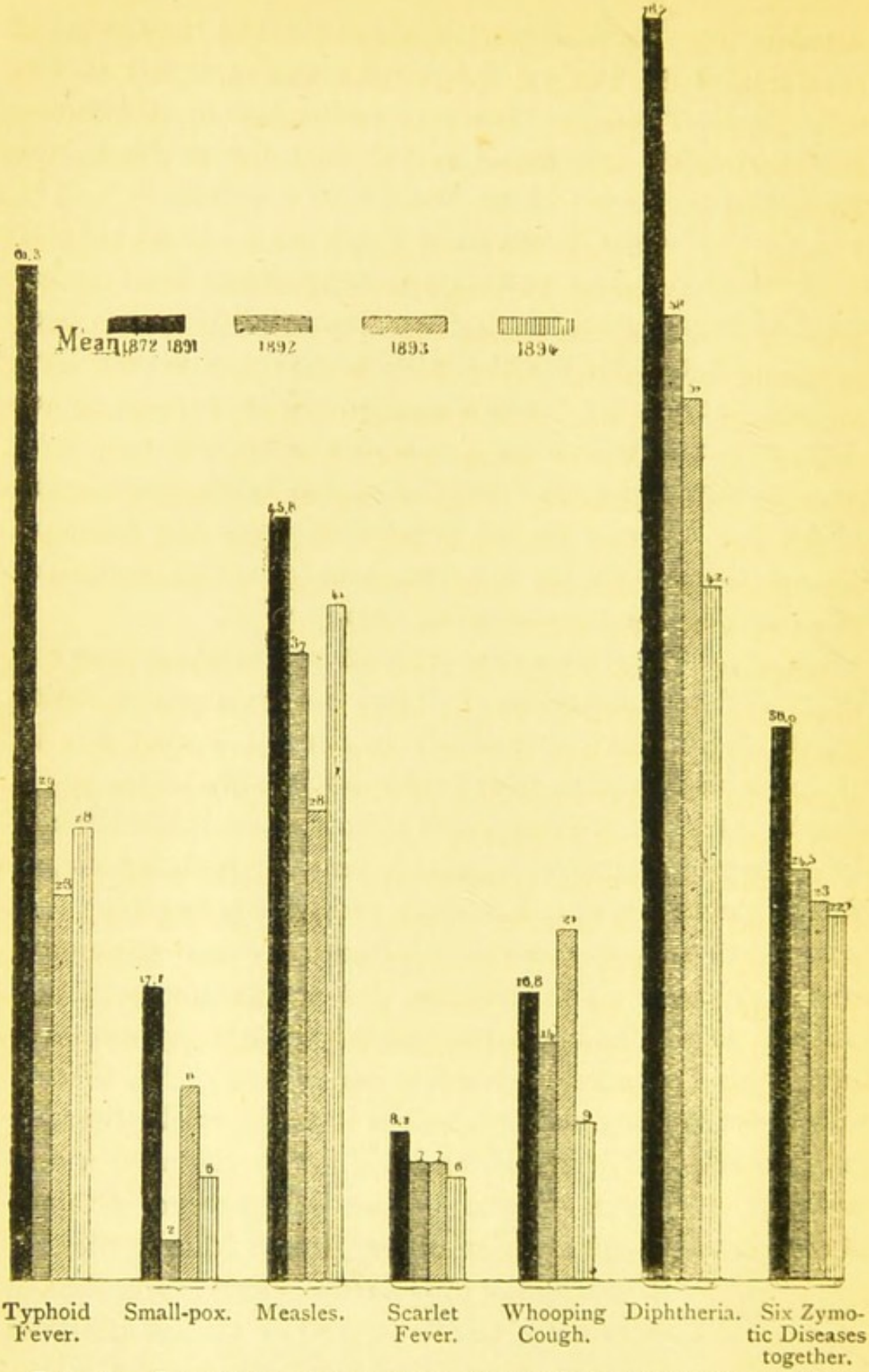


FIG. 3.—Comparison between the mean of the twenty years 1872–1891, and the years 1892, 1893, and 1894, of the deaths caused by the principal zymotic diseases per 100,000 of the population.

develop into a widespread epidemic. The unvaccinated condition of the Parisian population was such as to favour this view. However, energetic measures of disinfection and vaccination were taken, and the number of deaths was limited to 400.

Typhoid Fever.

It must have come rather as a shock to most Parisians to hear, after all that had been done to provide a pure spring water supply to the city, that a small epidemic of typhoid fever had broken out in the early months of 1894, and that it was attributed, apparently with justice, to the Vanne water, which had up till then been deemed irreproachable. One of the most pleasing features in the sanitation of Paris had been the fact that the death-rate from this disease had been steadily diminishing in Paris of late, as is shown in the diagram.

Since 1832 cholera has broken out in epidemic form nine times, the last having been in 1892. In this year, however, the mortality was less than on any of the preceding occasions. In all there were 823 deaths, or a proportion of 0·34 per 1,000 of the inhabitants.

Detailed reference, however, to the relation of typhoid fever and cholera to water supply, is made in the chapter on the Water Supply and Drainage of Paris, and also to the probable effect on the health of the city which will be effected by the recent important law passed relative to the sanitation of the city.

CHAPTER III

WATER SUPPLY AND DRAINAGE OF BERLIN

Improvement in Water Supply in recent years—The Works at Stralau, Lake Tegel and Lake Müggel—Arrangements in them for Controlling the Rapidity of Filtration—Bacteriological Control of Sand Filter Beds—The "Radial" system of Drainage—Improved Condition of the River Spree—Description of the Sewage Farms.

Subsoil Water.

A GREAT deal has been done during the last few years to provide Berlin with a supply of pure water. Owing to the peculiar conditions of the valley of the Spree, and its very moderate height above the level of the sea, the subsoil water is found everywhere at a depth of a few feet below the ground; and before the introduction of the waterworks, a pump well was situated in almost every court, offering an abundant if not irreproachable supply. Neither the bad quality of this water nor its insufficiency led to the demand, about the year 1850, for a central supply; it was merely the desire to have some means of flushing out effectually the open ditches which existed in the streets, and served to carry away the rain water and slop water from the houses. In 1856 the waterworks at Stralau on the Spree, but two or three miles from the centre of the city, were built by an English company, and continued to be utilized until November, 1893, when, owing to the construction of the new works on the Müggel See and the increasing pollution of the river, they were discarded. In 1881 these works passed into the hands of the

Corporation, which has since then had complete control of all the waterworks.

With the rapid increase of Berlin after the Franco-German war, it was soon apparent that the existing works would be insufficient to furnish the necessary supply, and as the subsoil water became more and more polluted *pari passu* with the growth of the city, making it necessary to desist from using it as a drinking supply, the Corporation proceeded to the erection, in 1877, of works for pumping water from wells sunk in the neighbourhood of the Tegel See, one of the many fresh-water lakes with which the neighbourhood of Berlin is so richly supplied. Unfortunately, the water so drawn was found to contain oxide of iron in very small quantities; sufficient, however, to give the water a very unpleasant appearance, and favouring the rapid growth of a crenothrix in the reservoirs and mains. The oxide of iron could only be removed from the water by prolonged exposure to the air to bring about chemical changes in its constitution, so that it was thought best to desist altogether from this means of supply and fall back on the much simpler method of placing the intake in the lake itself and filtering the water so gained through sand.[1]

New Works at Tegel See. In 1888 the works were completed. There are twenty-one filter beds, all vaulted over and arranged in a semi-circular fashion. The position of the intake is good, being situated at such a spot in the lake that the entrance of infective material is practically impossible.

Abolition of the Stralau Works. As time went on, the dissatisfaction with the Stralau works on the Spree became more and more pronounced. The city had spread out in this direction, and the traffic on the river past the point of intake

[1] *Die öffentliche Gesundheits und Krankenpflege der Stadt Berlin* 1890, p. 252.

was enormous. A few miles above it, at Köpenick, there are many clothes-washing establishments, and on the date of a visit I paid to it in July, 1893, not only were there many barges to be seen moored quite close to the intake, but, standing by the pipe which discharged the water on to the filter beds, one could frequently see large pieces of decaying organic matter. Professor Koch, in his well-known article on "Wasserfiltration und Cholera,"[1] said of it: "Should a danger of cholera again threaten us, I do not believe that any one would have the courage to undertake the responsibility of further continuing the supply from so suspiciously situated a water-works." Only three out of the nine filter beds were covered in, so that in winter, owing to the impossibility of regularly cleaning the open beds, the strain upon those that were covered in was very great, and often led to insufficient filtering effects; indeed, in February, 1889, an epidemic of typhoid fever was attributed to the water distributed from these works. That they have been able to function so long must be attributed very largely to the fact that they have been under the charge of Ingenieur Piefke, one of the greatest authorities on the subject of sand filtration, whose articles in the *Zeitschrift für Hygiene* and elsewhere are well known. The city has therefore taken a very wise course in closing the works as soon as the new beds at the Müggel See were sufficiently advanced to enable the water from this source to enter the old mains.

he new Filter Beds at the Müggel See.

These new works, when completed, will be the largest in Germany, and, for the matter of that, the largest on the Continent. An impetus to pushing on the work was no doubt given by the outbreak of cholera at Hamburg. At present, only one-half, comprising twenty-two filter beds, is finished. The

[1] *Zeitschrift für Hygiene*, 1892, vol. xiv., p. 393.

lake itself is a beautiful sheet of water, some three miles long and one and a half broad, situated in the course of the Spree, about twelve miles above Berlin. Pine woods on a sandy soil enclose it on all sides, and no towns or villages are on its banks. The filter beds are a little more than half an acre each in size, and of the twenty-two already built sixteen are kept constantly in use while the others are being cleaned. All are vaulted over, and covered with sand to a depth of one meter. Ample ventilation is afforded by a hundred ventilators. The filtering material does not vary much from the ordinary kind, 60 c.m. fine sand, 30 c.m. gravel, and 20 c.m. stones. On the vaulting over of the filter beds great stress is laid in Germany, not because of its keeping the water cool in summer, but from its preventing the water freezing during the four winter months, and so allowing the important operation of cleaning the filter beds to be carried on without interruption. Perhaps the most important point of detail in the water-works at the Müggel See and Tegel See are the arrangements that exist for controlling the rapidity of filtration.

Arrangements for Controlling Rapidity of Filtration.

As the water leaves the channel at the bottom of the filter bed it passes into a chamber divided into two parts, and, in the side of the division furthest from the filter bed, is the opening communicating with the pure water reservoir. All that is necessary then to cause the water to flow out of this opening at a constant rate is to maintain the level of the water above it permanently at the same height. A float working over a graduated scale records this height, and it is marked in such a way that the attendant, whose duty it is to control this arrangement, can at once see on entering the room whether everything is in working order. As the water passes through the filter bed and deposits its impurities on the surface of the sand, the pressure required to force the

water through will increase, and the level of the filtered water in the chamber will gradually get lower and lower. Two floats, one on the unfiltered water on the top of the filter bed, the other on the filtered water in the chamber, marks this difference of pressure, and gives the valuable indication of the time when it is necessary to clean the filter bed. To enable the attendant to regulate at once the rapidity of flow into the reservoir of pure water through the opening described before, the two divisions of the chamber communicate by means of a sluice valve. According to the amount that this valve is opened so will the level of the water above the opening be affected. When a filter bed has been recently cleaned, naturally a very slight opening of the valve will suffice; while later on, when the pores between the particles of sand have become clogged, it may have to be opened to its fullest extent.

Bacteria in Water.

Small bacteriological laboratories exist at both the works at the Tegel See and Müggel See, and the water from each of the filter beds is examined daily. The number of microbes in the filtered water is usually well under 50 per c.c. The number found in the water at the intake (that is, in the unfiltered water of the lakes), is also low, rarely exceeding 500 per c.c., and usually being under 200. Of sixty samples of unfiltered Spree water examined between April, 1889, and October, 1891, sixteen contained more than 100,000 microbes per c.c., 23 between 10,000 and 100,000, 20 between 1,000 and 10,000, and only one less than 1,000, showing very clearly how striking in this respect is the contrast between the old and the new supplies.

Bacteriological Control of Filter Beds.

Much criticism has been brought to bear on the question of the value of the bacteriological examination of water. Into the general question it is not proposed to enter here, but merely to touch

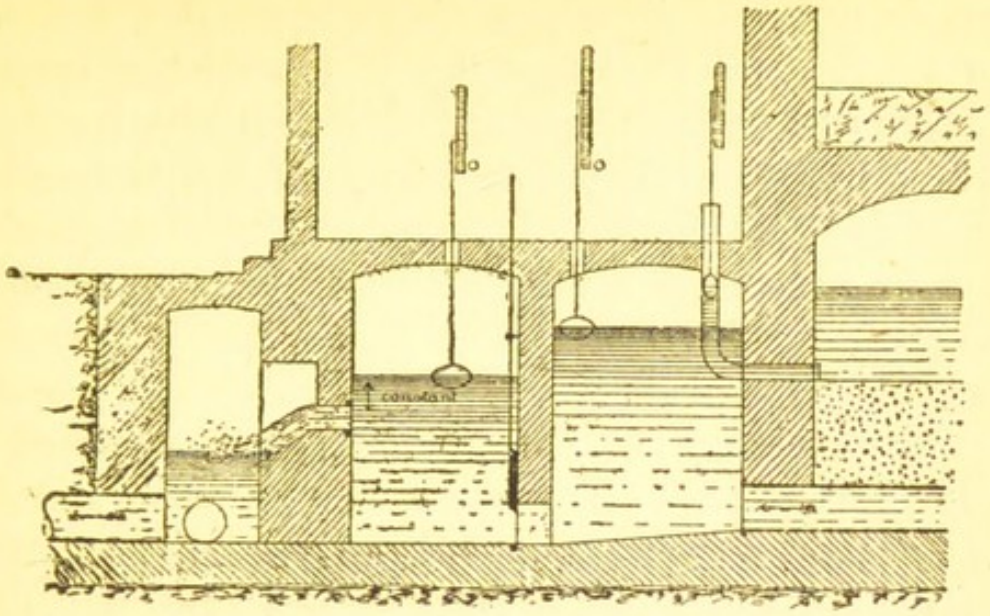


FIG. 4.—Gill's Method of Regulating the Rapidity of Filtration in the Berlin Filter Beds. (*For description see text.*)

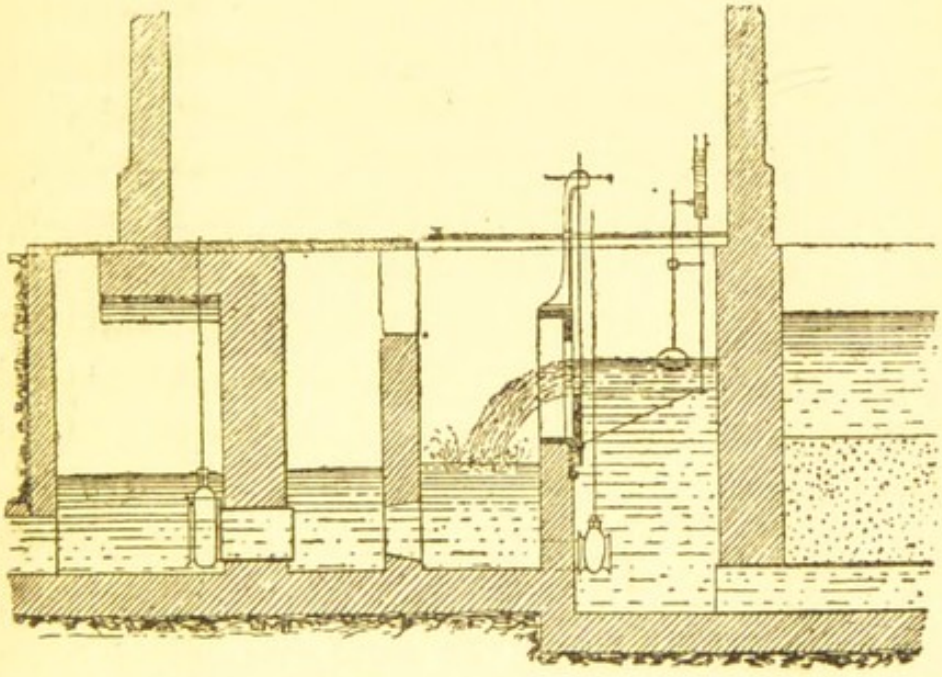


FIG. 5.—Meyer's Modification of the above Method in the new Filter Beds of Hamburg. (A definite head of water is made to flow over a weir, the height of which can be regulated as required. The indication for altering the height of the weir is given by the difference in level of the float on the surface of filtered water and of that attached to the movable weir.)

upon the matter in so far as it relates to filtering processes. Few will be prepared to deny that it gives the best criterion for determining the efficacy of the several filter beds. Of course it must be thoroughly done, and this is what they aim at doing in Berlin. It is, indeed, from observations made in connection with the filtering beds at Berlin, by such persons as Proskauer, Piefke, and Fraenkel, that much new and valuable light has been thrown on the processes of sand filtration. Dr. Proskauer, who has examined for the last ten years samples of the water both before and after filtration of the Spree and Tegel See, and has published his results in the *Zeitschrift für Hygiene*,[1] was perhaps the first to point out that it was not so much the sand itself that was the effective filtering agent, as the scum which forms on its surface, and fills up the pores between the particles of sand owing to the precipitation of organic and earthy matters from the impure water.

The film acts like a net and entangles in its meshes the bacteria, etc., which are therefore prevented from passing through the filter bed. The value of sand filtration therefore depends on the integrity of this network; and in nearly all samples of filtered water where the number of bacteria is considerably above the normal, this can be shown to be due to an interference with or breakdown of this filtering scum. The results of experiments made by Piefke and Fraenkel,[2] published in 1890, were considered quite revolutionary, namely, that sand filters do not give a germ-free water; that the commencement and end of the operation were dangerous times, owing to the non-formation of the scum in the first instance and to its formation in excess in the second; that the number of bacteria in the filtrate is dependent on the number in the unfiltered water, and lastly,

[1] Vol. ii., p. 401; vol. ix., p. 103; and vol. xiv., p. 250.

[2] *Zeitschrift für Hygiene*, vol. viii., p. 1.

that it is closely dependent on the rate of filtration. The experiments on which these conclusions were based were designed to resemble as nearly as possible the conditions existing in ordinary sand filters, and consisted in adding easily distinguishable species of bacteria, both pathogenic and non-pathogenic, to the water, and seeing whether they could detect the same in the filtrate, and if so in what proportion. Koch, in 1893,[1] as the result of the experimental and ætiological evidence then obtainable as to the connection between the outbreaks of epidemics (as at Hamburg and Halle), and known irregularities in the sand filter beds, summed up the conditions under which sand filtration could be employed in the following sentences :—

Koch's axioms.

(1) The rate of filtration must not exceed 100 m.m. ($3\frac{3}{4}$ in.) per hour. To effect this every filter must be provided with an arrangement by means of which the water can be admitted at this rate and no faster.

(2) Every single filter to be examined bacteriologically once daily, so long as it is in use.

(3) Filtered water containing more than 100 microbes per c.c. to be discarded. An arrangement must therefore exist for allowing insufficiently filtered water to be removed without letting it mix with the filtered water.

These are the conditions which will probably be imposed on all new large filtering works in Germany. The condition which meets with most objection is the third, as it necessitates the rejection of all water that passes through during the first 24 hours—for so long on the average does the filtering scum take to form properly. But that the conditions are practicable can be seen by a reference to an article by C. Piefke,[2] who describes how the difficulties

[1] *Loc. cit.*, vol. xiv., p. 417. [2] *Über die Betriebsführung von Sandfiltern.—Zeitschrift für Hygiene.* 1894. Vol. xvi., p. 151.

were met and overcome, even at such antiquated works as those on the Spree at Stralau. In this article he refers to actual defects in the filtering media which were, and could only have been, discovered by daily bacteriological examination of the filtrate from each bed.

Experimental Filter Beds. Attempts have been made to impugn the accuracy of Piefke's and Fraenkel's experiments referred to above, on the ground that the conditions under which they were made did not resemble closely enough those prevailing in large filter beds. For instance, the sides of their experimental filter were made of wood and not of cement; then, again, the rate of filtration they employed—300 m.m. per hour—was excessive; and, lastly, the rate of filtration, so it was maintained, could not be properly regulated. It was very necessary, therefore, that these experiments, so far-reaching in their effects, should be repeated under conditions more closely resembling sand filtration on the large scale. This has now been done by Professor Kabrhel, of Prague, and his results are published in the *Archiv für Hygiene*.[1] They confirm, in all essential points, the conclusions of the earlier observers. He finds, however, that Piefke and Fraenkel under-estimated the reduction in the number of microbes in the filtered water as compared with that in the unfiltered. Thus they regarded the proportion as 1:1000, while he puts it down as varying from 1:1666 and 1:7500, according to the number of bacteria in the unfiltered water and to the rate of filtration.

Sand filtration and epidemics. But, after all, the importance of placing sand filtration under very strict supervision has been most strongly emphasized by the facts which have come to light from the recent inquiries that have been made in Germany into the cholera epidemics of 1892 and 1893. At the lunatic asylum of Halle, for instance, where in the

[1] 1895. Vol. xxiii., p. 323.

course of a month there were 122 cases of cholera, with 52 deaths, the filters were overdriven, and seem to have acted more like a sieve than a filter, as the filtrate contained 52,410 bacteria per c.c.[1] Similarly at Stettin the rate of filtration exceeded 200 m.m. per hour, and sometimes rose to 400 m.m., a rate sufficient to break down any filtering scum that might have been formed. In two of the filtering basins on one occasion typical cholera vibrios were found.

The value of the bacteriological control on the water was well shown in the small cholera epidemic of Hamburg in the autumn of 1893. By its means it was found that a leak in the main existed, allowing the entrance of unfiltered Elbe water, and as soon as the defect was remedied the number of bacteria, which before had been 1,500 per c.c., fell to between 100 and 200.

Hamburg epidemic.

According to the official report edited by Professor Gaffky, on the great epidemic of cholera in Hamburg, in the autumn of 1892, the *causa causans* of the outbreak was the distribution of unfiltered Elbe water in the mains.[2] In all there were 16,956 cases, with 8,605 deaths. Another fact, brought out equally clearly, and incriminating still more the Hamburg water supply, was the fact that Altona and Wandsbeck, which are part of Hamburg as much as Whitechapel and Blackheath are of London, remained practically immune, the only significant difference between them being that Altona carefully filtered the Elbe water through sand before allowing it to enter the service pipes, and that Wandsbeck derived its supply from a lake. In Hamburg the death-rate from cholera was 14·22 per 1,000; in Altona, 2·13; and in Wandsbeck, 2·09; but from these numbers there has not

[1] Koch, *loc. cit.*, p. 405.

[2] *Arbeiten aus dem Kaiserlichen Gesundheitsamte*, vol. x.

been deducted those cases in Altona and Wandsbeck which were contracted in Hamburg, and it is estimated that they were 60 and 90 per cent. respectively.

Amount of water consumed.

The average daily consumption of water in Berlin, in 1892–3, was about 24½ million gallons, or an average of 15 gallons a head per day. The cause of this very small consumption is probably due to the fact that all water is measured by meter and paid for accordingly.

Payment by meter.

The water rate falls on the landlord, who no doubt takes cognizance of this fact in his rent charges. Seeing that nearly all persons in Berlin live in flats, and the average number of persons to a tenement is 70, the plan is by far the simplest that could be adopted, and is decidedly effective in checking unnecessary waste. The supply is a constant one, and only rarely in the long winters is there any interruption in the supply through frost, as great care is taken in seeing that the pipes are laid at a sufficient depth in the ground and that they are sufficiently protected in the house.

Drainage of Berlin.

Few, if any, large cities have grappled so successfully with the sewage question as has Berlin. And few, it may at the same time be said, have had so many difficulties to contend with in the work of carrying it out. Only in 1892, after twenty years' work, was the network of sewers completed. Prior to 1872 the drainage was of the most primitive description; privies were in nearly every house; open drains, badly built and with insufficient fall, ran through many of the streets, and discharged their contents into the Spree, the pollution of which became well nigh intolerable. Between 1860 and 1872 various commissions were appointed to examine thoroughly into the whole question; and as a result of their deliberations, after having visited various countries, especially

England, to gain exact knowledge on the question, a report was issued in which the conclusion was stated that, as the introduction of sewage, whether containing human excrement or not, into the Spree was not permissible, and as its purification by chemical means was deemed impossible, there remained no other course possible but to treat the sewage on suitable land outside the city.[1] From the general flatness of the plain of twenty square miles, in which Berlin lies, it was impossible for this to be done by gravitation; and so recourse had to be had to steam pumps. The natural fall of the ground, on which Berlin is built, did not allow of the sewage being collected at one spot, and consequently the city was divided up into twelve drainage areas, to which the name "radial system" of drainage was given.

The "Radial" system.

The name radial is rather unfortunate, for the different drainage areas bear no relation at all to one another in size or shape; they are determined solely by the contour levels of the city and the distribution of the natural watercourses. Undoubtedly the system is the best that could have been established in Berlin. Its advantages are that, the extent of each district being known, the sewers can be constructed of a size to suit this, and complete freedom is left in the choice of the point where the sewage is to be treated. At the lowest point in each of the systems a pumping station has been erected to force the sewage to the sewage farm. The main sewer, after receiving the branch drains, discharges into a large basin 39 feet in diameter at the stations where the sand and detritus are collected before the sewage is pumped away. The sewers are egg-shaped, rarely more than 5 feet high, modelled after those in London, and are made either of earthenware pipes

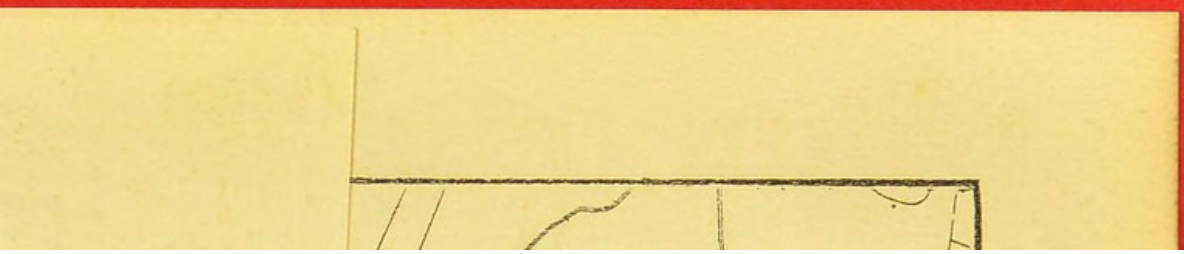
[1] *Die öffentliche Gesundheits und Krankenpflege der Stadt Berlin*, p. 283.

or of brick. The fall in many of them is very slight, so that a large staff is necessary for keeping them clean, and numerous ingenious contrivances have to be used to carry out the work. Gullies exist to catch road detritus at distances of 65 yards from one another. The ventilation of the sewers is not perhaps as satisfactory as it might be, being effected very largely through the rain water pipes which communicate directly with the sewer. Storm overflows into the Spree are necessary for the rare occasions when the pumps are unequal to the task of dealing with the amount of sewage brought down. It must be admitted, however, that the condition of the Spree, considering its small volume, the sluggishness of its stream, and the size of the city through which it passes, is remarkably good, and compares most favourably with other rivers flowing by large towns.

Excellent condition of the Spree.

House Drainage.

Connection of the soil-pipes of houses with the sewer is compulsory, and at the end of 1893 there were 22,661 such connections. The city authorities make the house drain as far as just inside the house wall, where there is an inspection chamber and a flap valve opening only in the direction of the sewer, to prevent the backing up of the sewage into the soil-pipe. The proprietor carries the soil-pipe up to the opening of the ventilating shaft above the roof, and he has control of the management of the fittings inside the house. This is perhaps the place to refer to the grave defects that are to be found in the w.c.'s in most of the houses as regards light and ventilation, defects which go far to detract from the otherwise successful drainage scheme. No disconnecting trap exists between the house drain and the main sewer, nor is there any means for the through ventilation of the house drains by an air inlet immediately on the house side of the trap which intercepts the drain from the main sewer, and an outlet at the head of



the drain, as in this country. But it is well known that abroad there is not the same feeling about the dangers that may arise from the entrance of sewer air into the house that there is here. Since the introduction of the drainage works the total mortality has declined from 32·9 per 1,000 in 1875 to, in 1892, 20·2, and the diminution in the death rate from typhoid fever, which gives perhaps the best indication of its value, has fallen from 23·05 of all causes of death in the ten years, 1871–80, to 7·13 in 1881–90.

The Sewage Farms.

In no place has sewage farming had such a chance, and been so brilliantly successful as at Berlin, for an almost unlimited extent of suitable land was obtainable. The ground was highly porous, consisting practically of sandy wastes, on which only stunted fir trees and birches could grow. To-day they have been transformed into fertile fields. There are five chief sewage farms, three, Falkenberg, Malchow, and Blankenfeld, situated some four or five kilometres to the north of Berlin; and two, Osdorf and Grossbeeren, some ten to fifteen kilometres to the south. The total area of the land which the city can devote to sewage irrigation works amounts to over 22,500 acres; but of this, so far, only about 11,000 acres have been laid out. In the year 1892-3, 61,858,754 cubic metres of sewage were pumped out to the works, which represents 106 litres per head of the population per day. This latter sum is in excess of the average water supply per head (68·48 litres) by 37·52 litres, which represents therefore the rain-water, pump-water, etc., in addition.

I was able to see in detail the method of working as carried out at the Grossbeeren farm. All the ground has been carefully levelled and underdrained to the depth of one metre. The sewage is pumped from Berlin in an iron main one metre in diameter, to the highest point on the farm, where it discharges into a chamber. From this central

point, in smaller pipes radiating out from it, the sewage flows to forty-six secondary raised points. Each of these secondary points dominates a certain area irrigated by the sewage running along open channels cut in the soil. The simplest kind of arrangements are used, wooden wedges sufficing for closing or opening the different channels. Almost everything is grown on the farms. Rye-grass fields naturally bear most of the brunt of sewage purification, and six crops of this are cut annually. But wheat, oats, barley, rape, mangolds, and potatoes all figure largely, while the roads intersecting the farms are lined with fruit trees. Only rarely is difficulty met with in the sale of the farm produce. Live stock is also kept on a large scale. At one of the farms roses are cultivated largely for the purpose of making the well-known scent, attar of roses. At Grossbeeren, and in other of the farms, the drainage water has been utilized for the purpose of making ponds for fish culture. Many of the peasants round about have become much enriched by arrangements made with the city authorities, whereby they obtain the sewage for irrigating their own land. The whole of the service is wonderfully organized, and the men on the sewage farm carry out their instructions and report to head quarters just as though they were soldiers on duty.

An interesting experiment has been made in employing those who have been condemned for begging and minor offences, on the farm. They are quartered in barracks in large batches of two or three hundred, and it has been found possible in the country to get them to do some work. No deleterious effect has been noticed on the health of those living on the sewage farms, and indeed on some of them, as at Blankenburg and Malchow, the city has built various hospitals for convalescents, for consumptives, and for those recovering from childbed, and the patients seem to thrive in them as well as they would anywhere else.

Typhoid Fever germs and drainage water.

The important point as to whether typhoid fever or cholera germs ever pass through the soil into the drainage water has been proved, as far as bacteriological examination goes, in the negative. Weekly bacteriological examinations of the drainage water are made with a view to elucidate this point. Up till 1892 there was a remarkable freedom from typhoid fever amongst the labourers on the farms, even though the city itself in 1889 suffered severely from an epidemic of this disease. In 1892, however, a few cases of those diseases occurred among workers on the farm who were alleged to have drunk largely of the drainage water, but in them other sources of infection could not be excluded. Certain it is that the purification that the sewage undergoes in its passage through the soil is most remarkable. Not only is the organic matter largely oxidised, but the bacteria also are reduced to a number considerably less than that normally present in the river Spree. The cost of efficiently superintending these sewage farm works is, of course, enormous. As a rule, the working expenses have been covered by the sale of the produce; in 1889 the surplus was £11,511, but during the two years 1892–93 and 1893–94, owing to the very dry summers which caused a total failure in some of the crops, there has been a deficit.

Street cleaning.

In concluding this chapter, the following remarks by Mr. Pollard, in his book on Berlin,[1] appear to me so apposite that I take the liberty of quoting them: "In connection with this part of municipal work (street cleaning), there is a simple and yet very suggestive matter which strikes the visitor to Berlin who is comparing notes with the state of things at home. It is that the scavengers are all clad in overalls and wide leggings of coarse hempen

[1] *A Study in Municipal Government*, p. 46. London: Blackwood & Son, 1894.

stuff, which gives them an appearance of tidiness and preserves their ordinary clothes from pollution. With an official cap on his head, a belt round his waist, giving his plain large tunic a somewhat smart appearance, the Berlin scavenger feels that he is a public servant, and that though his occupation may be menial, yet his health and comfort are of some concern to his masters. The municipality take no credit for philanthropy in providing these overalls. On economical grounds, which are the only grounds on which any expenditure of the sort is justified, the Corporation do what they can to make their servants an example to the community in respect of clean habits."

CHAPTER IV

WATER SUPPLY AND DRAINAGE OF PARIS

Double service of Spring Water and River Water—Excellence of the former—Water supply to Houses made compulsory recently—Insufficiency of Spring Water in the past—Its deficiency made good formerly by the use of River Water—Effects of this in increasing Typhoid Fever—Connection between late Cholera epidemic and the use of River Water—The Pollution of the Seine—Construction and form of Sewers—The Water-carriage system—The new Law making this system compulsory—Old methods of removal of Night-soil—Sewage farm at Gennevilliers.

M. BECHMANN, Engineer-in-chief of Roads and Bridges, in an interesting report presented to the Société de médecine publique et d'hygiène professionnelle, has carefully tabulated the statistics from 691 towns in France, giving particulars as to their water supply and drainage.[1] From these statistics it is seen that—

219 towns with 2,792,850 inhabitants use spring water.
215 ,, ,, 1,752,243 ,, ,, ground or surface water.
144 ,, ,, 5,950,020 ,, ,, both kinds.

Early attempts at providing a Water Supply.

Included in the last is Paris with 2,500,000 inhabitants. In 1709 the supply of water in the capital did not amount to quite three gallons a head, whereas in 1892 it equalled forty-seven gallons a head per day; but of this, it must be remem-

[1] *Enquête statistique sur l'hygiène urbaine dans les villes françaises. Revue d'Hygiène*, vol. xiv., p. 1062.

bered, only twelve gallons were spring water, the remaining thirty-five consisting of river water. Probably to-day, since the opening, in 1893, of the new supply of the Avre, the amount of spring water is about twenty gallons a head. The first, and by far the most important supplies, were taken from the Seine. In 1837 the Canal Ourcq was opened, bringing an additional 5,000,000 cubic feet of water daily for the growing needs of the capital, more and more water being, at the same time, pumped from the river. But as the city increased, so did the sewers, and with them the pollution of the Seine, as they were carried, as in the case of London, by the shortest route straight to the river. It became, therefore, more and more necessary to obtain a purer water supply for drinking purposes.

Double system of Water Supply.

During the time of the Second Empire, the engineer Bertrand, working in conjunction with Haussmann, Prefect of the Seine, developed the idea, which has since been carried out, of the double system of water supply, namely, spring water for domestic use, and river water for public and industrial purposes. Theoretically, for so large a city this system is an admirable one, for it must have struck every one at times that there is a fearful waste of good drinking water, when only filtered water is used for all purposes; but, practically, it has to be admitted that the matter has not worked out as satisfactorily as could be wished, partly owing to the expense of supplying spring water, and partly owing to the fact that, in one way or another, access is had to the unfiltered water for drinking purposes.

Spring water.

