

8 Eldon St.

April 27<sup>th</sup> 1875

Greenock

I hereby certify that the  
accompanying thesis on  
"Enteric fever" is composed  
and written by myself  
on Soul and Conscience

Robert Blacir

---



*"Enteric Fever"*

*Graduation Thesis*

*John Robert Black*

*8 Eldon Street - Greenock*

*April 26<sup>th</sup> 1875*

*Dedicated to*

*Douglas MacLagan Esq*  
*Professor of Medical Jurisprudence*  
*Public Health*  
*Esq Esq*  
*Edinburgh*

## Preface

I have selected Enteric Fever as the subject of the following Thesis, the interest in which has of late become intensified in consequence of its frequent out-breaks, and the mysterious way by which it is promoted, sometimes appearing in a densely populated neighbourhood, not infrequently among the select and well ventilated dwellings of the rich, attacking well fed, and ill fed, well clothed, and ill clothed, and often varying its virulence from that resembling a deadly poison on the one hand, to the slight attack of febrile sickness on the other.

During the short period of my practice in the town of Greenwich I have attended and administered to patients suffering from this disease to a larger extent than any other class, and, having in that time had the opportunity of tracing out the causes of two epidemics of this fever, and gaining

myself profited by this experience it may not be thought an unlikely subject for a Tyro in the profession, to at least attempt to deal with.

The extreme difficulty, which an ordinary Practitioner in a Provincial Town like Greenock has to contend with, in not having the advantage of a Medical Library, for reference and perusal, must serve as an apology for what I feel to be a great want in compiling this Thesis; and also, for the ~~meagre~~ way in which I have dealt with the last head of the second division, a subject, of which more might be made, had I the opportunity of a reference Library.

## Contents

### I. Is it Contagious

- A. Excreta as a means of Infection.
- B. Exhalations (other than excreta) as mediums of conveying the disease.
- C. The difficulty of tracing the contagious germ to its origin.

- D. Does any time require to elapse, before the Enteric fever poison will act, after being discharged from the body of the patient.
- E. The vehicle conveying the poison.
- F. The effects of different conditions of the ~~atmosphere~~ weather upon the origin and spread of Enteric fever.
- G. Enteric fever poison prolific.

## II Can Enteric fever arise spontaneously.

- A. Can we form any idea as to the probable nature of the poison.
- B. The vital nature of the contagious germ is an obstacle to Spontaneous Generation.
- C. All the necessary circumstances and conditions that are said to give rise to Enteric fever often exist - and yet it does not show itself.
- D. Years of foecal poisoning without Enteric till at length the Enteric germ is added, when the previously inert-sewage gas and foecal matter become specific, and an outbreak takes place.
- E. Other contagious fevers with a similar specific germ never arise spontaneously.

## I Is it contagious

Is it contagious? That is, viewing it in the general or broad meaning of the term, or, in other words, can the elements or embryo of the disease be conveyed from the sick to the healthy.

When we say that a fever is contagious, we thus select from amongst the symptoms and properties of the disease its most important characteristics, as it is shown to be a specific disease produced by a given cause, & originating in a certain manner. Thus, whatever may be the cause, or from whatever source its origin, it will and must be conceded, that the germ of the disease consists of a virulent poison, specific in its character, and solid or gaseous in its nature.

The poison being imbedded into the human body is reproduced, multiplied and thrown off to an incredible extent, without being diminished, but, on the contrary increased in its virulence, and in this way the surrounding atmosphere is charged with a poisonous taint, ready<sup>to</sup> fix upon, and again enter the system which may be prepared to receive it; and, it is a fact worthy of observation, that by no

possible chance has it ever occurred that the poison of one distinctive fever ever gave rise to that of another kind.

Opinions are still to a considerable extent divided as to the contagious nature of Enteric fever, though, if the ideas expressed in modern literature be taken as representing the minds of the majority of the profession, then it must be held that the disbelievers in the contagion of Enteric fever are gradually diminishing.

As it is almost impossible in large towns to trace to its source of contagion an individual case of Enteric fever, this gradual change in the minds of many is produced by the observations made and published regarding the epidemics of Enteric, that have either occurred in the country or in small villages, where the importation of the disease, ~~the~~ by one who has already contracted it, and the subsequent propagation of it, in a previously healthy district is usually apparent, especially, if the circumstances be made the subject of careful investigation. And yet, it is, generally speaking, the men who live in large towns such as London Berlin Paris etc. who have been the advocates.

3.  
of the non contagious character of Enteric fever, while we have examples without number reported to us from country districts of both England and France, in each one of which there is not the slightest possible doubt, the circumstances having been investigated with great care, both at home and abroad, but that the fever was imported into the village and then spread over the district.

During the last twelve months I have had occasion to notice an epidemic of Enteric fever which occurred in two different places—first—in the country district around and within the village of Inverkip, and the second ~~within~~ in the most healthy and fashionable abodes of the inhabitants of Greenock.

Towards the latter end of the month of February 1874, many of the inhabitants of the west end of Greenock were almost simultaneously, or at very short intervals seized with Enteric fever, the disease did not choose any particular locality but was scattered very generally through the neighbourhood of the west end, it did not select any particular class of houses but was

4.  
apparently indifferent as to whether they were old or new, well drained or ill drained, or, even, devoid of drainage altogether; whether elevated in situation or low by the sea side, — Enteric fever everywhere occurred attacking in some houses two or three individuals, in others only one, and having a particular desire to affect females and children, in fact, during its first outbreak, as far as I could learn, no single male adult was attacked.

- In this epidemic there were one or two things which at first puzzled the Medical men of the Town.
- (1) The fever did not originate in any given spot and then gradually spread over the district; nor show any inclination at first, to spread from house to house, or to follow the course of the drainage.
  - (2) That it had appeared almost simultaneously in many of the best as in some of the poorer houses of the affected part of the Town, while in the more densely populated Town itself there were very few cases. The conclusion arrived at by the Medical officer of health for the Town (who is a firm believer in the spontaneous nature, and spontaneous origin of Enteric), was

that it had arisen spontaneously, in consequence of the defective nature of the drainage; he reported such to the authorities, to be the origin of the epidemic. No doubt one or two instances of defective drainage were discovered, but, generally speaking, the drainage was all that could be wished for, while, in some of the houses a system of privies out side ~~of the~~ were in use. The fever having attacked one of the family with whom I resided, caused me to make careful inquiries, into its origin or cause, the result of which was, that in the district embracing the West End of the Town wherein the fever appeared, milk was supplied from one particular farm or dairy, and it was only in the houses supplied with the milk from this farm that the fever ~~off~~ broke out.

The farm in question is situated in the neighbourhood of the village of Inverurie, in which village Enteric fever had been epidemic from the Autumn previous, the milk was brought in a cart, and retailed to the families resident in the West end of the Town. At my request the Sanitary Inspector visited the farm, and therein the farmer denied

having been indisposed, or having had illness in his household. Notwithstanding this report I was not satisfied, but put myself in communication with the Medical Man who I was told, had visited the farm, and who privately reported to me that he "had attended the farmer early in the month of February who was then complaining of febrile symptoms and diarrhoea".

Taking into account that the fever had existed in his neighbourhood, and that the epidemic had followed the course of his milk, no doubt was left in my mind, that he had been affected with a slight attack of Enteric fever, and that the contagion was conveyed to the various houses in Greenock by means of the milk detailed by him.

But the question still remained unsolved, How did Enteric fever, if such it was, attack the member of this farm? To this query I also set my mind, and I found <sup>that</sup> preceding the farmer's illness, an epidemic of Enteric fever had broken out in the village of Invermick about a mile distant from the farm.

This village of Inverkip is situated at the mouth of a glen, through which flows the stream of water known as the Kip, debouching into the Clyde, on the shore of which Inverkip rests. One street of second rate houses forms the village, and the resident population consists, for the most part, of the families of labourers working in the neighbouring Quarries. Although, during the summer season, the houses are sublet to families from Glasgow and the other large towns up the Clyde. But an efficient drain exists in the village. Cesspools are common, but for the most part, refuse and drainage matter is emptied into the streets or carried to middens behind the houses. The water supply of some of the houses is obtained from private wells in close proximity to such house, while that of the inhabitants of the village proper is derived from a public well at the Eastern extremity of the street.

For years previous to 1843 there had been no fever in the village, which was easily ascertained to be the fact in so small a place. However, about the month of May of that year a family came from Greenock to the village

and lodged in a house situated in the village proper. One of his family, (a girl), was complaining when they came to the village, and in ten days after, she died of decided Enteric fever. Three weeks thereafter another case cropped up in the house adjoining, and during the whole of that summer, and the Autumn following, cases of Enteric fever occurred in the village one at a time in different places, till about the end of November when the fever broke out with great violence, in nearly every house in the East end; and from that date it rapidly spread affecting many of the villas, and several of the farms in the immediate neighbourhood, including the farm we have already mentioned, and thus the Enteric fever was imported by means of the milk to the West end of Greenock.

Here we have an unbroken chain of evidence, which may be summarised as follows.

- (1) Inverkip, a healthy village without disease
- (2) Greenock, a town with Enteric fever endemic, in the lower and poorer quarters.
- (3) A case imported from Greenock to Inverkip.
- (4) As a result an Epidemic of Enteric fever spreading from the village to the neighbouring farms

- (5) Infection brought from an infected farm to a healthy part of Greenock by means of milk.  
 (6) And finally an epidemic arising in the West-end of Greenock, from this <sup>new</sup> milk's consumption. All showing in the most incontrovertible manner, that this fever is contagious, when received into a system prepared and fitted for the poison.

It might be well to add to the cases detailed above, some of the experiences of others.

Dr. Massillie states that Typhoid fever was imported to Currie, in France, by a young workman, a cooper, who came home with his relatives, his family consisted of seven individuals, who lived in a large well ventilated house; they all took the disease in a severe form, and three of them died. From that centre the malady radiated, showing itself in persons in communication with those affected, and the persons so contracting it, by removing to other and sometimes distant localities, where the fever did not previously exist, took it with them to those places.

Dr. Ballard gives the following example from an Epidemic of Interc in the village of Ambrose.

A row of three cottages made out of an old Farm house under one roof, stood midway in the little

street office village of Combroke near Stratford on  
Avon, and was inhabited by three families.

