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Remarks on the Recent Outbreak of Typhoid or Enteric Fever at Southampton, L I.

BY

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REMARKS ON THE RECENT OUTBREAK OF TYPHOID OR ENTERIC FEVER AT SOUTHAMPTON, L. I.

THIS paper presents the facts in regard to the recent outbreak of typhoid fever at Southampton, points out sanitary defects constantly present, and urges the importance of absolute cleanliness in the management and disposal of all filth and refuse. It is only by individual effort that the water supply can be kept free from contamination, but, as appears in the sequel, this is not only possible but practicable. The sanitary suggestions which close the paper apply not only to Southampton but to every small seaside resort in a developing state where there are similar conditions of soil, surface of country, and water supply.

Every physician can, in a desultory way, contribute a few facts to sanitary knowledge, but his opinion can never have much weight; therefore, outside of the facts the analyses and the cases, a large part of what follows is made up of quotations from undoubted sanitary authorities. Dr. Hill (*Lancet*, October 20, 1887,) writes: "Every hygienist has deplored the non-existence of a physiological and pathological institute, properly furnished for the scientific investigation of many questions affecting public health."

The village of Southampton has a population of about twelve hundred, together with, in the summer, about a thousand visitors, composed largely of children and young adults. The summer population live in boarding houses, and cottages (of which there are about eighty), partly rented and partly owned by their occupants. All are subject to the same sanitary conditions and surroundings, and all drink water pumped fifteen or twenty feet from a common source—what may be called surface water. All live upon the same level, so that none can be said to drain directly upon his neighbor. The soil throughout is composed of sand and gravel, resting upon clay fifteen feet below, allowing of rapid percolation of rain water and other fluids to the impervious clay layer, upon which they collect and remain.

All the village, including the eighty cottages, dispose of their sewage and waste independently, either upon the surface or in cess-pools, there being no system of drainage into the lake or ocean. Most of the cottage cess-pools, and those more recently constructed in the village, are from twelve to sixteen feet deep, made of brick lined with cement, and are water tight, while the rest, which have no brick or cement at the bottom, are in reality only wet earth pits. (1) The villagers more often drain their waste water upon the surface near their houses, and use for the reception of all excremental matter the old-fashioned privy, kept dry and odorless by the free use of earth, in this way getting along without cess-pools. A very few of the cottagers employ this method. (2) Some of the cottagers, possibly the majority, drain the waste water of the house and all excremental matter into the cess-pools, using water closets with a large amount of water, and emptying the cess-pools as often as once a week. (3) Others of the cottagers, and a few of the villagers, drain the waste water and fluid excrement into the cess-pools, and for other excrement use dry earth in boxes or pails, which are emptied daily. Of these three methods the first or village method, which is unsightly, is, when properly carried out, the safest; the second, dumping on the surface near the houses, is bad; and the third, if used with care, is moderately good; both the second and third methods are unsafe, if the cess-pool is leaky, has an unsound bottom, or none at all, for all drainage takes place into the sand at the level of the water supply, which can hardly escape contamination. The contents of all the cess-pools are pumped into a tight wagon and poured upon the ground in the immediate neighborhood of the houses, there being no common dumping-ground at a distance. The contents of the boxes or pails, are carried away daily, but where is dimly known. The emptying of the cess-pools is done at night by careless workers who, entirely contrary to orders, have been known to dump within less than seventy-five feet of the houses and upon the roadside. The stench attending the pumping and dumping is, if appreciated, unbearable, hence the selection of the hours of midnight and early dawn; a selection bad because carelessness is thereby undetected, and because the odors fall upon a sleeping community in the hours when vitality is at its lowest point.

"In the night and early morning there is no breeze to keep the air in motion, and the density of the air and the deposition of dew prevents a free admixture of the impure with the higher

strata of pure air."—"Sanitary Examinations of Water, Air and Food." Fox, p. 230.

"Families, visiting the seaside for the benefit of their health, do not desire to inhale the exhalation from hundreds of cess-pools, however much they may be diluted by the sea breezes."—"Sanitary condition of Margate." *Lancet*, July 30, 1887.

Other sources of stenches are the pigstys in the village and elsewhere, and a few heaps of rotting manure. The cess-pools, especially those used for all excremental matter as now managed, are a nuisance, and perhaps this term may justly be applied to the pigsty and the manure heap.

