quently, we shall not expect efficient compensation, and slight exertion will be liable to produce symptoms.

One of the dangers to be apprehended in the future in cases of mitral incompetence, which should make our prognosis guarded even in apparently favourable cases, is the possibility of the onset of mitral stenosis, and my impression is that in many cases the patient who has had mitral incompetence for some years, it may be, only comes up for medical advice when mitral stenosis has set in, and symptoms attributable to that affection compel his attention.

ART. XIII.—*Report on an Outbreak of Typhoid Fever caused by Infected Milk.* By SIR CHARLES A. CAMERON, C.B., M.D., F.R.C.S.I., F.I.C.; Medical Superintendent Officer of Health for Dublin.

ON Monday, September 28, 1908, I received six notifications of typhoid fever from Clontarf. Two were sent from Dr. M. S. McIntosh, and referred to a female, aged twenty, residing in Hollybrook Road, and a girl, four years old, living at Belvoir Terrace, Dollymount. From Dr. John O'Donoghue, District Medical Officer of Health, came four notifications of typhoid fever, as follow:—A girl, five years old, in Castle Avenue; an adult female in Haddon Road; a girl, three years of age, in Victoria Road; and a girl, five years old, in Haddon Road. Dr. O'Donoghue observed that these cases occurred in houses supplied with milk from the same dairy.

On September 30 a case of typhoid fever in Howth Road, an adult male, was notified by Dr. W. R. Lemon. On October 1 five cases of the disease in Castle Avenue, Haddon Road, St. Joseph's Square, and St. Lawrence Road were notified by Doctors O'Donoghue, McIntosh, and Hopkins. On inquiry I found that the houses in which these patients were located were supplied with milk from the same dairy as that from which milk was procured by the occupants of the houses from which the first six notifications were received. The following

shows the dates on which the first few notifications were received :—

Date	No. of Cases
Monday, September 28, 1908 ...	... 6
Tuesday, September 29, 1908 ...	... nil
Wednesday, September 30, 1908 ...	... 1
Thursday, October 1, 1908 ...	... 5

The dairy, which I shall now and further on refer to as the “suspected dairy,” supplied a very large number of houses in Clontarf. It might at first appear as if the supply of milk to, and the appearance of typhoid fever in, the same house was only a coincidence, but as case after case was notified, and when, on inquiry, in every instance it was found that the patient’s dwelling was supplied with milk from this dairy, the inference that the milk was infected became irresistible.

Examination of the Dairy.—On the day the first notifications were received a Sanitary Inspector visited the dairy, and reported that he found no one ill in it, and nothing on the view that would account for the infection of the milk. Next day Mr. Andrew Watson, M.R.C.V.S., inspected the dairy, and examined the cows. His report was that the dairy and its utensils were very clean, and that the cows were free from disease, and were in a cleanly condition. Four samples of the milk from the dairy were obtained—one from the dairy and the others from customers—and all were found to be free from typhoid bacilli. These micro-organisms have rarely been detected in cases where milk was undoubtedly the vehicle of enteric fever poison.

On Wednesday I made a prolonged inspection of the dairy. The owner was present, also his wife, son and three daughters. None of them exhibited any sign of recent illness, and all declared that they had not suffered from sickness for a long time. The workmen engaged in the milking of the cows and distributing the milk were a man and his son, another man, and the proprietor’s son. The first three named were chiefly engaged in milking cows out at pasture. The three workmen whom I examined and interrogated several times protested

that they never had had typhoid fever, and had not recently been ill.

On October 3 I received a certificate from Dr. Sheppard stating that he had examined all the persons connected with the dairy and found that they were free from disease. As medical attendant of the family he could say that none of them had typhoid fever.

The cows of the dairy numbered 58—13 of them were within the curtilage of the dairy, some were in a field near the upper part of Vernon Avenue, and the rest were on pastures abutting on Mount Prospect Road. The family of the owners of the dairy resided in one of a terrace of eight houses, at the re-re of which there were two large yards communicating with each other. A door gave entrance to the basement story of the dwelling, and in this basement story there was a small apartment in which milk was stored. People came to this door for milk, and, so far as I can learn, generally handed in a vessel for the milk. Some of the milk was sent out by hand, and not in a cart, to customers residing near the dairy. At the re-re of the dwelling there was another small milk store. It was situated at a distance of a few feet from a water-closet. On pointing out the closeness of the store to the water-closet it was intimated that the water-closet would be removed if required.

On Thursday, October 1, I had an investigation made as to the drains of the dairy and adjacent houses, and the sewer into which their contents were discharged. In a lane there is a pipe sewer into which the drainage from the dairy and that of several houses close to it are discharged. All the houses have intercepting traps on their cross drains; but the drain from the dairy had neither an interceptor nor a ventilator. There was, moreover, a defect in the water-closet. Notices to remedy these serious defects were at once served, and immediately complied with.

The drainage in the lane referred to passed into the sewer of another lane, and from thence into a main sewer in Vernon Avenue. Of course the want of an interceptor and ventilator was very serious in the case of a drain from a dairy; but even

so I was much more inclined to regard the carriers of the milk as the carriers of the micro-organisms of typhoid fever and the means of spreading the disease. This view was founded chiefly on the fact that most of the milk was distributed from the fields and not from the dairy.