In these three cottages on our bank of Typhoid,  
a Interic, occurred in February 1849, while  
all <sup>the</sup> other houses in the village on either side  
entirely escaped. — What was the reason of this  
attack, and this escape? For many years  
prior to this there had been no cases of Interic in  
the village. There must therefore have been some-  
thing very special to cause such a localized  
out break. On November 14<sup>th</sup> a girl, (age 17) from  
one of these cottages went to service in Leam-  
ington, to a house where a younger lady had  
just recovered from Interic fever. On November  
25<sup>th</sup> the girl was attacked with ~~diarrhoea~~,  
On December 3<sup>rd</sup> she had a shivering and  
went to bed, and on December 8<sup>th</sup> she was re-  
sumed her own house at Combroke with the  
diagnosis of Interic fever, confirmed by  
four Medical men, and became convalescent  
in about three weeks, after her return home.  
All her evacuations were thrown into an  
ashpit privy, common to two of the cottages,  
her soiled linen was washed by her mother  
and the water was emptied into a grating in

11.  
the yard. The family in this cottage consisted, (in addition to this girl) of nine persons, of whom four were at home at the time, three came home in March, and two others were occasionally at home. There was also a nurse in the house in March who was not attacked. Of the nine, seven were seized with Enteric fever in February and March, and the remaining two who were not attacked, were the two who were only there for a short time. In the next cottage which used the same privy there was a family of nine, of whom three took the malady. In the third cottage where there was a separate privy there were two cases and both mild. This case likewise demonstrates the infectious nature of the disease.

Dr. Joseph Wolfsteiner cites a good example, on the ~~extension~~ of its spread in a country district.

A Jewish trader went from Munich to a village called Halmässig, where ill with Enteric fever. Shortly after, some of his family took the same fever, and then it attacked many, but chiefly Jewish families who had much intercourse, through their social and trading connections. From Halmässig

The disease was carried to the village of Tiefenbach, - three miles off, and there prevailed. A peasant's son in service at Tiefenbach went to his own village of Ebmricht, six miles from Tiefenbach and immediately fell ill there with Interic fever, and then his family, partly at the same time partly after him took the disease. Previously, there had been no Interic in them or the neighbouring villages, and Wolfsteiner was able to trace all cases back to the imported one.

iv Medical Journal 1873.

The Following Example is an extract from Dr. Russels report on the outbreak of Interic fever in Parkhead Glasgow 1843.

"The suburb of Parkhead is similar in many respects to a country village. There are no water closets in the houses, the combined ashpit and privy are universal, - the drainage mostly surface, leading to the fields, and the water supply from Loch Katrine abundant.

During the year 1842. only five cases of Interic were known to have occurred in the village, but, about the middle of January 1843. many families were suddenly attacked with it, the whole epidemic being limited to the month

13  
of January; as the facts were suggestive of some common cause acting for a limited time on this limited area, the whole matter was very carefully investigated into. It was found that in November there were four cases of enteric, in December there were three cases, and one was in the family of a dairy man, and in January it broke out in thirty nine families attacking fifty three individuals.

In the course of my enquiries" says S. Russel "I found, that not only had enteric fever been in the family of this dairy man in December, but among those attacked in January was a daughter in law who lived at the other end of the street and her sister who lived next door. Following this clue I found that every family in this street where the fever was, got their milk from the same dairyman. Having found out the source from which every family in the district got their milk he gives the result thus. In five streets where the milk supply of every family was ascertained, out of seventy three families supplied by this dairyman (Mr. X), twenty two had fever, and out of one hundred and forty six families supplied by other parties, only two had fever.

The Enteric fever in those supplied by Mr X frequently attacked several members of the same family, so that, thirty two families yielded forty six cases. In families supplied elsewhere it occurred only in isolated cases, as we usually see Enteric fever in Glasgow. The fever was much more fatal in the families supplied by Mr X. And in two of these families we were told that, the two individuals seized were the only members of the family who used that milk, - All showing the extremely contagious nature of the disease and the entire possibility, nay, certainly that the germs could be carried from place to place, from an infected house hold to a healthy one, and this through the medium of the milk used by the parties.

As an example of a similar kind we have Dr. Robertsons report on the outbreak in Leeds 1873.

A Farm house in the country became infected with Enteric in September. The head of the family died and subsequently five of the household suffered from the disease. Milk from this infected house is supplied by a dairyman, to a respectable district of the Town where a virulent outbreak of Enteric takes place.

and eighty persons who obtained their milk from this dairyman contracted fever - fourteen of whom died. No fever existed in the dairyman's house where the cause of the outbreak was discovered, (though subsequently his daughter took it.)

The Farm is visited - the water is found harmful, being obtained from a source at a higher level than the house and analysis showed it to be pure. In the house itself the sick were placed in a room communicating with the kitchen and dairy. Those engaged with the milk attended the sick. Unclean linen was observed placed side by side with the lids of the milk cans. Outside was an immense filth reeking mass of manure adjoined the stable, where the cows were milked, on the surface of which the drains from the kitchen sink and slop stone, poured their contents. The common privy which received the interior excreta was overflowing. Thus immense particles of poison must have been floating around the house, and, from their close contiguity permeating the Byre, in which vicinity the milk remained till sent away.

Of the various additional accounts

quies by medical men of these aut leaders of Enteric  
Fever, but one other is inserted here by way of exam-  
ple, in it also the milk was clearly shown to be  
the vehicle by which the contagion was disssemi-  
nated. The Account referred to is that by,  
Dr Taylor of the Enteric Epidemic at Penrith  
in the North of England.

High Medical

at 1858.

About the beginning of September 1854 a  
young girl (E.A.) age 15 was brought home to Penrith  
from Liverpool, at which place she had been at-  
service for three months. She had been ill for a  
week of the fever, and was taken direct to her father's  
house, which was small and ill ventilated. E.A. con-  
tinued very ill for a fortnight after her return home,  
but, at the end of September was convalescent. In  
the same family two children subsequently took  
fever, and passed through it; the mother attending  
on the sick. Up to this time there was no fever in  
Penrith. A Byre adjoined the premises and the  
parents kept two or three cows, and retailed the  
milk to about a dozen families in the Town.  
The mother, who acted as the nurse milked the cows,  
and the milk was brought into the kitchen, where  
the sick children lay, direct from the byre and then  
distributed to the customers. Dr Taylor traces most

carefully the spread of the fever, and shows that the primary outbreak, was entirely confined to those who drank the milk supplied by these people. The earliest case having occurred amongst their customers in the first week of October.

Not only was it confined to the customers, but, these were almost universally attacked, for, of about a dozen families supplied, in seven the fever appeared attacking principally the young being those who consumed most of the milk.

Two families having discovered the fact of there being fever in the dairy stopped the supply and so escaped, leaving only some one or two others of the customers to be accounted for. From this focus it spread in all directions being in some cases carried to villages at a considerable distance off.

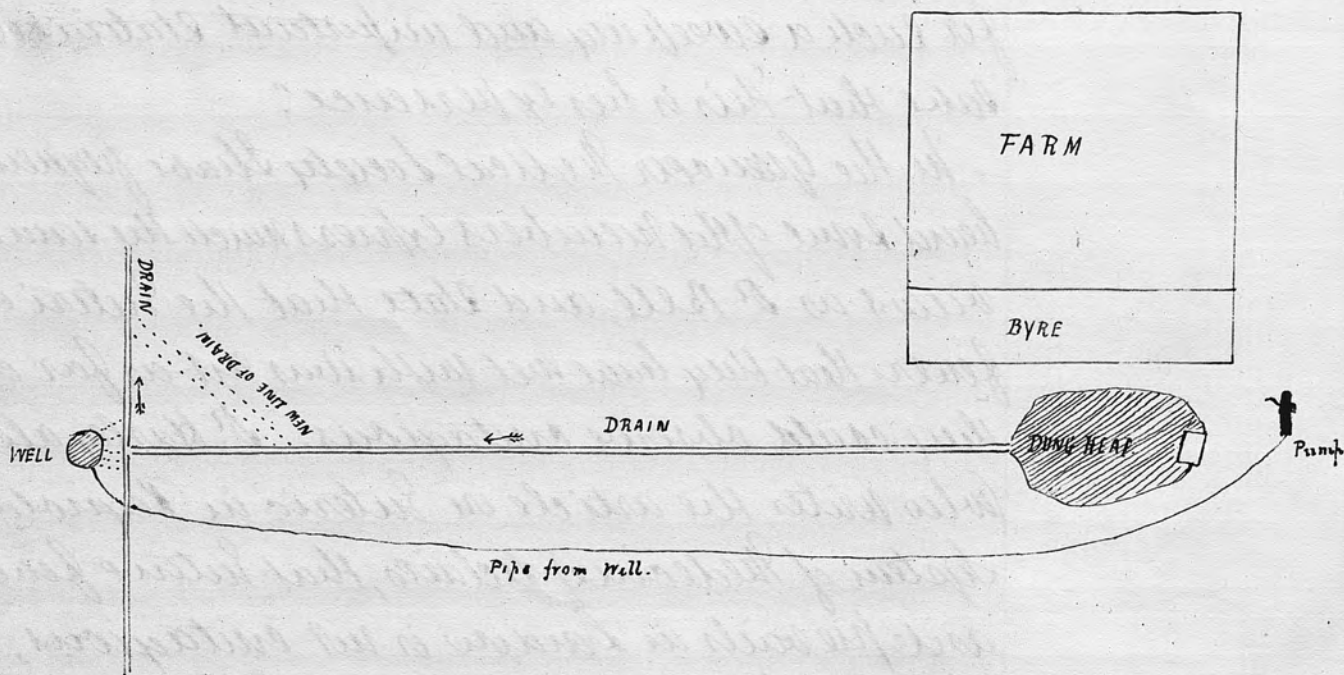
If it were necessary, to prove that Enteric Fever is contagious, it would be a simple matter to do so by introducing the pages of this essay with numerous other examples.

Dr Budd in his able treatise at once convinces all impartial readers as to the contagiousness of Enteric, both from the great number of examples he was fortunate enough to have under his obser-

-bation, as from the clear and lucid manner in which he has shown that the conclusions he draws from the cases cited, are clear and distinct. It is difficult to conceive of men who have read and studied the works of such men as Rudel, Parres, and ~~considered~~ ~~the~~ ~~works~~ ~~of~~ ~~the~~ ~~numerous~~ ~~other~~ authors from whom they have drawn so largely, still being unbelievers in the contagious nature of Enteric fever.

We have lately had a paper read before the Philosophical Society of Glasgow by Dr. Bell, in which he holds it forth as his opinion that "Gastric Enteric or Typhoid fever is neither contagious nor infectious", though he gives no valid reasons for such a sweeping and important statement save that "this is his experience".

In the Glasgow Medical Society I have frequently heard some of the members express much the same views as Dr. Bell, and state that the Enteric fever that they have met with was not as far as they could observe contagious. Dr. Harley also (who writes the article on Enteric in Reynolds's System of Medicine) declares, that Enteric fever as it prevails in London is not contagious, because he never had the slightest suspicion of



its being so in any case under his observation.

The fact that so many are still opposed to the doctrine of the non-contagious nature of typhoid, must serve as an excuse for my entering so minutely into the details, and citing the above examples, as the views held by men who have had the opportunity of observing its spread by contagion.

A. Excreta as a means of infection

The most obvious manner in which this fever was communicated, from the sick to the healthy was by the stools.