"All unpleasant smells are to a certain extent deleterious, although infinitesimally so perhaps."—Fox.

The summer of 1887 was characterized by periods of intense heat followed by heavy rains, during which every form of soluble filth was washed into the source of the driven wells, to wit, the surface water.

On the other hand, Southampton, which is near the open sea, enjoys the benefits of broad spaces, strong sea breezes and uninterrupted sunshine. There is no crowding of houses or cottages, and no mobs of transient visitors. Its food supply is good, fish, meat and vegetables, arriving in excellent condition and in abundance. The milk, while not rich, is good, and carefully and promptly served.

In a summer resort one looks for first rate health, and if it be only second rate the attention is at once aroused to search for the explanation or causes. Second-rate health may be said to exist when diarrhœa, digestive ills, general debility, and attacks of lassitude with headache occur ; such disorders indicating that the sanitary conditions of a place are unsatisfactory and approaching the danger line, while the occurrence of one or all of the graver disorders—dysentery, diphtheria, typhoid fever—indicates the crossing of the danger line. Now, preceded by the minor evils referred to, toward the close of the summer, typhoid fever made its appearance in Southampton. In contrast with this, the summers of the preceding two years presented an almost entire absence of these lesser evils and freedom from every grave disease.

The history of the outbreak is briefly as follows :

Dr. John Nugent writes : "I was called to see Mr. Waters (near the Shinnecock Reservation about three miles from Hildreth's) about August 25th. He died September 12th, after

an illness of five or six weeks. My notice was called to his daughter September 6th. Mrs. James A. Hildreth was taken sick September 20th. I was called to see Mr. George Folk, the water-mill man (about two miles from Hildreth's), October 4th. He had been sick a week then. I had another case about two miles west of Pond Quogue lighthouse. I was called there September 22d, finding patient had been sick about a week. There have been quite a number of cases up that way since, and two or three deaths. I have not had a case of low fever in the past year that I can recall."—Extract from letter November 10th, 1887.

Dr. P. Brynberg Porter, in the latter part of August and September, attended Miss E., sick with typhoid fever of a moderately severe type, at Mr. Hildreth's.

On the 16th of July I was called to see Mr. G. C. at James A. Hildreth's boarding house. He had been sick a number of days, and after a week's observation I concluded he had not, as I had feared, typhoid fever, but remittent fever, with sharp rises and falls in the temperature, and constipation, and cured by brisk cathartics and quinine. Mr. C. was in perfect health when taken sick, was subject to attacks of remittent fever, and had been in Southampton two weeks when he was suddenly taken sick in the way described. This case, which is out of place here, is described and included for the reason that many erroneously assumed it to be typhoid fever.

On the 11th of August I was called to see Miss de L. (at Mr. Hildreth's), who was suffering with fever and headache. On the third day pneumonia (croupous) developed in the upper lobe of the left lung and ran a course of fourteen days, masking the typhoid fever present, which gradually became characteristic, until it was evident that it was the chief malady, the pneumonia being a complicating or intercurrent affection ; and from the two diseases, but chiefly from the typhoid fever, death occurred on the 11th of September.

On the 17th of August I was called to see Miss C. (at Mr. Hildreth's), who in the best of health was suddenly taken sick with a chill followed by fever. At first I thought that she had remittent fever, but I soon learned that free doses of quinine had no beneficial effect on the disease, which became gradually a typical case of typhoid fever of moderate severity.

In addition to these cases I saw at Hildreth's in August three patients who suffered from digestive disturbance with complete

loss of appetite and frontal headache, and recovered in from seven to ten days.

From Mr. F. O. de Luze I received the following:

"I have seen Mr. R. who also boarded at Hildreth's. On his return he was ill with malarial fever for ten days, and is still under treatment (September 15th), and looks much pulled down. His sister (the youngest) is ill now in bed and has been so since August 14th, and her doctor says that she has just escaped typhoid fever, and that both cases were contracted at Southampton. Mr. R. never used ice in the water, but drank much water and milk."

