AN ADDRESS ON THE PROGRESS OF SANITARY REFORM.

DELIVERED AT

The Annual Meeting of the Social Science Association.

BY

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My address has been written under peculiar conditions, and requires apology. When the session of Parliament ended, I had not found time to consider even what the subject of the address should be. Since then I have been rambling in Switzerland and Italy, and of course have had no access to books of reference. Under these circumstances, I thought it best to address you in the capacity of an old sanitary reformer; for it was as long ago as 1846 that, as a member of the Royal Commission on Public Health, I published my report on the state of large towns in Lancashire. The memories and gathered experience of a veteran sanitary reformer may not be without interest, even if they are related without that method which would have been more apparent had the address been written in his library.

The first question which occurs is, Are we making distinct and satisfactory progress by our sanitary measures? The answer to that question depends upon our periods of comparison. If we go back far enough in the history of our country, there are distinct assurances of improvement. Suppose that we begin with the Restoration, although our earlier records relate to London only. For twenty years after the Restoration, there was an exceptionally high mortality, even for that epoch, in the metropolis, and no doubt throughout the kingdom. Macaulay describes it as a time "when men died faster in the purest country air than they now die in the most pestilential lanes of our towns, and when men died faster in the lanes of our towns than they now die on the coast of Guiana." He was right, for the rate of mortality in London from 1660 to 1679 was no less than 80 in the thousand. Let us put in a tabular form the rates of death at various periods since then. The annual deaths from all causes per thousand of the population were:—

1660-79	...	...	...	...	80.0
1681-90	...	...	...	...	42.1
1746-55	...	...	...	...	35.5
1846-55	...	...	...	...	24.9
1871	...	...	...	...	22.6

If, instead of a single year 1871, we take the average of thirty-four years, the existing death-rate in England is 22.4 per 1,000. Hence one gratifying fact comes out clear and palpable, that the death-rate is on the whole continually decreasing in this country, and that the chances of our lives are much better than in the days of our ancestors. If we restrict our view to the periods of the last two censuses, 1861 and 1871, we are at first disappointed by learning that the mean age of the whole population was exactly the same, 26.4, in both these years, and that the rate of mortality is only slightly different, two children out of 1,000 of the population being annually saved in the last year of the decade, while one more adult is cut off. But it would be a mistake to suppose that a stationary mortality necessarily indicates no improvement. The causes of mortality are increasing, and though the mortality remains stationary, there must be improvements in our hygienic arrangements to prevent the deteriorating action. There is a constant disposition among our population to congregate in towns and to leave rural districts. Hamlets become villages; villages are transformed into towns; and towns grow into cities. At the beginning of this century, England had no town except London with more than 100,000 inhabitants; now there are thirteen. There are 103 towns now in England and Wales containing upwards of 20,000 inhabitants, and these 103 towns contain a larger population than the whole of England and Wales did at the beginning of this century. And as the rate of mortality is largely influenced by the density of population, the causes producing sanitary improvement must be at least equal to those of deterioration. But that remark applies to England only; for when we turn to Scotland the deteriorating influences become unhappily too apparent. The following numbers give the rate of mortality for every thousand of the population in Scotland.

	1855-59.	1861-70.
Principal towns	... 26.93	... 28.18
Large towns	... 23.94	... 24.58
Small towns	... 20.27	... 22.08
Rural districts	... 16.20	... 17.30

Thus, every class of districts in Scotland is augmenting in its rate of mortality. Do not let us Scotchmen, saturated as we are with national pride, shut our eyes to this startling fact. Our towns are increasing in density of population, and sanitary appliances are not equal to the increase. But the character and habits of the population are also changing. Scotchmen emigrate in large numbers, while an Irish Celtic population takes their place. From ten to thirty per cent. of the population of our towns now consists of this Irish Celtic element, and their habits have not improved the sanitary condition of the Scotch urban populations. But this one circumstance is far from explaining the general deterioration, which is nearly as marked in small towns and rural districts as it is in the centres of manufacturing activity. No doubt the death-rate is much in proportion to the density of population; but it is not in proportion to the numbers in a city. The death-rate of London, that huge metropolis, is only 22.4 per 1,000, or the same rate as that of small Scotch towns, and very different from 30.4, the death-rate of Glasgow, or 31.3, the death-rate of Greenock. Nor can the difference be due to climatic severities, for while 30.4 out of 1,000 die in Glasgow, only 19.4 die in the rural districts of Lanarkshire. Let me leave this part of the subject for the present, although I will return to it hereafter, to consider the causes which govern life and death, so far as disease is preventable by agencies over which man has control. My phrase is unphilosophical. Man has not control over a single natural force. He may indeed use the forces of nature, by means of his intelligence, to effect a specific end, but he cannot turn them a hairbreadth out of their course. The laws of health, like other laws of nature, are relentless in their severity. If you stand on the verge of a precipice and overbalance yourself, the law of gravity relentlessly pulls you down and dashes you to pieces on the base. Equally without mercy are you punished for the smallest infraction of the laws of health, whether you live in cities or in fields. Man, indeed, has no control over a single law of nature, but if he live in obedience to these laws, he will find that they are arranged with supreme beneficence for his well-being. An intelligent submission to them produces health and longevity, while the slightest infraction of them is mercilessly punished with disease and shortness of days. What are these laws? Many are known; others remain to be discovered. For my purpose, at present, I can only refer to some of the more important.

By Public Health is meant the health of communities, as distinguished from that of its individual members, though necessarily the former is the sum of the positive and negative conditions which act upon the individuals. The health of an individual depends not merely upon existing, but also on antecedent causes. Part of his health is transmitted from his ancestors, and may be a mere survival of hygienic conditions which have been extirpated. Part of our health also depends upon the external conditions of our upbringing when young, and part also on the influences, physical and moral, to which we are exposed all through our lives. As there is no individual who can be said to have all his organic functions in the most perfect action, so there is no community that can be considered in a perfectly healthy state; for the general health depends upon all the moments of the private health of individuals. The health of a nation, physiologically considered, stands closely in relation to that of an individual. The nutrition and health of an individual depend upon the well adjusted balance of the supply and waste of the particles which compose the body. These particles of the body, all through the life of a man, are incessantly dying and are being replaced by new particles continually springing into life. Every organ is thus undergoing, through its particles, a continued and rapid alternation of death and life. As the whole body is to one of these particles, so is the whole body politic of a nation to the individuals of which it is composed. The death of an individual in a State is strictly analogous to the death of a particle in a single man, and the birth of an individual in a State is the analogue of the moulding of a new living particle into the body of a man. When an individual becomes diseased, there is some want of balance between the waste and supply of his organs—or rather, of the underlying protoplasm which is incessantly changing from life to death. When the waste of the ultimate particles is greater than the power of restoration, disease attacks the individual. So in the body politic: when the rate of mortality is too high, that is, when the individuals of its population, which constitute the particles of the State, waste too rapidly, the State suffers from public maladies. Hence the State medical officer and the private physician work on like principles; for to the former the community, to the latter the individual, is the patient. This relation of the individual to the community, and the reflex action of the community on the individual, give a double motive for sanitary action. For the community, depending as it does on all the moments of health of individuals, requires to watch and cherish them; while each individual must feel that it is his interest to watch the health of his neighbour,

upon whose soundness rests the foundation of his own well-being. So that the common law of health is the Christian law :—"Thou shalt love thy neighbour as thyself."

If this analogy between the physiological condition of a community and an individual be real, as I believe it to be, the essential conditions in the health of communities and of individuals must be the same. They must be well clothed, well fed, well housed, well aired, and well watered.

