Aids to public health / by J.L.W. Thudichum.

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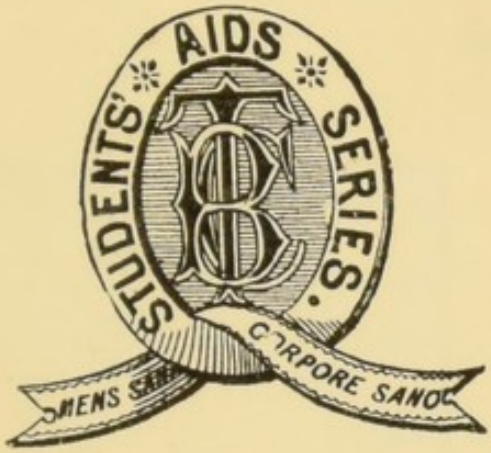

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AIDS TO PUBLIC HEALTH.

INTRODUCTION.

The Science concerning *Public Health*, its preservation, and its restoration from disturbance, is a product of modern times. Its application was forced upon the attention of legislators mainly by two factors, one being smallpox and the means taken for its prevention, the other being poverty caused by sickness, and the means required for its relief. The first laws enforcing certain results of public health science upon every individual in the community were those concerning vaccination so-called; subsequent enactments dealt with three subjects mainly, namely, the increasing of the salubrity of towns, villages, and homesteads by the removal of matters which from their effects were termed nuisances, and proved or supposed to be frequently carriers of disease-causes; secondly, the supply to communities of pure water, instead of water which was liable to become a carrier of disease-causes; and thirdly, the removal from communities of a few direct disease-causes by the isolation or removal to hospitals of persons afflicted with infectious diseases. In the course of the administration of the laws enforcing these proceedings, it was found that ques-

tions of fundamental importance arose, with which medical science as ordinarily circumstanced was unable to deal, particularly the question as to the nature of the disease-causes themselves; and the legislators of several countries thereupon made inquiries in etiology a part of the pursuits of those to whom the administration of public health laws was remitted. The legislature also made the execution of certain measures for the protection of individuals from fraud in mercantile transactions concerning food, drink, and drugs, which had formerly been left to the cognizance of the police only, a part of public health administration. Finally, the execution of the public health laws was remitted to the elected governors of communities, and the state, as represented by its central government, reserved to itself only certain powers of initiation, superintendence, and control.

By continuing and widening the considerations, a few of which are indicated in the foregoing, the student will find that the Science of Public Health did not spring as a fully armoured Pallas Athene out of the aching head of the political Jupiter Tonans by a blow of the sledge-hammer of public opinion, nor did it fall as a brilliant jewel out of the mouth of the serpent of Asklepios, however frequently and vigorously it was rapped on its head with the magic club—it required the strong initiative of the educated public at large, guided by the light-bearers of general science, for public hygiene to become a recognised power in the state. It is now a power without its equal for the improvement of man's estate.

The aim of the science and practice of medicine in the curing of individuals is the suppression of the causes which have made them ill; the aim of the

science of public health is suppression or stamping out of disease-causes, if possible before they have succeeded in affecting individuals. In this sense hygiene is also termed preventive medicine. The science of medicine, therefore, and that of public health, deal actually with the same causes and effects, but they do so in a very different manner. For whereas the relations of an ordinary patient to his physician are entirely optional, the relations of a patient whose health or illness may be taken notice of by authority, to the public health officer, are regulated by certain special laws, which may, and in many cases must, be enforced. In this way public hygiene becomes a kind of scientific police.

By the possession of this power of enforcing its behests, public medicine becomes the bearer of grave responsibilities of two kinds: firstly, it is bound to see carried out the laws actually made for its free exercise, and, secondly, it is bound to see them carried out in a manner which shall be free from the objection of involving injuries. An officer of public health therefore must be not only a conscientious and strong executive agent, but also a learned and thoroughly scientific man, a physician in the widest and best sense of the word, familiar with all the modern sciences, so that he can use them in the business of his office without halt or hesitation. The student should distinguish between absolute hygiene scientifically so called and that amount of hygiene which is practically attainable. It would be desirable to stamp out smallpox, and not merely to produce in each human being an artificial temporary immunity from it by so-called vaccination. Against smallpox, however, no direct measures of prevention have hitherto been of any

avail. Vaccination, on the other hand, is an incomplete protection, and one also involving certain extraneous dangers. Vaccination therefore is a temporary compromise to be adopted as long as smallpox cannot be cured directly, or stamped out directly.

It is essential to the success of public hygiene that all citizens should co-operate in its maintenance, not only by observing the laws of private hygiene, of which the state takes no notice, but by active participation in the execution of the laws, in the spreading of useful information, and by the support of measures tending to increase the stock of human knowledge by new researches on subjects connected with etiology or medicine.

Public hygiene may be divided into several branches, which are mainly the result of the historical fact that legislation has applied itself to dealing with different matters at different times. During the last twenty years most modern states have removed this anomaly by prudent consolidation of their laws. The division of the subject for the purpose of its descriptive representation has thereby been much simplified. We begin with the description of hygienic public measures applicable to persons, which in the language of the relative Acts of Parliament are termed more particularly *measures for the prevention of disease*. The hygienic measures applicable to land, habitations, and things have been termed *measures for the removal of nuisances*. It was found convenient to define sundry persons affected with zymotic disease as 'nuisances,' and deal with them as inanimate objects. We should not perpetuate this practice, but speak of all such persons with the respect due to fellow-

creatures, and of all those suffering from infectious diseases particularly with that sympathy which arises from the fact that they are the most unwilling *sufferers from a nuisance* against which they have a right of protection, but which they have failed to receive. In addition to the two classes of measures, there are a number of hygienic enactments which, though they arise out of the former, do not come under the definition involved by their title, but might be termed *measures for the provision of wholesome materials and things*. Of such materials, water is the most important: of things, habitations, and buildings of all kinds, streets, roads, and public places. *The hygiene of animals* is considered by legislation to be less a sanitary than an economical question, a conception which seems to us to involve a want of appreciation of tangible dangers to which society is liable from that side. It is probable that many persons are made ill, and a number die, not only as is certain occasionally, but constantly, from the effects of meat from animals affected with highly contagious and vitally dangerous diseases.

The student should make himself acquainted with all parts of hygiene which may make public interference necessary, whether there are laws relating to them in existence or not. For in truth legislation is always far behind science, and has, in not a few questions, been rather a reluctant helpmate of it. On other questions of hygiene the legislators in not a few states are divided in opinion, and sometimes so equally that proposed good laws either are not enacted, or existing laws are abrogated. On most questions the student should have his scientific ground prepared, so that when he enters upon active life he may be able to support

a high-minded sanitary state-policy and oppose the pusillanimity of crotchetmongers.

SMALLPOX AND VACCINATION.

Smallpox has been the plague of mankind in all ages and most countries. America is said to have been free from it up to the time of its so-called discovery. It was known that persons who had suffered from smallpox and recovered were protected from a recurrence of the disease. This experience was made use of to produce an immunity by inflicting the disease under circumstances and at times favourable to recovery. This communication of disease by will and premeditation was effected in the East, India, and China, at least for a thousand years, by blowing through a tube into the nose of the person to be infected powdered dry smallpox matter. Later on it was discovered, also in the East, that the transfer of a minute particle of lymph from a smallpox pustule to the lymphatic space of the skin of a healthy person did communicate the infection more certainly and quickly, and consequently inoculation superseded insufflation. Then it was discovered by Jenner that a pustular disease found upon cows, when transferred by contact or inoculation upon healthy beings, could produce immunity from smallpox in the same manner as the natural or inoculated smallpox. The educated classes adopted this proceeding, and the uneducated classes were gradually persuaded or compelled to allow it to be performed on their children also. The disease inoculated was supposed to be a disease peculiar to cows, until it was discovered that human smallpox, when transferred to cows, assumed the character of cowpox or vaccinia. It is now supposed that all vaccinia is such human