In 1866 the sources of the Dhuis, a small river in the department Aisne, were tapped and brought to the reservoir at Ménilmontant, a distance of over eighty miles, to serve the XVIIth., XVIIIth., and XIXth. arrondissements. The amount of water from this source is,

however, only $4\frac{1}{2}$ million gallons a day. The same was done in 1874 for the waters of the Vanne, a river taking its rise in the department of the Aube and joining the Yonne at Sens. In this case the distance traversed between the source and the reservoir at Montsouris was 110 miles, and the cost of the aqueduct and reservoir amounted to nearly £2,000,000. The total amount of water supplied

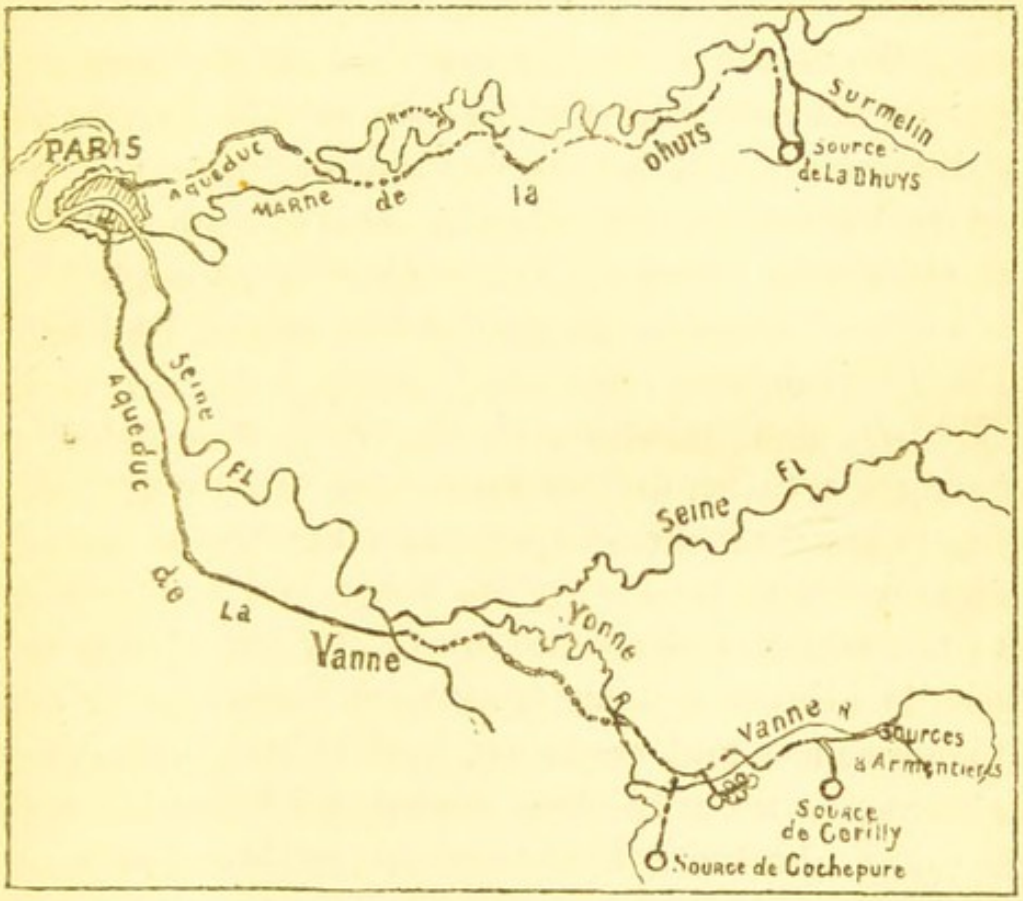


FIG. 7.—Sources of the Dhuis and Vanne (*after Bechmann*).

by the Vanne is over $24\frac{1}{4}$ million gallons (110,000 cubic metres) a day, and it has served to supply the remaining arrondissements with spring water.

In June, 1893, a fresh and much needed supply of spring water was made available for the city by bringing from a distance of sixty-seven miles the waters of the valley of the Avre and the Vigne in Normandy to the newly-built reser-

voirs at St. Cloud. This supply nearly doubles the amount of spring water. It comes from the chalk, and is in every way suitable for domestic purposes.

In this last instance the city, however, met with much opposition from the inhabitants of the districts from which the waters were derived. The objections were based on the damage that would be inflicted on the inhabitants in respect of hygiene, agriculture, and the various industries depending on water for their motor power, and it was not until full compensation was promised by the city in the payment of indemnities for the substitution of steam power or the water power previously used in the manufactories, that the opposition was allayed. There is no doubt that the objections raised at the time were exaggerated, but Paris has done well in going out of its way to meet them in a generous spirit.

The water, after leaving the reservoir at St. Cloud and crossing the Seine, divides into three main branches, one going to the reservoir at Montrouge, another traversing the quays on the right side of the Seine, and communicating with the mains of the Vanne, and the third passing to the Place de l'Étoile to connect with the mains of the Dhuis. The aqueducts and reservoirs, both of which are covered in, belong to the very finest works of engineering skill in France. The reservoir at Montsouris is remarkable in being divided into two absolutely distinct chambers, one immediately above the other. The reservoirs at St. Cloud, from their newness, are perhaps the most interesting. It was only as late as 1890 that the work of constructing the aqueduct was commenced. To expedite matters, operations were started at three different points along its course, 3,500 workmen were employed, and the work progressed at the rate of six kilometres a month. The expense is estimated at £1,040,000. There are to

The Reservoirs.

be three reservoirs, each of a sufficient capacity to hold 3,500,000 cubic feet of water, and of these two have already been finished. The total quantity of water supplied from these three sources is equal to nearly 9,000,000 cubic feet a day, sufficient to give about 22 gallons of drinking water to each inhabitant per day.

Money voted for a fresh supply.

But even this supply is not sufficient for the needs of the capital, and hence, by the law relative to the sanitation of Paris and of the Seine, passed in 1894, 50,000,000 francs out of the total 117,500,000 borrowed, are set aside for the construction of reservoirs, for improvements in the conduits, filter basins, and aqueducts; and, lastly, for bringing a fresh supply of spring water from the valleys of the Loing and Lunain to the city. At present, however, the operations for carrying out the last-named step have not been commenced. When it is finished it will add another 11,000,000 gallons daily to the pure water supply of the city. The principal station for pumping Seine water is situated at Ivry, and that for the water from the Marne at St. Maur. Altogether the various pumping stations are capable of raising over 88,000,000 gallons of river water a day.

Conditions under which Water is supplied.

Until 1892 there were no compulsory powers to compel houses to connect with the municipal water supply. Connection was voluntary, and the charges made for the water supply diminished according as the amount taken increased. This state of things has been completely altered by the resolution adopted in 1892 by the Municipal Council as to compulsory *abonnement* to the water supply.[1] According to the new system a certain limit (50 litres or 11 gallons) is recognised as sufficient for ordinary purposes for each inhabitant, and quantities used in excess of this are paid for at

[1] *Les Services Sanitaires de Paris;* A. Joltrain, p. 208.

increasing rates. In order to avoid waste, the only method allowed for determining the amount used is that by meter. This must be of a pattern approved by the municipal authorities, and the amount of water used is read off during the first fortnight of every quarter. The yearly price paid is at the rate of 120 francs per cubic metre (220 gallons) per day, provided the amount used does not exceed 50 litres a head per day. This works out at 6 francs for each inhabitant yearly.

Abonnements are also allowed for quantities of 125 litres (27½ gallons) and 250 litres (55 gallons), at the rate of 20 francs and 40 francs a year respectively. Exceptions to the above rule are made when persons only make use of the water during the day, and when the rental of the house is less than £32 a year. When the amount used exceeds 50 litres a day, but not 100 litres, the tax is 146 francs per cubic metre yearly, and for quantities above 100 litres, 240 francs.

The spring water must not be used for any but domestic purposes; it is distinctly forbidden to use it for the watering of gardens, washing out of courts or stables. All the expenses connected with the laying down or repairing of the water supply from the main fall upon the proprietor, the work being carried out, as far as to the meter, by the workmen of the administration. Inside the house, the proprietor is allowed a free hand in the distribution of the pipes. No right to an indemnity or action against the city can be had in consequence of interruptions in the service as the result of frost, drought, or repairs in the conduits or reservoirs, nor even in the case of the substitution of Seine or Marne water for the spring water. Opportunity, however, is always given to the householders to signalize these defects to the police, and if the interruption has exceeded three days, he is entitled to a corresponding reduction in

the charge for the current three months. When Seine water has been substituted for more than twenty days in the year, the householders have the right to a reduction.

The application of this measure will have the effect of supplying some 23,500 houses, representing a population of about 580,000, with pure water, one half of which has received hitherto scarcely any water from the public supply, whilst the other half has had to depend on river water.[1]

Evils resulting from mixing River with Spring Water.

The great advantage of this additional water supply at St. Cloud is that Paris is able to provide all its arrondissements with pure spring water, and, it is hoped, will not have any longer to bear the reproach of turning on impure Seine water, in times of drought, when the supply of the Dhuis and the Vanne becomes insufficient. Because hitherto not only has there been a communication between the reservoirs of spring water and those for Seine water, but it has been the regular thing every summer to make good the insufficiency of spring water by unfiltered Seine water, drawn at Ivry, which is turned into the reservoirs. At first this was done without any notice being given of the change, but for the last few years notices have been put up stating on what day the change of supply was to be made, in order to allow the inhabitants to take such precautions as they thought fit against the impure supply. This condition of things, however, has often been the signal for an explosion of typhoid fever in those quarters supplied by the infected water, and it has indeed been this question of typhoid fever, and the still more persuasive effects of cholera, that has brought about this demand for a sufficient supply of pure water.

Its connection with Typhoid Fever.

One or two examples, showing the direct effect in the

[1] *Études d'Hygiène Publique*; G. Jourdan, p. 130.

causation of typhoid fever by the substitution of Seine water for spring water, may be cited. In 1886, river water was turned on about July 20. During the week ending July 24, 40 patients with enteric fever entered the hospitals, while from the 1st to the 7th August the numbers jumped up to 150. The river water supply was cut off on August 7, and from the 15th to the 21st of that month the number of enteric patients had gone down in the hospitals to 80.[1] In 1887, on January 27, Seine water and water from the Canal Ourcq was distributed, and from the 13th to the 19th February the hospitals received 95 typhoid patients, instead of the usual number of 20. In 1888 no river water was turned on, there having been no prolonged drought, and typhoid fever in that year was excessively rare.[2] But, perhaps, the most striking example is that of the year 1889, when, owing to an accident to the conduits bringing spring water, in the month of November, for five days the whole town received nothing but river water. Fifteen days later the deaths from typhoid fever began to increase, reached their maximum in the middle of December, after which they began gradually to diminish. M. Jules Rochard[3] states that he has calculated that this accident to the conduit of the Vanne caused 1,570 cases of typhoid fever, with 220 deaths, and cost the city 1,000,000 francs.

And with Cholera.

With regard to cholera and its relation to Seine water, the matter has passed almost into a proverb, "Pas d'eau de Seine, pas de choléra." In the epidemic of cholera in the environs of Paris in 1892, Professors Proust, Nettier, Ogier, and Thoinot, who were commissioned to report on it, stated clearly their conclusion that it was limited to those places alone where Seine water

[1] *Des Modes de Propagation de la Fièvre Typhoïde.* Brouardel. 1887.

[2] *Les Causes de la Fièvre Typhoïde.* Gasser.

[3] *Encyclopédie d'Hygiène*, vol. iii., p. 183.

was drunk, although there were plenty of opportunities for its spreading. Thus, at St. Denis, with 50,000 inhabitants, the centre of the town relied on artesian well water, and remained practically immune from typhoid and choleraic diarrhœa, while the surrounding districts had a supply from the river, and it was on them that the mortality from these diseases chiefly fell.[1] Further, the places supplied by water taken from the Seine above Paris were not affected, whereas the epidemic spread in the months of May, June, and July, without getting beyond the confines of the north and north-west, where the pollution of the river is greatest. At Argenteuil, an old village with narrow streets and closes, badly ventilated and drained, during the summer drought, water was pumped from Épinay (where the Seine is frightfully polluted) to supplement the supply from the river Oise, which was running short. The water is described as having been yellow, with an unpleasant smell, and with organic matter in suspension. The effects were disastrous. Choleraic diarrhœa became epidemic, and the mortality here was greater than in any other of the suburbs? At Clichy, until 1884, the water supply was taken from Neuilly-sur-Seine, and the average number of cases a year from typhoid was 200. Since then a pure supply has been obtained, and the number of cases has dropped to 40. In 1892, an epidemic of this disease broke out because impure water from the station at Épinay was supplied temporarily. No wonder there was a demand that this pumping station at Épinay should be abolished, which fortunately has been done. Other towns in this north-western district around Paris were supplied with Seine water taken below the city, and therefore polluted, and many of them were centres of cholera.

What makes this north-western district of the suburbs so unhealthy? Undoubtedly the pollution of the Seine and

[1] *Revue d'Hygiène*, 1892, vol. xiv., p. 913.

the employment of its water for drinking purposes is one of the factors. There is, unfortunately, no nation that is in a position to throw stones at another with regard to this question of the pollution of rivers. We know at home how the Rivers Pollution Act has failed to realize the hopes that were entertained of it, and how, in open defiance of it, many towns, even health resorts like Bath, pour their sewage, absolutely untreated, into the nearest stream. But, perhaps, to see in perfection the result of passing an enormous mass of untreated sewage into a river, one could not do better than take a walk along the right side of the Seine.

Pollution of the Seine.

The main sewage outfall has been removed from the Seine directly at Paris to Clichy, a mile or two below the city. Just above Clichy the water of the river, although it has passed right through Paris, is green, and of surprising clearness; a condition of things that undergoes immediate change as soon as the sewage outfall is reached. By far the greater quantity of sewage passes in wholly untreated, the simple process of screening off the grosser matters (excepting a small part of the sewage), being dispensed with. The condition of the stream below almost baffles description. The smell from it is overpowering. The banks become covered with layers of filthy fermenting mud, from which nauseous gases are constantly being disengaged. Fish are absent. They have often been seen lower down killed by the foulness of the water. This condition of things continues without improvement to St. Ouen. Between this and St. Denis it is beginning to recover, and islets of green weeds for the first time appear below the outfall; only, however, to entangle and cause accumulations of corks and scum that have escaped the snares in the shape of logs of wood jutting out at intervals from the bank. Any improvement that might have occurred

in the river by the time it reached St. Denis, is at once destroyed by the discharge into it there of the great sewer of the North of Paris, which causes a repetition of the appalling state of things existing below the first outfall. On the stream goes towards Épinay (where was the intake of water, now disused, mentioned above as having been employed during an emergency in the summer of 1892 to supply Argenteuil with water), surcharged with filth, emitting constant bubbles of gas, blackish in colour, the banks lined with every imaginable kind of refuse, only to receive, about a mile lower down, the sewer of St. Denis. For miles below this the river shows evidence of what it has received, but after its junction with the Oise the condition materially improves, and by Meulan there are no signs of the previous pollution.

Number of Bacteria in the River.

Perhaps the most graphic way in which to see how great is the pollution of the river, and how undesirable to use it as a water supply, is to trace the number of bacteria per cubic centimetre in specimens taken at different points along its course, and to compare these with the number contained in a similar quantity of the spring water supplied to the city. Thanks to the daily researches in this line made by Dr. Miquel, Chef du Service Micrographique de l'Observatoire Municipal de Montsouris for many years past, this is not a difficult matter.[1] Taking as the standard for bacteria per cubic centimetre in—

	per c.c.
Excessively pure	0— 10
Very pure	10— 100
Pure	100— 10,000
Impure	10,000—100,000
Very impure	1,000,000 and over,

[1] *Manuel Pratique d'Analyse Bactériologique des Eaux.* Miquel, 1891.

he finds that for Paris the average number of bacteria per cubic centimetre is—

	per c.c.
Vanne (spring water)	800
Dhuis	1,890
Seine (above Paris)	32,500
Marne	36,300

Taking the Seine alone in its passage above, through, and below the city he found [1]—

Above the city—

	per c.c.
Choissy le Roi	27,000

Through the city—

Pont d'Austerlitz	99,000
Pont d'Alma	250,000
Suresnes	105,000

Below the city—

St. Ouen	4,500,000
St. Denis	1,500,000
Épinay	1,600,000

Comment is needless when we compare these numbers with the 800 contained per c.c. in the Vanne water. Above St. Ouen the great collector discharges its immense volume of sewage, each c.c. containing not far short of 20,000,000 bacteria.

The Sewers of Paris.

To understand this pollution it is necessary to consider of what the sewage of Paris consists, and what are the methods commonly employed there for getting rid of waste matters from houses. A very fine network of sewers exists, designed in 1856 by Belgrand; but there still remain some 150 kilometres length of them to be constructed before the necessary 1,000 kilometres are

[1] *Altération Progressive de la Seine.* Lévy et Miquel. *Revue d'Hygiène*, 1892, vol. xiv.

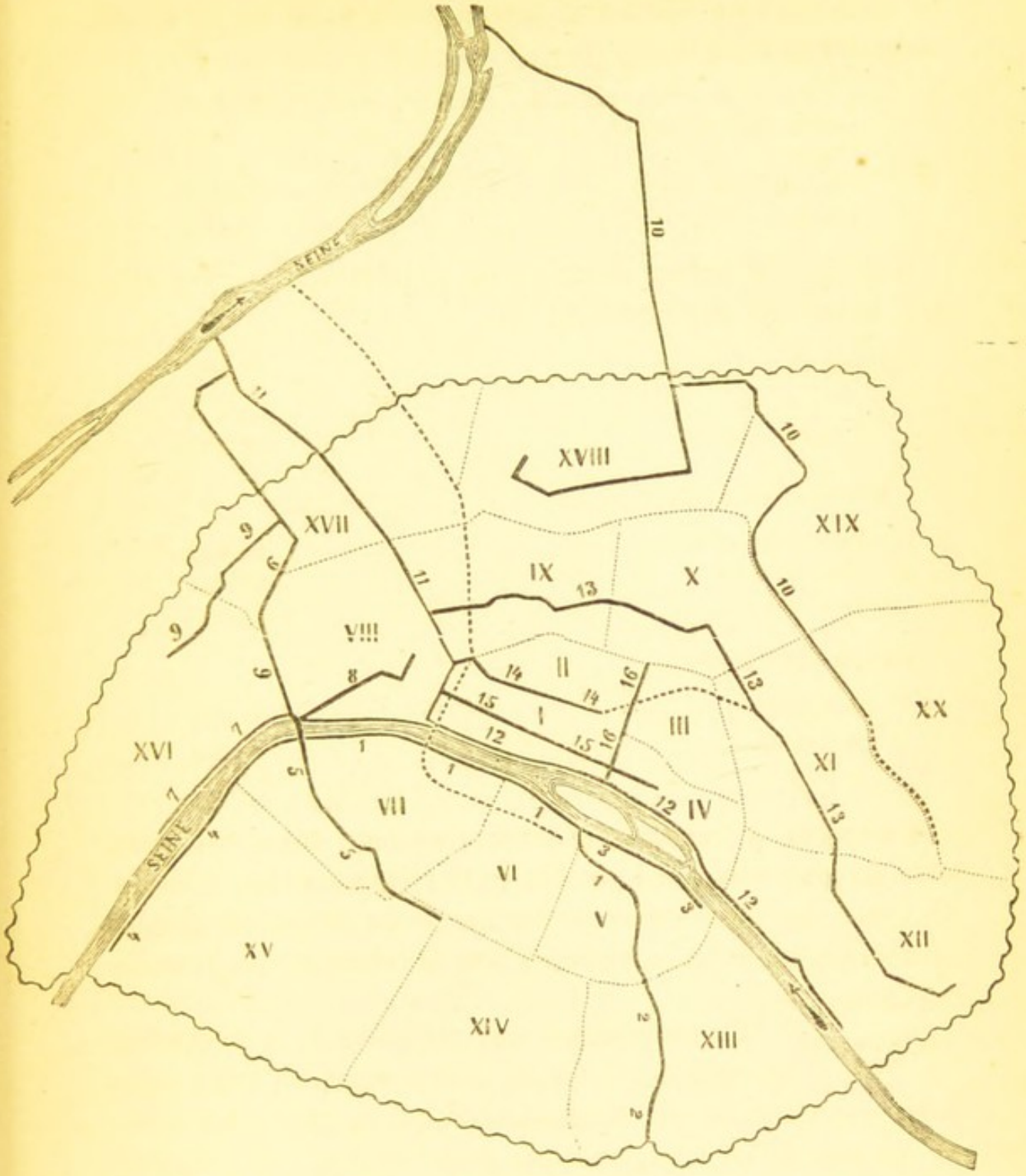


FIG. 8.—Plan of Paris, showing the Course of the Principal Collectors and of the new ones it is proposed to construct (*after Humblot*). The Roman figures show the Arrondissements of the City; the Small figures refer to the names of the Sewers, of which (11), Collecteur d'Asnières, and (10), Collecteur du Nord, alone need be mentioned.

——— Present collectors. ---------- Proposed collectors.

reached. The sewers differ entirely from those in this country in their much greater size and in the fact that they subserve other purposes than that of the removal of waste

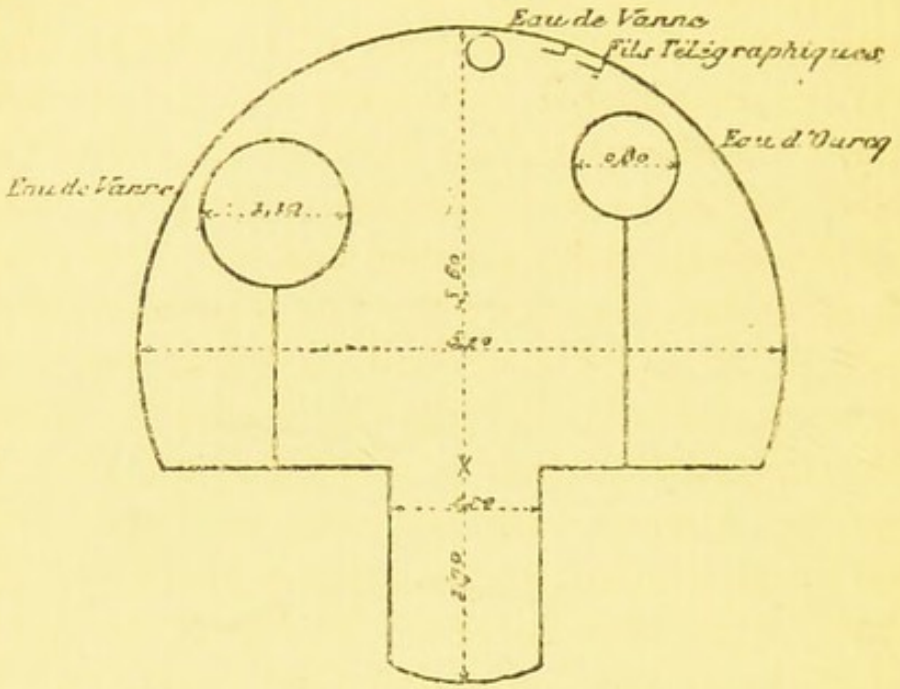


FIG. 9.—Section of Main Sewer, showing Water-pipes, etc., in it.

matters. They are, in fact, gigantic subways, everywhere accessible, freely ventilated, in which the sewage flows along in a special channel at the bottom; on both sides in the larger sewers, or on one side only in the smaller, is a foot-

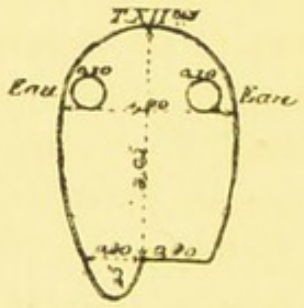


FIG. 10.—Ordinary Type of Sewer.

path for the workmen to move along; against the walls on racks are the mains for conveying the drinking water and those containing the Seine water for public purposes, while along the roof is the network of telegraphic and telephonic

wires, and the pipes for compressed air. The gas pipes, owing to the risk of a possible explosion, are not carried in them. The sewers are of fourteen types. The largest, which include the three main intercepting sewers of Asnières, that on the left bank of the Seine, and that serving the north-east of Paris, have a height of about 14½ ft. and a breadth of 19 ft.; those in the ordinary streets are 7½ ft. high and 4 ft. 2 in. broad. The public is allowed to visit the sewers in the summer, and the journey from the Place de la Madeleine down the Rue Royale and along the Rue de Rivoli to the Boulevard de Sebastopol gives one plenty of ground to marvel at the excellence of construction and the admirable manner in which they are kept. Their dimensions, however, and slight fall are such that they cannot be self-cleaning, and an army of about 900 men are constantly occupied in the task. The sewers receive all the refuse of the streets, horse droppings, sand, etc., that is washed into them, partly by the action of the men who keep the main thoroughfares so beautifully clean by constant watering, and partly by the sweeping action of the water which is turned on and allowed to run by the edge of the pavement for a short time every day. No intercepting trap is placed between the street and the sewer. The sand that is washed in gives rise to an immense amount of trouble, owing to the accumulations of it which form, and the damage caused to the sewer itself by the friction. In 1893 no less than 33,311 cubic metres of this material had to be removed at a cost of 118,866 francs.[1]

The principal method adopted for cleansing the sewers is to flush them out by means of flushing reservoirs, the number of which have been largely increased of late years. When there are accumulations of sand to be removed

[1] *Service de l'assainissement. Notes à l'appui du compte des dépenses de l'Exercise*, 1893. Ville de Paris.

some special apparatus is required, with the object of breaking it up and moving it onwards. In the smaller sewers the machine used is called a *mitrailleuse*; it is shaped to the size of the sewer and is moved by hand. In the larger sized sewers the apparatus moves on rails, and in the collectors it is fixed to an iron boat. At certain points there are chambers for retaining the sand and other solid bodies from which the matter can be readily removed. Six syphons carry the sewage from one side of the Seine to the

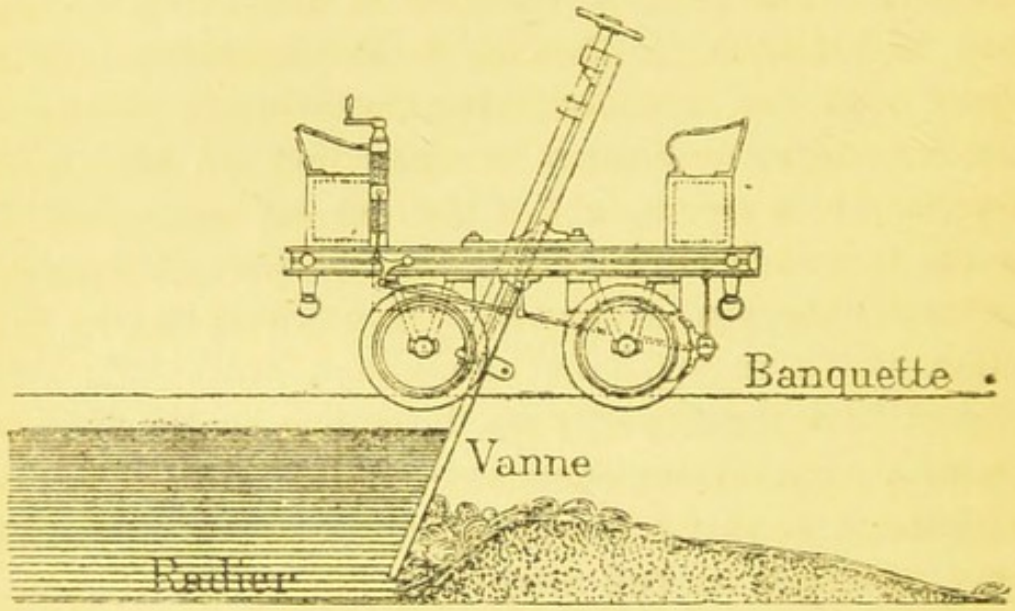


FIG. 11.—Arrangements for Cleaning the Sewers by means of a Sluice Valve.

other. Storm overflows from the sewers into the Seine exist, only coming into use, however, during times of very heavy rain.

Water Carriage System adopted.

The sewers were not intended in the first instance for the removal of night soil, but as the advantage of the water carriage system in large communities became more and more manifest, at the same time that the difficulties attending the emptying and removal of the contents of the cesspools, etc., became more apparent, water-closets have gradually been introduced, and now, by the law recently passed, their introduction is

made compulsory. Already the first list of streets, to the number of 650, has been drawn up, in which the connection with the sewer is made compulsory, and in many of them the works necessary for effecting it may be seen in active operation.

New Law on Sanitation of the city.

This law relating to the sanitation of Paris and the Seine, for which those who are interested in public health matters there have been fighting so ardently and so long, was passed on July 10, 1894. The germ of the idea of abolishing the cesspools and draining all houses in Paris directly into the sewers, with the subsequent treatment of the sewage on irrigation fields, originated in the mind of M. Durand Claye, and it is a pathetic fact that, having consecrated his life to the realization of this project, he should have died in 1888, at the age of forty-six, before witnessing its completion.

By this law the city of Paris is empowered to borrow a sum of £4,500,000 to complete the sanitation of the city, under which head the chief points included are: (1) The works necessary for conveying and raising the sewage to irrigation fields and the laying out of these lands; (2) the finishing of the network of sewers, improving the existing ones, and the construction of new collectors; and (3) the completion of the water supply by bringing the waters of the Loing and Lunain to Paris, which has been referred to before. For the first of these objects a sum of £1,232,000 has been set aside; for the second £1,400,000; and for the third £2,000,000. In order to cover some of this large expenditure, and to pay the working expenses, it is made compulsory on every one who can, to drain into the existing sewers within three years, and an annual tax is to be levied on every house for so doing, the tax varying with the rent of the house. Clause 6 stipulates that, by the end

of five years, the whole of the sewage shall be treated by irrigation, and none be passed directly into the Seine. More recently there has been issued a *Réglement relatif à l'assainissement de Paris*, dated August 8, 1894, answering all the purposes of a bye-law, which sets forth the conditions that must be fulfilled in the sanitary appliances; the materials of which they are to be made, their dimensions, etc. In the main these follow very closely those laid down in the Model Bye-laws of the Local Government Board as regards disconnection of the soil-pipe from the sewer, ventilation of the soil-pipe, the trapping of all house drains, and the necessity of their discharging, as well as the rain water pipes, over a trapped gully before entering the sewer. No reference appears to be made to a point on which stress is laid in this country, namely, that the soil-pipe should be placed outside the house.

Systems in vogue hitherto. The enormity of the task which the city of Paris has undertaken will be best understood when it is remembered what are the methods that have been in vogue up to the present for the disposal of night-soil. The 11,000 direct connections with the sewer represent but a very small portion of the methods at present in use. At the end of 1893 there were 64,175 *fosses fixes* or cesspools, 36,353 *fosses mobiles* or barrels, and 34,653 *tinettes filtrantes*, an apparatus by which, while the solids are retained, the liquids pass into the sewers; and 402 cases in which the disposal was made in other ways. All the objections urged against cesspools in this country have just as much force in Paris. The cesspools are very often placed immediately beneath the houses, ventilated by a pipe passing up to the roof, but which also serves for the connection with the closet without the intervention of a trap, and consequently the gases penetrate into the house readily through these. The operation of emptying them takes place at night, and is

one by no means looked forward to by the householder. The contents are aspirated by means of an air pump into a large metal cylinder placed on wheels, and removed at varying intervals of time, either to the Municipal depôt at Villette, from where they are pumped to the depôt in the forest of Bondy, to serve for the manufacture of sulphate of ammonium, or they are removed to various manufactories in the suburbs. The contents of the *fosses mobiles* and *tinettes filtrantes*, which are removed by private companies, are converted into manures in manufactories outside Paris. The condition of many of the manufactories, however, leaves very much to be desired from a sanitary point of view.

The new law must therefore be welcomed as likely to effect a very great improvement in the condition of the sanitation of Paris. In future years it will be matter for astonishment that it took over twenty years to persuade the Government that the frightful pollution of the Seine must be stopped.

In large communities all methods of dealing with and purifying sewage are open to objection; but the one which, if properly carried out, is least so, is undoubtedly the irrigation of suitable soil with the sewage.

Sewage Farm at Gennevilliers.

For several years a portion of the sewage of Paris has been treated on the 1,850 acres used as a sewage farm at Gennevilliers, and, the soil being suitable, the results have been exceedingly successful, both from the point of view of the cultivation of crops and also in the reduction of the number of the microbes in the sewage. These, which number over 20,000,000 per c.c., are reduced by their passage through the soil to an average of about 7,500. Further irrigation fields have been purchased and laid out in the neighbourhood of Achères, and when they are finished the main sewer will be prolonged to the plain of Méry Pierrelaye, and Carrières-sous-Poissy, in

the forest of St. Germain, so as to dominate an area of over 20,000 acres of land suitable for irrigation, far more than will be required for the city itself. It is hoped that all will be finished by the year 1900.

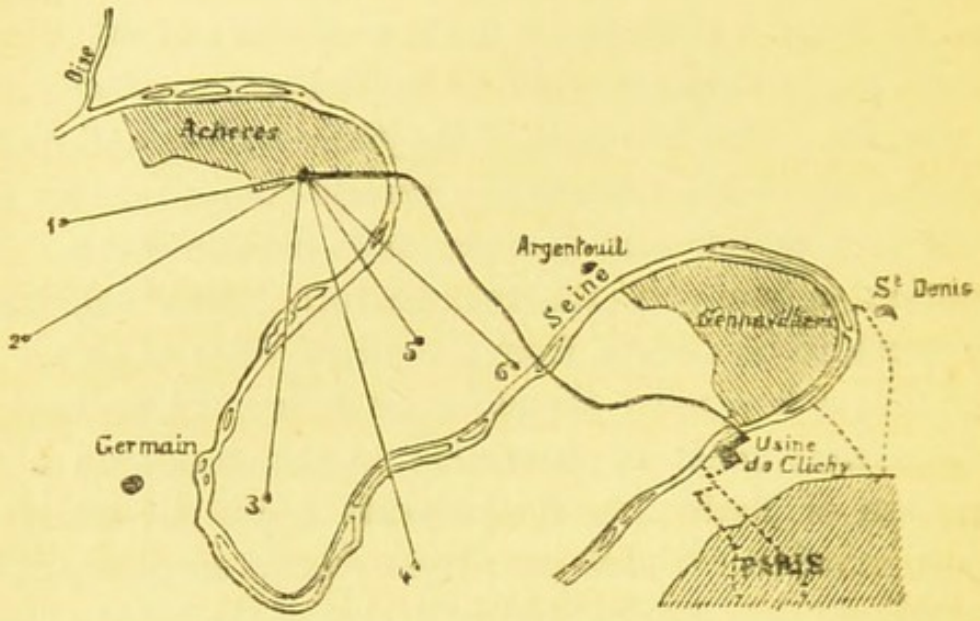


FIG. 12.—Plan of the Irrigation Fields of Gennevilliers and Achères.

The lines radiating from the end of the collector show the distance of the neighbouring places from the irrigation fields.

1. Achères, 6 kilometres. 2. Poissy, 3 kil. 3. Le Vesinet, 8 kil.
4. Rueil, 10 kil. 5. Houilles, 5 kil. 6. Bezons, 7 kil.

CHAPTER V

THE HOUSING OF THE WORKING CLASSES IN BERLIN AND PARIS

BERLIN.—Little attention paid to the subject in the past—Absence of Slums—Prevalence of Overcrowding—Cellar Dwellings—High Rents—Berlin Architects on the existing Tenements—Night lodgers—Building Regulations—Recent Development of Building Societies.

PARIS.—Recent interest created on the subject—Street Improvements during the Second Empire—Overcrowding and High Rents—Lodging-houses—New Working Men's Dwellings.

BERLIN.

Neglect of the subject in the past.