The Pastures.—I visited the pastures on which by far the greater number of the cows were kept. The field at Mount Prospect Road had neither pond nor ditch on it. There was a supply of Vartry pipe water. A huge vessel, full of water, was under the tap. At the bottom of the vessel there were some leaves, which had been blown into it. I took a sample of the water, and examined it, and found nothing deleterious in it. One imperial gallon of this water contained :—

Total Solid Matters	...	...	...	4.200
Including :—				
Albuminoid Ammonia	...	...	...	0.014
Saline Ammonia	...	...	...	0.010
Nitrous Acid	...	...	...	none
Nitric Acid	...	...	...	trace
Chlorine	...	...	...	0.890
Sulphuric Acid	...	...	...	0.7206
Equal to Calcium Sulphate	...	...	...	1.0000
Phosphoric Acid	...	...	...	none
Hardness	...	...	...	2°
Coloured, looked at through a tube two feet long	...	...	...	slight yellow
Odour at 100° F.	...	...	...	none
Suspended Particles	...	...	...	numerous
Turbidity	...	...	...	much
Sediment	...	...	...	slight

Microscopic Examination :—A rather large number of micro-organisms was present, but none of an objectionable character, such as the *B. coli* group, were detected in it.

The slight variation from normal Vartry water was due to the leaves present in the vessel.

At the field near Vernon Avenue there was also a supply of Vartry water. There was a ditch there which contained a little muddy liquid, but the sides of the ditch exhibited

no foot-prints of man or beast. It is incredible that any of the workmen would use, as was suggested, this scanty and filthy liquid instead of the pure Vartry water at hand.

The three workmen were on the pastures at one of my visits. They would not admit having been ill recently. They stated that they brought the milk from the fields direct to the houses they supplied, and not at first to the dairy. The means of straining the milk were on the pastures.

What caused the Outbreak.—I was strongly, at this time, of opinion that in some way, either by having had an attack of typhoid fever or by being in contact with a case of the disease, one or more of the milkers were carriers of the micro-organisms of the fever. I was rather strengthened in this view by the fact that very few of the earlier cases of the malady occurred amongst the people who got the milk direct from the dairy or supplied to them by hand; it was the houses supplied direct from the fields that at first, at least, were infected.

From September 28 to October 5 there were 42 notifications of typhoid fever, and of these only one was in a house not supplied from a cart. No doubt, by far the larger proportion of the milk came from the fields; but, dealing with the whole epidemic, the milk from the dairy appeared to do less mischief than that from the fields.

Means taken to Prevent the Spread of the Epidemic.—The milk from the dairy and specimens supplied by it to houses in Clontarf were examined bacteriologically, and no micro-organisms characteristic of typhoid fever were found in them. I believe it is rarely, if ever, in the numerous outbreaks of typhoid fever attributed to infected milk that the *B. typhosi* have been detected in the milk.

By far the larger number of the patients were treated at home. This led to large quantities of their excretions passing into the sewers. Both liquid and solid excretions contained myriads of the infective micro-organisms which cause the disease. I, therefore, thought it would be useful to put disinfectants into the sewers, and that the best way to do so would be to pour the disinfectants into the water-closets of the houses, so that the cross drains would also be disinfected.

Accordingly, 805 houses were visited, and disinfecting solutions were poured into the water-closets. Some disinfecting solution was also applied to the foreshore laid bare during the ebb of the tide.

On October 1 I sent the following letter to all the Dublin morning and evening newspapers :—

“ PUBLIC HEALTH OFFICE,
“ DUBLIN, 1st October, 1908.
“ *Typhoid Fever in Clontarf.*

“ SIR,—Typhoid fever is rather prevalent in Dublin at present, and especially in Clontarf. As a precaution, I would strongly urge upon the residents in that district to see that the drains of their houses are in good order. The use of disinfectants in the drains is desirable. It would be well to boil the milk used, as this liquid is sometimes the vehicle of the poison of typhoid fever.

“ I am, Sir,

“ Yours faithfully,

“ CHARLES A. CAMERON,

“ *Medical Officer of Health.*”

At the same time, two Sanitary Officers were sent round all the houses in the infected district to warn the occupants and to ascertain the names of the persons who supplied them with milk. I have the strongest reason to believe that my advice to boil the milk was generally adopted, and this, I have no doubt, was the means of saving many persons from contracting the disease. It must, however, be borne in mind that the virus of typhoid fever takes from ten to fourteen days, or even longer, to develop the disease, and even after development the first symptoms are not always serious, and do not attract much attention. There are by no means few instances in which the infected person does not take to his bed, but goes about his business. This is what is termed ambulatory typhoid fever. Before any warning could be given, the disease germs were multiplying in the systems of scores of people in Clontarf.

I requested the proprietor of the dairy to remove for a while the persons who were engaged in milking the cows and distributing the milk, but the request was refused. I

procured specimens of the urine of the three workmen, and submitted them to Professor McWeeney for bacteriological examination. He reported that the result was negative. I then verbally, and subsequently in writing, suggested to the proprietor of the dairy that he should get an eminent bacteriologist—Professor McWeeney, for example—to examine all the persons connected with the dairy, in order to determine were any of them carriers of the bacilli of enteric fever. My idea was that the excretions should be examined and the Widal blood test employed. Professor McWeeney's services were obtained, as were also those of Professor Mettam, Principal of the Veterinary College. Although repeatedly asked for, I have not been informed as to the results of those gentlemen's investigations.