In the case of the epidemic in the West End of Greenock, I have not the slightest hesitation in saying that the poison was communicated from the sick farmer to the inhabitants of Greenock by the excreta in question. In looking at the sanitary arrangements of the farm the reason is apparent. While the farmer was ill his excreta (as in the custom) was thrown into the privy which is open and in connection with the dung-heap; from this dung-heap there is a small surface drain, to carry off the liquid matter, and this in turn is lead into another surface drain, part of which flows into the well, which supplies the house with water for domestic purposes.

The ground between the well and this second surface drain was light and sandy, and the well being on a lower level, there was a constant passage of fluid through the soil, from the drain into it. In this case the Sanitary Inspector stated that "after careful examination of the Farm and its surroundings" he was satisfied "that the well, from which the supply of water for culinary purposes, and for washing the milk dishes &c. was taken, was contaminated with liquid matter from the dungstead and Byre"; and so <sup>was</sup> convinced the farmer of the same, that he at once altered the course of the primary drain, that it might enter the second drain at a point below the level of the well.

Having thus traced the course of the poison from the stools to the well, it is easy to see or imagine how it got from that into the milk, as the milk dishes were washed with this water.

In the Ipswich Epidemic\* the stools of the patient were again the means of disseminating the poison of the fever; at least, they were the cause of the sudden out-burst in December. After the case which had been imported died, we have in a village previously healthy every now

and again a case of Interic cropping up, the first case happening in the house adjoining that in which the primary case occurred. I had not the means of tracing the poison in this instance from case to case, as my attention was not directed to the fever in the village till later; but, about the end of November or the beginning of December the fever broke out with great violence in nearly every house in the east-end of the village. In searching for the cause, here we again trace it back to the ejecta thrown off by the sick.

To supply part of the village (the east-end) with water, there is one well from which alone the inhabitants of this part of the village get their supply. The well is situated in the back yard of an Inn, with a midden or dunghill beside or rather behind it, and at a higher level. The liquid manure from this heap was led away by a small covered drain running down beside the well and passing into the Nip Burn. The midden was used in common by the Inn and various one storied cottages around it; and was the place where all the ejecta slips etc. from these houses were thrown

When this midden and its outlet was examined, the drain was found to be entirely choked up, so that none of the liquid matter could pass through, and in consequence it filtered from the midden down through the sandy soil, and part of it in so passing away got into the well.

Such being the premises, - given a case of Intermittent Fever in one of these cottages (and there were one or two there), and the excreta being thrown on to this midden, passing to the well, and being swallowed by nearly all the inhabitants of the east-end of the village, it is easy to imagine, and account for, the result which followed, especially as there were the people so suddenly and simultaneously attacked with Intermittent.

As long as there were no cases of Intermittent in one of the cottages which supplied this midden with manure, so long did the fever spread slowly, and occurred at long intervals, but the moment it reached these cottages the aspect of affairs was changed, and we have a severe and virulent epidemic, among all those who partook of this fever tainted well.

In the cases of these epidemics, we can trace the

poison passing from the bowels of the sick; and find that it is directly swallowed by the healthy, and these previously healthy people contracting the fever, so that we have not the slightest doubt as to the stools being directly contagious.

In the other epidemics two at least point to the stools being the agent containing the poison.

Page 9.

Dr. Ballard states that the fever attacked those who used the privies into which the excreta was cast. And in the epidemic at Leeds, Dr. Robertson found the soiled linen close to the nichans, and as the discharges were flung on to a dunghheap right at hand, the poison germs were not directly put into the vessels, but found their way into the atmosphere, and from thence to the milk.

Page 14.

But the stools will not account for all the cases of contagion that arise. Day after day we find that, though the discharge which comes away from the intestine is the principal vehicle for carrying the poison thrown off by the fever stricken patient, yet the fever is sometimes conveyed from the sick to the healthy in a manner that seems to exclude the stools, as the only media for conveying the poison.

B. Exhalations (Other than excreta) as mediums of conveying the disease.

Every exhalation from the person ill of Enteric seems also to be, to a certain degree capable of conveying the poisonous germ, to persons who were previously healthy, though of this the evidence is not so strong, and more liable to be called in question.

In the out break at Penrith as observed and recorded by Dr Taylor, we do not find him suspecting the milk to have become contaminated by the Enteric stools, but we see that the milk was brought straight from the bye into the room in which the sick children lay, which atmosphere was of course loaded with the exhalations coming from the bodies of the sick, and, as it is generally acknowledged that the stools do not give off to the atmosphere the poisonous germs which they contain, in the fresh state, we are left with the only other hypothesis, that in this case it must have come directly from the patients into the atmosphere by their breath, or carried up by the evaporation from their skin, and so got into the milk.

\*Page 12.

Again, in the report given by Dr. Russel of the out break at Park Head, the water was irreproachable, and the Dr. gives utterance to no suspicion of the milk, being tainted with sewage matter, so that here again we must fall back upon the supposition, that the general exhalations from the river, had alone imparted the poisonous element to the milk.

Dr. Budd, who is one of our greatest authorities on the causation of Interie, gives it as his opinion, that, all the discharges from an Interic fever patient are more or less contagious, and he cites many examples, where the clothes of the fever patient had carried the poison into houses, where, before it was unknown.

\*Budd page 102.

"In 1864 there was a severe epidemic of Syphilitic  
fever in one or two small villages in the neighbour-  
hood of Berkeley, and, among others several  
members of a Clergyman's family were laid up  
with it. A young woman who lived in a hamlet more  
than two miles away, but who washed the tainted  
linen of these patients, caught the fever, which  
afterwards attacked two other sisters living under  
the same roof. Here we have a very good example  
of the contagious nature of the disease, and the

danger of looking at Intoxic as non contagious except from the stools. These girls had without doubt contracted the disease by washing the underclothing which had been worn <sup>by</sup> these fever patients.

The great difficulty which arises in proving that the fever is contagious from the sick to the attendants, is, that in the majority of cases, the patient has been admitted into the houses by the drains, so that those who nurse the sick and take the disease, are generally supposed to have received the poison, not from the sick patients, but from the original source viz the drains.

\*Page 3.

\*In the Epidemic which occurred in Gloucester it has been shown that the fever was not the result of defective drainage, nor from any general cause affecting the whole population such as atmospheric influences; but was due to a specific cause, viz, the poison in the milk. So that in many families, when it was discovered, that the milk was the cause, it was at once stopped. In several of these families the fever was not confined to those who alone were infected primarily by the milk, but in several cases the attendants, or more commonly other members

of the same families were laid down with Intermittent fever, in some cases after the first patient was convalescent, and in others, a considerable time after. It could not be said of cases such as these, that they got the fever from the same source, as the first members of the family, nor could they have got it from the Intermittent excreta, because this happened in houses, where <sup>the</sup> closet system was in use, with a plentiful supply of water, and the excreta was thrown down the water closet, and, so far as the immediate attendants were concerned effectually disposed of.

In the last mentioned cases no doubt was left in my mind, that wherever the attendants or members of the family have been affected, the fever had been contracted, from a careless intercourse with the sick, not having been sufficiently warned of the danger, from the Medical Attendant ~~enunciating~~ his theory that contagion was to be dreaded only from the excreta.

\* Murchison. Treatise on  
Intermittent Fevers.

The practice which Dr. Murchison carries out of having Intermittent fever patients "treated in the same" wards with the many patients sent to the hospital who "have not been the subjects of any form of contagious fever", even though he finds that in no case has it

spread to those in the same ward, only goes to prove that the contagious principle coming off from the bodies of the fever patients by breath and evaporation from skin is less virulent than that contained in the stools; but that, as he and many others affirm, that such emanations are perfectly innocent of any contagious matter whatever.

Though this has been Dr. Murchison's experience in Hospitals, (for in private practise he has quitted ~~one~~ or two exceptions) still I do not think that it is at all to be recommended to the profession, especially when we regard the further light that has been thrown on the causation of this fever in later times.

On entering upon my duties as Physician to the Fever Hospital in Greenwich, I found that it had been the custom to have separate wards for the Enteric and Typhus fevers, but, owing to there being only two of the latter in the Hospital and these being convalescent, they were put into the Enteric Ward, as a matter of convenience for the nursing department. The result was, that one of the Patients who was convalescent from an attack of Typhus (spotted) contracted Enteric Fever.

The following is a short account of the case from notes taken at the time by the House Surgeon.

Robert Pattison age 33. Policeman.

Admitted September 28<sup>th</sup> 1844. "Ill 5 days, sent in as a case of Typhus. There was a copious eruption all over chest-abdomen & extremities". The fever ran a favourable course, and when the patient became convalescent, he along with another, were placed in the Interior Ward. When I came on duty I discharged him as well Nov<sup>r</sup> 2<sup>nd</sup> and on Nov<sup>r</sup> 3<sup>rd</sup> he was re-admitted having been seized that day with rigors headache, pain in breast, and when seen by House Surgeon both pulse and temperature were high. He now went through a course of Pueric, the temperature being on an average  $1\frac{1}{2}^{\circ}$  to  $2^{\circ}$  higher in the evening than in the morning.

Nov<sup>r</sup> 8<sup>th</sup> "Complained of being very feverish last night (F. 102<sup>nd</sup>) up to 2 am, after which he slept well. Temp 100. Pulse 88." "Skin slightly moist, - 10 rose coloured spots over abdomen which is tympanitic and tender on pressure over the Epigastrium."

Nov<sup>r</sup> 9<sup>th</sup> "Several of the original rose coloured spots became" disappeared, slight gurgling in right-Iliac fossa "bowels open"

Nov<sup>r</sup> 11<sup>th</sup> "One or two new rose coloured spots appeared "

" " 14<sup>th</sup> "Rose coloured spots referred to formerly have dis" appeared and 2 new ones have appeared. Patient improving"

He was dismissed on November 24<sup>th</sup> Having had a mild attack of Intermittent Fever.

Here was one case, - in my own limited experience of an individual contracting Intermittent, by sleeping in a ward where such cases are treated. It affords a positive example amounting to complete proof, and surely in such cases, one distinct and decided case proved, is of more value than, negative examples, even although they may be numerous.

C. The difficulty of tracing the contagious germ to its origin.

In all the contagious fevers with the exception of Intermittent, the work of tracing their origin is, as a rule not-difficult. In all these it is shown that the contagious germ, ascends in large quantities into the atmosphere surrounding the patient along with the exhalations from his body, ready to take root, in some suitable soil for reproduction. Of course in these cases persons living in the same houses, are the most exposed and, as a rule are the first to take the fever, and then those who occasionally visit the sick. While those who never go near the sick bed, though it may be residents either in the house above or adjoining, and carefully avoid ~~avoid~~ all connection with the

attendants on the fever patient, may feel themselves tolerably secure. All this is so palpable that outsiders have noticed it for themselves, and are at once convinced of the contagious nature of the fever they have to deal with. But it is not so in Sinteric; "In none of the fevers does the contagious element labour under so many difficulties of at once making itself apparent"

Here the germs of the contagion, are passed off principally and in their most concentrated form, from the bowels; and are held so to speak in a solution mixed with excrementitious matters discharged in a moist or as is generally the case, in a fluid state. This being the case, it is almost impossible, that the germs can pass immediately into the atmosphere, not having any power of their own to rise out of this fluid excrementitious mass. In towns generally and in hospitals the chance of exhalations is guarded against by the stools being at once deluged with water, and sent down the closets, into the drains. The poison coming from the skin and other sources seems often not to be sufficiently concentrated to do harm to the attendants or those of the family who visit the sick, though this ought not to be depended upon as has already been shown, and the stools laden with

the most virulent of the poison germs, being cast out of the house, nurses and friends at once come to the conclusion that the fever is not contagious.

