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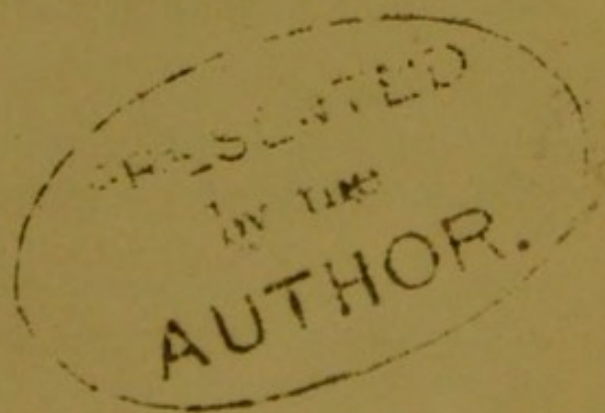
SEWAGE, SEWAGE PRODUCE, AND DISEASE.

*Read October 3rd, 1873, before the Health Section of the
Social Science Congress, held at Norwich.*

BY

ALFRED SMEE, F.R.S., F.C.S.,

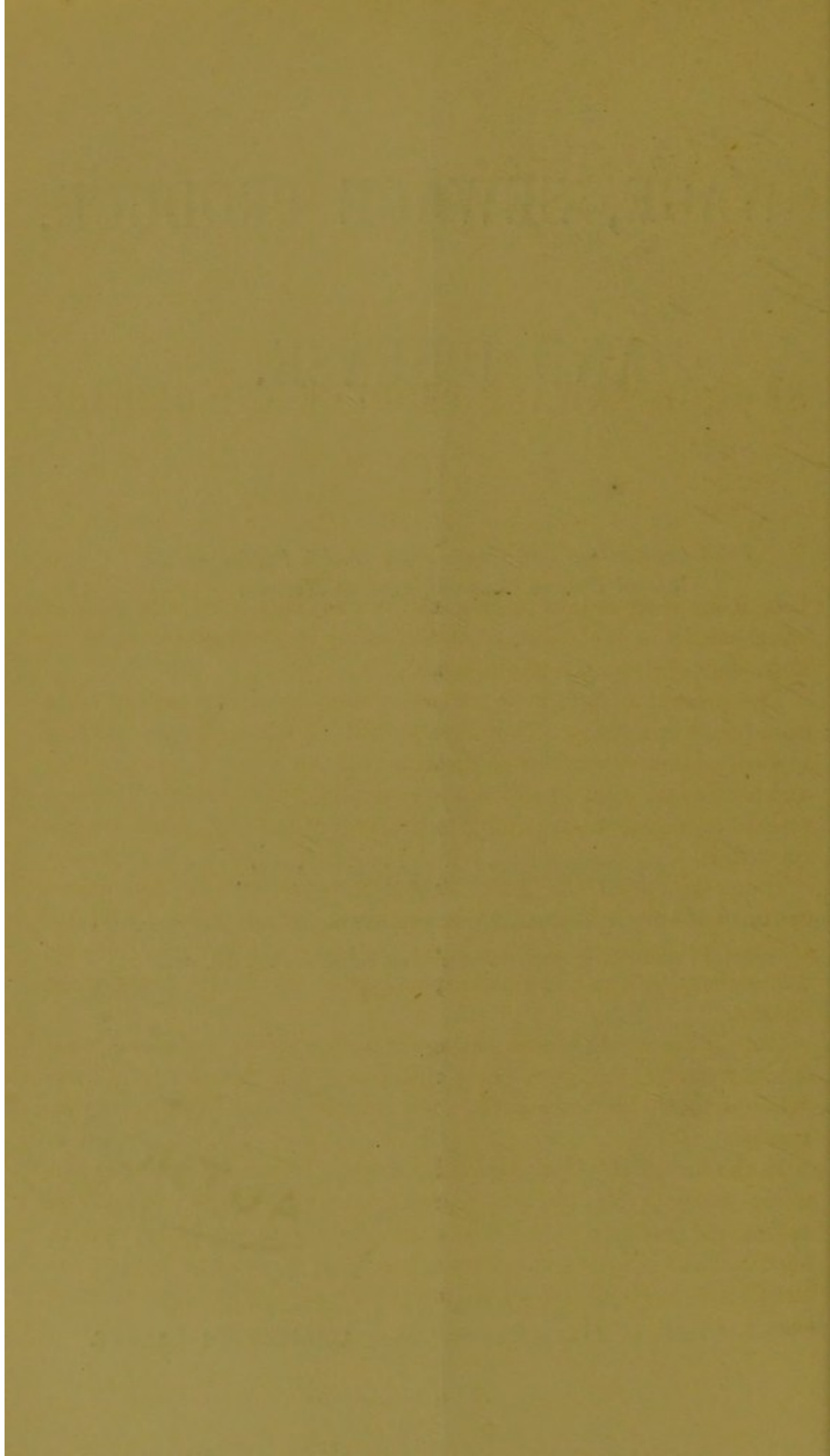
CHAIRMAN OF THE FRUIT AND VEGETABLE COMMITTEE OF THE HORTICULTURAL
SOCIETY; MEDICAL OFFICER TO THE BANK OF ENGLAND; &c., &c.