The more we consider the question of public health, the simpler does the problem become in theory, though its attainment is difficult in practice. All that we need aim to secure is purity or cleanliness in the house, the air, and the water, and genuineness in the food and clothes. In fact, a great part of sanitary science can be comprised in that one word—cleanliness. No epidemic can resist clean houses, clean air, and clean water. Death, like the evil demons of old, shuns cleanly places. In olden times, as among the Jews, evil spirits dwelt in filthy places, especially loving tombs and ordure. Every latrine contained a special demon of its own, and does to the present day in a different sense. I am quite sure that the chamber of Sara, the daughter of Raguel, as described in the book of Tobit, must have overlooked a dunghill, otherwise she would not have been so grievously afflicted by Asmodeus, who, out of love for her, strangled her seven husbands. But Tobias, her eighth husband, for whom her father-in-law considerably dug a grave as soon as the marriage was performed, obviously knew that there might be smells even too bad for a demon, for, on the bridal night, he threw the putrid heart and liver of a fish on some burning embers in her chamber, and, as the narrative tells us, "the which smell, when the evil spirit had smelled, he fled into the uttermost parts of Egypt". To my mind, the book of Tobit is a distinct hygienic allegory. The good Tobit had a craze for burying dead bodies, and had all his troubles in consequence of his hygienic propensities. Sleeping in a foul place, the sparrows muted warm dung into his eyes and rendered him blind. But Raphael, whose name, by interpretation, means "the medicine of God", comes as an angelic guide to his son Tobias, and puts all things right by his hygienic knowledge—conquering even the foul demon Asmodeus and curing Tobit of his ophthalmia; acquired, as our workhouse children now get it, by foul air.

The ancients fought against evil smells more vigorously than the moderns. Sometimes, indeed, they simply tried to mask them with perfumes. Thus, when we hear that ancient Capua had whole streets filled with perfumers' shops, we know that it must have been a foul-smelling and ill-governed city. If you were to ask me at the present day what are the best rules for disinfecting foul smells, I could not give you simpler or better ones than those of Ulysses, as described in Homer. After slaughtering Penelope's suitors, and scattering their blood and brains over her spacious halls, he first makes a thorough cleansing :

"With thirsty sponge they rub the tables o'er
(The swains unite their toils) ; the walls, the floor,
Washed with the effusive wave, are purged of gore."

And it is only after thus thoroughly removing every origin of bad smells that he uses a disinfectant to destroy any foul gases which might still lurk in the room :

"Bring sulphur straight, and fire, the monarch cries :
She hears, and at his word obedient flies,
With fire and sulphur, cure of noxious fumes,
He purged the walls and blood-polluted rooms."

Contrast the proceedings of the wise Ulysses with those of Eidothea, the daughter of the old sea-god. She fell in love with Menelaus, who, with his two companions, was cast upon the island of her father. To conceal them from the old sea-god, she wrapped them in the skins of fresh flayed seals, and made them lie among the flock. Menelaus groaned under the horrid smell of his disguise, till the divine lady brought a powerful scent to mask the putrid odour :

"Dire was the ambush, and the scent severe,
Who could a rank sea-beast at such close quarters bear ?
But she, delivering us, a great help planned,
And placed ambrosia near the lips of each,
Which in our nostrils breathed an odour bland,
And the sea monster's stench did overreach."

Ulysses was an excellent hygienist, but Eidothea was not. The first went to the root of the matter and first removed all sources of impurity ; the latter merely concealed a stench by a perfume. Hercules, too, was one of the oldest and most thorough of the ancient sanitarians. He saved the Eleans from pestilence by draining their marshes, and executed a thorough sanitary operation when he cleansed out the Augean stables by turning into them the waters of the Alphaeus. But, of all sanitary reformers, Moses was among the most practical. He was learned in the wisdom of the Egyptians, and they, as we know, were hygienists. One of their commandments, though it does not remain among the ten which Moses brought down from the Mount

for our guidance, was, "Thou shalt not pollute rivers". The hygienic laws of Moses, supplementary to his ten moral commandments, are full of wisdom. The purifications required by religious observances were in the main hygienic precautions. The ceremonial part still remains in the East as a survival of a purpose which is now forgotten. Moses gave to us the principle of the modern earth-closet, and excellent rules for isolating and disinfecting diseased patients and their excreta. He established health-officers, or rather, gave to the high priest the function of an officer of health. Before long, we may be obliged to enact the ancient laws of Moses for isolating patients with infectious disease, and for cleansing the houses in which it occurred. In the case of cattle, we knock them on the head and kill them, and there is an end of cattle-plague. We cannot do that with men. But, if we could isolate cholera patients and disinfect their excreta, we could as easily prevent its spread as in the case of cattle-plague. We do isolate them in the case of ships ; why not in houses ? The isolation of patients afflicted with small-pox, scarlatina, and measles will one day become a part of hygienic law, though at present it would not be supported by public opinion. In the time of Cardinal Wolsey, plague patients were strictly isolated. During the best times of Greece and Rome, public health was much studied. The anatomical and pathological examination of the intestines of sacrifices was a hygienic precaution to ascertain whether the locality upon which a city was to be founded or a camp pitched was in a healthy condition. The supervision of hygienic arrangements was an office of dignity among the Greeks and the Romans. Epaminondas, one of the greatest military geniuses that Greece produced, did not refuse the office of "telarch" at Thebes, though its chief duty was to supervise the cleansing of the streets. For this Plutarch justly commends him. In like manner, at Rome, the cleansing and disinfection of streets and sewers were placed under a high officer of state, because, as Justinian tells us, "uncleansed and unpaired sewers threaten a pestilential atmosphere, and are dangerous". Of the surviving works by which the greatness of Rome is still evidenced, perhaps, the first is the civil law, but second stands its sanitary works, as evidenced in the great aqueducts, the cloaca maxima, and other hygienic appliances. It is, then, clear that the ancients knew as well as the moderns the main conditions of public health ; viz., that foulness is the source of disease, and that cleanliness is its preventive. Purity of the person, purity of the dwelling and its surroundings, purity of the air, purity of the water, purity of the soil—in one word, cleanliness—form the beginning and the end of hygiene. It is chiefly amid great plagues and calamities that men look for more occult causes of disease, such as comets, terrestrial exhalations, volcanic emanations, celestial conjunctions, or the poisoning of wells by Jews, just as now people are apt to refer them to electricity or magnetism. Sydenham himself, that model physician, must look deep down into the bowels of the earth for the causes of epidemics—into the *interiora terra viscera*. Men would not then look at their own surroundings for a simpler explanation, but fastened on some strange phenomenon which might appear. There are some rough mining districts in this country, where, if a strange traveller appear, the boys run after him with the shout, "Here is a stranger ; come let us stone him !" Philosophers seized hold of any strange phenomenon in like manner, and pelted it as the cause of human woe. But the progress of knowledge brings us back to the simplicity of ancient faith, that foulness breeds the demons who desolate our hearths, and that they cannot abide in cleanly habitations which they abhor. And so the sum and substance of all our sanitary science accumulated by ages may be summed up in the pregnant advice of the prophet—WASH AND BE CLEAN. It is the simpleness of the remedy as a cure for the public ills which so grievously affect us that prevents its public recognition. If I had talked to you about *schizomycetes*, including bacteria and its allied forms, if I had described vibriones, and all those organic bodies which are floating in the atmosphere, or which appear in decaying substances and in the blood of diseased persons, you might have thought that the chairman of the health section had some sanitary learning, and that it was worth coming to hear his discourse. But you revolt at the simplicity of his statement—that cleanliness is the beginning and the end of all practical sanitary work. Well, you are not singular. There was once a rebuke to such doubts given on another occasion : "If a prophet had bid us do some great thing, would we not have done it ? How much rather when he saith unto us, Wash and be clean ?" That cleanliness—both physical and moral purity—is next to godliness, should be the saving faith of every sanitary missionary.

