

*Some Ancient and Modern Ideas of Sanitary Economy.*

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As I believe this Society has not yet had introduced to it the subject of Sanitary Economy generally, which certainly is becoming of greater importance daily, I have ventured, although the popular agitation is now somewhat allayed, to bring forward this paper, not as a full discussion of any one point, but rather in the Essay form, putting together some few prominent points, and in a rude way connecting the faint struggles of past and present times in the direction of wise distribution and arrangement, in accordance with acknowledged sanitary laws.

Sanitary economy has scarcely attained for itself a distinctive place in our country or literature; the whole idea is novel to many persons, and it has not the names of great lawgivers, traceable through many generations, from whose dicta it can gain great authority, and from whose judgment it can find many important precedents. We have only lately had a suitable Nuisance Removal Act; we have not in all these centuries been able to remove, legally and thoroughly, what was offensive to the senses or detrimental to the health, even were we sufficiently aware of the consequences. Science has now certainly made us see what before was quite invisible, and the Legislature, recognising the justice of her conclusions, is acting according to her dictates.

And yet, although to us a new era has begun, wherein the community unites to remove evils, and to produce comforts



entirely beyond the power of individuals to attain, there have been no perfectly new truths discovered, no perfectly new principles acted on, and perhaps we may add, no strikingly new laws made. The laws have been better defined, been made more comprehensive and more easily carried out, and known principles have had an extension, both expansively by taking higher ground, and intensively by a care for smaller objects. Yet in examining antiquity, we find it by no means devoid of general laws, nor of clearly defined regulations within certain limits; and we sometimes see indications of great progress in sanitary habits, rising up especially in connection with religious feeling, when the purity of the soul and of the body have been looked on as analogous, and have been conjointly sought after.

We have all some idea of the sanitary laws of at least a portion of the ancients, the Jews, and in them we see no vague ideas about cleanness, but exact and definite rules, the value of which science may take in hand distinctly to prove. But the whole East has more or less of a sanitary code also, as may be seen from the baths of the Mahommedan to the clean clothes and clarified butter of the Hindu. True, with all these the mere form alone remains, having been originally sufficiently important to have been introduced by more than merely legal authority, and bearing amongst them the veneration of a divine command. But this decay is in a great measure owing to the decay of the several nations; the same personal habits cannot be kept up in a falling state. An age of violence or of instability puts down all orderly actions, the result of orderly thoughts; whilst science, or the reasons for acting, sinks, and the arts, each in their order, gradually decline.

On the other hand, a nation in actual warfare does not need the personal habits of a nation at peace. We see, in an unquiet period, that it becomes the glory of a man to live simply and to want little, whilst, in other circumstances,



the same man would seek his highest honour in surrounding himself with all the complex devices and refined ornaments which are the products of civilization and of peace. And although it has been sufficiently shown that a rough, semi-savage life is not productive on the whole of a longer average life, but on the contrary of a shorter, it requires at least no tours to Scotland, Ireland, or Wales for health, and no infirmity life by the sea shore. With them there is no saving of the tender life, no nursing of the weak child into the healthy man, but a rapid death for him who is seized with illness, whilst violence and excitement remove from him many of those smaller evils to which in a calmer life men are liable. The whole community seems to feel the advantage of the change, the farther men remove from the habit of leaving the sick behind, and of killing those who are slow on their march; and in the sympathies which suggest this change, and the circumstances which bring leisure for their growth, we probably find the first rude spot where the natural history of sanitary economy begins.

Looking also at the history of the subject in our own country, and what little I may know of ancient countries or distant ones, it would seem as if the attention to health arose, not so much from any sense of sanitary or of healing measures, as from the simple natural desire of the sick to obtain more comfort of place, whilst the more extended part of the question arose from the desire of appearance and the natural tendency in certain stages of civilization to heap up luxuries; these luxuries being, however, the abuse of instincts evidently tending, to a considerable extent, in a natural and desirable direction. Every virtue is said to have its companion vice; and when a proud king of Nineveh builds a palace for his own vanity, at the expense, no doubt, of much misery, it is not from any keen perception of natural laws that he makes the rooms larger than his predecessors did,—that he puts glass in them, (if indeed that is a glass furnace which is found in



the neighbourhood,) or if he puts in earthenware sewers, and makes it water-tight with pitch from the inexhaustible sources on the banks of the Euphrates. The size is for grandeur, the sewer becomes an absolute necessity in a large house; the mind that constructs the rooms can construct the drains, or perhaps the inferior work may be left to inferior agents, and one most useful invention of these few years was in all probability carried out by some wretched inhabitant of a mud hut in the neighbourhood. Neither when this same king, or even petty savage chief, seeks a drier room or hut and a warmer couch, does he seem to have the least thanks due to him for beginning to teach us that the cold beds on the heath or in the morass are favourable to ague and to fever; on the contrary, these generally seem to have felt themselves in the wrong, being ashamed of their indulgences, and not without a cause: but from the observation of such beginnings that middle course must have arisen which teaches us that neither in the degradation of luxury or of want, can the use of the faculties of men be fully obtained. The effects of indulgence have often led by reaction to the most contrary habits. In a country at various periods given to excessive sloth, was found the home of the most energetic huntsmen; and the description given by Xenophon of the exercises of the Persian youth, shows that attention to personal health was carefully studied, and, in many respects, well understood.

In Egypt, too, where whole strata of extinct habits have been recently dug up, we find remains of sanitary economy among those of pomp and rule,—sometimes beside superstition, or in the happier neighbourhood of taste or of religious feeling. Their physicians were considered admirable, and no doubt that observing nation must have made much progress, with such a complete organization of learned men, appointed to cure each his own department of the body. The organization of that body showed also a something more than a mere regard to personal health; it was an attention



to the health of the community. If, as we may reasonably suppose, there was originally a sanitary intention in embalming their dead, it certainly answered the purpose well, whilst the decayed bodies which now are said to pollute Cairo, were converted into objects of respect and lessons of wisdom to the ancient inhabitants. There is no doubt that their exercises were intended for health as well as amusement, because in a place where daily walks could not be taken as with us, they used all those methods of exercising the muscles by artificial postures, dumb bells, &c., now only becoming common with us. But here, again, the real part of our subject is left unknown; we do not know well how they dealt with crowded communities, with streets, with houses, and the sites of towns.

That sanitary arrangements in towns arose more from the love of appearance and luxury, than from sanitary law, I am more disposed to believe, from the method in which many of these towns have grown. Whether we take Edinburgh or ancient Athens, there has been the same close building of streets, so that the opposite sides nearly met, especially at the top; ceilings being low, and ventilation bad as a consequence. When life in Greece became more languid, these houses became intolerable; the active men of an early period did not feel the discomfort of the small houses they so little used, whilst to the luxurious man of a quieter period, they became intolerable, and gave way to the mansion; whereas it is to be hoped, in modern times, we seek improvement not to prepare idle days for ourselves, but to increase our vigour. Yet in that country, probably, among certain persons, it was as well understood as anywhere, what were the advantages of good air, good water, and good exercise. Hippocrates gives directions to physicians to examine carefully the situation of a town as to winds and as to soil, and is apparently the first writer on sanitary economy in an extended sense. His treatise on *Air, Water, and Situation* is not an uncommon



book, and is to be found in Sir John Sinclair's *Code of Health*. Not having that, I give a rough translation of one sentence—

“When he (the physician) comes to a city, he should consider how it lies, both as to situation, prospect, and winds. For the winds have not all the same strength from the north, south, east, and west. And these things are to be observed,—what water there is about the place; whether soft from marshes, or hard from high rocky places; or hard and saline. The land is also to be looked at, if it is naked and without water, or if it is wooded and moist; whether it is low and suffocating, or high and cold. Also what kind of food the people use, is to be examined; whether they are great drinkers or eaters; or if they delight in exercise or in work, and are temperate in eating and drinking.”

He then discusses the effect of climate on men, as to their mental and bodily development, still a contested subject, and it is curious to see that there is no element introduced in the present day which he did not then introduce. True, we have in some cases the element of accuracy affecting certain branches of the subject. If we look at Sir James Clark on *Climate*, however, we see the same things, “hot, dry, cold, moist,” and so on, in constant repetition, but the thermometer and rain gauge are made use of in many instances. Still, I imagine, we know as little of the cause as Hippocrates, when he tells us that one wind takes away the appetite, another causes coughing.

Sir J. Clark's book is full of remarks such as these:—

“Florence is subject to sudden transitions of temperature, and to cold piercing winds during the winter and spring.” “Rome; the peculiarity of it deserving notice is the stillness of its atmosphere, high winds being comparatively of rare occurrence.” Also—“More is to be feared from currents of cold air in winter, than from a confined humid atmosphere, which last is the evil to be avoided during summer.”

But even before Hippocrates, evils of this kind were attended to, and Hercules is said to have saved the Elians



from a disease by draining pestiferous ground. The neighbourhood of Rome was healthy or unhealthy according as it was inhabited, nature producing disease, and art health. Cities, also, seem to have been carefully drained before the historic times, whilst a drain tile of modern form has been taken from the neighbourhood of the Euphrates. The Greeks were well aware of the value of having streets wider than they possessed in Athens, although the municipal economists of early times would not permit a change, for fear of the leading men misusing the money,—making what we should call a job; as it seems to have happened there as here, that the best schemes were not always proposed by the most suitable characters.\* In the later Empire, however, very particular directions are given as to widening the spaces between houses, removing obstructions from the street, and raising balconies to prevent the street air from being close. Most of these laws came from Rome apparently, and there, also, we find that elegance and security are more looked to than actual health. Houses were not allowed to be above nine stories, not because they occasioned a crowding of the population and a closing of the street, but because they were apt to fall down. In Rome houses were ordered to be five feet apart. Augustus ordered that they should not exceed seventy feet in height, whilst Trajan thought sixty feet high enough. In Constantinople, Zeno ordered all houses to be twelve feet distant from each other, from the ground upwards, that is, they should not project as they rose, nor should they deprive a neighbour of his view of the sea. This looking to the sea was considered very important, as no one was allowed to stop the prospect from houses, excepting from kitchens, baths, stairs, passages, &c.† One too severe law in connection seems to have been useful at times; workmen who did not do their work well, were compelled to make good any damage that might result, or if not able through poverty, they were beaten

\* Boeckh's Public Econ. of Athens.