Having traced the fever poison from the patient to the drains, the question now arises, how does it get free? Dr Budd answers this question in a very simple and lucid manner. He writes that after a true fermentation begins, breaking up and freeing the contagious elements from the excrementitious matters, giving off carbonic acid gas etc. and these sewer gasses in the act of rising, carry up the contagious germs along with them. This is very probable and accounts for the fact of Enteric fever spreading more rapidly in Summer and Autumn than Winter.

This process of fermentation frees the poison, but if the stools have been put into a drain, this matter is carried to a distance from the source from which it emanated, rising up with the gasses of the sewer it finds its way into some habitation. There it is reproduced, and gives rise, — as many would suggest, — to cases of spontaneous origin; while those in immediate attendance on the sick, or

Budd Typhoid Fever  
Page 94.

using the same chambers,—as in the cases cited by Murchison, and also observed in Hospitals,—~~to~~ escape because the poison is not yet liberated from its twist-heel.

On the other hand let the Interior Stools be put into a dry privy, cesspool, or dungheap, and the contagion very soon affects all in its immediate neighbourhood, i.e. the neighbourhood of its primary origin. This is abundantly exemplified by the cases of the Epidemic in the Villages of North Tawton and Chaffcombe, recorded by Pridi, and in the outbreak recorded by Dr Ballard in Cambridge, as well as by other cases.

Dr Crosslee writing to the *Lancet* gives a very practical example of how this fever will spread when once imported into a country village.

"Its history" he says "commences with the return of a family from Mentone in the first week of July, one member of which a little boy seven or eight years old, was only just convalescent from an attack which had kept him there far into the hot season. On July 27<sup>th</sup> we were called to the Lady's Maid

\* *Recd Page 13*

*Lancet Jan. 1868*

"a thin weak looking woman of about 40 years.  
 "Her symptoms were referred to the heat and  
 "fatigue of the journey after long waiting and  
 "nursing by the bedside at Mentone. At this time  
 "the end of the 1<sup>st</sup> week after indisposition, I con-  
 "fess to have had some suspicion of the true  
 "nature of her malady, a suspicion abundantly  
 "confirmed by the appearance of the same sympt-  
 "oms in the lady of the house a week later, in  
 "two of the servants at the end of another week,  
 "then in the gardeners wife (who had been  
 "called in to assist in the kitchen), and also  
 "in the cook, butler, and others of the house-  
 "hold soon in all. - To go on with the history  
 "of the progress of the malady; at the end of six  
 "weeks, a woman of the parish who had volun-  
 "teered to wash the clothes in a cottage at the  
 "end of the garden failed with it; and it was  
 "discovered afterwards, that some blankets  
 "she had washed had somehow escaped dis-  
 "infection; three other children took it in  
 "succession, then a man, his wife and five  
 "children in a cottage some 300 yds from where  
 "she lived and so it spread. In all about 30  
 "cases occurred"

In the cases above cited the contagious principle acts like that of any of the other contagious fevers, strikes down all in attendance on the sick, and even those who live in the same neighbourhood.

In some houses where the drainage has been found to be perfect, without any chance of direct contagion, and where the water is supplied by a water company, the poison has been found to enter the household in a manner so insidious and unlooked for, that I have never met with reference made to it in any records of Intercie yet published. In towns generally the water supply is not direct from the main pipes, but cisterns are usually erected in houses. These cisterns are supplied with what is called an overflow pipe. This pipe carries the surplus water from the cistern direct to the drains. Up this pipe it is plain to the most uninitiated, sewer gas containing the Intercie poison will ascend, and that this is a fact and no theory I have myself ascertained, indeed, I found the foul gases, passing up from the sewers with such force as to extinguish a light when placed in front of the pipe, so that it was deeply

impressed with the danger which the inhabitants of towns incur, when such an overflow pipe is placed in an immediate contiguity with the cistern, and sufficiently explains — what has been sometimes attributed to spontaneous generation, — the cause, of fever arising in dwellings otherwise well drained and ventilated.

D Does any time require to elapse, before the Enteric fever poison will act, after being discharged from the body of the Patient.

In treating of the contagious nature of Enteric fever I have not, as far as I have gone referred to the theories of some writers, that the stools when fresh are not deleterious, but that after they have undergone certain changes, the poisonous element is developed, giving rise to Enteric fever, nor so far as I have read has this subject been tested. In order to satisfy the believers in the theory that the poison is in the stools when passed, it is of the utmost importance to determine the period between the time when the stools had been so passed, and the first case of fever arising in a particular locality.

The fact that when the stools are passed into the drains in a liquid state, sometime generally elapses, before they give off the gasses which, carrying up the poison spreads the fever, rather sustains the view of those who say that the stools must undergo certain changes before they become charged with the poison.

In Dr Budds second of the out break of Enteric fever in the Convent of the Good Shepherd at Arncliffe Court near Bristol, we find that the length of time between the imported case, and the first outbreak within the house was fully six weeks. In Dr Ballards account of the outbreak in the village of Combrake where the discharges were thrown into a privy, we find that, between the first discharge into that privy of the Enteric stools, and the first member of the family seized with the fever, the time that elapsed was two months. These and similar others show, that a considerable period of time elapsed, before the Enteric poison took effect on the healthy individuals, and, it is during this time that Murchison and others say, the process of Manufacturing the poison goes on.

But let us suppose that in this liquid state the poison by any means gets at once into the drinking water. In such a case no time will require to elapse during which the process of fermentation may take place, the poison itself is swallowed and immediately begins to act.

Dr. Budd points out how very much more virulent an attack is, and how much more rapidly it spreads if the poison is actually swallowed, and in this, the epidemic in Greenock will bear him out. The Farmer was taken ill at the end of January or the beginning of ~~March~~ February, his loose and Enteric discharges were thrown on the dung heap, and the epidemic broke out in the last fortnight of February, about fourteen days having elapsed. It is evident from this that the poison must have at once contaminated the water, and begun its fatal work, as we may allow, in such a case as this where the dose of the poison was evidently large, a period of incubation extending to 4 or 8 days.

It was in fact, the experiment required, on a gigantic scale and with fatal results.

And I and others were satisfied that the stools even when newly voided, were loaded with the specific poison of Enteric fever, and only require favourable circumstances to become known.

E. The vehicle carrying the poison.

The examples already given point out to us that there are numerous ways by which this fever is disseminated. The most common, and, till within a year or two ago the only known way was, by gasses from sewers cesspools etc. carrying the poison up to the atmosphere. Afterwards sewage tainted water was not only suspected but found to be a very common vehicle of its transmission, so much so, that, when the cases were examined the majority were traced to this source, especially in country districts, where wells were common. The epidemic in Ipswich is a good illustration of this, where nearly the whole population of <sup>the</sup> one end of the village were laid down with the disease. And without dwelling upon the example, I would just refer to the case of the overflow pipe contaminating the cistern supply, and thus communicating the fever.

poison to the water. This may explain the phenomena why the fever is more common in the dwellings of the rich than the poorer classes, and shows the difficulty of stamping it out so long as the real cause remains unaltered. Having thus stated what the writer considers to be the chief beliefs by which the contagion of this fever is spread, he will now look briefly at the other and more secondary article of milk, which however has lately been proved to be the means of spreading the fever in more than one epidemic.

In the epidemic in Greenock the milk was ~~the~~ undoubtedly the secondary vehicle of transmission, having been more or less diluted with the poisonous water. While in the outbreak in Glasgow it was traced to the milk by Dr. Russell as the primary agent, the water supply being unadulterated. The outbreak in Leeds as reported by Dr. Robertson, was characterised by a similar state of matters. And in Dr. Taylor's account of the epidemic in Penrith, though he does not tell us in what condition he found the water supply, yet, he clearly indicates that the milk here again was the primary

agent; having received its supply of poison direct from the exhalations of the sick.

Milk then may convey the poison after having received it, in two very different, and distinct manners. In the one, there is actual carelessness and ignorance shown, by keeping milk in the same room with fever patients, though it is difficult to attribute blame to people who are told over and over again that such a fever is not contagious. In the other method of transmission, which is by far the most subtle, and in spite of every care, by leaving a separate dairy and exercising extreme cleanliness, the very washing of dishes with water contaminated with uterine excreta may introduce the poison into an article of diet, and thus produce the fever in families and districts where it had never before appeared.

That this matter is worthy of most serious consideration, few will deny, when it is remembered that our fever patients especially, are for the most part fed with milk. It so happened in Greenock that patients were fed with the very milk which contained the fever poison until it was suspected, and the supply stopped.

In the meantime two ladies had died, both young and both fed upon this very milk.

If the fever poison can be thus carried by milk without doubt there exists many other articles both of diet and clothing by which it may be likewise disseminated. This is pointed out by Dr Taylor, who very properly shows that in many cases, small shop keepers living in a room behind the shop, and as that class of people are not exempt from fever, - if there is a case in the family it is quite natural to suppose that nearly every article in the shop whether edible or otherwise, becomes a vehicle for carrying the fever poison far and wide.

In this I quite agree with Dr Taylor having attended several families in these circumstances. The abode being a front shop with a back room, and having an entrance through the shop.

F The effects of different conditions of the weather upon the origin and spread of enteric fever.

While investigating into the cause of the outbreak, as it occurred in Greenock, I was much struck with the effects different kinds of weather had upon the origin and

spread of this fever.

(1) Wet Weather

Heavy rain, or a continuation of rainy weather had two very different and opposite effects at the farm from which the fever sprang. First, it was due to the wet weather that the fever spectra passed so soon from the dung heap to the well, and in that case the weather acted the part of a rapid disseminator of the disease, the water from the well being used for washing the milk dishes; Second it was found that a few days rain acted a very different part at the same farm but under altered circumstances.

The Sanitary Inspector reported that "the farmer at once altered the course of the drain from the midden so that no more of the leach-  
age could by any means get into the water". It rained heavily for 3 days thereafter, in the afternoon of the third day, ~~water~~ samples of water from this well were taken and an analysis were found to be pure. The effect of these few days rain was to clear away all the poison that existed in the well, after the source from which it emanated was removed.

In this case then the rain did good it-

acted as a great sewer in washing out the nucleus of infection, and thus removing all fears for the further spread of the disease.

It has been remarked that in towns, heavy rains are very beneficial in decreasing the danger arising from the fecal stools, introduced into the drains, by so diluting the poison and hurrying its exit; as to prevent further harm accruing therefrom.

(2) Dry Weather.

