effect of colour on vision, and for this purpose he has kept rabbits in hutches which, whilst amply provided with the most modern system of ventilation, and perfectly clean, have prevented the occupants seeing any light whatever which was not filtered through the coloured glass in the windows. After leaving the animals in for some months they were taken out, killed, and the eyes examined under the microscope. Dr. Johnson showed a number of charts illustrating the marvellous improvements in vision which continued application of this spectrum blue had wrought in certain grave diseases of the eye.

The PRESIDENT, in closing the meeting, remarked that he had used Dr. Johnson's spectrum blue glass, and could confirm the results attained.

SOME CAUSES OF PREVENTIBLE DISEASE.*

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"DISEASES are more easily prevented than cured," says Farr, and the first step to their prevention is the discovery of their exciting causes; and the science which has to do with the prevention of disease, or the preservation of health, is called public hygiene.

Disease has been differently defined by various pathologists and medical authorities. Thus, Green says—"By disease is understood some deviation from the state of health, a deviation consisting for the most part in an alteration in the functions, properties, or structure of some tissue or organ, owing to which its office in the economy is no longer performed in accordance with the normal standard. Disease in most cases is merely an abnormal performance of those processes which constitute life." Hilton Fagge, again, says that many attempts have been made to frame a satisfactory definition of disease; but hitherto no better result has been arrived at than that it is the opposite of health, a derangement of structure or of function in some part of the body, or in the whole of it causing pain or discomfort, or tending to shorten life. Russell Reynolds defines disease to be any condition of the organism which limits life in either its powers, enjoyments, or duration. The central idea that runs through all definitions of it is, that

* Read at the Meeting of the Sanitary Association of Scotland, held at Inverness, July, 1889.

it is the opposite of health. Unless, then, we know what a healthy life is, the definition of disease must be imperfect. Now, until we can form a standard of life, and say what atoms, what molecules, and what relation of these to one another constitute health, it will be impossible to define health. Indeed, though we had arrived at such a precision of knowledge, the definition would still be inadequate. For as Paget says—"If there could be a fixed standard of health, all deviations from it might be called disease; but a chief characteristic of living bodies is, not fixity, but variation by self-adjustment to a wide range of varying circumstances, and among such self-adjustments it is not practicable to mark a line separating those which may reasonably be called healthy from those which may as reasonably be called disease." But though an exact scientific definition of disease is not attainable, being a relative term, it is not necessary for our purpose. The definition that comes nearest to my way of thinking is that given by the late Professor Sanders—"Health is life under favourable conditions, disease is life under unfavourable conditions."

We have next to consider what is the cause of disease. Every human ailment must be traced either to a man's hereditary predisposition, or to the influence of his surroundings. The influence of heredity on disease is well known, and is truly remarkable. As often in father and son bodily shape, peculiarity of gait, and similarity of ideas can be traced, so can the diseased forms of these. Thus insanity, fits, neuralgia, asthma, and other nervous diseases are due to the influence of heredity. So, too, the diseases of the pulmonary system are liable to be transmitted from father to son. Pulmonary consumption has a marked tendency to appear in families. Weakness of the digestive system, in whole or in part, may be the heirloom of families, as shown by stomach, liver, and bowel troubles appearing again and again in descendants. Diseases of the blood are prone to be hereditary, as gout and rheumatism. Weakness of the whole system, as scrofula, belong to the same category. Tumours or growths in the body often appear in one family after another, such as cancer and simple growths. The different specific diseases are more liable to attack one family than another. In reference to this Sir John Simon says, "that the certainty of premature death—a certainty quite irrespective of the immediate influence of exterior circumstances—is a condition under which many are born. Children come into the world, sometimes with malformations, which render life impossible; sometimes with inherited disease or inherited morbid predisposition; sometimes with

various ill-defined weaknesses of vitality, which render them unable to struggle onward even for a single year, or dispose them more readily to sink under the ordinary trials of infancy. One family has become liable to gout and rheumatism; another to tubercular diseases; another to epilepsy and mania; another to this or that other of visceral or humoral disease; and children born of these stocks have not the average expectation of healthy life. A certain share of every existing generation has in it from these sources the seeds of premature death. In respect of many of the cases referred to, medicine has hitherto but imperfectly learnt the art of prevention." But Sir John adds—"in respect of others (and fortunately this applies to the most fatal of the number) exterior circumstances can be shown to exert immense influence over the development of the individual predisposition, and perhaps also exert some influence over the further propagation of hereditary fault." The lesson to be inferred from this is, that a person should study the hereditary diseases of his ancestors, and try to prevent them by attention to his surroundings, and also marry into a healthy stock.

Now, if all the human race were descended from the same individuals, and the environments were always the same, then the whole race would be exactly similar. They are not the same, as the surroundings differ; indeed, are constantly changing. Hence the different diseases of man are due to these different surroundings originally, and may be said to be natural variations. But further, disease is inimical to life, and must cause death sooner than without it. Hence those whom it attacks die sooner than they ought to, and leave behind them fewer to become affected by the same diseases. Especially is this the case with disease that affects man before the procreative period. There can be no doubt, then, that disease would be gradually eliminated if mal-environments were not constantly reproducing it.

Hence, of the two elements in the causation of disease—hereditary predisposition and unhealthy surroundings—the first must be included under the second.

We have thus arrived at the conclusion that mal-environment is the cause of preventible disease, and we have next to consider what some of these unhealthy surroundings are.

First among them are food and drink. "So great," says Parkes, "is the influence of food on health, that some writers have reduced hygiene almost to a branch of dietetics." Then again he says—"The diseases connected with food form probably the most numerous order which proceeds from a

single class of causes; and so important are they, that a review of them is equivalent to a discussion on diseases of nutrition generally." There are various ways in which food might cause disease. It might be improper in quality and quantity, it might be given in excess, or it might be deficient to nourish; it might be taken in improper proportions; the food might be diseased, and as such lead to disease of the same as, or of a different nature from, the diseased food; or it might be loaded with poison of an animal or of an altogether extraneous kind. In the economy food might generally be said to have two purposes—the one to build up and maintain the structure of the body, and the other for the evolution of force. The body is not like a machine that when once made it serves its purpose till it is worn out. The very life of the organism consists in change; indeed, incessant change seems a necessary condition of every known form of existence, and this change is established and carried on by the ingestion of food. In the same way the body could not stand still and do no work. It is an essential of health that the proper nourished frame should be performing work. So that disease will be produced by the imperfect administration of food for either or both of these two great purposes—bodily structure and exercise of all the proper functions of the body.

Now, the several articles of human food contain very different proportions of digestible and indigestible substances, and, moreover, offer very unequal degrees of resistance to the action of the digestive secretions. Hence it follows that some foods are much more digestible than others, while some are very indigestible. At the same time, the absorptive power of the intestine has limits, the overstepping of which reduces proportionately the value of the nutritive administered. Hence the overburdening of the digestive canal with materials which it cannot perfectly elaborate is, in the highest degree, hurtful (Bauer). Especially is this the case with the feeding of infants. No greater destruction to life, no greater amount of suffering to humanity can be imagined than is done by the improper feeding of infants, by which the foundation of life is sapped at its start, and the result at the best is a weakly individual and a degenerate race. The digestive powers at birth are in a state of imperfect development. The saliva of an infant's mouth does not act upon starch in the same way as that of an adult. In fact, it is not meant to digest starch at all. The secretions of an infant's stomach can no more act upon meat than so much pure water. The absorptive power of an infant's intestine is very much more limited than that

of an adult, far less can it be expected to absorb what has not been chemically prepared for absorption. And yet it is astonishing to what an extent the custom prevails amongst ignorant mothers of giving the actual food they are eating themselves to the youngest infants. In reference to this, Dr. Allan Jamieson in his book on skin diseases says—"That the mammary gland in the female is no longer to be regarded from its functional but merely from its æsthetic side—indispensable to a due conception of beauty, but useless as a milk producer, the cow or goat, but more particularly the inventor and vendor of various infant's foods having taken its place. But a survival of the instinctive element in women is seen in the mother being incapable of refusing her child anything it may ask of which she herself partakes. Education has as yet failed to impart in many cases the necessary instruction which instinct no longer supplies. A modern mother, in too many cases, is in a state of blissful ignorance as to how her infant should be fed, and the counsels she receives from trained and untrained nurses, and the tribe of old women, always so ready with advice on any subject, are not calculated to improve matters. The newspapers are crammed with advertisements of wonderful feeding stuffs, many, no doubt, excellent in their places, but few capable of replacing healthy women's milk. But bold assertion does much, and the sale of such substitutes must be immense." Then, again, Sir John Simon tells us "that there are certain large towns where women are greatly engaged in branches of industry away from home; where, consequently, the home is ill-kept; where the children are little looked after; and where infants who should be at the breast are improperly fed or starved, or have their cries of hunger and distress quieted by those various fatal opiates, which are in such request at the centres of our manufacturing industry." I do not know in this age, great in popular lectures, anything that would do more good in its kind than a well devised and easily intelligible course of lectures for young mothers how to feed their infants.