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1873.



SEWAGE, SEWAGE PRODUCE AND DISEASE.

ONE of the most serious problems of the day connected with medical social science is the question of the effect of Sewage Grounds, as now conducted, on the public health.

The present system is to collect sewage by drains arising from each house in a town. These are joined together, first, according to streets, then according to districts, till the whole forms one vast and continuous stream, which flows by night and by day, differing somewhat in amount according to the hour of the day, till it reaches its outfall.

From this point the great stream is again sub-divided over a territory of varying extent, when the sewage is supposed to be disinfected by the land, and the quasi-purified water is again collected into a channel, which has its outpourings in one of the rivers of the district.

During the whole course, sewage is a dangerous nuisance, tends to many deaths, and more cases of illness, which by skill and prudence, acting with due regard to the rules of social science, may be averted.

In the first part of its course, the sewage is in a state of fermentation, decomposing and disintegrating the solid matters to such an extent that pieces of paper, which all photographers know may be kept in water for days and weeks, are torn to shreds, and at the outfall nothing but discoloured water with slimy particles are to be seen.

During this fermenting process, the so-called sewer gases are exhaled, faint and sickening in odour, and, unmistakably, according to the experience of all medical men, the cause of typhoid fever and other diseases.

A preventible cause of these maladies is to be found in the successful dissipation of the sewage gases. If pent up in the sewers, as they are reported to be at the West-end of London, they find their way into the houses and poison the inhabitants. The whole doctrine and practice of ventilation ought to be regarded in this part of the subject to dissipate or alter the poison. I have known cases of typhoid fever at the top of a hill, from the drain forming a flue, acting as certainly as the tall chimney used by the manufacturer, to carry the sewer poison directly into the rooms of the dwelling-house.

In the City of London ventilating openings are placed in the centre of the streets, and it is rather grotesque to see openings on either side of a narrow lane trapped, while in the centre, about two feet distant, a ventilating shaft is left open. Upon the whole, this ludicrous plan is better than that adopted at the West-end of London, where these openings are either wanting or much less frequent. The distribution of sewage gases still requires study and experiment to render them innocuous to the public. I should myself recommend the trial of small shafts from the sewers to the tops of the houses from the house drains. The engineer to the city of London has, however, presented a most important exhaustive report upon this subject, demonstrating all the dangers and difficulties, but candidly confessing that he is unable to settle the questions which have arisen.

At the outfall of the town, if of any magnitude, a river of sewage exists, carrying down stones, brickbats, bottles, sticks, and other solid rubbish. As may be expected, the stench is equal to the increased volume of the sewage. About thirty gallons per day may be reckoned roughly for every inhabitant of a town, and at Croydon the magnitude of the sewage river is sufficient to work a turbine wheel, a form of hydraulic apparatus used in France, but very seldom in this country. Of the few employed, it may be mentioned that one is used for the manufacture of the paper used for the Bank of England

notes. The amount of sewage yielded by a town may be understood when it is stated that the sewage of Croydon for one day would cover an acre fifteen feet deep, and for the year 5,475 feet deep.

The sewage river exhaling its pestiferous gases ought to be protected in any well-devised scheme; but it is a curious fact that the moment sewage is removed from a town it appears to cease to be an object of thought and attention to the authorities of the town.