† Cod. Just. Lib. viii. Tit. 10.



out of the town; still, I am not aware of any method of teaching them their work, and they were thus kept up to a higher standard of duty than those who paid them. The plan in Manchester, when gas is fitted badly, is to fine the gas-fitter, and if he continues to fit in such a way as to allow the dangerous and unwholesome gas to escape, he is suspended.

In Rome, there were some laws with a merely sanitary object, clearly enough expressed, for example\*—"The Prætor took care that all sewers should be cleaned and repaired for the health of the citizens; for uncleaned or unrepaired sewers pollute the atmosphere and are dangerous, if not repaired. This is for private sewers; public sewers have the public care." A sewer is defined—"A hollow place through which any impurity flows." (*Cloaca autem est locus cavus, per quem colluvies quædum fluat*). Also a tube or pipe is said to be comprehended in this definition—"Cloacæ appellatione et tubus et fistula continetur."

It is forbidden, also, to throw refuse on the roads,† either offal or animal refuse, (or to quarrel in the streets is added as a similar nuisance.)

"*Idem ait, Si odore locus pestilentiosus fiat;*"‡ so that smell itself was considered unwholesome or pestilentious.

We have, then, in these early times, the elements to be worked out, a point scarcely worth proving, because the senses of men in all ages might be supposed to teach them to avoid an atmosphere obviously unpleasant, as well as to seek a pleasant or a wholesome one; but the truth is, we had gone back a great deal, and did not believe these things. Ascetic habits—solemn protests against self-indulgence of all kinds—

\* "Curavit autem Prætor per hæc interdicta ut cloacæ et purgentur et reficiantur: quorum utrumque et ad salubritatem civitatum et ad tutelam pertinet; nam et cælum pestilens et ruinas minantur immunditiæ cloacarum; (item) si non reficiantur."—(Ulpian, Digesta Just. Lib. xliii. Tit. 23.)

† Lib. xliii. Tit. 9.

‡ Lib. xliii. Tit. 9. (29.)



having spread among the finest minds of both the east and west, produced, no doubt, a carelessness in many respects among the very persons who were most likely to be careful of health; and instead of purifying by washing and by fumigation, as their forefathers, they came to consider numerous sufficiently apparent evils, as not to be remedied by a short-lived race, or as purposely established as trials for our benefit. Another stage of reasoning made men consider them as actual benefits, capable of promoting health, till, when evil consequences could no longer be hidden, it was said, and still is said, through some abuse of a scientific idea, that the greater the number, the greater the benefit, as they then tend to exterminate each other.

Although, therefore, Hippocrates had been praised for fumigating the streets by fires, by the odour of flowers, and by the opening of certain windows and shutting of others, Sir Kenelm Digby, a long time after, when the lesson ought to have been better learnt, tells us that—

“In times of contagion or universal infection of the air, pigeons, cats, dogs, and other hot animals, used to be killed, which make continually a great transpiration or evaporation of spirits which issue forth of evaporation; the pestiferous atoms which are scattered in the air, and accompany it, used to stick to the feathers, skins, or fures.”

Yet he did not give up the fires. He says—

“By reason of their (*i.e.* the fires) attraction, they used to make great fires where there is household stuff of men that died of the pestilence, to disinfect them.”

But it is curious how directly to the point, at an early time, Ulysses came; when he had killed his suitors, he fumigated the place with sulphur:—

“ὥς εἶφαθ' οὐδ' ἀπιθῆσθι φίλῃ τροφῷς Εὐρυκλείῃ  
 ἠνεγκεν δ' ἀρὰ πῦρ καὶ θῆιον· ἀντάρ Οδυσσεὺς  
 εὐ διεθειώσεν μέγαρον καὶ δῶμα καὶ αὐλήν.”

Hom. Odyss. book 22, l. 492.



Or the whole passage from Cowper's *Homer*—(Pope slurs it over):—

“Bright blast-averting sulphur. Nurse, bring fire  
That I may fumigate my walls; then bid  
Penelope with her attendants down,  
And summon all the women of her train.  
But Euryclea thus, his nurse, replied:—  
My son, thou hast well said, yet first I will  
Serve thee with vest and mantle. Stand not here  
In thy own palace, clothed with tatters foul  
And beggarly; she will abhor the sight.  
Then answer thus, Ulysses wise returned:—  
Not so; bring fire for fumigation first:  
He said; nor Euryclea his loved nurse  
Longer delayed, but sulphur brought and fire,  
When he with purifying steams himself  
Visited every part, the banquet room,  
The vestibule, the court.”

I adduce this as a contrast to the opinions of a man of the 17th century, certainly not the most ignorant, for Sir Kenelm Digby was a man of some observation, although of more imagination, and reasons on the “strange subtlety of little bodies which issue forth from living bodies, by means of which our dogs in England will pursue the scent of a man's foot, or of a beast's, many miles.” This is in a “Discourse made in a solemn assembly of nobles and learned men, at Montpellier in France;” and shows the strange rational and irrational channels in which men's thoughts even then ran. In this last he runs down coals, which were getting into use in London—

“The soot from the coals dirties tapestries, clothes on the hedges, &c.” “It has a great quantity of volatile oil, very sharp.” Also—  
“We find that the most neat and polished silver plate, exposed to the air, becomes in a short time livid and foul; which proceeds from no other cause than those black atoms (the true colour of putrefaction) which stick unto them.”



Bad as smoke is, it is fortunate that this happened, especially at a friend's house, where they were emptying sewers.

The chain of reasoning on every subject from the beginning of time till now, has been so much broken, that it is not surprising if we have not, on some points, kept alive all the knowledge that has been gained, or made additions with sufficient constancy. Chemistry, such as it was, medicine, and the knowledge of hieroglyphics, were alike lost together, and similar events must always occur if the custody is in the hands of a few. Nothing has more lamentably been lost than the arts; they have had no teachers, and had no historians. No writers seem to have thought it worth while to tell us how the carpenters, bricklayers, and potters did their work; their arts must have been devised with great wisdom, often after much patient observation and ingenuity, but the lesson only went to the next door. We could have spared many battles to have known the duties of the keeper of the streets in Rome, with his whole host of workmen, and how they worked. Indeed, minute knowledge in any department is scarcely to be got at the present day. Knowledge and habits are transmitted, as of old, by chance words of masters,—a mere scolding observation in the workshop at best. Now we know that a great advance is not made by mere work, and chance thought; the thought should be as regular as the action. What could professional men do without their theoretical teaching, their books, and their lectures, in which they learn to arrange their knowledge systematically, and by doing this sow the seeds of future advance? Teaching of a similar kind is as necessary for every art; every workman should have his lectures and his books.

Even now it is a fact that the men who work in our mills are educated to one action only; their fingers are taught the movement, and they live by that one movement; they are absolutely unfitted for any other after a time, and seldom have a chance of learning another. It is found impossible



to carry on a work of any kind in the place where no works of that kind are known, without long and laborious teaching and often much loss. The generations teach their next generations their own peculiar movement, and it might almost be expected that after a time children should be born which, like pointer puppies that point by instinct, should, by some instinctive movement, tie unseen threads in the air. The general system of work is in the lower stage, or imitative, and has only partially risen into the higher, or self-supporting independent stage, as the sciences and some more refined arts have done. We want theoretical teachers, that the men may cease to be mere attachments of the town or mill,—a serfdom inherent in ignorance and incapacity. It is from this want of the means of communicating knowledge, that the first steps of civilization have to be repeated so frequently, and we must be constantly learning the beginning, when we might be employed in unravelling the difficulties that constantly become more complex.

The learned discourse of Sir Kenelm Digby on the *Power of Sympathy*, from which I gave an extract, was published in English in 1658; and he might have been supposed to know better, but the great men even of that great century were not in all things on the shoulders of their predecessors, so hard was it to know what was done.

I obtained some time ago a little collection of old opinions in a small volume which I have never met but once, when I got it at a London old bookshop, and which, from a passage in it, I suppose to be either very rare or seldom read. It is by Philip Beroaldus. I may perhaps introduce here, somewhat contractedly, a part of his treatise on *Pestilence*:—

“Pestilence not only exhausts towns by constant deaths, but even whole nations, by a deadly disease. Some say that it is from the anger of God, some from the inclemency of the weather, and some from vitiated waters;—others from the noxious exhalations of the earth.



“Excellent medical men and philosophers have believed it to arise from the inclemency of the weather, that is, from the too great heat, cold, moisture, or dryness.

“So also every thing grows better where there is no excess of heat, cold, moisture, or dryness. But with any excess of these the force of the disease increases, and man and beast are attacked by pestilence. Whence it happens that inhabitants of moist and marshy places are liable to be attacked by this evil. But heat is especially destructive, whence some say they call the sun Apollo (*ὡς ἀπολλύντα τὰ ξῶα.*) But as the immoderate heat of the sun destroys all living things, so also its temperate heat removes all diseases, whence the Greeks called Apollo *Ἀλεξικακόν*, the remover of evils, a name also given to Hercules.

“Some say that waters, vitiated and corrupted by foetid matter, destroy health and prepare pestilence. For Aristotle says that the changes of water are very important, and Lucretius agrees to it in the line—

‘Nonne vides etiam cœli novitate et aquarum.’

“Some are greatly tried by being at a distance from their homes; and Vitruvius writes, that grave and pestilent humors escape from the Pontine marshes. And, as Seneca says, noxious and pestilent waters lie in the depths of the earth, containing nothing but what is pestiferous and unwholesome to our bodies; these, after an earthquake, come out, and when people drink them, they cause pestilence.