This, gentlemen, may appear to you to be away from my subject, but I assure you it is not. I consider that the infant mortality is a test of the health of any population. It is likely, if the infant mortality is high, that there is a corresponding high proportion of infant illness, and in proportion to the degree of illness a weakened race will be the result.

When food improper in kind is taken into the stomach and is not digested it passes on into the bowels and sets up diarrhœa. There are two kinds of diarrhœa. The one is a mere

concomitant of some other disease, as the diarrhœa of typhoid fever, cholera, consumption, &c., and the prevention of this kind is only to be attained by the prevention or curing the original disease. The other kind of diarrhœa is that caused by irritant food, and it can be prevented by attention to the diet.

In the next place food must not only be of a proper kind for digestion, but it must be given in proper proportions to prevent disease. It has been ascertained that the proper proportion of nitrogenous to non-nitrogenous is 1 to $3\frac{1}{2}$ or at most $4\frac{1}{2}$. If this proportion were upheld, far less food than is usually taken would be required for maintaining the body in a healthy state. Moleschott has computed that 9 oz. of albuminous food, 6 oz. fatty, 28 oz. carbohydrates and 2 oz. salts is the daily allowance for a working man. The excess over this is thrown out as waste, or taken to the liver to be destroyed there or stored up as fat. Physiological research has now pretty clearly established the fact, that the liver exercises most important functions in assimilation and nutrition. Murchison says that "many observations, pathological as well as physiological, point to the conclusion that the liver is not only a blood-forming organ, such as that white blood corpuscles take their origin in the liver, but a blood-destroying or purifying organ as that the red corpuscles are destroyed there, and that it contributes in a great degree to the destruction of albuminous matter derived from the food and textures, and the formation of urea and uric acid, which are subsequently eliminated by the kidneys." Other functions of the liver are, the secretion of bile and the formation of glycogen. But it is the connection with its destruction of albuminous matter and formation of urea that I want to speak of. When the albuminous matter is not properly disintegrated, instead of the soluble urea being produced, the insoluble uric acid is the result. The formation of uric acid and its retention in the blood lead to the condition known as lithiasis or lithæmia, typically represented by gout. Murchison holds, and I think rightly, that lithiasis may be manifested by very many diseases, such as gout, urinary calculi, biliary calculi, degenerations of the kidney, liver, and tissues throughout the body, local inflammations, constitutional diseases, &c. This diseased state is caused when more food is taken into the blood than is necessary for the nutrition of the tissues. The liver at first may be capable of dealing with this excess, but its energy through time gets overtaxed, and what was at first mere functional disease becomes real organic disease in the end. Alcohol often greatly aggravates this

diseased state. So long then as the excess of food taken in is thrown off by the kidneys, lungs, and skin, in the form of urea, carbonic acid, and water, there is no disease, but as soon as the liver fails to cope with the excessive work and produces a less oxidised salt as uric acid and oxalic acid disease follows. This diseased state, though a preventible one, gentlemen, does not fall within the province of the sanitarian so much as the physician, and with him the cure is not by physic but by regulation of the diet.

But one of the more important kinds of food is meat, and the condition or state of nutrition of the animal when slaughtered makes a considerable difference in the quality and composition of the flesh. All food may be said to come from the vegetable world. Some animals take it directly and live on it alone, and they are called herbivora. Others require it to be elaborated into organised matter before it can be digested and they are called carnivora. Others yet again subsist on a mixture of these two, and man is such an animal. Man cannot consistently with health be a vegetarian. The wide extent, therefore, to which meat is used, and the very important part it plays in man's dietary, make it essential that all meat should be of good quality. By a strange anomaly laws are made to prevent the adulteration of foods, and yet meat is left pretty much to discretion to be sold and eaten in a more or less diseased state. Some would draw the line at parasitic disease, and hold that the meat of any other diseased animal may and should be consumed. Others would condemn all meat that is in the slightest degree suspicious. I must confess that I belong to this latter class. I consider that the profit that butchers make by the retail of meat is so great, that they ought to be compelled to give to the public meat perfectly untainted. Why should other articles of food be labelled in large letters what they really are and not what they merely seem to be, while the meat of a diseased beast may be sold as that of a healthy beast?

First of all there can be no question that meat infected with parasitic disease and known under certain conditions to produce such disease in man, ought not only to be uncompromisedly forbidden as food, but the sale of it ought to be followed by severe punishment. Tapeworm may not be a fatal disease, but it is often a very troublesome affection and difficult to get rid of. Hydatids of the liver cause very many deaths. Trichina spiralis is a very deadly and painful disease, and we cannot always be sure that thorough cooking will avert the danger of infection. Happily this class of diseased

meat is such that all are nearly of one mind regarding its perfect unfitness for human food.

But regarding the next class there is not the same unanimity. The class I refer to are such diseases as pleuro-pneumonia, foot and mouth disease, small-pox, typhoid fever, and other contagious diseases of stock, splenic apoplexy of horned cattle and sheep, braxy of sheep, parturition fever of cows, red water of sheep, and other anthracic diseases. There can be no doubt, that the diseased meat of all these kinds has been and is eaten with apparent impunity. If meat is thoroughly cooked, much that would be hurtful may be destroyed. The stomach has a certain amount of protective force in its digestion. The liver, too, may prevent to a certain extent the entrance of poison into the system. But though thorough cooking of meat is always a wise precaution it cannot always be relied upon; for though it may destroy the bacilli causing the original infectiveness, cooking even to a great heat will not destroy the ptomaines or ferments caused by these microbes. Indeed, in regard to the animal itself which is infected, Coats says, "that it is not to be inferred that the micro-organisms, where they are concerned, themselves irritate the tissues;" "it is more probable," he says, "that the irritation is due to chemical products resulting from the vital processes." Hence Lauder Brunton in his Croonian Lectures alleges that meat which has become tainted by the presence of putrefactive microbes, may possibly be cooked sufficiently to destroy the microbes themselves, while the ferment they have formed continues to decompose the meat and give rise to poisonous substances. "We can thus see," he says, "how a cold beef-steak pie, or other cold meat, may become poisonous and produce serious symptoms, although the same food may have been eaten with impunity immediately after being cooked; for during the process of slowly cooking poisons may have been formed in the meat, although there may have been none in it immediately after it had been removed from the oven, and any microbes present were likely to have been killed by the cooking."

Then, again, though the stomach and liver of a healthy person might be capable of destroying what is hurtful in diseased meat by the process of digestion, those of a person ill might not have the same power. Nay, more, what might not be hurtful to the one might be so very much to the other. Indeed, Pasteur has shown, that there are some diseases that cannot be produced by inoculation in the lower animals, if the animals are healthy and well and properly fed; but if you

feed them on putrid meat the inoculation at once takes. So, too, Pasteur has shown that some animals in a state of health are refractory to some diseases, but if the part is injured or bruised the inoculations will then take. But even this does not cover the whole ground. For as Sir John Simon contends, it may very well be, that even where cooking can divest a meat of some original specific infectiveness, the meat may still not be susceptible of quite the same digestive changes as healthy meat when eaten undergoes. Besides, though the immediate effect of eating diseased meat may not at once be perceived, it may produce such a change on the system as ultimately to lead to some chronic disease. It is well known that boils may be produced by the consumption of meat of this class. Diarrhœa and digestive troubles are also a frequent result. It must be admitted, however, that there is a difficulty in proving the exact amount of illness produced by eating diseased meat, especially as the effects on different individuals may not always be the same, and this difficulty is enhanced when the question is often between meat and no meat, between the illness which may be slight caused by the eating of diseased meat, or death by starvation.