smallpox, modified by having passed through the body of horned cattle. Much of the vaccine in England is said to have been derived from human smallpox by passing the poison once through the cows, and then using it for the so-called vaccination of human beings. Public vaccination is enforced and regulated by the Vaccination Acts, 1867 and 1871, 30 and 31 Vict., c. 84, and 34 and 35 Vict., c. 98, consolidations of several previously existing Acts. By these laws every parent or person having the custody of a child is bound under penalties to have it vaccinated, and after vaccination inspected, within three months after birth, or if it be declared unfit to undergo the process, after such time as may be required for its recovery. The person who registers the birth of the child receives from the registrar the necessary notice relating to vaccination, and to any eventual temporary dispensation from the obligation. Persons who neglect to have a child vaccinated may be fined up to twenty shillings. Those who persist in refusal have been fined repeatedly, though it is questionable whether it is authorized by the Act. Latterly a tendency has been shown by authorities not to insist upon repeated prosecutions, as they fail in their object, and give rise to the thought of persecution among some classes of the people. To make himself fully acquainted with the subject of vaccination, the student should read the Vaccination Acts, 1867 and 1871, and practise for three months at a recognised public vaccination station. Public vaccination is superintended and controlled by the Local Government Board, through the agency of special officers. Premiums are given to vaccinators out of funds voted by Parliament for certain qualities of success. It was long believed that the transfer of other diseases than vaccination from children upon

children by the lancet was impossible. But it has been proved that syphilis can be, and in a limited number of cases has been, so transferred. It is consequently deemed not impossible that tubercle may also be transferred occasionally in this manner. It is, therefore, clear that the vaccinator has to take the greatest care regarding the purity of the vaccine-lymph which he uses. To ensure this purity, vaccination has for some years been carried out with lymph produced upon calves ; this was done at first as a matter of private speculation, until at a later period Government also provided institutions for the rearing of calf-lymph and its distribution to the public. Vaccination is therefore now carried on by means of three varieties of lymph : (1) Vaccine from cows, it being unknown how the cows were infected ; and such lymph transferred from child to child an unknown number of times ; this is termed 'humanized cowpox.' (2) Such humanized cowpox transferred to the calf, and then transferred from calf to calf, and from calves only upon man, but not from man to man ; this kind of lymph is termed 'calf-lymph.' (3) Lymph from cows, which have been inoculated with human smallpox, whereby the lymph has been made similar in effect to vaccinia. This lymph also is now largely transferred from man to man, and is preferred on account of its active properties. This alleged fact has led to the belief that vaccine is nothing but human smallpox which has been modified by reproduction of its microzyme in the body of a calf or cow, and that there is consequently no vaccine so called of any kind which has not at one time or another been derived from human smallpox. By special clauses inserted in the Vaccination Acts inoculation with smallpox as formerly practised was made illegal, and punishable by heavy fines.

CONTAGIOUS DISEASES.

Under the somewhat general name of 'Contagious Diseases' preventive legislation had taken notice of certain enthetical diseases which are propagated by sexual intercourse, namely gonorrhœa and syphilis. The law which treated of these was the Contagious Diseases Act, 1866 (29 and 30 Vict., c. 35). It was confined in its operation to certain military garrison towns and naval stations, and its administration was left to the judgment of the military and naval authorities, acting by the agency of the police. The measures to be taken under it had for their object the medical examination of prostitutes, and, if they be found diseased, their detention and cure in hospital. This in itself very merciful law, and which many high authorities maintained should be extended to the whole of the United Kingdom, was strongly opposed by a certain section of the community, which even formed a society for furthering its objects, and used arguments in support of its contention which were anything but scientific. The Act was repealed totally in 1886 (see 49 and 50 Vict., c. 10). Nevertheless, the student should not only study the Act, but also the chief evidence given before the Royal Commission on the Act, and make himself acquainted with the contentions of Parliamentary parties and social coteries, in order to obtain a correct and practically useful view of the scientific and political sides of the subject. Its importance will at once be evident by the following fact. The preventive laws formerly enforced at Paris were left in abeyance during the siege, 1870-71. At its termination at the beginning of February, 1871, out of 100,000 *gardes mobiles*, who had been collected from all parts of France, 8,000

were affected with 'constitutional' enthetic disease, not including the more curable forms of contagion. We take these data from the evidence of General Trochu, given before the Committee of Inquiry of the French National Assembly.

QUARANTINE.

This word may remind the student of the excessive precautions which communities and states practised in former times when threatened by epidemic diseases. It comes from the French *quarante*, forty, and indicates the length of time in days during which travellers or ships coming from places actually infected with spreading disease, or suspected of being so infected, were detained in particular places set aside or constructed for the purpose, in order to make sure that they were not infected with disease, and could not carry it into the place or country. Quarantine was instituted mainly by the Latin nations against *the Levantine Plague*, which from time to time was carried into towns on the Mediterranean by ships and travellers. It was further developed after Europeans had made the acquaintance of *yellow fever*, which is indigenous to America, and the system reached its climax during the invasion of Europe by *Asiatic cholera*. The discussion of quarantine therefore actually involves that of the measures to be taken when a place is threatened with an importation of, or has actually been infected with, any of the three diseases mentioned. Ships were kept in quarantine or contumacy by not being allowed to enter a harbour, or discharge passengers or goods. As this involved commercial loss, and hardships to persons, passengers and goods were allowed to be landed in isolated places, termed lazarettos, or quarantine

buildings, and there to stay during the chosen time of probation. These buildings were mostly like prisons; the rooms had to be furnished by the passengers, and they had also to provide for their living at the extravagant charges of the authorities left to watch over these prisons. Thus an immense amount of misery was generally inflicted upon all but the very richest passengers, who mostly contrived by bribery to obtain their liberty long before the crowd obtained theirs by expiration of the contumacy. Those who have known and seen the system in action, *e.g.*, at Trieste, in the first half of the century, or at Lisbon, can form an idea of its barbarity and its uselessness. Happily in our days, through the strong initiative of Great Britain, it has become next to impossible. And it must be the constant endeavour of authorities for the preservation of public health in all countries to abolish it entirely, and devise means of protection from the importation of spreading disease more certain and effectual than those which pass under the name of quarantine.

Such measures are unquestionably necessary, and their essence is comprised in three proceedings: (1) Medical inspection and examination of suspected arrivals, whether passengers or ships. (2) Isolation and medical treatment of sick persons in properly appointed hospitals or residences, and isolation of persons suspected of being infected. (3) Disinfection of ships, or vehicles, or goods which have carried such persons, or matters which have been in contact with such. From the moment that these measures are acknowledged to be the only possible and effectual means to the desired end, the cases formerly subjected to the exceptional treatment of quarantine come under the cognizance of the

ordinary permanent public health authority of each place or country, and are dealt with just as other infectious diseases are, or ought to be, which continually victimize populations, by being epidemic, such as enteric fever, typhus exanthematicus, scarlatina, or diphtheria.

The properly constituted modern state is in duty bound to exercise *constant*, not merely occasional, care in the suppression of infectious diseases, and wherever this care is exercised, occasionally imported diseases have no more chance of spreading than endemic diseases have of becoming epidemic, and both may be gradually stamped out.

The Quarantine Act, 6 Geo. IV., c. 78, is applicable only to seaport towns. It is supplemented by certain provisions of the Act 29 and 30 Vict., c. 90, the execution of which has been transferred to the Local Government Board. As an example of the application of these Acts may be quoted an order issued July 17th, 1873, which provides that in case of any vessel arriving in any port of the United Kingdom, having Asiatic cholera on board, the vessel shall be detained, and no person shall land from such vessel until the following prescribed examination is made. The Sanitary Authority shall forthwith cause all persons on board the said vessel to be examined by their medical officer of health or some other legally qualified practitioner, and shall permit all such persons to land immediately who shall be certified by such medical practitioner to be free from such disease. All persons certified by the medical officer to be affected with symptoms of cholera shall be removed, if their condition admits of it, to some hospital or place to be designated for such purpose by the Local Authority; and no person so removed shall quit such hospital

or place until a medical practitioner shall have certified that such person is free from the said disease. In the event of any death from cholera taking place on board such vessel, the body shall be taken out to sea, and committed to the deep, properly loaded to prevent its rising. The clothing or bedding of all persons who shall have died, or had an attack of cholera on board such vessel during the voyage, either at any foreign port or on shore at such port, or on her passage to the United Kingdom, shall be disinfected, or (if necessary) destroyed. The power to make such regulations as the foregoing is conferred on the Local Government Board, by clause 134 of the Public Health Act, 1875, as explained by sec. 2 of the Public Health Act, 1889, and applied to London by the Public Health (London) Act, 1891. Any person who wilfully violates any regulation so issued, or obstructs its execution, is liable to a penalty not exceeding five pounds.