“Some say that pestilence arises from the noxious evaporation of the earth, and that the earth is constantly giving out vapours; and certainly it is clear that the earth is not without a spirit, which it pours out abundantly for the growth of all vegetation.

“Avicenna also says that the corruption of the air is raised from the earth. Silius, also, in describing a pestilence, says that the vapour of the earth is pestilential, in the verse—

‘Atque ater picea vapor expirabat in Ethra.’



Ammianus Marcellinus agrees with this; others think that the exhalation of the earth makes the air thicker, and so kills.

“Mathematicians think that pestilence and other evils come from the power of the stars, and chiefly the dog-star: with this the poets also agree.

“But most writers are agreed that pestilence comes from corrupt air, which spreads its evils all around—which kills the living who inhale it; for there is a constant interchange of air in us, and when without it, we are instantly killed; so when the air which we constantly breathe is foul and pestilential, it must enter, by our breathing, into our vitals, and produce disease and death. Hence Virgil says,—

‘Corrupto cœli tractu miserandaque venit  
Arboribusque satisque lues et pestifer annus.’

And in like manner Lucretius says,—

‘Et cum spirantes mixtas hinc ducimus auras  
Illa quoque in corpus pariter sorbere necesse est  
Consimili ratione venit bubus quoque sæpe  
Pestilitas.’

And Ovid, explaining the poetic pestilence, thus speaks:—

‘Ora patent auræque, graves captantur hiatu.’

Wherefore Avicenna, the most celebrated by far of physicians, thinks, that in pestilence, respiration and inhalation are diminished, and that odours should be used to mitigate the corruption of the air.

“Winds also, which are called flowing air, are the causes of pestilence; but chiefly the south wind, of which Celsus thus speaks:—‘Pestilences occur in all winds, but chiefly in the south wind.’ And Ovid also shows that pestilence comes by a south wind:—

‘Lætiferis calidi spirarunt aestubus Austri.’

“Aristotle, in his *Problems*, says that the south wind makes bodies warm and moist, and therefore liable to corruption; which wind also is the cause of bad breath. According to



him also, men become heavier and weaker during south winds, and less inclined for food; whilst, during a north wind, animals have more appetite and become more robust. He shews also, that south winds produce a warm moisture in bodies; for those that are warm and moist are subject to fevers. Hippocrates also, in his *Aphorisms*, says, that a south wind dulls the ears, weakens the senses, causes headaches, looseness of the bowels, and a general moist, flaccid, and languid state of the body. Vitruvius also says, that the town of Mytelene, in Lesbos, was magnificently and elegantly laid out, but not wisely situated; when a south wind blew in it the people sickened, and when an east wind blew they coughed, but when a north wind blew they were restored to health. And our Pliny, who omits nothing, has comprehended all about the south wind in one word—"The north wind is the most wholesome of all; the south wind is bad, and animals are less liable to hunger when it blows."

More from Pliny and Albertus Magnus:—

"Nobody doubts that the dog-star, in whose mouth is Sirius, is pestilential and noxious.

"Among the causes of pestilence, also, is filth and excess of filthy substances, as lawyers\* also in their writings have shown; for the filth of common sewers threatens to make the air a very pestilence, and this constant stream coming from a polluted source, gives out an odour not otherwise than infectious, according to the best writers.

"Among the causes of pestilence, also, I find want of food and change of food, which Cæsar the Dictator shews plainly in his *Commentaries on the Civil War*, writing that the people of Marseilles were much affected by a great pestilence, from the change of food; for when they were brought by a long siege to a great scarcity of provisions, they lived on old bread and bad barley.

\* "Lawyers" here refer probably to the edicts already quoted.



"Hippocrates also allayed a pestilence that came to the Greeks from Illyria and Peonia by this remedy. He ordered fires to be lighted through the whole state, with flowers, with the most fragrant garlands and ointments, and perfumery, so that a purer, clearer, and fresher air should be spread about. Galen also says, that the air, becoming pestilential by respiration, becomes a poison.

"The same Hippocrates preserved many towns in Greece from pestilence, having stopped the windows, changed the doors, and let in the north wind by new windows; for which they gave him honours formerly given to Hercules.

"Also the learned Varro Terentius, when the island Corcyra was filled with sick and dead, stopped the windows, changed the doors, and let in the north wind by new windows, keeping his family and companions in health."\*

We see, from these extracts, that a general idea of sanitary truth had risen in various times and places, sometimes marked by magnificence as the leading principle, sometimes by usefulness. The great water-works were for use, absolute necessity prompting the origin—munificent and enlarged feelings suggesting the scale. The same may be said of the baths, which, however, rose up to be a great curse to Rome, as the early Roman washing was more akin to the modern practice of the

\* Phillipi Beroaldi de terræ Motu et Pestilentia, cum Annotationibus Galeni.

Perhaps I may be allowed to introduce here a short note. In the book above mentioned there are notes on Galen, or rather comments on his translators and interpreters. In speaking of *vapκη*, he says—"Quod genus piscium, Galenus cæterique Græci Scriptores appellant *vapκην* id interpres ineptè nimis vertit in stuporem, propterea quod Græcè *vapκη* dicitur stupor, unde narcotica dicta medicamenta, quibus utimur in sectione membrorum quasi stuporem inducentibus, ut citra sensum cruciatus fiat sectio;" that is, "The kind of fishes called by Galen and other Greek writers *vapκη*, the translator has very absurdly termed *stupor*, because in Greek *vapκη* does (at other times) mean *stupor*; whence the term, in Medicine, Narcotics, which we use in cutting off limbs, producing a stupor so that the amputation is made without pain." This is another instance of the want of teaching even in a profession. The practice seems to have gone out, and there is no distinct record of the reason.



more careful classes: they washed the arms and legs once a day, and bathed the whole body once a week;\* whilst the marvellously luxuriant baths converted many of the best citizens into idlers, and tended, amongst other things, to demoralize the inhabitants.

The importance of attention to wholesome food, and still more, the pleasure arising from luxurious dishes, was known to the ancients, but to a few only after all, as a general diffusion of any information was not to be found in early times. Even the delicate state of food cooked with softer water was known, as the wells were often preferred, on account of the hardness, I suppose, of the aqueduct water running from the limestone hills.

Their principles, however, were not very extensively carried out; their bed-rooms were closets, and their poor were numerous and degraded to a degree that none of our towns can in any way approach.

Although purification is a distinctly practical act, we see it taking a much wider range as an idea merely, and the act of purification as a ceremony. Washing before the performance of religious rites, seems to be a most natural action, but the ceremony of washing became a mere form with most nations. The priests of Egypt were rigorously clean, but their descendants, keeping the forms even among the laity, are by no means addicted to wholesome habits. The temples had always a reservoir of water about them; the mosques have water still, which water is a filthy stagnant pool, dangerous to health, but nevertheless a place where the form of washing is undergone. The Jews also have, from necessity, probably, adopted a mere form, dipping of the fingers and touching the body becoming a substitute for immersion. It is, however, frequently a result of idleness,—a mode of finding an excuse for an unpleasant act. Our Saxon forefathers had to be drilled somewhat in a similar way to the Easterns, and

\* Smith's Diet. of Gr. and Rom. Antiq.



their priests were made to sing three hundred psalms as a punishment for eating or drinking what a cat, dog, mouse, or weasel had spoiled.\* But after a time the habits of the priests became spread over the people, they became general,—necessary for comfort, and not ceremonial;—another instance of the manner in which a strict command becomes dissipated.

No doubt, from a sanitary beginning, the more observing classes, the priests, were accustomed to avoid swine and fish, both of the sea and Nile, as well as lentils, peas, garlick, leeks, and onions.† From some similar reason, they used pure linen next the skin,—a custom and command in India also.

Amongst the Brahmins, too, were forbidden “garlick, onions, leeks, and mushrooms, which no twice-born man must eat, and all vegetables raised in dung, red gums or resins exuding from trees, and juices from wounded stems, &c.”‡

But with them, too, it became a form;—a Sudra might be purified with water touching the extremity of his lip, whilst the higher order, the Brahmin, is purified by water that reaches his bosom,—a Vaisya must take it into his mouth, and a Chitriya must let it descend to his throat.

I have no intention of attempting a regular picture of the progress of thought on sanitary matters, and shall only give a few examples of different modes of thinking on the subject in process of time. The plague in Italy gave occasion to many physicians to think of the subject, and diseases which attack men and the lower animals, as well as plants, took up the attention of many, introducing disquisitions on cleanness of food, cleansers of houses and of stables, arrangements for dry beds for cattle, some made of odoriferous herbs, as Bernardini Ramazzini counsels. The theories long wandering began to be put into shape, although Lord Bacon seems

\* Sharon Turner's Anglo-Saxons.

† Wilkinson's Manners and Customs of the Egyptians.

‡ Institutes of Menu.



to have found it necessary to say, as a thing not well known even then, that the vapours found in crowded places in gaols, were poisonous. As a correct statement of the opinions of the period in their most advanced state, or rather, as the statements of a man who was beyond his time in most things, I may quote the following rather interesting passages from the writings of that philosopher, "*Sylva Sylvarum*," 328, &c.:—

"The inducing and accelerating of fermentation is a subject of universal inquiry. The means to induce and accelerate putrefaction are,—First, by adding some crude and watery moisture, as in wetting of any flesh, fruit, wood, with water, &c.; for contrariwise, unctuous and oily substances, preserve. The second, by invitation and excitation, as when a rotten apple lieth close to that which is sound, or when dung, which is a substance already putrefied, is added to other bodies. And this is notably seen in church-yards, where the earth will consume the corpses in far shorter time than other earth will. The third is by closeness, as in corn and clothes which wax musty; and therefore open air doth preserve. Fourth, by solution of continuity, as we see an apple will rot sooner if it be cut or pierced, and so will wood. Fifth, by exhaling—as in pestilences, where the malignity of the infecting vapour daunteth the principal spirits—and the humours, flesh, and secondary spirits do dissolve and break, as in anarchy. Sixth, is when a foreign spirit, stronger and more eager than the spirit of the body, entereth the body, as in the stinging of serpents; and we also see the spirits coming of putrefaction of humours in agues, &c. The seventh, by such a degree of heat as setteth the spirits in a little motion, as is seen in flesh that is kept in a room not cool; whereas in a cool and wet larder it will keep longer.