The custom pursued in the dead meat market as given in the *Glasgow Herald* reminds me very much of what Mr. Gamgee reported to Sir John Simon. The report said that—"Horned cattle affected with pleuro-pneumonia are much oftener than not slaughtered on account of the disease, and when slaughtered, are commonly (except their lungs) eaten; and this even though the lung disease has made such progress as notably to taint the whole carcass; that animals affected with foot-and-mouth disease are not often slaughtered on account of it, but if slaughtered are uniformly eaten; that animals affected with anthracic and anthracoid diseases, especially swine and horned cattle thus affected, are (except their gangrenous parts) very extensively eaten; that the presence of parasites in the flesh of an animal never influences the owner against selling it for food; that carcasses, too obviously ill-conditioned for exposure in the butcher's shop are abundantly sent to the sausage makers, or sometimes pickled and dried; that especially diseased organs will often, perhaps commonly, be thrown aside; but that sausage makers will utilise even the most diseased organs that can be furnished them—that the principal alternative on a large scale, to the above described human consumption of diseased carcasses is, that in connection with some slaughtering establishments, swine (destined themselves presently to become human food)

are habitually fed on the offal and scavenage of the shambles and devour—often raw and with other abominable filth, such diseased organs as are below the sausage maker's standard of usefulness." It is horrible to relate such a state of matters, and we need not expect much protection from it on humanitarian grounds, but it must be got by law of an obligatory not permissive kind.

There is still a third class of diseases in animals, the true nature of which has only recently been discovered. I refer to the class of diseases represented by tuberculosis, actinomycosis, and such like. This class differs greatly from the preceding classes. For the animal may not appear ill, indeed often seems to be in the best of health, and is killed for the sake of its meat. The meat of the slaughtered animal generally appears to be healthy looking, seems of good quality, and eats well—it may be without any taint or suspicion. And yet for all this it may be ladened with disease germs, capable of producing in the consumers of it, if predisposed to the affection, one of the direst diseases that afflict the human race. No one deserves greater credit for laying this danger before the public than Dr. Russell, the eminent medical officer of health for Glasgow. Dr. Russell's scientific attainments and his remarkable practical ability have deservedly placed him in the foremost ranks of Scotch sanitarians; and the Sheriff's decision in the recent case condemning tuberculous meat has paved the way for preventing the consumption of such meat in the future. The pathology of tubercular phthisis in man has made great advances within very recent times. Not long ago bronchitis, broncho-pnuemonia, pneumonia, tubercular phthisis, and other pulmonary troubles were confusedly mixed up under one common head. Wasting, sweating, and pyrexia by night were quite sufficient symptoms for branding the disease as tubercular phthisis. The diagnosis now, however, rests entirely upon the discovery of the tubercle bacillus; and this can easily be made at a very early stage of the disease by the microscopic examination of the sputa. Now we generally find that one of the first symptoms noticeable in a consumptive person is the derangement of the digestive organs, so much so that consumption has been said to begin at the stomach. Therefore, I would presume, the stomach and other digestive organs are less able to resist the attack of these bacilli than they would be in a healthy state. Then, again, it is a most important fact, that when the starting point of the disease was in the lungs, and as they become much involved, and the sputum contains these germs in numbers, the

sputum may be swallowed and be passed on to the bowels, and cause ulceration of the bowels. Animals too have been fed with tubercular matter, and have contracted tuberculosis of the intestines and mesenteric glands. This tubercular ulceration of the bowels is proof that the bacilli were not destroyed by the gastric digestion, and that though the stomach might be capable of protecting itself from the action of these bacilli, it was not able to destroy them. It is also known that if the sputum is allowed to lodge about the larynx, the bacilli attack it and set up ulcerative laryngitis. Tubercular disease of the kidneys and the brain is by no means uncommon, and this fact renders it very probable that these bacilli get at these organs through the blood.

Now, in some of the diseases of the preceding class, as pleuro-pnuemonia of cattle, the disease only infects animals and not man. In this class it is entirely different. Not only are the tubercle bacilli known to infect man and cattle—indeed nearly all animals—but it is very likely the same bacilli in all cases. For experimental purposes these bacilli can be transferred from one animal to another, and they are found to multiply and breed and cause the same kind of disease. In reference to this, Theodore Williams says, "that tubercle bacilli abound in perlsucht or bovine tuberculosis, and in the tubercle of horses, and were found in all the tubercular lesions of the various carnivora and rodents experimented on. Bovine tubercle contains bacilli in greater abundance, as a rule, than human tubercle, and is stated to be more effective for inoculation purposes, the experiments of Koch and Watson Cheyne showing that the relative success in inoculating animals depends on the number of bacilli contained in the inoculating material. Bovine tubercle produces more certain results than human, and culture fluid containing the largest number of bacilli being the most successful of all." "Bacilli," he continues, "have been detected in the milk of cows affected with bovine tuberculosis, but it appears that this is not the case unless the milk glands or udders are affected." If we take into account, then, how easily the disease can be recognised by the microscope; if we take into account how extensively these bacilli attack the body—that they are found not only in the glands and lymphatic system generally, in the lungs, kidneys, intestines, liver, brain, larynx, but even in the blood and milk; if we take into account that these bacilli grow and multiply and flourish in almost any kind of vertebrate animal; if we take into account how exceedingly difficult it is to kill them—that their spores resist much disinfection

and high temperatures, and that the vitality of healthy tissues cannot resist their influence; and lastly, if we take into account how prone or predisposed a great number of the human race is to this disease, and what a mortality yearly occurs from it, it would seem to be not only mere folly, but perfectly inconsistent, to be doing so much to prevent the occurrence of tubercular phthisis in man by attention to all other matters that favour its development, such as damp houses, damp soil, impure air, and so forth, and yet neglect this which threatens to be the most important and general of all causes. I am therefore decidedly of opinion that all animals distinctly and clearly proved to be suffering from tubercular disease, no matter what stage the disease is in, are not fit food for man, and as such ought to be unqualifiedly condemned. Meat in a state of decomposition or poisoned, should not be eaten for obvious reasons. In reference to this, Lauder Brunton says, "That there may be very great danger indeed of poisoning by alkaloidal substances formed in meat by its decomposition. Yet we know that while tainted beef is strongly objected to, high venison is looked upon as a delicacy, and the experiments of Bocklisch indicate that very probably the presence of two kinds of bacteria may be the cause of poisons being formed, and that the danger is increased when the high meat has been diseased, for then there are the putrefactive bacilli with the microbes of the particular disease." Finally, foods are often adulterated, sometimes with poisonous or hurtful substances, sometimes with innocuous principles. It is the object of the Adulteration of Food Acts to prevent this. Adulterations with harmful substances should be sharply punished, and if not harmful, ought still to be prevented, as the substituted substances must be of less value, and generally less nutritive, than the real, otherwise there would have been no necessity for such insertions.

I have already said so much about foods as to show you how injurious an environment they may become, and lead to disease. But I cannot leave this part of my subject without taking up some of the drinks.

The first drink to be mentioned is alcohol. Alcohol, when taken into the body, undergoes certain changes, and produces certain effects. About 25 per cent of it is oxidised into carbonic acid and water—thence it is a source of heat. In small doses it excites, while in large doses it paralyses the nervous system, it diminishes the sensation of hunger, and excites the vascular system. Landois and Stirling say "that alcohol in small doses is of great use in conditions of temporary

want, and where the food taken is insufficient in quantity. When alcohol is taken regularly, more especially in large doses, it affects the nervous system, and undermines the physical and corporeal faculties, partly from the action of the impurities it contains, such as fusel oil, which has a poisonous effect on the nervous system; partly by the direct effects, such as catarrh and inflammation of the digestive organs which it produces; and lastly by its effect on metabolism." It lowers the temperature in moderate doses, and is of great use in some diseases. Taken in moderation alcohol does not seem to be injurious, but is rather a food, though an expensive one. Parkes gives 1 to 1½ fluid ounces of absolute alcohol as the minimum amount that can be consumed in the twenty-four hours, and in this quantity it is harmless. One ounce of absolute = 2 fluid ounces of brandy, or 5 ounces of sherry, or 20 ounces or a pint of beer. Parkes says—"It does not appear to me possible at present to condemn alcohol altogether as an article of diet in health; or to prove that it is invariably hurtful as some have attempted to do. It produces effects which are often useful in disease, and sometimes desirable in health." Notwithstanding all this I do not believe that there is any one other substance known that does more to produce disease, and to hinder recovery from disease, than alcohol. For if taken at all, it is rarely taken in such small quantities as the physiological dose. Still the effect on different individuals is not the same; some can take large quantities without any apparent bad effect, while small quantities will kill others. When it is taken long and to excess it leads to premature old age; it causes various well marked diseases as those of the nervous system, turns like epilepsy, paralysis, brain troubles, &c.; diseases of the digestive system, as cirrhosis of the liver, gin drinker's liver, fatty liver, gastritis, diarrhœa, &c.; diseases of the urinary system, as Bright's diseases of the kidneys, cystitis, &c.; diseases of the blood system, heart troubles, as fatty heart, atheromatous arteries; degenerations of any or all the tissues of the body; the deposition of fat; special poisonous effects, as alcoholism; and renders disease more fatal in the attacked. Accordingly, though I strongly condemn the abuse of alcohol, I do so from the scientific standpoint. The hysterical and nonsensical ravings of the teetotallers and total abstainers do far more harm to their cause than good. I consider it is very bad taste to limit other people's tastes by their own. It never will prevent sensible people from drinking to hear the lavish abuse of it by reformed drunkards, who now don't drink

because they cannot, while it may prevent them to tell them the actual diseases it has produced and will produce.