THE SUPPLY OF WATER.

All water fit for drinking is derived from rain, and is directly taken either from springs, which issue naturally out of the earth, or from rivers, or from wells dug into the ground; there is also rain water collected from the roofs of buildings, or from surfaces of the earth in ditches and ponds. These sources of water are hygienically of very different value, so that while some may be above suspicion or reproach, others may be occasionally or always dangerous to health.

Of springs, those are to be hygienically preferred which issue out of the ground at the foot of extensive mountains or plateaus, formed of rock pene-

trable to water, such as sandstone or chalk. As an example it may be stated that the Thames valley is surrounded by such springs, and the earliest municipal enterprise of the citizens of London for the conveyance of pure water to the city had for its object the copious springs at the head of the valley of the river Lea. If the student should like to see natural springs yielding many millions of gallons of purest water all the year round, flowing quite unused, he should visit the valley of Basingstoke, and investigate the springs of the contributories of the river Loddon.

Water from wells which are dug deep into the ground, or into rock, such as chalk or sandstone, is equal in quality to spring water. But as it has mostly to be raised by human, animal, or steam power, it is more expensive than water from springs. Artesian wells, so called, are artificial springs, which also yield hygienically unobjectionable water.

Water in shallow wells is liable to contamination with various impurities, some only disgusting, some dangerous to health. Thus, it might be contaminated with sewage from manured lands or farmyards, or cesspits or privies. It is by such water that filth diseases, such as enteric fever, are most frequently disseminated.

Water from watercourses, canals, ditches, and rivers is mostly very impure, and is liable to carry disease-causes. Thus, the epidemic of cholera which visited the south of London in 1854 was caused by the distribution of impure Thames water, and that which visited the east of London in 1866 was produced by the distribution of contaminated water of the river Lea. While formerly river water was used domestically in an unfiltered state, now it is

purified by subsidence and filtration. But even artificially filtered river water is unsafe for drinking. For this reason the legislature has during several years, whenever there was a choice between river water and spring water for the supply of a place, given the preference to spring water.

Water derived from surface drainage is very varying in quality, according to the geological formation of the country, and this fact affects not only river water, but also that of lakes, which are now frequently used for the supply of towns. The water in lakes has the advantage which is given artificially to river water by subsidence basins; it is partially purified.

Water derived from geological formations containing, or composed of, carbonate of lime, always contains a certain quantity of this carbonate in solution by means of carbonic acid. Such water is called hard, and is less fit for many purposes of life than water free from earthy impurities, which is termed soft. Hard water curdles soap, and therefore requires larger quantities in the process of washing; it forms crusts in kettles and boilers, which make the metal a bad conductor, and waste fuel; it makes certain vegetables, particularly pulse, which are boiled in it, hard and indigestible. Water is made hard, not only by calcium carbonate, but also by the sulphate of that earth, called gypsum, and by the nitrate. As the carbonate hardness can be removed by boiling, it is termed *temporary*, while the hardness caused by sulphate and nitrate, which is not altered by boiling, is termed permanent. From the point of hygiene, water to be used for drinking, therefore, should, in the first instance, be absolutely pure from disease-causes and sewage;

it should next be soft, if this quality is obtainable. And it is well to know that the character of softness can be artificially imparted to even large quantities of water, by a process termed, from its inventor, Clarke's process, and consisting in the addition of caustic lime. Therefore, soft spring water is the best of all waters; second in order is softened chalk spring water; third in quality is hard chalk spring water; fourth, is filtered soft river or lake water; fifth, hard filtered river or lake water; and after that come various qualities, which are difficult to classify.

Now, as the best qualities of water are difficult to procure, and great masses of water which are not required to be of a high degree of purity are used in communities, it has been found best to rely for domestic purposes upon several kinds of water, and even towns have instituted a double supply, one for drinking and cooking, another for other domestic or for manufacturing purposes, *e.g.*, Stuttgardt in Wurtemberg is thus supplied. Such an arrangement has also been proposed for London, where it is, moreover, requisite to obtain water under higher pressure and at a quicker rate than can now be supplied, for the extinguishing of fires.

For the chemical analysis of water, with a view to estimating its fitness for domestic and manufacturing purposes, many methods have been devised. By one method water is judged of from the amount of carbon and nitrogen which it yields by combustion of its organic matter; by another it is judged from the amount of ammonia which can be obtained from its organic matter; by a third from the amount of oxygen which can be taken up by its organic matter. In fact, these analyses are mere quantifica-

tions of organic matter, such as may be, and mostly is, quite harmless, while true disease-causes, when present, are not necessarily indicated in any way by these analyses. Chemical analysis, therefore, affords no guarantee for the purity of a water, and does not indicate its disease-causing impurity. In the present state of things the innocuousness of water can be ensured only by taking it from a pure source, and keeping it pure until it is consumed. The student should make himself acquainted with the numerous cases in which these fundamental rules are neglected, to the great disadvantage of the public health. The student is also advised to make himself acquainted with the essential details connected with various modes of providing water, the securing of springs, the construction of reservoirs, the digging of wells, the pumping of water; the conduction of water by gravitation, through culverts and pipes, and its distribution in towns, villages, and houses. He should pay particular attention to the various modes in which even the purest water may become occasionally contaminated with disease-producing matters during transmission or distribution. Such contamination has not rarely been caused by a system of supply which is termed intermittent, as opposed to the system of constant supply. The latter system, in which the water pipes are always under pressure and filled with water, is the one recommended by sanitary science. For it does not admit of the suction into the pipes of foreign impure liquids, which the intermittent system does admit of; and it does away with cisterns, which are frequently a means for the contamination of water originally pure. The provision of good water for troops in the field is one of the most important and most difficult problems. To this the military surgeon should give the greatest attention, as the

fate of a campaign may sometimes, at least in great part, be determined by this factor. Impure water spreads enteric or typhoid fever with great rapidity, particularly amongst stationary, besieging, or besieged troops, and produces results quite beyond the original calculation of those engaged in the operations of war. Soldiers may carry a small charcoal filter, which will keep out the crudest impurities; they should boil their water as often as is practicable. The boiling of water is also recommended to all persons who have doubtful or impure water to use, particularly in times of epidemics.

As regards the most important laws concerning water supply, Local Boards *may* supply, and in case of danger to health of inhabitants of a district for want of water or proper water *shall* supply, water to their constituents; in case of their failure to do so Local Boards may be compelled to supply or may have a supply provided at their cost by a machinery to be set in motion by the central government. Local Boards may require that houses without a proper supply of water be supplied, and institute such a supply at the cost of the owners, and at an expenditure for the water supplied not exceeding two pence per week or a certain maximum, to be fixed by the Local Government Board. (Public Health Act, 1875, sec. 51 to 67.)

An occupied house without a proper and sufficient supply of water shall—sec. 48 Public Health (London) Act, 1891—be a nuisance liable to be dealt with summarily under this Act, and if it is a dwelling-house shall be deemed unfit for human habitation. This Act contains also provision for the maintenance of the purity of the water supply in tanks, cisterns, and other receptacles for storage.

SEWAGE AND SEWERAGE—REMOVAL OF EXCRETA.