"914. The most pernicious infection next the plague is the smell of the gaol, where prisoners have been long and close and nastily kept, whereof we have had in our own time experience twice or thrice, when both the judges that sat upon the



gaol, and numbers of those that attended the business, sickened upon it and died. Out of question such smells consist of man's flesh or sweat putrefied. There may be great danger of such compositions in great meetings of people within houses, for poisoning of air is no less dangerous than poisoning of water. And these empoisonments of air are more dangerous in meetings of people, because the much breath of people doth further the reception of the ferment."

Becher also was thinking the same thing, with others in other parts of the world, and, after a long and rather imaginative passage, he says, in his "*Physicæ Subterraneæ*," Lib. i., sect. 5, cap. 1, n. 17, published in 1669:—

"Secundò, ejusmodi particulæ vario quoque modo alterantur, per putridas emanationes corporum sive vivorum sive mortuorum, hinc multi morbi contagiosi, refertque *Pancirollus in observationibus* vespillonem ex aperturâ cujusdam sepulchri, mortuum esse, presertim cùm cadavera insepulta jacent, nihil enim magis inficit, quàm cùm aër iisdem inquinatur."

This asserts the danger of the putrid emanations of bodies, whether living or dead.

Closely connected with this is the theory of putrefaction and fermentation, both of ancient and of modern times, leading to the term *Zymotic*, for a class of diseases having the power of propagating themselves.

Fermentation in putrid bodies had, in fact, been much spoken of, as a cause of disease, until men were weary of the indefinite word. According to Kopp's "*History of Chemistry*," Willis, in 1659, first explained what fermentation meant, and referred numerous, if not all diseases to it. He said that "Fermentation was an intestine motion of any body, either tending to perfection or change." Stahl says, in Shaw's edition, 1730,—"Now 'tis manifest both to sense and reason that a body, actually in motion, coming to impinge against another which is moveable, though not yet actually moved, will communicate thereto so much of its motion as the proportion of the other's magnitude will allow it to receive."



Also—"Fermentation, which we define an intestine motion of mixed parts, that separates them in proportion to their mobility, and resolves or combines them according to its degree. So that this operation requires for its subject the parts of a mixt which differ in mobility, that is, have different degrees of tenuity; and in the next place it requires a certain management of this motion, so that it be inherent or intestine, and not *loco pulsive*."

This theory of fermentation was with great success applied to the solution of the food in the stomach, to diseases, and to contagion and miasms. Liebig has brought it forward in the same form, with the great power of illustration which modern science has furnished. His conclusions are very well known, and I need only give two sentences from his *Letters*, p. 209:—"All the phenomena of fermentation, when taken together, establish the correctness of the principle long since recognised by Laplace and Berthollet, namely, *that an atom or molecule put in motion by any power whatever, may communicate its own motion to another atom in contact with it.*" Then having referred the same principles to putrefaction, and shown, that in a similar way, disease may be produced and continuously communicated, he says—"Hence according to the rules of scientific research, the conclusion is entirely justified, that in all cases where a putrefactive process precedes the occurrence of an epidemic or contagious disease, or where the disease can be propagated by means of solid, liquid, or gaseous products of diseased action, and when no other cause for the disease can be discovered, the substances which are in a state of transformation are, in virtue of that state, to be regarded as the proximate causes of the disease." Letter 18, p. 230.

The whole reasoning, as given by him, is very clear and full, and it is one of the most singular instances of a theory made apparently very early and in the darkest periods of science, receiving illustrations now at the hand of science, with scarcely any difference of views, but only a clearer perception of the meaning of the words used.



Although there have been intervals of contradiction, the statements have been made early, but perhaps nowhere made so clearly as in a pamphlet written in 1721, entitled—*“An hypothetical notion of the Plague, and some out-of-the-way thoughts about it. By Mr. Place.”* Speaking of infection, he uses the terms—“A body that works another to conformity with itself;” also, “perfect infection—the communication of specifical form and motion by matter of superior activity to some of inferior, that is, a substance fitly disposed or naturally capable of being wrought upon.” And in few words—“Infection is the communication of motion by activity”—“among particles allied.”

This seems to represent our knowledge of the subject as fully as anything yet said, and indeed more so, although it may not express, like the words of Stahl and Liebig, the mechanical law. If we go so far, we form a theory of the motion; if we adopt Mr. Place's remarks, we adopt a representation of the state of our knowledge.

It may happen that the extreme mechanical mode of stating this law is the right one, although not at present capable of absolute proof; and it may be remarked here that chemistry has gained by the application of mechanical laws in instances where affinity only had been supposed to act. As the most remarkable of all instances may be mentioned the failure of every method of explaining chemical combination, until at once made perfectly clear by what may fairly be called the Mechanical Atomic Theory of Dalton.

We may suppose the question of the production of disease, according to the chemical theory, to be put in this form, or to be illustrated by such reasons as the following:—

1. Permanent chemical compounds, gases or otherwise, are not capable of acting as infections, that is, cannot convey disease directly, although every gas is more or less able to cause death, the atmosphere excepted. Some decompose the tissues rapidly, and may give rise to other chemical



compounds, but they themselves are no infection, no zymotic disease. Ammonia, for example, has a great duty to perform; but in excess it exhausts action very much both in living and dead vegetation.

2. A true gas diffuses itself in the air, or in the gases, but all are soluble to some extent in water. All living bodies contain water; in fact, the motion, mechanical and molecular, necessary to life cannot be carried on without a liquid, nor indeed, generally, can substances act chemically on each other as many substances in the living body do, without the intervention of a liquid. Infecting matter is generally connected with diseased moist or liquid bodies, which are always to a certain extent giving off gaseous products in vapour.

3. Sulphuretted hydrogen, for example, is not miasma; it is deadly enough, but the sources of it are resorted to by invalids, which could not be the case were it a miasma. It may destroy the constitution, and produce other diseases which may have various effects: the same of carbonic acid, &c. Therefore in looking for miasma or infection, we are not to look for chemical compounds, and to decide on the presence of disease from these grounds. From this cause, chemistry has not carried us far in advance of the ancients, who did not know analysis.

4. The senses are not sufficient to detect miasma. Miasmas do not, at least always, possess a smell, or we are not able to perceive it. We do not smell what we are much accustomed to. In Germany there is the "Englisches Geruch," the smell that all English articles have, a smell of coal, I believe. In some districts every article is found to smell of peat, and this is especially felt on bringing them into a coal district.

5. The results produced by time, whilst the senses were unconscious and chemical analysis at fault, are to be depended on above all things. For example, bad air may injure important organs; the senses see the accumulated result. The chemical action is decided and progressive, whilst no pain is



felt. The senses in many cases come second in sensitiveness. Although chemical analysis often comes behind, it is capable, no doubt, of changing its place and going foremost.

6. Old writers, speaking of animal functions and of diseases, use the word "fermentation." Fermentation is the splitting up of a body into several parts, by a power within itself, or imparted to it by another body in contact with it. Sugar may give out alcohol and carbonic acid; but sugar also may give mucic acid and lactic acid. Some of it may form another body, fusel oil.

There are, then, some bodies which act on each other gratuitously, as it were, that is, they do not require either a proportionate amount of physical force or an atomic equivalent so as to act by quantity. Their power is apparently in proportion to their quality, not their quantity. Sulphuric acid decomposes common salt; when it has satisfied its equivalent, it is placid, and the common salt beside it is quite untouched. Not so with a ferment; it ends with the material to be decomposed,—that is, if sulphuric acid acted like common salt, it would set in motion the decomposition, so that it would never end till the salt were done. This is not exactly the case with the action of a ferment on sugar, because that requires a certain quantity; but of the action of a ferment on grain, for example, where the ferment may be reproduced as it is used.

7. Bodies dried do not decompose; moisten them, and they begin to putrefy.

8. The infectious matter of fever, plague, and cholera is not a true gas, it does not diffuse. It runs unequally, and without following the laws of diffusion, along streets and to distant towns. A true gas would go everywhere equally, unless it were taken more to one place than another by differences of wind and moisture.

9. The similarity of decomposition produced in one person by contact with another, is so analogous to fermentation or



putrefactive decomposition, that we have no stronger mode of producing identity of action.

Let us suppose an illustration:—The body is well, and decomposition goes on, producing certain pretty well known results by the action of life and all its subservient forces. One takes cholera, and decompositions go on in him also, but with different results. Instead of nitrogen being retained by the kidneys, they cease to act, and the bladder is empty; instead of the lungs decomposing the carbonaceous compounds, the gall bladder is filled with them, and the breathing is difficult. The fœces take the nitrogen. Its analogy to a reverse fermentation, or a diverted one, is complete. But there is no power of recomposing what was destroyed. It is a splitting up of particles of the bodies into parts; what is begun quietly goes on till all the material is worked up. If it passes to another person, it is a further illustration of the same action.

10. But a ferment acts by self-destruction. When it is done, what becomes of it? It converts the material next it, if capable, into a ferment also. We therefore conclude that infections increase according as the material to feed them increases; in other words, they convert all impure matter into infection, because it is fermentable in a particular way. In this way, then, various ferments would produce various substances. Or a substance putrefied might go into plague, fever, or small pox, just as the parts of the body do. Filth, therefore, is a conveyancer of disease, taking the lead of any infection which happens to have the reins in its hand at the time. No wonder, then, if all diseases disappear before a great disease,—one great ferment banishing the others. There cannot, in one liquid, be both the mucous, acetic, and alcoholic fermentations at once.