The usual practice is, for the councillors of a town to carry their sewage to the boundary of the land under their control, and then pass it to the land in the district of their neighbours, when economy and not efficiency guides their actions.

In any part of a medical social science scheme for dealing with sewage, every district should dispose of its own sewage; thus Croydon should not purify itself by poisoning Beddington, nor Enfield by poisoning Edmonton.

As an example of the utter recklessness of the council of a town to the inhabitants of another district, it was alleged, upon many strong affidavits, that Croydon had so purified its water that it was fit to enter the Wandle for the inhabitants of the next parish to drink! I mildly replied, upon affidavit, "that I was not aware of any process which could turn sewage into a good potable water." The Croydon irrigants adhered to their statement, and were not a little surprised and disconcerted when I rejoined that their statement disposed of all difficulties, for they had only continuously to pump back the transformed sewage into their own water tanks when the law proceedings would be terminated, a test of the perfection of their process which Croydon never for one moment contemplated.

As a fundamental principle of a medical social treatment of sewage, one person ought not to be relieved at the expense of a second.

The river of sewage freed from large matters, is next conducted by various channels to the land, as theoretically, earth is capable of assimilating to itself the manurial particles, and of separating the water.

Now comes into play the overwhelming difficulties which are afforded by the small quantity of solid sewage which exists in proportion to the enormous quantity of water.

About a quarter of a century ago a company was formed by an

enthusiastic sewage irrigant, and a pumping engine was erected at Fulham. Within a mile of the pumping engine one of the principal gardens which supplied Covent Garden exists, and the company requested me to offer to lay down suitable pipes and supply sewage gratuitously, as an experiment. I visited Messrs. Fitch with the landowner for the purpose of offering this supposed boon; and, after a long discussion, each of the partners pointed out the necessity to get the water off the land if successful culture was desired, and they declined the offer.

Those experienced cultivators at once hit the blot of successful sewage application, for the problem still remains, how to separate the water from the sewage in solution.

Practically, it is not now done. The sewage is passed over the land, which for a short time absorbs the water, but the sewage continues to run by night and day, the land becomes water-logged, and refuses to take more. It becomes inactive, and putrescible water runs over the land to the neighbouring brook, there to poison those who have recourse to it for drinking purposes.

It is pretended, by the Croydon Local Board, that about fifteen feet of sewage in depth is filtered by every square foot of ground per annum, which amounts to about seven times the natural rainfall of the district, an amount which is so preposterous that, with the feeblest intelligence, the councillors ought to know it is practically impossible.

When the land is water-logged, the earth is not aërated, and what soaks through passes to the springs of the district, and renders them poisonous. Wells near the Sewage Farm of Croydon cannot be used, being thoroughly poisoned by the pestilential sewage.

It is not a disposal of the sewage question for the inhabitants of a town to turn the sewage into the wells of the next village; and this is a question in social science which requires a vigorous treatment.

As the sewage is supplied over a large area, all good water supply ceases. The cattle are compelled to drink sewage, and the men, under the great pressure of thirst, seek the cleanest water they can find, although, if taken near the farm, it is poisonously contaminated with putrescible matter.

As a matter of medical social science the wells of a district should never be allowed to be poisoned, if possible; and, if impossible, without an adequate supply of pure and wholesome water being afforded.

When the land is water-logged, the sewage passes over the surface, when, instead of the pestilential effluvia being restricted to a channel a few feet wide, it is spread over acres of surface, where the utmost possible amount of sewage poison is communicated to the atmosphere.

What a perversion of medical social science it is for the doctors of a town to protest against the exhalation from a few square feet of exposed sewage, and yet to regard as immaterial the effluvium of hundreds of acres of sewage marsh.

But the sewage, as it runs over the earth, is now generally caused to run through rye-grass, because the irrigants say that grass has a cleansing effect. They are true to this extent, that the grass acts as a sort of brush to the sewage, and the pestiferous slime adheres to the blades of the grass, to be carried elsewhere, to be eaten by cattle. When the sewage grass is made into hay, this slime is still adherent; and, if it be steeped in water, the infusion is acted upon by the sewage ferment, and sometimes putrifies with disgusting effluvia.