Sewers in the original sense (issuers) are natural or artificial watercourses by which liquids effused on land find their way to rivers and the sea. In the course of time the word has been more particularly applied to conduits constructed of masonry or earthenware, or cement cast pipes, intended to remove from towns and villages rain, surface and house water, and the excretions of human beings, and partly those of animals. The smaller pipes are termed *drains*, a word also preferred for any aggregate of pipes by which agricultural land is liberated from its underground water to a certain depth. Sewers were built in towns at all ages of history, but it is only during the last thirty years that engineering science has discovered the proper shapes for these canals, namely, that they shall be oval on section with the narrower end of the oval downwards. Such sewers can be kept clean by a moderate flow or by artificial flushing, while in square sewers, or arched canals with a flat bottom stretching from side to side, deposits form, and are ceaseless sources of trouble and foul odours. While in olden times sewers mainly served for the removal of surface and rain water, but also received, mostly contrary to law, a certain amount of human and animal excretions, the introduction of the water-closet changed the character of sewers, and forced on what we now know as the questions of sewage and sewerage.

At all times people, in Europe, neglected to deal with excreta in a systematic, rational manner. The injury which this neglect has inflicted upon

countless generations can be measured by the scientific intellect, but cannot be described. It is marvellous to behold how quickly, with a certain complication of his habitation, man becomes conservative of filth. He will let it lie above ground, to contaminate his habitation, his grounds, his streets; he then digs holes in the ground to collect the materials, and removes them when excess and overflow have caused an intolerable nuisance; but he prefers holes in the ground so constructed that the matters shall, if possible, soak into the earth and disappear from his sight and from the necessity for attention; these holes are termed *cesspits* or *cesspools*. The history of cesspits, particularly in towns, discloses one of the most deplorable aberrations of the human intellect, engendered partly by poverty, partly by absurd laws, partly by mere neglect and idleness. The ground on which towns and villages stand became honeycombed with cesspits, and as it was also honeycombed with wells, many of which were in close proximity to cesspits, it followed that there was a constant percolation of matter, more or less altered, from the cesspits to the wells. Now, when a cesspit became infected with disease-causes, particularly the germs of typhoid fever or of cholera, the neighbouring wells also became infected with the disease-causes, and the people drinking the water from the wells became the victims of the relative diseases. As illustrations of these conditions, the student should read the details of the history of the Pumpwell in Golden Square, London, and of the epidemic of cholera which it was instrumental in producing in its neighbourhood in 1859, and also of the more than sixty epidemics of cholera and typhoid fever which have been investigated and recorded in the Annals of the Public Health Department of the

Government of this kingdom. They are collected in an abbreviated form in a publication provided and sold by the Society of Arts, Manufactures, and Commerce, John Street, Adelphi, London.

These experiences have established the certainty that cesspools are always dangerous, should therefore henceforth never be constructed, and those which exist should be abolished. With cesspools the sanitarian can make no compromise whatever. He is already greatly aided in the execution of this resolution by public law, which has decided that no man may construct a cesspool so that the well of any other man may thereby become polluted.

Thus society, by meeting with countless evils, by the desire for comfort, and the necessity of securing health, became confronted with the question of the best modes of disposing of excreta. Scientific and practical men concurred in efforts to solve this question with due regard to all considerations. The desired disposal had to be effectual, had to take place at the lowest possible cost, and, further, with due regard to the economy of nature. For it was shown by agricultural chemistry that the constant abstraction from land of certain valuable constituents, which entered into the composition of the crops, impoverished the soil so as to make it less and less fit for profitable cultivation. These considerations were met by various contrivances and arrangements to be now alluded to.

A cheap and simple method of disposing of excreta was found to be their reception in, and covering with, dry earth. This may be termed the *dry earth system*. For its practical application

various simple machines have been devised, termed *dry earth closets*, or, shortly, *earth closets*. The student should make himself acquainted with the various commercial patterns introduced into practice. The system is suitable for rural cottages and habitations, where earth is easily obtained and dried, and where the resulting compost can be dug under ground as manure without the necessity of carriage to distant places. It is unsuitable for homes without yards and gardens, and consequently quite unsuitable for towns.

Another mode of disposing of excreta, which has been adopted in towns with large wage-earning populations, is their reception in portable vessels, pails or tubs, and then direct removal by carriage to places where they are disposed of either directly by committal to the soil, or indirectly by being transformed into portable manure. This system, which may be termed the *portable pail system*, is of course connected with some degree of nuisance at all times, but if energetically and cleanly worked by authority, satisfies the main demands of public health, by keeping the soil of and around habitations uncontaminated. It is, however, liable to spread disease germs, as has been proved by experience in the so-called pail quarters of some German towns, and requires therefore unceasing sanitary supervision.

The third mode of disposing of excreta, and the only one which is applicable to towns, and also the only one which the comfort-loving classes will adopt, whether living in or out of towns, is removal by water by the instrumentality of the so-called water-closet, and of drains, and eventually sewers. This system is known as that of *water*

carriage. This, when applied by itself in such a manner that refuse liquids, not being excreta, and rain-water are disposed of separately, is relatively easily managed, as the sewage produced can be cleared of the insoluble matter by straining, the solid matter can be dug under ground, and the liquid can all be absorbed by a relatively small piece of suitable ground. I have seen this carried out in isolated habitations provided with a garden in the most perfect and almost self-working manner, the only attention required being the removal from time to time of the odourless strained-off matter. Indeed, this experience proves that the system is applicable to towns, in which there is room for a double system of sewers, one for rain and surface water, another for the products of water-closets only. Such a double system of drainage is the only one which could, as regards towns, solve the problem of the profitable application of the sewage. It has been proposed many years since, but deemed to be either too expensive or impracticable in certain localities. It should, however, be kept in view for all towns in which there is room and where new arrangements have to be made. To the double water supply a double system of drains would worthily correspond.

A separation of the liquid from the solid parts of the excretions has also been proposed and carried out in several modes. This would ensure the collection of the principal part of the manurial value (10s. per adult head per year) of the excreta, namely, of the liquid part, and its application to chemical manufacture or to the land. But as the arrangements required are complicated, and involve scientific management, this method has never found extended application.

There remains, then, the system hitherto commonly preferred, namely, the discharge of all refuse matter, excreta, and rain-water into common drains and sewers; and with this system arises the problem, now to a large extent unsolved in European countries, of the final *disposal of the sewage* so produced.

At first the sewage was, by common consent, allowed to run into rivers and watercourses. But with the increase of the volume of the sewage, to which was added an enormous volume of refuse waters from manufactories, rivers became so polluted as to be unbearable nuisances, and laws had to be made to prevent sewage and defiled waters from entering rivers. (The Rivers Pollution Prevention Act, 1876, 39 and 40 Vict., c. 75.) It became necessary to purify or utilize sewage, and many processes were adopted with these views.

Practically, however, sewage utilization has met with many hindrances, and is hardly carried out completely anywhere. It mostly in practice amounts to this, that the sewage, on leaving the town, is strained, or freed from suspended matter by short repose, or by the addition of precipitants, clay, sulphate of alumina, and of iron, lime, and other matters, and the liquid decanted from the precipitate is now distributed over fields and meadows, to irrigate them, or is allowed by permission of authorities to flow into watercourses as 'purified effluent.' This latter effluent defiles the upper reaches of the Thames and Lea, and is one of the principal objections to the use of Thames and Lea water for drinking, as the sewage in many cases is not strained, but allowed to run on land directly, when the solid matters easily cause a nuisance, or are deposited as a surface layer, which becomes

gradually impenetrable to water. If the surface be taken off or dug under, and the soil be permeable, or be made so by construction, a very good filter-bed for sewage utilization can be produced. If the sewage is poured on such a filter-bed at intervals, so that the porous ground can be penetrated by air after the sewage has percolated, so-called *intermittent sewage filtration* is produced. Many fields which have been allotted to sewage utilization are either naturally unfit for it, or have not been suitably prepared, and in consequence the process either fails in part or becomes injurious. But there is no difficulty in sewage utilization by irrigation which cannot be overcome by skill and perseverance. For example, chalk soil will absorb any amount of sewage at all seasons and in all weathers; sand and sandy soil, with good drainage, will do the same; gravelly soil the same; only heavy clay soil is not suitable, and lets much sewage run over its surface unpurified. If such soil is the only one at disposal, it must be prepared by an admixture of gravel and sand, and by under-draining. Practically, much sewage continues to run into rivers, even where sewage purification is obligatory and is practised, during rainy seasons and storms, when the processes and machinery are unable to deal with the enormous volumes of sewage suddenly produced. Even the Thames receives great masses of sewage in London during storms from the main drainage by the storm overflows. The entire London sewage is discharged into the Thames at two stations, Barking [Becton] and Crossness. The conservators of the Thames maintained that the river was fouled by the sewage, and that banks of mud were formed by it. This was denied by the guardians of the London sewage system, the late Metropolitan Board of Works, and, in an arbitration, the view of the

Board was unanimously maintained by the judges. The theoretical value of the manurial constituents of the London sewage is more than a million and a half of pounds sterling per annum. The student should remember that the public health of London is administered mainly under the Public Health (London) Act, 1891, and partly under Acts affecting the kingdom.