11. But they may come in succession; so after one disease another may arise on its remains. Is this the explanation of the rise of new diseases, or the history of the progress of some we know, which go on from stage to stage?



In this hasty sketch of opinion, I have chosen quotations not perhaps the best,—medical literature may be able to put them to shame by greater fulness; but chiefly because I thought them interesting, and also little if at all quoted.

We have seen that the notion of sanitary law has had its origin in the earliest history of nations,—that it is founded on simple, material truths, which it is easy to recognise by ordinary powers of observation,—and that it is supported in its conclusions by the more elaborated reasonings of scientific times. In itself it is not a science: we see in parts only, a distinct claim to logical sequence, uniting the beginning and the end; but it must receive the aid of many other sciences, and adopt their results. It may become a science: at present it includes the knowledge of many valuable arts. We can suppose it struggling through years of great darkness, groping onwards by mere instinct, and at last arriving at a state, if not of great power, at least of self-consciousness, although perhaps it will be disputed as to when that period was attained. At the time of plague it seems everywhere suddenly to have reared its head, and we may observe that it keeps its head erect continuously, whenever it finds that a continuous state of plague exists, or continuous causes operating against health. I am not encroaching on the province of medicine in speaking of this subject; the subject is a separate branch, it may be, of medicine, but equally a branch of chemistry, which certainly claims a right, as it has a power, of examining and explaining to some extent the action of the elements on man, and the means of rendering them serviceable instead of deleterious. It is a worthy study, because it enables us to remove many evils easily dealt with; it is also an ennobling study, as are all studies which shew that man is not of necessity degraded, and which give him hope even in this world of a higher and happier future.

I fear to go beyond the allowed bounds of the Society, and can scarcely therefore link, otherwise than abruptly, the foregone part of my subject with that which is to come.



STATISTICIANS have done so much to illustrate the painful condition of a great deal of the population of Europe, that vague notions of equal happiness and equal health among all classes have given way to the simplest facts, and I suppose we cannot pay any attention to the opinion of that man who will say that ignorance, poverty, and dirt, may enjoy life as much as he who has taken the greatest advantage of all the gifts of wisdom.

We have learnt the state of man in many things, but we must avoid supposing that we have arrived at the laws which regulate man's life. Speaking with reference to laws such as those mentioned in Quetelet's "*Treatise on Man*," we may say that he and such statisticians shew the laws which govern Frenchmen, Englishmen, or Belgians, in certain conditions; and that if the countries remain in the same state of education,—if they keep the same mode of government, and the same manufactures,—if they do not change their habits, and if no great religious or other movement seize hold on them,—then their bodily and mental health is in all respects likely to remain the same. But these men are all capable of immense change, as history proves. With us the sanitary movement has for a time been very active, and the knowledge of many necessary conditions of public as well as private health has been disseminated among all the reading public, so as to be now proverbially true; but their adoption by the unreading and unthinking has to follow, and that probably will not be done until public bodies shall have shewn a public example. This example is being shown, to more or less advantage, in some hundred places in this country, and the course of procedure in making a town to some extent less unhealthy, has been very nearly reduced to a system.

We have seen that all who think on the subject, condemn moist land, and although I think we may fairly dispute the reasons given, it may now be taken for granted that the somewhat sarcastic remark of one of the best of satirists had some foundation, that "the great object of a wise man is to



live on a gravelly hill." (Peacock.) Still the draining of land produces a benefit to us in every point of view. It improves the crops, it improves the health, and while it banishes vapours, it banishes probably superstition also, which sees the dim ghost in the mist of an undrained field. As I elsewhere said, every field has its own peculiar climate, and if we come to particulars, every portion of a field. We may say that every quarter of a town, every street, side of street, and house, has, from some circumstance natural or artificial, its own climate also, sometimes in a very marked degree. The thorough draining of a field is a ready mode of improving and equalizing at the same time every portion; a town will be benefitted in exactly the same way, as far as its natural position is concerned. A town surface is generally almost impervious to water, but even were it quite impervious, there are sources of water below, which supply town wells abundantly. Many towns are drained in this way by these wells, and this may in many cases be effectual, but of course a general plan is better. The most careful drainage of towns has been by sewers, but the evil from water in the soil has not been remedied. The Rev. Mr. Milner, of Penrith, has proposed a triple drainage, by which first the moisture of the ground is removed by tile-draining, refuse water being removed in the usual way, and flood-water from the surface. This offers many advantages; it gives a dry soil, and is a means, hitherto unused, of drying the soil. This plan might very well be extended beyond the town, and the land around the town might be subjected to drainage some time before building.

The drainage in the neighbourhood of Manchester has already been before the public in a paper by Mr. Roberton, read before the Statistical Society of Manchester in 1850. The mode of building at present resorted to deteriorates the neighbouring land from easily avoidable causes. This land lies waste, waiting for a builder: it is made of no use for agriculture, and offensive to the eye and to health. It would



seem a proper arrangement, that as soon as it is given up for agricultural purposes, it should be subjected to tile drainage, if that has been before neglected, and if within the limits of a town circle. But it must be still a more effectual way of ensuring efficient drainage if the men who build would prefer land which had been one or two years under the influence of drains. It is a wise provision of nature that organic matter which has travelled far under ground, should itself become so much transformed as to come out in an inorganic form ; but there is frequently not enough of room for this process in the passage of organic matter from yards to cellars ; and as the matter becomes somewhat stagnant, so to speak, we have frequently more than mere dampness under our houses. To draw it off as it comes is the best way, of course ; and to drain the land before building, also, is still better, when the land is not very porous, and when it is in that very common condition of requiring one, two, or three years, in order to get the drains into a good running state. The outside of many towns, and of certain unbuilt portions of all our towns, are unsightly pictures of stagnant water.

The surface drain for rain water is perhaps not to be objected to in small towns ; but when the distance to run is great, the accumulation by the way is great also ; and instances frequently occur where even the sewers are not able to receive the water with sufficient rapidity, causing the streets to be flooded. Every spot of a field absorbs water, and the run is equal to the extent of field for some distance down through the soil ; but a town has only a small strip down every street for the whole water fall, thus rendering the mere surface drainage for rain quite insufficient. If, however, the water from water closets were conveyed in a separate drain, as it has been proposed, we should gain many advantages, in all likelihood. To most persons this seems a very wild scheme, but it may be viewed quietly and without fear. At present all refuse water runs down the sewers, and there is only to be



found in them a very weak solution of decomposing matter. Of this water there will probably very soon pass 20,000,000 gallons per day through the sewers of Manchester. This makes a large stream, and collected it will be a small lake. Such an amount of water it does seem preposterous to lift, so as to cover land by irrigation. If this water were spread over a portion of land equal to 15,000 acres, it would be immensely to increase the rain fall. Now, the difference in fall of rain in London and Manchester is only 12 inches in the year; yet how very different is the climate! True, however, the water is not to be put on in dry weather, and it will therefore not increase the number of wet days; but it will increase the amount of water, and we know that in that case the time of drying the ground must be much greater. Also the manure is of course weakened still more, and the great excess of water acting rapidly upon it is apt to carry a good deal away. If put on with no excess of water, and allowed quietly to be absorbed into the soil, there is a provision of nature for absorbing the impurities and returning the water clear, if not perfectly pure. This might, I think, be effected more readily by using stronger liquids during wet weather, allowing the rain to dilute them. There would be also less to manage, less apparatus and expense, and no change of climate, from the enormous amount of liquid. The irrigation of land by sewage water is warmly recommended by the Board of Health in a very valuable report. If this water were not to be put on as liquid manure, but to be treated by precipitation, a plan which I think might succeed well, and be in many places to be preferred, then it would be found much easier to manage the liquid when concentrated. Used as liquid manure in moist weather, we have all the advantages of very dilute manure; we have the proportion of dry and wet days unchanged, and the state of moisture of the soil also unchanged to any extent worth mentioning; and as, wherever this liquid is transported, water is transportable, we have the means also



of irrigating, when such a mode of fertilizing does become advisable.

But would it not be expensive to have separate drains for removing the water in question from towns? The amount which might be calculated on is surely not more than a gallon a day for each inhabitant; but let us give two for 400,000 persons, or two and a half gallons, if it is wanted, making the whole 1,000,000 gallons. This quantity might be passed through by small pipes like private sewers, and at the very largest opening it would be but a very small pipe. But supposing the half were to be run off in three hours, which is a very probable occurrence, this is not a twentieth of the capacity of some of the water pipes. It is therefore by no means an enormous scheme.

The value of the substance detained cannot be disputed; we may fairly reckon it as capable of manuring land sufficient to feed all Manchester. This would seem to be the true quantity to be calculated on. It is not easy to say how much land is wanted to feed a man who eats beef and flour, but let it be only half an acre, we have 200,000 acres capable of being manured. I might fairly from this launch out into a very brilliant calculation, but it may lie at present. The plan might be carried out on low lands, of which there are many about Manchester, and that great expense of pumping, of water pressure also, and all its consequences, be saved. The liquid might be taken to a small reservoir outside the town, and distributed over the low grounds; if wanted, pumped up from that reservoir to higher grounds. But to pump by enormous power the weak solution of our present sewers through pipes, which are in fact a new water-works of a reversed kind, seems to be utterly hopeless of good.