A VERY slight acquaintance with the problems which confront the authorities in the large continental cities, like Berlin and Paris, is sufficient to show that the one which demands the most immediate attention is the question of the housing of the working classes. It is difficult to understand why the subject has been neglected so long. Probably the many wars and the state of unrest consequent thereon have diverted men's minds from this particular point, or at any rate have prevented that attention being paid to it that the subject deserves, and the expenditure of the necessary funds that it requires. Certainly one cannot find on the continent the same liberality in gifts and donations for this object that has been so characteristically shown in London and throughout this country generally. The State undertakes so much abroad, especially in Germany, in the way of State Socialism,

that the habit of voluntary contributions to various institutions has not been cultivated to the same extent as here. Whatever the explanation may be, it is universally admitted that the first attempts to combat the evils attendant on the inadequate housing of the poor were made as the result of private benevolent effort in this country. And even now, when German philanthropists and writers are fully alive to the necessities of the case, it is matter for regret and loudly expressed protestation that the parish and district authorities remain, for the most part, blind to the importance of the subject. The feeling is growing stronger every day in Germany that the present conditions under which the poor live seriously endanger the maintenance of family life, and may be a powerful lever in upsetting existing institutions. Unfortunately, except in the country districts abroad, the admirable system that prevails with us of a single family, or at most two or three, living in the same house hardly exists, most of the families living in houses on the block or tenement principle. This is seen in the following table which gives for a few German towns the number of inhabitants per dwelling-house (*Grundstück*) as compared with those in England :—

	1885.	1890.
Berlin	67	73
Hamburg	31	34
Leipsic	41	33
Cologne	15	14·6
	1881.	1891.
London	7·84	7·72
Manchester	5·09	5·04
Birmingham	5·12	5·01

In some of the poorer quarters of Berlin, as in the Luisenstadt, 127 persons is the average to a dwelling-house. The average number to a family was, in 1890, 4·2.

The ideal state that every working man shall possess his

own small house and garden is still cherished by some philanthropists in Germany, but in a town like Berlin it must be regarded as absolutely impracticable, although something is being done to advance it in the suburbs.

Absence of Slums. Yet it must be admitted that slums, such as are known in London, and, in fact, in most of our great cities, or in Paris and Brussels, do not exist in Berlin. The streets are mostly broad, and in the suburbs might be dignified with the name of boulevards, taken in the Parisian sense of wide streets planted with trees. Flanking them are houses of that hideous monumental style, so dear to the heart of dwellers in towns abroad, five or six stories high, presenting outwardly a grandiose appearance, with stucco decorations and elaborate cornices. But the eye looks in vain for some break in the monotony of the sky-line which is carried perfectly straight from one end of the long street to the other. Few cities leave a more monotonous impression on the mind than Berlin, and the whole town may be characterized as a table-land of bricks and mortar 72 feet high, cut up by intersecting valleys representing the streets. Exception to these remarks must be made for the main street, Under den Linden, which is a beautiful one, chiefly owing to the irregularity in the sky-line and the lowness of the houses on either side in comparison with the breadth of the street.

Overcrowding and High Rents. Nevertheless, it is in these fine streets in the suburbs that the poor live, a fact made sufficiently evident by the crowds of children to be seen playing in the streets. The great evil that prevails is overcrowding combined with high rents. Since 1861, investigations as to the dwellings, their occupants, the rent paid, etc., have been made at the time of the census-taking in Berlin, and the results published in the Annual Report of the Statistical Office, which has, since 1875, been under the present able

chief of the department, Dr. Richard Boeckh. An expression of the worst conditions is found in the number of dwellings with rooms incapable of being heated; these numbered in 1885, 2,974, with 7,675 inhabitants.[1] One hundred and two out of every 1,000 dwellings consisted of only one room, which served as bedroom, kitchen, and sitting-room for a whole family; 324 per 1,000, or nearly a third of all dwellings, consisted as a rule of only two rooms, a kitchen and sitting-room; and 225 per 1,000 dwellings had three rooms, including, as one of them, a kitchen. This shows that nearly three-fourths (740 per 1,000) of all the dwellings in Berlin consist of from one to three rooms. Rooms were considered to be overcrowded when more than one inhabitant lived in a single room unprovided with means for heating, and where there were more than two inhabitants per room in those that were so provided. According to this estimate, more than a third, 335 per 1,000, of the total number of dwellings were found overcrowded, containing almost the half of the total population of Berlin. In some quarters, as, for instance, the Luisenstadt, a working-class district, the conditions were much worse, as many as 548 per 1,000 of the dwellings, with 688 per 1,000 of the population of the district, being overcrowded. In 75 per 1,000 of the dwellings, containing 122 per 1,000 of the total population, there were more than four persons to a room, a condition of things showing a high degree of over-crowding.

Cellar and Attic Dwellings.

Especially unhealthy are the cellar and attic dwellings which house over 100,000 of the inhabitants of Berlin. The worst of them are

[1] For most of the figures relating to the Housing of the Working Classes in Berlin, I am indebted to the excellent article on "*Wohnungs statistik und Wohnungsenquête*," by Dr. H. Albrecht, in Weyl's *Handbuch der Hygiene*, vol. iv., 1895.

let out to widows and women of a low class who receive outdoor relief from the parish. A publication of the Society for Improving the Condition of the Working Classes (*Arbeiterwohlfahrtseinrichtungen*) gives details as to the condition of a number of them and of the disastrous effect on the health and morals of the occupants.[1]

The mortality per 1,000 of the inhabitants, according to the part of the dwelling occupied, brings the same out clearly.

	1875.	1880.	1885.
Cellar	35·6	23·6	21·1
Ground floor . . .	29·4	21·8	20·4
First floor	28·6	20·6	18·4
Second floor . . .	29·2	22·3	18·8
Third floor	32·9	22·0	19·0
Fourth and fifth floors . .	36·5	25·8	21·4

This table shows also the diminution that has taken place in the total death rate since the improvements in drainage, etc. It is not only in Berlin that the bad effect of these cellar dwellings is seen. The fact was brought out clearly in the great epidemic of cholera in Hamburg in 1892, that the mortality from this disease per 1,000 was greater amongst those living in the cellars than in any other part of the house, and the proportion of deaths to attacks was also higher amongst them. The housing of the working classes in Berlin appears in a very bad light when the elements of which the different households consist are considered. To eke out the high rent they have to pay, many of the families are in the habit of admitting night lodgers. This class of persons during the day is out at work or is seeking work, and at night helps to still further overcrowd the dwellings, to the detriment of both health and morality. The number

Night Lodgers.

[1] *Untersuchungen über die Wohnungsverhältnisse der ärmeren Bevölkerungsklassen in Berlin.*

of these night lodgers was in 1890, 95,365, as compared with 59,087 in 1880. The increase, however, is not so glaring when reckoned in terms of the total population 60·8 per 1,000 in 1890, and 52·6 in 1880. In 1885 the number of households taking in night lodgers was 53,787, and in 2,298 of these households all the occupants herded together in a single room.

One of the factors most potent in leading to this overcrowding is the excessively high rent that has to be paid for dwelling-rooms in Berlin as compared with other cities, and, instead of diminishing, this rent appears to get higher and higher from year to year. In 1886 the number of lodgings per cent. up to a rental of £10 a year was 30; five years later it was only 19, and the number of houses rented at from £10 to £12 10*s.* rose from 15·7 per cent. to 19·7. That many of the inhabitants of the city belong to a class which has to live in dwellings of a comparatively low rental is seen from the fact that 318,753 persons pay taxes of the first and second division, that is, on an income not exceeding £45, whereas 162,540 only belong to the higher divisions.

Local Enquiries.

The results of an inquiry into the sanitary condition of a single street, Sorauer Strasse, in Berlin have been published. The inquiry was undertaken by the Berlin Workman's Sanitary Commission, and throws a lurid light on the question of the housing of the working classes. The street chosen was typical; just such an one as is to be met with by the dozen in Berlin. The houses are of the characteristic kind, front and back blocks with side wings enclosing a court. Only in the front block were any of the dwellings found with more than three rooms; almost all were either one or two roomed. Of the 657 two-roomed dwellings 301 were occupied by more than four persons, 212 by from five to six, 76 by from seven to

eight, 12 by from nine to ten, and one by eleven persons. Night lodgers were taken in by the inhabitants of three-tenths of the dwellings, and in more than a fifth the families taking in the same had children. As to the rents charged for the dwellings, in the case of three-sevenths which consisted of a kitchen only, they were as much as £7 5*s.* a year. The majority of the two-roomed houses were rented at from £10 to £12 10*s.* In about three-fourths of the houses there were ten persons to a water closet and in some as many as 21·35 or even 40 persons.

Other reports undertaken by private individuals tell the same tale, and show how difficult it is even for the best situated workmen to get proper house accommodation. Dwellings consisting of but a kitchen and sitting-room are rarely to be got for less than £12 a year. It is no uncommon thing for a quarter of the total wages to be paid merely for house accommodation. It is little wonder then that the evil of sub-letting should be resorted to, and the poorer the family and the greater the number of the children the more readily are night lodgers taken in. A meeting of the Berlin architects summed up recently the chief difficulties that are met with in the housing of the working classes, and pointed out how they could best be overcome, in their opinion, somewhat as follows:[1] (1) the excessively high price that has to be paid for building land in Berlin in comparison with other large cities; (2) the unsuitable size and form of such houses as have been built, especially their too great depth; (3) the difficulties placed in the way of properly laying out the site owing to the building regulations in force; and (4) certain unnecessary expenses connected with building operations.

Berlin Architects on the Difficulties of Housing the Working Classes.

[1] *Die Verbesserung der Wohnungen*, p. 366. *Schriften der Centralstelle für Arbeiter-Wohlfahrtseinrichtungen*. Berlin, 1892.

They point out the impossibility of much being done out of public funds, and indicate that recourse must therefore be had to private speculation while ensuring in every way possible the erection of good sound tenement houses. The price is determined, like everything else, by supply and demand, and to increase the former and diminish the rent it is necessary to encourage and facilitate building operations. The building sites should be diminished in size so as to do away with the necessity of the erection of posterior blocks with side wings.

Building Regulations. It may be pointed out that amongst the building regulations are to be found the following points. The houses must not be higher than the breadth of the street, and in no case more than twenty metres (72·1 feet) high. Three-quarters only of the building site can be built over. The buildings must be broken up by courts which have a superfices of at least 72 square yards, and the least breadth of this court permitted is 19½ feet. The depth of a building must not exceed 59 feet. The total area of the windows must be one-seventh that of the floor area. The dwelling rooms must have a height of at least 2·5 metres (8½ feet). As regards cellars, the floor must never be more than 18 inches below the level of the ground, except when an open area exists in front of it with a paved floor six inches below the level of that of the cellar, in which case its depth may be increased to one metre. Damp courses must be present in all buildings.

Agencies at work for improving existing conditions. A good many agencies are at work in Berlin for improving the condition of the housing of the working classes. First and foremost, the "*Centralstelle fur Arbeiter-Wohlfahrtseinrichtungen*" by its various publications and congresses has done much to stir up an interest in the subject, and to point out the best road to travel towards attaining the desired end.

Building Societies.

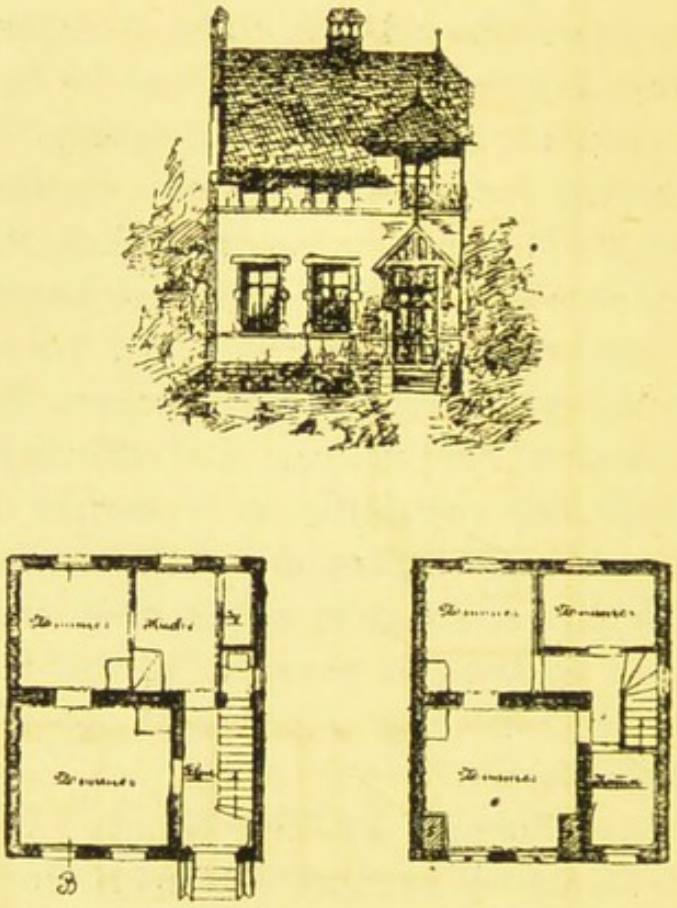
Much has been done by the law of May 1, 1889, with regard to the formation of societies with limited liability, in encouraging the development of building societies often united with the principle of savings banks. Within the last few years there have arisen in Berlin the building society "Eigenes Heim," Deutsche Volksbaugesellschaft, and the Spar und Bau Verein, etc.

It may in general be said that these societies fall into two classes; those that seek to build houses in the suburbs for one or two families, and those building large blocks in the town and letting the dwellings to their members. To the first belong the Berliner Baugenossenschaft, which, since it was founded in 1886, has built over 120 houses in three of the suburbs of Berlin. The houses pass into the possession of the members, either on payment of a third of the total cost and effecting a mortgage (*hypothek*) on the remainder at a certain interest; or, secondly, the house is taken at a certain rental, the total amount of which is equal to 6 per cent. interest on the initial cost of building; 4 per cent. of this is regarded as rent while the remaining 2 per cent. goes towards the purchase of the house.

Cottage Dwellings.

The German People's Building Society (*Deutsche Volksbaugesellschaft*), started as recently as 1891, does not confine its operations to Berlin, although, so far, the greater part of its work has been confined to the suburbs of the capital, such as Gross Lichterfeld, Hermsdorf, and Neu-Rahnsdorf, but seeks to extend them over the whole of Germany. Already over 250 houses have been built. Those who propose to come into possession of one of the company's houses must, in addition to paying a certain sum, pay the first premium of a life insurance of the full value of the house in one of the life or age insurance offices with which the company has dealings. Where an age insurance

is in question, the money is usually payable at the end of the 60th year. The individual then enters the house by a contract, and can to all intents and purposes be regarded as the owner, which of course he does actually become at the end of his 60th year, or at his death the house passes to his heirs, in both cases free from all debts, as the whole



Ground Floor. First Floor.

FIG. 13.—House built by the Deutsche Volksbaugesellschaft near Berlin, showing plan of ground floor and first floor.

sum is paid out in full by the life assurance office. Exceptions are made in particular cases where, owing to advanced age or other causes, a life insurance can only with difficulty be taken. Unfortunately the very class of working men which mostly needs to be benefited is excluded from the operations of the society, for it is only in a very few instances that men of this class are able to

pay for the premium on a life insurance, and the prospectus of the company for 1894 shows that only 24 per cent. of their householders are workmen or artisans, most of the occupiers being small officials, railway employés,

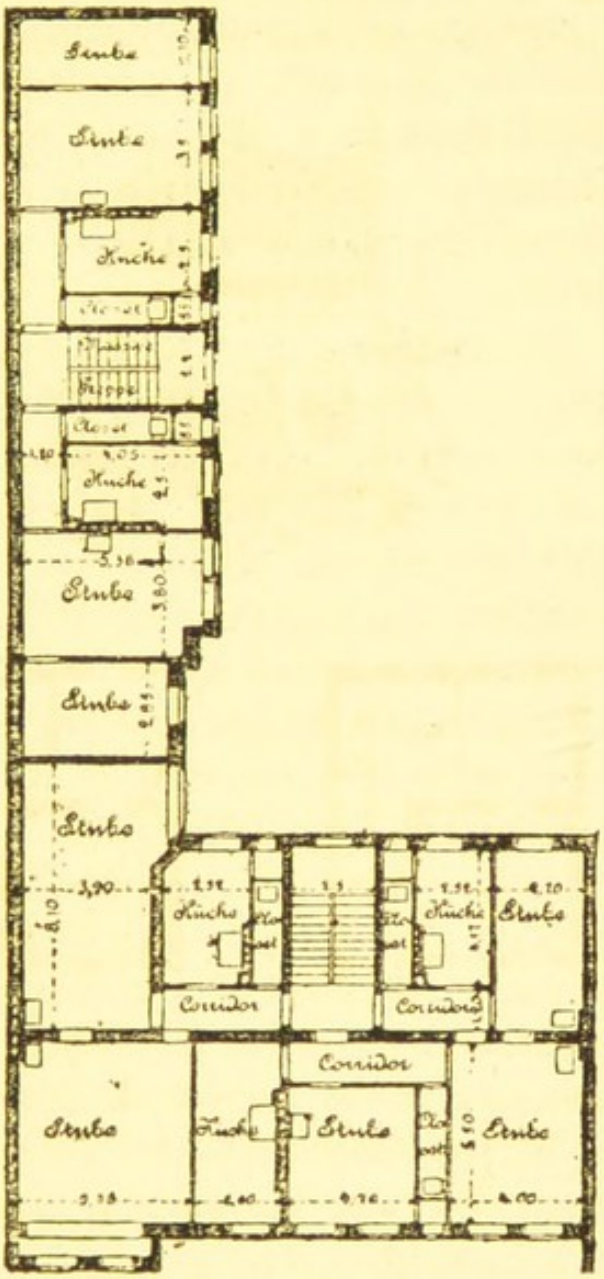


FIG. 14.—Arrangement of Rooms in the Block Building erected by the Bau und Spar Verein, Berlin.

or even members of the liberal professions. The houses cost from £250 to over £750. Houses at £250 contain a kitchen, fair sized sitting-room, small bedroom and cup-

board, and they stand in a small garden. The houses that I saw (and I went over a large number) at Gross Lichterfeld struck me as being very suitable for the class of small officials.

But these societies for building houses on the cottage-system must undergo an enormously greater development if they are to contribute at all to the solution of the question of the housing of the working classes in Berlin, where the population increases by some 50,000 or 60,000 persons every year, for whom 11,000 to 13,000 small dwellings are required.

Block Dwellings.

The *Spar und Bau Verein* has gone on the principle of building large block houses and letting the rooms to its members. It was founded in 1892 in imitation of the very successful and similar society in Hanover, where indeed, the question of the housing of the working classes has been worked out perhaps more fully than anywhere else in Germany. So far their operations have been confined to the building of one or two large blocks, but these give a sample of what they would do were their means greater. The block building in the Siekinger Strasse built by the Society is the most striking workmen's dwelling that I saw in Berlin, both from an architectural point of view and from the excellent arrangement of the dwellings. Most of the lodgings consist of a large sitting-room, a kitchen, a corridor, in which a bed may be placed, and a well-lighted water closet placed against an external wall. As a rule the price of the rooms varies from £10 to £13 yearly. The great difficulty that this and the other societies find is in getting the necessary funds to start building with. The Spar und Bau Verein has over 1,200 members, of whom 800 are workmen, and the income amounts to £2,000 yearly. But this sum is ludicrously inadequate to start any extensive building scheme. The

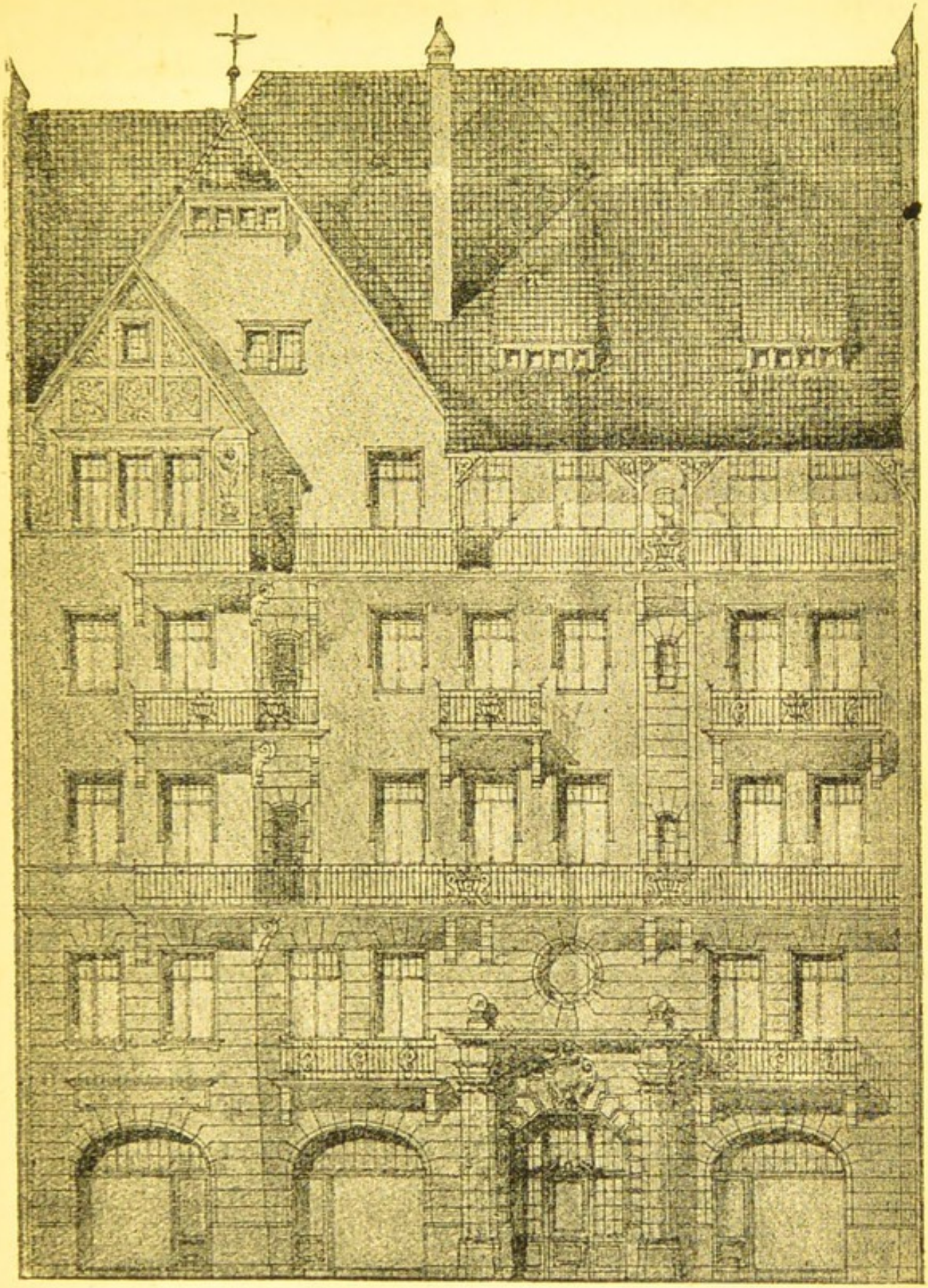


FIG. 15.—A portion of the Façade of the Block Building erected by the Bau und Spar Verein, Berlin.

building referred to cost over £12,000, and had it not been for the generosity of friends of the society and the loans of the Railway Servants' Pension Fund it could never have been begun.

Age and Sickness Insurance Funds.

The question of how building societies can best secure the necessary funds was made the subject of a special congress, in 1894, of the Centralstelle für Arbeiter-Wohlfahrtseinrichtungen at Berlin, and delegates from various parts of Germany came together to give their experiences.[1] It was the opinion that much might be expected in the future from the money received by the age and sickness insurance offices (*Invaliditäts und Alters Versicherungsanstalten*) distributed throughout the country, to which, by a clause in the law of 1889 which originated them, permission is given to lend a portion of their capital for the building of workmen's dwellings. So far, of the thirty-one insurance offices only six have seen their way to take any steps in this direction, and amongst them that in Berlin is not to be found, although it has been approached on the subject again and again. The insurance office of Hanover, however, has been the pioneer in the matter, and in 1892 determined to devote one-tenth of its capital to this object. So far, up to May 1, 1894, it had lent over £65,000 to various building societies which had sprung into existence because they knew that money could be had from this source. The money is lent at 3½ per cent. interest, and the loans are advanced up to two-thirds of the value of the site and of the building to be erected on it. The insurance office stipulates that one of its officials must be a member of the council of every society to which it lends money. Naturally private building firms oppose as much as they can any assistance being given to club building societies from public

[1] *Die Beschaffung von Geldmitteln für Baugenossenschaften*, 1895.

sources as damaging their own interests; and the opinion is expressed that modifications in the law must be made before any great assistance can be expected from the insurance offices, especially by allowing them to advance money before the building operations have been commenced.

For three years past the pension fund for employés on the Prussian State railways with a membership of 200,000 and a capital of 28,000,000 marks has given considerable assistance to building societies in various parts of Prussia, amongst others to two in Berlin.

It can hardly be said, therefore, that the question of the housing of the working classes has in Berlin or in Germany generally been advanced as yet beyond the experimental stage; but signs are not wanting to show that before long, with the energy and devotion that is being shown in the cause by many, great things will be accomplished in the near future.

Paris.

Recent interest taken in the subject.

It is unfortunate that France, the country in which the principles of hygiene were first enunciated, should be one of the last to carry them into practice. Progress and scientific initiative seem to be choked by the formalities incident to the routine of administrative work, and often an idea, which has long been recognized as correct, will take a quarter of a century before it is put into practice. As recently as 1885, in Paris, a judge declared that for a landlord to be compelled to lay on water in his house for the use of the tenants was an interference with the liberty of the subject, and held that a water supply was not an indispensable necessity for maintaining the healthiness of a dwelling.[1] The defect in the law of 1850,

[1] *Encyclopédie d'Hygiène*, vol. iv., p. 405; article "*Les Habitations*." By M. M. Faucher et Richard.

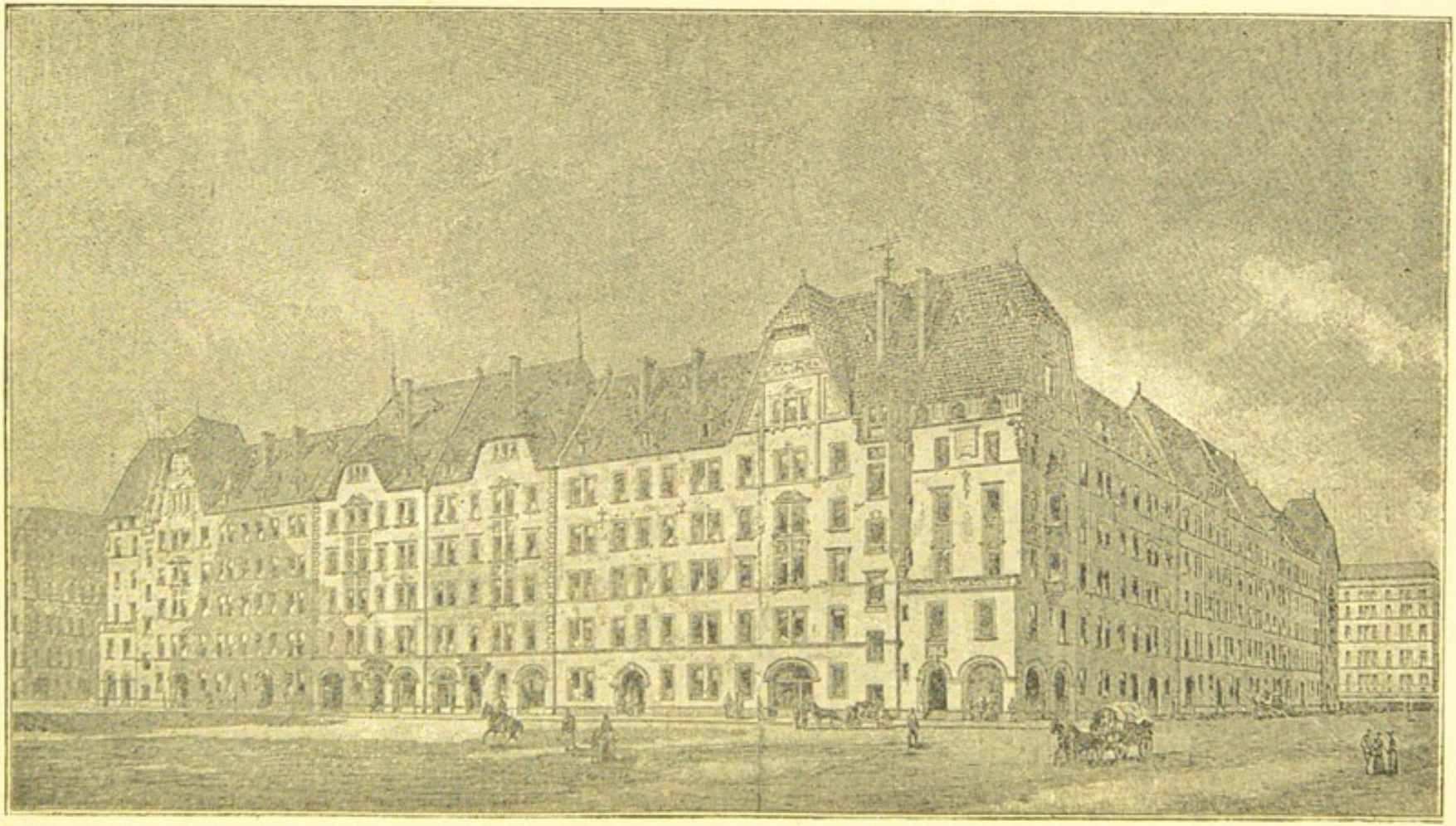


FIG. 16.—Project for building Working Men's Dwellings in Berlin on land belonging to Her. Weissbach.

relative to the appointment of a Commission des Maisons Insalubres, has been referred to in a preceding chapter, and attention was especially called to the absence of any power being given the commission to act on its own initiative, which allowed the owners of slum property to defy the action of the authorities for years.

Of late years considerable interest has been aroused in the subject of the housing of the working classes. La Société Française des Habitations à bon marché, recognised of public utility in 1890, has done much by its publications to foster this interest, and has been the means of establishing in a number of French towns societies for the building of working men's dwellings. It is hoped that the administration will show itself less exacting in its demands on the creation of such societies than it has done in the past. The Institute of Paris has taken up the subject, and has moved for an inquiry to be instituted for investigating the condition of the working classes in the principal towns of Europe.

New Law on Working Men's Dwellings.

A considerable impetus will no doubt be given to the formation of societies for building working men's dwellings by the passing of the law, originally proposed by M. Jules Siegfried, one of the most active workers of the Société Française mentioned above, by which the savings banks, benevolent societies (*Bureaux de Bienfaisance*), and hospitals, will be allowed to devote a fifth of their reserve funds in loans to such building societies.[1] Other points mentioned in the law are, the formation in every department of one or more committees to promote the construction of cheap dwellings under a Superior Council in Paris ; exemption of such societies from the payments due for the door and window tax, etc., over a period of ten years ; authorization to insurance offices,

[1] *Annales d'Hygiène Publique.* L. Reuss. Vol. xxx., p. 543.

in case of death, to make temporary insurances guaranteeing the annuity of the house; and, lastly, in the case of the death of the head of the family, the maintenance of the property undivided amongst the heirs for a certain length of time.

Street Improvements in the city.

Although the houses in Paris have externally, in most cases, a well-favoured appearance, their arrangements internally, as shown by the small kitchens, bedrooms, and insanitary closets, leave much to be desired. The houses are, as a rule, far too high in proportion to the breadth of the streets. Still it must be admitted that no city has undertaken so systematically as Paris the work of street improvements, commenced by Haussmann when Prefect of the Seine during the Second Empire. The object has been to connect the principal quarters of the city, first by main thoroughfares parallel or perpendicular to the course of the Seine; secondly by circular boulevards; and thirdly by roads leading to the six main railway stations. These streets are the admiration of every one, but opening immediately out of them are narrow, tortuous streets, the houses of which have become still more overcrowded by the population displaced in the improvement scheme.

Insanitary condition of some quarters.

Of 804,011 dwellings in Paris in 1890, more than three-quarters, 604,306, were rented at less than £20 a year, and the great majority at less than £12. Statistics of the dwellings occupied by those in receipt of outdoor relief brought out the fact, in 1881, that 24,663 consisted of but one single room, and 12,734 of one room and a small kitchen in addition. In Paris, in bygone times, a large number of block dwellings have been built without the least regard to the requirements of hygiene. In these light and ventilation are impeded, overcrowding and promiscuous living prevail, and crime and infectious

disease find their most agreeable soil. Some of these blocks, as the Cité Jean d'Arc, where 2,000 persons were lodged, and the Cité des Kroumirs, etc., are described in Dr. du Mesnil's book, *L'Habitation du Pauvre.* Many of the worst slums have no doubt been abolished through the action of the Commission des Habitations Insalubres, but no provision is made for the accommodation of the persons displaced, who migrate into other low quarters, and reproduce the same state of things in them.

Quite recently Dr. du Mesnil has published some facts relative to an investigation he made into a small district in the thirteenth arrondissement, containing 191 houses and 1,327 families.[1] He found that the average price paid for the lodging came to between a sixth and a seventh of the total earnings of the occupants. In some of the arrondissements, as, for example, the XVIIIth, almost exclusively occupied by the working classes, it amounts to between one-fourth and one-fifth. In some cases the landlord made 300 per cent. profit out of his lodgings. The details of the report show how unfortunate the condition of the poor in Paris is, the overcrowding that exists, and the extortionate price that has to be paid for the rooms. It is to be noted, however, that what was referred to as so common in Berlin, and so detrimental to health and morality, namely, the practice of taking in night lodgers, does not exist amongst the poor in Paris.

Common Lodging Houses.

The condition of the common lodging-houses (*hôtels garnis*) were, prior to 1878, about as bad as they could be, seeing that they were placed under no control whatever. Owing, however, to the overcrowding and disease that prevailed in them they were in that year brought under the control of the Prefecture of

[1] *Bulletin de la Société Française des Habitations à bon marche*, No. 1, 1895.

Police, and in 1883, special inspectors, chosen from amongst doctors of medicine and architects, to the number of fourteen, were appointed. In 1891, 10,000 such common lodging houses were inspected, of which 6,200 were found in a satisfactory condition.

Early attempt to build Workmen's Dwellings.

The first attempt in Paris to construct workmen's dwellings dates from 1851, when Napoleon III., struck by the example of Prince Albert, proceeded to the erection of the Cité Napoleon, a large block building with 194 dwellings in the Rue Rochechouart. A few years later other block dwellings were constructed at great cost; but in no case did they become occupied by the class for whom they were primarily intended, and must therefore be regarded as failures.

In other parts of France, notably at Mulhouse, the subject was taken up practically, and a society formed under the presidency of M. Jean Dollfus, for building houses for workmen on the cottage system, and to enable the occupiers to enter into entire possession of the same after a certain number of years. The society has been very successful, and had in 1887 built 1,000 houses, of which 672 had passed into the hands of the workmen by gradual payment. The work of this society became widely known, and its example has been followed in other towns, as at Havre. Nor must what has been done by the large employers of labour (as for example, M. Menier, of chocolate renown, and M. Godin), railway companies, manufacturers, and the like, in the building of dwellings for their workpeople, be forgotten.

Cottage Dwellings in Paris.

In Paris the most extensive work has been done by M. Cacheux, whose work on *Les Habitations Ouvrières en tous Pays*, is one of the most valuable that has ever been written on the subject. An architect himself, he has devoted his capital to the

purchase of lands, and has constructed on them cottage dwellings designed by himself, as, for example, the Cité des Lilas, and the Boulevard Murat, which covers 9,000 metres of ground. In reading his book, *État des Maisons Ouvrières a la fin du XIX. Siècle*, one cannot fail to see how little he has been backed up by the State or city authorities whenever he has sought to go outside his private means and receive their assistance in carrying out any extensive scheme.