Do not, however, think that I undervalue the numerous researches which have been made in recent years as to the organised causes of disease, whether we call them by such general names as microzymes or *contagium animatum*. I have read all the memoirs on these subjects with the highest possible interest, for the specific characters of diseases

lend much support to such views. When you find that the virus of small-pox reproduces small-pox only, and that of scarlet fever breeds scarlet fever only, you are as much inclined to refer their origin to a specific organism as you are to attribute a puppy to a dog or thistle-down to a thistle. But the researches on the microzymbic origin of disease, though vastly important, are scarcely yet within the domain of practical application. These bodies of low organised types are always associated with foulness. But whether putrid emanations are the result of the growth of these organisms, or whether the emanations form the only soil in which they can grow, neither I, nor any one else, can tell you with certainty. Perhaps the problem will ultimately be as insoluble to philosophers, as that involved in the doubt whether it was the first hen that laid the first egg or the first egg that produced the first hen. But what is quite certain is that if filth be entirely prevented none of these entozoa will permanently remain, and therefore the practical maxim should still guide you—WASH AND BE CLEAN. But understand this practical maxim in its full significance. I do not mean mere personal or objective ablution, but an uncompromising war with uncleanness of all kinds. In this war you may use water as an agent, or disinfectants, or drains, or fire, or any other means of utterly removing and destroying all filth and all its consequences.

Let me now give a few illustrations of the consequences attending the neglect of this hygienic maxim. When the civilisation of the Egyptians, the Jews, the Greeks, and the Romans faded, the world passed through dark ages of mental and physical barbarism. For a thousand years there was not a man or woman in Europe that ever took a bath. How different that time was from the times which preceded it—when daily baths were common among the poor—you may gather from the praises of personal ablution which abound in ancient authors. Take, for instance, Martial's address to his friend Oppian, on the limpid and unpolluted water in the Virgo and Marcian wave, in which it was rapture to bathe:

"Water so bright, and clear, and fair,
You think no liquid can be there;
You're not attending, Oppian,
You'll die without once having washed, poor man!"

But only think what must have been the state of Europe when thirty-three generations were like Oppian, and never once washed, if their historian Michelet is to be believed. No wonder that there came the wondrous epidemics of the middle ages, which cut off one-fourth of the population of Europe—the spotted plague, the black death, sweating sickness, and the terrible mental epidemics which followed in their train—the dancing mania, the mewing mania, and the biting mania. But even when the middle ages had passed away, and the sun of civilisation was again rising over the gloomy darkness of these centuries, what a heritage of filth-produced disease still remained! Look at Defoe's or Montaigne's description of the plagues of their day. Montaigne gives us some statistics which Defoe does not do. The plague at Bordeaux, from which Montaigne fled to his country-house, killed 18,000 out of 40,000 people. It followed him and destroyed whole villages. The harvest was not reaped, the grapes were ungathered, and men's minds were occupied not with the thought of life, but how to protect their bodies from wild beasts after their death. He draws a terrible picture of one of his own workmen, whose last act of life was to draw the earth over his expiring body. It is not a pleasing task to dwell on the habits of the population, even in our country, in past times. Go back only to the time previous to the Reformation, and you can have no difficulty in understanding why luxury and squalor produced the plagues of the times of the Tudors and the Stuarts. High above all other dwellings were the castles and the monasteries; but the cabin of the peasant was worse than any to be now found in the furthest isles of Scotland. It was made of reeds and sticks plastered over with mud. In these wigwags lived an ague-stricken population. In the towns, the mechanics lived in rooms without glass windows, slept on straw beds, and worked in workshops unheated by coal fires. Even in well-to-do houses, rushes covered the earthen floors, and got saturated with scraps of food, which remained to putrefy under a new layer of rushes scattered over it, so that the "petremen" came to dig saltpetre out of the floors. Filth, instead of being abhorred, was almost sanctified. The monks imitated the filthy habits of the hermits and saints of early Christian times, for the early fathers commended them. Even St. Jerome used to praise the filthy habits of hermits. He especially commends an Egyptian hermit who only combed his hair on Easter Sunday, and never washed his clothes at all, but let them fall to pieces by rotteness. St. Antony never washed his feet. St. Thomas à Beckett, when martyred, had under garments in a state which makes one shudder in the remembrance. And so the monks up to the time of the Reformation, and indeed in part up to the present day, thought, or professed to think, that by

antithesis, pollution of the body indicated cleanliness of the soul. Practically, indeed, it helped to it; because the odour of sanctity, which infested these old monks and hermits, helped to keep them apart from the temptations of the world; for the world scarcely cared to come into too close contact with these odoriferous saints. But this association of filth with religion was unhappy in its consequences, for men ceased to connect disease with uncleanness, and resorted to shrines and winking Virgins for cures of maladies which were produced by their own physical and moral impurities. Under all these influences plagues were very destructive in England. Men first began to connect them with filth by some striking examples. Thus, in 1665, when the Court and Parliament assembled at Oxford, it had an immunity from plague, and the reason of this immunity was traced to the thorough cleansing which the magistrates gave to the city to fit it for its distinguished guests. The great fire of London, also, taught Englishmen a wholesome lesson, for it came as a great sanitary agent to extirpate the foul nests of disease in the metropolis; and so at last the moderns learnt what the ancients knew very well, that public health can only be assured by cleanliness, and that filth is the parent of disease both among individuals and communities.

Hippocrates, who was the first hygienist that wrote a whole book on public health, took as his text pure air, pure water, and a pure soil, and you see we have arrived at nearly the same view of the essential conditions of health. Napoleon, as a result of long experience in the hygiene of armies, came to the same conclusion, for he said to Antonomarchi at St. Helena, "Life is a fortress which neither you nor I know anything about. Why throw obstacles in the way of its defence? Water, air, and cleanliness are the chief articles in my pharmacopœia." And so are they in the pharmacopœia of the public health medical officer. Let us consider them separately. Air is of all things the most familiar to us, and the one most forced on our observation. To breathe it is the first act of life; to be unable to respire it is the last act, which is followed by death. All during life it is never absent from our voluntary or involuntary actions. It fans us with gentle breezes, and it buffets us with storms. Surely we ought to know everything about this familiar object; yet, in fact, we are by no means intimately acquainted with it. During my lifetime it has incessantly presented new phases to closer observation. When I was a student of chemistry at the Andersonian University in this town, a pupil of my dear friend Graham, whose statue now adorns George's Square, air was a mixture of oxygen and nitrogen, with moisture and accidental quantities of carbonic acid. Then, when I went to Giessen to study under another dear departed friend, Baron Liebig, I learned for the first time that it contained ammonia, and that this with the carbonic acid constituted the food of plants; then, as years passed, nitric acid and ozone were found in it. Still later, it was found to contain organic matter in decay and multitudes of living organisms, which exercise much influence on decay and putrefaction. When such interesting strangers are born in the lifetime of an individual during half a century, how little do we know of any object the most familiar to us. Of the air that we incessantly breathe, and of the water which we continually drink, our knowledge even now is far from complete. But this we do know, that air, pure, free, and abounding air, contains within itself the power of purifying itself from all the abominations which we pour into it, and that it is a wonderful mechanical scavenger for carrying away all gaseous impurities. If you only imitate the ways of nature in your hygienic arrangements, they will be fruitful in good results. The excreta of animals during life, and their bodies after death, all pass through the processes of putrefaction and decay, and in new forms enter into the atmosphere. With such a mass of festering corruption in the world, there must be some provision not only to render these gaseous emanations innocuous, but also to convert them into objects of positive utility. The first process is never to allow the contaminated air of one part of the atmosphere to remain in the same place. By the great polar and equatorial currents, and by the local winds which are mere eddies in these great streams, the putrid emanations are spread uniformly throughout the atmosphere, and when made truly gaseous they are still further mixed by diffusion. The oxygen of the air chemically attacks the organic matters of the miasms and foul products of decay, and burns them up as completely as if they were passed through a fire. Their organic character is thus destroyed, and they pass into the inorganic forms of carbonic acid, water, and ammonia, which are in fact the food of plants. The ozone of the air is oxygen in a more active form, and is a strong burner up of decaying matters. Supposing, however, that a shower of rain washes some of the foul matter out of the air before its oxidation or burning is complete, the air follows it to the soil, which from its porous character absorbs oxygen, and thus the soil acts as a disinfectant, and prepares the foul materials to become the food of plants.