Milk is a complete and typical food, in which are present all the constituents necessary for maintaining the life and growth of the body of an infant. That from diseased animals is liable to quick decomposition. On account of its nourishing properties it is a suitable pabulum for many disease germs, and it is as a conveyer or medium of conveying disease that it most concerns us. Scarlet fever, for instance, is often carried from person to person in milk. There can be little doubt that the way in which this is done is, that some of the throat discharges or skin peelings of the infected person are carried in the milk. Typhoid fever is another disease that is often spread by milk, and probably it finds its way into the milk by diluting it with impure water. The milk of cows suffering from foot-and-mouth disease often produces aphthæ or ulcerative stomatitis in children. We have already seen that milk taken from tuberculous udders contains tubercle bacilli, and it is very likely to produce the disease in persons who are predisposed to such disease. I think that the hygiene of cows is a subject that requires more attention than it has yet got, for the cow is not only the producer of a very important article of food, especially for the young, but it is the mother of animals that are the chief food of the adult, and much hereditary consumption in animals might be prevented. Too often cowhouses are situated down dirty little lanes, which, because they are not fit for human habitation, are thought to be fit for the poor cows. They ought to be in the open country. Too often we find cows crowded into miserable little houses, where the same care to prevent the fresh air getting in for fear of colds is given as for man. The overcrowding of byres is as fit a subject for legislation as it is for human dwellings, and the exact minimum cubic space for a cow should be defined by law for all sanitary inspectors. As to the means for preventing disease being spread by milk, I cannot do better than refer you to the admirable memorandum on milk supply drawn up by Mr. George M'Kay, the sanitary inspector of Govan, in which he maps out the extra legislative powers that he proposes should be conferred on local authorities.

I have only one more drink to bring under your notice and that is water. "The supply of wholesome water," says Parkes, "in sufficient quantity is a fundamental sanitary necessity. Without it injury to health inevitably arises, either simply from deficiency of quantity, or more frequently from the presence of impurities. In all sanitary investigations

the question of the water supply is one of the first points of inquiry, and of late years quite unexpected evidence has been obtained of the frequency with which diseases are introduced by the agency of water." ·58·5 per cent of the body consists of water, and it is continually being given off by the urine, fæces, skin, and lungs, and it is needed for the purposes of solution in digestion and absorption. The quantity of water, therefore, should be ample and the supply should not be intermittent, but it should be supplied at all hours of the day and night. For when water is shut off a vacuum is produced, and sewage may be sucked into the pipes. Professor Sir Douglas Maclagan considers 37 gallons per head per day required as the minimum quantity. Thus he allows 2 gallons for dietetic purposes, 16 gallons for cleansing, 9 gallons for sewers, and 10 for manufactures. Mr. Bailie Denton allows 8 gallons as the extreme quantity that can be required for dietetic purposes, and increases the 8 gallons to 15 gallons to include that for cleaning purposes, as for closets, washing floors, stables, carriages, and 10 gallons more for public purposes—equal to a total of 25 gallons per head per day. Different manufactories require different quantities. It is best to allow about 50 gallons per head if it can be got.

Now water in the first place is essential for cleansing purposes. Cleanliness lies at the root of all sanitary arrangements. The great advantage of public baths and laundries cannot be over-estimated. There are diseases that only breed in dirt and filth, and are propagated by the same agency. In order, then, to reduce that vast quantity of preventible disease which has its type in enteric fever, and in relation to which each individual case of typhoid fever which occurs ought to be regarded as having an important local signification, the one essential condition is cleanliness. How can we expect people living in dirty houses, themselves unwashed, their clothing never taken off their backs to be healthy? To quote again from the truly admirable reports of Sir John Simon. He says that—"to such people if you were to give a coal-scuttle, a washing basin, and a water-closet, these several utensils will be applied indifferently to the purposes of each other, or one to the purposes of all." He further says—"that there do dwell whole hordes of persons, who struggle so little in self-defence against that which surrounds them, that they may be considered almost indifferent to its existence or almost acclimatised to endure its continuance. It is too true," he continues, "that among these classes there are swarms of men and women, who have yet to learn that human beings should

dwell differently from cattle, swarms to whom personal cleanliness is unknown." He then speaks of an education, which by model and examples, would lead them to know cleanliness from dirt, decency from grossness. Water is necessary not only for personal cleanliness, but for washing out sewers and keeping the streets clean. But it must be remembered that however clean the pavements, however pure the water, however effective the drainage, yet fever and the allied disorders could never be absent from a filthy and uncleanly population.

"No city," says Sir John Simon, "so far as science may be trusted, can deserve immunity from epidemic disease except by making absolute cleanliness the first law of its existence. Such cleanliness, I mean, as consists in the perfect adaptation of drainage, water supply, scavenage, and ventilation, to the purposes they should respectively fulfil; such cleanliness as consists in carrying away by these means, inoffensively, all refuse materials of life—gaseous, solid, or fluid—from the person, the house, the factory, or the thoroughfare, so soon as possible after their formation, and with as near an approach as their several natures allow, to one continuous current of removal."

Let us now turn from the use of water for cleansing purposes to its dietetic uses. The chief pollution of water is that by sewage. When ordinary sewerage gets into the drinking water it causes on being drunk derangement of the digestive organs, sets up diarrhœa, and leads to a general state of ill-health. But the two diseases that arise *par excellence* from drinking sewage polluted water are typhoid fever and cholera. There are always two factors in the causation of these two diseases, the one is the specific element of the disease, and the other is decomposing sewage. Typhoid fever, for instance, amid overcrowding and non-ventilation, and refuse odours and foul water supply, will develop itself to be the most spreading pestilence, but in thoroughly clean atmospheres and with thoroughly clean water supply, will be so restricted in its infectiveness as scarcely to be recognised as infectious. That is to say, that though the infective element is there, it will not infect unless the proper medium for its conveyance is also present, and this is the real preventive element. It, like cholera, may be said to touch no healthy spot. Douglas Galton goes the length of saying that cholera and dysentery are intimately connected with the condition of the water supply; while an epidemic prevails the question whether a given population shall suffer or escape may almost

be predicted from a chemical analysis of the drinking water. During the great epidemics of cholera in 1848, 1854, and 1866, it was seen that cholera attacked the filthy towns, the towns with sewage polluted drinking water, and the severity of the attack was in proportion to the amount of filth, and it passed by or almost so, the towns with pure water and healthy surroundings. The mystery that once attached to cholera is now solved, and it is seen to proceed upon known laws. How largely sewage drinking water can spread those diseases is well seen in the cholera epidemics of 1848 and 1854, in a part of London. In 1853-54, the Lambeth Company supplied water to 166,906 people, and of these 611 died of cholera, being at the rate of 37 to every 10,000. During the same year, the Southwark and Vauxhall Companies supplied 268,171 people with water, and of these 3,476 died, being at the rate of 130 to every 10,000. The population drinking the latter, which was dirty water, accordingly appears to have suffered three and a half times as much mortality as the population drinking the other water. In 1848-49, the Lambeth Company had a far worse water than the other, and a mortality from cholera of 125 per 10,000, while the Southwark and Vauxhall Companies had bad water but not so bad as the other, and a mortality of 118 per 10,000. So that in the one population the cholera death-rate rose from 118 to 130, in the other it fell from 125 to 37, the only difference being the quality of the water. This, gentlemen, opens up a great question, what are we to do with our sewage? Are we to continue pouring it into the rivers and then drink from them? Are we, as Sir John Simon remarks, to make a change from an unwholesome house to a polluted water source; is that which would have been poison to inhale to return to us as poison to drink?