The Société Anonyme des Habitations Ouvrières de Passy Auteuil has carried out successfully on a small scale the construction of small houses on the cottage system in the Impasse Boileau, where some sixty-seven cottages have been built. In the smallest houses there is a fair-sized sitting-room, bedroom, kitchen, back yard with water closet, and front garden. The house, however, cannot be built (including the expenses of water supply and drainage) for less than £220, and the annual rental varies, according to the size, from about £16 to £28, the occupier entering into possession in twenty years time. It is evident, therefore, that only the *élite* of the working classes are in a position to make use of such opportunities.

Block Dwellings.

Little though it is in comparison with the needs of so great a city, the Société Philanthropique has worked most on the lines that are wanted. Started as recently as 1888, and aided by the gift of 735,000 francs from M. Michel Heine, it has built three large blocks in the poor quarters, one in the Rue Jeanne d'Arc, another in the Rue Grenelle, and a third in the Boulevard St. Mandé. All three are built on almost exactly the same lines in flats, with two or three sets of rooms of fair size with plenty of window space. There are numerous staircases; the long passages with rooms opening out on either side having been found not to give sufficient privacy, and being

objectionable in many ways. As regards the separate tenements, the chief objectionable feature that I observed was the position of the closet in a little cupboard, opening directly out of the kitchen, without provision for external ventilation. The minimum rent was £5 14*s.*, and the maximum, £14 10*s.* yearly. Drinking water and gas were

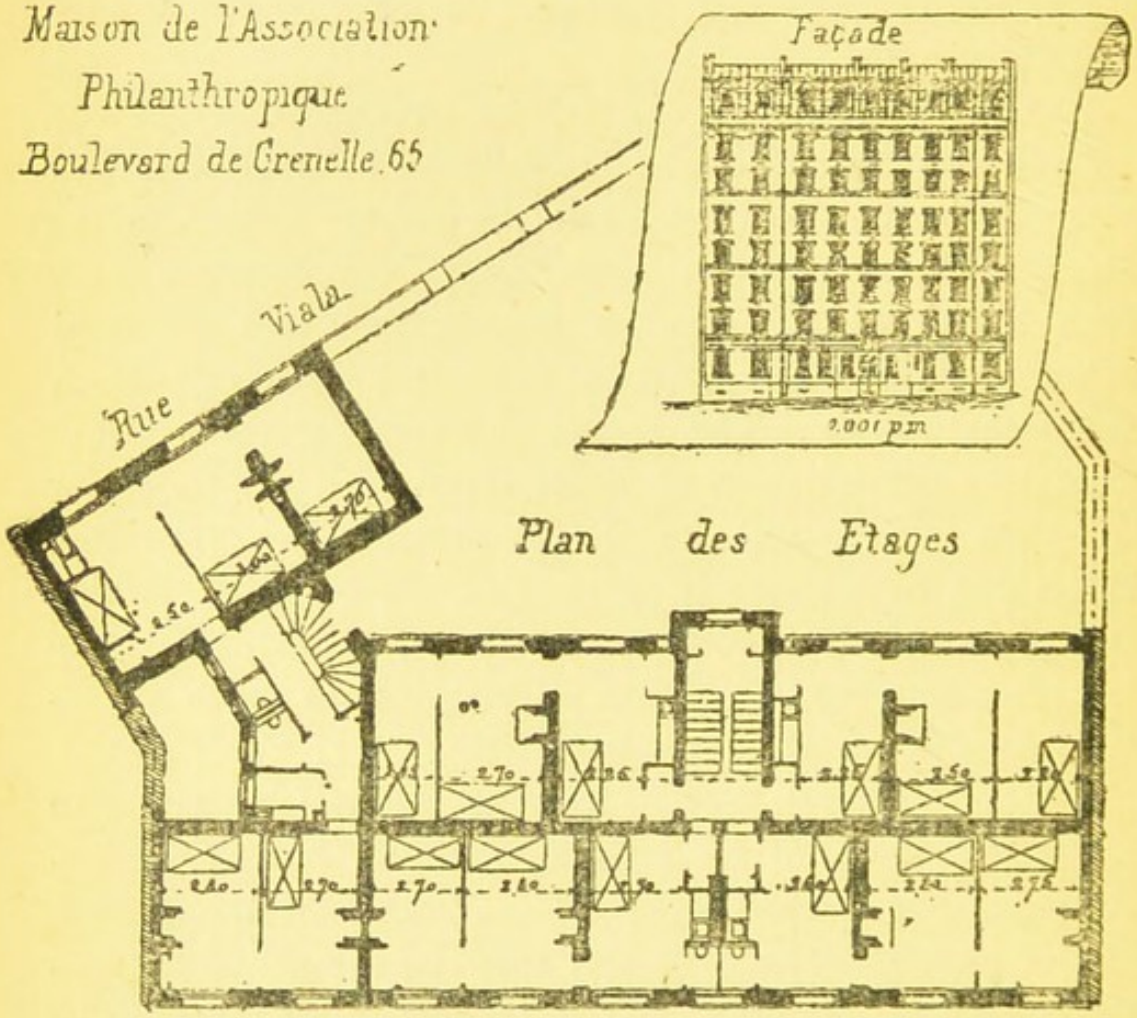


FIG. 17.—Block Building erected by the Société Philanthropique.

laid on to every set of rooms. In the three blocks were some 137 dwellings, and in every case the occupants seemed exceedingly contented and pleased with their lodging. The height of the rooms is 2·6 metres, and there are seven stories. Each house has a small court for the children to play in. It is, probably, in the further building of some-

what similar houses that the question of the housing of the working classes will be solved in Paris.

A very charming group of workmen's dwellings has just been built close to St. Denis, called *La Ruche*, or "The Hive." In all there are some forty-nine separate dwellings. Everything about this group has been executed with the greatest care, and no expense has been spared in making the buildings models of what such dwellings should be. The rent of the rooms varies from £11 10*s.* to £16 a year.

In France the subject of the housing of the working classes has been perhaps most developed in the town of Lyons, owing to the efforts of the Société Lyonnaise des Logements Economiques. Founded in 1886 by M. Mangini, its capital in 1894 was 4,000,000 francs. It received considerable assistance at first from the Caisse d'Épargne of Lyons, an example which might be imitated with advantage in other large towns. At the end of 1894 the society had, after eight years' work, provided 1,051 dwellings, and it is in a sound financial position. The dwellings are let from thirty to thirty-five per cent. cheaper than those in their immediate neighbourhood, and cost from £4 for two rooms to a maximum of £10 5*s.* for three or four rooms. Some 5,000 persons are lodged in them, and naturally the influence of the Society has been for good in improving the condition and lowering the price of workmen's dwellings in the neighbourhood. Houses have been built in the very worst quarters of the town, and the occupiers in nearly every instance have paid their rent regularly.

Similar societies have already done excellent work at Havre and Bordeaux.

CHAPTER VI

NOTIFICATION OF INFECTIOUS DISEASES, DISINFECTION, AND ISOLATION HOSPITAL ACCOMMODATION, IN PARIS AND BERLIN CHIEFLY

General Principles—The New Law on the Subject in France defective—The Diseases to be Notified — Should Measles, Whooping Cough, and Consumption be included in the list?—Case Notification in the Scandinavian Capitals—Excellent Organization for Disinfection in Paris—Its Methods—The Methods adopted in Berlin—Defective Arrangements for Isolation Hospital Accommodation in both Capitals—Use of Animal Lymph in preference to Human in Vaccination Abroad.

General Principles.

EVERY one is agreed on the fact that for checking the spread of infectious diseases the three things essential are: (1) early notification of every case; (2) isolation of the patient; and (3) proper disinfection of the premises, especially of all articles that are in any way likely to have been in contact with the patient or his discharges. It is by the proper carrying out of these conditions that the medical officer of health in this country has mainly to justify his existence. Brussels and the Scandinavian capitals must be regarded as the pioneers of the compulsory notification of infectious disease. As long ago as 1824 this was enforced in the former, while in the latter it dates from about 1874. In London, the law with regard to notification was only made compulsory as recently as 1890; in Berlin it has

Compulsory Notification.

existed since 1881. Paris, and France generally, has lagged behind in this matter (except as regards cholera), and only in 1893 was the general principle accepted. There can be no doubt that the physician who first sees and attends a case of infectious disease is the person best fitted to notify it, and but very little doubt that the person to whom the information is sent, with a view to the carrying out of preventive measures, should also be a medical man, devoting the whole of his time to the questions of public health coming within the province of the sanitary authority.

In France.

In France the law passed in November, 1892, dealing with the practice of medicine, renders obligatory the notification of every case of infectious fever as soon as the diagnosis is completed. The persons charged with this duty are the physician in attendance, the *officier de santé*, or the midwife, as the case may be. Where the application of the law is, however, most open to criticism, is the fact that in France, there being no medical officers of health, the notification has to be made to the Mayor of the Commune and to the Sub-Prefect of the district. It can hardly be expected that either of these will have the necessary knowledge to carry out with discretion and conscientiousness matters requiring very delicate handling, and there seems a distinct danger that in some cases a too excessive zeal on the part of the mayor may lead to great friction between himself, the practitioners, and the general public; and in others that, beyond the mere filing of the notification returns, the Act will become a dead letter, especially as at present there are no compulsory powers for enforcing the necessary measures of disinfection. It seems essential that the mayor must have some competent medical assistant in the matter, and I do not see how this is to be got without constituting some public health service.

Diseases Notified.

Certain infectious diseases, such as cholera, small-pox, diphtheria, typhoid fever, typhus fever, scarlatina, and puerperal fever, are unanimously adopted in the list of notifiable diseases; but there are others as to the advisability of including or excluding which opinion is divided. For instance, erysipelas is amongst those usually included, yet the results gained by so doing have not been productive of much good, and therefore in France, profiting by the experience of other countries, it has been omitted from the list, and ophthalmia neonatorum, and two diseases which, still, at times, break out in epidemic form there, namely, sweating fever and dysentery, have been substituted for it. The inclusion of the former was doubtless prompted by the disastrous results arising from neglect in its treatment; but though its notification by a midwife seems desirable, there hardly seems the same necessity for its notification by a medical man. However, the effect of including it will be watched with interest.

Much discussion has arisen as to whether measles and whooping cough should be compulsorily notified. In this country any sanitary authority, if it likes, can adopt this course, and considering that these two undoubtedly infectious diseases cause more deaths every year than do all the others at present notified put together, there is much to be said in favour of notification. But it has not been considered hitherto in this country that the advantages to be gained by so doing would balance the great additional expense that would be incurred; and seeing that the mortality from them is almost directly dependent on the social condition of the parents, by whom they are usually regarded as trivial complaints, medical aid often not being called in until complications, such as bronchitis, have arisen, it is held that, as this social condition is improved so will

the fatality of the diseases be diminished. And further, with regard to measles, there is the additional difficulty that its infectiousness appears to be greatest before the disease is usually recognized by the appearance of the rash.

Consumption, again, is a disease of which the infectiousness is now clearly recognized, and consequently there are those who advocate its treatment by isolation, as in the acute infectious diseases. But this is carrying the dread of infection to an absurdity, because as its infectiousness is of a vastly lower degree of intensity than that of the others, it would be ridiculous to think of isolating thousands of individuals, many no doubt suffering from very slight symptoms of the disease, who would be perfectly capable of earning their livelihood. The idea of impressing upon people afflicted with consumption the notion that they are going about disseminating disease in the same way that a man at large with small-pox does, is greatly to be deprecated. By all means, after a death from consumption, let the rooms occupied by the deceased person be disinfected, as is the case in Berlin, and let the patient, during his life, take the precaution, as far as possible, of spitting the phlegm containing the bacilli into a vessel holding a disinfectant, and disinfect the handkerchiefs used. More than this does not seem to be warranted.

Notification forms.

So far as I can make out, Great Britain is the only country which pays the practitioner for his notification. In the capitals of Europe to which the following remarks refer, only the postcards and forms for this are distributed gratuitously; but, nevertheless, the information which the practitioners give is much greater and more useful than that which is ordinarily found in the forms common with us (for which *2s. 6d.* is paid). For instance, on the postcard distributed in Christiania the following headings are printed for information to be given

under: — Name, age, disease, place of employment or school, dwelling, date of onset, cause of illness (relation to infection or sanitary defects; in the case of puerperal fever the name of the midwife). Has the patient been removed to a hospital? Can he be sufficiently well treated at home? What are the measures that have been adopted? A space is left for any further remarks. In addition to this compulsory notification of infectious diseases, a monthly list of other diseases, relating to the health of the community, treated by the physicians, is returned to the health office, and it is this notification of cases as well as deaths which makes the returns of these Scandinavian health offices such a mine of wealth to the statistician. In Copenhagen the list of such diseases of which a monthy return has to be made, amounts to twenty-three, and includes amongst others, influenza, varicella, rheumatic fever, croupous pneumonia, broncho-pneumonia, bronchitis, pleurisy, tonsillitis, delirium tremens, and the venereal diseases. In many towns, both at home and abroad, the medical officer of health draws up concise and simple instructions how best to avoid and combat infectious diseases when they are prevalent. These leaflets, when widely distributed, are of considerable value, both from a practical and educational point of view.

Monthly list of Diseases Notified in some places.

Coming now to the question of disinfection, it may be said that abroad they are rapidly giving up the fetish of sulphur fumigation to which we, in this country, fondly cling. In Paris the organization of the Service des Étuves Municipales is a most elaborate one, and small points of detail are attended to in a manner that will be looked for in vain in this country; and indeed, let me say here, that it is the minute attention to detail when once a principle is looked upon as correct, that strikes the observer most in continental sanitation. At the time

Disinfection at Paris.

when this service was organized in 1888 by Dr. A. J. Martin, there was absolutely no power for compulsory disinfection, and the suggestion to the inhabitants of infected houses that they should turn out of them for twenty-four hours while sulphur fumigation and the stripping of the walls was carried out would probably have been resented. The service of disinfection, therefore, offered instead to remove gratuitously and to submit to steam under pressure all infected materials, while the walls, floor, and such articles as could not be removed, should be disinfected by the action of a spray of corrosive sublimate of a strength of 1–1,000, the whole operation not lasting more than one hour. The extent to which the service has increased may be judged from the fact that in 1890 only 652 operations were carried out, while in 1894 there were about 38,000.[1] Hitherto, the operations have been carried out without any charge, but the expenses in 1894 amounted to over £12,000; and consequently, to diminish this in future, since September, 1894, a tax has been imposed for disinfecting the dwellings, which varies with the rental. Dwellings with a rental under £32 a year are disinfected free of charge; those with a rental between £32 and £40, are charged 5 francs; between £40 and £80, 10 francs, and so on. At present there are four disinfecting stations, that in the Rue des Récollets being the largest and most important. It is centrally situated not far from the Place de la République and adjoins a night shelter. The building is divided into two distinct halves with separate entrances to each. The one half is devoted exclusively to the reception and treatment of infected articles, the other to the same when disinfected. A wall divides the two, and, built into it, half on one side and half on the other, are the disinfecting

[1] *Service Municipal de Désinfection.* Ville de Paris, 1894.

machines. Two panes of glass are let into the wall to permit of the workmen on one side seeing what those on the other are doing. Actual communication between the two sides is arranged for by a passage divided into three compartments. The workmen who are engaged on the infected side come into the building in the morning, and enter the first compartment where they strip themselves of their clothes and put on the clothing disinfected over night. On leaving to return home, the men pass into the third com-

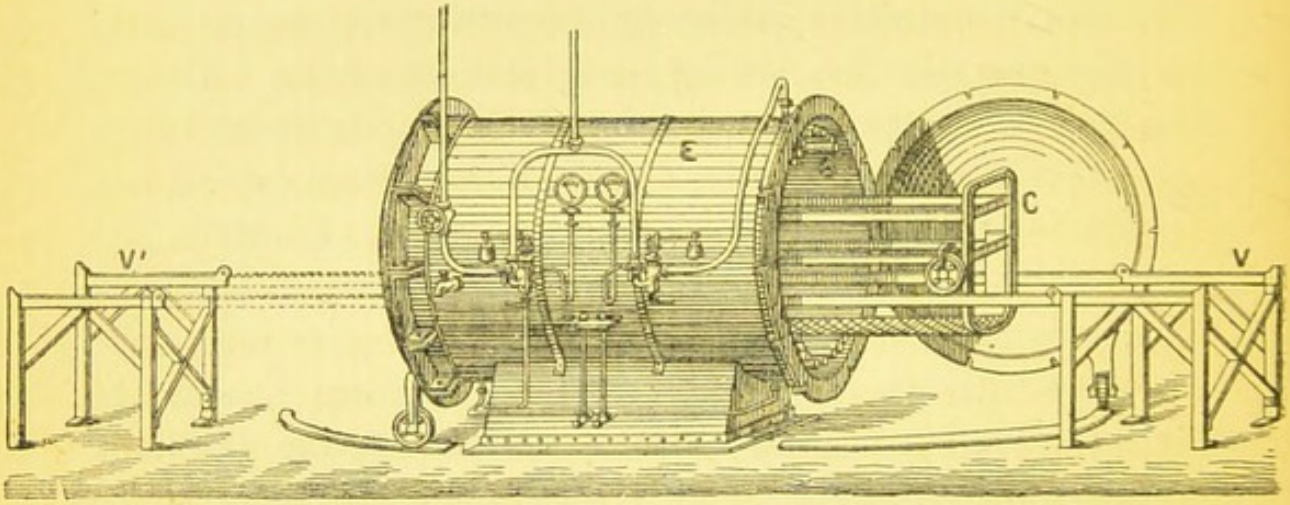


FIG. 18.—Steam Disinfecting Machine of Geneste and Herscher.

partment, leave their infected clothing, and pass into the second which is a bathroom. Having taken a disinfecting bath, they pass into the last compartment and put on their ordinary wearing apparel. A mechanical arrangement prevents the door on the infected side being opened before that on the uninfected side is closed.

There are three steam disinfecting machines at this station, made by the engineers Geneste and Herscher. They are of iron, circular in shape, and provided with a door at each end. The capacity is such that each disinfector contains a cradle provided with three shelves, each

shelf, when charged, holding a large mattress and pillows. Between each shelf plenty of room is left to allow of the steam penetrating readily to every part. When the doors are shut steam under pressure is admitted and allowed to remain in contact with the goods for about fifteen minutes. The temperature usually reaches 239° F. The door on the opposite side is then opened and the articles are removed. Should any of the articles to be disinfected by steam be soiled with blood, etc., they are subjected to a preliminary soaking in a bath.

In the morning the men are engaged in going to the various houses to which they are directed, carrying out the disinfection there, and bringing back the goods to be subjected to steam in the afternoon. Every carriage is disinfected after each journey, and a separate service of carriages returns the goods. I was allowed to accompany the men engaged in disinfecting the rooms to see how the spraying with corrosive sublimate 1–1,000 was carried out in practice. The instrument used is called a *pulvérisateur*, and is made by Geneste and Herscher. The apparatus varies in size, the smaller being carried by a single man. They are not unlike the small fire extinguishers to be seen about public buildings in this country. It is a force pump, and from the long nozzle a very powerful, finely divided spray is obtained, which is directed systematically over the walls, floors, furniture, and bedsteads, until they are thoroughly wet. Of course other disinfecting fluids besides corrosive sublimate may be employed in the same way, such as carbolic acid or cresylic acid in a strength of 5 per cent. Every person engaged in these operations wears a linen suit, which, after the work is over, is taken off and returned to the station. I was struck by a small but important detail, namely, that the blouses worn by the men engaged in carrying out the funeral

Disinfection of Rooms.

arrangements after a death from infectious illness were left in a little tin case and sent to the station to be disinfected.

It is interesting to note that now the number of disinfections effected considerably outnumbers that of the deaths from infectious disease, showing the increasing value that the people are placing upon disinfection.

Different Procedure in Berlin.

In Berlin, disinfection is carried out compulsorily in all cases of cholera, small-pox, relapsing, typhus, and typhoid fevers, diphtheria, and after death from consumption in a hotel or lodging house. Strangely enough, it is only carried out in severe cases of scarlet fever on the recommendation of the Chief of the Police. The steam disinfecting station has existed since 1886. Only in matters of detail do the building and ovens differ from those just described. The principle is the same—steam under pressure, at a temperature of over 212° F., in contact with the goods for a period of fifteen minutes, and absolute disconnection between the infected and uninfected sides.

In the matter of house disinfection, however, the method of procedure is entirely different from that described as prevailing in Paris, and our own and the Brussels method, of sulphur fumigation. Every one knows the cleansing power of rubbing a dirty surface with bread crumbs. This is the germ of the Berlin method. Permission was given me to see how it was carried out in two rooms, a large sitting-room and small bedroom in a flat where a child had died of diphtheria. Four men were engaged in the rooms. After the linen and woollen materials, and in fact everything that could be subjected to steam without detriment, had been removed to the waggon in the street for conveyance to the disinfecting station, all the things were removed from the walls, which were then rubbed with bread. Ordinary German loaves are used, forty-eight hours old. If

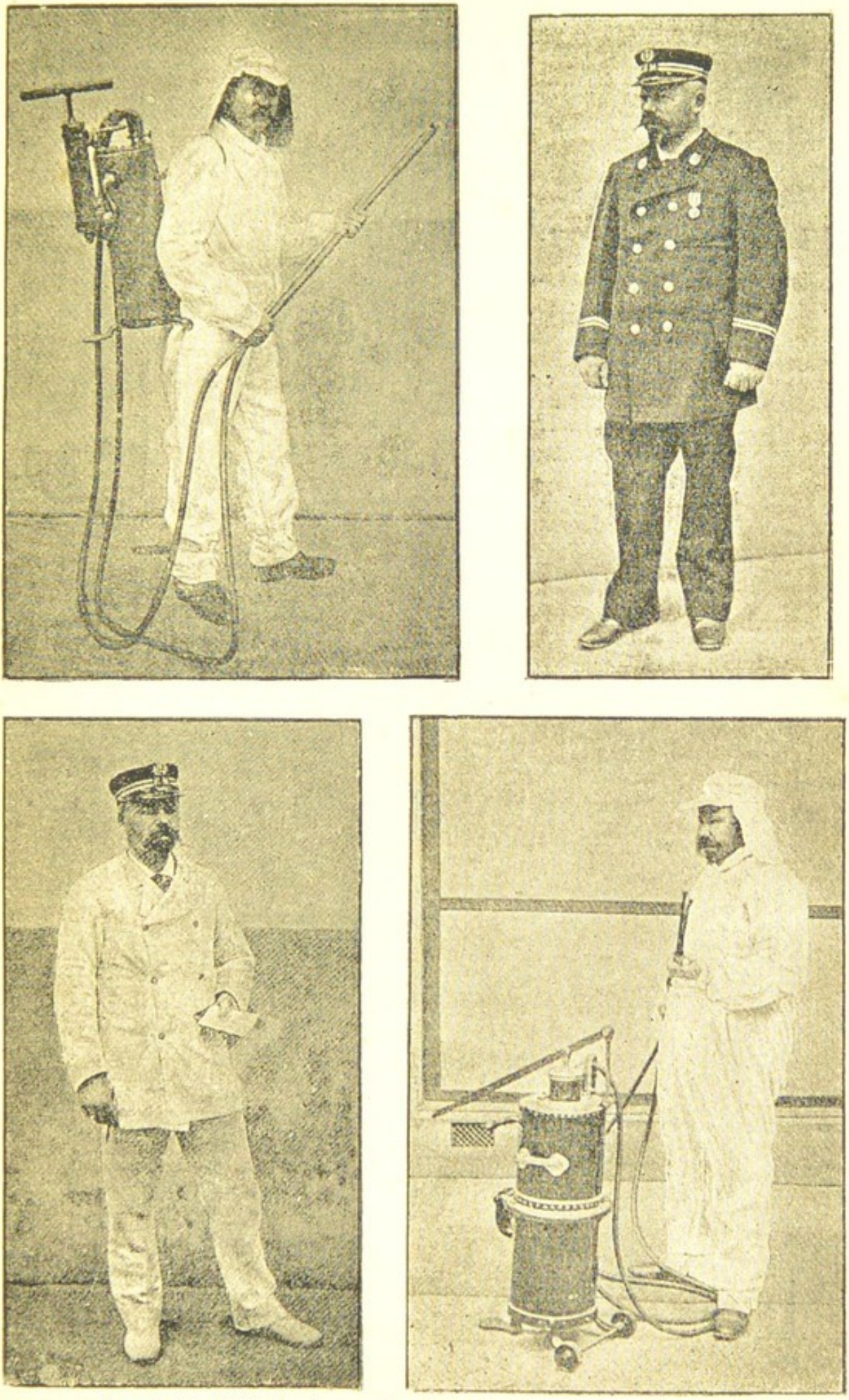


FIG. 19.—Agents for Disinfection at Paris in Uniform and in Working Costume.

newer than this it sticks to the walls too much, and if older crumbles too readily. The loaves are cut into substantial pieces about six inches square with the crust at the back to allow a good hand-hold. The walls are systematically attacked with strokes from above downwards, and there can be no question as to its efficacy in cleansing them. The experiments of Von Esmarck [1] show that by this means the bacteria are removed better than by any other. The crumbs are swept up and burnt. The walls are thoroughly sprinkled with carbolic acid, $2\frac{1}{2}$ or 5 per cent., and the floors and furniture washed with the same acid. The impression left on my mind, however, was that the operation is a very exhausting one for the workmen, nor can their existence in an atmosphere reeking with carbolic acid add to their health or happiness.

All the men engaged in the work of disinfection at Paris and Berlin undergo a special training and examination in the theory and practice of the work, which, considering how dangerous not only are some of the diseases with which they have to deal, but also how poisonous are the materials placed in their hands, must be regarded as a wise and necessary proceeding.

Disinfection of the Clothing of Casuals.

The fact that, in two instances, the disinfecting stations in Paris adjoin night shelters has been turned to good account in passing all the clothes of the casuals through the disinfecting machine every night. That this proceeding may be of service in preventing the spread of serious epidemics is shown by the fact that within the last few years small epidemics of typhus fever have broken out in Paris and the large towns to the north-west of France. In almost every instance the first cases were detected amongst tramps (just as in this country lately has been the experience with regard to small-pox), and

[1] *Zeitschrift für Hygiene*, vol. ii. p. 491.

this disinfection of their clothing is one of the most powerful means of checking the spread of infection by them.

Isolation Hospital Accommodation.

It cannot be said that either Paris or Berlin can be compared with London, or even the Scandinavian capitals, in the provision made for isolation hospital accommodation, without which the full benefit of the notification of infectious disease can never be gained. Nowhere in the world are there such facilities for the transport of those suffering from scarlet fever, diphtheria, or small-pox, as are proffered by the organization of the Metropolitan Asylums Board in London. In Paris infectious diseases are received into some of the general hospitals, and especially into the children's hospitals, where, as a rule, but by no means universally, isolation pavilions have been built. For instance, at the Trousseau Hospital for Children there are isolation pavilions for scarlet fever, measles, diphtheria, whooping-cough, and one for doubtful cases. With the exception of the ward for doubtful cases there was little or nothing that could be said in praise of them. At the Hôpital des Enfants Malades, which has 593 beds for ordinary medical and surgical cases, the top storey of one block was the ward for scarlet fever, and adjoining it, that for measles. It must be said, however, that for some reason or other, there is a great deal less scarlet fever in Paris than there is in London. At this hospital diphtheria was treated in an isolation pavilion, where the arrangements were quite satisfactory. Recently a special isolation hospital has been constructed on the outskirts of Paris, at Aubervilliers, for the treatment of cases of small-pox, erysipelas, measles, diphtheria, and scarlet fever, and there is a pavilion for doubtful cases. All the wards are in duplicate, one for acute cases, the other for convalescents. But the buildings are all constructed of wood, and therefore of but a temporary char-

In Paris.

acter. The small-pox pavilion is placed well in the centre of the others.

In Berlin.

Berlin, like Paris, has no hospital destined solely for the reception of cases of infectious disease. Such cases are received into the general hospitals, and in nearly every instance housed in isolation blocks with a special staff of nurses, having nothing in common with the others. It is true that the Moabit Hospital was erected in 1871 originally to meet a widespread epidemic of small-pox; but since vaccination and re-vaccination have been made compulsory, small-pox has practically disappeared, and the hospital has been converted into a general one for ordinary medical and surgical cases. Within the last few years, however, owing to the danger to which Berlin has been exposed of an invasion of cholera, arrangements have been made by which a portion of this hospital can at once, should this disease ever break out, be utilized for cases of cholera alone.

Attached to the Charité Hospital are a number of small wooden pavilions termed *Baracken*, where only cases of infectious diseases are taken in; but this arrangement is made to offer facilities for the careful examination and scientific study of such diseases by the staff attached to the Institut für Infectiöse Krankheiten under Professor Koch, than in connection with any general scheme of isolation hospital accommodation.

Vaccination.

Use of Calf Lymph.

Abroad the use of animal vaccine lymph has replaced very largely that of human, which is still almost exclusively used in this country for purposes of vaccination. For instance, in Paris, Brussels, and Berlin, only animal lymph is employed. In Stockholm 96 per cent. of the vaccinations are made with the

same material. There are certain points in which the use of animal vaccine is superior to human, notably the fact that the animal can be killed and examined to see whether it is perfectly healthy before any of the lymph obtained from it is used. Nor again can such charges be laid at the door of animal lymph as are at times made against human lymph—namely, that objectionable diseases may be transmitted from the vaccinifer to the vaccinee. And although these charges are in the majority of cases baseless, yet, as Dr. McVail has said, "in an ocean of error there may be a droplet of truth"; and the fact remains that they have been substantiated in a very few isolated instances. There can be little doubt that the prejudice against vaccination rests largely upon this possible danger, and if animal lymph were used universally in this country, much of the support which anti-vaccination agitators receive would disappear. At any rate, the option of being vaccinated with animal lymph in preference to human should be offered to every parent. It would be wasting paper, to my mind, to discuss the question as to whether vaccination is or is not a prophylactive against small-pox, so irrefragibly established do I hold the view to be that it is the best means of dealing with the disease, notwithstanding compulsory notification and the provision of isolation hospital accommodation. Germany is the best vaccinated country in the world, as they enforce re-vaccination as well as vaccination. France, on the other hand, while encouraging vaccination in every way, does not make it compulsory. The fact stands out, however, that there are more deaths from small-pox in the one city of Paris alone every year than there are in the whole of the German Empire.[1]

[1] Article "Small-pox and Vaccination," in *A Treatise on Public Health*. Edited by Stevenson and Shirley Murphy. Vol. ii.

CHAPTER VII

PUBLIC ABATTOIRS AND THE INSPECTION OF MEAT IN PARIS, BERLIN, AND BRUSSELS

Great attention paid to the subject Abroad—Neglect in England—Causes of this difference—Advantages of Abattoirs over Private Slaughter-houses—Different Types of Abattoirs—Description of those at Paris and Berlin—Legal Enactments as to Meat Inspection in Germany, France and Belgium—Tuberculous Meat—Veterinary Surgeons and Meat Inspection Abroad—Routine Examination of Meat—Examination for Trichinosis in Berlin—Statistics as to Meat Condemned in Berlin.

Systematic Inspection of Meat abroad.

PERHAPS the most striking point of difference between English and Continental methods of hygiene is to be seen in the great stress that is laid on the systematic inspection of meat by qualified veterinary surgeons abroad. It would be within the truth to say that in this respect Great Britain is at least twenty years behind Germany, France, Belgium, and Denmark. Public opinion here is not sufficiently aroused as yet to the importance of the subject, nor can it be said even that the members of the medical profession have expressed themselves at all strongly on the dangers that may arise from the consumption of diseased meat. And yet the conclusions arrived at by the recent Royal Commission appointed to enquire into the effect of food derived from tuberculous animals are sufficiently startling, and it is a matter for regret, I think, that the scope of that enquiry was not extended to

Conclusions of Royal Commission on Tuberculous Meat.

other diseases besides tuberculosis, so as to cover the whole question of meat inspection. The conclusions, amongst others, at which the Commission arrived, are as follows :—

"We have obtained ample evidence that food derived from tuberculous animals can produce tuberculosis in healthy animals. The proportion of animals contracting tuberculosis after experimental use of such food, is different in one and another class of animals ; both carnivora and herbivora are susceptible, and the proportion is high in pigs. In the absence of direct experiments on human subjects, we infer that man also can acquire tuberculosis by feeding upon materials derived from tuberculous food-animals.

"78. The actual amount of tuberculous disease among certain classes of food-animals is so large as to offer to man frequent occasions for contracting tuberculous disease through his food. As to the proportion of tuberculosis acquired by man through his food or through other means, we can form no definite opinion, but we think it probable that an appreciable part of the tuberculosis that affects man is obtained through his food.

"79. The circumstances and condition with regard to the tuberculosis in the food-animal which lead to the production of tuberculosis in man are, ultimately, the presence of active tuberculous matter in the food taken from the animal and consumed by the man in a raw or insufficiently cooked state."

Public and Private Slaughter-houses.

To the question, Why are they so much ahead of us in this matter abroad? the answer must be that in most towns in this country private slaughter-houses are the rule, and public slaughter-houses the exception ; whilst on the Continent the reverse is the case. No one can, without disgust, inspect many of the private slaughter-houses existing here. Often hemmed

in by dwelling-houses on all sides, through ventilation in them is well nigh impossible; the light sometimes can but with difficulty penetrate; the floor is often altogether unpaved, or so badly paved that the ground becomes sodden with blood and ordure; the walls are often made of wood that has become saturated with filth; and the lairs are not unfrequently insufficient to accommodate the animals. And even in such towns as London, where owing to the rigid enforcement of bye-laws the structural arrangements are satisfactory, the great central fact remains that their distribution in different parts of the town renders impossible a systematic inspection of the carcases. Public abattoirs having existed for a considerable time abroad, the need of a scientific control as to the healthiness of the animals slaughtered in them has become more felt. Then, again, veterinary science has always been on a higher level abroad than it has been here, partly because the veterinary colleges are State supported, and partly because more opportunity has been given to veterinary surgeons in the practice of their profession, by the numerous appointments given them as experts on meat. Any one who has seen the veterinary colleges at Berlin, at Altfort near Paris, at Brussels, and at Copenhagen, and compares them with similar institutions in this country, must be struck by the difference between them. Nor must it be forgotten that Germany, owing to her contiguity to Russia, the breeding-place of plagues and pestilences amongst cattle, has been compelled to elaborate the veterinary defences of the country.

The question of substituting public for private slaughter-houses stands, I think, on a different footing from that of meat inspection. On the grounds of decency and cleanliness alone there can hardly be two opinions as to the advisability of the change. An occupation such as the slaughtering of animals, which is in many of its details re-

volting, and which may lead, if proper care is not exercised, to grave nuisance, ought to be centralized as far as possible. The advantages to be derived from centralizing this, and all the various processes incidental to slaughtering, such as gut-scraping, fat-melting, the extraction of the albumen from blood, etc., far outweigh, to my mind, the objections urged on the other side by the butchers. After the establishment of public slaughter-houses a meat inspection would follow almost as a matter of course. The erection of abattoirs has preceded, as a rule, the introduction of meat inspection on the Continent. For instance, the abattoir of Copenhagen had been in use for five years before the veterinary control was introduced, in order to break down gradually the prejudices of the butchers. By far the most satisfactory arrangement is for the municipal authorities to take over the management of the public slaughter-houses, because it has not, or ought not to have, any other interest to subserve beyond acting fairly both to the public and the butchers.

The credit of having introduced public slaughter-houses in modern times in France, must be attributed to Napoleon I., who ordered (1807–1810) their erection in towns, and forbade them to be built near dwelling houses. In Germany, the law of March 18, 1868, supplemented by that of March 9, 1881, gave to local authorities the power of compelling the butchers to close their private slaughter-houses, and slaughter only in the public abattoirs; making it at the same time a penal offence for any one to introduce into the city from outside fresh meat without first having it submitted to an expert examination. And, be it observed, it was the insanitary condition of the private slaughter-houses (of which in 1866 in Berlin there were as many as 800), and the difficulty of controlling the meat traffic, which led to the above laws being passed.

