Typhoid Fever

especially in reference to its aetiology as illustrated by various epidemics occurring in jealousy, Newport, from within recent years.

A thesis offered by Robert

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Index

Anatomical Characters

Bacillus, Eberth. Saffrey
  "growth in decomposing animal matter 5
  "Water
    "Milk
    "Specially prepared materials 20

description of
  Salmon Brachyca

Coli communes

Causes of death

Clinical history

Complications

Immunity

Inoculum (aetiology)

Predispensing causes

Prognosis

Relapse

Sequelae

Temperature (aetiology)

Treatment
  64, 71

Varieties

Virtually no written

Widal

59
The continued fever which bears
the name of Enteric or Typhoid has come
into considerable prominence during the last-
few years with regard to its etiology and
treatment— and more especially its diagnosis.
It consists in an increased tissue
change, caused by the entrance into the
system of a definite Bacillus which produces
certain characteristic symptoms chiefly in the
intestinal tract. _Eberth's Gaffky's Bacillus is
now recognized as the specific organism of the
disease_. To prove that any definite Bacillus
is the cause of any particular series of symptoms
and morbid changes it is necessary to:
1. Isolate the Bacillus in every case.
2. Grow the Bacillus in a suitable medium out
   of the human body.
3. Produce the original series of symptoms and
   morbid changes in an animal by the intro-
   duction of the Bacillus into that animal.

Each of these steps is very difficult in the case
of Enteric Fever. _Eberth first pointed out
rod-like bodies with rounded ends in certain
cases of Typhoid Fever and then Gaffky de-
monstrated their existence in almost every
case he examined in sections of the intestines throughout. Before patches in sections of the spleen and mesenteric glands. 2. Although, he was not able to cultivate them from every case, still in a large number of cases he was able to cultivate them from the stools, portions of gut, mesenteric glands and spleen and to show that they were not present in the blood.

3. The final step, the most important, has been found to be the most difficult to attain. Klein in Stevenson and Murphy's Treatise on Hygiene and Public Health Vol. II page 168 (published 1878) states that "Typhoid fever has not been communicated by any experiment to the lower animals." It was found that the introduction of the Bacilli into various animals such as monkey, while mice he produced very violent symptoms but all pointing to acute septicaemia. In the British Medical Journal March 12th 1879 it is noted that E. Frankel & Simmons in the result of intraperitoneal injections of the Bacillus Typhosus in rabbits & mice, succeeded in producing a disease marked by hypertrophy of the spleen, mesenteric glands.
of Papyros patches. In this case, however, it was possible that the symptoms were caused not by the growth and multiplication of the Bacillus but by toxic substances in the organisms originally injected. The experiments of P. Reutlinger (Annals de l'Inst. Pasteur, No. 11, 11 Dec. 25th, 1897) have shown removed any doubts that may have existed as to the possibility of communicating Sorey from to animals. His method of procedure was to feed rabbits or rats upon cabbage or lettuce leaves soaked in water containing a culture of Bacillus Typhosus. The feeding was not in any case prolonged beyond ten days and was stopped at the first appearance of symptoms of disease. Unless the diet was ample Typhus continuously it was found that no effect was produced. Of eight rabbits experimented upon four were unaffected, although the B. Typhosus was found in the faeces during the whole period of feeding. Their blood did not give Widal's reaction. The fifth rabbit suffered from a febrile attack of eleven days duration, but recovered. Here again, no Widal reaction could
be obtained. The three remaining rabbits suffered from what may be regarded as a typical attack of enteric fever, rise of temperature, malaise & diarrhoea being prominent symptoms. The blood in all three cases was shown to have an agglutinating action on cultures of the Eberth-Gaffky bacillus. Post-mortem examination showed congestion of the small intestine, proliferation & ulceration of Peyer's patches, with enlargement of the spleen & mesenteric glands. Cultures of the typhoid bacillus were made from various organs of the body. The same method of feeding gave similar results with white rats. In one case a pure culture of the typhoid bacillus was obtained from the blood of the heart. The proof that the Eberth-Gaffky bacillus is the specific cause of enteric fever is thus complete.

For its full development, the bacillus requires: 
1. Suitable media which may be: 
(a) Decomposing animal matter
(b) Water
(c) Milk
(d) Various specially prepared materials
II. Moisture as considered in Reference

(a) Action of the ground water

(b) Flooding of low-lying lands along river banks

III. Temperature which may be

(a) General

(b) Local

I. Suitable Media —

(a) Decomposing animal matter —

It is connected with the media in which the Baillus will grow and increase in virulence that the greatest importance has to be attached, as on this depends chiefly the measures to be taken to eradicate the disease. It is owing to its partiality for jills that enables it to produce epidemics of typhoid fever. Wherever the drainage system is incomplete, thus the drainage of a large area may become infected by the stools of one single case with the results of producing typhoid in persons living in houses into which the excretions of the contaminated drain can penetrate through inefficient traps, etc.