Sewage irrigation cannot be said to be practised according to the rules of social science until the irrigation is so conducted that the earth does not become water-logged, and until the grass is not besmeared with all the poisonous materials which sewage contains.

If the sewage ground remains wet, vegetation is crippled, and it is quite remarkable to observe how the roots of trees rot and how the trees are blown over in the sewage ground when the ground is water-logged. Rose trees, &c., are shown, in the committees of the Houses of Parliament, as samples of sewage culture, which could not have existed on water-logged sewage grounds as now ordinarily conducted.

It has been stated that there is at the present time no town sewage ground which does not exhale its detestable stench, and which does not leave all the slush on the surface or on the grass. It is a curious fact that, when the slush is left on the surface of the ground, it still exhales, after the earth is dry, the faint, nauseous

odour of sewage; and I have walked over sewage fields in the depth of winter, when even intense frost has not prevented the faint and sickening exhalation from dry ground.

When the earth is dried after sewage irrigation, vegetation is prodigious, oats attain incredible growth of straw, monster cabbages are raised, extraordinary-sized onions may be grown, but, then, without particular care, their juices are impaired, and their texture is so imperfect that they have a tendency to rot.

It is necessary for the perfection of the vegetable tissue that the sewage should be commingled with the earth and changed in its nature before it is absorbed by the plant. Asparagus watered with putrid manure is most offensive, even after having been cooked. The strawberry, if watered too late with liquid manure, becomes disgusting; and it has been noticed that cabbages become bad, and cauliflowers nauseous, if grown in undecomposed foul manures.

Sewage produce is grown at one spot and transferred to another; so it is almost impossible to trace its baneful effects. Cartloads of watercresses are sold in London, where some sewage (for they will not grow in pure sewage) runs directly over them, so that their stalks are smeared with the excrete of typhoid fever cases, with the epithetical scales of scarlet fever, and with the ova of entozoon. And what may not happen, if we are again afflicted with the scourge of cholera, if persons eat vegetables besmeared with cholera virus? Sewage produce not only contains within it, but has disposed upon its surface, the germs of all contagious diseases, and who can tell how many isolated cases of disease may have happened from this source? for who can tell whence their food has come? and who can tell where sewage produce goes?

The followers of social medical science should take steps that persons may not be poisoned unawares, and, when the mother goes to market to provide the necessary fresh vegetables for her offspring, that she should not buy at great cost a scarlet fever, a typhoid fever, a diarrhœa, or a cholera. One town produces the poison, another, perhaps far distant, is affected by it; and, as the peer, as well as the poor man, in the great metropolis, has to depend upon the public markets for his vegetable supplies, competent authorities ought to take care that wholesome food, and not contagious poison, is sold to the public.

To the influence of sewage food upon cows I have lately called the attention of the public. It seems to be worse at one season than at another. When the experiment was tried in the spring, the milk became putrescible, and so did the butter. Both were so bad that they could not be used. Here again the difficulty arises as to how the wholesome milk can be discovered from the putrescible. As far as I as yet know, the best plan is to place aside some of the milk in a warm place, when, in a few hours, if it contains any putrescible matter, it will show itself by an offensive odour, and the amount in the milk may be determined by the amount of the odour and the length of time over which it is exhaled. Experiments are still proceeding on this matter.

Many attacks of typhoid fever have been traced to milk, and, as it is no small difficulty, from the nature of the case, to trace an attack of typhoid fever to milk, we may assume that there have been ten attacks from that cause for every one that has been detected.

When milk has been the vehicle of typhoid poison, the following causes have been assumed :—

1. Foul water, containing typhoid poison, had been added to the milk.
2. The milk had absorbed the typhoid poison from the air.
3. The cow had been in a diseased state.
4. The cow had drunk sewage.
5. The cow had eaten sewage deposited on the outside of the grass.
6. The cow had eaten grass the juices of which have been affected.

In the last cases the milk becomes putrescible, and, according to all known science, capable of either producing or conveying the poison.

In the recent epidemic at Marylebone, the source of the typhoid was traced to milk supplied by the Reform Dairy Company, and there the clue appears to be lost; and much more information is required, under all the circumstances of the case, before any one is warranted in forming a decided opinion.

The Reform Dairy Company, however, had some years ago, a contract with the Metropolitan Sewage Company for the supply of milk from the sewage farm at Barking.