The principal legal enactments concerning sewage and drainage, and the disposal of sewage, are contained in the third part of the Public Health Act, 1875, clauses 13 to 41.

THE MANAGEMENT OF STREETS.

The management of streets is properly a merely municipal business, in the disposal of which the science of the public health has only a subordinate voice. In accordance with this, the Public Health Act, 1875, c. 42 to 50, and the Public Health (London) Act, 1891, sec. 16, provide for their scavenging and cleaning. Streets should be of sufficient width, and of moderate inclination; they should be properly paved, lighted, watered, and swept. Badly inclined and paved streets endanger cattle, injure vehicles, and greatly fatigue the nervous system of those who have to travel over them. Dirty and dusty streets are very injurious to the eyes, noses, and lungs of the population, apart from the manner in which dirt and dust affect clothes and linen. Streets must be liberally lighted for the purpose of admitting of quick communication, and receiving protection from accident, *e.g.*, by collision, and from personal violence on the part of the dangerous classes. How necessary a most careful management of streets is in large towns

can be concluded from the many injuries which are daily inflicted upon passengers in the streets of London. The proper sweeping and cleansing, scraping or slopping of streets, is most beneficial to the community, and in these respects great improvements can yet be effected over actual practice in many towns. The nature of the pavement of streets and roads is only partially a sanitary question. The various modes of street-paving known as stone-paving, macadam, asphalte, and wood-pavement are known to all, and have each their advantages and drawbacks; but on the whole the balance of evidence is in favour of wood pavements. The regulation of highways and streets is placed in the hands of local authorities by the Sanitary Act, 1875, c. 144 to 159. Streets should be provided with so-called fire-plugs; that is to say, taps to water-mains, to which, in case of fire, flexible tubes can be quickly attached, and through which a torrent of water amounting to about two thousand gallons per minute, and capable of reaching the roof of the highest building by the pressure in the water-main, can be projected. Fires can on the whole be extinguished only in their incipient stages, and by great volumes of water; they reach great dimensions, in such wealthy cities as London, *e.g.*, frequently because the demands of engineering science, formulated in the foregoing lines, are not complied with.

PUBLIC PLEASURE-GROUNDS AND COMMONS.

Inasmuch as public pleasure-grounds contribute greatly, not only to the enjoyment, but also to the health, of the people, their establishment or maintenance should be encouraged by every sanitarian. There are special laws giving power to urban autho-

rities to provide and support such places. As to commons and open spaces in and around the Metropolis, 29 and 30 Vict., c. 112, 32 and 33 Vict., c. 107, and 40 and 41 Vict., c. 35, gave power to the Metropolitan Board of Works, now transferred to the London County Council, and the Corporation of the City of London.

RUINOUS OR DANGEROUS BUILDINGS.

If any building or part thereof is dangerous to occupiers, passengers, or occupiers of neighbouring buildings, the owner may be required to do all things necessary for restoring security; namely, to secure, repair, or take down the same. If he fails to do so, the Local Board can take all necessary measures, and compel the owner to pay for them. (The Public Health Act, 1875, clause 160.)

PUBLIC BATHS AND WASHHOUSES AND PUBLIC BATHING.

Public baths and washhouses are encouraged, and their establishment is regulated, by the Act 9 and 10 Vict., c. 74, and the amending Act, 10 and 11 Vict., c. 61. It does not appear that in prescribed by-laws any attention is given to measures for the prevention of communication of disease by persons or articles of clothing intended to be washed. The sanitarian should bear in mind that such communication is possible, and in the celebrated case of the Egyptian frigate, the *Faid Gehat*, which came to Liverpool with dysentery on board, actually did take place. Sailors from the frigate visited the public baths, and several attendants became infected with typhoid fever. Probably the disease on board the frigate was also typhoid fever.

COMMON LODGING-HOUSES.

A 'common lodging-house' means that kind of lodging-house in which persons of the poorer classes are received for short periods, and, although strangers to one another, are allowed to inhabit one common room. In London there are a great number of such houses, and the population seeking refuge in these nightly is estimated to exceed sixty thousand persons. These houses are regulated under the Public Health Act, 1875, c. 76 to 90. The Local Authority has to keep a register of such houses, and to make and enforce by-laws for securing their cleanliness and ventilation, and preventing their being overcrowded. In case of any infectious or contagious disease occurring in a lodging-house, the patient is to be removed to a hospital, and the bed and bedding and clothes are to be disinfected. To that end the keeper of the lodging-house has to give notice of any case of infectious illness to the medical officer of the Local Authority, and the poor law relieving officer of the union or parish in which the lodging-house stands. The medical officer has to certify that the case may be safely removed, and the proper officer has to disinfect all the things which the patient may have infected.

The air-space prescribed is, in a room used as a sleeping room, at least 300 cubical feet for each person, and in a room used both as a sleeping room and a day room, not less than 400 cubical feet for each person.

LABOURING CLASSES' LODGING-HOUSES.

Such houses are constructed and managed under the Labouring Classes' Lodging House Acts, 1851,

1866, and 1867, by Local Authorities. They are to be open to inspection of Local Authorities. No particular provisions are made to ensure their sanitary condition, which is supposed to be guarded by the constructing authority.

LABOURING CLASSES' DWELLING HOUSES.

By the Labouring Classes' Dwelling House Act, 1866 (29 Vict., c. 28), the Public Works Loan Commissioners were authorized to advance money towards the erection of dwellings for the labouring classes. They thereby obtained authority to fix the number of cubic feet in each room of the several classes of tenements; in the two-roomed houses, Class 1, there is to be no room with less than 715, the larger room is to have from 1,000 to 1,200, cubic feet. In Class 2, of four rooms, all four are to have 960 cubic feet each; in Class 3 five rooms are so distributed, that they have respectively 372, 675, 1,056, 1,056, 1,232 cubic feet, or 446, 459, 459, 781, 1,468 cubic feet.

ARTIZANS' AND LABOURERS' DWELLINGS.

Such dwellings are placed under the control of Local Authorities, under the Artizans' and Labourers' Dwellings Act, 1868 (31 and 32 Vict., c. 130, and the Artizans' and Labourers' Dwellings Improvement Act, 1875 (38 and 39 Vict., c. 36). There is to be a medical officer, and he is to inspect premises and see that they are in a state not injurious to health. The Local Authority may and shall cause any necessary alteration to be made.

MARKETS AND THEIR REGULATION.

The authorities regulating markets are entrusted with the execution of some measures for the protection of the public health, amongst which are the following: they are authorised to prosecute persons who shall sell or expose for sale any unwholesome meat or provisions; such persons may be fined any sum not exceeding five pounds for every offence. Any inspector of provisions appointed by any Local Board may seize unwholesome meat or provisions and carry the same before a justice, and thereupon such proceedings shall be had as are directed by 10 and 11 Vict., c. 14, to be had in the case of any cattle or carcase seized in any slaughter-house and carried before a justice (incorporated with Public Health Act, 1875). The Public Health (London) Act, 1891, sec. 47, raised the penalty to a maximum of fifty pounds, or imprisonment during six months.

SLAUGHTER-HOUSES AND THEIR REGULATION.