This conversion of putrid matter into carbonic acid, water, and ammonia is undoubtedly the final result of natural purification. The desire to attain it speedily has been recently expressed in the attempts to revive the cremation or burning of dead bodies. I quite approve of the end proposed, though I am not quite clear as to the means of producing it. Burial in a porous soil produces the same results; and, if the earth be sufficient and well selected, it does so quite inoffensively. Then the bodies decay, not by putrefaction alone, but by *eremacausis*. That word, which is merely the scientific word for decay, means burning by degrees, from *ἥρεμα*, "by degrees", and *καῖσις*, "burning". So a porous soil, containing sufficient loam to be absorptive, is in fact a slow furnace, where burning is complete in itself. Sepulture was adopted by the Egyptians, who never doubted the resurrection of the body, and was continued by the Jews, although there is very little evidence that they believed in a future state. But modern science tells us that we may burn or bury the dead utterly regardless of the body itself, for that inevitably, sooner or later, passes into gases destined to be the future food of plants, and, through them, of successive generations of men and animals. If cremation, therefore, be the most practical process of attaining this inevitable end, I see no objection to it. Only I doubt whether it is so. Many years since, I proposed that bodies should be thrown into gas-retorts, heated white hot. The volatile portions would be converted into illuminating gases, which might at once be burned, or, if desired, could be used, so that we might continue to live in the light of our ancestors; while the residue, in the same form as the body, would be harmless coke, and might be given to the survivors for sepulture. This process, I think, is more practically attainable than cremation in crowded cities, and is equally sanitary. But, as I get older, I am inclined to think that the process of burial in the earth is the wisest of all, provided it is done with honesty—not in the midst of populations or with overcrowding of the dead, as with the living—but allowing sufficient absorptive earth to secure the final result, equally the end of cremation and sepulture, that the whole organic matter of the body shall pass into the gaseous forms of carbonic acid, water, and ammonia. These, as I have shown you, are the final results of atmospheric purification.

How differently do we act in our civic arrangements! Instead of allowing garbage to be freely oxidised, or applying it to plant-life, which is its natural destination, we dig holes close to our own doors, and cherish the foul matter in cesspools, under conditions in which air cannot enter freely, and therefore the most favourable for injurious putrefaction. We forget the experience of our forefathers, that every cesspool has its own particular evil spirit residing within it; and we are surprised when the demon emerges, especially at night, and strikes down our loved ones with typhoid fever or other form of pestilence.

Perhaps we go a step further in the hygiene of moderns, and do throw the foul matter into drains, which empty themselves into our once beautiful rivers; though in many cases they are still used as a beverage by people lower down in the stream. And, when they remonstrate with us, we, surly wolves, growl at the poor innocent lambs lower down the stream because they object to drink our abominations. This country once gloried in her beautiful rivers; but they are now mere open ditches, which pollute the districts through which they flow. Rivers in their normal state contain dissolved air sufficient to oxidise and destroy any accidental organic contaminations. This purifying power of air dissolved in water is essential, because no water, either in rivers or springs, could otherwise be pure. All sources of water are ultimately obtained from rain; and that is never pure, because it washes out organic impurities from the atmosphere. At the same time, it carries down air in solution, so that it brings with the poison its natural antidote. The air-purifying process is, however, limited, and is altogether insufficient for streams polluted with town-sewage and manufacturing refuse. In them you find no free oxygen, for that has been used up by the first small portion of impurities poured into the streams. Take, for instance, the beautiful Clyde, which ought to wash, but which fouls, this great city. I have analysed its waters miles above and miles below Glasgow. Long before it reaches the outskirts of the city, it is already fouled; but, after passing Broomielaw, its condition is abominable. My friend Dr. Angus Smith has analysed the waters in its isthmus, and has found these pollutions even in the water of the beautiful sea-bathing resorts which are so much frequented by the upper classes of the city. The self-purifying power of rivers, and even of the sea pouring in its tidal wave to dilute them, has no chance against the mass of abominations which large towns pour into them. But there is no longer an excuse for their doing so, for there are now various effective and well matured processes for purifying drains before the water is ultimately discharged into the river. You cannot take out these abominations from the river itself, but you can readily prevent

them being put in. Coleridge saw this when he wrote so fiercely on the foul smells of the city of Cologne:

"But tell me, Nymphs! what power divine
Shall henceforth wash the river Rhine?"

The only mode of restoring our great rivers from their present condition of open ditches to their natural purpose of watering and purifying the districts through which they flow, is to prevent polluted matters being poured into them. Parliament must enact for this country the ancient commandment of the Egyptians, and say to all municipalities and manufacturers, "Thou shalt not pollute rivers". They have already said so to the latter in regard to air. When I was a student in Glasgow, I remember that the tall chimney of St. Rollox used to vomit forth noxious vapours, destroying vegetation, and annoying the inhabitants. I had some small influence in persuading the late Lord Derby to pass an Act forbidding the pollution of air, and I am sure that the Messrs. Tennant and all other soda-manufacturers are glad that we forced them to condense their acid fumes. Well, I say with perfect deliberation, and after full study of the subject, that our knowledge in regard to the purification of drain-waters, whether these contain town-sewage or manufacturing refuse, is abundant and practical; and that all municipalities and manufacturers should now be prohibited by heavy penalties from fouling rivers. The compulsion would be a positive benefit to both. I may remind you that the present Prime Minister has lately told a deputation that he is greatly interested in this object. I hope that he is destined to do for water what his former friend and political chief, Lord Derby, did for one of the many impurities in air. Such a triumph of sanitary legislation would be worthy of the great State doctor who has taken as his motto "*Sanitas sanitatum omnia sanitas*". If he achieve the purification of our rivers, I am sure that I can promise him from this Association, and indeed from all political parties in the State, an amount of applause which can best be expressed in the words, if not in the meaning, of Macbeth, when he says:

"Come, sir, despatch: if thou couldst, doctor, cast
The water of our land: find its disease,
And purge it to a sound and pristine health,
I would applaud thee to the very echo
That should applaud again."

Mr. Disraeli has obviously thought much about subjects of public health, as evidenced in the wise observations of Mr. Phœbus in *Lothair*. When, then, in his celebrated Manchester speech, he pledged himself that a Conservative Government would devote special attention to sanitary subjects, I believe that he expressed a deliberate and mature conviction. But hitherto, probably from the force of circumstances, we have had promises only, without their fulfilment. Surely another session cannot pass without a serious attempt at sanitary reform, when we recollect that the Prime Minister of England is the same orator who used the following remarkable words: "I think public attention ought to be concentrated on sanitary legislation. I cannot impress upon you too strongly my conviction of the importance of the Legislature and Society uniting together in favour of these important results. After all, the first consideration of a Minister should be the health of the people."