The Reform Dairy Company complained that the milk would not keep, but turned sour and stank.

By direction of the Reform Dairy Company the Metropolitan Sewage Company added to the milk at various times sulphate of soda, silicate of soda, phosphate of soda, and sulphide of sodium, to prevent the milk from going bad; nevertheless, the Reform Dairy Company alleged that the milk still continued to be very bad, and in the spring of 1869 the Reform Dairy Company claimed a considerable sum of money for damages on account of loss of customers from the bad milk, and proceedings at law were taken by the Reform Dairy Company to recover the same.

The Reform Dairy Company attributed the mischief to the bad water the cows drank; and the water of one well was reported by an analyst "as unfit for man or beast."

Since the action, the Reform Dairy Company were so impressed with the danger of putrescible milk from sewage grounds, that they determined to have no more sewage milk. It is not a little contradictory that, whilst Mr. Hope, the special advocate for sewage produce, belonged to a company which distributed typhoid fever to the community from farms a long distance off, he kept his sewage grass milk at home at a farm not half the distance from London.

It appears that two epidemics of typhoid fever have appeared in establishments whilst supplied with milk from the Croydon Sewage Farm, one at Beddington Schools, by the Wandle, where about sixty were attacked, and three died; one at the clerks' schools, where one child and one governess died. The second case was communicated to me by the Secretary lately, and was not known to me before. In these two cases it has been stated that there were unfavourable conditions in the houses, beside the supply of milk.

The use of bad milk affects the rich as well as the poor; and the twenty deaths and the 200 attacks of fever which occurred lately from poisoned milk distributed in Marylebone occurred amongst those in a good position in society.

All medical men treat typhoid and other fevers by milk, and what can be more contrary to scientific principles than to supply a fever case with putrescible milk? Hence the most stringent rules should be adopted to keep milk from the dangerous proximity to sewage; so that the cupidity of man should not cause it to be added to the milk, nor the thirst of the cow, for it to be drunk, and thus to be passed on to the milk. Every household knows that

when the nurse is injudicious in diet the baby cries, and cow-feeders are fully aware that when cows eat wormwood the milk is bitter, and when they partake of garlic it is highly tasted.

Milk is of such paramount importance to a metropolitan community, that it should be an object of solicitude to the medical social inquirer that it should be given to the public free from poisonous taint.

The effect of sewage food on the health of cattle and sheep is well known to be deleterious. It has lately been stated by Mr. Scott that the cows of Edinburgh, where they are fed upon sewage grass, have so high a mortality, that the Cattle Insurance Company refused to renew the insurance; and I have the authority of the late auditor of the company for stating that the enormous claims paid by the company for the Edinburgh cows insured by them, and which died, ruined the company, and the refusal to renew the insurance came too late.

An intelligent man, who worked upon a sewage farm, informed me that many of the sheep on the farm, as anybody might reasonably have expected, became, to use his own word, "rotten." The rot in sheep is due to an entozoon called a fluke, which in the human being becomes an hydatid, and whilst sheep had the rot and were passing the ova of hydatids, the water was flowing to water-cresses, from whence this terrible malady (which is estimated to kill 400 persons annually) might conveniently be conveyed by its host to the interior of man.

In 1869 a great epidemic broke out on the sewage grounds of Croydon amongst the cattle, about which there were strange reports. To clear up the mystery, the following questions were sent to the Croydon Board, who declined to answer them.

1. How many cattle existed on the sewage ground before the epidemic appeared?
2. Had cattle been introduced from any other locality; if so, how many, and from whence?
3. On what day did murrain appear on the irrigation ground?
4. How many cattle have been attacked in all since that day?
5. Have any cattle since that day been killed; and, if so, how many?
6. If sold, to whom were the carcasses consigned?

7. Were the carcasses used for human food; and, if so, who inspected them, to see that they were fit to be eaten?

8. Have any cattle been sold other than for human food; if so, were the purchasers informed that murrain existed in the sewage grounds, that the contagion might not be propagated?

9. What are the number of cattle now on the sewage grounds?

In a report in the local paper of the extraordinary proceedings of the Council of Croydon upon this letter, it is stated, "That Mr. Punnett said that, when you told a man he told lies, it was no argument. He would meet Mr. Smee slap in the face, and tell him that what he says is untrue;" and Mr. Haynes suggested "that Mr. Smee had better find the information himself." One of the greatest difficulties in the successful disposal of sewage is the class of men who are entrusted with its administration.