Time forbids me going further into this matter, and I must now pass on to the second class of surroundings that cause disease—viz., the unhealthy states of our houses. A house to be healthy must be well ventilated—must be free from damp, must be warm, and must be thoroughly drained. It is a most extraordinary thing that when a thing is free and easily got, however valuable it may be, it is little prized by the generality of mankind. In nothing can this be said with greater truth than in the case of fresh air. Though a man can no more live without air, or even in an impure atmosphere, than he could without food and drink, yet how often is he perfectly indifferent to the attainment of it. When man, in his natural state, lived free in the open air, he was free from many

diseases that now afflict him. When air is constantly breathed over and over again the carbonic acid and other impurities in such air give rise to headache, and if persisted in, to general ill-health. Indeed Douglas Galton tells us that the breathing of foul air contaminated by the breath of other persons appears to be the special agent which develops consumption and diseases of that class. For the most part this breathing of impure air can generally be avoided by people themselves. Sometimes, however, local authorities are responsible for shutting out the fresh air from the inhabitants of their towns, such as in closed courts and lanes. Overcrowding is known to be the chief agent in the production of typhus fever—a fever that may be ranked among the filth diseases; for as long as the two elements of causation—the specific poison and the air saturated with organic matter—are present, it is a very infectious fever, but as soon as you remove the typhus patient into the fresh air the fever loses much of its infectious nature. The windows in all houses ought to open at top and bottom, and the air ought to be got directly from the outside air. There are various contrivances in use for the inlet of fresh air. A very good plan in cold weather, and even in invalid rooms, is to raise the lower sash of the window, and insert beneath it a piece of wood 3 or 4 inches broad. This allows the fresh air to come in between the middle sashes, and the upward current between the windows is continued inside the room, and the air in this way gets warmed in the heated upper air, and descends warm. Tobin's tube is sometimes used for the same purpose, the tube entering at the lower part of the outside wall, and being carried up towards the ceiling. The fresh air enters from below, and is delivered above the heads of the occupants of the room. Sometimes sliding bricks below the line of the ceiling are used. These bricks are well adapted for the ventilation of larders and dairies. The inlet air may be passed through gauze, cotton wool, or water by deflecting plates, to keep out soot and other impurities. In the same way what may be called artificial outlets are made, such as Arnott's type outlet, which is fixed in the flue of the chimney near the ceiling line, or a zinc pipe may be taken from a point 5 inches below the ceiling, and brought down to within 15 inches of the floor level, and then led into the fire-place. Of course, the less contrivances of this kind require to be resorted to the better, and the smaller the room the oftener they will be required. The room must be a certain cubic capacity, proportioned to the number of individuals occupying it; for the air must be admitted at not too rapid current, else

draughts will be produced, and the room will be cooled down. Every healthy person ought to have at least 800 cubic feet of space in a room, and invalids more. Landois says that, in order to keep the air fairly wholesome—*i. e.*, with carbonic acid reduced to ·1 per cent, 694 cubic feet per head per hour is needed. But, then, a certain amount of air passes in and out through the pores of the walls, and chinks of the windows and doors and open fireplaces with fires are very important means of ventilating a room. Hence anything that checks the wall transpiration, as dampness, will prevent the ventilation being carried on in this minimum space. But damp walls are dangerous, not only because they prevent the breathing power of the walls, but they keep the house cold, and, in particular, they retain and breed infectious germs, vegetable fungi, &c., heat and moisture being known to favour the decomposition of animal and vegetable matter. All cellars, therefore, and houses with walls abutting on the soil, are not fit for habitation. So, too, houses ought not to be built on damp soils, far less built over buried-up decaying organic matter. Douglas Galton says that it would be just as healthy (indeed probably far healthier) to live over a pig-stye than over a site in which refuse has been buried, or in which sewer water has penetrated, or over a soil filled with decaying organic matter. Consumption has been proved by Drs. Buchanan and Bowditch to be so prevalent as to be considered caused by an atmosphere made damp by the impermeable nature of soil in localities where moisture accumulates on the surface. Sir John Simon and Dr. Theodore Williams both consider such to be an important exciting cause of phthisis.

Then as the overcrowding of single houses leads to disease, so does the crowding of houses together. Douglas Galton says that the greater unhealthiness of towns is largely due to the too close proximity of the dwellings, the consequent absence of fresh air, and the saturation of the subsoil with impurities passing into it from the closely occupied surface. Hence it is essential for health that buildings should have free circulation of air all round them, and as much sunlight as possible. There should be no rows of back-to-back houses, which do not admit of free ventilation, no narrow lanes or alleys, or *cul-de-sacs* of such. Newsholme has shown that the mortality from pulmonary diseases, from phthisis, from the seven zymotic diseases, and from diarrhœa, increase *pari passu* with the proportion of back-to-back houses. The streets, too, like the houses, should not be damp, for, says Galton, the careful paving of a town, coupled with adequate

drainage to carry off the water filtering on the gravel surface, is a great protection to health.

The question of ventilation and dampness of houses is intimately connected with the warming of houses. "Comfort and health," says Galton again, "are practically synonymous, and for these purposes, in this climate, the day temperature of a room should be maintained at something between 58° and 66°. The night temperature should not be so high, but it is not desirable that the night temperature should fall below 40°." Open fires are the means generally employed to warm houses. Hot stoves are not so healthy, for the iron pipes are apt to become red-hot, and the effect produced is unequal both on the air and on persons in the vicinity of the stove. But the chief objection to them is, that iron, when very highly heated, may take up the oxygen from the carbonic acid prevalent in the air, and thus reduce carbonic acid to carbonic oxide—a more poisonous gas even than carbonic acid. Hot water and hot steam pipes are not so objectionable, as the heat can be regulated with more exactness. The higher the temperature of air the less oxygen it contains, and therefore a constant, steady heat, as from hot air or steam pipes, gives the less oxygen to be breathed. The method of warming rooms by close stoves, or by hot water pipes in the room, does not of itself necessarily entail any change of air; on this account open fires are the best. Some idea to what an extent an open fireplace ventilates a room will be got by considering the velocity of air in a chimney. The air passes up an ordinary chimney flue at the rate of 4 to 6 feet per second, or from 14,000 to 20,000 cubic feet per hour, and with the chimneys in ordinary use, 10 to 15 feet per second, or 35,000 to 40,000 cubic feet per hour, often prevails. The chief objection to the fire ventilation is the draught of cold air. The weather, however, in our country is generally so temperate that it is rarely necessary to apply artificial warmth to the outward air. Hence this objection may be discarded. General Morin has invented a fresh air flue, where the air of the room is heated by the heated air in the chimney. If coal is not properly burnt it gives rise to thick smoke, and the soot forming centres for condensation of vapour, causes fogs which are apt to be unhealthy. This is beginning to be recognised as a nuisance in towns, and various contrivances and kinds of grates have been devised with the view of preventing the production of smoke, all of which have for their object the complete combustion of coal. Scotch coal is, of course, worse than English coal.

On account of the draught that would be produced by too rapid a current of air being drawn through a room, the amount of air that can be changed in it is limited. Hence, for more reasons than one, one-roomed houses for families are very undesirable. It is to be feared that the description given by Sir John Simon of these one-roomed houses in London is to be found to prevail in smaller cities. "Instances," he says, "are innumerable in which a single room is occupied by a whole family, whatever may be its number, and whatever the ages and sexes of the children; where birth and death go on side by side, where the mother in travail, or the child with small-pox, or the corpse waiting interment has no separation from the rest."

Dr. J. B. Russell, in his address to the Glasgow Philosophical Society last year, proved that in both one and two-roomed houses the deaths were 2·3 per cent above the average, while in houses above this size they were all below in varying degree. Thus, one-room, population—24·7 per cent, and deaths 27·0; two-room, population—44·7 per cent, deaths 47·0; three-room, density—16·0, and per cent deaths, 13; four-room, density—6·1, and per cent deaths, 4·3; five-room, density—7·1, and per cent deaths, 3·3; institutions, density—1·4, and per cent deaths, 2·2.