It is well established that convalescents from enteric fever, and even persons long completely recovered from that malady, continue to discharge in their excretions the micro-organisms which cause the disease. Cases are on record showing that even after several years have elapsed, the Widal reaction and the bacteriological examination of the fæces indicate the presence of the bacilli. It is rather significant that after the experiments of Dr. McWeeney and of Professor Mettam had been concluded, one of the three men who were milkers, and two of them distributors of the milk, was taken from dairy work and transferred to other employment.

Various causes assigned for the Fever Outbreak.—The owner of the suspected dairy regarded himself as a much-injured individual, and could not believe that his milk caused the outbreak of fever. Some persons assigned to the emanations from the Fairview sloblands the cause of the epidemic. These sloblands are in course of reclamation by the deposition thereon of street sweepings and other refuse of unobjectionable nature. Usually there is no unpleasant odour noticeable from the refuse ; but in September large quantities of vegetable refuse from the city markets were deposited on the sloblands, and the weather being warm at the time the vegetable matter soon began to decompose and produce a bad odour. It is, however, clear that the emanations from the sloblands had no

connection whatever with the typhoid outbreak. In Fairview itself there was not one case of typhoid fever. No man working on the sloblands contracted the disease. With the exception of the upper part of Howth Road, all the cases occurred on the east side of the great embankment of the Great Northern Railway, and remote from Fairview.

The roadway along the Clontarf shore is being opened up in order to lay the sewer into which the sewers of Clontarf are to discharge their contents. This new sewer is to be brought into communication with the main drainage system of the city. It was alleged that the soil dug up in making the excavations for the sewer might have given off noxious exhalations. The soil was under the roadway, and it was inconceivable how it could possibly contain the characteristic bacilli which cause typhoid fever. I examined the soil and found nothing objectionable in it.

It was alleged that the Corporation opened a sewer close to the suspected dairy, and kept it open for several days, and that from that sewer noxious exhalations proceeded. It was also alleged that "black stuff" was taken out of the sewer and placed on the surface of the land. Mr. Brady, who acted as solicitor for the owner of the dairy, said to me that if the milk was really infected it must have been by the exhalations from this sewer or stuff out of it. Reference to this sewer and black stuff will be found further on.

Progress of the Epidemic up to November 2, 1908.—The area affected by the epidemic contained 748 houses; of these 193 were supplied with milk from one dairy, and 555 from 28 other dairies. Eighty-two of the houses were invaded by typhoid fever and 127 of the inmates became victims of the disease. Seventy-nine of the 82 houses were supplied with milk from the suspected dairy—that which supplied 193 of the houses. The remaining three houses had a supply of milk from three other sources. One of these houses—a cottage—was occupied by a charwoman, and she developed typhoid fever. She, however, worked and obtained food in one of the 79 houses in which there were cases of typhoid. Another of the three houses got

milk in the morning from a dairy which was not the suspected one. On close inquiry, the lady who owned the house stated that she also often got milk in the evening from the suspected dairy. The third house obtained milk from a dairy which was not the suspected one; but it has been proved to demonstration that on several occasions the owner of this dairy procured milk from the suspected dairy, and some of it was supplied to the house last referred to. There is the clearest evidence that the 127 persons affected with the disease used milk supplied from the suspected dairy. This was the state of things up to November 2, 1908.

If the outbreak of typhoid fever was not due to infected milk, what would be the chances that all the cases would occur in the 193 houses supplied with milk from the suspected dairy out of the 748 houses? Not one in many millions. In 1878 and the early part of 1879 I investigated an outbreak of typhoid fever in Dublin, in which there were 67 cases and 6 deaths. Besides the evidence of fever in the dairy, I came to the conclusion that the milk was infected by employing the theory of probabilities. The suspected milk was supplied by a dairy, which I designated x , to 25 of the 120 houses in Fitzwilliam Square, Raglan Road and Elgin Road. Twenty-five other dairies supplied the remaining 95 houses. Cases of typhoid fever occurred in 14 of the houses. Now, assuming that milk had nothing to do with the outbreak, what were the chances that the milk from x dairy would supply one of the 14 houses, or, say, what would be the chance of one case of the disease occurring in one of x houses? The probability of—

$$\text{One case} \quad - \quad - \quad = \frac{25}{120} (1)$$

$$\text{A second case} \quad = \frac{24}{119} (2)$$

The probability of one event is $1:4\frac{4}{5}$.

The probability of *both* events $1:23\frac{4}{5}$.

Worked out in this way, I found that the probability or chance of x supplying all the 14 houses was one chance in

150, 180, 296, 639 chances. The chance that the 127 cases of fever in Clontarf should all occur in the houses supplied by the suspected milk is even much less than that in the *x* milk outbreak.

Mr. James Brady, solicitor for the owner of the suspected dairy, made an application to the Local Government Board to hold a sworn inquiry into the cause of the epidemic, but the Board declined the application. Mr. Brady subsequently applied to the King's Bench for a *mandamus* compelling the Local Government Board to hold the inquiry, but he withdrew the application. It is rather significant that the withdrawal was made after Dr. McWeeney's examination had been carried out.