Absence of rain on the other hand has an opposite effect. The sewage matter runs slowly, retaining the Enteric discharges, which ferment & give off deadly gases carrying with them the fecal poison.

Perhaps no better example could be given of this principle than that which I observed in the Borough of Sarnoon, last Autumn.

Drains have been constructed by the Authorities but no water was introduced to deluge and clear out these conduits —

The case of Enteric fever was imported from Glasgow towards the end of the summer, and, until winter's rains deluged these drains and carried off the lurking poison the Borough

was not clear of the fever. The poison had remained in the sewers giving off the gases and thus sowing broadcast the germs of the fever.

G. Enteric Fever poison prolific.

In proof of this, the epidemic in Greenock furnishes us with a good example.

- (1) The farmer already referred to had a very slight attack.
- (2) Only part of the liquid manure impregnated with the Enteric discharges passed into the well.
- (3) The milk dishes were merely washed with this water; inferring from this that the poison existed in the small quantities left in the milk dishes after washing. That the milk was not to a great extent adulterated with water may be acknowledged from the fact that, on enquiry, it was ascertained the demand was greater than the supply, this farmer having a reputation for selling a good article, yet minute as was the quantity of poison our matter which impregnated the milk, the result was a dire spread of Enteric, of a malignant type and causing deplorable consequences.

In the outbreak in Parkhead Glasgow, and

Leeds, as recorded by Dr. Russel and Robertson the amount of the fever poison that entered the milk was obviously small, as in these two cases the water was beyond suspicion, without the inference in fact, that the milk must have absorbed the poison from the atmosphere. And yet notwithstanding the epidemic in both cases was widespread, showing that if the poison of Enteric fever be allowed favourable circumstances it proves itself more virulent and with a vitality much greater than that of Typhus.

So strongly have these circumstances impressed themselves on some of the profession that we have Dr. McDougall suggesting the proposition that it is not improbable, when the Enteric poison finds its way into a vehicle like milk, it here finds a soil, a bed itself suitable for reproduction, and growth.

Could this be proved it would certainly account for much of the mischief which is produced and is at present attributed to the virulent principle of the poison contained within itself.

An opinion similar to this has been held by Dr. Keall for we find him writing that "The

"disease germs of many contagious fevers will retain their vitality in water and other fluids for a length of time, and there is reason for concluding that some of these germs not only grow and multiply in fluids different from any in the organism, but that in the course of such growth and multiplication they acquire still more virulent properties."

## II Can Enteric Fever arise Spontaneously?

We have now arrived at a point in the history of this fever which has entirely divided the profession into two bodies.

- (1) Those who think with Marchison, that it may under certain atmospheric influences arise Spontaneously from the gasses generated in decomposing sewage matters.
- (2) And those who are inclined to think with Dr. Budd and his party, that it can never arise but from a preexisting fever germ and is Non Spontaneous in its origin.

This question being just a section of the great subject of Spontaneous Generation I

will begin with the earliest records I can get of the experiments and views of those holding the doctrine of spontaneous origin, and conclude with an examination of those very definite results that have been arrived at within these few years.

Before the year 1668 there seems to have been no doubt in the minds of "savans" as to the possibility of, not only contagious diseases arising spontaneously, but also that all those low forms of life which are seen to spring up, in stagnant water, or in decoctions of either animal or vegetable matter, when permitted for any length of time to be exposed to the atmosphere —, may arise in the same manner.

As Italy was at that time ahead of the age in learning, so to Italy we must turn for the first originator of the doctrine of Biogenesis. Francesco Redi an Italian wrote opposing the old established theory that living matter might arise spontaneously. After him and during the whole of the 17<sup>th</sup> century there are many writers who advocated both doctrines.

See Cunningham MD on  
enquiry into the theory and  
practice of Antiseptic Surgery.

Cumming

Towards the end of the 18<sup>th</sup> century we have recorded the experiments of Spallanzani another Italian, who boiled various solutions, and decoctions, for  $\frac{3}{4}$  of an hour, and having hermetically sealed them he found on microscopic examination that they never contained organisms of any kind.

Cumming

About the beginning of the 19<sup>th</sup> century Messrs Schultz and Schwann repeated the above experiments with similar results, and further found that when the decoctions were supplied with air that had been raised to a high temperature, putrefaction never set in. He therefore inferred that putrefaction was not caused by the air itself but by something in the atmosphere and which could be destroyed by raising it to a high temperature.

In the above it will be seen that in the series of experiments made exclusion of the ordinary atmosphere is an absolute necessity. First in Spallanzani's experiments where he boiled the solutions for  $\frac{3}{4}$  of an hour and while boiling hermetically

sealed the necks of the flasks. Next Schultz and also Schwann did not exclude the air, but after boiling the solutions, allowed it to pass into the flasks, after it had been raised to a high temperature, by being passed through red hot tubes. Their efforts were directed in the first place, to the killing of any germs or organisms that might be in the solutions, and in the second place, to a careful guarding against any of them passing along with the atmosphere into the solutions. So that they had flasks containing highly putrescible compounds, and yet, the result was, that at no time as long as they were undisturbed did they upon careful microscopic examination ever find any traces of organisms of any kind, and yet the flasks containing similar solutions but left free to the atmosphere, in a few days became crowded with low forms of animal and vegetable life.

<sup>+</sup> Humming

<sup>+</sup> M. Gay Lussac took exception to all these experiments on the ground that if the atmosphere is removed it is impossible for

organic life to be produced or sustained, or even suppose access is permitted to air first passed through red lwt. tubes, the condition of the ordinary atmosphere is altered to that of an atmosphere incapable of sustaining organic life. — We now know that it is not necessary for the growth of these two forms of organic life, that they should have a pure atmosphere, as some of them are known to grow and reproduce themselves in an atmosphere of Nitrogen alone —

Summing

About 10 years after this Nelmboltz made a step in advance. One of his experiments the simplest and yet the most conclusive will serve as an example. He had in one vessel two solutions separated by a partition of some membranous substance such as thin parchment. On one side of this Membrane the solution is fresh, but capable of being put into a state of putrefaction, in the other compartment the solution is the same in composition, but in this case in a state of putrefaction. In a short time Indanur is set in, and the fluids from the putrescent solution pass into the compartment of the un-

nonputrescent solution and vice versa, and yet; there was no change in the fresh decoction; it did not putrefy, — it remained as it was pure and uncontaminated. It is quite clear that though there was a free exchange of the fluid contents of these two compartments the cause which gave rise to putrefaction could not pass through the membranous partition from the fluid in which it existed to the solution which was uncontaminated.

luminescence

Again, we have the experiments of Schroeder, which, as they are simple and more easily accomplished than any of those which have preceded, and are indeed the same experiments in use at the present day, so are they the more conclusive. His Experimenters bearing in mind Lussac's protest which had to a great extent nullified the results of previous experimenters, allowed the solution free access to the atmosphere, and simply filtered it of all solid particles, so that the air in contact with the solutions should be of the ordinary atmosphere, quite capable of sustaining life, but minus the solid particles floating about in it. He put a

putrescible fluid into a flask, and after boiling it for some time to be certain that there were no living organisms of any kind in it, he at once plugged the neck of the flask with cotton wadding, and as the contents of the flask cooled the air passed back through the cotton into the solution unaltered in any way as to its composition, and the result was the same as in the experiments already recorded; the solutions remained clear with no signs of organic life or putrefaction.

By this simple experiment we have the theory of Gay Lussac upset; air unchanged and quite capable of sustaining organic life admitted to the solutions and yet no change takes place.

And lastly, we have the conclusive experiments of Pasteur, Lister and Tyndall who by a process of filtering the air before it has access to the solutions contained in the flasks entirely prevent the formation of organic life and putrefaction from arising.

Pasteur by introducing gun cotton as the plug, and allowing it to remain for some time, after dissolving it in ether and examining the deposit that was left; under the microscope

was able to demonstrate the cause of fermentation and putrefaction, to be due to corpuscles of various sizes, whose form and structure showed that they were organised, and some resembled the spores of minute plants.

The last and greatest blow that the theory of spontaneous generation received was at the hands of those who carry out the antiseptic treatment of wounds as taught by Professor Lister. Instead of solutions in flasks we have wounds and sores, which, if left exposed to the atmosphere, at once become putrid and give off an unpleasant odour, and the discharges contain living organisms in large quantities. But make that wound under an atmosphere of some antiseptic fluid, which has the power of poisoning the germs, that give rise to the putrid condition, and the wound continues clean and odourless, and heals without any septic matter showing its appearance, or in the case of flasks containing solutions, their contents remain innocuous as long as the atmosphere in them has first to pass through an antiseptic medium.

Having shortly stated the opinions

of those who have upset the old notion, that a solid material or specific germ —, it matters not of what species it belongs whether the germ of putrefaction or of fever —, can arise spontaneously, without the aid of any preexisting germ, the question arises.

A Can we form any idea as to the probable nature of the Zymotic Poison

On a retrospect of the experiments recorded it is evident that there is some specific cause in the atmosphere which gives rise either to putrefaction, fermentation or to fever. They also demonstrate that it can neither be a fluid nor gaseous substance. It being then solid what form does it take? This subject is open for discussion as it has not to my knowledge been definitely settled.

We have Pasteur's idea that the specific cause of putrefaction, is a specific germ, and each kind of putrefaction, has its own specific germ. In this Hallier supports him, he contends "that fungi and microzymes, are not only the cause of putrefaction, but also of the various kinds of infection, and each kind having its own peculiar microzome."

Beale on the other hand says that

when Bacteria and Fungi appear they are but  
 harmless concomitants of the disease. But he  
 rather advocates that the poison consists of  
 particles of protoplasm; As the results of his  
 laborious investigations into the origin of the  
 Cattle Plague. "It has" he says "been shown  
 " that the contagious poison of contagious fevers  
 " and allied affections, is not volatile, nor com-  
 " posed of mere albuminous matter capable of  
 " being dissolved in fluid, it consists of minute  
 " particles of matter in a living state, and as  
 " was stated in my report of 1856 this matter  
 " increases and multiplies in a manner pe-  
 " culiar to matter which is alive." And having  
 proposed to his satisfaction that the poison  
 in this fever - the cattle plague - was a  
 living animal germ, he says "the char-  
 " acters of the actual contagious material  
 " having been demonstrated in several in-  
 " stances, I don't think any will urge an  
 " objection to the general application of the doctrine  
 " here taught, that the same characters ought  
 " to have been proposed in the case of every contagious  
 " Malady known to us; knowing what we do  
 " of the several diseases, it would not be reas-

"able to infer that the poison of Smallpox  
"consisted of matters in an essentially different  
"state from that of vaccine poison, or that  
"the poison of Typhus, Typhoid, Relapsing,  
"Scarletina, and Measles, consisted of matter  
"in very different physical states, - in the one  
"fever being a gas, in the other a liquid et c."