In the recent progress of hygiene, nothing has been more clearly proved than that diseases are largely propagated through foul water; and recent investigations seem to point to the unpleasant circumstance that the germs of disease chiefly come from the excreta of men as they enter into a state of putridity. Whole villages and streets in large towns have been stricken with disease by portions of human excreta finding their way into water. Take the fever epidemic in London last year. A dairy company used the water of a well which had received the drainage of a person infected with fever; this drainage having percolated through the soil to the well, and contaminated it in the usual manner in which well-water is so constantly fouled. Hundreds of persons, among whom were some of my relations, were stricken down by the milk polluted with this impure water. Take as another example the case which has happened while this address is passing through the press. A large public school, supported by national subscriptions, is thoroughly wrong in its hygienic arrangements. In its cisterns are foul waters, and close to its playgrounds are filthy cesspools. A most distinguished sanitarian—Dr. Anstie—visits it, and is lost to the world and to science during his inspection. Let us hope that the sacrifice of this precious life may lead to much sanitary improvement in our public schools. When the virus of disease enters the body in a state of solution, it is in a state most favourable for development. And, as water is the common vehicle for removing impurities from dwellings, it becomes especially important to prevent waste water from entering into any source of water-supply which is to be used for drinking or any other domestic purpose. But what is the condition of many towns,

such as London itself? They are situated on rivers from which their water-supply is derived; and it may be, and often is the case, that hundreds of thousands of persons pour their abominations into the river before it is used for the town lower in the stream. London in this way has to drink all the foul drainage of about a million persons above it in the stream. The people cannot realise this nastiness, or they would not tolerate it for a day. Glasgow is happily situated in this respect, for it receives the pure and soft water of Loch Katrine. If London had such a source of supply, I believe that it would stand as a model in its death-rate to all the towns in the kingdom.

From what I have already said, you will observe that the natural purifiers, on which we should rely in combating the pollution of our cities, are a free supply of untainted air, unpolluted water, a porous soil, the pores of which are open and not filled up by undrained waters, and, let me add, a healthy vegetation in the squares of our towns to help to purify their atmospheres, and to pour into them life-giving oxygen. It is the want of these conditions which make both town and country dwellings unhealthy.

In ancient as well as in modern hygiene the importance of an adequate ventilation of streets and houses was well known. It was also a matter of recognised experience that even efficient ventilation of these would be of little use unless the ground on which they were built was also ventilated—that is, drained of underlying water, so that the air might penetrate and circulate freely through the porous soil, in order to disinfect it from the continually accumulating *débris* of a crowded population. A few years since, while wandering amid the ruins of Cæsar's palace at Rome, I was stricken with the well known fever of that city, and during my convalescence I had ample time to speculate on its causes. Those of you who have been in Rome will recollect how shallow now is the depth of the Tarpeian rock, and how deep down below the level of the surrounding streets are the floors of the forum and ancient temples and palaces. All that is above them is the organic and inorganic *débris* of thousands of years, which when stirred up, and coming into contact with oxygen, begins again to decay, and continually emits those exhalations which find their expression in the Roman fever. The same is the case on the site of ancient Jerusalem. I remember to have read somewhere that when a shaft is sunk to the base of the Temple, the decaying matter of many past generations is set into action, and quickly destroys the wood with which the shaft is lined. Unless, therefore, the soil upon which a city is built is well drained and ventilated, the dwellings of the city cannot be healthy. It is not in fevers alone that the influence of the soil is apparent. Probably consumption itself, that great scourge of this country, is a chronic zymosis, or disease like many of our fevers, arising and communicable from like hygienic deficiencies. It is greatly mitigated by drying and ventilating the soil, as well as by ventilating the dwellings. After the sewerage of Salisbury had been made effective, the deaths from phthisis fell 49 per cent., in Ely they fell 47 per cent., in Rugby 43 per cent., and in Banbury 41 per cent. Dryness, and elevation, and well-ventilated rooms are powerful means to prevent, as they are to retard, consumption. In the last generation the average period of that sad disease was two years. Now, according to Dr. Williams, it is eight years. With pure air in the soil and in the dwelling, let us hope that the succeeding generation will point to it as a rare disease instead of as one of the most common maladies of this country.

Free ventilation around the houses, as well as within them, was enjoined by the ancients, but was as much neglected by them in practice as it has been by the moderns. Zeno ordered, after a long neglect, that houses in Constantinople should be twelve feet apart all the way up. His orders were disobeyed, but fire in Constantinople has repeatedly done for it what fire has done in London. Ancient Rome, like modern Glasgow, became very bad with its closely built houses, and at last they were ordered to be five feet apart, and not more than nine storeys high. Augustus limited their height to seventy feet, and Trajan to sixty feet. We do not know how many people lived in these houses, or how many congregated on an acre. But we do know some facts as regards our own population. Taken on an average all through England, the towns are less packed with houses and people than one could have anticipated. In primitive countries, where the savage lives on the produce of the chase, there is one inhabitant to each square mile. In the time of our Saxon ancestors in this country there were five houses to each square mile, and probably about thirty inhabitants. Good but high-handed Queen Elizabeth was so horrified with the gigantic growth of London, although it then contained only 160,000 people, that she forbade the erection of any more buildings within three miles of London and Westminster, and she prohibited the division of a house into tenements for various families, "because" (I quote her own words) "great multitudes of poor people inhabiting small rooms, and those very poor, and such as must live by begging or worse means, being therein heaped

together and in a sort smothered, with many families of children and servants in one house or small tenements, it must needs follow that, if plague or sickness came amongst them, it would presently spread through the whole city and confines." Well, does this not sound like modern lecturing in the crowded city of Glasgow, where noble and gallant efforts, however, have recently been made to mitigate the evil, and with a large promise of success? In Queen Elizabeth's time there were 15 houses and 83 people to the square mile in the whole of England. Now there are 73 houses and 390 people. In all the English towns—excluding the rural districts—there are 713 inhabited houses, and 4,061 inhabitants to a square mile. That gives nearly an acre to each house containing six persons. You see, therefore, that the area of a town is far from being wholly occupied. But just compare that with large parts of Glasgow before the passing of its Improvement Act in 1866. Instead of six people to an acre, which is the urban average in England, there were districts with 600 people to the acre, 50,000 people being huddled together on 80 acres. In 1871, when the census was taken, only 5½ per cent. of all the families in Glasgow had more than four rooms, or, in other words, 94½ per cent. of the families had such insufficient accommodation that in no case had they more than four rooms, and in most cases fewer. Edinburgh has 78 per cent. with this scant accommodation, and 22 per cent. with the superior, and its rate of mortality is 2.57. If you now compare, by a simple rule of three, the relative density of population with the relative mortality of Edinburgh and Glasgow, you will find that the increase of mortality in Glasgow nearly corresponds to its increased density in population.

The four towns of largest mortality in Scotland—Paisley, Dundee, Glasgow, and Greenock—have such dense populations that from 93 to 94 per cent. dwell in houses with four rooms and under. Notwithstanding the efforts made in Glasgow and Edinburgh to improve the house-accommodation of the poor, the latter often defeat the intentions of those who built capacious houses, because they overcrowd them with lodgers. The working man does not spend the same proportional amount on rental that the middle class man does, and is apt to try to decrease his weekly house payments by adding lodgers to the other inmates, who are already amply sufficient for the accommodation provided. If a room be adequate in its cubical contents of air for one person sleeping within it, yet it may be wholly inadequate for two or more persons. Although the amount of air required by an individual for respiration is comparatively small, yet he fouls so much air both by carbonic acid and organic exhalations that a large quantity of air must pass through an apartment to keep it sweet. If the air contain even one cubic foot of carbonic acid to 1,000 cubic feet of air it is vitiated air in an apartment. Now, to keep pure air in a room, from 2,000 to 3,000 cubic feet should be allowed to pass through a chamber every hour for each person sleeping or living in it. I need not trouble you with the data for this assertion. It is not a large enough allowance for hospitals or for rooms where there are exhalations of the sick. And, unluckily, the prevailing impression is that a far smaller amount of air suffices. In schools, for instance, often not one-fifth the amount of ventilation is given which is requisite for health.