Legal Action.—When satisfied that the outbreak appeared to be due to infected milk, the question arose—How should action be taken to restrain the sale of it? If a case of fever had been found in the dairy, or that any person connected with it was, or had been, recently ill, the Public Health Acts and the Dairies and Cowsheds Orders could be employed for the purpose. In the absence of any knowledge of disease in connection with any one in the dairy, I consulted the Law Agent of the Corporation on the subject. He was of opinion that in the existing state of the law no legal action could be taken. The Assistant Law Agent was of the same opinion.

Some time after the expression of the Law Agent's opinion I received the following letter from the Local Government Board:—

“LOCAL GOVERNMENT BOARD,

“DUBLIN, 6th October, 1908.

“No. 55,017 : 1908.

“Dublin County Borough.

“SIR,

“I am directed by the Local Government Board for Ireland to acknowledge the receipt of your letter of yesterday's date relative to an outbreak of typhoid fever at Clontarf, and I am to state that, having regard to the observation in your letter that ‘in all the cases the milk used by the patients was supplied from the same dairy,’ the Board presume that you have taken

action under Section 4 of the Infectious Disease (Prevention) Act, 1890.

"I am, at the same time, to draw your attention to the provisions of Section 53 of the Public Health Acts Amendment Act, 1907, and of Article 21 of the Dairies, Cowsheds and Milkshops (Ireland) Order of 1908.

"I am, Sir,

"Your obedient servant,

"A. R. BARLAS, *Secretary*.

"Sir C. A. Cameron, C.B.,

"Medical Superintendent Officer of Health,

"Municipal Buildings, Dublin."

I informed the Local Government Board that the Corporation law officers were of opinion that no legal action could be taken in the matter.

Subsequently the Local Government Board expressed an opinion that the Public Health Committee should consult senior counsel on the subject. This was accordingly done, and the case for counsel's opinion was stated by Mr. Rice, the Corporation Law Adviser, as follows :—

"Counsel will please advise :—

"(1) Has the Corporation or the Public Health Committee power under the Infectious Disease (Prevention) Act, 1890, or otherwise, to interfere with the sale of milk by the owner of the suspected dairy ?

"(2) In case the Corporation makes such an order as that referred to in Section 4 of the Act in question, would it be a good order under the circumstances ?

"See opinion below.

"(3) If such an order is made and is afterwards held to be *ultra vires*, would the dairy owner have a cause of action against the Corporation for making the order, or against the individual members who acted in the matter ?

"(4) In view of the fact that there was no direct evidence to show that the milk of this dairy caused and is causing the spread of typhoid in the district, can the Corpora-

tion take any step to compel the owner to discontinue the supply of milk in the district of the City of Dublin ?
 “ And counsel’s general advice is requested.

“ IGNATIUS JNO. RICE,

“ City Hall, Dublin,

“ *October 21st, 1908.*”

Mr. Ignatius O’Brien, K.C., to whom this case was given, gave the following opinion :—

“ The 4th section of the Act of 1890 is highly penal, and must be construed strictly. It is manifest, on careful examination, that it contemplated a condition of things where it could be clearly shown either that the milk supplied from a dairy was itself polluted, or while under the control of the dairyman was liable to an ascertained cause of infection. This is shown clearly to my mind by the provision towards the end of the section that the order made by a local authority must be withdrawn if it is established that the milk supply has been changed, or that the cause of infection has been removed. It might be suggested that the general nature of the words, ‘ changing milk supply,’ shows that the section was intended to cover a case where it was impossible to prove affirmatively that the milk itself was polluted ; but this, in my judgment, is not the true construction of the section. It is clear to my mind that the inspection which is to take place under the first part of the question must disclose some physical fact which can be pointed to either as showing the existence of infected milk or such handling of the milk as would be liable to produce infection. I do not mean handling within the dairy itself ; that it might be so but for the provision as to removing the cause of infection. I have inquired what the dairy in the present case is, and I am informed that so far as registration is concerned it is only the dairy at No. 6 Vernon Avenue. Sir Charles Cameron’s report is perfectly clear that he cannot trace any cause of infection from milk supplied at 6 Vernon Avenue which would justify him in saying that the fault lies there ; on the contrary, he says that all the cases of infection are traceable to the supply from certain fields which do not appear to form part of the registered premises. These fields may constitute a dairy within the meaning of the Act, but it is clear that any order which could be made must be confined to these fields. So far as the dairy proper goes, I see

no ground on which any order could be justified. Treating the fields as being the dairy, it becomes at once clear that the application of the section to the facts of the present case is a matter of some difficulty. I doubt if it is adequate at all to deal with the position where the whole matter rests on a scientific presumption, not based upon any ascertained fact, but a probability. The section, in my opinion, requires something more than this. It requires affirmative evidence of infection or cause of infection to the milk. I do not think the evidence which the Medical Officer of Health is to possess must be such technical evidence as would be required, let us say, in an action for damages for supplying infected milk. The Medical Officer of Health is not a lawyer, but a scientific man, and he is entitled and bound to place before his Board such facts as induce him to come to the conclusion that the section should be put in force; but when the dairyman comes to show cause against the order, the local authority is, in my opinion, bound to consider all the facts quite irrespective of the medical officer. How can it make an order unless it finds the existence of a state of facts in respect of which the dairyman can say afterwards, 'I have removed the cause of infection,' or 'I have changed the milk supply'? It is difficult to see what change can be ordered in the supply of milk, when the milk supplied is shown to be unpolluted so far as the source is concerned. Suppose all the cows were removed and new cows brought in, the order, if made, would have to be discharged because the milk supply had been changed, while the source of infection, whatever it would be, remained; and, on the other hand, you cannot remove a source of infection which no man can put his finger on. Therefore, it appears to me that, if the Corporation comes to deal with this case in its quasi-judicial capacity, there is no evidence on which it ought to act, and, owing to the manner in which the section is drafted, any evidence on which they could act. If I be right that there is no evidence in the latter sense, their order could be quashed. If, however, I be wrong in this, and they have acted on what is legally evidence, then, of course, the order would not be quashed on *certiorari*. I only express my own opinion on a matter of great doubt.