This was well shown in the case of two epidemics of typhoid in the County.
Borough of Newport, now in 1891 & 1892. The seaport town of Newport lies on the river Usk; part of the town being on the flat land along the banks & part on the higher land on either side at some little distance from the river. The town being in its infancy, confined to one bank of the river & having recently increased rapidly, has as all such towns has to do, taken into itself various outlying sanitary areas. One of such areas occupied the other bank of the river & the corresponding high ground beyond. This area called Maundee was absorbed in 1886 & in it the sanitary arrangements were far from perfect. In it also there are numerous wells, at the foot of the high ground and attached to private houses. These wells have always been a source of danger being very liable to the entrance of surface water & in the event of insufficient drainage to the entrance of sewage. Thus more than at various times been sporadic cases of dysentery which could be traced to the use of this water of one of these wells contaminated at least with sewage. The summer of 1891 was wet-
Gold with the result that there was a number of the wells contaminated, more than the average number of cases of dysentery occurred in the Autumn and the sewers of all that part of the town became contaminated with the result that cases occurred in houses where there were no wells but where the house drain connections were at fault. The cases from the wells were in the low-lying part of the district while the majority of the cases from entrance of sewer gases were in houses on the high-lying ground. The late Dr. Davies, Medical Officer of Health, at that time, reported to the Sanitary Authority that in 1891 there had been 10 deaths and 61 notifications of dysentery in that Borough. The considerable number of cases of dysentery from reported in a great measure was explained by a limited outbreak of this disease which was confined to a certain district in Manchee which on investigation was traceable to defective house drainage connections which allowed the entry of sewer gases into the houses. It probably also in some instances to the use of polluted water.
By October 27th 1911 he was able to report that with reference to the outbreak of typhoid fever which had taken place chiefly in the upper part of Dundee all possible precautions had been taken to prevent its spread. He found the owners of houses most ready to adopt any suggestions for structural amendments with the result that it had now abated. During the two succeeding quarters two Typhoid deaths from typhoid were respectively noted but during the quarter ending March 1912 there were no deaths from this disease. In his report of October 27th 1911 he notes that: "The deaths from diarrhoea among children have been few which has always been the case in cold wet summers as it has been shown that it requires a certain rise of temperature in the soil before this complaint makes any head." All through, this small epidemic the attention of the sanitary authorities was chiefly directed to closure of the polluted wells to house to house inspection of drains. The wells were closed for drinking purposes but some were not filled or sealed up but left for use in stables etc. The drains found defective
were of course remedied 4 during the winter frosts. The disease died out completely. It was not till the 30th September 192 that Dr. Davies reported "a very serious outbreak of typhoid at Maudlin" after a very hot, dry summer. It was noticed that a majority of the cases now occurred on the high lying ground. This suggested the idea that the sewer gases rising to the higher level were the chief factors in the dissemination of the disease. Thus on September 3rd it was also considered that the sewers in several of the streets where typhoid had occurred required to be ventilated by the construction of gratings. On the 25th October he reported that since his last report there had been 9 deaths, 7 being in Maudlin. "Since the ventilation of the sewers has been carried into effect it has been no deaths on the high ground and only one fresh case of the fever notifed. This fact lends to corroborate the theory as to the origin of the outbreak in insufficient ventilation of the sewer. Thus. through, defective house connections allowed sewer gas which happened to be charged at the time with the specific poison to enter the houses in the locality which became infected."
Seven polluted wells in the same district had been closed. Foul drinking water, however, I am satisfied played but a subordinate part in the propagation of the fever, as no more than 18 out of the whole 100 cases can in any way be attributed to the use of bad water. The poison of the fever in by far the majority of instances entered the body by the lungs and through the stomach; in other words, it was inhaled not swallowed. Although fresh cases did not arise, some of those already infected died during the next quarter and on the 24th January 1893 he reported 9 deaths in Mambef. In his report for the year 1892 he states Nine were 17 more notifications of typhoid with 20 deaths and three deaths of the epidemic. The sudden outbreak of typhoid fever on the East (Mambef) side of the river began during the very hot weather in August—9 continued until more or less intensity for the next three months, there were 130 cases in all. 22 in August, 74 in September, 26 in October, 7 in November and December (this is population of less than 6000). It originated in my opinion in want of ventilation of the street sewers and defective house connections.
permitting sewer air to enter freely into houses in the infected locality. A few of the cases were also traceable to the use of water from polluted wells (these wells were tested for away not for berth Jaffa Bacteri). The steps taken by the Sanitary Committee to cope with the epidemic were house to house inspection to find out defects. The free use of eau de toilet and in the absence of any hospital provision the engagement of nurses to attend the sick at their own homes. The ventilation of the severs was at once taken up and a number of fresh ventilators put up. The polluted wells were closed. This epidemic gradually died out - still during the quarterly survey in March 1930 there were 3 deaths, though a localised outbreak occurred in the Adjourned of 1929 on the opposite side of the river to the Braundee District but still on the left - causing 6 deaths. This outbreak was abruptly closed by at once pulling in numerous ventilators in the severs.