Slaughter-houses may give rise to nuisances of a serious description by uncleanliness, the putrefaction of collected blood, the effluvia of collected intestinal contents, and the decomposition of many kinds of animal matter and offal. For this reason, slaughter-houses have in most countries been placed under supervision. In this country they are under the inspection of Local Boards; those bodies may also provide slaughter-houses. Local Boards may license slaughter-houses if they approve of them, or withhold any license if they think the house to be situated in an undesirable locality. The inspector of nuisances, the officer of health, or any other officer

appointed by the Local Board for the purpose, may inspect slaughter-houses and examine any cattle or carcase deposited there, and if he find any which appear unfit for the food of man, he may seize and carry it before a justice, who is forthwith to order it to be further inspected and examined by competent persons. If the carcase then be found to be unfit for the food of man, the justice is to order it to be immediately destroyed, or otherwise disposed of in such a way as to prevent its being exposed for sale or used for the food of man. Although the inspector is authorized to examine *cattle*, as well as carcases, yet the inspection in this country has been practically confined to dead meat, except in the cases of imported cattle or in times of epidemics, such as the cattle plague. This inspection of animals before slaughter, and of their carcases and offal after slaughter, should be carried out with regularity and minuteness, for reasons which we shall exhibit lower down. (*Cf.* the Public Health Act, 1875, c. 166.)

WORKSHOPS AND BAKEHOUSES, AND THEIR REGULATION.

In workshops, where children, young persons, and women are employed, it has been found neces sary to enforce some rules to regulate and limit the hours of labour; this is done by the Workshop Regulation Act, 1867 (30 and 31 Vict., c. 146). According to this law, no child under the age of eight years shall be employed in any handicraft. Older children may be employed during no more than 6½ hours; no child under the age of eleven years shall be employed in grinding in the metal trades or in fustian cutting. In shops where dust

is produced it must be removed by a fan or other mechanical means.

Bakehouses are controlled by the Bakehouses Regulation Act, 1863 (26 and 27 Vict., c. 40). It makes certain provisions for cleanliness and ventilation of the buildings, and for limiting the hours of labour of young persons in such establishments. (*Cf.* also Public Health (London) Act, 1891, sec. 25, 26, 27, and as regards dairies, sec. 28.)

PLACES FOR THE SALE OF FLESH AND FISH.

Places for the sale of butchers' meat, poultry, game, flesh, or fish, may be visited by the inspectors of nuisances, and anything found to be unfit may be treated like the carcase described in a previous paragraph (p. 36). (*Cf.* the Public Health Act, 1875, c. 116.)

OFFENSIVE TRADES.

The offensive trades which come under the cognizance of Public Health Authorities are, principally, in alphabetical order: the businesses of blood-boiler, bone-boiler, brick-burner, fellmonger (slaughterer of cattle, horses, or animals of any description are not here again considered, as they have been treated of in previous paragraphs), soap-boiler, tallow-melter, tripe-boiler, and others. Fish-frying is no doubt an offensive trade, however appetizing the product of the trade may be, but it is certainly not injurious to health, in the same sense as the other trades previously enumerated may become.

Blood-boiling, consisting essentially in the preparation of blood for manure, or for animal charcoal, is less practised now, because the blood finds a more profitable use for the manufacture of albumen. As it must be quite fresh for this purpose, the trade demand has removed the motive for a nuisance, and produced one for cleanliness.

Bone-boiling means the manufacture of glue from bone and any other collogenous matter. It is undoubtedly one of the worst smelling manufactures, because the bones, before getting into the caldrons, are mostly putrid. But scientific inquiry has established that the mere smells from this manufacture do not alter the vital statistics, either of those who are engaged in it, or of those who have to suffer the smell of its effluvia.

Brick-burning produces a mixture of smoke and evil-smelling fumes, which travel for many miles; these fumes have been rightly declared by a decision in the Court of Chancery to be a nuisance to the inhabitants whose houses they reach, and the Court would restrain the nuisance without requiring any scientific evidence upon the subject.

Fellmongering is an offensive trade, mainly because it is mostly carried on without due regard to cleanliness. The skins of animals are painted with cream of lime and then put in a warm place until the epidermis and hair comes off the skin proper. Some hides are made to shed their epidermis and hair by being hung up in moist, cool rooms to 'sweat,' as it is termed—in reality to undergo a first stage of superficial putrefaction without the intervention of lime. Leather dressing also gives rise to various effluvia, such as from dogs' fæces, which are used and said to be indispensable, and

from coarse animal oils, with which skins are impregnated.

Soap-boiling and Tallow-melting give rise to disgusting odours, some of which, being attributes of volatile fatty acids, or of alkaloids, have the unpleasant property of adhering to the hair and clothes. While the effluvia of these trades cannot be said to be directly injurious to health, they are like that of brick-burning, certainly very unpleasant, and should not be allowed to annoy communities. Such trades should be carried on in isolated places. When manufactories are, or have become, surrounded by habitations, they should be displaced compulsorily, but with due indemnity to the proprietors.

There are many other trades and manufactures which may be carried on in so negligent a manner as to be offensive or even injurious to health: thus, a tobacco mill was held to be a nuisance; furnaces for burning bones or blood for making animal charcoal; chemical works from which sulphuric acid or hydrochloric acid escaped; bleaching and dye works from which sulphurous and other vapours were distributed. Many of these give rise more to civil disputes about injury to property than about evil effects to health. But with the aid of scientific sanitarians most of these nuisances have been abolished, or are in course of being removed. (See Offensive Trades. *Cf.* the Public Health Act, 1875, c. 112 to 115.)

SMOKE AND ITS PREVENTION.

The production of smoke by the ordinary domestic operations of cooking and warming, and by the thousands of manufacturing processes or fires for

the production of power, fixed or movable, like those in ships and locomotives, is one of the most important sanitary and economic subjects of consideration. Some of the mechanical effects of smoke are that it obstructs light, and soils all objects with which it comes in contact. By these it causes economical losses which the reader will easily sum up for himself. But the chemical effects of smoke are much more serious, and some of these are directly injurious to public health. When mixed with water vapours in the state of fog, during calms in cold seasons, smoke develops all its obnoxious qualities. It directly injures the eyes, noses, and lungs of healthy men and beasts, and makes traffic difficult and dangerous. But it injures much more, and sometimes fatally, those who are out of health, the generally weak and sick, and particularly those numerous sufferers from acute or chronic affections of the respiratory passages. There can therefore not be the least doubt that smoke as now produced in large districts and large towns is a serious nuisance from the sanitary point of view, and should be abated by all means in our power. Smoke from coal has also an economical disadvantage connected with it, in that it contains, besides the tarry products, sulphurous and phosphoric acid. These settle upon corrodible matter, lime and dolomite stones of buildings, mortar, metals, particularly iron, and destroy them. As regards fireplaces in factories, etc., the law (the Public Health Act, 1875, c. 91, Nuisances) provides that they shall consume their own smoke. Considerable latitude was formerly given to public authorities in permitting, at least for a time, smoke to escape from works for the coking of coal, the calcining of ironstone, the burning of limestone and cement mixture, the burning of bricks, earthenware,

tiles, or pipes for drains, the raising of minerals from mines, the smelting of metal ores, the working of metals in whatever manner by fire, the manufacture of glass, and others. Some of the cases here mentioned are by no means simple smoke nuisances, but the escaping smoke is sometimes heavily charged with chemical products, being collateral results of the manufacture. Thus the smoke from soda glass works contains hydrochloric acid, that from earthenware kilns contains this acid and salt; effluvia from phosphate works contain hydrofluoric acid, and vapours from metal-smelting works contain arsenic in one form or another; copper and lead are also volatilized together with smoke in not a few instances. With all these cases the sanitarian should make himself well acquainted, in order to be able to aid the manufacturers by scientific advice, and the public in obtaining pure air. It is a satisfaction to know that all compulsion hitherto exercised by law against manufacturers has been of positive advantage to them, in helping them to economize their coal, and collect useful products, *e.g.*, hydrochloric (or muriatic) acid, which formerly they lost. It will be much more difficult to effect the necessary improvements in the use of fuel in private houses. For here we meet with hindrances which arise from the fundamental laws concerning land and house property, and which nothing but the widest measure of political reform, or a veritable social revolution, can overcome. We cannot discuss this important political question at length in this place, but we can formulate categorically the reforms which sanitary science indicates as necessary. All buildings should form one property with the soil on which they stand, and the land by which they are surrounded, as far as it is necessary for their useful occupation. This is necessary to give

to owners the required interest for the making of those permanent constructive arrangements which are the first condition of the cure of the smoke nuisance. A mere ground leaseholder has only one interest, namely, to build as cheaply as he can: a freeholder has the permanent interest to build as well as he can. He may fairly be compelled to construct what remains to him for ever. But a leaseholder is only a little better off than a mere tenant; and a mere tenant is quite helpless as regards these questions: if he be rich enough to make the structural alterations required for the consumption of smoke, he loses the whole of his expenditure at the termination of his tenancy; but as he is mostly not in a position, or not willing, to improve at great expense the property of others, the necessary recognised improvements are not made, and smoke is triumphant.