"A recent case which was decided by the English Courts explains my meaning. A man while being shaved received in the barber's shop a cut from the razor which set up disease. Evidence was admitted that a number of other people had received similar cuts,

and that the same disease resulted ; but the evidence was only held to be legal, because it was first established that it was in itself a negligent act not to disinfect razors, and that other instances were admissible to show continuous disregard of this sanitary precaution. But if it had been established that there was a habitual regard for sanitary precautions, this evidence would hardly be admissible.

“ I believe the section has been practically a dead letter, as it is cumbersome, though, of course, the jurisdiction to set it in motion undoubtedly exists. Legislative interference with the law is essential if a case like the present is to be dealt with.

“ 2. I have explained my position with regard to this above. I think it would be a bad order, but it is quite possible that a Court might hold that legal evidence was not contemplated at all ; but in this view I could not agree until a Court decides it.

“ 3. This question does not appear to me to arise, being based entirely upon the assumption that the Corporation act in a manner that, to my mind, would not be legally justifiable. The position of the Corporation would be analogous to that of Justices.

“ 4. I am not aware of any special powers except these in the 4th Section.

“ IGNATIUS J. O'BRIEN,

“ 6 Lower Merrion Street,

“ Dublin, 22/10/08.”

The Local Government Board subsequently suggested that it would be desirable to obtain a further opinion on the subject, and forwarded one of Mr. Vanston, K.C., to the Law Adviser.

Mr. Rice sent me the following :—

“ LAW AGENT'S OFFICE, CITY HALL,

“ DUBLIN, 2nd December, 1908.

“ *Enclosures.*

“ Sir Charles Cameron, C.B.,

“ Chief Executive Medical Officer of Health.

“ *Infectious Diseases Prevention Act.*

“ DEAR SIR CHARLES,

“ I enclose you a letter received from Surgeon-Col. Edgar Flinn, with a copy of the opinion of Dr. Vanston on this matter. I also send you a copy of a letter received by me from Mr. Ignatius O'Brien, K.C., after reading Dr. Vanston's opinion.

"I do not see how, under the circumstances, the Corporation would be justified in expending more money in taking legal opinion on the subject, as, after all, if the Local Government Board think a further legal opinion is necessary, it ought to take it on its own part, the Corporation being, I am sure, satisfied with the opinion which it has received and paid for.

"IGNATIUS JNO. RICE."

"10 LANSDOWNE ROAD,

"DUBLIN, *November 16th*, 1908.

"DEAR MR. RICE,

"With reference to my interview with you I enclose you copy of Dr. Vanston's opinion.

"Although with the abatement of the outbreak of enteric fever at Clontarf, the circumstances of the case are now of less immediate practical interest, it is, however, most essential that the powers of the Corporation should be clearly defined with a view to dealing with similar outbreaks in future.

"In view of the great importance of the question, would it not be very desirable and necessary to obtain further advice on the matter ?

"Yours faithfully,

"D. EDGAR FLINN."

"No. 59,605 : 1908.

"Dublin County Borough.

"*Copy of Dr. Vanston's Opinion, dated 9th November, 1908.*

"The case is one of much difficulty and doubt, but my own opinion is that a Court could, under the terms of the section, and would in the circumstances, construe the section so as to bring the case within it, having regard especially to the paramount object of the section, and of the entire Act being the preservation of the health of the community by preventing the spread of disease. I do not agree with counsel that the section must necessarily be construed in the very strict way in which he looks at it. It is entirely remedial as regards the public, though penal as regards the dairyman, and should be construed with reference to the true meaning and real intention of the legislation, which was to prevent the spread of disease."

(Copy.)

“LAW LIBRARY, FOUR COURTS,

“DUBLIN, 26th November, 1908.

“DEAR MR. RICE,

“I have read the opinion of Dr. Vanston, K.C., which you have sent me, with reference to the question of dairies and inquiries by the Corporation. I cannot concur in his view or alter my own, and I may add that, quite apart from the merely technical grounds on which I based my opinion, I think the section is a very unworkable one.

“Yours faithfully,

“IGNATIUS J. O'BRIEN.

“Ignatius Jno. Rice, Esq.,

“Law Agent, Dublin Corporation.”

The Public Health Committee took no further action in the matter. It is clear that further legislation is required in reference to disease caused by infected milk.