On the 25th of August Miss S., at the Fondey Cottage, on the lake, one half mile west of Hildreth's, was taken sick with fever and constant frontal headache, with feeble and rapid action of the heart, ending in prolonged sickness in bed. The diagnosis, after a few days observation, was typhoid fever of mild type. Miss S. drank milk, and water from the basement well of the cottage, but no water from the Hildreth well or milk from his farm. There is no evidence that the milk, which was supplied by Goodale, was ever impure or in the least contaminated.

Scattered about during August and September there were a number of cases of moderately severe and obstinate diarrhœa, which were attributed to the use of impure water, as no sufficient cause could be found either in intense heat (the latter half of August and September were cool), or improper diet.

At Seamarge, one-quarter mile south-west of Hildreth's, we suffered from digestive disturbance, with obstinate colic and diarrhœa, and persistent nausea, which could be attributed to nothing except the water, and this was finally sent to Dr. Martin for analysis.

At Mr. Hildreth's a cess-pool, without a bottom of brick or cement, receives all the waste water (a large amount), and allows of immediate drainage into the ground at the level of the water supply. Connected with the cess-pool, at the south end of the hall, there is a shallow sink into which waste water is constantly emptied. All fluid excremental matter is thrown upon the ground at a safe distance from the well, and all solid excremental matter is deposited in privies supplied with earth, which renders them dry and odorless. There being no leak from a drain directly into the well, its contamination, which took place, can be explained only by percolation through fifty feet of sand. As this occurred there

is no reason to doubt that contamination could extend further, and I learn that the analysis of the water from the new well, one hundred and fifty feet from the house, indicates similar impurity.

"The cess-pool at the Fondey Cottage has no cement at the bottom, only on the sides ; it stands a little lower than the house and the ground slopes from it to the lake. (The driven well is in the basement of the house.) Last winter the cess-pool was thoroughly cleaned and left open until spring. There is one water closet and bath tub on the first floor in the corner nearest the cess-pool, and one sink room on the second floor, these with kitchen sink and wash tubs drain into the cess-pool. There is also an earth box outside, as the water closet is only a small one, and we had only a small tank of rain water. New pipes were put in last summer. We never had any smell from the sinks, but had to pour pails of water down the closet when the water was low."

It is evident that contamination of the surface water from the cess-pool could easily take place, and, as the analysis of the basement well water indicates, it did take place.

At Seamarge, the cesspool, one hundred feet from the house, is made of brick cemented thoroughly, and is water tight. It receives all the waste water and fluid excremental matter, but no other excremental matter, which is deposited in earth boxes and removed daily. In July the waste pipe became plugged, allowing leakage upon the surface of the ground twenty feet from the driven well. From this or some other source, as is shown by the analysis, the well water became impure.

A comparison of the analyses of these three waters shows a little difference in the degree of contamination only, and in each case the impure water produced sickness, so that it is probable that the boarders at Hildreth's would have suffered equally severely if they had been either at the Fondey Cottage or at Seamarge.

At the Waters' place there is no cess-pool proper, tapping the ground twelve or sixteen feet to the water level, and the drinking water comes from a spring. The analysis indicates very little or no drainage into the source of the spring, which may be protected by the trend of the clay layer between the primitive cess-pool and the spring, being away from instead of towards the latter. It is worthy of note that there are no surrounding sources of contamination, in the shape of cess-pools, as in the other cases.

I know nothing of Mr. George Folk's sanitary surroundings or the condition of his drinking water, or of the sanitary sur-

roundings and water supply of the Pond Quogue lighthouse case, or of the more recent cases, referred to by Dr. Nugent, in that neighborhood.

Lake Agawam receives no drainage and is subject to contamination only from leaky drain pipes or cess-pools, which surround it, and surface filth washed into it by heavy rains.

The life saving station has no cess-pool and uses an old-fashioned privy. The contamination of the water comes from leakage from surrounding sources of impurity, the drains and cess-pools.

The water from D. Burnett's well at Wickapogue, a little east of Hildreth's, was analyzed by request of Dr. Nugent, who refers to the well in the following words: "There are willow trees not far from the well, and in summer the water smells so bad they can not use it; the roots grow into the well."

Having briefly related the cases and described their sanitary surroundings, where shall the explanation or causes of the fever, around which the lesser evils probably also cluster, be sought for?