The sanitarian has to see what can be done to mitigate by symptomatic treatment the evils which must eventually be eradicated. Smoke from private houses may be diminished—(1) By burning coal-gas for some minor operations of heat-production for which now much coal is wasted; (2) By burning coals which by their nature do not give out smoke of the objectionable kind, *i.e.*, anthracite; (3) By burning coke—that is to say, carbon from which the volatile smoke-forming elements have been abstracted by skilful manufacturing processes. It is this skilful manufacture of coke by processes lately elaborated which seems to us to offer the first available means for the abatement of the smoke nuisance. As soon as smokeless carbon can be produced at a price not exceeding the value of common sorts of fuel, every householder may be compelled to have smokeless fires only.

OBSTRUCTIONS AND NUISANCES IN STREETS.

Obstructions and nuisances in streets are only in part subjects of sanitary consideration, the rest are matters for the cognizance merely of the police. Amongst the dangerous nuisances are rabid dogs, and dogs infected with parasitic diseases, so-called entozoa. Other dangers to streets and passengers are connected with petroleum and explosive substances. The safe keeping of petroleum is regulated by the Petroleum Act, 1871, 34 and 35 Vict., c. 105; the former Act was extended to nitroglycerine and other dangerous substances. Petroleum, which gives off an inflammable vapour below 100° Fahrenheit, may not be sold without a label being attached to the vessel in which it is sold, setting forth that it is so inflammable. The Explosives Act, 1833, deals mainly with measures for public security.

FIRES AND THEIR EXTINCTION.

Fires are mainly private, but become public dangers to property, and also to health and life. (*Cf.* Public Health Act, 1875, Police Regulations, c. 171.) The measures for their prevention are mainly in the hands of builders, for the most frequent cause of fire is faulty construction of fireplaces. This fact leads to the same considerations concerning the laws of real property as those which we have discussed under the chapter relating to the smoke nuisance. The student may peruse on the matter the Report of the Select Committee of the House of Commons on protection from fire, session 1867, No. 471. He should also remember what we have stated above, as the fundamental

condition of a good water supply, namely, that it should by quantity and high-pressure always available be capable of being used for the rapid extinction of flames. In Germany liquid *carbonic acid* is now used for the extinction of flames, and sold in bottles of which each gives out 4,000 litres of the gas.

HACKNEY CARRIAGES AND LOCAL AMBULANCES.

Hackney carriages come under the consideration of the sanitarian, because they are liable to be used for the conveyance of persons labouring under infectious diseases, and then by retaining infective matter, to transfer the disease to healthy persons, who may use them after the sick. As regards exanthematic typhus, scarlatina and diphtheria, this danger is very near; as regards typhoid or enteric fever, and cholera it is more remote. But it should be avoided in all cases in which the disease can be known to be in any way infectious. The exposure of a person in a state of infectious illness in a hackney carriage licensed to ply for hire is therefore properly considered to be a dangerous nuisance, and liable to be punished. To aid in avoiding such occurrence Local Boards may or shall provide special carriages, ambulances, in which infectious cases can be transported. The student should make himself well acquainted with the best mode of construction applicable to such ambulances: they should be handsomely and well constructed vehicles, so as to avoid that their appearances should produce any disinclination to their use, and to make their interior easily amenable to disinfection.

CONSERVATION, BURIAL, AND CREMATION OF THE DEAD.

It is a demand of public health science that the dead should be disposed of in such a manner as not to cause injury to the living. This rule applies with the greatest force to the bodies of persons dead from acute infectious diseases. But it also affects every dead body in this sense, that as it may become dangerous by entering upon a state of decomposition, although the disease or other cause from which the person died was not an infectious one, it should be disposed of as soon as possible, with due regard to the exigencies of human life and feeling. Corpses give rise to more than one so-called septic poison, whether it be a microbe or a shapeless ferment. Most of these poisons are transferable by inoculation, and many are the students, doctors and anatomists who have fallen victims to such accidents, either in losing their lives—the most frequent result—or in losing limbs and health as the price of a narrow escape from destruction. The rules for counteracting corpse-poison the student will find exhibited in every dissecting-room. The rules, however, for preventing effluvia or molecular matter from the dead, from causing injury are more difficult to define, though, when once defined, less difficult to execute. A corpse should be placed as soon as feasible into a coffin, made water-tight, so that no liquid oozing from the body may leave the coffin. The very best mode of enveloping and keeping before burial a corpse is to surround and cover it in the coffin with dry pine sawdust, to which anhydrous zinc sulphate in fine powder has been added. Four kilos of the salt should cost two shillings at the most, and be able

to take up (at 44 per cent. of H_2O in zinc vitriol) $4 \times 785{\cdot}7 = 3142{\cdot}8$ grammes of water, therefore much more than any body could exhale in the most active state of decomposition. The sawdust of pine, being penetrated by turpentine, is a perfect disinfectant and deodorant. The mixture therefore impedes and kills external microbia, oxidizes all evolved smelling gases, absorbs any and all oozing liquids, and mummifies in a slow manner by absorbing moisture. At the price of a few shillings, therefore, any corpse can be made innocuous to health, and inoffensive to the senses. If it were said that the sawdust daily produced would not suffice to serve the purpose generally, it may be answered that it would be worth while to transform pine-wood into dust for the purpose of enveloping the dead, and enabling the living to consider them without that aversion which produces such a bitter conflict of feeling in many minds.

Local Authorities are empowered to provide reception houses for the dead of the poor, sometimes called mortuaries. It is clear that the treatment of corpses indicated in the foregoing is particularly desirable in such places, which are necessarily visited by many persons.

Burial-places or cemeteries should be selected so as to offer dry, sandy, gravelly, chalky, or otherwise porous soil, through which air can easily penetrate, and effect the natural eremacausis which is the most desirable mode of dissolution of human remains. Clayey soils, and all situations in which the underground is liable to contain stagnating water, should be avoided. Burial-grounds should be at some distance from human habitations, and so situated that their underground drainage is not

liable to contaminate wells situated in the course of the drainage.

The progress of sanitary science caused the old modes of burying in and around churches or places of worship, and depositing bodies in coffins below churches in vaults, to be not only abandoned, but to be forbidden, by law. The horrible conditions sometimes produced by this now illegal practice baffle description. At St. Peter's, Colchester, the mites (*sarcoptes setosus*), which multiplied in the coffins, in the vaults, one day paid a visit to the living, covered the benches in the church like a film, and drove out the congregation. This case and other experiences have made it necessary not only to prevent further deposits of corpses in vaults under churches, but also to remove and dispose in cemeteries in proper situations of those which had been mouldering there for ages. To appreciate this now past state of affairs, the student should read Mr. Frank Buckland's account of the clearing of the vaults under the church of St. Martin's-in-the-Fields, Trafalgar Square, and of his search for and finding of the body of John Hunter. Burials are regulated by the Burial Acts, a series of eight statutes, and by various clauses in sanitary Acts and Acts concerning Local Boards.

During the last twenty years a desire has arisen in many persons of the better classes to introduce burning by fire, so called *cremation*, as a mode of disposing of the dead. In several parts of the continent this has been actually carried out, and any person may either be buried or burnt after his death. In Britain also a society has made arrangements for systematic cremation. After careful inspection of the Crematorium at Woking, and practical experience of its performance, we can pro-

nounce the institution and its process as simply perfect, and worthy of all public confidence.

NUISANCES AND THEIR REMOVAL.