A Case of Fever in St. Joseph's Square.—Surgeon-Colonel Flinn, Medical Inspector of the Local Government Board, from almost the very beginning of the outbreak spent a considerable amount of time in the investigation of it. In conversation with a medical man, who had notified several cases of typhoid fever, the latter mentioned that he had attended a sick child some weeks before in a house in St. Joseph's Square. Surgeon-Colonel Flinn called at the house and saw the sick child, and in conversation with its mother the latter informed him that she had had an attack of typhoid fever, beginning early in August and ending in the early part of September of the present year. My attention having been drawn to this circumstance, and knowing that the case had not been notified, I visited the woman and questioned her. She said that the doctor told her that she had typhoid fever. She was attended to during her illness by her two sisters-in-law. I visited them, and the elder of them said that she did not hear the doctor state the nature of her sister's illness, but her sister told her that the doctor had informed her that she had typhoid fever. I wrote to the doctor for an explanation why he had not notified the case, and in reply he stated that

he had a "complete answer" to make. The question of prosecuting him under the provisions of the Infectious Diseases Notification Act came before the Public Health Committee. The doctor attended before the Committee, and his explanation was that he was not certain that the case was really enteric fever, as the most characteristic symptoms, such as enlargement of the spleen, diarrhoea, and continuous high temperature, were absent. The Committee did not decide to prosecute him. On a subsequent occasion, and in reference to a communication from the Local Government Board, the Committee again discussed the question of a prosecution in this case, and on a division decided not to prosecute in the case.

The discovery that what might, at least, have been a case of enteric fever in St. Joseph's Square before the outbreak of the disease was important from the circumstance that the house in which it occurred was separated from the suspected dairy only by a wall. During the patient's illness milk was sent for three times daily from the patient's house to the suspected dairy. I interrogated the two girls who went for the milk, and they stated they merely went to the door of the basement story and handed in a jug. Was it possible that this jug contaminated the milk to such an extent as to account for the great and widespread outbreak of typhoid fever? It might be possible, but it is extremely unlikely. Could the micro-organisms of the disease have been wafted over the wall of the rear of the house in St. Joseph's Square into the milk vessels of the dairy? This would be still more unlikely. Besides, the yard in which the milk vessels were washed was not next to the rear of the house in St. Joseph's Square. If milk, the case of fever in St. Joseph's Square began in the first week in August, and the patient was convalescent in the first week in September. Supposing that her excretions were the cause of the outbreak, it is strange that no cases of typhoid fever occurred until late in September.

Almost from the beginning of the outbreak I strongly suspected that one or more of the men who milked the cows and distributed the milk were carriers of the typhoid bacilli. That is still my opinion. When my request to supersede

these men was refused by the owner of the dairy, I suggested, at first verbally, and subsequently in writing, that they should be examined by a bacteriologist. Professor McWeeney's services were obtained, and I am informed that he made the necessary examinations. On speaking to him on the subject he said he could not inform me what the results of his examinations were, as he was obliged to regard them as confidential. Neither the owner of the suspected dairy nor his solicitor could be induced to give me any information on the subject. The examination was made, I believe, about October 17; and it is a significant fact that immediately afterwards one of the men whom I suspected, and who no doubt was examined by Professor McWeeney, was taken from the dairy work, and his place supplied by a fresh man. Soon after this event the epidemic died out, except for a few cases, which were the results of antecedent ones, and were not due to infected milk.

Cases not directly due to Infected Milk.—I am satisfied that none of the cases of typhoid fever in Clontarf which occurred after November 2 were due to infected milk, but the greater number of them contracted the disease from patients who had drunk the infected milk. On November 11 two cases were notified from different houses. In both houses there had been milk-infected cases of typhoid fever which no doubt were the causes of the secondary cases.

On November 12 a case was notified from Dollymount. In this house there had been a previous case due to infected milk.

On November 29, a case was notified from Walpole Terrace. From the same house a case had been notified on November 28. A case was notified from Vernon Avenue. As this was a house in which no previous case of typhoid fever had occurred, I visited the house at once. The patient was a child aged six years. His mother informed me that he had not been in any house where there was sickness. There was no reason to suppose that the drainage was in a defective state. On leaving the house I recollected that in the one adjacent there was a typhoid fever patient. On examining the rear of the house I

noticed that the rain-pipe passed directly into the ground instead of delivering the rain over a gully trap. Next day I had the ground opened, when it was discovered that the rain-pipe passed directly and untrapped into the drain, and that there was no interceptor on the drain to prevent currents of air coming into it from the main sewer in Vernon Avenue. Having regard to the experiments of Major Horrocks and Dr. Andrewes, referred to on page 281, I came to the conclusion that the bacteria of typhoid fever could have ascended through the untrapped rain-pipe and been wafted by air currents into the adjoining house. The hopper head of the rain-pipe (or spout) was close to the windows. On December 19 a second case was notified from the "Cottage" in Vernon Avenue.

On November 28 I received a notification that a child in St. Joseph's Square had enteric fever. There had been no illness previously in the house, but Dr. Sheppard, who attended the child (aged four), thinks she probably got infected in playing about the square, in which there had been cases of fever. The child's mother subsequently contracted the disease, apparently by nursing the child.

On December 2 a case was notified from a house in Vernon Avenue. The milk used by the patient (a boy six years old) was taken from cows owned by the family. Dr. Lemon, who attended the patient, thinks that the child might have swallowed the poisonous bacilli from apples which had been stored in a loft to which rats had access. It is well known that rats are the carriers of disease germs, and as the dejections of typhoid fever patients had been largely discharged into Clontarf sewers, some of the infective material might have been carried from the sewers into the loft and transferred to some of the apples.