These poison germs are known to be ex-  
cessively minute, as though they are not  
gaseous, they float about everywhere in the  
atmosphere, and can not be detected, their  
effect by tanning coat in suit and rail alone  
demonstrating the fact. Dr. B. Saunderson  
says of them "that they are so minute as to be less  
"than the 100,000<sup>th</sup> part of an inch, because  
"in water known to be Zymotic they were not  
"seen with the highest power of the microscope.  
Following out Dr. Beale's argument when  
he proposed that the Zymotic poison of the  
Bottle plague was a small mass of protoplasm  
and therefore a living animal germ, it is  
also to be supposed that the Zymotic germ  
of the other fevers will be found to consist of  
solid germs whether animal or vegetable.  
We have since then to a certain extent

a confirmation of these views by Chauveau and also by Saunderson who have clearly ~~proven~~ that the only part of the vaccine and smallpox matter which is contagious is not the liquid, but the solid particles which are not more than the 20,000<sup>th</sup> part of an inch in diameter.

Professor von Gietel of Munich says in *Spreading of Intestinal Fever* "that the experience of many years has convinced him that the poison bearer must be a minute colourless body perhaps a fungus or a spore, which is everywhere deposited and continues to live long."

The fact is now being acknowledged that the contagium or contagious principle of infectious diseases, is a solid organic material, both from the direct observations of some writers such as Waller, Beale, Chauveau, Saunderson, and others, and also from the manner in which these poisons propagate and reproduce themselves.

I will now refer to some of the arguments put forth in support of the statement that this Enteric fever will not arise spontaneously.

B The vital nature of the contagious germ is an obstacle to Spontaneous Generation.

It is, as already stated, now of almost universal belief, that the principle or contagium that conveys the fever is a specific living germ either animal or vegetable.

And, of as it has been shown that the specific germs of putrefaction and fermentation — which are also living matter, — can not arise spontaneously but require for their origin the preexistence of an organic germ, it can also be safely said of the fever germ that it can not arise spontaneously but requires for its very existence, an ovum or spore from which to spring.

This implies the belief that the fever poison is an atom or spore which is ever present; and more numerous in the neighbourhood of towns and populous districts, where they are continually being given off to the atmosphere from the bodies and discharges of the sick; and, if this be the case why is it that the whole population does not contract the fever, but that it should be developed only here and there?

Beale in writing on the contagious principle says "that it depends upon a poison which

" Having entered the body grows and multiplies  
 " there in a marvellous manner, peculiar to  
 " matter which is alive, it grows and multi-  
 " plies and produces its kind as all living things  
 " do, and as nothing that does not live has  
 " been proved to be capable of doing". And  
 " further " that no one on our part will en-  
 " sure against invasion, but though sur-  
 " rounded by infection and living amongst  
 " contagious disease germs, it is by no means  
 " certain that we will be attacked, indeed the  
 " probabilities of escape are very great"

How is this? how can we explain  
 why living in towns amidst an atmosphere  
 more or less contaminated with the exhal-  
 ations from contagious diseases, i.e. with  
 the germs of the different fevers floating about  
 in the atmosphere around us, and yet escape  
 harmless?

In nature we see something similar both in  
 the animal and vegetable worlds. Take a  
 matted Puff Ball (*Leopordum gemmatum*), in  
 our hands. It teems with with spores each  
 of which if placed in a suitable soil will  
 take root grow up and produce a plant the

same as the parent-fruit which it sprang.

Burst it open and there is thrown into the atmosphere Millions of these spores, which are carried by currents of the air in all directions, and cast upon soils of very different and various compositions, becoming imbedded there, with what result? That out of a fraction of these germs ever take root and become fungi. The great majority finding an ungenial soil, become extinguished.

Were it otherwise, - were every germ to take root - grow and multiply, and cast off in its turn its Millions of spores, the earth would be too small to contain them. Take the case of the common mould, the spores of which literally crowd the atmosphere of our dwellings, and in fact are to be found everywhere, and yet, it is only in certain soils and under certain conditions that it will take root and grow.

And is it not so with the morbid germs or spores of the various fevers, they also must have a soil suitable upon which to grow or in other words there must be a predisposition. Take a single case and consider the Millions of germs that are given off, and then think

Of the thousands of cases of infectious diseases which every day are each and all giving off its germs into the atmosphere, impregnating the air we breathe with a most deadly poison, and then suppose that our bodies were all predisposed or suited to receive the poison, boundless gratitude to an all preserving care should possess our minds, that predisposition alone can induce an attack of the disease.

Some than adopt the speculative theory, of the spontaneous generation of murbific germs which are supposed to arise here and there, spontaneously under certain unknown and peculiar conditions, Murchison and others aver, that over crowding and starvation, the gasses from stagnant and confined human excrement and offal, will, under certain atmospheric influences give rise to fevers, but as far as I have read, they have been unable to prove these to be the originating causes.

Some than adopt such a theory for cases of fever arising in isolated spots where it has been impossible to trace any previous connection with a centre of infection, I would

incline to the suggestion I have read some-  
 where, that it is not just possible that those  
 persons have been so much predisposed that  
 the small number - comparatively speaking -  
 of the germs, in the ordinary atmosphere, were  
 able on passing into their systems, to give rise  
 to the fever, and which though breathed or  
 absorbed into the ordinary run of constitu-  
 tions, not so predisposed, have no effect and  
 therefore die, like the seeds of the Puff Ball in  
 unemgenial soil. As in the case of *Pediculus*  
*Corporis* in a healthy body, they can not  
 thrive, but die out, or at least multiply to such  
 a small extent that they are easily eradicated.  
 But let the person be in a low state of health  
 or in such a state of health as to predispose  
 to and favour their growth, they then  
 multiply with extraordinary rapidity and  
 can by no means be removed unless the  
 affected persons health be brought up to a  
 proper standard, or rather by not touching the  
 insects at all, but merely changing the un-  
 healthy soil in which they live for one more  
 healthy, when they seem to become starved out  
 and may be removed by simple ablutions.

So in the case of Fever, the poison is an omnipresent one in the atmosphere, with different proportions as to amount in different localities, and, as long as the soil is ~~harmless~~ barren it can not take root; but let a class of people so predispose themselves by starvation or over crowding them their little - to almost harmless poison will at once take root and develop itself in the soil and be given forth in renewed strength to attack even some not so predisposed to take it in its weaker form.

C. All the necessary circumstances and conditions that are said to give rise to Enteric Fever, often exist, and yet it does not show itself.

'As the same causes, exeteris paribus, must always produce similar effects' we have a right to expect that if the emanations from confined and putrescent human discharges are at all able to generate contagious fevers, on all occasions in which we have such accumulations, fever ought to be produced, especially when collected in great quantities, kept confined for long intervals of time, and assisted by what are said to be the most favorable cir-

circumstances— But this I think can be proved not to be the case.

Berlin situated in the centre of a sandy plain, almost on a level with the surrounding country is virtually a sun-drained city, what drains it does possess are open ditches along the sides of the streets, but these only contain the sewage matter, from the hotels and villas the Proprietors of which, can afford to have water pumped into cisterns on the roof and are so supplied with water closets. The great majority of the houses, are supplied with common privies, and it is usual for one Tenement or Quadrangle of houses to have only one large privy in the centre, for the use of all the resident families. This privy is not to be confounded with the outdoor privies to be found in Scotland, a system which is gradually being acknowledged as the healthiest, and the best method of disposing of human excreta. In Scotland such are generally in connection with a dungstead entirely apart from the house, and with a free access of air to carry off the gasses resulting from the fermentation and decomposition going on within. These

in Berlin are most pernicious. As an example — and from what I saw the majority are the same, I will describe as far as possible the position of the one connected with the quadrangle of houses, in which I resided for some time.

On entering the house we pass into, from the street, a large area or court; upon the three sides of this court, the different flats of the building are approached from main doors.

The tenements were composed of three flats with three houses in each flat; and from the circumstance that for the most part the houses were occupied by Lodgers, I calculated that about 150 people, adults and children, resided in the building forming the three sides of this court. On the fourth side there were some low buildings, along the wall of these buildings ranged the privies, three or four in number and the discharges passed into a large cesspool situated in the centre of the court. Into this cesspool the inhabitants put all their offal, ashes, &c. The only connection this large cesspool had with the atmosphere was through the seat-holes of the privies, and the gasses passed from them into the court; passing up

the different stair cases, and in at the numerous windows, and so pervaded all the rooms inhabited by these families. This large hole, containing the discharge from so many people, was only cleaned out once in the year. During the months of August, September and October, the heat was great; the smell which pervaded all the different rooms in these houses was excessively offensive, as during the summer months the windows were open day and night. In close proximity to this cesspool was sunk a well, from which the supply of water was got. This water was bad, I did not test it in order to prove whether it was tainted with sewage impurities; but its taste was suspicious. Shortly after being placed in a vessel it gave off numerous little gas bubbles and unless the water was constantly replenished, there was visible in the vessel or bottle which held it, those low forms of vegetable life which are to be observed in stagnant water. Though the Berliners are not a water drinking community, yet on many occasions I have seen the inhabitants drinking this water, and it was the only water

used for culinary purposes

We have here a train of circumstances which according to the Pythogenic Theory of Enteric, was, of all known causes the most certain to produce that fever. According to Murchison and those who think with him, it would be almost impossible to have such a condition of affairs without Enteric Fever. We have here a great collection of human excreta mixed with other garbage lying for at least six summer months undisturbed except with daily additions, fermenting, and putrefying, and giving off gasses, and what is most important - without free access to the air. And lastly the water from a well which lay close to the cesspool in a light sandy soil, partaken freely of and used for all household purposes.

Yet, what do we find as the result of this?

After a careful inquiry, and strict observation into the health of the people resident there, we were unable to find that a single case of fever of any kind had occurred in the locality for upwards of a year, although it is fair to say, that Scarrhoe was a frequent.

visitor.

Dr Budd in arguing that sewage emanations can set off themselves give rise to this fever, says that examples proving this to be the case have often occurred in his practice and cites the following "The epidemic at North Tawton, from which I have already drawn so largely, was a very complete one. I have already referred to that epidemic to show that the prolonged immunity from typhoid fever, which the village had previously enjoyed, was fatal to the hypothesis that common sewage emanations had any hand in the disease which at length fell so heavily upon it. The violation of all reason involved in this hypothesis was undeniably more apparent by taking a wider survey. For, at the very time when typhoid fever was so ripe in North Tawton, all the other principal villages in the neighbourhood remained entirely free from it. And yet, not only were many of them far worse off than North Tawton, in respect of drainage, but there was one, the village of Exbourn, four miles away, that had long been a by-word in the country for its flagrant neglect of sanitary precautions.

" Pools of foul and stagnant water, dung heaps,  
 " open cesspools, and every other conceivable  
 " nuisance, abounded in the place. If the like  
 " impurities were the cause of the fever which  
 " was raging at North Yawton, how did they happen  
 " to have no such effect here, where they were so  
 " much more ripe? It could not be that the  
 " season was not favourable; neither could  
 " it be that there was no food for the disease.  
 " For when the same fever was introduced into  
 " Exbourn, fifteen months later, it spread there,  
 " also, with great virulence, and, as if to com-  
 " plete the demonstration, when it had already  
 " died away in its former seat."