But probably the most important part of house sanitation, as far as you, gentlemen, are concerned, is its drainage. Refuse from dwellings falls under two heads. The one consists of sewage proper, such as the solid and liquid ejections and washings for cleanliness, and the other of ashes, stable manure, and kitchen refuse. The one is removed generally in drains by water, and the other is removed by the hands in carts. No house can be healthy unless it is properly drained, and every house ought to have a water-closet, for the great secret of preventing ill health by sewage is to have it speedily removed. Indeed, putrefactive decomposition of one kind or another is the principal cause of unhealthiness in towns. Cesspools have been rightly done away with for ever as an abomination. Ashpits, too, if they are deep and seldom emptied, are dangerous to health. If they are to be allowed at all, they ought to be placed as far away from dwellings as possible, and should never be sunk in the ground. Galton says that the floor of an ashpit should be at least three inches above the surface level, that they should be drained, and their floors should be paved or flagged. It is also most important that they should be covered on the top, but open to the air at the sides. In this way they will be protected from the sun and rain, which is necessary, as decomposition goes on best

under heat and moisture. If they are not drained some sewage is never removed, and remaining, is ready to ferment fresh stuff as it is put in. The space in front should also be paved so that none of the refuse be left as it is carried away from the ashpit. I have seen typhoid fever and diarrhœa produced by filthy ashpits. In connection with ashpits, I am strongly against allowing collections of animal manure from cowhouses, and stables, and piggeries. Often these heaps are left for long —"till the dung makes," as they say—and worth the farmer's while to remove them. The house, like the occupants of it, if they are to be healthy, must be out of the range of the atmosphere of its filth. Simon is very strong on this point. "The atmosphere," he says, "in which epidemic and infectious diseases most readily diffuse their poison and multiply their victims, is one in which organic matters are undergoing decomposition. Whence these may be derived signifies little. Whether the matter passing into decay be an accumulation of soaking straw and cabbage leaves in some miserable cellar, or the garbage of a slaughter-house, or an overflowing cesspool, or dead dogs floated at high water into the mouth of a sewer, or stinking fish thrown overboard in Billingsgate dock, or the remains of human corpses undergoing their last chemical changes in consecrated earth, the previous history of the decomposed material is of no moment whatever." All refuse ought therefore to be carted away at once, for the extra expense will be cheap to the town in the long run.

The other part of the drainage system is drainage proper. Whatever imperfections attach to water-closets and drains, must be improved upon, but they must not be done away with, for it is the best system for the removal of sewage in towns that we yet know of. The water-closet is more apt to get out of order by a scarcity of them than by having a superabundance of them. No town can be healthy unless there is a complete enforcement of house drainage, until every house washes itself into the sewer. Great improvement has been made on house drainage by the introduction of Buchan's trap. Still it must be remembered that the very introduction of such traps is an indication that there is an imperfection or fear of an imperfection in the drainage. "The test," says Simon, "of successful sewers lies in an inodorous fulfilment of their duty, and every complaint of offensive emanations indicates, in proportion to its extent, a failure of that sanitary object for which the construction was designed." I have long, though only yet been partially successful, advocated in Perth, the thorough ventilation of the main sewers. It is

hardly necessary to mention, what is now like a truism, that every house drain ought to have a trap with a dip of at least $3\frac{1}{2}$ inches before it joins the main drain. But supposing it has such a trap, one must not imagine that there is no fear of sewer gas coming back into the house, and this may occur in various ways. A good flow of water to flush out the soil-pipe may carry with it all the water in the trap, suck it out by syphon action, and leave the trap untrapped. Another way is, as the capacity of water to absorb sewer gas is very great, the water in the trap will absorb gas, and when it is warm through the day it will give it out into the house, and when it becomes cool at night it will absorb more. Thus, as Galton says, a water trap without other precautions is but a frail protection against this very insidious and dangerous enemy, sewer gas, especially in a concentrated condition. And such gas is very apt to get concentrated in main drains without free and open ventilation, and it will rise to the higher levels like smoke up a chimney, to be drawn into the houses there or lie in *cul-de-sacs* or blind ends of the drains. "Indeed," says Galton, "it has been found by experiment that in unventilated sewers the concentrated gas becomes deadly, whilst in fully ventilated sewers with continued flow without deposit the sewer air is purer than that of stables, or even than that in a public room when fully occupied." For these and various other reasons, I am strongly of opinion that all main sewers should be ventilated at intervals not greater than 100 yards, which gives about eighteen fixed openings for ventilation in each mile of sewer. If sewer gas at any of these openings is offensive, then there is a want of flushing leading to deposit, or the ventilation is imperfect. The main sewers will be found to act well if they have a good incline, are frequently and thoroughly flushed, are freely ventilated, and the open mouths of them at their exit are protected from the sweep of the wind. As to the house drains they should not be carried under houses, should be situated so as to be easily got at, so that any leakage can be at once detected, and they should be made of "drawn" lead, and cast iron only allowed outside the house. Then as to closets, they should not be placed in the middle of a house even in the basement, but near outside walls and not ventilated into staircases; where this latter cannot be avoided it is better to carry a good-sized shaft from the closet up to the ridge of the roof than do so. The plan that is universally adopted of placing water-closets in bath-rooms is also bad in principle. The old pan-closet with the D trap, which is so much in use, should

be condemned wholesale. The filth adheres to the receiver and the interior of the D trap, in consequence of which foul air is always given off and delivered straight in the face when the handle of the closet is lifted. The deep Hopper-closet is also bad. The best closets are the "washout," such as "Jennings" or the "valve" closet of "Bramah." Another very common mistake is that the wastes of sinks, baths, lavatories, cisterns, and rain water pipes, deliver connectedly with the drain direct, or with the soil-pipe, or taken on to the trap of a closet, while they should be made to deliver in the open air over a gully outside. The rain water pipe should convey rain water only, no sewage, nor be used as a ventilator to the drains. These gullies should be outside and trapped. These gullies used to be very frequently seen in bakehouses and dairies, before they were prohibited by the Acts. If allowed at all each gully should be made to deliver once more into another gully in the open air, before they are connected with the main sewer. The same ought to be done with the scullery sink. These sinks should have grease traps outside, otherwise the grease will collect and block up the drain, and these grease collection chambers should be emptied of their fat once a week, for Dr. Russell has proved that grease will travel only a few feet. The old dip-stone trap should never be used, as it merely forms a cesspool. By far the worst kind of trap is the old Bell trap, for unless kept constantly filled with water it is no trap at all. The best traps for the soil-pipes are Buchan's, Weaver's, and Angell's.

It is easy to point out what should be, but unless we are backed up by the law to empower us to see these things done our advices will very often end in mere suggestions. As it is we have not even the power to compel a water-closet to be put into a house. And owners and factors of houses are not the most ready to make improvements for the mere sake of sanitation. Now that the land is no longer so profitable a speculation as it used to be, people are taking to speculating on house property, and being a mere money transaction they often save their own pocket at the expense of the health and lives of their tenants. Companies too are starting up to make cheap houses for the public. They run up mere shells of houses, badly built and badly drained, and they are often done by unskilled workmen, and made of bad material. Pridgin Teale says that scamped drain-work is one of the most dangerous of the sanitary flaws of new buildings; it is also one of the most common and one of the most difficult to detect, and is rarely found out except by means of the illness it produces.

The only test of anything being wrong is the perception of a smell. A heavy smell might arise from dead rats or other decaying organic matter beneath the floor, or it might be from a leakage in the illuminating gas-pipe—a deadly gas no doubt, containing, as it does, 12 per cent carbonic oxide gas—or it might be from spent smoke from faulty flues by cracks, or it might be ordinary sewer gas from closet or drain.

But I must pass on now to the third class of insanitary surroundings which are those got from a man's occupation. The various serious and often fatal accidents that take place in factories from machinery, though they may fairly be ranked in this class, yet cannot be taken up by me at present. Nor can the different chemical proceedings, such as tallow-making, gas-making, &c., be more than referred to, as if not absolutely injurious to life, they are at least injurious nuisances. "It is the common right," says Sir John Simon, "of the neighbourhood to breathe an uncontaminated atmosphere; and with this common right, such nuisances must, in their several degrees, be considered to clash." In the same way large volumes of smoke from factories are detrimental to health and injurious to property. It is simply unburnt fuel and unutilised heat. But the trades with which we are now concerned are such as cause injury to health from working amidst the injurious influence. Any trade may injure health from the same want of attention to the hygienic conditions of an ordinary dwelling-house, such as want of ventilation, and these influences are often more insidious in a large factory than in a dwelling-house, because although the building may look large and well ventilated, the numbers of people that work in it are entirely overlooked. But there are occupations that injure health from the very nature of the employment. Some of these occupations cause injury to the respiratory organs often by direct mechanical irritation and lead on slowly to consumption, confirmed asthma, or bronchitis. Other trades again are destructive to health from the fact that the substance worked with is a poison that may get into the system by handling it, such as working with phosphorus, and making arsenical green. Others again affect the skin by outward irritation causing eczema, as in bakers, grocers, and others. Worry, anxiety, and overwork increase the mortality in others.