On the Braundee side the streets run on terraces along the side of the prong ground so that the gases prong to its highest level.
accumulated in long stretches of sewer pipes. The houses with defective drains acting as extractors. In the case of the small outbreak in 193 in the street - where the cases broke out - it was found that the sewer ran into a cul-de-sac past the houses from the main sewer. There was no ventilation at the cul-de-sac.

The theory has been advanced that the Baedeker can originate de novo from sewer emanations, justifying annual malady, usually exposed mid-summer, supposing that the germ producing the germ is a product of decomposition. But in the great majority of cases the direct infection of the patient by emanations from a known case of typhoid carried in contaminated water, milk, food, sewer gas in direct, directly by the personal emanation of a typhoid patient has been found. The extreme probability of the germ remaining quiescent in the soil for sometimes 14 years becoming virulent - though some accidental cause would lead to show that the Baedeker does not originate de novo.

The remedial action of fresh air and sunlight was well shown in their applications.
While the gratings were being put into the sewers in the main streets to act as ventilators, there was a great outcry and numerous complaints were made as to the obnoxious smells arising from the gratings. One or two cases stated that they were sure that they had caught the infection while crossing the road over one of the gratings, inhaling the poisonous gases that in their cases the drains of their private residences or places of business were invariably found to be defective so that there was a much more likely source of infection. One thing is certain that during the whole epidemic only one man among the number employed in opening the infected sewers and drains and pulling off ventilators became ill with typhoid fever. It is very possible that he may have been infected through his hands not being thoroughly cleansed after being in contact with the filth, and thus contaminating either his food or drink. A very large number of gratings were put in opening into the main streets and some of those passing on them became in other parts of the town became infected, thus showing that fresh air and sunlight had a diluting effect, in a medicinal action and that...
it requires long exposure to the sewer laden gas to enable a large number of germs to enter the system before the Bacillus is able to produce syphoid. The Bacillus has not yet been discovered in sewer gas and it may be that the Bacillus syphoides is present often in the intestinal tract in a modified form that inhalation of sewer gas assists its evolution into Bacillus syphoides. In which the way sewer gas acts within as a vehicle or a stimulating agent in the process of evolution there is no doubt that the entrance of sewer gas into dwellings has resulted in syphoid.

It should be noted that the Maindee district drinking water supply is the same as that for the whole Borough and there was never any suspicion with regard to it.

(b) Water. The fact that water may come a vector in which the Bacillus can actually grow and increase in virulence is extremely important as it is owing to this fact that the water supply of a town may become infected with a comparatively minute quantity of syphoid germs and produce a most violent t
widespread epidemic. It has been found that
the Bacillus Typhosus can grow in some
sterilised water but in a juble way it will
ultimately die out in this medium. But in
water to which some small amount of
detrital matter has access it will grow readily.
The fact that it can remain alive in water
chemically pure points to all the usual tests
of sewage as the important point.

The most complete evidence in
(Freemans Abridged History of Hygienic Public Health,
Vol II p 167) as to the contamination of drinking
water by typhoid stools was made by Dr. Johnstone in elucidating the
most famous epidemic of typhoid fever in
 xmst. Catterham. His report for 1876 published
in The Volume of the Medical Officer of the D. O. E. 13
contains the full account of the most
instructive and classical piece of epidemiological
work. It was proved that one of the
employees at the Catterham works of the Kent
Water Co. while actually affected with typhoid
fever managed to contaminate with his stools
the water at the original wells of the Company.
This contaminated drinking water, in its
distribution about Caledon, Regent & other
places produced in the consumers typhoid
form. More recently the terrific out-
break at Maidstone again in Kent in 1877
was shown to be due to contamination of
certain springs most probably by hop-pickers.
The water of these springs passed into the
main drinking supply of Maidstone.