(1.) It did not spread from the first case by contagion, for it is universally believed to be not contagious from person to person. "But the most remarkable fact is what follows: Since 1861 for nine years 3,555 cases of enteric fever have been treated along with 5,144 patients not suffering from any specific fever [in the London Fever Hospital]. From 1871 to 1882, 1,795 cases of enteric fever have been admitted and treated in the same wards with 982 cases of other diseases, no special precautions being taken, and not one of these became infected."—Murchison: "The Continued Fevers of Great Britain," p. 462. By contagion none of the cases outside the Hildreth's house could be explained.

(2.) There is no evidence that it originated from the use of contaminated food or milk.

(3.) Its origin and spread has been briefly and simply explained by saying that Mr. G. C. had a low fever with diarrhœa, contracted in New York; that by his dejecta the Hildreth well became polluted; that upon his linen the poison or germ was carried to the Waters family (who took in washing), draining with the waste water into their spring; and that it was carried in Goodale's milk from Hildreth's to Miss S. in the Fondey Cottage.

This explanation, attractive from the fact that it limits the water pollution to Hildreth's well and implies importation of the disease, has been eagerly accepted, but it is unfortunately at variance with the facts.

The nature of Mr. G. C.'s illness is stated in the history of his case. He writes: "My linen was never washed by the Shinnecock Indian" (Waters).

Mr. Jas. A. Hildreth writes: "I have never sold milk to the Goodales. They have not washed cans from my well nor used the water in any way."

"The fever is occasionally believed to be introduced into a house by a newly-arrived person, when it really has a local origin from which the stranger naturally suffers first."—Murchison, p.364.

(4.) It could have arisen from the use of water contaminated with sewage containing typhoid poison from unrecognized cases occurring during the preceding winter and spring, the germs living on and doing no harm until carried into the water supply by the rains of the middle and late summer. It is impossible to exclude the occurrence of contamination in this way and equally impossible to trace it. Dr. Nugent says that he had no doubtful cases of typhoid or low fever and knew of none in the winter and spring. Owing to the grave illness of the late Dr. Hallock it was impossible to get an expression of his experience. Possibly doubtful cases did occur and it is perhaps possible that the typhoid poison, be it a bacillus or animal matter in dry form, is endemic here as in most country towns, and that, after very hot weather or prolonged drought, it is by heavy rains washed into the water sources, or else slowly leaks in from defective drains or cess-pools.

(5.) It could have arisen from the use of water polluted with sewage only, the pollution being limited to no one locality.

"Although in large towns it may be difficult to exclude the possibility of contagion, on turning to the history of circumscribed epidemics in country districts, it is found to be often impossible to attribute the first appearance of the disease to contagion. It is not uncommon for the inmates of an isolated country-house to be seized with enteric fever, although no case has occurred within many miles, and there is no evidence of importation of the poison.

"In the admirable report of the medical offcer of the Privy Council it will be found that the experience of many years repeats again and again the general lesson that enteric fever denotes 'excremental poisoning;' while the president of the Society of Engineers has recently declared that, having examined many hundreds of houses in which enteric fever had occurred, he had in every

instance been able to trace the outbreak to some unlooked-for defect in the drainage. But there is not the same unanimity of opinion as to how the poison appears in the sewage. Many adopt the view taught at Munich for more than thirty years by Prof. F. von Gietl that the poison, although contained in sewage, is always derived from the excreta of an individual already suffering from the disease, a drain being merely the vehicle for its propagation or, in fact, a direct continuation of the diseased intestine ; while others believe that the poison may be generated in the sewage independently of typhoid excreta. The solution of the question is undoubtedly beset with many difficulties.

"During the last fifteen years, however, I have met with few examples of enteric fever, which, on investigation, could not be traced to defective drainage, the explanation of which was often unknown to the inhabitants of the infected locality. Enteric fever is constantly appearing where decomposing sewage is present, but where every effort of acute observers fails to trace the presence of typhoid excreta.