In order that I may give you a better idea of the importance of a man's occupation in regard to his health and longevity I shall draw from the valuable and trustworthy reports of the late Dr. Farr in his Vital Statistics. "Every occupation," he

says, "has its peculiar dangers, which, in their results sometimes counterbalance each other. Thus, the tailor is not exposed to the explosions which are fatal to the miner; and the labourer has exercise which is denied to the tailor." But a comparison of the average mortality in the various trades and professions will at once show not only what a difference the occupation makes on the lengthening or shortening of one's days, but also reveal what it is that is the most healthy element in occupation and therefore to be aimed at, and what it is that brings ill-health in occupation and therefore to be avoided. For instance at the age of 45-55, out of every 1,000 farmers, 12 died; of 1,000 weavers and others employed in the manufacture of cotton, silk, and wool, 15 died; out of an equal number of grocers, 16 died; of blacksmiths, 17 died; of miners, 20 died; of bakers, 21 died; of butchers, 23 died; and of inn and beershop keepers, 28 died; the mortality at that age among the whole population of England being at the rate of 18 in 1,000. The four classes which on the whole experience the heaviest rates of mortality are miners, bakers, butchers, and inn-keepers, while the farmers and agricultural labourers are at present the most healthy classes of the population classified. Publicans have the highest mortality, and there can be no doubt but drink is the cause of it. For, says Dr. Farr, "the numerous body of men, who supply the community with drinks, food, and entertainment in inns, are shown to suffer more from fatal diseases than the members of almost any other class. There can be little doubt that the deaths will be found to be due to delirium tremens and the many diseases induced or aggravated by excessive drinking. It seems," he continues, "to be well established that drinking small doses of alcoholic liquors, not only spirits, the most fatal of all the poisons, but wine and beer at frequent intervals without food is invariably prejudicial. When this is carried on from morning till late hours in the night few stomachs—few brains can stand it. The habit of indulgence is a slow suicide. The many deaths of publicans appear to prove this. Other trades indulge in the publican's practice to some extent, and to that extent share the same fate. The dangerous trades are made doubly dangerous by excesses." Then again as to the butchers on what does the great mortality of them depend? "On his diet," says Farr, "into which too much animal food and too little fruit and vegetables enter? on his drinking to excess? on his exposure to heat and cold? or, which is probably the most powerful cause—on the elements of decaying matter by which he is surrounded in his slaughter-house or its vicinity?" and,

we might add, in his shop? for there in hot weather often the smell of decaying meat might sicken the buyer who is only there for a few minutes, far more the man who is in its midst the whole day, and day after day. The high mortality among butchers arises from alcoholism, and, like other trades in which there is evidence of alcoholic excess, from phthisis, liver diseases, and urinary diseases. The mortality among fishmongers is as high as that among butchers. Bakers have a pretty high mortality, probably from working in close and overheated bakehouses, as well as from alcoholism and suicide. Miners die in undue proportion from working underground amongst poisonous gases, meeting with accidents, and so forth. In striking contrast to these, we find a low rate of mortality among clergy, priests, and barristers. The reason which Farr gives for this is—"That the clergy lead a comfortable, temperate, domestic, moral life in healthy parsonages, and their lives are good in the insurance sense. The young curate, compared with the young doctor, has less cares." "Physicians and surgeons," he says, "from youth up to the age of forty-five experience a mortality much above the average; after that age they do not approach the priesthood in health, but differ little from the average. Many young practitioners have hard struggles to encounter. They are in contact with the sick; are exposed to zymotic disease, and their rest is disturbed. In states of depression deadly poisons are at hand. There is an excess of practitioners in cities. Country practitioners have to visit their patients in all weathers, at all hours." Chemists and druggists die early too. There is a very high mortality amongst commercial clerks, working often in close and ill-ventilated rooms, and stooping at their desks. The railway service, coachmen, cabmen have also a high mortality, often due to drink, exposure to weather and violence, showing that an open air life is not in itself sufficient to insure healthiness. Veterinary surgeons and farriers have a higher rate of mortality than physicians, probably from drinking to excess. The mortality of gamekeepers is low, from the healthiness of outdoor life. "Publishers and booksellers fare well in life and health, being generally masters in better circumstances than their confederates, while bookbinders and printers work in badly ventilated rooms, and die at a rate above the average; and this high mortality is entirely due to phthisis. Tool, file, and saw makers, from inhaling steel into their lungs, have a high rate, and needle manufacturers are exceedingly high. The excessive mortality among chimney sweeps is chiefly due to cancer. Coachmakers, wheelwrights, carpenters, joiners, saw-

yers, and blacksmiths are low, being mostly in the country. Workers in wool, cotton, silk; drapers, much of whose work is better suited for women than men; especially tailors from phthisis, and from diseases of the circulatory and nervous systems, alcoholism, and suicide; hairdressers, tobacconists are higher than the average, while shoemakers, grocers, tanners are below the average. The mortality of grocers from phthisis is one of the lowest, that of drapers one of the highest. The grocer suffers from circulatory diseases, alcoholism, and suicide. The earthenware manufacture is one of the unhealthiest trades in the country, even higher than the publicans. All workers in glass, copper, and iron experience a very high mortality.

More recently Dr. Ogle, Dr. Farr's successor, gives a complete death-rate of 400 occupations. He takes the age from 25 to 65 years as the working age, and he draws his conclusions from the years 1880, 1881, 1882. The mortality of all England and Wales is taken as 1,000; then the mortality of clergymen is 556; gardener, 599; farmer, 631; agricultural labourer, 701; schoolmaster, 719; grocer, 771; fisherman, 797; carpenter, 820; bookseller, 825; solicitor, 842; draper, 883; groom, 887; coal miner, 891; plasterer, 896; watchmaker, 903; tanner, 911; shoemaker, 921; architect, artist, sculptor, 921; commercial traveller, 948; corn miller, 957; baker, 958; mason, 969; blacksmith, 973; clerk, 996; tobacconist, 1,000; chemist, 1,015; tailor, 1,015; printer, 1,071; wool manufacture, 1,032; cotton and linen, 1,088; doctor, 1,122; law clerk, 1,151; butcher, 1,170; glass manufacture, 1,190; plumber, painter, glazier, 1,202; cutler, needle, saw, tool makers, 1,273; carter, carrier, 1,275; bargeman, 1,305; musician, 1,314; hairdresser, 1,327; brewer, 1,361; cab driver, 1,482; chimney sweep, 1,519; inn-keeper, 1,521; porter, watchman, 1,565; file maker, 1,667; earthenware manufacture, 1,742; miner, 1,839; costermonger, 1,879; general labourer (London), 2,020; inn or hotel servant, 2,205.

Had we time to analyse the various causes of the high and low mortalities of the occupation much food would be given for reflection, besides being interesting it would be profitable to sanitarians. "Man," says Farr, "is naturally an open air animal; he is made to work, and the sky is his native covering." So, after taking everything into account, the hunter, the sportsman, and the husbandman in a cultivated land are at present the healthiest of all workmen. But even this low mortality could be made lower, for the farmers heap up ordure to dung their fields, and keep it there "for a nosegay all summer." We might add that they dip occasionally deep in their potations.

So in the different manufactories, the grinders and polishers of steel, china scourers and potters, carders in cotton factories. miners, strawplaiters and glovemakers, lacemakers, silkworkers, in all these mechanical irritation of the lungs is the chief cause of the bronchitis and consumption that are so prevalent amongst them; and yet that these influences can be reduced without detriment to the respective industry is well known, and should be reduced by preventive measures. "For," says Simon again, "the canker of industrial diseases gnaws at the very root of our national strength. The sufferers are not few nor insignificant. They are the bread-winners for at least a third part of our population. To be able to redress their wrong is, perhaps, among the greatest opportunities for good which human institutions can afford." And thus "it has been determined," says Dr. Lakeman, "that the physical condition of the people shall be the basis upon which the future structure of legislation shall be built, that employment in vitiated atmospheres must be checked, that unhealthy occupations should be hedged round with proper restrictions, that overcrowding shall not be permitted, that life and limb shall be protected from accident, and therefore, that all dangerous machinery shall be securely fenced, that children shall not be employed as of old, prematurely used up in body and in mind, but that they shall work in manner suitable to their years, and permitted to add by their tiny efforts to the industry of the country under conditions favourable to the development of a sound body, and with educational opportunities of their mental growth."

This is a subject, gentlemen, that greatly concerns us all. For you know it is one of the duties of the medical officer of health to make himself acquainted with the diseases that especially prevail in his locality, and, having done so, try to find out the causes of the increased mortality in the particular trade in which it may be, and having found out the causes, the state ought to help him to eradicate them in a peremptory and not permissive manner.