Different Types of Abattoirs in France and Germany.

In France and Germany, the abattoirs are built on different systems.[1] In the former the slaughter-houses are separate small chambers, whereas in the latter, as a rule, they are large halls. The German model is perhaps the better, as it ensures greater cleanliness, better ventilation, and facilitates the supervision over the slaughtering of the animals, and the inspection of their carcases. An essential point in a well organized scheme of meat inspection is to have the cattle-market adjacent to the abattoir, and to have both in direct connection with the main railway lines.

Abattoir of La Villette.

The abattoirs to which the following remarks apply, viz. those in Paris, Berlin, and Brussels, are all on the French model, and only differ from one another in points of detail. At Paris there are three—Villejuif, Grenelle, and La Villette. The last named is the chief abattoir of the city (that of Villejuif being exclusively devoted to the slaughter of horses), and together with the cattle-market, from which it is separated only by the Canal Ourcq, it covers an area of about twenty acres. The cattle-market consists of three enormous sheds, open at the sides all round, and a number of sheds for stabling the animals. The centre building is for cattle, the other two are for sheep and pigs respectively. The ground is paved with granite blocks set in cement. The supply of water is everywhere abundant, and arrangements exist for immediately disinfecting with dilute cresylic acid any place in the market where an animal is discovered with a dangerous infectious disease. A staff of eight veterinary surgeons inspects all the animals as they stand in their stalls, and such as they think necessary are removed to the consultation

[1] *Weyl's Handbuch der Hygiene*, vol. vi. ; article "*Markthallen, Schlacthofe, und Viehmarkte*," by G. Osthoff, containing good diagrams of various abattoirs.

room or elsewhere for further examination. Those animals that are not destined for immediate slaughter, are removed to commodious stables, where they are housed until the following day. These stables are kept beautifully clean. As soon as the animals leave and the litter has been removed, a jet of water is made to play upon the floor, after which it is brushed, and finally washed down with cresylic acid. One man is specially deputed to cleanse the mangers (rendered in smooth cement to facilitate their disinfection), which, by reason of the animals licking them, are a likely source of contagion. The movable wooden partitions, which form the stalls for the sheep, are submitted after each market day to the action of a *pulverisateur* of cresylic acid.

The buildings of the abattoir comprise, in addition to the administrative block, eighteen large buildings divided up into small slaughter-houses for sheep and cattle, twenty-one stables, one large building for the various processes connected with the slaughter and dressing of pig's flesh, two large stables for the pigs, besides various buildings for bone-boiling, fat-melting, gut-scraping, the extraction of the albumen from the blood, etc., and, most recently built of all, a building for the electric light installation.

The buildings in which the slaughtering is done consist of a central court, roofed in with glass above, and two side wings open out from this on either side, in which are the chambered slaughter-houses. Most of the slaughtering is carried out in the central court, and the carcases are dressed and hung up in the small slaughter-houses in the wings. The floor is cemented, and has a sharp fall to the central drain, along which water must continuously run so long as any slaughtering is going on. Trays are at hand to catch the blood, and receptacles are provided for the offal. All the organs must be retained until the carcase has

been inspected by the veterinary surgeon. Alternating with these *cours de travail* are the long, roomy, brick sheds, in which the animals are kept until required for slaughter. Provision is made for some 12,700 animals.

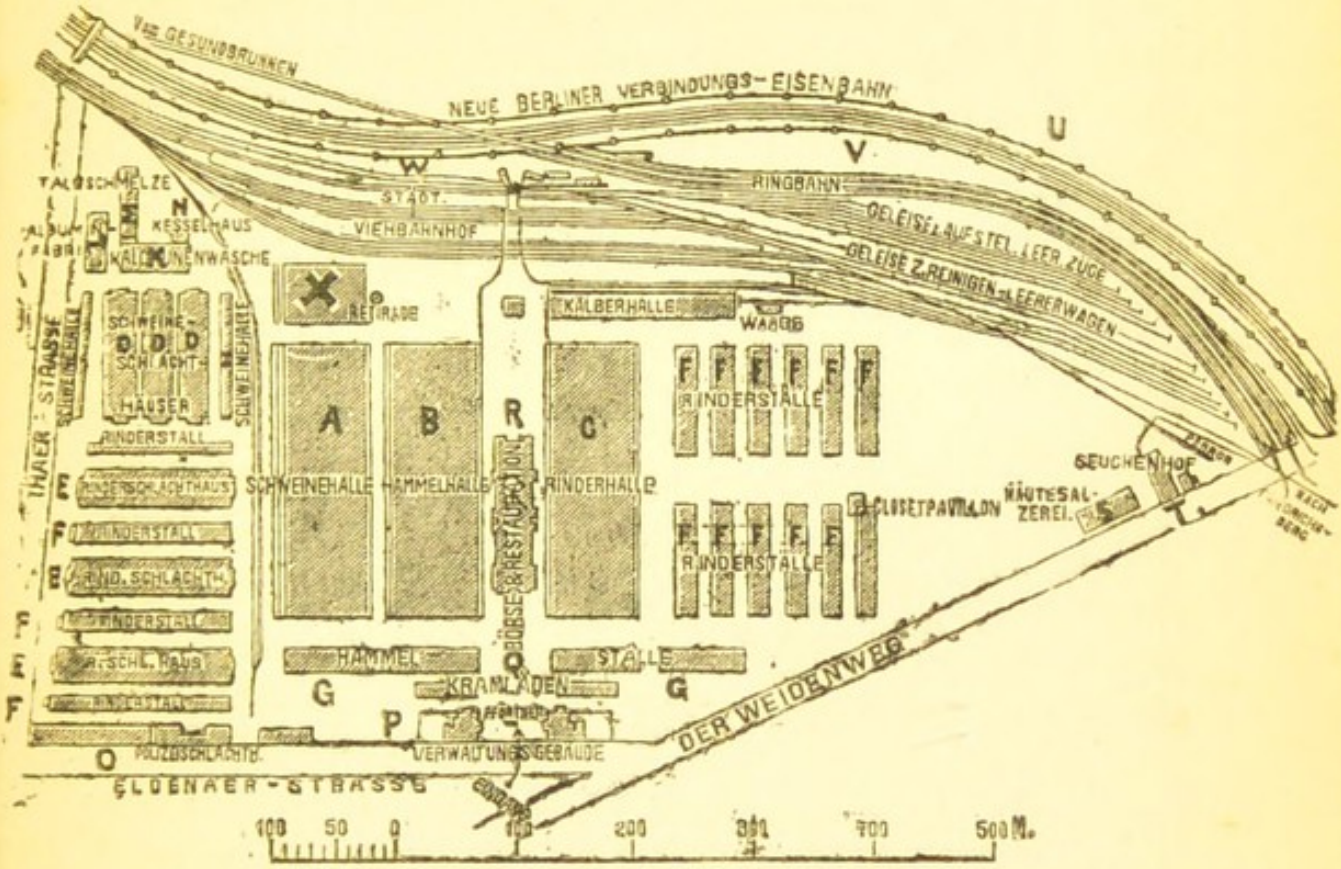


FIG. 20.

A.	Market hall for pigs.	L.	Manufactory for extracting albumen.
B.	,, ,, sheep.	M.	Fat-melting rooms.
C.	,, ,, cattle.	N.	Boiler house.
D D D.	Slaughter-halls for pigs.	O.	Police slaughter-house.
E E E.	Slaughter-houses for cattle and sheep.	P.	Administrative buildings.
F F F.	Stalls for cattle.	Q.	Retail sale shop.
G G.	,, sheep.	R.	Bourse.
H H.	,, pigs.	S.	Room for salting skins.
I.	,, calves.	T.	Isolation buildings for contagious diseases
K.	Gut-scraping rooms.	U V.	Railway lines.
		W.	Railway station.

X Cattle shed.

Abattoir of Berlin.

The abattoir and cattle market of Berlin does not differ very materially from that just described. They are, however, rather larger than the similar buildings in Paris, covering some twenty-nine acres. The extent of ground alone covered by the three great halls in the market

for the cattle, sheep, and pigs, exceeds eleven acres. A special railway depôt has been built at some distance from the main buildings, with the necessary accommodation for such animals as arrive from infected areas. There is, too, a large bourse, where the business between the cattle-dealers and butchers is transacted, and where the animals bought can be insured against the chance of their flesh being condemned, an arrangement which the butchers largely avail themselves of.

The general structure of the three long rows of buildings used for slaughtering cattle and sheep is as follows: From a central hall or passage, roofed in above, but open at each end, are on either side the small slaughter-houses. The central hall is divided up into a number of compartments, each compartment corresponding with a slaughter-house, and the carcases, as soon as they have been dressed, are hung up in them for about twelve hours. There is no cooling room as, owing to the fact that the carcases are not retained for any length of time, but are sold either whole or in halves to the butchers in the towns, who cut them up into pieces, the need for it has not been felt. As in Paris, alternating with the slaughter-houses are the sheds for stabling the animals. In some of them, especially in those intended for housing the pigs, the ventilation seemed to me insufficient. On the other hand, the large halls (constructed after the German model), for slaughtering the pigs in, could hardly have been improved upon. Attached to the abattoir, but leased to private individuals, were the fat-melting, gut-scraping, and other premises for working up the various residues for trade purposes. Gut-scraping is well recognised as one of the greatest stench provokers, and the condition of things in Berlin left a good deal to be desired. That the nuisance can be kept under by care and cleanliness is best seen, as far as my experience goes, in the similar

rooms at Munich, where the tables on which the process is carried on are of polished marble. Since 1888 the institution for furnishing calf lymph has been situated at the Berlin abattoir.

At Brussels there are two abattoirs, one belonging to the municipal authorities, the other carried on by a private company at Cureghem, on the outskirts of the town. The former is modelled after the abattoir of La Villette, in Paris, but it cannot be said to be so good in its arrangements; and certainly the new one at Cureghem strikes one as being much the more cleanly and better ventilated. In this the cattle market consists of a large shed, open at the sides, with an asphalted floor. Behind it are the twelve stables for the cattle, floored with tiles set in cement, sloping on either side to the central drain. The mangers are rendered in smooth cement. The slaughter-houses are handsome brick buildings with walls cemented to a height of five feet. Adjoining the inspector in chief's office is an excellently arranged laboratory, fitted up with microscopes, microtomes, and bacteriological apparatus.

What constitutes Unwholesome Meat?

According to M. Villain, Chief Inspector of Meat at the Halles Centrales, Paris, the seizure of meat is justified and is made—[1]

(1) When deprived of all edible qualities;

(2) When the eating of it might be followed by injurious consequences;

(3) When, for some reason or other, it has acquired qualities making its taste repugnant.

Under the first head would come the flesh of animals that have died too young, and of those that are dropsical or cachectic; under the second, that of animals affected with febrile diseases, pyæmia, septicæmia, anthrax, rabies, glanders, farcy, and tubercle; that of pigs affected with

[1] *Manuel de l'Inspecteur des Viandes*, by Villain & Bascou, p. 289.

trichinosis or cysticerci; that of animals which have died from the effects of eating poisonous food or medicines; and, lastly, meat in a state of putrefaction.

Veterinary Surgeons regarded as the Experts on Meat abroad.

In both Paris and Berlin, and, speaking generally, in all towns in France, Germany, and Belgium, the control of the meat inspection is placed in the hands of veterinary surgeons. Under them there may be sub-inspectors who are not veterinary surgeons; but the function of the latter is to search out, and not to pass judgment on, bad meat. The system of sub-inspectors has been worked out, perhaps, more fully in Belgium than anywhere else. There the law of August 4, 1890, on The Adulteration of Food-stuffs, necessitated the creation of a service of meat inspection throughout the country; and by the decree of 1891 the control of the expert examination of meat was confided to veterinary surgeons in the districts where there were any. Where there were no veterinary surgeons such persons should be called on to exercise the functions of an expert on meat inspection as had passed an examination, both theoretical and practical, in (1) the legal enactments bearing on the subject; (2) anatomy of the animals used for food; (3) signs of health and of disease in animals when alive and after slaughter; (4) characters of fresh meat, etc., and of the various preparations from it; (5) knowledge of the abnormal circumstances in which he should be prepared to take action himself, and of those when he should call in the assistance of a veterinary surgeon without delay.[1]

This examination is to be held in the capital of the province before a commission composed of the veterinary surgeon attached to the minister of agriculture, the veterinary inspector-general of the province, and a veterinary surgeon nominated by the minister.

[1] *Manuel à l'Usage des Inspecteurs non Vétérinaires.* P. Coremans, Brussels.

The functions of such an inspector are incompatible with the profession of a butcher.

At Paris inspectors of meat have existed since the time of the Revolution. Since 1879 the matter has been entirely handed over to veterinary surgeons, the vacancies in the staff being filled up by open competition. Their number (1890) was fifty-seven, comprising a chief inspector, three assistants, and fifty-three inspectors in three divisions. Their duties are to superintend the inspection of meat at the abattoirs and markets (including those of La Villette), and the butchers' shops of Paris and the suburbs.

In Berlin the service of meat inspection at the abattoir and different meat stations in the town comprised forty veterinary surgeons—twenty-three for the abattoir, and seventeen for the stations. They commence with a salary of 2,400 marks, rising by an increase of 600 to 800 marks every three years to a maximum of 4,500 marks (£225) yearly. In addition to the veterinary surgeons there are at the abattoir forty-eight men who take samples for the trichina examination, sixteen meat stampers, various officials connected with the office, and some 200 men and women charged with the microscopical examination for trichina.

There are eight stations at which the carcases of animals that have been slaughtered outside Berlin are examined when brought into the city. They are placed close to the principal markets or chief routes by which the meat arrives. As the organs do not accompany the carcase the examination has to be a very strict one. A control by ambulatory inspectors is also kept up, to see that no meat finds its way into the market that has not passed the expert examination.

Routine method of Inspection in the Market and Abattoir.

As regards the routine method of inspection at these abattoirs abroad, the following is an outline of the process.

The animals in the cattle market are examined by the

veterinary surgeons, and any suspicious cases are removed to special isolation stalls, where they can be further examined at leisure and in quiet. When the animals have been slaughtered and dressed, the veterinary surgeon, accompanied by the meat stamper, goes the round of the slaughter-houses. All the organs must remain near the animal for the inspector's examination, and nothing may be removed until his visit is over. In the case of cattle, after taking a general look at the carcase and examining closely the condition of the pleura and peritoneum, he incises the retro-pharyngeal, bronchial, and mediastinal glands, to see whether they are the seat of tubercle or other morbid processes. The masseter muscle is incised on both sides to see whether cysticerci are present. The tongue is rapidly passed through the hand and incised to detect actinomycosis, if present. The lungs, liver, and spleen are cut into, and lastly, the renal, portal, and mesenteric glands are incised. Should tubercle, for instance, be found in any organ, then a much more minute examination than that described is made. Not only are all the glands carefully examined, but also the liver, spleen, lungs, and kidneys are very closely examined, and a most careful search made for evidence of the generalization of the disease. When, say, only the lungs and liver are affected, these are cut away and destroyed, the carcase, for the rest, being passed as good. If the spleen and kidneys are both found affected with tubercle, the carcase is always condemned, and nearly always when the pleura and peritoneum are both affected. If the meat is passed as good, it is stamped in six places. Naturally, the veterinary surgeon, having so many carcases to examine, cannot inspect them all as minutely as he could wish; and consequently, after his round is over, he writes a report on the suspicious cases, and these are afterwards (having previously been marked as "*vorläufig zuruckge-*

wiesen und beanstandigt") thoroughly examined by the inspector in chief, whose word on the matter is final. Between 4 and 8 p.m. on one day sometimes as many as 900 oxen will be examined at the Berlin abattoir. Great attention is paid to the examination of pig's flesh in Germany, as so much of it is eaten raw. As soon as the carcase has been dressed, an attendant comes with small numbered boxes to take the specimens for microscopical examination. He first numbers the animals with the number corresponding with his specimen box, and then cuts out a small bit of flesh from the intercostals, diaphragm, pharyngeal, and abdominal muscles. In the microscopical rooms are 184 microscopists, 92 men and 92 women. From each of the four bits of flesh six preparations are made, twenty-four in all. Slabs of glass, with twenty-four divisions marked on them, on to which another piece of glass screws down, serve for mounting them. Whenever trichinosis is detected, the animal is branded in many places with a red stamp, and the flesh destroyed. The examination of the organs of the pig is made in much the same way as is done in the case of cattle. Although one recognises the fact that the inspection of meat is sadly neglected in this country, one is glad to admit that such a search as has to be made in Germany for trichinæ would be quite unnecessary in England. Of 515,526 pigs slaughtered at the abattoir in 1891, 257 were found to be affected with trichinæ—about one in every 2,000.

Inspection of Meat in the Market.

At the Halles Centrales in Paris, at the head of the veterinary staff is M. Villain, the first authority on meat inspection in France, and under him are the numerous veterinary surgeons. In one corner of the building is the "Salle des viandes saisies," where the suspected meat is taken, and where it can be submitted to examination better than can be done when it is

suspended amongst other pieces of meat on the hooks in the market. The inspector, who sees only the dressed animal, must have much experience before he can satisfactorily discharge his duties. By placing meat in an inconspicuous position, the butcher may seek to evade the vigilance of inspection; or, in the case of cachectic animals, he may deck them out in borrowed plumes, as, for instance, is done somtimes by wrapping round a cachectic sheep the omentum of some other that is quite healthy. Or again, the farmer may send the one half of a diseased animal on one day and the other on another, or sell one half to one butcher and the other to a second, in the hope that a part, if not the whole, may escape seizure. Indeed, it is proverbial that the unscrupulous dealer in the country has been under the impression that there was nothing too bad for the Paris market; and hence the inspector must be up to all the tricks of the trade, and be very alert in his passage up and down the stalls in the market. Needless to say, too, the inspector must be possessed of considerable tact.

As to the signs which guide the inspector in condemning the flesh of cachectic animals, they are, chiefly, the wasted condition, the absence of fat in the omentum, and the lack of resistance in the muscular tissue.[1] With regard to animals that have died of inflammatory diseases, the signs are: (1) a general tarnished colouration of the tissues more or less deep red; (2) a capillary injection of the fat, which in extreme cases is penetrated deeply by it; (3) arborescent markings on, and a tendency to a livid colouration of the serous membranes; (4) a violet tint in the kidneys; (5) a brown or blackish colouration of the spongy bone, seen best in the vertebræ; (6) loss of firmness in the muscular tissue. But in addition there is the evidence that can be

[1] Loc. cit., p. 188.

gathered from the manner in which the animal has been prepared. Often when it dies the proper means for dressing the carcase are not at hand; and, consequently, this has to be done roughly. Meat in this condition frequently comes to the Halles Centrales, and is just the kind that would be overlooked by an unskilled observer.

Legal Enactments on Meat Inspection in Germany.

In Germany there is no general law throughout the Empire making the examination of meat compulsory; but any States, if they choose, can impose this condition by making bye-laws on the subject. And further, such towns as adopt the law as regards the suppression of private slaughter-houses and the erection of public abattoirs, may make such regulations as they like for the proper control of the same, including an inspection of the meat, subject to the approval of the district government.

The Imperial law of 1879 on "The Trade in Foodstuffs," etc. (under which the inspection of meat falls) recognises only two kinds of bad meat, viz.: (1) *Gesundheitschädlich*, injurious to health, and (2) *Verdorben*, bad or spurious.[1] As regards the first, it is a punishable offence not only to sell or offer for sale such meat, but also if the meat is made accessible for consumption by any person by giving it away or otherwise (*Inverkehrbringen*).

Punishment follows if the nature of the food were calculated to injure health, even supposing the injurious effects were not produced. The sale of living animals the flesh of which, after slaughter, might be injurious to man, when consumed, is punishable in the same way, even though the dealer does not sell the animal directly for slaughtering purposes.

[1] *Deutscher Veterinär-Kalendar*, Berlin, 1895, to which I am indebted for most of the facts relating to the legal enactments as regards meat in Germany.

In the case of *verdorben* (bad) meat, no matter what the kind or degree of badness is, punishment only follows when the seller does not tell his customer what its condition is. Under the term *verdorben* is included meat that has been given an appearance better than that which in reality it possesses, and also horse flesh which is sold as beef.

Local Regulations. The local regulations, however, which usually go much further than the law referred to above, chiefly determine the action of the veterinary inspector at the abattoir; and the question he has to decide is not so much: Is the meat injurious to health or not? as, Is it suitable for human food? Hence the second division *verdorben* becomes subdivided into, (*a*) meat that is bad in the ordinary sense of the word, meaning unsuitable for human food, and to be treated therefore as equivalent to injurious; and (*b*) bad, but not so seriously bad that it may not be utilized as food, provided its condition is marked as being either of "diminished value" (*minderwertig*), or as "defective in quality" (*mangelhaft*).

The only meat that should be designated as injurious to health is such as has been scientifically proved to have injured the health of the persons who have consumed it. A great deal of meat, ordinarily spoken of as bad, would fall under the heading (*b*), as, for example, the flesh of animals in a poor state of nutrition, but which it would be foolish not to allow to be sold.

Tuberculous Meat. The question of what should be done with the flesh of animals affected with tuberculosis (and, according to the statistics of the abattoir, from 15 to 20 per cent. of all cattle are more or less so affected), has long exercised the minds of the veterinary surgeons at the slaughter-houses. In general, prior to 1892, all meat so affected had to be marked as of diminished value, and in cases where the disease was generalized, the entire carcases

were withdrawn from consumption, and only the fat, hide, etc., utilized for trade purposes. The ministerial decree of 1892 has materially modified this state of things in several important directions, allowing far greater latitude in the consumption of such food. The following are the most important points in this decree :—

(1) The meat of tuberculous cattle must, as a rule, be regarded as dangerous to health (and therefore be condemned) when the muscular tissue contains tubercles, or when the animal is wasted, even though no tubercles are to be found in the muscles.

(2) Such meat must not, as a rule, be regarded as injurious to health when the tubercles are found (*a*) exclusively in one organ, or (*b*) when two or more organs lying in the same cavity are affected, and are not connected with one another by lymph channels or by blood vessels belonging to the systemic circulation.

(3) Since a tuberculous condition of the muscles is excessively rare, and experimental evidence is, in the main, lacking to show that tuberculosis can be communicated to man by eating meat affected with tubercle, the meat of animals that are affected only to the degree mentioned in paragraph (2) can, as a rule, be regarded as of the first quality and be sold as such without any restrictions.

When it is recognised that this paragraph includes about 65 per cent. of all tuberculous cattle, the importance of the regulation will at once be seen. The introduction of the words "as a rule" leaves, however, much to the discretion of the veterinary surgeon ; as, for instance, in paragraph (1), the degree of wasting will have to be considered before proceeding to the extreme measure of total seizure. And again, when several organs are affected, but no wasting exists, he can pass it, and allow it to be sold without any restriction. The result of this has been that large

quantities of meat now come upon the market that formerly were condemned.

Other Morbid Conditions.

The presence of trichinosis in pigs leads to its total seizure, except for trade purposes. Similarly, when cysticerci cellulosæ are found in pig's flesh or in that of oxen in large numbers, the meat is condemned; but when only a few are found, it is allowed to be sold, provided it has been properly cooked under police supervision. The same remark applies to the meat of animals affected with tubercle not sufficiently extensive to necessitate its total seizure, nor so slight as to allow its sale without restriction; to meat with numerous hæmorrhages in its substance, etc. The erection of two large Rohrbeck steam ovens at the abattoir of Berlin has been a great boon in rendering tuberculous meat absolutely sterile, and so enabling it to be sold, of course at greatly reduced prices. The oven resembles very much an ordinary steam disinfector. After the temperature in the oven has reached 100° C., which usually is the case in two hours, the pieces of meat, each not weighing more than 3 kilos, are introduced, and are allowed to remain in contact with the steam for about 30 minutes. By allowing the steam pressure to act intermittently better penetration is effected. The beef is then sold at from 30–35 pfennige the pound, and pork at 40 pfennige, instead of the usual price, 80 pfennige. A litre of broth is given gratuitously along with each kilo of meat. The sale of such meat must take place at a specified spot in the abattoir, with the notice up in large letters: "Sale of the cooked meat of tuberculous animals." Such meat is always tender and juicy, and is readily bought by the poor.

Anthrax, glanders, and rabies, *charbon symptomatique*, and cattle plague, lead to total seizure of the carcase. In the case of pleuro-pneumonia, swine fever, and swine erysipelas (*rothlauf*), it is not considered that, if the animals

be killed in the early stage of their illness, objection can be raised to the flesh of such animals being sold when marked as of inferior quality. Should, however, the disease be advanced, it must be treated as injurious to health.

Widespread purulent inflammations, and necrotic processes, in fact, all processes of a septicæmic or pyæmic nature, cause the flesh of animals so affected to be regarded as dangerous to health and to be treated accordingly. The flesh of animals killed in the last stages of illness, owing to the fact that it rapidly passes into putrefaction, must be condemned. The flesh of animals affected with dropsy, or jaundice in a high degree, must be excluded from consumption. The expert veterinary surgeon must be the judge how far meat with more or less extensive hæmorrhages, abscesses, tumours, etc., although it may not be injurious to health if consumed, should be condemned, or sold as of diminished quality. The flesh of newly-born calves, deprived as it is of all nutritious qualities, "blown" meat, and meat in a state of putrefaction, must be condemned. The flesh of animals that have to be slaughtered as a result of difficult labour must be treated as of deficient quality.

Legal Enactments in France.

In France, and at Paris in particular, the laws and regulations dealing with the control of food-stuffs and meat inspection are very numerous; and even as far back as 1775 and 1784 edicts were issued forbidding the sale of the flesh of animals that had died of contagious diseases.

Most of these sanitary regulations were embodied in the law of July 21, 1881, and the various decrees supplementing it, especially that of July 28, 1888.[1] The law of 1881 deals with the contagious diseases of animals and the

[1] *Manuel de l'Inspecteur des Viandes*, p. 493, by Villain et Bascou, which contains a good account of the state of the law in France on meat inspection.

measures which it is necessary to take to combat them. Article 14 provides that the flesh of animals that have died of contagious diseases, no matter of what kind, or of animals slaughtered for cattle plague, glanders, anthrax, and rabies, must not be used for food; and the same conditions are applied by the decree of 1888 to *charbon symptomatique* and tubercle in cattle, and swine erysipelas and pneumo-enteritis in the pig. With regard to tubercle, the conditions imposed are, that the flesh must be excluded from consumption (1) if the lesions are generalized; that is to say, not confined exclusively in the visceral organs and their lymphatic glands; (2) if the lesions, although localized, have invaded the major portion of a viscus, or show themselves by occurring on the walls of the thoracic or abdominal cavities. Pigs affected with swine erysipelas or pneumo enteritis can only be slaughtered by the authority of the mayor, who is guided by the veterinary surgeon as to whether the flesh can be utilized for food or not. Similar conditions exist in the case of contagious pleuro-pneumonia. No limitation is placed on the sale of the flesh of animals affected with foot-and-mouth disease or variola of sheep.

The penalty for infringing the above conditions of the law is imprisonment for periods varying from six months to three years, and a fine of from 100 to 2,000 francs. No one is permitted to exercise the functions of a veterinary surgeon, with regard to the contagious diseases of animals, who is not duly qualified. An indemnity is paid to the proprietors of animals slaughtered by reason of their being affected with cattle plague and contagious pleuro-pneumonia, but not in the case of other contagious diseases. By the law of 1851 as to the control of food stuffs, the selling or offering for sale of food stuffs which are known to be adulterated or bad, is a punishable offence, and under this clause much food may be seized; such, for instance, as

the flesh of animals that have died of disease, the flesh of cachectic animals, etc.

Statistics of the Meat seized in Berlin.

In concluding this chapter, it may be of interest to see what results are obtained with all this elaborate system of meat inspection abroad. Taking Berlin as an example, the report of the city meat inspection for the year ending March 31, 1894, shows that in all 1,238,866 animals were slaughtered and examined at the abattoir. This number was made up of 142,874 oxen; 108,348 calves; 355,949 sheep; and 518,073 pigs.

The diseases which led to the whole carcase of the animals being considered unfit for human food in the raw state were :—

Tubercle	2,122 times.
Pneumonia	14 ,,
Various inflammatory diseases	142 ,,
Jaundice	96 ,,
Dropsy	155 ,,
Hæmorrhages in the meat	29 ,,
Swine erysipelas	191 ,,
Swine fever	398 ,,
Objectionable condition of meat	60 ,,
New growths	5 ,,
Cysticerci (oxen)	276 ,,
,, (pigs)	2,584 ,,
Trichina	122 ,,
Psorosperms	5 ,,
Actinomycosis	6 ,,
Multiple hæmorrhages	194 ,,
Calcareous deposits	45 ,,
Purulent inflammations	4 ,,
Blood poisoning	14 ,,
Killed in last stage of illness	30 ,,
Total	6,492 cases.

In addition 86,617 organs and isolated portions of meat

and 6,000 newly-born calves, etc., were destroyed. Altogether 25,050 animals were found affected with tubercle. Of these 20,953 were oxen, 130 were calves, 20 were sheep, and 3,947 were pigs. But only in 1,597 oxen, 76 calves, 17 sheep, and 430 pigs was the condition so serious as to lead to total seizure and destruction, the rest either being passed, or being cooked in the Rohrbeck steam oven before being sold. Of the 2,584 pigs, in which cysticerci cellulosæ were found, 1,707 had only a few, and 877 had many. The 1,707 with few cysticerci were cooked in the Becker-Ullman apparatus, and sold for food.

Of the 122 cases of trichinosis, 39 were affected badly; 34 in a moderate degree, and 49 but slightly.

In the 398 cases of animals the flesh of which was rejected because of swine fever, no account is taken of the large number in which isolated portions only were removed, and the rest of the carcase allowed to be consumed.

The seizures made of organs and portions of meat were due, for the most part, to old inflammations, echinococci, abscesses, hæmorrhages, tubercle, and liver flukes.

At the eight stations for imported dead meat there were examined 163,087 quarters of beef, 156,981 calves, 39,598 sheep, and 96,714 pigs. Seizures were made for tubercle, cysticerci, trichinosis, actinomycosis, swine erysipelas, jaundice dropsy, putrefaction, etc., etc.

CHAPTER VIII

BRUSSELS

The Health Office and its Organization—Certification of Births and Deaths—Medical Inspection of the Communal Schools—Regulation of Prostitution—Drainage Improvements of the City—Condition of the Senne—Defective Isolation Hospital—Vaccination—Reports on the Housing of the Working Classes—New Law on Workmen's Dwellings.

Dr. Janssens and the Health Office.

BRUSSELS is a remarkable instance of a Continental city that has been subjected to the careful supervision of a highly elaborated administration of hygiene for very nearly twenty years. Although a royal residence it is the Burgomaster of Brussels, whose powers have suffered hardly any diminution from what they were in the Middle Ages, who really rules the city. Up till 1874 he and his aldermen had a medical adviser in sanitary matters, but in 1874 the Health Office was created, and from its very start up to the present time Dr. Janssens has held the position of its inspector in chief. He has made such good use of his material and has struck out such original lines that his work has served for a model to many other towns, notably to Havre, Lille, and Nancy. This is especially noticeable in regard to the admirable statistics kept of the deaths according to sex, age, civil condition, and social standing; and also the tables of deaths from general causes and from zymotic diseases, set down as they have occurred in every street in Brussels. Such a work as this can only be done with the collaboration of all

the medical men in the town, and this M. Janssens has secured in the most hearty way. Everything is made as easy as possible for the practitioners; printed forms are issued to them which they have only got to fill in, and in exchange for duly transmitting them, they receive a copy of the *Weekly Bulletin of Demography and Statistics*, compiled by the officials of the Health Office, containing particulars not only of the health of Brussels and Belgian towns, but also of all the principal towns of the world.

This sanitary organization developed by Dr. Janssens deserves the more attention, because it is probable that future improvements in the public health service abroad will be made by adopting its methods rather than those of Great Britain. For instance, at the present time in France there is an agitation for a general public health law, and one of the points on which stress is laid, is that every town of over 50,000 inhabitants should be provided with a central health office somewhat similar to that of Brussels.

Its Work.

The *Bureau d'hygiène* forms the fourth division of the municipal administrative office of Brussels. The subjects with which it concerns itself (and it will be noticed that they differ in not a few points from those with which medical officers of health in this country have to deal), are the following: (1) certification of births and deaths; (2) medical examination of those seeking employment in the public service, medical attendance on the police and other employés, and the granting to them of the certificates of exemption from work in the case of illness; (3) medical examination of prostitutes; (4) certification of the insane; (5) medical superintendence of the communal schools; (6) house sanitation, and the inspection of building plans; (7) prophylactive measures against infectious disease including vaccination; (8) analysis of water and foods; (9) supervision of dangerous occupations,

theatres, lodging-houses, abattoirs, markets, epidemic and epizootic diseases; and (10) the preparation of demographic statistics.

Its Organization.

The carrying out of these various points is not placed in the hands of a single medical man, with a trained staff of sanitary inspectors, as in England, but in the hands of a *group* of medical men. Attached to the Health Office is the medical inspector in chief, his assistant, and five physicians for the six divisions into which the city is divided up for administrative purposes. Five additional physicians are enrolled to replace the latter in case of illness or when they are away on leave. Further there are two physicians occupied solely with the medical examination of the prostitutes, a dentist for attending to the teeth of the school children, a veterinary surgeon and four assistant veterinary surgeons, a chemist, etc., etc.

Fortunately Brussels is of manageable size. Without the nine suburbs, from which however it is difficult to separate it, it numbers 180,000 inhabitants, and with them 450,000. Such an arrangement as has been described secures a most efficient sanitary control over the city, from the fact that all the officials are directly in touch with the central administration itself.

The points that are perhaps most interesting to us in this country in the sanitary administration of Brussels, are: The certification of births and deaths, the inspection of schools, the part taken by the Health Office in the regulation of prostitution, and the inspection of meat.

Certification of Births and Deaths.

Every birth and every death must be certified by one of the ten physicians mentioned before as officially connected with the Health Office, in addition to the announcement of the fact by the physician in attendance. Every day the physician goes to the office between 3 and 4 p.m., and receives the list of births and

deaths. Before 10 a.m. on the following morning he must have made the verification. He must fill in a form stating the exact date at which the death has taken place, the age and profession of the deceased, as well as that of the parents. To this is appended the declaration of the two nearest friends, and information as to the social standing and the property possessed by the deceased in Belgium or elsewhere. Should the body present any signs of violent death or any appearances awakening suspicion, he must at once inform, by writing, the *Officier de l'État Civil*, as well as the Commissioner of Police, to whom he further transmits a notice stating that the burial cannot take place without the permission of the police. Should he find the death due to an infectious disease, he must at once inform his inspector in chief, and with him prescribe measures for disinfection. He must not criticise the treatment of the deceased by the doctor in attendance.

As regards births, a form must be filled in, giving the date and profession of the parents, etc. In the case of children notified as stillborn (who are registered as carefully as the others), the doctor is required to make a very close examination, and to state whether the child died before, during, or after the accouchement, and in the last case how long it had lived after birth.

Medical Inspection of Schools.

In no town in the world is the inspection of the national schools carried out so thoroughly as it is in Brussels. Their number is about forty-three, and they are divided up for inspection purposes amongst no less than fifteen doctors. Every school is visited once in ten days. In addition to this there are two dentists charged with seeing to the proper condition of the children's teeth, whose visit takes place once a month. The method of inspection I am able to describe, as one of the visiting physicians allowed me to accompany him.