"An increased rainfall sweeps away the impurities to which the origin and spread of the disease are in drained towns mainly due ; but in undrained places it may conduce to an outbreak of the disease, by washing these impurities into the water used for drinking purposes, as happened at Festiniog in 1863 and in Dundee in 1864."—Murchison, p. 449, *et. seq.*

"The waters of wells are greatly influenced by (1) height of the subsoil water, which is always varying ; (2) by the amount of water that is passing through the subsoil of a country ; and (3) by heavy downfalls of rain or periods of drought. I have many times found a water pure at one time and impure at another, and this occasional pollution of a water is often due to the periodical washing of filth into a well by heavy rains. The disagreement in the opinions of able analysts respecting the purity of samples of water, taken perhaps within a short interval of time from the same well, is often due to these causes, which are not sufficiently recognized."—Fox, p. 61.

"The experience of Lausen (where filtration through a mile of earth occurred) seems to prove beyond a doubt that the poison of typhoid may undergo what appears a very efficient natural filtration without losing its activity.

"It is more than doubtful whether there is any absolute safety in obtaining water from deep wells. The Dudlow Lane well, near

Liverpool, having a total depth of 443 feet, was fouled by percolation from cess-pools, and percolation from a defective sewer would certainly prove equally disastrous. Surface wells are not now regarded as at all safe, but our suspicions with regard to them were not aroused until after the introduction of the plan of mixing water with putrescible matter. There was no soakage from an old-fashioned dry pit. There must be soakage from a cess-pool or 'dead-well.' The only way of securing pure water is to make sure that there is no fouling of water sources."—*Lancet*, July 23, 1887.

"Some may triumphantly observe that they have been endangering their health during a great many years, and are not, to their own knowledge, at all the worse for the filth that they have taken with their water. They conclude, therefore, that impure water, like tea which the old woman of ninety was informed was a stealthy poison, must be exceedingly slow in its action.

"Mr. Simon, who rightly insists upon a high standard of purity for drinking water, in his second annual report to the city of London, observes that: 'We cannot expect to find the effect of impure water always sudden and violent. The results of the continued imbibition of polluted water are indeed often gradual, and may elude ordinary observation, yet be not the less real and appreciable by close inquiry. In fact it is only when striking and violent effects are produced, that public attention is arrested; the minor and more insidious, but not less certain evils, are borne with the indifference and apathy of custom.'

"All waters, even the purest, contain some organic matter. The excess is alone objected to; and especially that of animal origin, which is especially prone to pass through certain putrefactive changes.

"Thousands are still to be found who believe that if a water is bright and clear, and not unpleasant to the taste, it must be good; whilst it has been proved, over and over again, that such a water may be polluted with unspeakable filth, and that an excessive brilliancy of a water is a suspicious sign."—Fox.

The following analyses were made by Dr. Edward W. Martin, of the School of Mines, Columbia College, and Prof. Herbert E. Smith, of the Medical Department of Yale University.

SCHOOL OF MINES.

COLUMBIA COLLEGE.

NEW YORK.

Results of Analyses of Samples of Water from Southampton, L. I.

(Figures indicate grains per U. S. Gallon of 231 cubic inches.)

	2294	2323	2306
Appearance, etc.	Clear Greenish.	Clear Blueish.	Clear Greenish.
Odor, heated to 100° F.	Faint Musty.	None.	None.
Chlorine in Chlorides	1.4993	1.5978	1.5990
Equivalent to Sod. Chl	2.4726	2.6365	2.6365
Phosphates	Traces.	Traces.	Traces.
Nitrites	None.	Traces.	FaintTraces.
Nitrogen in Nitrates and Nitrites	0.1888	0.3265	0.1440
Free Ammonia	0.0005	0.0017	Traces.
Albuminoid Ammonia	0.0029	0.0040	0.0005
"Hardness" Equivalent to Carbonate of Lime, before boiling	2.0411	3.7900	1.5162
"Hardness" Equivalent to Carbonate of Lime, after boiling	1.8952	3.5689	1.5162
Organic and Volatile (loss on ignition)	2.9159	1.9828	1.7495
Mineral Matter (non-volatile)	20.1197	6.9981	4.0822
Total Solids (by evaporation)	23.0356	8.9809	5.8317

The samples were marked as follows :—

No. 2294—Hildreth, September 19, 1887.
No. 2323—Fondey, November 1, 1887.
No. 2306—Seamarge, September 28, 1887.

No. 2294. This sample of water appears to be contaminated with sewage and is not suitable for domestic uses.

No. 2323. This sample of water cannot be considered as satisfactory in quality. I should recommend boiling before using it for drinking purposes.