Blackstone, in his *Commentaries*, says that nuisance, nocumentum, or annoyance, signifies anything which works hurt, inconvenience, or damage. And nuisances are of two kinds; *public* or *common* nuisances, which affect the public, and are an annoyance to all subjects, for which reason we must refer them to the class of public wrongs, or crimes and misdemeanours; and *private* nuisances, which may be defined as anything done to the hurt or annoyance of the lands, tenements, or hereditaments of another. The sanitarian has to deal with *public* or common nuisances only; to them belong things or proceedings which make the enjoyment of life uncomfortable, or are injurious to health. But injury to health need not necessarily be a consequence for an occurrence or a thing to be a nuisance. The action of the sanitarian is confined to common or public nuisances which are likely to injure the health of persons passing by or living near to the place where the nuisances exist.

The Public Health Act, 1875, c. 91, defines the word 'nuisances' as including (1) any premises in such a state as to be a nuisance or injurious to health; (2) any pool, ditch, gutter, watercourse, privy, urinal, cesspool, drain, or ashpit, so foul as to be a nuisance or injurious to health; (3) any animal so kept as to be a nuisance or injurious to health; (4) any accumulation or deposit which is a nuisance or injurious to health; any overcrowded houses or rooms which are dangerous or prejudicial to the health of the inmates; further, any factory,

workshop, or work-place not kept in a cleanly state, or not ventilated in such a manner as to render harmless, as far as practicable, any gases, vapours, dust, or other impurities generated in the course of the work carried on therein, that are a nuisance, or injurious or dangerous to health, and so overcrowded as to be dangerous or prejudicial to the health of those employed therein; further, fire-places or furnaces which do not, as far as is practicable, consume the smoke produced by the combustibles therein consumed, and are used for working engines by steam, or in any mill, factory, dye-house, brewery, bakehouse, or gas-works, or in any manufactory or trade process whatsoever.

Some of the subjects which may come under the definition of nuisances have already been considered in special chapters in the foregoing, such as the offensive trades, smoke, and others. *Cf.* also Public Health (London) Act, 1891, sec. 1 to 74 *et seq.*

The Local Authority has powers to disinfect premises upon the certificate of any registered medical practitioner, that the cleansing and disinfecting of any house or part thereof, and of any articles therein likely to retain infection, would tend to prevent or check infectious or contagious disease. The same authority may provide a proper place, with all necessary apparatus and attendances, for the disinfection of woollen articles, clothing, or bedding which have become infected, and they may cause any articles brought for disinfection to be disinfected free of charge.

Local Authorities may provide carriages for the conveyance of infected persons. Such persons may

not enter any public conveyance without notifying their condition to the owner, and paying him the expenses of disinfection, to which the owner or driver is bound to subject his conveyance.

The fundamental remedy for many nuisances consisting in good drainage and sewerage we have already described in a special chapter; also the measures which may be taken with regard to the exposure for sale of meat unfit for food; and also with regard to noxious trades.

DISINFECTION.

It is evident from the foregoing that the foundations of Public Health are clean and well-ventilated habitations, a perfect drainage of all inhabited places and their surroundings, and a sufficient supply of pure water for all purposes of diet and comfort. It is also evident that sewage must be disposed of in such a manner that it can never become dangerous to health. If these conditions were all fulfilled in an entire population, several of the most important infectious diseases would have no chance of propagation. In cases where such diseases do arise, or where the conditions which favour their development exist, it becomes advisable to destroy the disease-causes or the favouring matters by artificial means. This process is called *disinfection*. The term, as practically used, is made to include also those means which *deodorize* offensively smelling matters. But the student should bear in mind, that while some of these deodorizers are very useful adjuncts, they are not at the same time destroyers of disease-causes. Also, not all disinfectants are available for use on a large scale. Thus bichloride of mercury, or corrosive sublimate,

is an excellent disinfectant and destroyer of bacteria, but its use on a large scale by unskilled hands would be fraught with danger, to which nobody ought to be exposed. The disinfectants and deodorants which are commonly used are the following: quicklime; chloride of lime; chloride of soda; carbolic acid; sulphate of zinc; chloride of zinc; sulphate of iron; chloride of iron; chloride of manganese; manganate and permanganate of potash and other bases; chlorine gas; nitrous acid gas; sulphurous acid gas.

Quicklime is used as milk of lime to whitewash walls and ceilings in infected places; it is also largely used to disinfect cattle trucks. In the case of these railway carriages sufficient cleanliness must be practised before the whitewash is applied. If the whitewash is applied to unclean infected surfaces, the infectious matters are liable to be only enveloped, without being destroyed. And thus an apparently disinfected, because newly whitewashed, cattle truck can infect animals which are placed in it. Quicklime is also used as dry powder, *e.g.*, for covering an ox, dead of splenic fever, in the trench in which it is to be buried. This will prevent the earth-worms from getting at the carcase and carrying the spores of the bacilli upwards. Chloride of lime may also be used as a milk, but as it has an action different from that of quicklime, it must be more diluted; a pound may be shaken up with a gallon of water, in which case nearly all that is active as a disinfectant will dissolve, and any insoluble matter may be thrown away. *Chloride of lime* is the most powerful and certain disinfectant, particularly of disease-causes and products. But it is not so useful as a deodorizer, unless, indeed, it can be washed away quickly after use; for its action

being destructive of almost all organic substances, gases are evolved during the decomposition which have themselves a disagreeable odour. *Chloride of soda* is a perfect solution, and preferable to the lime compound in some respects, though dearer. *Carbolic acid, or phenol,* is mainly useful by its power of combining with albuminous substances, and making them imputrescible. It may be used in solution in water, with which it mixes in any proportion; for large surfaces a one per cent. solution is a practical recipe. *Sulphate and chloride of zinc* are powerful, the first as dry powder, and in solution, the latter in strong solution. They deodorize very well, and are useful for directly disinfecting the evacuation of sick persons. In a similar manner, only weaker, act *sulphate and chloride of iron.* The sulphate or green copperas is a good deodorizer for ammoniacal and sulphuretted surfaces and matters; it should be dissolved in hot water, as it contains a great amount of water of crystallization; more than ten times its weight of additional water should not be employed for its solution. *Chloride of iron and manganese* would be sold most cheaply in the form of concentrated solutions; these may be diluted with ten times their bulk of water. *Manganate and permanganate* are sold in concentrated solution, the latter in the shape also of dry crystals. These substances are useful for removing smells from surfaces; like chloride of lime, they also destroy organic matters, when applied in sufficient quantity, but the chloride is as yet much cheaper, though more disagreeable, than the odourless permanganate.

The best mode of disinfecting a room is by distributing chlorine gas in its atmosphere. The rooms being unoccupied, place a quarter of a pound of

chloride of lime in a wide basin, stir it up with a quarter of a pint of water, and pour into the mixture a quarter of a pint of hydrochloric (muriatic) or dilute sulphuric acid. The person who has to mix these matters should be cautioned not to inhale the vapours, which are rapidly evolved. *Nitrous acid* gas is also a powerful destroyer, and can be produced from copper, one ounce, and nitric acid, three ounces. *Sulphurous acid* is the weakest disinfectant of any, and as much as three pounds of it will retard the fermentation of a hundred gallons of must only for a few days, so that it is not fatal to the yeast plant: it seems to have more control over the viscosity plant.

The bodies of living persons may be placed in a bath, to which permanganate of potash is added in quantity to colour the water deep red; body linen and washing apparel are best disinfected by boiling with water in a copper; clothing and bedding may be heated in closed chambers filled with steam; mere heating in hot-air chambers without steam is less certain to destroy all germs, as they, when dry, have great power of resisting even high temperature, while in moisture they perish at the curdling temperature of albumin.

Ships should be disinfected like houses. Ships in which yellow fever has appeared must be disinfected with the greatest care by fixed and gaseous disinfectants, as the contagion of yellow fever is liable to become a true miasm, and to be suspended in the atmosphere, particularly the air of deep holds, which is stagnant and impure. The French Admiralty disinfected a transport by scuttling it, and leaving it submerged for a fortnight at St. Nazaire.

ALPHABETICAL INDEX.

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