It is surely a legitimate conclusion  
 to draw from these striking examples that the  
 Enteric germ is alone able to produce the fever,  
 however much it may be assisted in its action  
 by surrounding circumstances.

The very fact that this fever is con-  
 tagious implies that it is of a specific char-  
 acter, that it is produced by a certain germ  
 or poison of a peculiar and definite character  
 which does not change, but, after passing into  
 the body comes off again renewed and multi-

plied, but still of the same character and sure to give rise to the same fever. This is very different to the poison which gives rise to the Fever and Ague, Diarrhoea et c., as in these cases the poisonous element is not specific - they, on passing into the body produce certain symptoms, the result of this poisonous action, such as any of the organic or inorganic poisons would effect if taken in poisonous doses - They produce certain symptoms the result of Nature's efforts to expell them; if Nature is successful the patient recovers, but he is not dangerous to his neighbours, the poison does not reproduce itself within the body nor given off during the illness to form contagion. In short that class of disease is not contagious, and this is where the line is drawn.

Bowerst- in his investigations into the cause of fevers remarks. "That though various vapours should result from those fortuitous and ever decaying collections, of unclean and putrefying matters commonly denominated filth, which as in the instance of Marsh Effluvia, may produce diseases, including fever, yet the

" diseases so produced will be incapable of exciting  
 " similar diseases in other persons, and will there-  
 " fore be destitute of the most essential property of  
 " contagion, indeed if it were true that the  
 " vegetable or animal matters while decompos-  
 " ing or putrefying could de novo originate con-  
 " tagion properly so called, the species or variety  
 " of contagion ought necessarily to have become  
 " as numerous and various as the matters so  
 " decomposing, and also as various as their  
 " relative proportions?"

" As well might we revive the forever exploded  
 " doctrine of equivocal generation and believe  
 " as formerly, that insects reptiles &c. are  
 " the offspring of mere corruption, as to believe  
 " that a substance so analogous to them in their  
 " most mysterious and essential function of  
 " self-propagation, could originate from that  
 " cause or from any operation of chemical agencies  
 " alone". He also gives a very striking illustration  
 " of how the confined vapours and emanations  
 " from dead bodies and filth, were able to strike  
 " workmen down insensible, and yet not  
 " produce fever. It was during the removal of the  
 " church yard of St Innocent at Paris situated in

one of the most populous quarters of the city numerous complaints were made concerning the offensive smells which arose from this spot, and penetrated into the adjoining houses, so much so, that the inhabitants became alarmed, and it was resolved to remove the whole yard to the level of the streets. This mass which was impregnated with the remains of carcases and of quantities of filth and ordure thrown upon it from the adjoining houses, took a winter and a summer to remove, and during the whole of that time nothing occurred to interrupt the work. Nor did it appear after the fullest enquiry that any febrile disorder was ever produced by this immense mass of corruption during the removal made, or while it was suffered to remain as a burying ground. The grave diggers were indeed sometimes thrown down suddenly, and for a time deprived of sense and motion by the concentrated vapours which escaped. These vapours also in a more diffused state are said to have sometimes produced nausea, loss of appetite and in a course of years paleness of countenance debility tremors &c. but fever of any kind, and much less contagious fever, does not appear

"to have been ever noticed as resulting from the  
 "offensive or putrid matters of this churchyard  
 "either to the grave diggers or to the neighbour-  
 "ing inhabitants".

"The dwellings in which the natives of  
 "Hamstchakra live constantly during seven  
 "months of the year and which are called  
 "Gauts" are sunk seven or eight feet below  
 "the surface of the ground and are covered  
 "with a thatched roof, in the form of a truncated  
 "cone, open at the top; they consist of one small  
 "apartment which usually contains six fam-  
 "ilies with their utensils and store of provisions  
 "for the winter the chief part of which is dried  
 "fish almost putrid. If the combination of  
 "personal nastiness with the most putrid  
 "smells, and foul air were capable of cre-  
 "ating the contagion of fever every Gaut-  
 "would be a centre of infection. Here they eat  
 "sleep and drink, crowded promiscuously to-  
 "gether, and satisfy all the calls of nature without  
 "modesty or restraint, and never complain of  
 "the noxious air that prevails in their habi-  
 "tations. Yet instead of being attacked with  
 "fever every winter they seem to enjoy as good

health during this season of confinement as any other people".

Again look at the Esquimaux according to the accounts of Arctic Explorers, they live crowded into small close houses, without ventilation, and no fire but a lamp, the floor being composed of an accumulated mass of filth and garbage, and the mule heat and moisture in these dwellings entirely unbearable to strangers, and yet, we know that contagious fevers are very rare amongst them. I have not been able to find records of any other continued fevers, but, when Small Pox and Measles were introduced for the first time from Europe they spread with a rapidity and deadliness that was appalling. When we remember how these people live such a result is not surprising for though their filthiness and crowding together could not generate a contagious fever, yet the fever having once been introduced, the circumstances were certainly the most favourable for its propagation.

These are exaggerated examples of a state of affairs that is known to exist more or less over

the whole world. The same in civilized the nation  
 the same unhygienic are the circumstances  
 in which they live, especially with reference  
 to over crowding, excremental poisoning and  
 famine, the great fever producers, of those who  
 believe it can thus be produced. If this be  
 the case we ought to find Enteric and other  
 contagious fevers rife amongst the Esquimaux,  
 Hamsthatchians, etc. and not so common  
 in Europe and other civilized countries.

Among these savage nations who are extremely  
 filthy in their habits, over crowded in their  
 dwellings, and breathing an atmosphere  
 poisoned with faecal excrement; fever  
 is rare and only occurs, when carried from  
 the civilized world.

Parent Duchatelet - in his investi-  
 gations into the cause of fever found by innum-  
 erable examples, that mere dirt and foulness of  
 air could not produce a Specific Fever, while  
 Trausseau, Budet, Bennett, Watson, Louis,  
 Parkes, The staff of the Privy Council and  
 many other independant-observers have  
 come and are gradually arriving at a  
 similar conclusion.

D. Years of faecal poisoning, without Enteric, till at length the Enteric germ is added when the previously inert-sewage gas and faecal matter become specific, and an outbreak takes place.

We often have such a state of affairs in a community, as ought, according to some, to produce Enteric Fever. Such as stagnant drainage, with defective pipes, from which the gasses escape into our houses, water polluted with sewage matter, together with many other unhygienic circumstances. Summer passes with its heat and drought. Autumn merges into winter with its rains and colds. Years roll on with their varying temperatures, and states of the atmosphere, and yet, fever does not show itself. The people of that community may or may not be healthy, in fact it is more than likely that they will be complaining of Diarrhoea, of Febricula's, Malaise etc., but the great fact to be borne in mind is that, they are exceptionally free from Enteric Fever; till at length an affected Patient arrives from an adjoining Town, his stools are passed unprotected by antiseptics into the

drains, the poison impregnates the water, the gasses pass into our houses, enter the systems of the inhabitants, and in a few days the whole community is aroused into a state of alarm, by a sudden out break of Enteric fever.

Acting under our system of Sanitary Police-Inspectors, — whose Education and Training ill qualifies them for so important duties — are despatched to report on the supposed causes, and they attribute the first cause to bad drainage, disregarding entirely the principle of any argument that, there must first be a poison introduced into the drain, ere, the system of drainage can be attacked as the primary cause.

That this is no mere supposition I hope to be able to prove; In fact the two epidemics upon which this Thesis is founded are typical examples of this state of affairs; and its subsequent Crisis in an outbreak of Enteric.

In Invership, as we have already stated the inhabitants of the East end of the village were dependant upon one well for the supply of water for domestic purposes.

up to the time of the outbreak of Enteric in the  
 village the quality of this water seems never  
 to have been challenged, but, when the  
 Medical Officer of Health was called upon to  
 visit the cases, he suggested that this well  
 should be examined, as it lay in close prox-  
 imity to and at a lower level than a large  
 dungstead into which the cottagers and an  
 hotel in the neighbourhood cast their slops.  
 On examining the dungstead S.W. found  
 that "the liquid manure from this heap was  
 "lead away by a small drain running down  
 "beside this well, and which was entirely  
 "stopped up, so that none could escape, the  
 "result being that the liquid manure instead  
 "of getting freely away from the dung heap  
 "filtered down into the well which supplied  
 "the people with drinking water"; and further  
 he was of the opinion that this state of affairs  
 had been going on for many years.

The inhabitants therefore, for years had  
 been drinking water from this contaminated  
 well, and yet as one of themselves expressed it  
 to me, "there had not been fever of any kind  
 in the village for some years". The adulteration

of the drinking water with unspecific sewage matter, if I may use the term, had no effect in producing Enteric fever. But no sooner did the specific poison given off from the imported case of Enteric, penetrate into the water in the well, than there was an outbreak simultaneous in its appearance over the village, striking down a large percentage of the people. The medical officer who, — I may say is a keen advocate of the spontaneous origin of this fever —, reported that the epidemic had arisen in the village, from the unsatisfactory state of the drainage, together with the use of water contaminated with sewage matter. Such a report had not already been possessed of the real facts, might have had the tendency to strengthen the belief of those who are inclined to think that this fever can arise spontaneously; and had I not been able to prove that it was imported, it would have been recorded as one of those cases where the origin was obscure but rather inclining to the spontaneous theory, and passed without contradiction by those who were unable

to investigate the case for themselves.

In the Greenock epidemic again, the amount of sewage matter partaken of by the Inhabitants was very small indeed, but on the other hand the time during which this had been consumed was much longer.

It is evident that as long as the Farm with its accessories, - including the midden-  
stead and well, have been in existence so long has that well been contaminated with the liquid manure, the quantity of the impurities in the well depending upon the amount collected in the manure heap. Therefore, from the very day on which the Inhabitants of the west-end of Greenock were first supplied with milk from this farm up to the time of the epidemic, they had been partaking of a fluid more or less contaminated with sewage matter. Yet, during this time we hear of no epidemic of Enteric in this neighbourhood - though isolated cases have occurred from time to time, here and there, as they will continue to occur till the etiology of the fever be definitely ascertained and acted upon - , when

if we are to believe in the capabilities of Milk or water contaminated with sewage matter per se, giving rise, when partaken of to Enteric Fever, all who had used this milk, if not already protected by a previous attack ought to have passed through the fever long ago. At length the Farmer is attacked with a very mild form of the disease, the specific poison of the fever is added to the water, and the milk no longer continues to be the vehicle for simple sewage matter, but for sewage matter plus the specific poison of Enteric Fever, and at once the epidemic breaks out - attacking over 20 families of this man's customers alone, a very large percentage indeed, so that though the sewage matter simple had not given rise to Enteric it did evidently predispose the milk drinking inhabitants to the first-attack of the poison. The drains were also said to be in some cases bad and in the majority to be defective, but granting this, such defective drainage had long existed, with perfect impunity to all, until, the poison was introduced.