As to the nuisance of having a reservoir of water of that kind near the town, it is better to have it of the smaller size, with the more concentrated material; it affects fewer persons, and it might be covered easily. It is also better than having



the nuisance spread by every house over the whole town, carefully planted, one piece at every man's window. Our streets are long rows of houses and long rows of cesspools, &c. in alternation; and we must remember that it is no matter how clean a town may be, if we have before our own houses, or behind them, a constant source of impure air as we now have; it is of no consequence what is around us if we are in a little unwholesome circle of our own. But let water-closets be universal, and this kind of drainage used, we should get rid of cesspools, which are still building in our neighbourhood; we should get rid of the moist part of middens, and of those enormous town middens which are a very curious feature of this city, lighted up at night and receiving stores from every quarter, carted in a manner not so different from the old Edinburgh system, so much ridiculed. Although we have made great efforts, yet it does appear as if the plan now used were one entirely out of accordance with the self-acting machinery of the age.

Let us consider what happens at present. The sewer water does not receive even a large proportion of the night soil; if the town were perfectly drained into it, how much more valuable it would be! But this small quantity pollutes the water almost as effectually as a great, that is, it pollutes it so much that it becomes unfit for all use whatever. A river is the natural drain of a country, but it is also a natural supply of water; and whenever the two characters interfere, the distinction seems to call for distinct channels. The amount of matter which will destroy the purity of a gallon of water is very small; 1 part of iron with 800,000 parts of water becomes perceptible with sulphide of ammonium. The impurities therefore which the eye does not see, may of course be in much smaller proportion, although some do exist in greater quantity still invisible. We may conclude, therefore, that by one grain of impure matter we may render impure a million grains, or about thirteen gallons of water. I believe that we may injure



much more with some common substances. We may, therefore, by using a very small amount of water, and sending it out impure, pollute a fine stream, so that all below us must be compelled to seek new sources of water. Now a stream is constantly increasing; it is a channel frequently of drainage all along the sides; we therefore destroy the valuable water coming from every point into the stream, the property of others, for some trifling use of our own.

It seems to me that the old laws about water may very fairly be revised in such new circumstances; and indeed, if the district is to increase in activity, a change both of the pure and impure water flow is indispensable. Now, it often happens that private parties must have water-works made for themselves; lodges, as they are called, are in abundance around us,—the water is either got out of the carefully drained ground, which has become valuable, even if it produced nothing but water, or it is got out of a filthy stream, which must be filtered and stored up at a great expense, and with a merely moderate result. The one grain has already spoiled the beauty of the one million grains of water, and it cannot be returned. But suppose the water were sent along the stream bank in a simple earthenware sewer, which would collect all that accumulated on the way, each man would have some justice, and the expense of lodges, which by no means improve a country, would be saved. This would be very appropriate in counties like Lancashire or Yorkshire, which have not only large towns, but a very dense manufacturing population living in numberless small villages, hamlets, and isolated houses and works, which are in frequent want of a method of draining, involving great expense when divided among a few. We should have a valley drain, a district drain, at a small expense, and the isolated spots around us would partake of the advantages of a closely-combined population. The amount of water actually rendered impure in print-works, dye-works, &c., is not great: the larger amount



which passes through is not much injured. The washing water, for example, is not rendered much more impure than on entering, whilst the dye-water can be emptied into a very small tank. The amount of water unnecessarily spoiled is far beyond what is used. Suppose 200 gallons are in a beck, and 50 becks are emptied in a day, (a very large supposition,) 10,000 gallons only are sent out impure by this means; whilst the same works could not get on with even half a million, and yet that would render many millions impure.

It is probable that a stream would, even when low, supply the wants of all in cases where there have been many separate collections of water; but if not, the union of the millowners in the valley would make a reservoir which would cause a constant supply; the interest of all would be the same, whilst now it is the interest of each to hurt his neighbour.

The appearance of our rivers would change, and the refreshing appearance to the eye and to the whole man, of a pure stream, would not be an imperceptible element in the result.

The substances which come from manufactories have all a great value. On examining the Medlock some time ago, I found the following:—

	Per Day.		Per Annum.
Potash .....	178 cwt.	.....	3,200 tons.
Soda .....	257 "	.....	4,640 "
Lime .....	940 "	.....	16,900 "
Magnesia .....	9 "	.....	160 "
Phosphoric Acid .....	71 "	.....	1,280 "
Silica .....	266 "	.....	4,800 "
Alum .....	18 "	.....	310 "
Oxide of Iron .....	124 "	.....	2,240 "
Sulphuric Acid .....	444 "	.....	8,000 "
Chlorine .....	151 "	.....	2,720 "
Organic Matter, containing 6 per cent. of Nitrogen.....	80 "	.....	1,440 "
Insoluble Matter, chiefly Silica, Alumim, and Iron Oxides ...	1,866 "	.....	33,600 "



In the remarks on this table in the Report of the Board of Health, it is said that the phosphoric acid here is capable of manuring 95,000 acres of wheat, or 184,000 acres of clover, 258,000 acres of potatoes, or 280,000 acres of oats.

Still this could not be made available, as it at present flows, with any moderate expense, and the best way is without a doubt to separate it before being diluted, instead of attempting to separate it after diluting. It is not even necessary to carry all the matter into a reservoir below Manchester, but it might be used in its passage downwards wherever opportunity occurred, either for preparing the manure dry, or putting it on the soil as liquid manure. From one of these refuse substances, the waste soap, Mr. A. Mc.Dougall has already prepared marketable commodities of great beauty and value.

The population is becoming so close that it does appear time that we should cease to act as individual towns only, and endeavour to act as a collection of towns, which the district certainly is. This could not affect the Manchester water supply, but only its drainage; it would, however, affect the supply of numerous smaller towns and villages, and many works. Every valley would become united in its economy, as seems to be the most natural method. The impure water running along river courses would not very much increase; it would be used along the line in part as manure, and the mode of carrying it forward need not be an expensive one; a simple stone or brick channel covered would be enough. If we examine the sides of a stream, we see drops trickling down from the banks, growing larger and larger until they have force to fall into the brook; if we examine the banks of the Thames, of the Irwell, or Medlock, we see the blackest and most impure trickling drops, which imitate the others in falling into the stream, but not in improving it.

This mode of collective water supply and drainage might be carried on to a great extent, that is, between villages,



towns, and works, without making any extensive change in the water-closet system essential, but to make it complete that change is essential. The mode of building here offers many advantages in a sanitary point of view; the houses are low, they occupy a great deal of space. But if that space be not clean, of what advantage is it? A yard behind a house may be made an agreeable spot, but we do make them by no means agreeable or wholesome. There is scarcely a row of houses to be found where the backs are not actually unpleasant, not to say disgusting, to look at; it is, in fact, the habit of the country to have the backs of the houses filthy more or less, generally damp, and instead of a place for play or for air, mere nuisances. No one living in a town can, with the smallest degree of satisfaction, look out at his bedroom window at the back of the house. It is not wholesome to leave the window down, and it is also unwholesome to put it up.

The wide-spread streets and small houses in Manchester might be made the most wholesome residences, by adopting a plan long recommended by the Board of Health, and which is now past a mere opinion. I have seen it abundantly tried in Scotland, where, in a country which has suffered from being behind in cleanliness, an effort has been made which is likely to put them a good deal in advance. There, however, the great disadvantage of living in flats has to be overcome,—a very great one, I believe, and one which I am sorry has been adopted in model houses in London. Such houses never appear to me to be so well ventilated; there is the large space of the staircase wanting, and there is its ventilating power in sweeping from below up to every room and through every window. But they are adopting the water-closets even in small houses of ten or twelve pounds rent, and they are gaining the advantage. The yard behind is kept clean, and clothes may be dried in it; it is not, as before, a place to be actually feared. To the water-closet they have added a bath, and over it a shower-bath; the whole is compactly placed



in a small closet out of the lobby. The whole of this has been done for £10. Water-closets have been put up in England, water supply introduced, and drainage effected, at about £4. for each cottage. In several cases at Rugby, Croydon, Barnard Castle, and Tottenham, quoted in a Report of the Board of Health, the combined expense of all the work did not amount to above 1½d. per week in the highest.

Even in large houses silver cannot be kept in certain parts, generally at the back of the house, because if a water-closet exists, it is not for sanitary purposes, but simply as a luxury, whilst the yard is made as bad as that of a house even of the poorest classes. Indeed the water-closet is often a decided nuisance, draining, as it does, into a cesspool. I was looking at a row of houses the other day, about twenty in number, of a good appearance, and with many modern improvements, but I was surprised to find that every one had a large cesspool behind, so that there were twenty cesspools all in a row, just below the bedroom windows, beside the middens. This was not enough: there were also for every four cesspools a pump. It would not be convenient without this arrangement, as the cesspool would fill up too rapidly, if not pumped out.

Now I wish to speak very distinctly on the water-closet system, that the subject may be more attended to here; and as the early supporters of the name of this Society have great weight, I shall give some of their opinions on the opposite system. In a communication made to the Manchester Board of Health in 1796, Dr. Percival, whose tablet stands behind our President's chair, says—"The first object of the Board of Health is to obviate the generation of disease. Under this head are comprehended—The inspection and improvement of the general accommodation of the poor; the prohibition of such habitations as are so close, noisome, or damp, as to be incapable of being rendered tolerably salubrious; removal of privies placed in improper situations; provision for white-washing and cleansing the houses of the poor twice every



year; attention to their ventilation by windows with open casements, &c.; the inspection of cotton mills, or other factories, at stated seasons, with regular returns of the condition as to health, clothing, appearance, and behaviour of the persons employed in them; of the time allowed for refreshment at breakfast or dinner; of the number of hours assigned for labour; and of the accommodations of those who are parochial apprentices, or who are not under the immediate direction of their parents or friends; the limitation and regulation of lodging-houses, or the establishment of caravanseras for passengers, or those who come to seek employment unrecommended or unknown; the establishment of public warm and cold baths, provision for particular attention to the cleaning the streets which are inhabited by the poor, and for the speedy removal of dunghills and every species of filth; the diminution, as far as practicable, of all noxious effluvia, such as those which arise from the workhouses of the fellmonger, the yards of the tanner, and the slaughter-houses of the butcher; the superintendence of the several markets, with a view to the prevention of the sale of putrid flesh or fish, and of unsound flour or other vegetable productions."