Without previous notice he enters the school and passes to the class-rooms one after another, observing the condition of each, and asking the teacher if there is anything particular to bring under his notice. It is not often that in these formal inspections his attention is called to sick cases, for the teacher, whenever she notices anything the matter with a child, sends him or her off at once to the doctor's house. Once a month the doctor gives a short talk to the scholars in the upper classes, for the inside of a quarter of an hour, on some point connected with hygiene, as for example the care of the skin, of the teeth, advantages of vaccination, etc., and at the end of the term the scholars have to undergo an examination in the subject of these lessons. Any child whom the doctor may think requires it is given medicine—usually cod liver oil—every morning, under the direction of a master or mistress. A record must be kept of every case treated, with details as to the form this has taken, and its result. For checking the spread of infectious diseases in schools, considerable powers are placed in the hands of the doctor. Thus, if he finds a child suffering from scarlet fever, not only does he prevent that scholar's going to school until he shall have given it a certificate, but he also excludes the brothers and sisters until such time as he may think fit. Every month a form has to be returned to the Health Office containing the number of scholars who have been ill, their abode, the nature of the illness, how many days' absence it has entailed, the number of prescriptions issued, and the amount of cod liver oil dispensed. In addition, this form gives particulars as to the dates of the visits, the condition of the class-rooms, closets, playground, gymnasium, and the subjects of the health talks.

The directress of the school has in her room a small box containing bandages, etc., sufficient to render first aid to the wounded. The city of Brussels, recognising the aid that

teachers can give to the doctors in the early recognition of infectious diseases, and in view of the importance attaching to it, have had printed and circulate among the teachers a small pamphlet of six pages containing concise instructions as to their initial symptoms.

The school that I went over was admirable in its arrangements. The rooms were not close nor overcrowded, and were well lighted. On each desk was marked, in large figures, the height of the child for which that size was specially designed. The closets were of the best trough design. The playground was bricked, and had trees in it. A large gymnasium forms part of every school. A few statistics may be cited as giving some idea of the work done in this medical inspection. For the year 1891–92 the figures are :—

Scholars treated	2,451
Cured	71
Improved	2,259
No effect	19
Not known	102

In 1891, 1,517 scholars passed through the dentists' hands.

Medical Supervision of Prostitutes.

It should be clearly understood that the measures adopted in Brussels for the regulation of prostitution are directed against the practice. In the Report presented by the Burgomaster[1] to the City Council on the subject, stress is laid on the fact that no punishments, however severe, have ever been able to stamp out the evil, seeing that it has its origin as much from the pitiable social conditions of life always prevalent in large communities as from defects of a purely moral character. Enquiries extending over twenty years in Brussels, having for their object the discovery of the causes which led the women to adopt a life of prostitution, elicited the fact that in

[1] *Réglement sur la Prostitution, Ville de Bruxelles*, 1887.

1,523 out of 3,505 cases it was poverty. And until, therefore, this chief primary cause is removed, the existence of the evil cannot be ignored.

The principles then which guide the authorities in Brussels, and indeed in most Continental countries, in this matter are to endeavour to restrict the evil within as narrow limits as possible, and to hinder access to a life of prostitution. In adopting measures to carry these principles into effect they believe that they not only check the spread of disease, especially of syphilis, the baleful effects of which are not confined to the one individual contracting it, but are transmitted to the offspring; and that they are also protecting their citizens from the scandals which are only too apparent in the streets of such towns as fail to adopt regulations, so removing one of the principal causes by which the vice is kept up.

The measures are briefly as follows :—

The prostitutes are divided into two classes, those dwelling in houses tolerated by the administration (*en maison*), and those living in their own lodgings (*éparses*). The number of the tolerated houses has been gradually reduced, and at the present time there are but seven of them. Both classes must be inscribed on the books of the police, a step which is taken only after the most careful enquiry into the previous history of each case has been made. Efforts are made at this inscription to point out to the women the character of the life they seek, and how they may be assisted to an honest mode of life. In the case of any one under twenty-one years of age the inscription is never made without the consent of the parents or guardians, and in the case of foreigners the terms of the regulations to which they will be subjected are read over to them in their own language, and must be signed by the police officer, the interpreter, and the person concerned. One of the conditions

imposed is that no prostitute may lodge in a house where tobacco or spirits are sold, nor may she herself sell them.

For the present purpose the regulations of the police imposed on the occupants of the various public or private houses in which the prostitutes live, or the supervision which the police exercise over the latter as regards their good behaviour in the streets, do not concern us so much as the medical control to which the prostitutes are subjected by the two physicians in direct relation with the Health Office. The one attends daily at the *Dispensaire* (a building that has been specially constructed for the work so as to ensure the greatest amount of privacy combined with efficiency in the examination), to see such of the women as come there, afterwards visiting those who live in their own private lodgings, while the other visits such as live in the tolerated houses. At each visit the physician notes on the book which every inscribed person must possess, the date and result of his investigation. Any neglect on the part of the prostitutes in putting in an appearance at the appointed time leads to their compulsory removal to the *Dispensaire* for examination. On the detection of any case of contagious disease the person affected is removed in a closed carriage to the hospital of Saint Pierre, where special wards, isolated from the others, are set aside for their treatment.

The medical inspector in chief is charged with the duty of assuring himself that the visits of the two physicians are carried out with all necessary care and conscientiousness. One of the greatest benefits to the health of the women that has resulted from the attention called to the subject by the physicians, has been the abolition in all the tolerated houses of the sale of spirituous liquors. Nor can it be doubted that in numerous other ways the periodical visits of the physicians must ensure better conditions being made for the health of the unfortunate women.

Statistics on the subject. From the statistics published on this subject in the Report of the Health Office for the year 1893, it is seen that in all fifty-two prostitutes were sent for treatment to the hospital. Of these, forty-six were due to venereal disease, thirteen of the cases occurring amongst those living in their own lodgings, nine in tolerated houses, three on their arrival in Brussels, and twenty-one amongst those arrested for clandestine prostitution. In the same year 198 women were inscribed on the books of the police, and 16,205 medical examinations were made. During the five years 1886–90 the number of cases of syphilis per 1,000 of the prostitutes was 94·3, and of venereal diseases in general 130·4. The number of cases of the former per 1,000 examinations was but 1·2, and of the latter 1·7. It cannot be doubted that the effect of the medical control is to diminish markedly the amount of venereal disease amongst those inscribed, as compared with those clandestinely prosecuting prostitution.

But in looking at the figures dealing with this subject from 1881 onwards, it is impossible not to be struck by the fact that the number of the prostitutes inscribed, and the number of the medical visits paid, has enormously diminished of late years. In 1881, 391 persons were inscribed, and in 1894 only 189; during the same years 33,028 examinations were made in the former, as compared with 15,469 in the latter. It is unfortunately difficult to believe that prostitution in general is diminishing in Brussels, and therefore one is driven to the conclusion that the difficulties in the way of regulating it are so great, that its practice clandestinely, which is the worst from the point of view of the spread of contagious disease, must be increasing.

Meat Inspection. Reference has been made in the preceding chapter to the question of the inspection of meat in Brussels, so that it is unnecessary to dwell on it here.

Water supply. The general sanitary conditions of the town are good. The water supply of Brussels resembles that of Paris in this respect, that it is a spring water, and is brought without previous filtration straight to the reservoirs within the city. It differs from the water supply of Paris and London in the fact that, with the exception of a few pumps, there is no other supply. Most of the water comes from near Waterloo, where the springs of the Hain are tapped and led from there to a large covered-in reservoir. Another supply has been obtained by constructing galleries at the level of the subsoil water in the immense Bois de la Cambre and forest of Soignes, and leading this to a large reservoir. An extension of this work is now in progress, and in the forest can be seen the large works for still further effecting the drainage of the subsoil water.

Drainage. The drainage and sanitary arrangements in the houses are in the main the same as in England. There are still not a few antiquated sewers in Brussels, but they are fast being replaced by a kind that is eminently satisfactory, and a compromise between those of Paris and London. In most of the streets their height is $6\frac{1}{2}$ feet, which easily allows of a man moving about to clean them.

The great improvement scheme of the city, however, as far as its drainage is concerned, was effected by the Burgomaster Anspach, twenty years ago. Up till then the city was traversed by the small river, the Senne. This performed the function of an open sewer, and abutting on to it were the houses of the lowest class of the inhabitants. In the summer, when the banks became exposed, the nuisance was intolerable, and in winter, during floods, the water backed up into the sewers, leading to stagnation of the matters in them. Between 1867 and 1874 the whole length of the river, as it passed throught he city for a distance of

nearly a mile and a half, was covered in at a cost of about £1,000,000. A special vaulted channel, divided into two parts, was made for the river, and on each side of these channels, yet quite separate from them, were made the right and left main sewers. The old dilapidated houses were pulled down, and to-day, in the place of the foul river, there exists a magnificent boulevard, which is the finest street in Brussels.

The main sewers are of the Parisian pattern, the sewage flowing in a special channel below, 6½ feet deep, and on either side of this is a footpath for the workmen to move along. Only a very small portion of the sewage is used for irrigation purposes. About eighteen acres of land, however, are treated, but apparently in a rather primi-

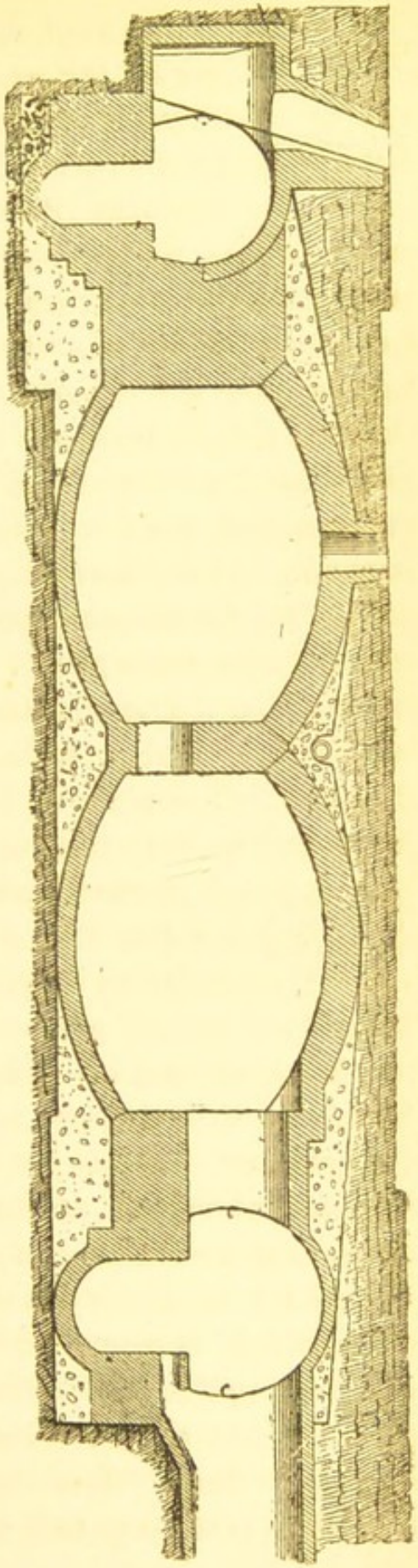


FIG. 21.—Section of the Boulevard Anspach, showing in the centre the two channels for the river Senne, and on either side the sewers.

tive fashion. Beetroot seemed to be the chief vegetable grown. Nearly all the sewage is pumped straight into the Senne some three miles below the city. The condition of this stream below the outfall is horrible. By no means lovely above, it is not so impure as to prevent green weeds growing. Below it becomes inkily black, emitting constant bubbles of gas, and the banks, in dry weather to a large extent exposed, yielding the most abominable stench to the surrounding atmosphere. The contrast was indeed striking between the condition of the Senne and the Canal Willebrœck, not fifty yards distant from it. In the latter the water was almost stagnant, but not receiving 104,000 cubic yards of sewage daily, it was comparatively clear and its banks richly covered with water plants. A scheme has been suggested for pumping the sewage to certain sand plains some fifteen miles away. One is inclined to doubt even then, although the condition would be vastly improved, whether the Senne could ever be anything but a very unlovely stream.

Condition of the river Senne.

Another point in which the city appears to be defective is in the arrangements it has for isolation hospital accommodation. There is no isolation hospital proper. Infectious diseases, including small-pox, are treated chiefly at the general hospital of St. Joan, where, on the roof of one of the blocks, isolation wards are provided. From our knowledge gained at Fulham and Sheffield of the danger that results from treating small-pox in the centre of largely populated districts, the necessity for a special hospital for this disease at least seems imperatively ordered. It is true that Brussels as a rule is remarkably free from epidemic diseases, and the authorities there would probably say that, having the compulsory notification of infectious diseases and the complete sanitary organization that they have, they can cope with these diseases without

Defective Isolation Hospital Accommodation.

going to the expense of building a special hospital. The fact remains, however, that in 1891 there was a double epidemic of small-pox and of measles, 164 deaths resulting from the first of these alone.

Exception must be taken to the above statement as far as cholera is concerned. In the autumn of 1892, in some spare ground of the Hospital St. Pierre, to meet cases of this disease an admirable pavilion of wood with fifty-one beds was run up. Doubtless, in times of other epidemics, this pavilion would be brought into use.

Vaccination. Vaccination is largely resorted to, and is compulsorily performed on every child in the national schools, and on every one who seeks employment under the State. Only calf lymph is used, and this is prepared under skilled hands at the national vaccine establishment attached to the veterinary college. The arrangements here for the cleanliness of the beasts, and for insuring the absolute purity of the lymph, are excellent. For instance, they assure themselves, by a post-mortem on the calf, of its freedom from tubercle or other disease before allowing any of the lymph that has been collected from it to be used.

Statistics as to Housing of the Working Classes. In a report presented to the Comité de Patronage des Habitations Ouvrières of Brussels, in 1890, by MM. Lagosse and de Quéker, on the condition of the dwellings in the city, some interesting statistics are given.[1] Altogether there were at that date, in Brussels itself, 19,594 houses with 168,145 inhabitants. Of these 4,601 were workmen's dwellings, or about 23·48 per cent., representing 19,284 workmen and their families. The average rent charged for a dwelling was 11·68 francs a month, or about £5 16*s.* a year. The average daily wage was 3·14 francs, or about £45 a year, so that the relation of

[1] *Enquête sur les Habitations Ouvrières, en* 1890. Brussels.

the total wages to the rent paid was one-eighth, showing in this respect a situation more favourable than in either Paris or Berlin. Of the 19,284 families, no less than 10,462, or more than one-half, were in receipt of assistance from the *Bienfaisance Publique* or charity organization society. As regards the size of the dwellings, the following figures are significant :—

Number of workmen's families occupying—	
A whole house	491
Three rooms or more.	1,371
Two ,, ,, ...	8,058
One ,, ,, ...	6,978
One attic	2,186
One cellar.	200
	19,284

36·18 per cent., therefore, occupied but a single room, and in 11·33 per cent. this single room was an attic.

Of the 9,634 workmen's families occupying a single room, 1,511 consisted of more than five persons. In 90 per cent. the rooms were kept clean. Nine rooms were found which it was impossible to ventilate, and in 19 the daylight did not enter at all, or scarcely at all. Although the condition of the closets were in most cases good, 51 houses were found which had none, and 1,767, or 38·18 per cent. of all the workmen's dwellings had only one to every 15 persons. 823 workmen's houses had no court, and only 195 had any garden.

The condition of things brought to light, however, in Brussels does not reveal so much misery as exists in other great cities, such as London, Paris, and Berlin. The working class population is mostly of Flemish extraction, and retains much of the natural cleanliness characteristic of this race.

Old Tenement Buildings.

About the year 1869, three or four large tenement dwellings were built, as, for example, those in the Rue de Vautour, Rue des Fabriques, and the Rue aux Laines. In the first some 150 families are lodged, comprising 700 to 800 persons. The blocks are five or six stories high, and it is highly improbable that a beam of sunlight has ever entered the rooms at the back, owing to the unfortunate way in which one block overshadows another. The rooms are of fair size, and the lodging generally consists of two rooms — a sitting-room and a kitchen. The price naturally varies on the different floors—from 35 to 45 francs per month in the first, to 15 to 20 francs on the fourth.

The Cité Leopold in the Rue des Fabriques lodges some 250 families, representing about 1,000 persons. The blocks resemble that already described, in being six stories in height, with rooms to the back and front. The place is kept clean, but the ventilation in many of the rooms, owing to the narrowness of the courts on to which they look behind, is very defective. The rents vary from 20 francs on the first floor to 13 francs on the fourth and fifth.

In the Rue aux Laines the block is smaller than those described, and has about 60 dwellings, renting at from 25 francs to 17 francs the two rooms, and 13 to 10 francs the single room. Attempts have been made in the suburbs to provide houses on the cottage system to workmen, as at the Cité Génin at Ixelles. Here there are about 20 small houses, each with two rooms, one below and one upstairs, and a cellar, the rent being about 14 francs a month. This colony, however, did not strike me as being much better than a slum.

Report of Dr. Janssens.

Dr. Janssens in a report on the houses of the working classes in the province of Brabant, which includes Brussels and its various suburbs, has made

an analysis of the answers returned to the various questions set by the Conseil Supérieur d'hygiène sur les Habitations Ouvrières by the various local committees.[1] The question, "In what condition are the houses of the working classes who live singly and in families?" was answered in such a way as to show that in many cases improvements were desirable. In Brussels, especially in the neighbourhood of the Boulevard Anspach, where the great improvement work of bridging over the Senne has been accomplished, large numbers of the working classes were displaced from their homes, and have tended to overcrowd still further the narrow streets and alleys of the Rue d'Anderlecht and neighbouring streets. Indeed, some of these that I visited, as the Rue des Navets, Rue des Potiers, Rue des Pêcheurs, are as bad as anything to be seen in London. All the efforts of the Bureau d'Hygiene are often frustrated by the acts of vandalism on the part of the inhabitants of the district, who destroy at once the improvements that may be made. To the question, "Does the condition of the houses guarantee not only the health but also the morality of the inhabitants?" the answer usually given was "Rarely." The reason given why the working classes prefer to dwell in overcrowded districts are: (1) that they like to remain where the charity organization societies are rich; (2) because they object to the expense and trouble of a long journey before and after their work; and (3) that they may be near their club or favourite public house in the evening. Their education is as yet totally insufficient to enable them to realize the advantages of a healthy dwelling. As a rule, the workpeople of Brussels and its suburbs dwell in tenements, in houses of three or four stories, and only rarely in their own cottages.

[1] *Enquête sur les Habitations Ouvrières de la Province de Brabant.* Brussels, 1888.

New Law on Workmen's Dwellings.

Much, it is expected, will be effected in Belgium by the law passed in August, 1889, on the question of workmen's dwellings. Amongst the articles of this law are the following :—

I. One or more councils are to be formed in each district for the purpose of facilitating the construction of healthy workmen's dwellings, and their sale, either for cash down or by annual instalments; for studying all that concerns the healthiness of the houses in the particular locality, and for promoting the development of thrift (*épargne*), insurance, mutual aid societies, and pension funds. These councils are to be called "Comités de Patronage," and shall consist of at least five, and at most eighteen members.

II. Prizes are to be given by the councils for good household management and thrift, and to further this object they are entitled to receive donations and legacies, and subsidies from public funds.

III. The councils shall signify to the various communal authorities the measures which they deem necessary, and shall present an annual report on their operations to the Ministers of Agriculture, Industry, and Public Works. The Caisse génerale d'Épargne et de Retraite is authorised by the law to employ a portion of its funds (of course under certain restrictions) in advancing loans in favour of the construction of workmen's houses, with a view to their ultimate purchase. These loans are made to societies at a minimum interest of $2\frac{1}{2}$ or 3 per cent.

The only formality which it is necessary for the workman to make when he has the necessary funds for building or purchasing a house, and to avail himself of the reduction in the charges, is to get a certificate from one of the Comités de Patronage attesting that he gains his livelihood by working with his hands in the employ of some one else.

The Caisse d'Épargne lends money to the societies for constructing workmen's dwellings, or to societies who make advances to working men to enable them to buy or build. The latter advances bear interest at 3 or 4 per cent. Five such societies exist in Brussels and its suburbs, and extensive building operations have already been begun. The conditions under which these societies lend are: (1) that the borrower possesses 10 per cent. of the cost of the house which he proposes to buy or build (a society exists for advancing under certain conditions even this 10 per cent.); and (2) the workman contracts to pay the nine-tenths borrowed within a certain number of years, varying from 10 to 20. These repayments do not markedly exceed the ordinary rent charged for dwelling-houses, so that by paying but a little more than the ordinary rent, in 10 to 25 years the occupant becomes the owner of the house.[1]

[1] *L'Habitation Ouvrière.* Brussels, 1893.

CHAPTER IX

CHRISTIANIA

Climatic Conditions, and Difficulties caused by them—Water Supply —Drainage — Meat Inspection — Notification and Isolation of Infectious Diseases—Vital Statistics—Sanitary Administration.

General Considerations.

CONSIDERING the extensive trade that exists between Great Britain and Norway—on the part of the latter, indeed, greater with this than with any other country—it is well to try to get an insight into the steps that are being taken in the large cities there to ensure the public health. Norway, too, is becoming every year more and more one of the great playgrounds of Europe, especially during the summer months, and consequently numbers of tourists pass through its cities, many remaining in them several days. It might truly be said that, often, the only unpleasant recollections of the country that those travellers take away with them have reference to the abominable sanitary arrangements to be found in some of the hotels and posting stations. Further, there is always the general interest attaching to the desire to see and note the special conditions that are imposed on public health arrangements by the variations in different countries of climate, geographical position, and the acquired habits and customs of the people.

Obstacles to Effective Sanitation.

It must be granted at once that the position of Christiania is unique, and places many obstacles in the way of an efficient carrying out of sanitary requirements. Situated at the head of a narrow fiord, it occupies a triangular area of sloping land where the valley of the river Akers opens out to the sea, between two ridges of pine-covered granite hills. The soil on which the greater part of the city is built is a stiff clay; the surface is very uneven, and in the fiord the rise and fall of the tide does not amount to more than from three to six inches. Add to this the fact that the extreme severity of the winter months (the average temperature during them being about 23° F.), renders the introduction of a trap with a water seal, on which we pin our faith to keep out sewer air, absolutely impossible, and consequently water closets do not exist. Here, then, are the conditions most likely to lead to the retention of waste matters in close proximity to the city.

To counterbalance these disadvantages, however, Christiania can offer much. The air from sea, from mountain, and pine woods, combines to make the climate healthy and bracing; the town is fairly well provided with open spaces; and without difficulty, by water or land, access can be had to places of public resort, situated amidst romantic scenery, such as the gardens of Bygdö, Holmenkolmen, Frognersaeter, etc. The population of the city at the beginning of 1893 was 161,157. Since 1860 it has more than trebled, a result in a great measure due to the flocking into it of the people from the smaller towns and the rural districts. At first most of the houses were constructed of wood, but it is now only in the oldest part of the town that these are to be seen, a part now rapidly disappearing to make room for three-storeyed brick and stucco buildings after the modern continental style.

Water Supply. The water-supply is drawn almost entirely from two lakes, only ten or twelve miles from the city, known as Maridalsvand and Sognvand. The former is by far the larger and more important supply, and will alone be described. Lake Maridal covers an area of about one and a half square miles and has an average depth of 20 feet. It lies 1,000 feet above the sea, surrounded by granite hills and pine woods. Only on its western side is any of the land bordering on it under cultivation. The water is very soft and pleasant to the taste. Neither free nor albuminoid ammonia can be detected in it, and the solid matter is only from one to two grains per gallon; in fact, for all technical and pharmaceutical purposes it can be used in the place of distilled water. Before entering the mains it is simply freed from the solid matter held in suspension, first through a palisade of wooden staves, then through a coarse network of brass wire, and finally through very fine copper wire gauze, with 120 meshes to the square inch. There has been very much discussion lately about this water. As the analysis of Dr. Schmelck, the public analyst, shows, it must be regarded as exceptionally pure chemically; and bacteriologically too it must be so regarded, for except during a short time in spring his analyses, conducted, after Koch's method, with gelatine plates of a special alkalinity, show an average of only 20 to 60 bacteria per cubic centimetre; but during the melting of the snow for a week or two this number mounts up to some thousands per c.c. As has been mentioned, on the western side of the lake some land is under cultivation, and the manure used on it consists of night soil taken from the houses of Christiania, so that, during the short period of the rapid melting of the snow, the possibility of excrementitious matter being swept into the lake over the hard frozen ground is not absolutely excluded. And,

indeed, in November, 1888, an epidemic of gastro-enteritis spread through the city, affecting only those drinking this water, to the pollution of which it was rightly or wrongly attributed. This epidemic is popularly known as the "Maridals disease," just as we speak of the "Welbeck disease." Dr. Schmelck could not attribute it to any special organism, nor has he, indeed, ever detected the bacillus coli communis or any suspicious bacterium in the water. Further, a new railway line is about to be laid to Drontheim, and one of the routes suggested is along the shores of this lake. This, it is feared, will inevitably lead to the erection of villas, manufactories, and increase of population near it. The construction of filter beds, which naturally suggests itself as a solution of the difficulty, is considered impossible from lack of a suitable site and the expense that would be involved in their maintenance. The Health Office is fully alive to the danger, and there are three proposals before the town council—(1) to buy up the land under cultivation, (2) to compel the owners to use only artificial manure on the land, and (3) to remove the intake to another lake that feeds Lake Maridal and is quite free from the objections urged in the present case. The third of these schemes will probably have to be adopted, as it gives the most certain guarantee as to the absolute purity of the water. Subsidiary reservoirs are placed at various parts of the city, as at St. John's-hill and Kampen, to lessen the pressure on the mains. All the small house pipes are made of iron, or galvanised iron, lead never being used. Owing to the intense cold in winter, all pipes have to be laid at a depth of six feet at least. Mention should be made of an arrangement by which the water in some of the standpipes is allowed to escape automatically through a little hole placed low down in the ground so that the pipes can never freeze. Dr. Holst, Professor of Hygiene,

has repeatedly traced outbreaks of typhoid fever to this, the hole allowing the pure water to run out and impure water to run in. The danger only exists in winter, and is greatly diminished, now that it has been recognised, by improvements in construction and vigilant inspection. The average consumption daily in 1892 was twenty-five gallons per head. Payment is usually made in a lump sum, according to the insurance value of the house, or, if by meter, at the rate of about 1¼*d.* per 35 cubic feet.

Drainage, etc.

The drainage of Christiania has never been carried out after any definite plan; with the natural consequence that the drains have been carried by the shortest route into the fiord or into the river Akers. It is, however, important to state that, water closets being forbidden, no excreta find their way into the sewers, and the condition, therefore, is not so bad as it might be. The river Akers, as it flows through the town, instead of partaking of the limpid clearness characteristic of most Norwegian streams, looks black and unpleasant, and the stench from it is sometimes atrocious. This condition is principally due to dye-works and other manufactories situated on its banks in the upper portion of the town.

Until quite recently the drain-pipes to carry the slop-water from the houses were laid simply end to end with open sockets, a condition that has led to pollution of the soil. The slop water before it enters the sewer is collected in a large tank or pit situated, in the older houses, in the basement. Through defective covers to this tank noxious gases penetrate into the houses, there being, unfortunately, no provision in the building regulation for a layer of six inches of concrete to be laid under the floor to exclude the ground air. The provisions, too, against the entrance of damp into the dwellings are hardly stringent enough. Efforts are being made in all new houses to have this tank

placed outside in the yard, which would be a great improvement.

Mention may be made here of the condition of many of the streets in the poorer districts. The builders of the houses are clearly not required to make the roads, as any one can walk through street after street, where the houses, all three-storeyed, have evidently been built some time and are all occupied, but where there is not the faintest pretence at a footway or made road. There are no water traps to the gullies conveying rain water to the sewers, so that effluvia from them are not infrequently detected.

Removal of Night soil.

The question of the disposal of the night soil has given the greatest trouble in Christiania as in so many other places. What is wanted is undoubtedly a carefully carried out system of frequent pail removals undertaken at the instigation of the city authorities themselves. At present there is no definite system. Of 5,700 houses 2,500 have cesspits inside them. Many of these receptacles are not impervious; they therefore pollute the ground and render the walls damp. They are cleaned out, too, at irregular intervals. In other 2,500 houses the closet and cesspit are outside the house, and consequently give less occasion for complaint. In about 400 houses an arrangement exists for carrying off the urine directly to the sewer by a special pipe. Its disadvantages greatly outweigh its advantages. Earth closets are occasionally used.

The point that is perhaps most open to criticism in the arrangements at Christiania is the fact that so much of the work, ordinarily undertaken by city authorities themselves, has been placed here in the hands of private individuals, who contract in this way for the removal of house refuse, the cleaning of cesspits, etc. At present the house owner has to pay the contractor about £3 a year for removing this refuse. Nine companies compete with one

another in this matter in the city. Part of the material so collected is converted into *poudrette*, but by far the greater amount is carried out in carts to the country, or conveyed away by railway and sold to the peasants for manure. Before it is so removed it is usually treated with either lime or dried peat. When speaking of *poudrette* it must not be imagined that its manufacture is carried out, as at Rochdale, in revolving cylinders by heat. It is merely allowed to dry in sheds, the arrangements for which in the largest manufactory that I saw, at Grorud, were of the simplest description. It is sincerely to be hoped that before long the city will undertake this department of municipal hygiene, providing a suitable station with a properly equipped staff under the energetic engineer of the Health Office, Herr Weiser. The work would probably be considerably lightened by the erection of a dust destructor.

Meat Inspection.

It is an interesting fact, and serves to mark off very clearly the difference between English and Continental sanitation, that one of the questions which has most recently been engaging the attention of the city and has led to practical steps being taken, is that of the inspection of meat by specially trained veterinary surgeons. Although ahead of Great Britain in this respect, Norway has lagged a little behind France, Belgium, Germany, and Denmark, but is evidently determined to make up her lost ground. There is no abattoir at present; this will come, doubtless, before long. There are about thirty private slaughterhouses, where are to be found, as is pointed out in a report of the city engineer, the defects so commonly associated with the same in London and in most towns of Great Britain—bad situation, defective ventilation, insufficient accommodation for the animals, etc. Since January 1, 1894, however, no meat that is slaughtered in Christiania can be sold unless it has first undergone an expert examina-

tion by a veterinary surgeon. The station that has been built is admirably adapted for its purpose. It is a one-storeyed building, with four rooms opening one into another; each room has a tiled floor sloping to a central drain, and the walls are of glazed earthenware tiles. In each room are two large marble slabs on rollers, which can be run outside the doors when any meat arrives. As in Paris, Berlin, and elsewhere, localised tubercle is not regarded as a sufficient cause for seizure; the meat is, however, branded with a special stamp, marking it as of second-class quality.

Notification and Isolation of Infectious Diseases.

Another department, the administration of which is decidedly good, is that relating to the notification and isolation of infectious disease. In fact, Christiania can be regarded as quite one of the pioneer cities in notification, for as long ago as 1874 this was made compulsory. In addition to the diseases notified in England are varicella, syphilis (hereditary and acquired), and gonorrhœa. No payment is made for the return, although there has been talk of it. The return is made on a printed postcard, which requires very ample information as to each case. Disinfection of bedding and clothing is carried out by means of a Washington Lyons steam disinfector. Reliance is placed, as regards house disinfection, chiefly on soap and water and carbolic acid, 1 in 20. Sulphur fumigation has been given up. That essential of the process of disinfection—namely, accommodation of the household during the time that this takes—is provided for in a special building, which is also designed to serve as a place where relatives who have been exposed to infection from dangerous infectious diseases may be placed in quarantine. There are three such buildings—one for cholera, another for small-pox, and the third for diphtheria and scarlet fever. The Infectious Fever Hospital is situated just outside the borders of the town. It is of quite recent

date and consists of a number of isolated one-storeyed pavilions constructed after a good plan. During the cholera panic in the autumn of 1892 two small pavilions of wood were run up here, each with sixteen beds. To complete the original plan of the hospital, two pavilions and the administrative block yet remain to be built.

Vital Statistics, etc.

The birth rate in 1892 was 33·5 per 1,000, and the death rate only 19·3. In the working-class districts both are, as might be expected, considerably higher. In one the birth rate was 48·0 per 1,000, and the death rate 28·2. Illegitimate births are about 15 per cent. of the whole. Infant mortality (1887–90) was 165 per 1,000. The death rate from the seven principal zymotic diseases was 4·1 per 1,000 in 1892. It is worthy of note that typhoid fever caused only 6 deaths, and not one was attributed to small-pox. The phthisis death rate in the same year was 2·8 per 1,000, and 14·8 per cent. of all causes of death were ascribed to this disease. Christiania has suffered for the last ten years from a very severe epidemic of diphtheria, now happily declining. In the decennium 1870–79 only 76 deaths were put down to it, whereas in that of 1880–89 this number rose to 1,961. It reached its maximum in 1889, when 1,248 cases were notified. In 1892 the number notified had fallen to 267, with 81 deaths. The case mortality has been about 30 per cent. Its exact cause has not been clearly traced. School influence has not been thought to have played an important part.

As regards cholera, Christiania remained perfectly free in 1892 and 1893. The anxiety, however, that prevailed at that time was not without justification, for during previous epidemics the city had suffered much. In 1833 there were 806 deaths from it, and 1421 in 1853. The opportunity was therefore seized in August, 1892, to systematically clean out the city from one end to the other. Quarantine regu-

lations are still enforced. A ship with cholera on board would have to undergo five days' quarantine; this, however, would not apply in the case of ships merely arriving from infected ports, but without actual cholera on board. With regard to Scandinavian vessels arriving in English ports, it is a pleasure to have to state that it is the opinion of those most competent to judge—namely, the port medical officers of health—that their cleanliness and general sanitary condition are an example to all other nations. This is considered to be mainly due to the fact that deck-houses and not forecastles are the rule, which ensure better ventilation and more light. Disease is rarely met with on board. Leprosy is diminishing so much in Norway that there is talk of converting the large leprosy hospitals, many rooms in which are untenanted, into isolation hospitals for phthisical patients.

Sanitary Administration, etc.

Unlike the condition of things usually prevailing abroad, where sanitary matters are consigned to the tender mercies of the police, there is in Christiania fortunately a special department for public health. By the sanitary law of 1860 every district in Norway was compelled to have a "Sundhedskommission," or Health Office, consisting of the "stadsfysikus," or medical officer of health, the engineer, the magistrate, and three other members elected for the space of four years. The position of "stadsfysikus" in Christiania dates back for considerably over a hundred years. It is at present filled by Dr. Bentzen. The most important subordinate position is that of "Sundhedsinspektor," at present filled by Dr. Berner, an office not comparable with that of our sanitary inspectors, as the holder must be a medical man, and acts in the capacity of deputy medical officer of health. Naturally health requirements are very much the same all the world over, and this health office occupies itself energeti-

cally with much the same subjects as do our own at home. This is seen in the very interesting and valuable yearly reports of the Sundhedskommission, giving statistical tables and treating of matters of interest from a public health point of view with which it has been occupied. Its power for good would doubtless be considerably extended if, as it wishes, the city council would only hand over to it the carrying out of all matters of municipal hygiene now inadequately dealt with by private companies. Such definite by-laws as, for instance, we have in the model by-laws of the Local Government Board, do not exist.

The conditions under which the sale of milk occurs leave much to be desired. The same room in which it is kept is often used as a sitting-room, and very often the sale of the milk is associated with that of other articles calculated to prejudicially affect its taste or purity.

Mention should, perhaps, be made of a matter to which the public analyst has repeatedly called attention—the fact, namely, that in cotton stuffs imported from England he has frequently found arsenic present, in sufficient amount sometimes to be prejudicial to health, while similar goods coming from Germany have been quite free from arsenic. Samples of these stuffs were sent by the British Consul to the Home Government for analysis some years ago, and the results of Dr. Schmelck being confirmed, a circular on the subject was addressed to the manufacturers. The improvement manifested after this has now quite disappeared, and in 1894, in about 50 per cent. of the samples sent to the laboratory, arsenic was found.

CHAPTER X

STOCKHOLM

Climatic Conditions—Difficulties in the Water Supply and Drainage—Dry Methods of Sanitation—New Isolation Hospital—Absence of proper Meat Inspection—Animal Vaccine Station—School Buildings—The Gothenburg System for the Control of the Liquor Traffic.