\* *Lancet*. August. 1843.

The outbreak of Enteric Fever in Marylebone London, as reported on by Dr. Whitmore the medical officer of health for the parish, together with the further light that is thrown on it by the *Lancet*,\* furnishes us with a very good example of a similar state of affairs.

During the month of August 1843 a very serious and alarming epidemic of Enteric Fever developed itself in the parish of Marylebone "one of the wealthiest and - from a sanitary point of view, - one of the best cared for of the Metropolitan parishes." Where within a very limited area, and confined to the customers of one milk vendor, there occurred 200 cases of Enteric in about 80 families, while people living in the same neighbourhood who were not customers of this dairy, or, if so, carefully boiled the milk, ~~coming~~ into their houses, escaped entirely. All the facts collected regarding this epidemic, pointed to the milk as the sole source of infection. The dairy from which this milk was brought, got its supplies from a farm situated at Chiltern Grove, near Thame, and on being inspected by Mr. J. Netten Radcliffe and Dr. Whitmore,

it was discovered that one of the men employed  
 died on June 8<sup>th</sup> with all the symptoms of Typhoid  
 and that the son of this man is at present ill  
 with the same disease. And <sup>they</sup> reported further that  
 the well from which water was drawn for the  
 use of the Farm was contaminated with  
 sewage matter, having discovered a leak,  
 in the drain connected with the Farm allow-  
 ing part of the contents of said drain to pass  
 into the well. In this report nothing was  
 said regarding the length of time it was  
 thought this leakage had existed, but it  
 may be assumed as a curious coincidence, if  
 it occurred just at the time the fever broke  
 out in the Farm; In fact the probability is  
 that as in many other wells, the leakage  
 had been penetrating it for a long time, doing  
 no harm as long as it contained none of the  
 specific germ of Enteric fever. The quantity  
 of the water mixed with the milk was evi-  
 dently small, as the dairy had a good  
 reputation, and was well patronized by  
 the profession in that district; and yet this  
 small amount, which was left after wash-  
 ing the milk dishes contained enough of the

few tainted sewage matter to give rise to the alarming epidemic which followed its distribution, showing how insidious the nature of the poison is.

Another example of this kind occurs to me, the only difference being, that, in it, the atmosphere is the vehicle by which the poison entered the human system. It is drawn from Dr. Budd's able treatise on Enteric fever, and as a scientific experiment in reference to this subject, is about as perfect as could well be made.

In the spring of 1864 Enteric broke out in the Cumbent of Good shepherds at Arncliffe Court - near Bristol, and Dr. Budd was called in to advise. He found that the building was comprised of three separate divisions, around a quadrangle, the three were completely isolated from one another. The water was beyond all suspicion of contamination but they had long been troubled with the drains which were evidently defective but latterly were improved. "For several years after its first opening the ventilation was low and the currents slight; it is

" however worthy of note that after a time  
 " Consumption became in a marked degree  
 " prevalent - and at the same time Strumous  
 " Ophthalmia became so rife as to suggest  
 " that it must be spreading by contagion.  
 " Afterwards. "Diarrhoea appeared in the  
 " Reformatory and in the course of two months  
 " more than 50 girls were under medical  
 " treatment for it. But that during the whole  
 " period of years during which the Contagion  
 " was incubated no specific fever had  
 " ever appeared.

In November 1873 a girl was admitted  
 while labouring under Enteric fever, her  
 Medical attendant allowing and sanctioning  
 the proceeding, and further saying  
 that there was no risk of contagion, no  
 precautions were taken " the discharges  
 " were thrown down the Infirmary, Cabinet  
 " and her clothes went with those of the  
 " other girls to the common wash house.  
 " About six weeks after, another girl was  
 " laid up with the same fever, after that  
 " it spread rapidly & about by March several  
 " more than 50 of the inmates had been

"stricken, three had already died, and two  
 "more including the chaplain who fell a  
 "victim to his devotion, to the sick, were  
 "lying at the point of death. Such in  
 "an establishment in which hitherto,  
 "no single case of Typhoid fever had  
 "ever occurred, were the fruits of the doct-  
 "trine that; Typhoid fever is the result  
 "of bad drainage only, and is not in  
 "any way contagious."

On the drainage being examined  
 it was found to be sadly defective, the  
 main drain leading from the building  
 was entirely blocked up, the sludge of  
 the sewage, and some small coal, which  
 was kept in the court had been washed  
 into the drain, and formed a hard em-  
 erite perfectly impassable to fluids.

Then within the building the drain  
 pipe was so broken that the sewage  
 dammed back and found its way out-  
 there "into a large excavation in the  
 "ground, made when the foundations were  
 dug." Budd further says of it "The stoppage  
 "itself was probably a very gradual thing;

- partial probably, at first; possibly intermittent  
 - tant also in obedience to the various  
 - degrees of pressure from behind, through  
 - rainfall or otherwise. Such a state of things  
 - would explain perfectly the recurrent difficulties  
 - which occurred in the drainage  
 - on that side of the house. In the same way,  
 - the fracture of the pipe would explain  
 - the cessation from these difficulties  
 - already spoken of. It is of course in a  
 - case like this impossible to give an  
 - exact estimate as to time, but the  
 - builder who conducted the investigation  
 - and who was a man of great experience,  
 - felt confident, judging from the hardness  
 - of the concrete on the one hand, and the amount  
 - of sewage accumulated under the basement  
 - of the house on the other, that the state of things  
 - he found must have existed for a twelve  
 - month at least.

In these four epidemics, taken from  
 amongst many others of a similar nature,  
 we have as it were a protest against the  
 general opinion that cesspools, drains  
 badly ventilated, and the drinking of water

contaminated by sewage matter can produce Enteric fever.

We have in the first three, examples of Enteric fever, epidemic under very different circumstances, first in a small undrained village, then in the west end of a rapidly increasing town, where the drainage was not altogether perfect; and lastly in one of the best sanitary parishes of the great Metropolis where the drainage was evidently so well managed that Dr. Murchison on looking about for the cause, was convinced that it was not due to defective drainage.

Yet there were three facts common to them all.

- (1) The evidence of the water or milk, supplying, been for years contaminated with sewage matter.
- (2) During all this time we have no epidemic of Enteric fever; but this is nothing new for almost without exception where the out break, of Cholera or Enteric fever, have led to the analysis of wells, and the discovery of impure water, this impurity has existed possibly for years before. The supposed efficient cause exists

for years, but no effect follows."

- (3) And lastly the most important one of all, that whenever the specific poison of Enteric fever was added to the sewage contaminating the water and the milk, then, and not till then, did the epidemics break out.

In the fourth example we have evidence as strong as could be produced. The inhabitants of the Convent had for a long time been undergoing a slow process of focal poisoning, as shown by the ~~Diarrhoea~~ Diarrhoea, and Ophthalmia, which was so constantly present and so difficult to get rid of. At length an outbreak of Enteric occurs.

How is it that for years the unhygienic condition of this Convent should give rise to simple Diarrhoea and Ophthalmia only, and that at this time, under exactly the same hygienic circumstances, it should cause Enteric Fever? Undoubtedly the only solution for the difficulty is that the specific poison of the fever was for the first time added, and that the sewage gases before only capable of producing nonspecific complaints, now carried up with them the

elements of a contagious fever and the result was, the Epidemic of Interic fever.

E. Other contagious fevers with a similar specific Germ cannot arise Spontaneously.

Having proved that this fever is at least contagious why should we exclude it from amongst the other fevers as to its mode of origin. If Interic will arise spontaneously, why not also Small Pox, Scarlet fever, Measles et c. no one thinks of saying that these will arise, except from contact with a previous case.

Sir Thomas Watson writes very strongly on this subject when he says "Small Pox is produced by contagion alone, and yet the mode in which the contagious matter has been communicated, eludes sometimes our closest scrutiny, then we must conclude that the same thing may happen in other contagious diseases of which the contagious property may not be so obvious."

May the argument from analogy will lead us a step further. If once a disorder of this kind is clearly proved to be sometimes the effect of contagion we cannot help enter.

"taining a doubt whether the disorder in question really has any other cause."

The Metropolis and most of our large Towns are never entirely free from Small Pox, scattered cases occur, these are called *Spontaneous* cases, and in a great number of these cases it is impossible to find a cause for them by contagion, and yet they must so arise, as it is our acknowledged fact amongst the profession that Small Pox never arises *Spontaneously*. Yet let a case of Enteric fever occur *Spontaneously*, and after looking for and finding no cause it is at once set down as a case arising *Spontaneously*, when if we think carefully as to the probabilities of contagion in both, it will be seen that there is a more subtle method of the specific poison of the latter entering our houses, than there is in that of any of the other known fevers.

## Conclusion

In conclusion I would draw from the foregoing remarks,

- (1). That Enteric fever is contagious.
- (2). That the contagious germ is to be found principally in the stools.
- (3). That all the exhalations from the sick are more or less laden with the Enteric germ.
- (4). That the stools when freshly voided are contagious.
- (5). That Sewer gas 'per se' does not give rise to Enteric fever, but that these sewers act as disseminators of the disease when once the Enteric germ gets into them.
- (6). And lastly, that Enteric fever can not arise spontaneously.

Since writing this there is an epidemic of Enteric fever has occurred in Crosshill near Glasgow, and on being investigated into by Dr. Littlejohn, he reported it as having been imported into that district, and that the vehicle carrying the poison was the milk.

More over the great outcry about the epidemic  
 led to an investigation of the drainage, and  
 judging from the official reports, the state of the  
 drainage, had been up to that time most abom-  
 inable. In some of the unsanitary lands, on taking  
 up the flooring of the sunn flats, where the smell  
 had long been unbearable, the drainage matter  
 was seen lying almost motionless in the sewers,  
 or, having found its way out of the drains flooding  
 the foundations and forming a cesspool of the  
 worst description, the gases from which found  
 their way freely into the apartments. And yet  
 we hear of no epidemic of Intoxic till it was im-  
 ported. But ~~now~~ when once the poison is put into  
 these drains, the fever attacks those who are most  
 exposed to the sewer gases, and the people as a rule  
 are too apt, to put the fever down to this cause  
 without asking the question. If the fever is due  
 to the sewer gases, why did the epidemic not break  
 out before? What difference is there in the  
 sewer gases to account for it only now, being  
 able to produce Intoxic fever?

One would surely not talk vaguely  
 about, "special Meteorological conditions,"  
 "atmospheric influences" et: et: when

we can tell them certainly and surely, that the difference is this, - that the sewer gasses now carry up with them the Enteric Fever Germ.

I have also to note that during the discussion which followed upon this epidemic, a Medical correspondent in answering the question as to how the sewer gasses get into our houses, gives the following as one of the ways. "By the overflow pipe terminating directly in the soil pipe and so establishing a direct communication with the common sewer"; verifying the observation I had myself made during the Greenock epidemic.