It is reported that twenty cattle died last winter on the sewage grounds of Croydon, and that four horses died this summer, so that it is both heartless and cruel for boards of health to sell sewage grass as a healthy produce.

In this case, again, the cattle are fed at one place, sold to a butcher at a second, and distributed for food to a third, and the person who eats them does not know that he is eating sewage-fed cattle, nor can any person tell where the sewage cattle are sent.

When illness arises from the use of bad meat, how is the poor person to trace it, when the local so-called Boards of Health will not assist, but resist the application for information in a contemptuous way?

I once asked a clerk, who was troubled with tape-worm, why he bought second-rate meat, which might have been grown on a sewage farm. He replied that he had a large family, and could not afford to pay more. "Then," I rejoined, "why do you not thoroughly cook it, to destroy any germs of disease?" "If I do so," was the ready answer, "the meat would so waste that there would not be enough to go round." The tape-worm in the man and the wasting of the meat showed the diseased state of the food consumed; but the councillors of one town do not eat the diseased meat—it ultimately finds its way to other towns, and the poor man obtains no protection. In this case it is hardly to be expected that either a Bishop or a Chancellor will suffer from disease or tape-

worm as a sacrifice for the good of the people, because they obtain good meat, and it is left to the middle-class clerk to suffer from the cupidity of the sewage irrigants.

Labourers and navvies cannot perform their labour without good meat, and they contrive, when in full work, to get the best beef, and leave it to those above them, with limited incomes, to eat that which is inferior.

If social science is here to step in to protect the people, it must act at the source of the mischief, where the cattle become diseased, and stop the supply thence to the cities.

The sewage grounds, after long continued irrigation, become converted into pestilential swamps, which snipes and wild ducks visit in winter, and which exhale the most disgusting effluvium. The stench varies with the weather. In a bright, windy day, it is comparatively little apparent, but in a close evening it is most disgusting.

Why such a state of things, contrary to social scientific principles, should not always give rise to cholera, typhoid and scarlet fever, no medical man can tell. But when these diseases have a tendency to appear, then the action of the sewage poison intensifies the maladies. And upon these grounds social science ought to interfere and compel the sewage irrigants to conduct their operations without causing these poisonous exhalations.

Whether it is possible on a large scale, by under-draining or otherwise, to thoroughly purify the water remains to be proved; but, when we see a large sewage ground, as that of Croydon, left undrained, the probability of any improvement seems hopeless.

It may be possible, by a thin distribution of sewage—say not more than two feet in depth per annum, in favourable porous soils—to dispose of sewage, that it may all be taken into the earth. There is no doubt but that such an absorption might be effected in some uplands in the vicinity of Croydon; but, as there are four millions of gallons per day to be disposed of, no less than 2,700 acres would be required to take the water. The amount is so large that the mind does not realize it, for who can form any conception of 1,460 million gallons of sewage, which is the sum per annum of the sewage of Croydon upon the chairman's statement of its amount at

4,000,000 of gallons a day, though I should have thought that it would not have averaged above half that amount.

After the sewage soaks through the land, the water is collected again into another main stream. If the whole has filtered through the earth, the fluid is clear; but, notwithstanding its brightness, it is frequently found to be putrescible, when it ought not to be allowed to pass to the neighbouring brook. In practice, the irrigator is often neglectful; and I have seen an acre or more transformed into a small sewage lake, from whence the sewage has run unchanged into the river, to act as a poison to the inhabitants who live lower down the stream.

It is not safe to trust our senses to discover a small quantity of sewage in a large quantity of water. On the occasion of the last visitation of cholera, I was aware of a well the water of which was poisoned. I urged the immediate removal of the pump handle, but loud were the remonstrances of some of our most eminent bankers, who were thus deprived of their usual water for luncheon. The water was proved to have been derived from the worst of all possible sources; but the presence of saline matters in water is as attractive to human beings as it is to cattle.