General Consideration.

In his work on Public Health in Different Countries of Europe,[1] Dr. Palmberg, of Helsingfors in Finland, says that Stockholm disputes with Brussels the honour of possessing the best sanitary organization of any Continental capital; and certainly there are many points of resemblance in the management of the Health Office in the two cities, as both are occupied with very much the same work, and pay particular attention to the collection of statistical matter. Stockholm, however, is superior to Brussels in its arrangements for isolation hospital accommodation, while it is inferior in matters relating to abattoirs and the inspection of meat. The yearly report of the medical officer of health enables one to see how wide a field his department extends over, covering as it does not only much of the ordinary work of a medical officer of health at home, but also the supervision of the

[1] *A Treatise on Public Health, and its Applications in Different Countries in Europe.* By A. Palmberg. Translated and edited by A. Newsholme, M.D.

medical attendance on the poor, vaccination, school hygiene, the regulation of prostitution, and the collection of statistics as to the number and causes of death in the hospitals. The situation of Stockholm, just where the waters of Lake Maelar discharge themselves into the Baltic, leaves (in summer at least) very little to be desired from the sanitary point of view. The force of the stream, as it sweeps through the city, although the volume is much greater, reminds one not a little of the Iser at Munich. The ground on which it is built consists almost entirely of granite. Open spaces abound, and the numerous islands which add so much to its charm are made easily accessible by frequent steamers as places of public resort. There is, too, such a diversity in the style of the architecture of the buildings that the monotony of aspect, so often met with in modern continental streets, is entirely lacking. The streets, except in the oldest part of the town, are broad, well-paved, and are kept beautifully clean. The drawback, of course, is the long and severe winter. The average temperature during the three winter months is 22° F., during which time the harbour is usually ice-bound. The population in January, 1893, was 249,246. In 1892 the birth rate was 29 and the death rate 20·3 per 1,000. Stockholm is a good example of a city the death rate of which has steadily diminished with the introduction of a wisely directed sanitary administration, and illustrates also the fact that this end can be attained without the introduction of the *tout à l'égout* system. Dr. Linroth, the very able medical officer of health, has minutely tabulated the mortality statistics between 1871–90, according to sex, age, time of year, and city parishes.[1] In this work he demonstrates the diminution in the death rate in the four quinquennial periods as follows :—

[1] *Dödsorsakerna och Dödligheten i Stockholm*, af Prof. K. Linroth.

1871–75	35·3 per 1,000
1876–80	25·7 ,,
1881–85	24·2 ,,
1886–90	20·8 ,,

The diminution has shown itself in all the three principal groups of disease—namely, diseases of the respiratory organs, which include one-third of all causes of death, diseases of the alimentary system, and the infectious diseases. In the last of these, indeed, during the time stated, the decrease was over 50 per cent. Illegitimate births are very high, having been in 1892 28·2 per cent. of all births. The infant mortality (1886–90) was 175 per 1,000. The death rate from the seven principal zymotic diseases was in 1892, 3·1 per 1,000, the phthisis death rate was 2·87, and that of typhoid fever only 0·18 per 1,000.

Water Supply. The water supply of Stockholm is drawn quite close to the city from a small branch of Lake Maelar known as Arstaviken. The situation of the present intake has both its advantages and disadvantages. Amongst the latter is the fact that it is placed at the dead end of this somewhat narrow arm; consequently the water has very little movement and is inclined to be flat. Its advantage lies in the fact that occasionally, for a period of a week or two every year, the surface level of Lake Maelar is a little below that of the Baltic Sea, and when this is the case, naturally the flow is from the Baltic into the lake. A mixture of the salt and fresh water then takes place, and were the intake in the body of the lake, the water might be so brackish as to be undrinkable. The present site, two and a half miles up this narrow arm, prevents a mingling of the two kinds of water to any such extent as prejudicially to affect its potable quality. In the body of the lake for a distance of forty miles above Stockholm, as is shown in a careful report on this matter by Dr.

Sonden, chemist to the Health Office, the two kinds of water can be traced—the lighter fresh water at the top and the heavier salt water at varying depths below. The percentage of sea water in Arstaviken varies from 0·2 to 1·0. The analyses of Herr Ekendahl, chemist to the waterworks, carried out after Frankland's method, show that the water belongs to the type known as upland surface. The following are fairly typical samples of the water before and after filtration.

—	Parts per 100,000.							Bacteria per c.c.
	Solid matter.	Organic carbon.	Organic nitrogen.	Nitrogen as nitrates and nitrites.	Ammonia.	Chlorine.	Hardness.	
Before filtration .	14·2	0·618	0·044	trace	—	4·7	5·7	136
After filtration .	14·8	0·424	0·040	trace	—	4·0	6·6	56

Sometimes the chlorides, however, under the conditions alluded to above, run up to more than twenty parts per 100,000, although the organic carbon and nitrogen are hardly affected. The present water works date from 1860, and consist of eighteen filter beds with the necessary pumping stations. Most of the water is pumped directly on to these beds from the lake, but an additional supply is obtained from seven wells sunk at varying distances from the lake into which the water percolates, passing on its way through a sandy soil. The water from these wells, although it has undergone a natural filtration, is made to pass through the sand filters before distribution, and their chief advantage lies in the fact that they render the water a little warmer in winter and colder in summer. Ten of the filter beds have each an area of 775 square yards; the remaining eight are a little smaller. They are all quite open.

The vaulting over of filter beds in cold climates, as has been done in the Berlin waterworks both at Tegel See and the new beds at Friedrichshagen, must be considered advantageous, as it prevents the water freezing during winter, and allows a regular cleaning of the sand to take place. The layers composing the filter beds do not differ much from the usual type. In 1892 the average consumption daily was 18·4 gallons, and the greatest amount used in one day was only 27·2 gallons. The small consumption is, of course, largely due to the absence of water closets. The charge for the water is *2s. 6d.* for every room, or, if taken by meter, about *2d.* per thirty-five cubic feet. Herr Ekendahl, who has his laboratory at the water works, has now for several years been making periodical bacteriological examinations, and for some time he has been making daily such examinations for five of the filter beds. The method he adopts is that introduced by Koch. He is rather of the opinion that too much stress is laid in Germany on the mere number of bacteria found in a water as determining its potable quality, and does not agree with the view that a filtered water containing more than 100 bacteria per c.c. should be rejected, quite apart from the difficulty of practically carrying it out. He would, of course, agree that in many cases an increased number of bacteria in the filtrate points to some defect in the filtering process, but he considers the fact that certain harmless bacteria have a peculiar faculty of developing in the filter beds is rather lost sight of. More attention, as Dr. Migula of Carlsruhe has pointed out, should be directed to the number of different kinds of bacteria found in the water, and to their nature, than to the mere number per c.c.

Bacteriological Control of Filter Beds.

Drainage. The drainage of Stockholm is arranged on the plan of carrying the rain water and slop water from the houses into Lake Maelar. There are six

main openings, and the volume of the water into which the sewers discharge is so great that one can stand over them and not be in the least aware of their presence. Only one, and that from the least inhabited part of the city, empties into Arstaviken two and a half miles from the intake of the water works. Efforts are being made to divert what little does find its way in this direction into other channels. The sewers are mostly constructed of granite, and their formation is a matter of considerable difficulty and expense, as their track has to be laid in the solid rock.

The water carriage system is deemed out of the question owing to: (1) the extreme cold in winter; and (2) the occasional backflow from the Baltic into Lake Maelar, which, it is thought, might carry infective matter into Arstaviken. It should be said however that, with regard to the second point, the careful investigations of Dr. Sonden show that the danger is infinitesimal, and that if the water closet system were introduced (and it has its supporters) the increased impurity of the water due to it would not be detected by chemical means. It would be a matter of considerable difficulty to introduce in Stockholm what are considered essentials of the water carriage system, as, for instance, that all soil pipes should be outside the house and through ventilation of the same. Even in Berlin, where the system has been universally introduced, one is bound to admit that the arrangements there do not offer anything like the same security against the entrance of sewer air into the house as do those in England. The disposal of the night soil is managed much better in Stockholm than in Christiania, chiefly because there are no cesspits, the pail system being universal, and the fact that the sanitary authority itself undertakes the work of removal, and does not hand the matter over to contractors. In 1892 new regulations were passed compelling householders to replace wooden pails by

those made of steel. They are removed every fortnight, which certainly seems none too often, or whenever notice is given by the householder. Every removal costs *7d.* A lid, which screws down tightly, is placed on the pail before it is taken away. Dustbins are emptied every day, and the contents, together with the pails, are removed in special waggons by railway to the depôt at Riddersvik, ten miles above the city on Lake Maelar. The town has no particular reason to be proud of this station at Riddersvik, and it is very much to be hoped that a city like Stockholm, so admirable in its arrangements in many respects, will soon have more solid and suitable buildings than exist at present. An experimental shed has been erected here for making *poudrette* by mixing the contents of some of the pails with dried peat. The results so far have been very good, and the *poudrette*, which does not contain more than $8\frac{1}{2}$ per cent. of peat, fetches a good price from the farmers.

Isolation Hospital.

Compulsory notification of infectious disease has been in force for several years, and the means for getting every advantage from this by the provision of an isolation hospital, disinfecting station, etc., are now very complete; in fact, the new isolation hospital is quite one of the best of its kind to be found abroad. The scheme for its construction was drawn up by Dr. Linroth in 1884, and it was opened in September, 1893. It is well situated on a small rocky hill on the outskirts of the city near one of the poorest quarters. The grounds extend over 14 acres. There are five one-storey pavilions thirty-two yards distant the one from the other, solidly built of stonework, and intended for the reception of cases of scarlet fever, measles, diphtheria, typhus fever and small-pox. In addition there are the administrative block, kitchen, observation pavilion, disinfecting station, mortuary,

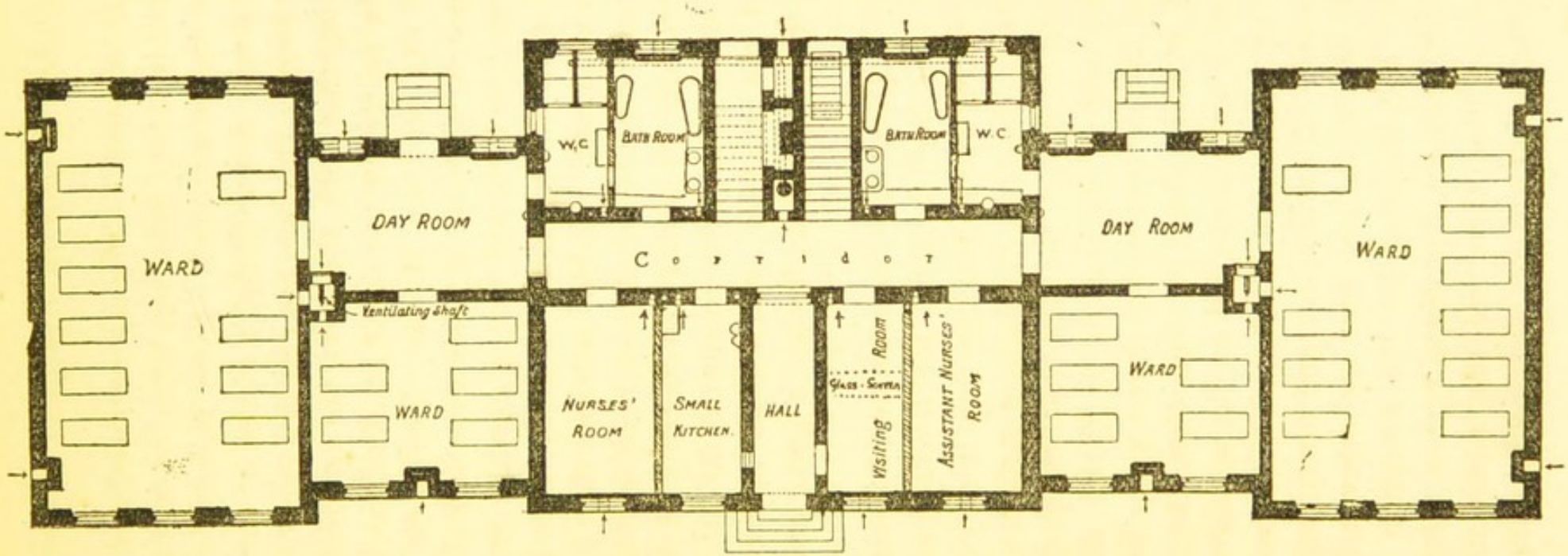


FIG. 22.—Plan of Wards in Isolation Hospital at Stockholm.

and ambulance station. Minute attention to detail has been paid in the construction, yet all the arrangements are so simple and ready to hand that there is no difficulty in at once getting a correct idea of the working. The floors are of cement mosaic, the walls oil painted, all angles rounded off, and glass and iron replace wood wherever possible. The windows are double because of the winter cold. Ventilation is effected by large extracting shafts, the air entry being directly from the outside, and provision is made for warming the in-coming air. Heating is done by steam radiators. The wards are all on the same plan, and a glance at the preceding plan will make their construction plain. A corridor in the middle divides the central block into two distinct halves. The one half is exclusively for the entrance of the patients; the other for that of the hospital staff, etc. The corridor at either end opens into a day-room, and this again directly into a ward with ten beds, while to the side of it is a small ward with five or six beds. In each pavilion is a visiting room, where convalescents can speak with friends, isolation between them being ingeniously maintained by a glass screen reaching half-way up to the ceiling. The observation pavilion is original in plan. It is semi-circular in shape. The small sick-rooms are placed round the periphery and are entered directly from outside. They have but one bed each, but are large enough to hold two should a member of the family wish to remain with the patient. Two pairs of rooms are so arranged that, if necessary, one can be occupied by the patient and the other by the nurse; or again, two or more can be thrown into communication and be controlled by one nurse. In connection with the administrative block is a double set of baths—one for the physicians, the other for the nurses, to be made use of before going into the town. A linen overall is worn by the physician when making his

rounds, and is always changed on going from one ward to another.

What has been said as to the arrangements in this isolation hospital might stand almost equally well for those existing in the new general hospitals. Here the principle of asepsis, as distinguished from antisepsis, in the treat-

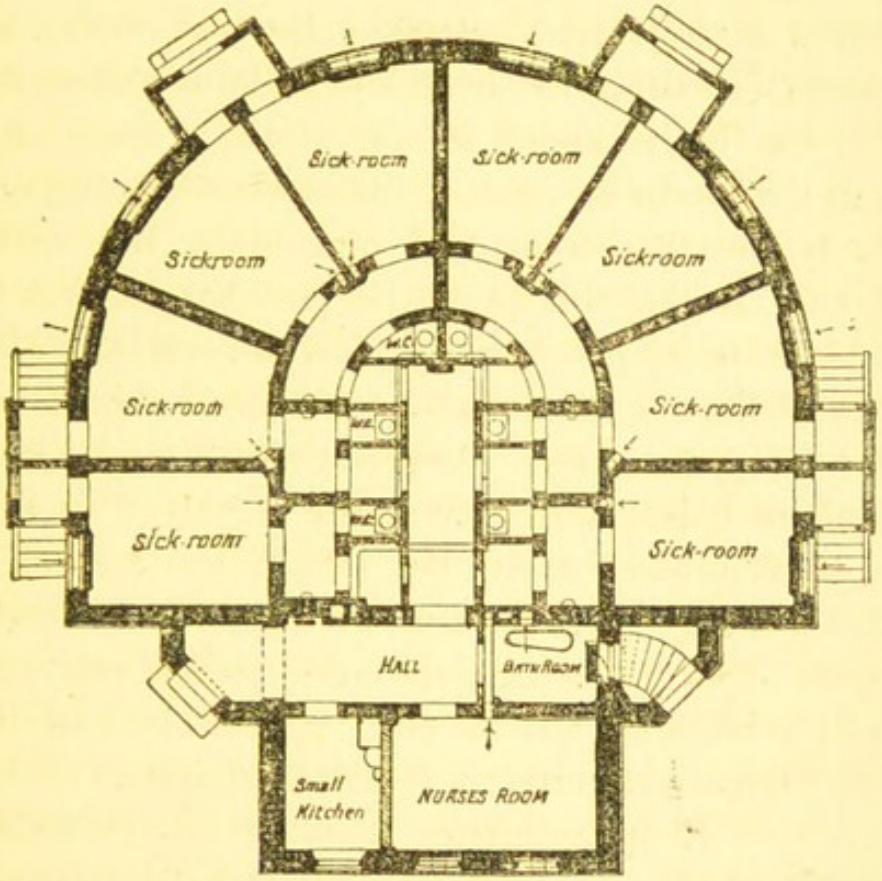


FIG. 23.—Observation Pavilion.

ment of surgical cases is minutely carried out. The operating theatre of the new Serafimer Hospital leaves nothing to be desired in this respect, all the latest improvements for obtaining sterilization of instruments, dressings, and water, being on the spot.

Disinfection. The station for disinfection is situated in the southern part of the city, and has existed since 1885. As in Christiania, but on a more luxurious scale, there is accommodation for the members of the household

during the time required for the disinfection of the house. There are two large disinfecting ovens, where steam at a temperature of 100° C. and under a pressure of 10 lbs. comes into contact with the goods for half an hour. Of course the *personnel* on the infected and disinfected sides is quite distinct. Disinfection after deaths from phthisis is becoming more and more common. In the dwellings sulphur fumigation is never used. Washing the walls with corrosive sublimate (1 in 1000) has been and is done, although, since mercury has been traced in the urine of some of those living in the rooms so treated, the method is being replaced by the tedious Berlin method of rubbing the walls with bread, and washing them and the furniture afterwards with a 5 per cent. or $2\frac{1}{2}$ per cent. solution of carbolic acid. This question of the use of corrosive sublimate in house disinfection is an important one. Any one who has seen it used in Paris, where it is almost universally employed in the form of a *pulvérisateur*, must be struck by the ease and simplicity of the method, and no bad effects have been attributed to it there. A quarantine station exists on one of the little islands below the city. Stockholm both in 1892 and 1893 remained perfectly free from cholera.

Meat Inspection.

It is surprising that the city is without an abattoir and carefully controlled system of meat inspection. It is not that these are deemed unnecessary, as it is estimated that 50 per cent. of the cattle are more or less affected with tubercle. Trichinosis and anthrax, too, are not infrequently met with in Sweden, but as uncooked ham is never eaten, the danger from the former is not so great as in Germany. At present private slaughter-houses exist and the meat inspection is under the charge of two veterinary surgeons, twelve inspectors, and ten microscopists who examine the pig's flesh as to the existence of trichinosis. The inspectors go round the shops and mar-

kets and carry to the inspection station any meat they think is suspicious. In 1892 the seizures of beef amounted to 234 pieces, of which 45 were for tubercle; of pork and ham 422, of which 111 were for tubercle, and 91 for trichinosis; of veal 507; of mutton 88; and of horseflesh 50. It is fully expected that in a year or two the city will proceed to the building of an abattoir, and a detailed scheme for this has been drawn up. The estimated cost is £100,000.

Animal Vaccine Station. In connection with the meat inspection station is that for the preparation of animal vaccine (the only one in Sweden), under the direction of the two veterinary surgeons. Very young calves are used, as they are only rarely affected with tubercle; but some difficulty is experienced from their great liability to diarrhœa, and the derangement of general nutrition consequent thereon. On the sixth day the vaccine is taken and intimately mixed with an equal weight of glycerine and water by being passed three times between glass rollers. It is then distributed in the usual way on glass slides and in little tubes, which are finally sealed by having the ends dipped in a mixture of wax and paraffin. Strict attention to cleanliness is observed, and before any of the lymph is used the calf is always killed and examined to see that it is quite free from disease. In 1892 93 per cent. of the vaccinations in Stockholm were made with animal vaccine.

School Buildings. It is well known how high education stands in both Norway and Sweden, and how much other countries have yet to learn from them, especially in the system known as *slöjd*, or practice in the use of tools. The national schools in Stockholm are built in a style which shows how fully the authorities have realized the requirements of hygiene as regards them. So palatial are some of them that one might almost be pardoned for harbouring the suspicion that the authorities had been a little too lavish

in their expenditure on them. Some of the schools have baths for the children in the basement, and all have a large gymnasium attached, where carefully planned exercises, after the method invented by Dr. Ling, are gone through, exercises designed not only to develop the muscles generally, but also to correct any tendency to spinal curvature or flat-foot. The accompanying plan shows the arrangements in one of the new schools for 1,300 scholars. It will be seen that all the classrooms open directly, on one side only, out of a well-lighted, spacious corridor.

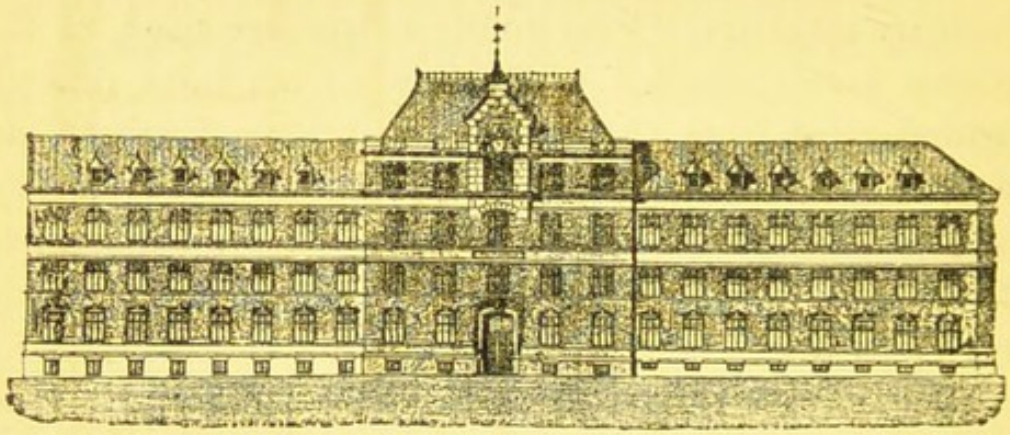


FIG. 24.—The Kungsholm School.

Foundling Hospital.

An institution which finds its nearest analogue in London in the Foundling Hospital exists in Stockholm, under the charge of Professor Medin, for the temporary housing of infants (chiefly those that are either illegitimate or have been abandoned by the parents), prior to their being drafted off when four months old to foster homes in the country. The foster-parents bring up the children until they are fourteen years old, receiving in return a definite payment from the institution, which thereby maintains a supervision over them. The nursing of the infants while in the Barnhus, as it is called, is principally done by wet-nurses. The services of these are secured for eight months by the institution guaranteeing to look after

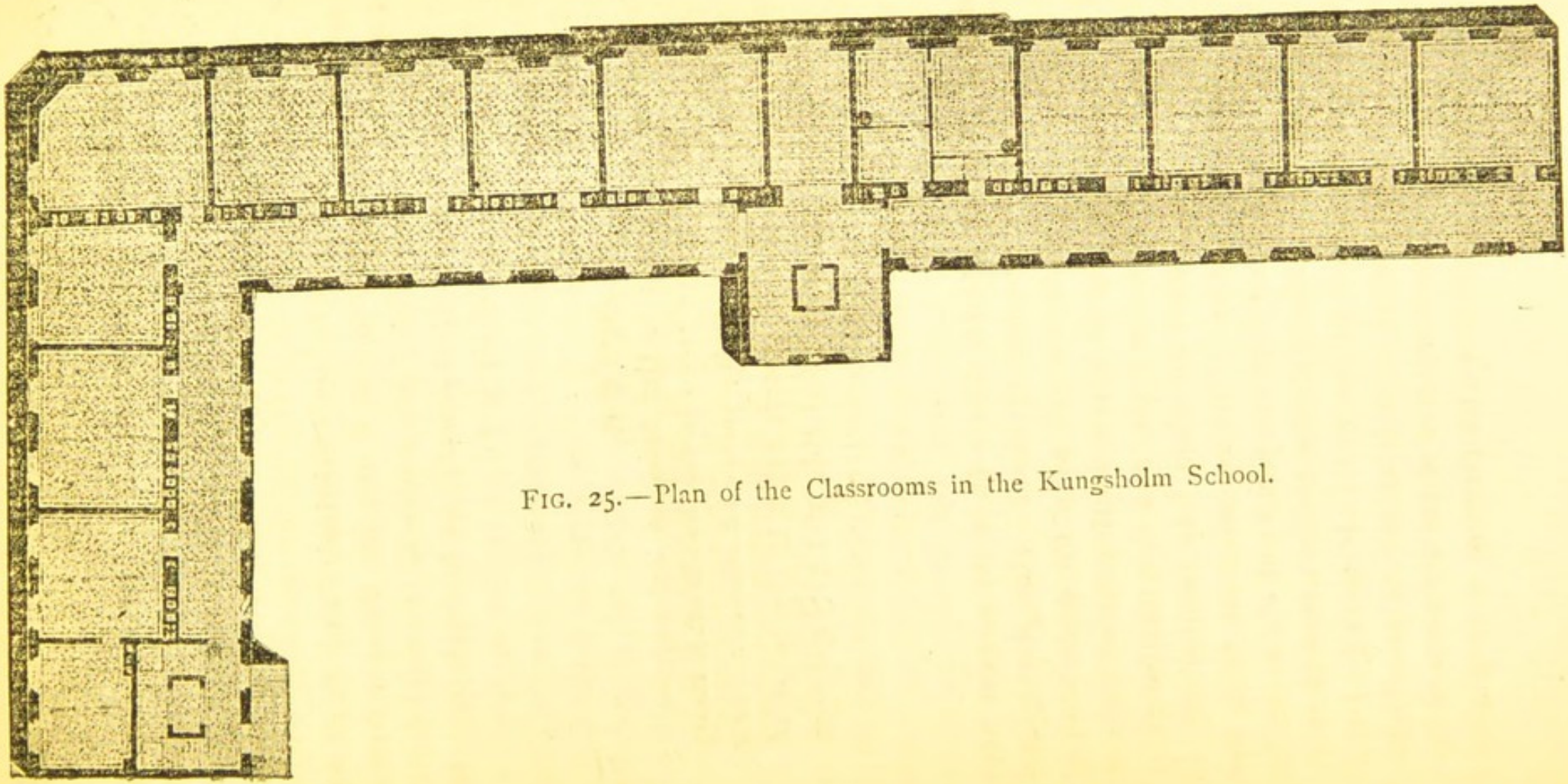


FIG. 25.—Plan of the Classrooms in the Kungsholm School.

the infant of the wet-nurse until it is fourteen years old, just as is done in the case of the others. The institution is one of the most interesting in Stockholm, and the general arrangements of the buildings are about as good as they could be.

Control of the Liquor Traffic.

No article on Christiania and Stockholm would be complete without some reference, however slight, to the systems in vogue for the control of the liquor traffic—namely, the Gothenburg system in Sweden and that known as Local Option in Norway—which have been brought very prominently before the public in this country recently owing to the proposals of the Bishop of Chester as to licensing reform. Both aim at reducing the number of licenses to the needs of the population by placing the monopoly of them in the hands of a company, which must devote all profits, over and above 5 per cent. interest on the capital invested, either to the relief of the rates, as in Sweden, or to charitable and philanthropic institutions dependent upon voluntary contributions, as in Norway. As far as impressions are worth anything, it must be admitted that both Christiania and Stockholm appear models of propriety as compared with many seaport towns in Great Britain, France, and Holland. That drunkenness has been abolished no one would admit for a moment, but that it has been diminished is proved by statistics as to the consumption of alcohol per head, and the number of admissions into hospital for alcoholism. In Gothenburg, for instance, the consumption of spirits has diminished from 28·9 litres per head in 1876 to 16·05 litres in 1889. During the same time the cases of delirium tremens treated in the hospitals had decreased 50 per cent. It used to be the custom in Stockholm to give every case of fracture admitted into the hospitals the stock mixture of bromide and chloral, but now only rarely has it to be given as a prophylactic

against delirium tremens in such cases. Dr. Linroth, in the work referred to before, has tabulated the deaths from 1871–90 attributed to alcoholism, calling attention, however, to the difficulty there is in getting true returns as to this as a cause of death. He gives the following table :—

	Death rate	Taking Death rate from 1871–75=100.
1871–75	0·39 per 1,000	100
1876–80	0·15 ,,	40
1881–85	0·14 ,,	35
1886–90	0·12 ,,	30

It would be unfair, however, to attribute the diminution entirely to the systems, as the national sense that has been aroused as to the evils of the drink traffic must in itself have done much towards lessening the consumption.

CHAPTER XI

COPENHAGEN

Overcrowding in Older Parts of the City—Workmen's Dwellings—Meat Inspection at the Abattoir—Water Supply—Drainage—Objections to Existing Arrangements—Notification and Isolation of Infectious Disease—Vital Statistics.

THE situation of Copenhagen on the island of Zealand, between the Baltic and the Cattegat, makes it one of the most important business centres in Northern Europe. About one-sixth of the whole population of Denmark is to be found concentrated in the capital. The central part of the city illustrates well the great difficulties that many Continental towns have to contend with in attempting to carry out the principles of hygiene. Hemmed in on one side by fortifications, and on the other by the sea, living space has had to be obtained by increased height of the buildings, narrowing of the streets, and utilisation of the cellars as dwellings. Only since the razing of the fortifications in 1872 has the natural expansion of the city into the surrounding country been allowed to take place. About 4·5 per cent. of the population inhabit cellar dwellings, and it is to be feared that a considerable amount of overcrowding exists in the older parts of the town, as in 1885 there were at least 800 one- and two-roomed houses containing more than double the average number (4·2) of persons to a household. However, more has been done in the way of erecting working-men's dwellings in Copenhagen than in any other Continental capital that I know, and it is interesting to note that the lines on which they have worked here are to build these dwellings on the cottage, and not on the barrack,

General Considerations.

Working-men's Dwellings.

system. Some of these form regular little colonies, as the Classen dwellings, with their church, day home for 120 children, steam laundry, etc. Other dwellings that I visited, built by the Medical Association, consisted of picturesque rows of cottages, each containing three rooms and a small kitchen, for which a rent of about 4*s*. a week was paid. One can walk through street after street of artisans' cottages that have been built by a society entirely controlled and managed by working-men. An interesting feature about them is, that the cottage can become the absolute property (subject to certain reservations) of the member of the association who is lucky enough to make a successful draw in the lottery that occasionally takes place for them. More than a thousand houses have been built by this society.

Meat Inspection.

The point that is, perhaps, most interesting in the sanitary administration of Copenhagen is the meat inspection, and certainly it is one about which we have almost everything yet to learn in this country. Meat inspection cannot be properly carried out except where there is a general abattoir, and only in the best manner possible when the abattoir is associated with the cattle market. These two, abattoir and cattle market, adjoin one another in Copenhagen. Slaughter of animals can take place nowhere else in the city, and here, too, it must be examined by specially trained veterinary surgeons. Carcases of animals, especially of pigs already slaughtered, may be brought from the country, but before they can come on the open market they must receive the official stamp of the inspector. The abattoir is situated close to the railway and harbour, and covers an area of five acres. Though opened in 1883, five years were allowed to elapse before the control was introduced. The market is partly covered and partly in the open. The ground everywhere is paved with granite blocks set in cement. The rooms in which the

slaughtering is done vary considerably in size. Some—those first built—are on the cell system, that is, small separate rooms, with accommodation for about six oxen; while the more recently built ones are large spacious halls that permit of as many as 120 animals being slaughtered at the same time. They are lofty and well lighted, the tiled or granite floor slopes to a central channel, the walls are of cement, and the pillars and beams used for suspending the carcases are of iron. A plentiful supply of water (an absolute necessity in a well-managed abattoir) is everywhere present. In none of the buildings could any unpleasant smell be detected. Before being slaughtered the oxen are stunned with a poleaxe. After slaughter all the organs must be retained until the veterinary surgeon has made his rounds. The animals are first inspected by a veterinary surgeon as they stand in the market, and any animal detected with contagious disease is marched off to a quarantine stall, and slaughtered in a special room.

The inspection of the carcases differs slightly from that in vogue in Paris, Brussels, and Berlin, but will serve very well as an example of how this characteristic feature in Continental hygiene is carried out. The veterinary surgeon, accompanied by the meat-marker, first cuts into the glands of the neck, examines the pleura and peritoneum to see if there are any signs of inflammation, and if he finds nothing amiss, does not examine the glands further. The meat is then stamped, in the case of large animals, in twelve different places. Should the glands in the neck, however, be found to be enlarged or suppurating, he undertakes a thorough examination of the submaxillary, axillary, bronchial, mesenteric, inguinal, and lumbar glands, rapidly cutting into them to see their condition. The muscles at the base of the tongue are always cut into to see if cysticerci are present. The lungs, liver, kidneys, and spleen are

carefully handled and incised. Tubercle when generalized is a sufficient cause for seizure, but not when localised in one or two places. In the latter case the diseased portions only are removed. When in doubt as to the dissemination of tubercle the vertebræ are sometimes sawn through the middle, and if found to be affected with it the carcase is condemned. A less minute examination is made of calves and sheep. Here the pleural and peritoneal cavities are inspected, and the lungs (not removed from the body) are incised *in situ*. The inspection is more careful when the animal has been slaughtered outside Copenhagen, and as the organs have been removed, it is attended with greater difficulties. Meat that is satisfactory is marked in blue. A black stamp, used liberally in the case of imported meat, is employed to mark carcases which, although not condemned absolutely, have had some exception taken to them. Such meat is regarded as of second-class quality, and is sold at a proportionate reduction.

The staff consists of a superintendent and twelve assistant veterinary surgeons. A private company converts the blood, by admixture with peat and sulphuric acid and drying in ovens, into a very valuable manure. The condemned meat is conveyed to a destructor, where, after the fat has been extracted, it is destroyed. No bone-boiling or gut-scraping is done at the abattoir. Some of the sausage manufactories in the neighbourhood are visited regularly, and the meat inspected by veterinary surgeons.

Water Supply. The water supply is derived chiefly from artesian and deep wells, and to a less extent from two small lakes, Sönder and Damhus. For nine months in the year (April to December) no exception can be taken to the supply, as then it consists almost entirely of the deep-well water, which is perfectly clear, pleasant to the taste, and practically germ free. During the remain-

ing three months, however, on economical grounds and owing to the difficulties placed by the frost in the way of utilising the well water, recourse is had almost exclusively to the lake water, which is not entirely above suspicion. One of the lakes, that of Damhus, is but three miles from Copenhagen, and the fields bordering on it are partly manured with night soil. Extensive experimental borings have been made in the country round about, with the result that various water-bearing strata have been discovered, so that it is hoped before long the city will be able to dispense altogether with the supply from the lakes, and rely entirely on the deep-well water. There is a little iron in the water, and to oxidise this the channels conveying it are for some distance uncovered. When it reaches the city the water passes on to nine sand filter beds, which have a total area of nearly three acres; and having gone through these, it is pumped into the mains. Pumping is continuous day and night, the surplus going into a covered storage reservoir in the Sönder Park. All the supply pipes are of iron, and the average daily consumption is not seven gallons a head.

Careful bacteriological examinations have been made weekly for a number of years by Dr. H. A. Nielsen. The following table, taken from the medical officer of health's report for 1892, gives the results of the analysis of the water before and after filtration for that year:—

	Filtered.	Un-filtered.	Supply pipes.
Less than 50 colonies per c.c.	40	1	33
,, ,, 100 ,, ,,	7	10	7
,, ,, 500 ,, ,,	2	27	10
,, ,, 1,000 ,, ,,	—	6	—
,, ,, 2,000 ,, ,,	—	4	—
,, ,, 5,000 ,, ,,	—	1	—
	—	—	—
Total	49	49	50

Since the waterworks have been established typhoid fever has diminished greatly, and no epidemic has ever been connected with the public water supply.

Drainage.