Our rooms would become intolerable if it were not that there are natural, though insufficient, sources of ventilation beyond our control. The walls and mortar, though not transparent to light, are transparent to air, and through them is constantly passing an interchange of vitiated and pure air. Brick, is, however, more porous to air than sandstone or limestone, and Scotch houses are not so easily ventilated by natural means as English houses. Indeed, were it not that the mortar which joins the stones happens to be readily permeable to air, stone houses would be in a bad condition. Of course it is obvious, that the fewer persons there are in a house or room, the greater becomes the superficial area of the building to each individual, and the more efficient the uncontrollable ventilation. Still air is of little use in ventilation, for the origin of the word, *ventus*, wind, indicates that there must be air in motion. There are only two practical modes of producing this in our dwelling-rooms. We must either admit the external air when it is in motion, or we must produce movement by an elevation of temperature, such as fires, within the room. As the pernicious effect of draughts on susceptible persons depends on an abnormal cooling of the body, the task of the ventilator is to obtain efficient change of air without chilling one part of the body more than another. In modern hygiene, nothing is more conclusively established than the fact that vitiated atmospheres in our dwellings and their surroundings are the most fruitful of all sources of disease. The exceptions to this statement are easily explained. Thus, in the wretched dwellings and filth-polluted premises in the islands of Scotland, you would expect to find a large rate of mortality, when in reality it is comparatively small. The reason is, that during the day the inhabitants respire pure air, and during the night it circulates freely through their badly constructed cabins, neutralising the foulness in

which they are content to live. But in great cities like Glasgow there is no ozone-bearing air within miles of any part of it, and the houses are built of materials which render natural ventilation difficult. Then comes the packing up of the population into an incredibly small area, and the death-rate tells the woeful result. There is no subject to which I look with more interest than to the results which may be expected from the vigorous effort which the municipality of this city has made in recent years to mitigate this evil. The example is already telling on London, and I hope that the efforts of my friend Mr. Kay-Shuttleworth, and others, will be crowned with success next session, and that we will see a large effort to improve the dwellings of the poor in the metropolis. Light and air are as necessary to the dwellers in cities as they are to the trees of a forest. There you see trees, pining for air and light, push their branches in the direction of every inlet. In their struggle for existence many are dwarfed, and come to nothing; a few, stronger and more robust in constitution, push aside the weaker, and appropriate the essential conditions of life to themselves. If the forest be under skilled care, the forester, with his pruning-knife, cuts down the weak saplings, and leaves sufficient space for air and light to those of promising growth. But, in an overcrowded city, grim Death, with his scythe, exercises little discrimination, and cuts down all those who come within its fell swoop. I have only alluded to the physical evils of overcrowding; but the moral evils are greater still. Although there is an excessive rate of mortality in overcrowded districts, there is no lessening of the population by such unhealthy agencies. A crowded and unhealthy district, with all its inevitable consequences of low morals and low intelligence—where the condition of human beings is scarcely above that of animals—where appetite and instinct occupy the place of higher feelings—where the barest means of support encourage the most improvident and early marriages—is not the place where we shall find a diminishing or even stationary population. For the early unions in such places are followed by early offspring; and, although more than half that offspring may be swept away by disease during infancy, yet nearly a third of it will grow up in spite of all the surrounding evils, to follow in the steps of their parents, and in their turn to continue a race, ignorant, miserable, and immoral as themselves.

Next session, the Friendly Societies Bill purposes to deal with some of the many causes of juvenile mortality. The death-rate of children in a district is a sort of hygienic barometer of the surrounding physical and moral atmosphere. It is in a falling state in Scotland. The deaths among illegitimate children especially are on the increase. That is new in Scotland, but it is old in England. In some districts in London their rate of mortality, when put out to nurse, is 70 to 75 in the hundred within the first year, and in many manufacturing towns the deaths of illegimates are 30 per cent. King Herod was not a more efficient baby exterminator than such hired nurses. But there are many moral causes of infantile mortality besides illegitimacy. When I reported on the hygienic state of the large towns of Lancashire in 1846, I was much censured because I dared to show, by statistics, that the children insured in burial societies died faster than uninsured children. That parents should neglect their children for their burial money is very horrible; but the conviction that they do so was strongly forced upon me by the evidence, and twenty-eight years later it is again forced on public attention by the far higher authority of the Friendly Societies Commissioners. In 1846 I also was distressed to find the use of opiates among children very prevalent in manufacturing districts. In this case the motive was not criminal; for the practice had arisen in ignorance of its bad effects. But it was not difficult to trace a large amount of direct and indirect mortality to this pernicious custom. Among children the administration of opiates, under the names of quietness and soothers, is nearly as destructive to health as the excessive use of alcoholic stimulants among adults. The craving for both arises from those depressing physical causes of disease which abound in cities. Dirt and drunkenness are often cause and effect. Indeed, the physical and moral causes of disease are nearly as intimately associated as filth is with the entozoa of which I have already spoken. Shocking and repulsive as some of these causes are, especially in relation to infantile mortality, it is no use for us, like ostriches, to bury our heads in the sand and refuse to see them; for it is the relentless King Death who is our pursuer. I have sometimes been unwise enough to think that the enormous infantile mortality of our crowded places might be an important provision for securing a more healthy race of survivors in the struggle for existence. But a little reflection shows how untenable such a view is. We might as well suppose that the abnormal waste of a particular organ of the body was best fitted for the health of an individual as to consider that the increased mortality of unhealthy districts in a town gave a superior race to its surviving inhabitants. No doubt unsanitary conditions first sweep off the weak, and those unfit to live under the continuance of existing causes of disease. But these become stamped at the same time into the organisms

of the survivors, who carry them, through inheritance, into succeeding generations, though the original causes may have been removed. The survivors carry with them the seeds with which they have been impregnated during an unhealthy upbringing.

"A man, perhaps, the moment of his birth,
Receives the lurking principles of death;
The young disease which must subdue at length,
Grows with his growth, and strengthens with his strength."

We are not always neglectful. Sometimes we look upon a human infant as a dangerous animal that may turn round and bite us when it grows up, and so we give some attention to the children of the dangerous classes, and try to tame them by improving their dens and educating them to a limited degree. But the children of the productive classes receive no such public care, and they grow up stunted in frame and of low productive value, because the State does not provide for conditions of healthy human development in crowded populations. If babies were pigs, or oxen, or sheep, the Vice-President of the Council would be daily questioned in the House of Commons if any unusual mortality came amongst them; but, being only human infants, no one thinks of their welfare. Beasts, with a selling value, are taken more care of than men in free countries. I do not remember the proportion of veterinary surgeons to horses, and of surgeons to men in our own army; but I recollect that Chenu, in describing the late French war, said that every 1,000 horses had $4\frac{1}{2}$ veterinary surgeons, while every thousand men had only two surgeons. If we succeeded in getting the dwellings of our working classes made as healthy as the cell of the felon—and surely that is not an unattainable luxury—eight years would be added to the productive ability of our working population.

I have mentioned various subjects in regard to which legislation is promised to us by the present Government, and I have no doubt of their desire to improve the condition of the people; but there is among their supporters a strong objection to increase local taxation, and without that large measures of improvement cannot be carried out. I should like, therefore, to show you by a single illustration how productive local taxation is. Sanitarians at present are inclined to believe that urban deaths need not exceed 17 in the 1,000. But let us assume, in the case of Glasgow, that its death-rate might be reduced to that of London—that is, to 22.4 in 1,000. In this case, the unnecessary and preventable deaths in Glasgow, as compared with London, are 3,817 annually. But these deaths imply a far larger number of cases of preventable sickness among the living. Statistical investigations made by Pettenger show us that for every case of death in public institutions for the sick there are 34 cases of serious sickness, so that the 3,817 unnecessary deaths must be multiplied by that number in order to give you the minimum cases of preventable sickness. These cases of sickness last on an average eighteen days and a half. Hence the cases of preventable serious sickness taken at only two shillings a day represent an annual cost to the city of Glasgow of £240,000. This, however, represents only a portion of the interest of money which might be well spent in paying borrowed capital for the improvement of the city. I put this for the present purposely on the mere money aspect of the question. Franklin's aphorism, "Public health is public wealth", is true even in its more vulgar meaning. Whether the saving of life of human beings, with higher hopes and aspirations than existence in the world, is to be appraised on a mere money standard, is quite another question. But my object is simply to show that, taking the smallest part of the money saving, it is obvious that money judiciously spent in sanitary improvement is not unproductive taxation, but capital bearing abundant interest.