But a man may have perfect healthy surroundings, he may eat the proper food and drink the proper liquid, he may live in a healthy house, and he may be engaged in a perfectly healthy occupation, and yet he may contract disease which is preventible more or less. He may, for instance, take small-pox, &c. And this leads me to speak lastly and shortly of the class of diseases called zymotic or miasmatic. They might be divided into two classes, the one of which is very amenable to sanitary measures as enteric fever and diphtheria; and the

other, much less so, but in them immunity is gained by previous attacks, as measles and scarlet fever.

The first of these is small-pox. The power of preventing this most loathsome, most fatal, most disfiguring, and most infectious disease, is one of the noblest triumphs of science. And yet, curious to say, a host of objectors have arisen to tell us "to beware of the Greeks while bringing presents." It would be useless to enter into these objections, especially as they have been so ably and fully answered by such as Sir John Simon, Dr. Marson, and your own able exposition in *Vaccination Vindicated.* Mr. President, the answer to them all might be summarily dismissed in one sentence. Show me the youth who has taken small-pox after he has been vaccinated in four good spots, or the adult who has been revaccinated in the same? The argument against compulsion is trifling. A man, in choosing to have small-pox, endangers his fellow-men who may not want to take it. Besides, the state does not allow a man to commit suicide, no more ought it to allow a man to take this form of it. Indeed, I should not only compel every one to be protected against the disease, but I should fine anyone who did take it. For the means of preventing it are so easy, and the rules so simple, that there is no excuse. As I have said, all the hygienic surroundings of the person may be perfect, and yet that person, if he be not protected by a former attack or have been properly vaccinated, will take small-pox, and that of the most fatal and virulent form. But supposing small-pox has arisen in our midst, we cannot therefore ignore its communicability, for there will always be some unprotected individuals. It behoves us, then, to isolate the infected as far as we can from the uninfected. We ought not to treat cases in our general infirmaries. This has been clearly proved to be dangerous in the town of Leicester. In London, too, the mortality is much greater than in the provinces, and this is found to be owing to the presence of several large small-pox hospitals being foci of infection. I have already fought this battle successfully amongst ourselves in Perth, and need not say more of it.

The next disease in this group is scarlet fever. The contagion in this disease lies mostly in the skin, and hence it spreads chiefly through the skin that peels off freely as the disease advances. There is as yet no known form of protection against this disease as against small-pox. Hence the isolation of the infected from the uninfected is the only way to prevent its spread. The disease is infectious for a long period, at least as long as six weeks, hence the difficulty of isolation

especially in mild cases. As hospitals are often of great service to physicians for the proper treatment and management of difficult cases especially amongst the poor, so hospitals are of great use to sanitarians to enable them to prevent the spreading of disease. For those diseases that we cannot protect except by isolation, there is need for more hospital accommodation throughout the country. There are not enough fever hospitals for this purpose. Scarlet fever is often carried in milk hence special care of dairies is needed, and wherever fever is among the inmates of the owners of dairies, the dairies ought at once to be shut up. It is probably spread in sewer gas and water, and mostly by fomites even to long distances as in letters. I have not a very great belief in the efficacy of the various disinfectants for the destruction of scarlet fever bacilli, such as carbolic acid, sanitas, &c. To my mind nothing is so good a germicide as fresh air, and hot steam of such a temperature as is found to kill the bacilli from clothing, &c.

Measles is another disease that can only be prevented by isolation. The infectious stage does not last so long as scarlet fever, probably about half the time, or about three weeks. The breath conveys the infection at an early part even of the disease. Ransome showed that the humidity of the air favours the mortality from measles more than hooping-cough.

Hooping-cough is a still more difficult disease to keep from spreading, on account of both the chronic nature of the complaint and the absence of acute symptoms. Hence the length of time that a child would require to be kept isolated, might be such as to injure the child's health. The younger the child the more dangerous is the disease likely to be.*

Typhus fever is a disease that I have already spoken of, as arising from overcrowding. Fortunately, it is not a common disease nowadays, as the cause is not often allowed to be in operation. With it the best disinfectant is fresh air. The windows should be well opened and the room thoroughly ventilated before any inspection is made. The immediate removal of the person ill to an Infirmary is the safest way of preventing its spread.

Typhoid fever and cholera may be taken together as typical diseases of the filth type. In both there is a specific element of infection, special bacilli, but this specific element can only take effect through the medium of

* Of these three diseases hooping-cough is at its maximum in the first year, measles in the second, scarlatina in the third and fourth years.—*Farr.*

sewage polluted water, or from the decomposition of sewage in sewage gas. Hence, as we cannot prevent the specific element satisfactorily by disinfection, we ought to try and prevent the second factor in the causation of it. It ought to be a rule with us, from which there is no departure, that wherever they arise, the drains and ashpits, and water require to be thoroughly examined, for I am convinced that it will be found that not only the cause will be seen to be some sanitary imperfection of the drainage system, but also by attention to it the spread of them will be effectually prevented. Of course I do not want you to understand that I mean that there is no use of disinfectants; on the contrary, all the ejecta of the patient ought to be thoroughly disinfected, otherwise it may be spread by carelessly throwing the stools into open ashpits or into pails, and carried from one place to another. In no diseases has pathology made greater advances than in these within recent days.

Diphtheria is a disease that I have always been accustomed to associate with bad drainage. I do not think that there can be any doubt that it arises from the decomposition of sewage. It seems, however, that vegetable mould and fungi have been proved to be capable of growing on the mucous membrane, and that even these though originally innocuous may become under certain conditions pathogenic. Whatever is the real cause, it behoves us to attend to the sanitary arrangements of the house such as the drains, dark and damp walls with fungi growing upon them, &c.

The conclusion, to which we have come, is that disease is preventible in two ways. The one is by attention to the surroundings, that they be natural and favourable to life, and then we have health, and the highest attainable health is to be got by a happy combination of a condition of *rus in urbe*, says Farr; the other is to protect the organism from the inroad of all those lower forms of life, germs or microbes, either by killing them before they have attacked or after they are in the body, or by rendering the system insusceptible to their influence. The former is the business of the sanitarian, the latter will be the province and work of the ordinary medical man in the future. Organic science is making rapid progress every day to help this object. And as to the first, the state ought to see that thoroughly fit men are appointed, both medical officers of health and sanitary inspectors for the accomplishment of this work, but it also ought to see that the implements with which they have to work are sufficient for the purpose. The Local Government Bill, as

pointed out by Dr. Russell is defective in this respect. The Public Health Act of 1866 gives far too little power to sanitarians for the fulfilment of their duty. It is too much permissive.

And now, sir, I am afraid that I may have wearied your patience, and must thank you for your kind indulgence. If I have appeared to you to be prolix in my talk my only excuse is the greatness of my subject. I should like to see preventive medicine properly recognised by the state. Instead of wasting its time in discussing whether Ireland ought to be an exception to the whole world in fulfilling its lawful and right obligations and agreements, and whether its people ought to be allowed to make themselves rich by usurping the property of others rather than work for it, see what a field of usefulness is open to it. Consider the immense relief to human suffering, the greater comfort of millions of the human race, and the greater prolongation of human life, besides the production of a far healthier, manlier, richer, and stronger nation, were the state to enter thoroughly into the matter of preventible disease. It would, however, be ungenerous on my part were I not to admit that the present government has done a great deal for public health, has done more in fact than any previous government by the introduction of their local government bills which are as yet *sub judice.* The state ought to know what the laws of health are and how to secure them, and then there ought to be nothing permissive which is against health.

Medical men have yet to learn that public health is a special department and requires special study, and that an ordinary practitioner is no more fit to give an opinion on the principles of public health than one specialist is on that of another. The one common enemy of mankind is disease,—disease caused by man's own making. To cure it is a noble art, to prevent it is a far nobler. "Ignorant men," says Sir John Simon, "may sneer at these pretensions, weak and timorous men may hesitate to commit themselves to these principles, so large in their application, selfish men may shrink from the labour of change, which its recognition must entail; wicked men may turn indifferently from considering that which concerns the health and happiness of millions of their fellow-creatures," but, gentlemen, that the day of preventive medicine has already dawned, and that it will go on to the full and perfect day when disease will be rooted out because it will not be allowed to arise, and that man will die of old age, "when death will come upon him like a sleep, in consequence of no other cause than gradual and unavoidable decay," need not be doubted.