On December 17 a case was reported from St. John's Terrace. The patient, a man aged sixty years, was treated by Dr. Sheppard. He was a long time—at least five weeks—ill with (as Dr. Sheppard, who attended him, states) the ambulatory form of enteric fever—that is, he did not lie up. He had used milk from the suspected dairy

On December 21 a case was notified from Seafeld Road. As the patient had not resided in Clontarf for several weeks until three days before his illness, it was clear that the infection had taken place before he came to Clontarf.

On December 16 a case was notified from St. Joseph's Square. The patient was a girl of fourteen years. She had been a servant in a house in Cabra Villas, near which there had been several cases of typhoid fever.

The cases reported on December 26 I am unable to connect with the infected milk. One of the patients was a charwoman, and worked in various places in Dublin and suburbs. Both patients were practically squatters in the house, which was in a dilapidated condition.

Cases of Typhoid Fever outside Clontarf attributed to the Infected Milk.—Three persons who had resided in Clontarf during the outbreak of typhoid fever, but who left the district before being ill, developed the disease a few days after their departure. Their illness occurred so soon after they had left Clontarf that there is no doubt whatever that the incubation of the disease had commenced in Clontarf. These three cases raise the total number directly attributable to the infected milk to 130.

They had resided in houses to which milk from the suspected dairy had been supplied, and in which cases of enteric fever had occurred.

In conclusion, I have to express my thanks to Dr. O'Donoghue, Medical Officer of Clontarf District, for his early intimation of the fact that several persons who had typhoid fever used milk out of the same dairy, and for much help in connection with the fever outbreak.

How did the Milk become Infected?—It is perfectly clear that the milk supplied from only one of the twenty-nine dairies which dispensed that liquid in Clontarf caused the fever outbreak. It is equally certain that any emanations from the Fairview sloblands, or from the trenches in the roadway made for the purpose of main drainage, had no connection with the outbreak.

I have referred to the possibility of bacilli of typhoid escaping

from the sewer leading from St. Joseph's Square and finding their way into the milk. Admitting that such were the case, it is inexplicable why cases of the disease should have occurred up almost to October. That the milk was extensively infected is shown by the large proportion of the persons who used it contracting the fever. It is inconceivable that the bringing of a jug to the dairy in the month of August and early in September could have caused a large infection of milk. The drain from the dairy, found at the outbreak of the disease to be defective, was promptly put in order. After the first week in October, the drain could not have allowed emanations from the sewer to pass into the dairy premises. The usual period of incubation of enteric fever is eight to twelve days. If the drain was the means of spreading the infection, its effects could not have been continued after the middle of October. There were notified in the two weeks ended on October 23 twenty-six cases, which I had no doubt were due to infected milk. If the epidemic arose out of the case of fever in the house in St. Joseph's Square, sewage emanations seem to be the most likely vehicle of the infecting bacteria. During August the discharges from the patient passed down the sewer, which extended from the square to Vernon Avenue. The sewer was an old-fashioned one, made of stone. At a right angle from the sewer a combined drain extended to the dairy premises. This drain ascended from the sewer; the air of the latter might also ascend, and, from the defective condition of the drainage arrangements in the dairy, mentioned at page 261, might infect the milk in it.

It is alleged that in the month of August, 1908, the sewer from St. Joseph's Square was opened near its junction with the drain from the rear of Vernon Terrace, and that a quantity of "black stuff" was taken out of the sewer and placed on the surface of the lane, where it remained, as alleged, for three or four days. If any portion of this "black stuff," which came from a sewer which conveyed the dejections of a typhoid fever patient, dried, and was carried by the wind into the dairy, the milk in the dairy might become contaminated. The "black stuff" was not allowed to remain long in the lane, and the

infection of the milk must have gone on for a good many days, the interval between the first and last case, undoubtedly due to infected milk, being at least five weeks.

For reasons stated further on I am of opinion that this case of fever, supposing it to have been typhoid fever, was not the cause of the epidemic.

Can Micro-organisms pass into the Air from Sewage?—Numerous experiments have been made to determine the chemical composition of sewer air and the nature and number of the micro-organisms in it. Levy and Miguel found, in 1891, that the sewer air in Paris contained only about half the number of micro-organisms present in the over-ground air. Carnally and Haldane found much smaller numbers of bacteria in the sewers of Westminster, Bristol, and Dundee than were present in fresh air, and they believed that the bacteria in the sewers came into them from the outer air. In reports on the Air of Sewers, made in 1892 and 1893, by J. Parry-Laws, it was stated that (1) the number of micro-organisms in sewer air was smaller than in fresh air; (2) the kinds of micro-organisms in sewer air are the same as those of fresh air; (3) moderate splashing does not affect the nature of the bacterial contents, even within four feet of the disturbance; (4) stagnant and decomposing sewage does not influence the nature of sewer air organisms. The results of these investigations would seem to show that pathogenic micro-organisms could not escape from liquids; therefore, that the emanations from undisturbed sewage did not include bacteria, and that even when agitated the organisms were not detected within four feet from the point of disturbance. If these conclusions were correct it is difficult to account for the fact that emanations from sewers have many a time been proved to have caused disease. It is common knowledge that defective drains permitting the escape of gases into dwellings often cause disease. If the dangerous microbes admittedly occasionally present in sewage cannot escape from the liquid, drains untrapped, unventilated and otherwise defective, cannot be regarded as a means of spreading enteric fever. I never could persuade myself that bacteria could not escape from

liquids. In some experiments which I made some years ago the contrary seemed to me to be proved. I placed dejecta from a typhoid patient in a large glass vessel, communicating through a wide glass tube with another vessel containing milk. The excreta was undergoing decomposition, and in a short time the milk was found to contain *B. typhosi*. The air bubbles formed in the vessel by the decomposition of the excreta carried over into the milk-vessel some of the typhoid bacteria. The vessels were so arranged that air currents could pass through both.