At the fifth annual meeting of the Board, May 30th, 1800, it is said, that "fever is continually generated in filthy lodging-houses, in crowded factories, in damp cellars, and in places exposed to the baneful effluvia of dunghills, from sewers, and stagnant waters."

And on December 10th, 1801, Dr. Bardsley read a paper containing the following:—"1st. Be careful to avoid living in dark, damp, and confined cellars, or in back streets, adjoining to privies or heaps of offensive and corrupted matter."

Then the Board adds, (and I may remark here that Dr. Henry was also engaged on this Board,)—"In many parts of the town, houses are erected with their fronts opposite to open privies, and joining to accumulations of every kind of filth, and where the space between the front of one range of buildings and the



back of the other is so narrow as to prevent the circulation of air and free admission of light." The landlords of such houses are much blamed by the Board.

There is great scope in this list, and already many of these things pointed out have received attention. There is already, in the Public Health Act, a prohibition of all very bad cellars, and arrangements for purifying very dirty houses. There is an inspection of mills, markets, slaughter-houses, and such places as may become nuisances. There has also been an attempt in Manchester at public baths and wash-houses; but the question of dunghills has been very curiously handled. It is supposed that if a dunghill has a wall round it, it is then quite clean, because it becomes an ashpit. Now we know that the evil can be very little diminished by this means. It certainly is diminished, because the nuisance is to be calculated by its superficial area; but it is so far from being a final sanitary measure, that it may be considered as the rudest form by which nightsoil can be prevented from actually occupying the ground on which we are to walk. The actual nuisance can no more be confined by a wall, than the spirit of a man by a soldered sarcophagus.

The evil to be feared is not merely that intense accumulation of odour which so affects the senses, and which we avoid in accordance with a very old sanitary law, the feeling of disgust. What we want to avoid is that diluted impure vapour which, steaming up as it does from 60,000 to 70,000 centres, must inevitably be found pervading every cubic inch of our atmosphere. Now it so happens that these places are generally behind the house, that part of the house which it is most important to keep clean,—where the daily work of the house is going on,—where the door is most frequently open,—and where there is the supply of air for the whole house. The whole house may fairly be said to be fed from the back yard, as houses are built, and thus it happens that when a house is large enough to allow room, a door is made solely to prevent



exhalations from the kitchen and yard. It is well known how rapidly without this door the house becomes aware of what is getting cooked. This part of the house, too, is damp generally. Streets are formed at the backs of houses of a very unwholesome kind. They are much worse than the old towns consisting of narrow lanes. Here there is room only for one person to walk conveniently, and as there is a high wall, and all the ashpits are arranged close to doors opening into these streets, we may be sure that there is behind our houses places where there can be no comfortable living. We must really avoid this system, or there must again be a sanitary inquiry into the system of nuisances. The walls there are generally too high; there is no need of such height, and with it the places never dry well; even in a burning summer, large yards will not dry when the walls are high. I believe that this part of the house should be as open and dry as the front, and that it may be made just as wholesome, not by more expense, but by more judgment. There is of necessity at the back of the house a good deal of work, of washing, and cleaning; now wherever water is used, there ought to be free access of air and good drainage; this is the only way of avoiding the bad effects of what is called dampness.

We may fairly conclude, I believe, that the backs of houses should be made open, clear, and dry; this can be done by preventing the high walls now in use, by making a dry ashpit, into which no nightsoil shall be put, and by having such drainage as will prevent the dilapidated state of the pavement of those narrow back streets, which ought to cease as such, and be made merely into open passages, at the most with open railings. If it is said that people like a suitable separation from their neighbours, then I may add that the highest walls now used are really no separation, as they are all overlooked by the windows of the next houses. There would be room in the yard for a water-closet, which might either open into the yard or into the house, and for a bath, such as is



now so common in Scotland. These baths and water-closets, very curiously, do not make the house any dearer; on the contrary, I think the houses are better than before, at the same rent, leaving these extra conveniences and luxuries out of consideration.

I am often sorry to see so many of the houses building around us so carefully imitating the faults of previous houses, and sometimes adding one of their own. Little talent has been applied to the building of small houses in our neighbourhood, although we find that the subject has not been neglected, especially in agricultural districts, which we sometimes are apt to regard as the dark corners of the earth. Drawings of some will be found, very neat, in Morton's *Encyclopædia*, but the expense is not given; it would, however, be different from the same building in Manchester. One thing seems never to be looked at in building houses, namely, the size of a family. Apparently, a poor man is supposed to have only a small family and a rich man a large one. It is true, to some extent, as far as domestics and visitors are concerned; but there ought certainly to be houses for working men with large families, not finished more elegantly than those now made, but merely extended, so that the increase of rent might be as small as possible; now, however, a house rises in its style and finish with the number of its rooms, and the man who needs it cannot have it. An extra bedroom might be added without costing more than a few pence of rent per week, whereas he would probably have to pay some pounds a year, perhaps equal to from two to four shillings a-week, to get the same accommodation, causing him also to go into a different class of street, and into a house demanding by its appearance a style of furniture which he cannot pretend to. I have often marvelled at this want of accommodation.

It is well known that the poor man pays most for his house, and we would think it should therefore have the most care. Unless the position and all the surroundings of a house be



clean, cleaning within is vain; and whilst this ought to be insisted on, the internal arrangements are not to be forgotten. It is exceedingly difficult to find a warm house; the walls are becoming very thin, and it would be much better if, instead of such brick walls as are used, mud or gravel walls were substituted; but better still if thicker walls were built and hollow bricks used, if even clay should be found too dear. This is a very wet country, but we have plenty of coals; still these coals do not warm us so much as the few chips of wood in other colder climates. Count Rumford long ago spoke of the great evils of roasting one side and freezing the other, and laid down some good principles, which are only sometimes attended to. One is, that the opening above the fire into the flue should only be four inches wide: we make a great cavern like the kitchens in old castles, and the heat runs rapidly up with a strong current of air.\* A small chimney-pot is put at the top to prevent draughts, but by making circular flues, which would be done cheaply, we could have the whole course of the air converted into a chimney-pot, and smoking would cease. These could be made as cheaply as common brick flues, which smoke so much, being so difficult to heat, and which are so rough as to accumulate a great deal of smoke above.

Besides that, we have the principle of the stove, the sand bath, the water bath, and the air bath, by all which means a room may be very well heated at a less expense of fuel. Why is this not applied to small houses? The same fire which cooks, might heat air; the fire-place might be between the kitchen and the lobby where there is one, and the warm air and warm water be sent up stairs. I am sorry I cannot give a proper estimate of this, but the price of iron is such as to prevent it being a large sum, whereas, ultimately, it would be cheaper. For the sake of warmth, absolute want of ventilation is resorted to. An instance came before me some time ago, when I was sent for to look for poison in the stomach of

\* With certain modifications this latter plan may be made the best.



a child: I found that in a fine country, with fine air and in a healthy place, three people had been nearly stifled, and one, a child, had died. Where there is not a warm atmosphere it will be sought for at the expense of health; and both here and in the snow-huts of the north, people will crowd together for the first demand of comfort—warmth. It is vain, as it is also absurd, to tell people to ventilate, when it simply starves them. Experience tells us that warmth will not be dispensed with, and all classes will be found to stop up ventilating holes if they send in a current of cold air. I consider, then, that the first step to be taken towards ventilation is warming. The modes of warming are already known, and it is known that by hot air or water it is done more cheaply than by open fires. Then why not do it?

If the temperature were raised only four or five degrees on an average during the year, it would be a difference equal to the warm south-west of England, and the south-east. No doubt many persons ask the question—Why should working men have such luxuries, which they have not been brought up to? It has been abundantly proved that they are not luxuries, but that these people have a less chance of life; the means, therefore, of ameliorating their condition become necessities of life. They do not live well enough; the result proves that they have not become accustomed to their condition. It has been shewn abundantly that they yield to it simply by dying. Dr. Percival, whose observations before the Board of Health were always very comprehensive, remarked of the state of infant labour at the time, (1796,) “that it tends to diminish future expectations as to the general sum of life and industry, by impairing the strength and destroying the vital stamina of the rising generation,” &c.; and Dr. Ferriar, in remarks to the same Board, said—“The obvious extension of the cares of the committee to a superintendence of the morals of the poor, as intimately connected with the preservation of their health, comprehends a variety of most



important objects, which cannot be obtained without application to the legislature of the country." How right these men were, and how painful the consequences of waiting longer before making enactments, has been seen by the inquiry of the Health of Towns Commission, which has shewn a great diminution of the length of life in large towns in Lancashire, whilst the country in general was actually increasing in strength.

The infant labour mentioned has been put a stop to; the other evils are to be prevented before they violently seize hold on us. The subject, so far now from being settled, is only getting fairly begun, and it will be no easy matter to complete it. We hear that a few cottages in the country may be infected with disease from filth, even on a hill-side; this will, therefore, give us some indication of the great care that is necessary in a town. The whole population, too, has changed its kind of work in sixty or seventy years, and their ordinary lives and habits have not sufficiently changed with it, as the progress has been made in those things chiefly which have made the means of improvement, not the improvement itself.