I began by discouraging statements of our slow progress in the improvement of the country as a whole. As regards Scotland, indeed, I had to admit that the causes of deterioration are still more powerful than the means of improving the social condition of the people. If I understand my countrymen aright, the conviction of this fact will not render them hopeless, but will stir them to new exertions. Yet I would not take leave of you without pointing out that there is abundant proof that sanitary measures are producing great results when well applied. Take the case of the army, for example. About twenty years ago, if my memory serve me right, I was a commissioner of inquiry into the hygienic condition of military barracks. Then their ventilation was in a woeful condition. I spent various nights in the sleeping-rooms of the soldiers, and found all the hygienic arrangements deplorably bad. Since the Crimean war, the military authorities, aided by the excellent hygienists among the medical officers of the army, have placed the health of the army in a much more satisfactory condition, and the result is that the mortality of the army is now less than half of what it was before the war. But it is not in our army alone that such results have been produced. Formerly the deaths from sickness in campaigns were four times greater than the deaths from wounds. Every campaign now

lessens the proportion, because the sanitary conditions of the soldier's life both in peace and war is much better attended to. In the last war, the German troops lost less than a third of their dead by disease, while formerly the loss had been four times that from wounds. The following figures give the deaths from disease for every hundred men lost in the campaign:—

French in the Crimean war	...	79
United States troops in American war	...	80
Germans in last French war	...	29

The small loss from disease as compared with wounds in the French war, promises much for military hygiene in future campaigns. In the Crimean war, after the sad experience among our own troops owing to defective sanitary organisation, we sent out a sanitary commission and improved the hygienic condition of our troops, while France failed to do so. And the final result, according to Chenu, is that while we lost 12 in the 1,000 of our men, France lost 155.*

Formerly the rate of mortality in the chief towns of British India, such as Calcutta and Bombay, was appalling; now, by hygienic improvements, and in spite of the tropical climate, it scarcely exceeds that of Manchester, Liverpool, and Glasgow.

If I had time, I could quote to you many cases in England where sanitary constructive works have largely reduced the mortality, but I have taxed your patience too long, and must now draw to a conclusion.

I have indicated the promises of sanitary legislation which have been given to us by the present Government, but to none do I attach more importance than a reorganisation of our system of local government which the Conservatives are bound to attempt. If wisely done, its consequences may be immensely beneficial. In England, at the present time, there is a casual agglomeration of 1,500 separate sanitary authorities, without system or cohesion. Their areas of administration are diverse in the extreme, being neither bounded by counties, parishes, nor natural watersheds, and their duties are divided without meaning between authorities in the same district. They have been lately put under medical officers of health without preparation or qualifications for their duties, some well paid and devoting their time to this important work, others having little more than nominal payment and giving little more than nominal time to their important duties. Notwithstanding this too sudden and unprepared universal appointment of medical officers, yet in the administration of the Health Acts there has been recently manifested a disposition to "distrust the doctors" and to work the Acts, at least at head quarters, by lawyers and other persons not connected with the medical profession. This is the old error of making common sense the fetish for worship, which Archbishop Whately and others have so effectively condemned. Even the most fervent worshipper of common sense, as opposed to technical training, never relies on it in important emergencies of his life. He goes to the lawyer to make his will or to convey property; he consults the parson on religious doubts when on the sick bed; and he does not spurn the doctor to cure him of his grievous ailment. But it is well known that the Local Government Board are afraid of the doctors in the administration of Health Acts. Who beside them possess the knowledge? I can testify, from an experience of thirty years in sanitary work—and impartially, because I am not in the medical profession—that there is not a class of men in the country who labour so zealously for the prevention of disease as the doctors, though their training hitherto has been cure, not prevention. Certainly their private interests have never been allowed to stand in the way of their efforts to uproot disease, although their living depends upon its existence. This unselfishness in the application of their science to prevention has always been to me a source of high admiration. Why, then, is there this vulgar distrust of the doctors in the administration of our Health Acts? Extend this prejudice against technical knowledge, and how absurd it would be. Would you improve the progress of telegraphy in this country by suppressing electricians; or the law and justice of the country by putting down lawyers? Would the Secretary at War promote the conduct of war by suspecting soldiers; or the First Lord of the Admiralty the efficiency of fleets by distrusting sailors? Would our railroads and harbours be better governed if engineers were held at a discount? But this is actually the state of things at the Local Government Board—the Health Ministry of the country. The Privy Council handed over to that board Dr. Simon and his associates, with a wealth of medical experience in public hygiene. Ever since, that wealth has been locked away from public use. Certain I am that their experience could not have guided the board in the utter confusion of organisation in regard to medical officers of health. They have been appointed without any system. Some

have a small parish to attend to, others have a thousand square miles. The last are appointed for combined districts, but are managed by uncombined authorities, and have neither assistants to aid them nor power to enforce their decisions. The officers of health are without any definite rule for obtaining available knowledge of prevailing sickness, even when it is treated at the public expense within their own districts; and they are not, universally at least, informed of the deaths as they occur. The medical officers of health have been appointed without any examination on their knowledge of State Medicine, and in the majority of cases they do not possess this knowledge. I am perfectly certain that this utter confusion could not have resulted had the Local Government Board consulted the experienced State medical officers belonging to them. This distrust of the doctors in higher administration is simply a general mistrust of science. And the time has now arrived when science must be trusted in government. Science is entering into the higher education of the country, and the prejudice against it among legislators, who were educated in classical universities, will in time be removed. For the progress of a country depends upon the progress of science, and the welfare of a nation is secured by the most intelligent application of science to its manufactures and to its government. The health of the country—and that governs the productive power of its people—depends as much upon the applications of medical science as the working of a machine depends upon a good application of mechanical laws. To trust the whole administration of Health Acts to Poor-law inspectors and lawyers is an amazing example of unbelief in the first principles of the laws of health. The well-being of the people depends upon physical causes, which, when intelligently understood, mean physical science, and the trained physician is the natural and most intelligent agent for extending its knowledge and application to the prevention of disease.

What we want in the future is not new law, but more efficient administration of existing law. To heap up new sanitary law on the decaying mass of indigested sanitary law which already forms a dismal agglomeration, is like the practice of our ancestors, who thought that a few clean rushes, thrown upon the corrupt mass of foul rushes on the floor, sufficed for sanitary purposes. What we want is superior organisation and efficient administration of existing law. But, in our happy-go-lucky style of government, are we likely to get it? I doubt whether it will be wise to continue the local government as a separate department of the State. Its functions, in reality, appertain to the Home Office, which, when properly organised, should divide itself into two great departments—the one dealing with police and justice, the other with the physical interests of the people. One Secretary of State might have the supreme responsibility, but each of the divisions should be scientifically administered. It would be as absurd to put a man trained in physical science at the head of the branch of police and justice, as it is to put a man merely trained in law in charge of the physical interests of the people. It is an exploded fallacy that only lawyers are good men of business, and that scientific men are not. Is my friend Sir John Lubbock a worse banker because he is an eminent man of science? Is Mr. Spottiswoode a worse printer because he has distinguished himself as a physicist? Is Mr. Warren Delarue a worse stationer because he is equally conspicuous as an astronomer and as a chemist? The local government of the country, in as far as it relates to the physical interests of the people, will remain an example of arrested development, unless science receives a recognised position in its administration. Now, the Local Government Board is drifting into the position of a large and responsible ministry dealing with the physical interests of only one portion of the people, and having no imperial object or comprehensiveness; for, though it includes England, it excludes both Scotland and Ireland.