In 1907 Major Horrocks, R.A.M.C., made some interesting experiments which proved that, under certain conditions, bacteria may escape from sewage. He found that liquids placed in a deep jar gave off bubbles, but no bacteria from them reached to a height of four inches—at least no bacteria were received on prepared plates at that distance from the liquids. When the bubble-producing liquid was placed in a trap connected with a vertical pipe, permitting of an air current, then bacteria were detected on plates nine feet above the liquid. Other experiments on a larger scale showed that bubbles rising through stagnant water may eject bacteria, which would be carried off by the air currents passing over the liquid.

Dr. F. W. Andrewes, who was associated with Mr. Parry-Laws in his work on sewer air, was unable to affirm that bacteria escaped from sewage; but his own later experiments, as well as those of Horrocks, have led him to change his opinion. Major Horrocks has shown that by the splashing of sewage against the upper part of the drain or sewer, matter may be deposited there which, after drying, would be carried by air currents. Such dried matter might contain pathogenic micro-organisms. Dr. Andrewes writes:—"It may be taken as conclusively proved that under certain circumstances, at all events, sewage gives up its bacteria to sewer and drain air. Such bacteria may form but a small proportion of those present in sewer air; this is likely, as they would not otherwise have escaped detection by previous observers. But it is probable that the circumstances under which sewage gives up

its bacteria are common and ordinary circumstances in sewer and drain construction.”^a

Amongst many interesting experiments recorded I may mention the following striking one. Prepared plates to catch bacteria were placed on the top of a 6-inch ventilating pipe, connected with a water-closet in the basement. An emulsion rich in a well-known microbe (*Bacterium prodigiosum*) was placed in the water-closet, and the closet was flushed. At the end of forty-eight hours the prepared plates, which had been removed from the pipe and incubated, were found to contain the microbes. In this case the microbes were brought up to a height of fifty feet from the water-closet.

I have described Major Horrock's and Dr. Andrewes' investigations, especially because they illustrate the way in which a case of typhoid fever in Clontarf was probably caused.

Ages of the Patients.—I assume that all the patients whose cases were notified up to and including November 2 contracted the disease from infected milk. These cases numbered 127. There were fifteen cases notified subsequently, extending to December 24. These appear to be, with two or three exceptions, clearly due to antecedent cases of the disease. The total number of cases was 142.

The following were the ascertained ages of 137 of the patients:—

	Males	Females	Total
Under five years	8	11	19
Five and under ten years ...	13	13	26
Ten and under fifteen years	8	10	18
Fifteen and under twenty years	6	6	12
Twenty years and upwards	22	40	62
	57	80	137

The ages of twelve of the oldest patients ranged from forty to sixty years.

^a Page 204 of the Thirty-sixth Annual Report of the Local Government Board (England), 1906-7, Supplement containing Report of the Medical Officer for 1906-7, London, 1903.

Case Mortality of the Disease.—The usual mortality in typhoid fever cases is one death in ten cases ; but it is sometimes higher and lower than this rate. In a milk-borne epidemic, which I investigated in Dublin in 1879, and which is recorded in the Corporation Reports, there were sixty-three cases and six deaths. In the Clontarf epidemic there have been, up to the present, only seven deaths.

Was Raw Milk always the Cause of the Disease?—I interrogated ten of the 127 patients as to whether or not they drank the milk uncooked ; they all replied that it was sometimes unheated. It is, however, unlikely that all the 127 patients drank raw milk ; some of them must have taken it only in tea or in puddings. The temperature of tea is not sufficiently high to ensure the destruction of the bacilli of typhoid fever.

CASES OF ENTERIC FEVER NOTIFIED IN THE CITY OF DUBLIN EACH MONTH FROM 1ST JANUARY, 1908, TO THE 2ND JANUARY, 1909

Month of	North Dublin	South Dublin	Clontarf and part of Howth	Drumcondra and Coolock	Glasnevin and part of Finglas	Kilmainham	TOTAL
January	6	11	—	1	1	—	19
February	11	10	1	1	1	3	27
March	7	10	1	3	—	1	22
April	7	4	—	—	—	2	13
May	9	11	—	3	—	1	24
June	8	9	—	1	—	—	18
July	10	7	1	2	—	—	20
August	19	41	—	1	—	1	62
September	16	40	7	—	—	1	57
October	45	40	119	2	1	10	225
November	18	21	7	2	1	4	53
December	18	38	9	—	—	4	69
Total	174	242	145	16	4	27	609
Population	131,407	139,391	5,269	11,382	7,534	8,891	303,874