One of the greatest sources of impurity in the atmosphere is, of course, the smoke; and it is the most difficult to deal with. The black portion is bad enough, but the portion which remains when the black is thoroughly burnt is also very far from being a wholesome gas, containing, as it does, much sulphuric acid and sulphate of ammonia. This is, even in small quantities, injurious, and it may be made clear to the senses by observing the action on colours; it reddens, for example, vegetable blues rapidly. When the sky is open, there is a fine clear air in our streets; the gases seem rapidly to follow the laws of their diffusion, and they leave at a rapidity which almost satisfies theory. There is then, no doubt, a constant flow of air into the town, along all the streets and roads, to make up for that great current which is



continually rising up into the atmosphere. If the air were constantly clear, we should then have very diminished evils of the kind, as this constant ventilation of the town would take place; but when it is clouded and moist, an entirely different state of things occurs. The acid and other impurities become dissolved in the moisture, and the black parts of the smoke become wet and heavy. At this time the air becomes very acid, and the atmosphere, as we approach the more crowded parts of the town, becomes sensibly deteriorated. This must have been observed by many. If the day be foggy, this takes place in still greater force, and these floating particles of liquid must have a strong influence on those who are subject to coughs, or are otherwise delicate, being, as they are, solutions of acid and acid salts. This is one of the ways in which we suffer from a moist climate, and it is another reason why we should do all we can to dry it, by removing the water when it does fall, and allowing only that which is pure to be exposed to evaporation.

According to one analysis of a coal used in Derbyshire, which is rather below what is a good deal used here, I believe, there is one quarter of a ton of sulphur obtained from 100 tons of coal burnt. This would give 15 cwt. of strong sulphuric acid, which itself would be a great deal to exist in the atmosphere at a time, if we take Manchester as four miles square, and suppose a space 300 feet high; but the calculation is of little value unless we know the amount of coal consumed. I do not know how much is burnt in one day, but it will be seen from this to how great an accumulation of bad air we are exposed, whenever an interruption occurs to the natural ventilation of the town. This interruption occurs not from entire calmness of the atmosphere, such a thing is rare with us, and if it did occur in clear weather, would not be a great inconvenience, unless it lasted long; on such occasions the gases escape readily, especially when with clearness there is warmth. But the interruption to ventilation



occurs by moisture, partly the natural moisture of the atmosphere, sometimes the removable moisture of the ground, or the accumulated moisture from works and private houses. The 100 tons of coal would give out, at a low estimate, 24 tons of moisture or water; with 1,000 tons this would rise of course to 240 tons of water.

I am sorry I cannot say how this evil is to be dealt with. It has been gradually decreasing on one side, whilst it has been increasing on the other; the amount of coal used for the same work is much less every year, from the improvements in boilers and engines, but the actual consumption is increasing from the amount of work being so much more increased. No doubt the burning of the smoke would greatly improve the atmosphere. I mean the burning of the black portion; and this should be more attended to. I fear it is becoming less thought of than it was. The air would then be clear, and the gases would rise more readily. But the removal of the sulphurous gases will not by this means be effected properly. Good drainage of the country around will improve the air and remove many fogs; we must look to this as another means, and perhaps the time may arrive when many persons may be induced to use coke instead of coal, and especially purified coke, such as, I am informed, Mr. Crace Calvert has been successful in making.

The minimum of evil will then be gained, as far as the burning is concerned, and another minimum must be sought for as far as the mode of using the heat is concerned. The most complete mode, however, of using coal, would be to take out its power without combustion, quietly oxidizing it, if possible, in a galvanic battery, and at a low temperature; taking the power from it, as Mr. Joule shews the power to be taken from zinc treated in this way, instead of by burning. This, however, is beyond our present means, at least at a cheap rate. Some different mode of burning coal is certainly desirable, from the enormous quantity of solid material



in the air carried up by the draught of the chimneys, falling down in abundance everywhere over the town.

That the mere burning of the carbon of the smoke is not enough for health may be seen from brick-kilns, although perhaps they do not present a very correct instance, as they give out also the gases from burning vegetable matter in the clay. Still the sulphurous vapour is distinctly recognizable, and they may be mentioned as an example of one of those things that ought not to be allowed to infect a neighbourhood. There has been no fair attempt to improve the mode of burning, and there is no appearance of any attempt to get the clay in such a way as to let the ground be agreeable to the eye, whilst above all things there is no attempt made to put it in order when brickmaking has ceased. There is surely no inherent impossibility in using high chimneys, although some attempts have not succeeded, and as to draining the ground, it is a self-evident duty. It is a curious thing, that whether through the cunning of the brickmakers, or a very common perversity of reasoning, it has come to be actually believed that it is wholesome to breathe the vapour from the kilns.

I have been saying that it is impossible to have a complete drainage as a town; we must have the whole district under one system, simply because whatever we may be called, whether Manchester, Bolton, or Bury, we are subjected to the same evils, and must work together for the same remedy. The same is the case as to manufactures. If we put out of the borough all disagreeable manufactures, we only send them to our neighbours, who may, after all, be so near us that we shall still feel the mischief. And where are nuisances to be sent? The whole of South Lancashire is like a town, some of it thinly peopled, but on an average a well-peopled town; so of other places. There has been a constant desire felt to avoid large towns; and very numerous small ones, from this as well as other causes, have sprung up; the former, however,



cannot be avoided without much inconvenience. It was to be supposed that when railways sprung up, large towns would diminish, as there might be a scattered population along the lines, thus avoiding concentration, the great need of large towns being done away with. This is certainly becoming more and more probable, and it is not impossible that the time may come when the work alone shall be concentrated, and the population greatly scattered. This would be a much better result than concentrating the population and scattering the work. Whatever mode be taken will be gradually evolved out of the instinctive feeling of the people, the convenience of living and of working. But the law gives us a right to remove nuisances, so that we may live in comfort. And now the question comes—Shall we remove them? If so, to what place shall they be removed? and which shall be removed?

Works here are not like works in Kingston or Richmond; we cannot afford to treat them badly. The work which we remove may take a whole street after it. It goes to a district near us; it settles down under few or no restrictions; it is a greater nuisance than ever to all its workpeople, who settle down in muddy land around it. The good done is often questionable, the evil is frequently unquestionable. There are, in fact, no works which are not more or less nuisances in the town, and as the town gathers round them, and will probably continue to gather round them, wherever they go, they must be considered as its nucleus, which it is really absurd to grumble at.

It seems to me, therefore, that all we can do in such cases is, first to see that every work is carried on in the most sanitary method which can be devised; secondly, to make regular investigations into the capacity of improvement of which some are capable. If any one is incapable of improvement, let it be removed; but if it can be improved, let it be so, remembering that if removal be a necessity in any case, it is by no



means good as a general policy. This town has sometimes done this certainly, but there has been no efficient mode of finding out the truth: and with the most laudable desire of doing right, the guilty have not suffered much more than the guiltless.

The great works of the town—the mills and foundries—must be preserved in it; that is an axiom. We could not remove them; but some are offensive to pass, and some are not so,—each should be kept up to its standard. Their lowest proportion of nuisance may therefore be called the standard amount which is tolerable; all others, therefore, have the same right to the same amount at least, and cannot justly be removed until they exceed this.

If works are removed, I think that even then, if at all in the district, or in any well-inhabited district, they should still be obliged to keep up to some standard of cleanness, interfering with liberty as little as possible. But to prevent the district around us from becoming unpleasant, it is necessary not to send all the nuisances outside of us, as the better policy, I believe, is to encourage by all means the growth of country houses, and the dispersion or diffusion, in opposition to the concentration of the population.

On account of the length to which this paper has grown, I leave many subjects of importance untouched. Individual nuisances might be spoken of if it were a paper on the sanitary condition of Manchester. At present, when speaking of the town, I confine myself chiefly to the proposal of a complete and united system of draining the district, with all its towns, villages, hamlets, works, and isolated houses, carrying away with it the necessary refuse of every house, making an entire reform in that important part of all streets, the back part of the houses, removing the obstructions to drying and ventilating, and making it look at least not disagreeable; and to calling attention to the mode of building smaller houses,



which have not hitherto had sufficient conveniences; and to warming, as essential before ventilating, a point which architects seem to have entirely neglected, at least in small houses, and which the sanitary movement has not yet made prominent.

It would not be a scheme too great to be carried out by a great capital, and its action would simply be thus:—

1st. All purely agricultural drainage would be separate from impure, going down to the nearest brook or river, adding to the supply of pure water, which would maintain its natural course. These drains would gradually increase as each proprietor drained his land. In fact, they do so now, but the system is not united.

2nd. Every house and village would be drained, the drains avoiding the agricultural drainage, and carried down into a separate conduit for impure water, which would pass down the valley, increasing constantly as a large town came in the way, but probably not increasing so rapidly as the towns, because a good deal would be used for agricultural purposes on its way. In this manner an immense track of ground would be brought near to a supply of liquid manure.

3rd. The streams would be left clean, and the water would be used as it came down, instead of one gallon being used and sent back to render impure a thousand others, as at present is universally the case.

4th. As this gradually increased, the water-closet system would be gradually increasing also, and in process of time it would be found profitable to make separate sewers for their contents. The result would be, that 70,000 middens, the number having increased very much since the last sanitary movement, would be removed from the town, and hundreds or thousands from all the district around us, whilst the ground would be made healthy to produce food, instead of the air being made unhealthy to destroy its legitimate effects.



5th. As to building of cottages, it would be well that some one would make a fair beginning and example; it may be doing, whilst we are ignorant of it. But if so, it shews the great want of a proper mode of diffusing information in the arts, and the necessity for a mode of teaching—a Mechanics' Institution, properly so called, which has never yet been established. But this requires a separate treatment.

6th. All these things could be done readily in this county, if Manchester encouraged it, and it would be a fine lesson to many others. As inquiries shew that these towns around us require more attention to minutiae than towns not manufacturing, some, or all of these things, besides many others, are necessary.

In conclusion, I know that Manchester has done a great deal lately in regulating its affairs, but it must not be forgotten that a great deal, if not all, was rendered essential, owing to the previous enormous neglect, which it showed in common with many other towns;—that the step it has taken was necessary, in order to prevent evils which had become alarming, and which threatened to be worse, and that the improvements made, have not yet been sufficient to raise the average life to the level of that of many other places.





Smith, Robert Angus. 1854. "Some Ancient and Modern Ideas of Sanitary Economy." *Memoirs of the Literary and Philosophical Society of Manchester* 11, 39–90.

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