No. 2306. This sample of water must be regarded with suspicion. If necessary to use it for drinking purposes I should recommend boiling the water.

EDWARD W. MARTIN.

YALE UNIVERSITY.

DEPARTMENT OF MEDICINE.

NEW HAVEN, CONN.

Results of Analyses of Samples of Water from Southampton, L. I.

Received from Dr. F. E. Beckwith, November 9, 1887.

(Figures indicate milligrams per litre, or parts per million of water.)

	1	2	3	4
Total solids (by evaporation)	122.	95.	84.	39.
Loss on Ignition	53.	31	24.	17.
Chlorine of Chlorides	41.	31.	30.	10.
Free Ammonia	0.56	0.12	0.01	0.02
Albuminoid Ammonia	0.44	0.07	0.06	0.02
Nitrogen of Nitrites	0.	0.	0.	0.
Nitrogen of Nitrates	0.25	1.09	0.08	0.33
Oxygen consumed (from permanganate in 30 minutes at 100° C)	6.59	0.09	0.12	0.05

The samples were marked as follows :—

No. 1—Lake Agawam.
No. 2—Life Saving Station.
No. 3—Wickapogue Burnett's.
No. 4—Waters.

No. 1 was turbid and somewhat yellowish ; No. 2, not clear ; but Nos. 3 and 4 were clear. No. 1 is impure to a high degree. No. 4 cannot be objected to from a chemical stand-point ; but with regard to Nos. 2 and 3, it appears that while the results do not indicate the presence of a quantity of organic matter which is necessarily objectionable as such, the waters should be regarded with suspicion and the question of their use be decided from a consideration of the probable source of the impurity : if this be a cess-pool or a privy, the waters should be condemned.

HERBERT E. SMITH.

One of these waters, No. 1, Lake Agawam, was analyzed in 1885 and pronounced pure.

Dr. G. V. Poore, in an address on the shortcomings of some modern sanitary methods, writes: "The principal aim of sanitarians has ever been, and will ever be, the securing for the masses of the people the two chief necessities of life—pure air to breathe, pure water to drink. Whether or not we are able to secure these two necessaries depends very largely upon the method which we adopt for the treatment of putrescible refuse.

"It has been the wise custom in all ages of the world to dispose of putrescible matter by burial in the earth. Dead bodies in all ages have been buried, and the greatest of all law givers and sanitarians, Moses, gave most explicit directions that excremental matter should be treated in the same way. The latest advances of modern science seem to show that in this particular Moses was absolutely in the right.

"The farmer may feel certain that if he buries his organic manure directly it is produced, it will not be wasted. It will not give off ammonia to the air, nor will the juices be washed away by rain to the same extent as when it is left above ground to be a nuisance. There seems to be no doubt whatever that all heaps of manurial matter which give off ammonia and other gases to poison the air, and perhaps do more serious mischief which we know not of, are allowing valuable matter to escape, which ought to be undergoing oxidation in the earth. There can be no doubt whatever, that to the agriculturist stench means waste; and it is to be hoped that when the bucolic mind has imbibed this great and important truth, the country will be more evenly pleasant than it is.

Most of the shortcomings of modern sanitary methods are due to the fact that in our dealing with organic refuse we commit a scientific error—*i. e.*, we pursue a course which is in opposition to natural law. When organic refuse is mixed with water, it undergoes changes which differ widely from the changes which it undergoes when mixed with earth. The most favorable amount is about 33 per cent., and if the moisture rise above or sink below this amount, the process of nitrification and the formation of carbonic acid is hindered.

"In the treatment of putrescible refuse, so that it shall not be a danger nor an annoyance, what we have to aim at is nitrification rather than putrefaction, and it is certain that by mixing with water putrefaction is encouraged and nitrification delayed. It

seems to be almost incontestible that the proper course to pursue with regard to organic refuse—putrescible matter—is the very reverse of that which we do pursue. We clearly ought to encourage oxidation and make putrefaction impossible.