The sewage question is a burning one just now in Copenhagen, and is likely to remain so for some time to come. The construction of the sewers is very good. They have been laid with care after a definite system, so that their fall shall be sufficient to enable them to be self-cleansing, and they are sufficiently large to carry off the rain water, as well as that from the houses. They almost all, however, discharge into the harbour. Here the condition of things is not what it should be. Indeed, sometimes, arriving by water at the landing-stage, one is made painfully conscious of the most frightful stench from the mud churned up by the steamer's propeller. More than ten years ago Dr. Tryde, the present medical officer of health, pointed to the growing pollution to which the harbour was subjected, and suggested the construction of intercepting sewers. A definite scheme is now under consideration by a committee of the town council for constructing intercepting sewers on either side of the harbour, carrying the one by a syphon arrangement under this, and uniting them both at a pumping station. From here the sewage would be pumped well out to sea, where there could be no danger of its being carried back by currents into the harbour. When this has been done the water closet system could with advantage be introduced into the city.

The scheme is a big one, and must take some years for its completion if adopted, and meanwhile something must be done to improve the existing tub system. At present all the evils so noticeable in Christiania are apparent, the removal of the tubs being contracted for by private companies, and not being undertaken by the sanitary authority. Here, however, the companies have fallen upon evil days,

since the conditions imposed on them of removing the matter by railway have increased their expenses, and they refuse any longer to undertake it at the present rate. It is to be hoped, therefore (there can be no question about its being desirable), that the sanitary authority will order the substitution of steel pails for the wooden ones, and provide that they be removed at least every ten days.

Notification and Isolation of Infectious Diseases.

Compulsory notification and isolation of infectious diseases are carried out as well and as carefully in Copenhagen as they are in Stockholm and in Christiania. The city is provided with two isolation hospitals. Öresund's, which abuts directly on to the harbour, may be regarded as the quarantine hospital for the cases of cholera and small-pox, which are nearly always imported by ships, are brought here. There are about 100 beds, which number, however, can be considerably increased by the erection of temporary pavilions on the unoccupied land hard by; and, indeed, owing to the very widespread epidemic of scarlet fever at the time of my visit, much of the ground was so occupied with Döcker tents. These consist of canvas stretched on wooden frames, which can be rapidly joined together, the ground being covered with some impervious material. They are much used now in Denmark and Germany, and look very ship-shape. A new cholera and small-pox pavilion, built here in 1892, though small, having only some sixteen beds, is very completely up to date in its arrangement.

The city has reason to be proud of the Blegdam's Hospital. Built between 1876 and 1883, it was originally intended for cases of small-pox, cholera, and typhus fever, and for the other zymotic diseases only during the time of their appearance as epidemics. Gradually, however, it has become an isolation hospital in the strict sense of the term

for scarlet fever and diphtheria. There are nine pavilions, eight of which are one-storeyed, and one two-storeyed, besides the administrative block, kitchen, laundry, bath-room, disinfecting station, etc. The buildings are solidly constructed, and the arrangements as to ventilation and heating, especially in the new two-storeyed pavilion, are carefully worked out. When I visited it a good deal of the spare ground was covered by temporary Döcker tents for the accommodation of the numerous scarlet fever cases, and a considerable amount of overcrowding prevailed in the wards; some designed to hold twelve beds having nearly double this number in them. An interesting feature in the hospital is what is known as the observation ward. Here there are a number of small rooms with one, or at most two, beds in each, in which the walls are of glazed tiles, and the floor of cement, set aside for the reception of tracheotomy cases only. Another pavilion, containing six baths, is intended not only for the use of the discharged patients before their actual departure from the hospital, but also for persons who are notified by any medical man in the town as being, in his opinion, likely to be the better for a disinfecting bath. The disinfecting station for the city, under the control of a foreman and seven assistants, is attached to the hospital. Here there are two Géneste and Herscher steam disinfecting machines.

Reck's Disinfecting Machine.

A word may be said of a steam disinfector that is widely used in the smaller towns of Denmark made by A. B. Reck, of Copenhagen. Over 200 of them are in use in Denmark, Scandinavia, and elsewhere. No doubt the great expense of a steam disinfector hitherto in England accounts very largely for the lamentable fact that it is the rarest thing in the world to meet with one in the rural districts. It is undoubtedly owing to the Reck disinfecting machine that disinfection is

more efficiently carried out in Denmark than in any other country. The apparatus is made of various sizes and shapes, but the one most commonly used has a length of seven feet, the height and width being three feet. The price of this with boiler and fittings complete is £68. The principle of the apparatus is steam under a pressure of about 1½ lbs. to the square inch, which remains in contact with the goods for thirty minutes. The wetting of the articles to be disinfected is prevented, or at any rate lessened, by a cold stream of water, which passes by special arrangements into the interior and rapidly condenses the steam. No very skilled attendance is required for managing it. The apparatus has been tested in this country (Captain Reck being desirous of introducing his patent into England), and it proved itself to be thoroughly efficient.[1]

Vital Statistics, etc.

The population of Copenhagen proper at the last census, in February, 1890, was 312,859, and including the suburbs 375,251. The former number must be now nearer 350,000, and the latter over 400,000. The birth rate in 1892 was 30·1 and the death rate 20 per 1,000. The infant mortality amounted to 187 per 1,000. The death rate from the seven principal zymotic diseases was 3·0 and that from phthisis 1·9 per 1,000. Typhoid fever caused 22 deaths in the same year, corresponding to a ratio of 0·07 per 1,000. No deaths were due to cholera asiatica, and only two or three suspicious cases of illness presenting symptoms resembling this disease were notified, which did not terminate fatally.

Diphtheria has shown the same tendency to increase of late years in Copenhagen that it has elsewhere. Dr. Tryde has given the attack rate per 1,000 in his 1892 report as follows :—

[1] G. Reid, *Public Health*, 1895, vol. vii., p. 148.

1. Administration block.
2. Kitchen.
3. Wash-house.
4. Old pavilions.
5. New pavilions.
6. Nurses' quarters.
7. Bath-rooms.
8. Disinfecting station.
9. Boiler-room.
10. Staff disinfecting-room.
11. Mortuary.
12. Store room.
13. Sheds.
14. Stables.

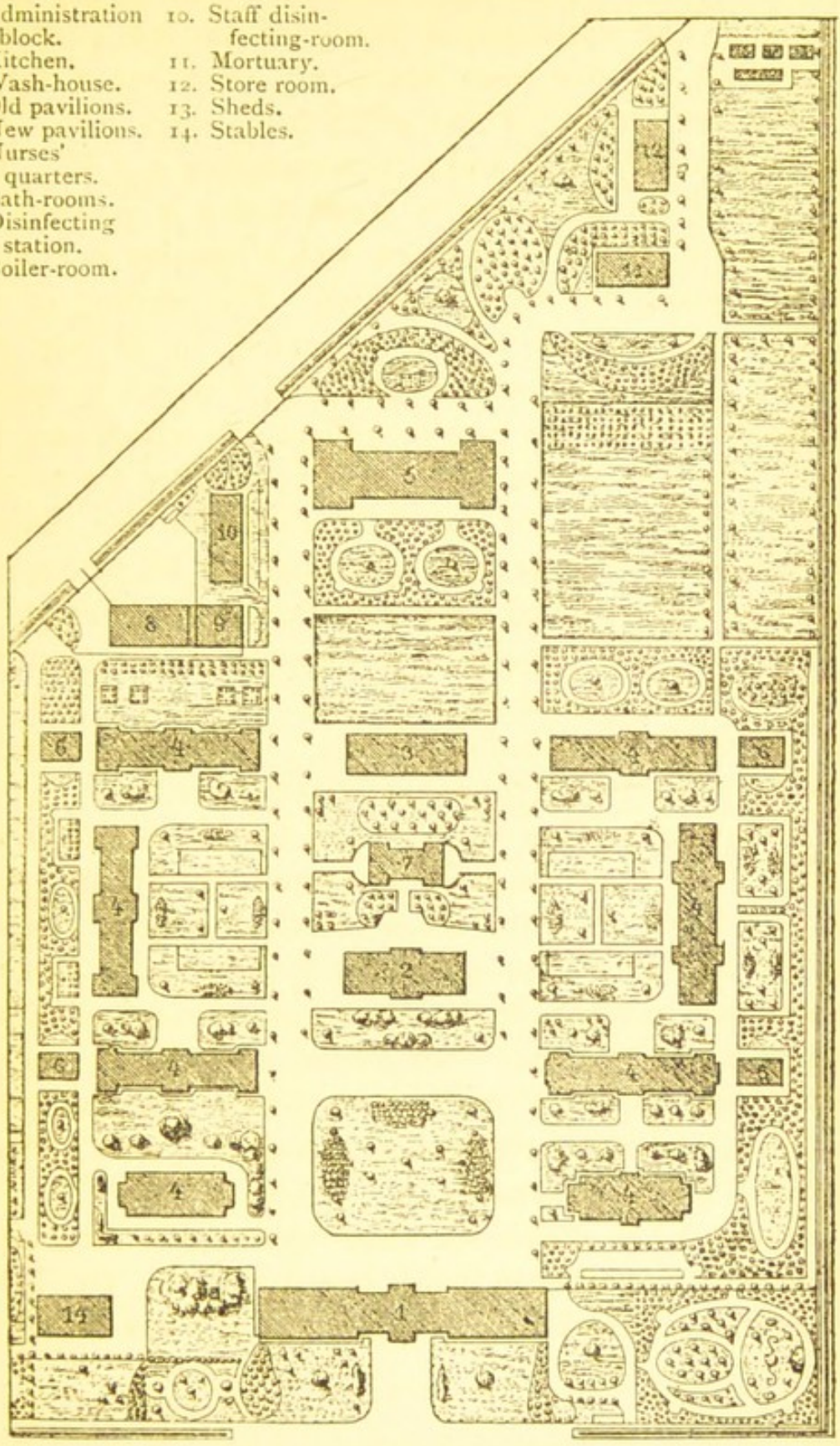


FIG. 26.—Plan of Blegdam's Hospital.

1885.	1886.	1887.	1888.	1889.	1890.	1891.	1892.
3·5	6·3	8·3	9·8	11·2	13·9	12 6	10·9

One of the duties that takes up a good deal of the time of the district medical officers of health in Copenhagen is the supervision they have to exercise over the children that are put out to nurse by their parents. No person is allowed to receive such children without a certificate from the Health Office, which is only granted after a careful examination of the nurse's home, and may be at any time withdrawn. Pauper children are boarded out whenever possible in homes in the country, where they are well looked after and fed, the foster parents receiving payment according to a prescribed scale.

In conclusion, reference should be made to the very valuable work prepared for the International Health Congress held in London in 1890, and published by the Danish Government, entitled *Denmark: its Medical Organization, Hygiene, and Demography.* As its name implies, this will be found a mine of information as to various public health questions in Denmark.

CHAPTER XII

MILK CONTROL IN COPENHAGEN, STOCKHOLM, ETC.

Diseases Communicable by Milk—Danger of the Milk from Tuberculous Cows—Veterinary Control of the Farms of the Copenhagen Milk Supply Association—The Filtration of Milk—Controlled and Uncontrolled Milk at Stockholm—Similar Arrangements in Berlin—Tuberculin as a means of Diagnosis—Action of the Danish Government.

MEDICAL officers of health are in the habit of distributing in their districts during the summer months circulars as to the best means of preventing infantile diarrhœa, laying especial stress on the boiling of milk. It may be of interest to describe what is being done in Copenhagen and Stockholm in the matter of providing a pure milk supply; for, unfortunately, it cannot be denied that the boiling of milk does not improve its flavour, and consequently the step is more often honoured in the breach than in the observance. The subject is the more interesting just now as recently a good deal has been written in the medical journals about the dangers to which milk is exposed by the way in which it is ordinarily sold in this country; and one of them has stated that the only way out of the dangers of the retail milk trade at present practicable lies in the distribution of milk in sealed bottles.[1]

Diseases which may be spread by Milk.

Since outbreaks of scarlet fever, diphtheria, and enteric fever, have in numerous instances been traced to infected milk, something has been done by legislation to safeguard milk from contamina-

[1] *British Medical Journal*, 1895, vol. i., p. 772.

tion, notably by the Dairies, Cowsheds, and Milkshops Order of 1885, with its section prohibiting a person suffering from any dangerous infectious disease, or who has been recently in contact with a person so suffering, from participating in the production, distribution, or storage of milk. But still, there is every reason to doubt whether in country districts, beyond the mere fact of being registered, the cowkeeper is much affected by the Order or at all realizes its importance. An additional source of danger must be attributed to milk, since it has become agreed that human and bovine tuberculosis are the samed isease, and few educated persons would not now be prepared to admit the extreme probability of tubercle being caused in the human subject by the consumption of cow's milk containing tubercle bacilli. Certainly numerous experiments have absolutely proved that calves may be infected when fed on such milk, and the large number of cases of tabes mesenterica occurring in children is not without considerable significance in this respect. One of the experts, Dr. Martin, appointed by the Royal Commission on Tuberculous Meat to inquire into this point, succeeded in producing tuberculosis in all of the fifteen test animals fed with the milk from three cows with tuberculous disease of the udder, and he writes that the virulence of such milk can only be described as extraordinary. Paragraph 63 of the report runs thus:—"The withdrawal from dairies of every cow that had any disease whatever of her udder would form some approach to security against the serious danger incurred by man from the use of tuberculous milk, but it would not be an adequate security. The presence in a dairy of a tuberculous cow, as Drs. Martin and Woodhead have shown, is a decided source of danger to the public, especially having regard to what we have learnt respecting the rapid development of tuberculosis in the udder and the

degree of danger to milk-consumers incurred by the invasion of the udder in tuberculous cows." One is therefore justified in saying that the milk from cows with tubercle of the udder is positively dangerous, and the supply of such milk should be regarded as little short of criminal. Fortunately, however, this condition is not very commonly met with, as it is usually secondary to tuberculous deposits elsewhere, and only appears late in the disease. Professor Bang, of Copenhagen, who has made the subject of bovine tuberculosis peculiarly his own, states that the udder was affected in but 1 per cent. of the cattle slaughtered in the abattoir there. The question then is, "How far can the milk of tuberculous cows be regarded as safe when the above serious condition is not found?" Professor Bang maintains that it must be considered suspicious, although in the great majority of cases it is doubtless consumed with impunity. This opinion he bases on his own experiments, and those of many other investigators, which were made by introducing milk from such animals into the peritoneal cavity of others prone to tubercle. Thus of forty guinea pigs inoculated with the milk from twenty-one tuberculous cows four became affected. Experiments in regard to this seem to show that it is a question of degree—the more tuberculous the cattle the more virulent its properties for infection, and *vice versâ*. It becomes, therefore, a matter of serious importance to try to exclude as far as possible the milk from animals affected with tubercle, and this is what is aimed at, amongst other things, both in Copenhagen and Stockholm. In both cases the problem of a pure milk supply resolves itself into a question of minute attention to detail; but the details are so important and carefully worked out that they deserve to be widely known. It should at the outset be stated that the description which follows does not by any means apply to the whole of the milk supply in the two towns, but only

to that of two large companies, the one in Copenhagen, the other in Stockholm. As there are certain marked differences in the methods adopted in each case, it may be well to deal with them separately.

Copenhagen.

Milk Supply Association of Copenhagen.

The guarantees that the Copenhagen Milk Supply Association give of the purity of their milk are: (1) veterinary control of all the cows on the farms and exclusion of the milk from suspected animals; (2) cooling of the milk by ice to 41° F., or lower, at the farms and at the company's depôt; (3) filtration of the whole of the milk through fine gravel; and (4) absolute cleanliness of all the bottles and cans used, and the fact that they are delivered under the security of the company's seal.

Veterinary Control at the Farms.

The company has in its service seven veterinary surgeons, one of whom devotes the whole of his time to the work of visiting the farms in rotation. Permission was kindly given me to accompany him and see the *modus operandi*. One of the conditions is that all cows in summer must be fed in the open fields on grass and clover. Stall feeding, except in winter, is strictly prohibited. In Denmark the custom is universal to tether the cattle out at short distances from one another, so that every inch of ground is covered, and the farmer can estimate almost exactly how much grass has been eaten. It can be readily understood that where 200 cattle are together it would be well-nigh impossible to examine them all minutely on one day; consequently, the veterinary surgeon examines each cow at every visit only as regards the condition of the udder, auscultating one-half of the animals at his first visit and the other half at the second. Each farm is visited twice a month. The points noticed as to the udder are: its

consistency, whether there are any signs of inflammation or induration about it, and whether nodules exist in its substance. The glands in its neighbourhood are also felt. Attention is then directed to the skin, which should in a healthy animal be soft and freely movable. The glands, especially those in the axilla and inguinal region, are carefully felt, as they often give valuable information as to the existence of tubercle. The submaxillary glands, the superficial glands of the neck, and those at the angle of the jaw are examined, but their enlargement is an accompaniment of so many morbid processes that not so much reliance can be placed on their condition as a means of detecting tubercle. Last year, among the 5,000 or 6,000 cows supplying milk to the company, 122 were found to be tuberculous, but only in two of these was the udder affected. If the veterinary surgeon detects a tuberculous cow it must be at once separated from the others and got rid of as soon as possible. Or, again, if he thinks that the health of a cow is so bad that the milk may be prejudicially affected thereby, he may order the withdrawal of the milk for a certain time. The farmer is bound to report any case of illness occurring between the veterinary surgeon's visits, and to withhold the milk until he arrives. Infectious disease occurring amongst the employés must at once be reported to the company, and the milk kept back. Other conditions which are set down in the agreement between the farmer and the company have reference to the storage of milk and the feeding of the animals. The greatest cleanliness must be observed in the milking, and, as has been stated, the milk must at once be cooled to 41° F. by ice, having been first strained through a sieve covered by a clean woollen cloth. The food in winter consists chiefly of rape-seed oilcake, hay and straw; anything likely to give the milk an unpleasant taste, such as turnips, etc., is absolutely forbidden. It might very

naturally be asked, How have the farmers been brought to acquiesce in these strict conditions, entailing both extra trouble and expense, imposed on them by the company? The answer is simply that it has been done by an appeal to their pockets, the company agreeing to pay them a better price than they could get from any other buyer. Even the milk that is withheld, owing to the temporary sickness of an animal or employé, is paid for at the full price, just as though it were used.

Treatment of the Milk at the Depôt.

The company's premises are close to the railway, so that very little time is lost in transit. When the whole of the milk for the day has arrived, the milk from every can is tested, and a sample from every farm is taken for analysis. The milk is then filtered, the arrangements for which are, I think, unique. A reference to the diagram, which I am permitted to reproduce here by the kindness of the publishers of an article entitled "Milk Supply in Copenhagen," by Mr. A. Stewart MacGregor, British Vice-Consul, will enable the principle to be readily grasped. The filtering material is fine gravel placed in perforated tin trays. The gravel in the lowest tray is about the size of a split pea, and in the highest that of a pin's head. The milk is poured in at *A* (see p. 189), and passes by a process of upward filtration into the receiver, *C*. The amount and nature of the filth that are kept back by the gravel have to be seen to be believed, and this, too, notwithstanding the precautions taken in milking. The perforated tube that is seen in the receiver, *C*, and is to be found also in the cans, allows of the milk being drawn from all depths; so that as nearly as possible a uniform quality is maintained from first to last. From the tube *m* the cans and litre bottles are filled. They are then placed in trays containing ice until required for distribution. About 3,000 litre bottles are filled every evening, and the milk in them is guaranteed

to keep fresh for twenty-four hours. Every can and bottle is most scrupulously cleansed before being used. For cleansing the cans a little soda is introduced, and a strong jet of steam is made to play upon the interior. Nor is the size of the cans so great that the bottom cannot be easily

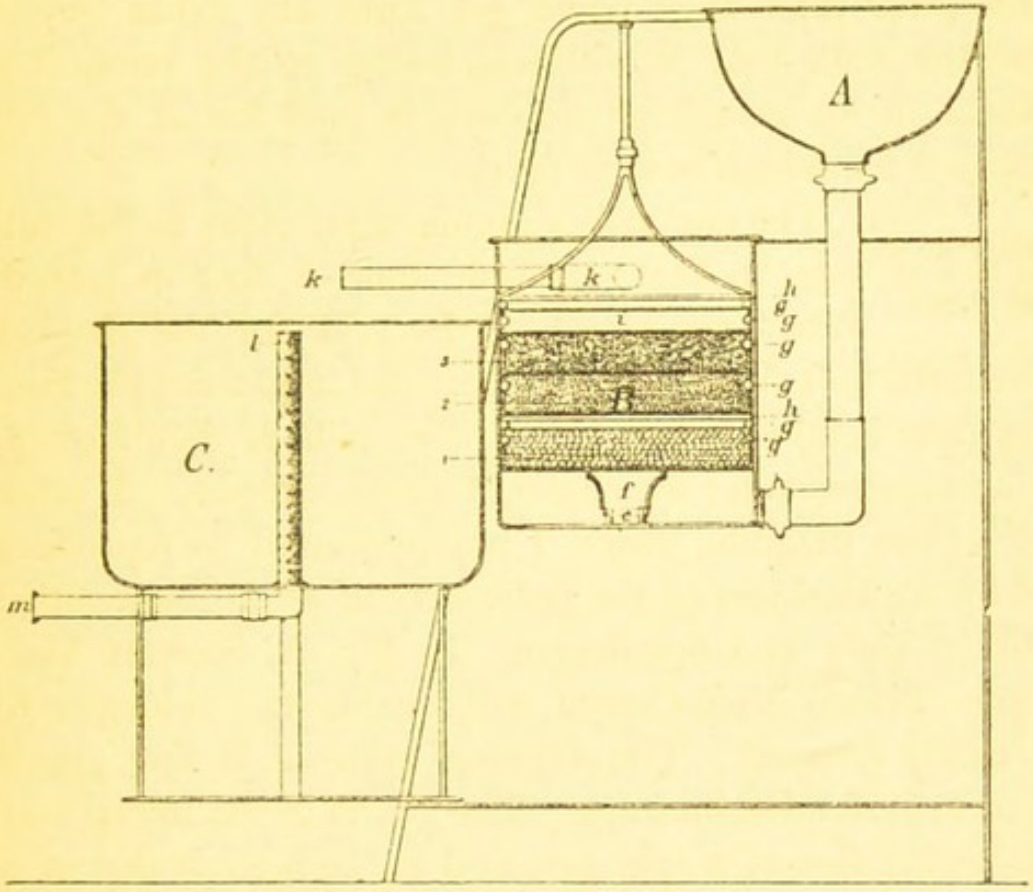


FIG. 27.—Filtering Apparatus.

A, receiving tank; *B*, filter; *C*, storage or mixing tank; *e*, indiarubber ring to preserve enamel against *f*, iron footpiece or base; 1, 2, 3, perforated metal trays to hold the gravel, of which No. 1 is the coarsest; *g*, *g*, *g*, india-rubber rings to protect enamel; *h*, *h*, *h*, galvanized rings; *i*, five| ply of filter-cloth of close texture, surmounted by one ply of very fine texture; *k*, *k*, pipes which lead off milk, as it rises in filter tank, into storage tank; *l*, perforated tube so constructed as to draw milk from every part of the tank, and so equalise the quality; *m*, pipe leading through partition to bottling room.

reached by the hand and well scrubbed. The bottles are cleansed by a soda solution and the insertion of a brush turned by machinery, being washed out afterwards with sterilized water. When empty all bottles and cans are placed on racks bottom upwards, so that air can not only circulate round them, but under them as well.

Children's and "Pasteurized" Milk.

In order not to complicate the description, reference has only been made to milk, but the company, as might be expected, does a large business in cream also, which is treated in just the same way, even to the filtering. The cream, however, is never got by the use of a "separator," as it is rightly contended that ordinary skimmed milk, containing as it does about 1 per cent. of fat and all the albuminoids and lactose, is still a most valuable food. Nor has reference been made to a great feature of the company's work—namely, the production of what is called "children's milk." Only the milk from the best and healthiest cows is used for this, and special regulations exist as to their food in winter. A great impetus, too, has recently been given to the preparation of "Pasteurized milk." Bottles of the milk to be sterilized are placed in frames in a trough of water. A coil of steam pipes heats this to a temperature of 75° C., when a contact thermometer rings a bell, which gives the signal for shutting off the steam. When the water has cooled down to 60° C. the bottles of milk are taken out and placed in ice. It is guaranteed to keep for forty-eight hours. For the sake of infants that must be bottle-fed sterilized milk variously diluted is prepared. A Chamberland filter supplies the water, and the bottles, with the degrees of dilution labelled on them, are sold in cruets containing just such a number as is sufficient for one day. The feeding nipple fits on to the neck of the bottle, so that there is no length of india-rubber tubing to become foul.

Financial Results.

Analyses of the milk are made not only at the company's depôt, but also under the direction of Professor Bohr, who publishes monthly the results of the daily analyses. All the milk that remains unsold is used for making butter. The sale takes place in general directly from the company's carts in the streets. The price paid for

the milk is as follows: children's milk, 1*s.* per gallon; sweet milk, 10*d.* per gallon; half-skimmed milk, 5*d.* per gallon; No. 1 cream, 5*s.* per gallon; No. 2 cream, 3*s.* per gallon. What has been described sounds, perhaps, rather utopian, but nevertheless the company is on a firm financial basis and pays its dividend of 5 per cent. on the capital invested. More than this it is not allowed to pay, as, when the company was started in 1878, express provision was made that anything over and above the 5 per cent. interest should be devoted to lowering the price of the milk, and to improving the general arrangements. Its origin and success are almost entirely due to Mr. Busck, founder of the Scandinavian Preserved Butter Company, who has brought the various points in general management and mechanical contrivance to the highest perfection. It is interesting to know that he would not undertake the task without first receiving an assurance of support on the part of the medical profession generally.

Stockholm.

Controlled and Uncontrolled Milk at Stockholm.

The company in Stockholm undertakes the sale of two kinds of milk—namely, controlled and uncontrolled. The conditions under which the former is produced, although its amount is much smaller than the latter, have naturally the greater interest. What is meant by "controlled milk" is that coming from the company's own cows, under the most careful supervision possible. On its large estate some thirty miles from the city the company has built two large cow-sheds. The one of these at Hjortsberga, has 150, and the other, at Mölnbo, 180 cows. The walls, floor, and feeding troughs are cemented; they are well lighted, and have special arrangements for ventilation. The great difference between the Copenhagen and Stockholm arrangements is that in the latter—and almost invariably in Sweden—the cows are kept in sheds

both in summer and in winter, only occasionally getting out for exercise, whereas in the former they must be out in the fields throughout the summer. A staff of men is constantly engaged in cleaning the animals and removing the refuse. There is no smell in the buildings, as everything is quickly absorbed by the dried peat, which partially fills the channel into which the excreta pass. Before milking is begun the floor is swept perfectly clean, and the milkmaids must wash their hands, wear special aprons, and clean the udders carefully. All the cans are washed with boiling water, and the milk is strained through muslin and very fine copper wire gauze before being removed to the cooling room, where it is kept in ice till it is required to be sent away. The most important point in the sanitary control is the fact that the company employs a qualified veterinary surgeon, who lives on the estate and regularly examines the animals, paying especial attention to the detection of tubercle. In addition, the city veterinary surgeon periodically visits and inspects the animals. Any animal found to be affected with tubercle must be got rid of. Nor does the company, further, keep any cows more than a few years. After they have calved two or three times they are sold, so that only those at their best milking periods are in the stalls. The milk from cows that have newly calved must be withheld seven days. Great stress is laid on the importance of keeping the standard of "children's milk" as high as possible, all the finest and healthiest cows being set aside to furnish it. The daily average in 1892 of the analyses was :—

	Sp. gr.	Fat.	Total solids.
Children's milk . . .	1,032 .	4·01% .	13·14%
Ordinary milk . . .	1,032 .	3·83% .	12·91%

The charge for the controlled milk is 18 öre per litre (about 2*d.*) and for uncontrolled 15 öre, a difference which, con-

sidering the infinitely superior guarantee as to purity given by the former, is not great. On the estate there is a small hospital for isolating any case of infectious disease that may occur amongst the employés on the farm.

Berlin.

Arrangements in Berlin.

The methods that have been adopted by these two companies are being largely imitated in various towns on the Continent. In Berlin there are two large milk businesses, which may be likened, the one, that of Herr Bolle, to the arrangements adopted in Copenhagen, the other, that of Herr Grub, to those in Stockholm; although, naturally, certain differences exist, due either to the altered conditions under which the sale has to be made, or to the improvements which have suggested themselves to the proprietors.

The *Milch Kur-anstalt* of Herr Oekonomierath Grub, situated at the Victoria Park, in the south-west of Berlin, is designed solely to provide milk of the first quality for children and invalids. No cream, butter, or cheese is made. Stalls for 250 cows are provided; they are lofty and well ventilated; the floor is made of cement, and the walls, to a height of eight feet, are covered with white glazed porcelain tiles. Dried peat serves to absorb the excreta, and prevents any unpleasant smell. Only such animals as come from the healthiest breeds (chiefly the Swiss) are bought, and, as a rule, they are not kept for more than one year. No animal is accepted without the district veterinary surgeon's certificate as to its healthy condition; and before its milk is utilised, it is placed in an observation stall for some days, under the control of the company's own veterinary surgeon, who also regularly examines all the animals in the institution.

As food stuffs, only hay from the Jura Alps and wheat

meal are allowed. Brewers' grain, various oil-cakes, and even grass, are excluded.

Before milking the udder is carefully washed, and the milk is received into pails made out of one piece of metal with no sharp angles. Great stress is laid on the importance of removing as quickly as possible from the cow-shed the milk that is drawn, and therefore, as soon as five or six pails are full, they are removed, and the milk is cooled down by a Lawrence cooler. The litre bottles, having previously been cleaned by washing in a soda solution and brushing, (the latter operation being materially assisted by introducing a little sand), are then filled, stoppered by a patent porcelain cap, stamped with a leaden stamp, and despatched to the city twice daily.

Sterilized Milk.

A large business is also done in the preparation of sterilized milk, for which the arrangements are exceedingly good. The sterilizer is capable of holding 600 bottles at a time, and these, when filled, are placed with the porcelain cap, with its india rubber collar loosely fixed, in the apparatus. The temperature in the interior is maintained for an hour to an hour and a half at between 90° and 100° C. This *milch Kur-anstalt* no doubt owes much of the success it has attained to the way in which it is supported by the medical profession, some of the best-known members of which having allowed their names to appear as references.

The other company, that of Herr Bolle, in Alt Moabit, is very much the larger of the two, having between 30,000 and 40,000 customers. The premises occupy some five acres of ground, and the dairy and stalls for the horses are as good as they can be. Starting in 1881 with three milk-carts, the business increased so rapidly that now 150 carts hardly suffice for its needs. No cows are kept on the premises, all the milk coming twice daily to the central

station from the farmers with whom the company has made contracts. Conditions are imposed on these somewhat similar to those in force in Copenhagen. The company has its own veterinary surgeon, who visits the various farms to see that the conditions are fulfilled, and to examine the cows, especially with a view to the detection of any that may be affected with tubercle. All the milk, as soon as it arrives, is made to pass by upward filtration through three layers of fine gravel. The milk is sold in quarter, half, and one-litre bottles, all sealed and stamped, and also from cans provided with a tap. In the latter instance the sale takes place at the door of the customer from the milk-cart. Each can has an arrangement inside for effecting as far as possible a mixing of the various constituents of the milk, so that the composition is from first to last almost the same. A large business is done here in the way of sterilized milk, cream, butter, and cream cheese.

The Danish Government and the Use of Tuberculin.

It is in Denmark that the first systematic attempt has been made to combat tuberculosis amongst cattle, owing to the success that Professor Bang, of Copenhagen, has obtained by the use of tuberculin as a means of diagnosing this disease. So important does the Danish Government consider these experiments to be, that by a law passed in April, 1893, it has placed nearly £3,000 a year for five years at the disposal of the Minister of the Interior, to assist the owners of cattle who might be desirous of making use of tuberculin, or of other scientific means of diagnosis, in the detection and prevention of tubercle. The grant of money was to be utilised by the farmer in inoculating young animals with tuberculin, and it was only to be given to such owners as promised to keep the healthy animals isolated from those that were tuberculous. Further, the

Minister was to have the power of employing a part of the sum in aiding associations for the breeding of cattle that might wish to have the animals tested with the material. In addition to furnishing the tuberculin gratuitously, the Government also gives the farmers the services of a veterinary surgeon to perform the operation.

Results of the Experiment.

In a paper read at the Congress of Hygiene at Buda-Pesth in 1894, Professor Bang gives the results of the first year's work, reports having been received concerning 327 herds. Of 8,401 cows examined, 5,039 were found healthy, and 3,362 reacted in the manner characteristic of tuberculous lesions. Tuberculosis was found much more prevalent in large than in small herds. Fifty-one herds in all were found quite free from the disease. In eighty-two others as many as 57·70 per cent. of the animals reacted. In seventy small herds, thirty-six had less than 50 per cent. of the animals affected (twenty-eight had less than 25 per cent.), whilst thirty-four had more than 50 per cent. including fourteen with 75 per cent. affected.

The method he adopts is the injection *sub cutem* of 0·4 gramme of tuberculin in full-grown animals, and of 0·1 gramme in calves. The reaction usually follows the inoculation in the course of from eight to twelve hours, the signs being raised temperature, loss of appetite, diminution in the supply of milk, etc. The first injection is of most importance, the second one often failing to produce any effect, even in animals with marked tubercle. Of eighty tuberculous animals killed, seventy-three had shown a marked reaction, five had not reacted—but in these the signs of tubercle were very slight, and not of recent date—and the remaining two, which gave a very slight reaction, had but little signs of tubercle. Professor Bang considers that tuberculin only fails as a means of diagnosis in less than nine per cent. of

the cases. There are certain elements which mark the effects of the inoculation, as, for instance, advanced tubercle which has healed or become surrounded by fibrous matter. Again, in other cases where reaction has followed inoculation, but no tuberculous lesion has been found, it is impossible not to think that some slight nidus has been overlooked. He does not believe that the inoculation leads to the generalization of the disease, or only on very rare occasions, certainly not sufficiently often to make one hesitate about using it.

Causes of Tuberculosis in Cattle.

The common life in the stable, in limited, badly ventilated quarters, he regards as one of the principal causes of contagion. To combat the disease effectively, it is not sufficient to hinder this common life in the stable, for another great danger lies in the feeding of animals with milk derived from tuberculous cows. In twenty-four out of thirty-five post-mortems on cows affected with tubercle, the disease was found in such positions as made it highly probable that it had been conveyed by feeding, as, for instance, the lymphatic glands of the pharynx, mesentery, and intestinal walls. Contrary to the opinion expressed in the report of the Royal Commission referred to before, Professor Bang believes that occasionally tubercle bacilli may pass through into the milk even when the udder is apparently quite healthy. The milk should be boiled, and when calves have been fed on such milk, they have, as a rule, remained healthy. Experiments carried out by him on a large farm of 208 cattle, 80 per cent. of which had reacted to inoculation, proved that it was possible to bring up a healthy herd directly by the side of an unhealthy one, provided the two were simply separated from one another by a partition; and this, too, when the healthy herd was chiefly recruited from calves born of cows that had reacted. He does not agree, there-

fore, with Professor Nocard and others, that tuberculous cattle should be prevented from reproducing their species, considering that it is only necessary to withdraw their calves, isolating them and feeding them on boiled milk.

In Denmark, the following points dealing with tuberculosis in cattle are embodied in the law on the contagious diseases of animals (April 14, 1894):—

(*a*) The owner must not conduct animals affected with manifest tubercle to fairs, shows, common pasture lands, strange stables, or other places for the assembling of cattle, nor sell the animal so diseased except for slaughter.

(*b*) Neither shall he sell nor use the meat of animals affected with manifest tubercle for the food of man unless the slaughtered animal and its organs have been examined by a veterinary surgeon, and certified by him as fit for human consumption.

(*c*) Neither shall he sell the milk of cattle affected with tubercle of the udder, nor use it for the food of man or manufacture of butter or cheese, its use only being permitted when boiled for feeding other animals.

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Butler & Tanner, The Selwood Printing Works, Frome, and London.