It is perfectly manifest that sewage irrigation as now practised is a failure, commercially as well as practically, for the disposal of sewage, as sewage farms are continually to let. It therefore becomes a question for social science to endeavour to devise, if practicable, some more perfect system for the disposal of sewage. On a small scale this has been effected by the earth closet; but this has never been adapted to a town, and its practical use on a large scale presents many difficulties and dangers.

If no better plan than irrigation can be discovered, then social science must determine whether any mode can be adopted to destroy the sewage matter before it goes upon the ground. The Lime process, the Salts of Iron process, the A. B. C. process, Anderson's precipitating process, as used by the General Sewage and Manure Company, Scott's process, and others too numerous to mention, are in this direction. If any plan for the thorough destruction of the poisonous character of sewage can be discovered, great good will be effected. Some of these processes have been

highly extolled; but further experience is required before the universal adoption of any such plan can be recommended.

The influence of carbolic acid in determining the mode of putrefaction is very remarkable. It is stated that it has been applied with success to sewage; but a more extended experience is required before it can at present be recommended on a large scale. The influence of animal charcoal, peat charcoal, and cinders, has also to be considered and made the subject of further experiment; but hitherto they have not been reported to be successful, and every process appears to fail to get rid of the urea.

Unquestionably difficulties present themselves in dealing with the sewage question. Financial companies are said to have large sums of money involved upon a false estimate of the high money value of sewage. The Mapplin Sand speculation influences the matter; complicated private interests are interfered with; and some landowners get as much as £10 an acre to permit sewage to be used on their land. The mode in which the subject is handled by committees of both Houses of Parliament, where so-called skilled witnesses have made the most ignorant and exaggerated statements of the money value of sewage and the perfection of irrigation, has interfered seriously with the scientific solution of the question. Notwithstanding all these difficulties, medical social science has only steadily to point out the ill effects of sewage irrigation, when we may confidently predict that ultimately the sewage irrigants will be compelled to respect the health of the general community as well as that of their own town, that the public may be protected against a vitiated atmosphere, poisoned water, water-logged soil, sewage-tainted vegetables, putrescible milk, and diseased meat.

It is curious with regard to all sewage questions, that the facts are cross stated. Whilst independent and disinterested observers see the great evils attendant upon the system as now practised, others, who are interested either in the promotion of sewage irrigation or continuing it, speak of the results in the most superlative manner. Dr. Carpenter and his household drink sewage milk; Mr. Creswell does the same. Mr. Hope gave a dinner at which Mr. Poove was present, who records that he never ate a better, although all of sewage produce. Others, however, will not buy sewage produce; hence its low price. The dissentients are fully entitled to

ask that all sewage produce should be labelled as such. If the produce is as good as the sewage irrigants declare, such a course must enhance its price; but, if it is as indifferent as impartial observers state, then those who do not like it will not have it thrust upon them by stealth.

The problem of the day is, how to deal with sewage in our inland towns, as vast sums of money have been already spent. The treatment of the subject requires great prudence and moderation, for it is clear, where millions of gallons of water have to be dealt with, that the fluid must ultimately go by some river or channel to the sea, or be distributed over so large a surface that it can be absorbed by the earth, a case which can but rarely happen. If a due supply of water for ordinary cleanliness be employed, the resultant discharge of water from large towns must always be enormous. I submit that the only safe plan, under the circumstances, is to confess our ignorance, and to set to work experimentally to decide the question at issue. First, let us try to keep the sewage proper within a more reasonable compass and separate from the enormous bulk of water with which it is mixed. Secondly, let us endeavour to destroy the poisonous character of the sewage, and get it into a state adapted for vegetation. Thirdly, let us endeavour to cleanse the water by precipitation, and then by filtration through so large an area of land that a pestilential marsh is not created.

When all these things are effected, and the public health secured, it will be time to consider the economical bearing of the problem; but life and health ought to be considered before any question of wealth and gain.

It is folly to trust the management of sewage to town councils, constituted as they usually are, especially whilst we are ignorant of the best plan to be pursued. The only practical method is for the country to place the sewage from one or two of our large towns under trained persons, accustomed to original investigation and to the interrogation of nature, to work out experimentally the matter, that the country may know upon what principles, under varying circumstances, the distribution of sewage may be rendered innocuous, when, from the circumstances of the case, it cannot be carried to the wide ocean, which, with our present knowledge, is the safest plan that can be followed.