"Putrefaction is certainly a great cause of ill-health. It is the putrefaction of organic refuse mixed with water in cess-pools and sewers that causes that long list of ailments which we ascribe to the inhalation of sewer air. The opinion is held by many that the dejecta of typhoid patients and cholera patients do not become dangerous to others until putrefaction has set in, and such an acute observer as the late Dr. Murchison held the opinion that common putrescible changes taking place in dejecta were a sufficient cause of typhoid, independently of the admixture of any specific poison. The putrefaction of organic refuse, when mixed with water, has, I think, been the chief cause of the development of modern sanitary 'progress.' Our forefathers were not given to this method of treating putrescible matter. House slops trickled along open gutters, and excremental matters were deposited in dry pits.

"Only the other day I visited a lone farm-house which a friend wished to take for the summer, and I found that the proprietor, having taking the soil pipe of a recently erected water closet into a cess-pool alongside a deep well sunk in the chalk, had rendered his house unlettable to any thinking person."—*Lancet*, July 23, 1887.

If these analyses and the foregoing facts indicate that the surface or subsoil water of Southampton has become contaminated to such a degree as to render its use unsafe for drinking and domestic purposes, then the water supply which is, as has been stated, the chief or only marked cause of ill-health, must be protected in every possible way; otherwise, when the town becomes large the following remarks of the Editor of the *Lancet* in reference to Margate, which recently suffered from typhoid fever, will apply to Southampton.

"Nothing but the abolition of cess-pools, the provision of a proper system of drainage and of a safe water supply, will make Margate fit to be regarded as a first-class health resort." July 23, 1887.

Fortunately these expensive improvements, which will inevitably come, are not now essential. They cannot be provided and for years the present methods of drainage and disposal of waste must suffice.

The flatness of Southampton, which is an obstacle to every form of drainage, renders the use of Waring's excellent system almost inapplicable from the fact that the terminal distributing pipes, if provided with the necessary fall, would lie not near the surface where oxidation readily takes place, but far below in sand instead of earth and in dangerous proximity to the water supply.

It also makes it impossible to provide drains over fifty feet in length with sufficient fall to the cess-pools to prevent the occurrence of stagnation and leakage.

Possibly pure water might be obtained by using driven wells passing through the surface water to a deeper source, but then safety would not be attained (as is shown by the Dudlow Lane well); and what is worse this would be only dodging the sanitary evils instead of removing them. All the water might be boiled and in this way safety would be attained, but this is only another method of shirking a plain duty. Dr. Geo. M. Sternberg writes: "We may then safely say that the thermal death point of the typhoid bacillus is 56 degrees C., or 132.8 degrees F."

Evidently wisdom lies in striving to remove all sources of the water contamination.

Therefore in closing I would make the following suggestions:

(1.) Decomposing manure heaps should be protected from the rain by simple roofs or else be stored in dry pits, thereby saving valuable fertilizing material and preventing soakage into the surface water.

(2.) When old-fashioned privies are used they should be kept dry and oderless by the use of earth frequently renewed.

(3.) If waste water is allowed to empty on the ground near the house the point of exit should be frequently changed to prevent saturation of the soil.

(4.) All cess-pools without bottoms of cement, and so-called cess-pools, mere holes in the gronnd with a few large stones thrown in, should be abandoned. All leaky cess-pools and drains should be made water-tight as shown by the smoke test. There is a current belief in the village, said to founded on observation, that the contents of many cess-pools rise and fall with the tides, implying the existence of leaky cess-pools.

(5.) If the contents are to be emptied as at present on the ground between the houses, the cess-pool should be used for waste water and fluid excrement only and emptied as often as once a week and always in a fresh spot. "Oxidation, in

other words the beneficial cleansing power of earth, does not continue for an indefinite period. Soil is liable to be in time overdone with filth, and is then unable to carry on this purifying action, so that animal matters pass through it unchanged. Its particles require rest and free exposure to the air, before it recovers its expended powers. Earth becomes relieved of the products of this dressing with filth by means of vegetation, which greedily incorporates them into its substance."—Fox. p. 50.

Other excremental matter should be deposited in dry earth in boxes or pails and removed daily.

(6.) If the cess-pool is used for all excremental matter, a bad practice, the contents should be carried far away and never emptied on the ground near the cottages and wells.

(7.) For the reception and proper treatment of every form of waste requiring removal a sewage farm should be provided at a distance.

Finally this outbreak of typhoid fever emphatically teaches that the only safe disposal of all organic matter is burial near the surface, where purification by chemical action rapidly takes place.