I have already shown that the sanitary conditions of Scotland are deteriorating, while those of England are improving. The natural course of administration, then, should be to bestow upon the former even a greater portion of ministerial care and responsibility; but it receives none at all. The time may, however, arrive, when English legislators will remember that there is a certain portion of Great Britain to the north of the Tweed, and that its local government, as well as that of England, is worthy of imperial care. In questions of such imperial importance as education and public health, it is a foolish policy to treat the three parts of the kingdom by fragmentary and unconnected legislation. In relation to sanitary questions, public conscience has been recently much aroused, and will ultimately obtain attention to its calls. No doubt sanitary science, both in the abstract and in its application, is, like many other sciences, of slow growth. The crop of truths, which we are now harvesting, results mainly from seed sown by our forefathers. The seed which we ourselves may throw upon the waters will assuredly come up into a harvest, though it may not be for many days. But he who will not sow for futurity, deserves nothing from the past. It is our

* In the Crimean war, 95,000 French died—75,000 from sickness and 20,000 from wounds. In the American war, the United States troops lost 42,010 men from sickness and 10,142 from wounds. In the late French war, the Germans lost altogether 40,381 men, of whom only 12,253 died from sickness.

duty to labour for a future which we may never see, and not merely to live on the wealth of accumulated experience, as the heir of riches does when he uses them for himself alone. This Association contains many missionaries for the propagation of sanitary knowledge. Their mission is to stand between the living and the dead, and bid the plague to cease. There have been times when a Scotch professor like myself dared not have preached such doctrines in Scotland; for his countrymen once hugged the belief that pestilences were divine judgments, which ought not to be interfered with by human agency. Even then they forgot that there is far more of mercy than of wrath in all divine arrangements. Undoubtedly, pestilences are warnings that man is transgressing the beneficent laws provided for his well-being. But a god of wrath and pestilence is now a god of the heathen, not of the Christian. That ought to have been understood long ago. The prophet heard the wind which clave the rocks, but the voice of God was not in the wind. He felt the earthquake which shook the world, but the voice of God was not in the earthquake. He saw the fire, as it pursued its track of desolation, but the voice of God was not in the fire. It was only after these terrors had passed away that the prophet heard the voice of God as a still small voice. That whispers to us still; not in plagues and pestilences, but, when these dangers have passed, as an ever-present voice in all the ordinary occurrences of our lives. It tells us of the beneficent wisdom which regulates all the laws of creation, made for our well-being, and not for our destruction. It is by disobedience to them that we are punished by 125,000 persons being unnecessarily cut off every year in this country. Our own acts produce those demons of destruction which the Jews of old credited with the slaughter of the people; and by our own acts we can convert them into preserving angels. I think it is in the epilogue to the *Honest Man of Fortune* that Beaumont and Fletcher thus describe our responsibilities for what befalls us:

"Our Acts our angels are, or good or ill,
Our fatal shadows that walk by us still."

The object of the health section of this Association is to show our countrymen how this sacrifice of preventable deaths may be avoided. That number of deaths imply more than four million two hundred thousand cases of preventable sickness. It is upon these that we must operate, by rooting out the causes which produce them. I began by drawing your attention to the death-rates of the country. These have been derived from the excellent system of death-registration which we now possess. But there is another system of registration which it would be important to add to our sanitary records—the registration of sickness. Registration of deaths represents the wrecks which strew the shore, while that of sickness would tell us of the coming storms and enable us to trim our vessels to meet them. Till we have such a system of disease-registration, public health cannot be administered with full intelligence. We must not forget that the function of the sanitarian is prevention. His function begins and ends before man reaches his final state of decay, "or ever the silver cord be loosed or the golden bowl broken...or the wheel be broken at the cistern". When this wheel, or circulation of the blood, is broken, a new and a great wheel begins, involving in its rotation all organic and inorganic matter. In this there is the highest example to us of hygienic organisation. You know how the waste of animals during life, and of their bodies after death, passes into the gaseous forms of carbonic acid, water, and ammonia. These substances form the aerial food of plants, which, in fixing and moulding some of their constituents into new forms of organic life, purify the atmosphere of its noxious products, and restore the life-giving oxygen abstracted in the respiration of animals. Thus plants convert the foul products of animals into new food necessary for their growth and development. The great and abounding air into which passes all the foulness of the living, and all the putrid products of the dead, becomes at once the grave of organic death and the cradle of organic life. In this wonderful circle death and life rapidly appear in correlation; and past generations of animals, by a process of dissolution, produce living generations by a process of evolution. All this is in the harmony of nature, without jar or disturbance. We should strive, in our hygienic efforts, to take part in this great circle, without vainly attempting either by ignorance or by design to mar such wonderfully conceived plans for preserving the world in purity and sanity.

PROMOTION IN THE INDIAN ARMY.—Under the authority of the Secretary of State for India, it is notified that, although a certain period of regimental service is not required by the Royal Warrant of July 1st, 1873, as a necessary qualification for promotion to the administrative grade of the Medical Department, it will still rest with the Government of India to select for promotion to that grade officers possessing sufficient regimental experience to enable them to exercise supervision over military hospitals and regimental military staffs.

INTRODUCTORY ADDRESS ON UNIVERSITY AND MEDICAL TEACHING.

*Delivered at the opening of the Medical Department of Owens
College, Manchester.*

By THOMAS H. HUXLEY, LL.D., F.R.S.,
Professor of Natural History in the Royal School of Mines.

MY first business to-day is to declare that the medical school which has now for some years been in course of erection, is formally opened, and ready for the work which will, I hope, for a very long series of years be successfully continued in it. I am very proud to be made the medium of this declaration to-day, and I might, perhaps, express my regret that official engagements, from which I could not free myself, prevented me from being present this time last year, when the magnificent buildings which I have seen to-day for the first time were formally opened by his Grace the Duke of Devonshire. Indeed, an occasion of that kind, and an inauguration such as took place last October, was one at which any man having the interests of so great a section of Her Majesty's dominions as Lancashire at heart might have been glad to be present; for although in name you professed only to have established a College, that which you practically did then was to lay the foundation of a great university for Lancashire. If you look into the origin of universities, you will find that it was no part of the original constitution of an university to be endowed with rich fellowships, or even the possession and power of granting degrees. Those admirable men originally associated themselves together for the purpose of forming corporations which were called universities, and they were impelled by a desire to learn and to teach, without caring more for the future fate of their learning and teaching than what might be necessary for securing the full efficiency of that learning and teaching. It was only subsequently that the power of granting degrees became conferred upon them, or, perhaps I should more accurately say, at first associated with them.

I find that, like the older universities, this body has practically divided itself into departments, which in the case of the older universities were true faculties, but are here known by the more modest name of departments. You have a department of arts, a department of law, a department of science, and a department of medicine; and this classification of the departments into which you have spontaneously divided yourselves, when contrasted with that which existed early in the history of the older universities, is in itself a striking indication of the times; and the present state of affairs differed from what would naturally have arisen in older times by the absence of something and by the presence of something. It would be wholly needless and undesirable for me to dilate upon the reasons which have led to this remarkable difference; they are patent and obvious to everybody; nor will I for a moment dwell upon what considerations might be urged to show that the difference which now exists is possibly not an essential and not a desirable one. On that point ideas vary. But I congratulate you upon having made this great step, and I congratulate Lancashire upon having seen that her highest interests are bound up not only with the elementary education of the people, but with the higher education of the upper and those classes which are more accustomed to depend upon their intellectual and less upon their manual labour. And I congratulate you upon having done so great a work and by your own spontaneous efforts. The sum that has been raised for the establishment of this College is perhaps not vast in relation to the enormous wealth of Lancashire, but it is a great sum; and let us hope that those who possessed that enormous wealth, when they considered what this College is doing, what a great work it is performing, what most beneficial results will certainly accrue from its efforts in the future, that they would understand that, although they were giving liberally, it is only a forecast of that which is to come.

I notice in these donations, and in these sums of money subscribed for the purpose of building and endowing and providing with scholarships this great institution, what appears to me to be a peculiar fea-