The cases in which the water has of
nearly contained an appreciable amount of
sewage other than typhoid before its infection
of the produced epidemics are numerous.
Reincke in a communication to the Hamburg
Surgical Society (Public Health, Vol. 18, Nov 2,
1896) showed that the recurring epide-
mics of typhoid in Hamburg were due
to the drinking water chiefly. This water
was taken from the river which was always
much contaminated with sewage. He noted
short outbreak outbreaks in February &
March where the flood mingled with the
feller beds. The mortality from typhoid before
1848 was very high. In 1848 the slopes of
Stonor was completed with a great- w-
progressment, even though the ven was becoming more and more polluted. In 1878 the filter beds were established with a very marked improvement: the media that were inefficient filtering at once dried on the typhoid rate. He specially refers to one instance on August 8th - 11th 1878 there was severe outbreak of vomiting and diarrhoea amongst the workmen at a wharf on the Elbe who were supplied with pure water filtered through a Bishop's patent filter. Shortly before the outbreak the filter had been cleaned. Consequently it did not work well. Some two or three weeks later 19 out of 110 showed symptoms of typhoid.

In Newport there has been no contamination at any time of the water supply, but there have been numerous cases as before mentioned due to persons using some of the old wells under exceptional circumstances such as hard frosts. These wells being deep and not liable to be frozen even in the severest winters. Contaminated water has been shown to be a source of danger in an indirect way.
viz. when taken into the stomach in the form of ice cream &c. &c. when it is used for the cleansing of utensils used to hold articles of diet such as milk &c. also when articles of diet such as water cress &c. &c. green vegetables have been soaked in it—also when various shellfish, mussels, oysters &c. have been grown in it. In fact, so strong has this feeling been with regard to outbreaks due to eating shellfish, especially oysters taken from sewage contaminated water that legislation interference has been asked for.

(c) Milk

The fact that milk can form a vehicle for the growth of the typhoid germ has been recognized for a long time. Milk may become infected in various ways—usually by the use of contaminated water in the cleansing of the containing utensils or by the germ being carried by the air from a dried mass of infected animal matter. It may be that milk stored in a room to which sewer gas from an infected drain has access may be able to absorb that which in the gases
can produce typhoid but I have not been able to find a record of any case caused in this way. Ballard has shown (Stevenson's Hygiene of the Modern Public Health, Vol II p 167) that in description of the times of typhoid fever as in the Holton Epidemic milk plays an important role (Tables Transactions of the International Medical Congress London 1887).

In Newport in 1897 a small outbreak occurred which was found to be limited to persons supplied with milk by a dairymaen living in a village a short distance out of the town. Various cases were found to have in this village but these at first seemed to have no connection with the said dairy as they did not obtain their milk supply there, not only so but the person from whom the village residents obtained their milk was on anything but good terms with the aforesaid dairymaen. His on inquiry it was found that at this particular time the person supplying the village residents had put some of milk for all her customers of had obtained some milk from the dairymaen...
through a third party. It was then shown that there was a well on the premises of the dairyman polluted in a marked degree with sewage matter both from the cow houses & private houses. The dairyman denied that he or his servants ever used this water to wash the milk vessels but the fact remains that whereas the well was closed no more cases occurred. The outbreak was limited to less than a dozen. This number only being attacked out of all the dairyman's customers might be due only to one or so of the milk vessels being washed with the infected water.

(a) Various specially prepared materials such as glycerine, Borax, agar, blood serum, boiled potato &c. have been found to be specially favorable for the growth of the Bacillus. Into virtue of course the Bacillus has to be placed by human agency & in these it grows in a definite form thus allowing of the use of these media in its differentiation from other Bacilli found in the same habitat.
II. Moisture

(a) The action of ground water

It has long been observed that various diseases, in particular tuberculosis, frequently increased or diminished with certain changes in the height of the subsoil water.

There are two views held in this connection:

1. The outbreaks of disease occur when the ground water was lowest — and especially when after having risen to an unusual height it had rapidly fallen.

   (Park's Practical Hygiene p. 8) This is the view of Pettenkofer & Burkii, but they also hold that "it is necessary to ban impurity of the soil from animal impregnation, heat of soil & the entrance of a specific germ."

2. A uniformly low ground water is most healthy — a uniformly high ground water is preferable to one that is fluctuating specially if the limits be wide. Baldwin Lahmann agrees with this & holds that "the most unhealthy time is when percolation commences after the lowest ground water period.

   Croydon — lowest June, maximum in January
   Paris — " June " from Aug to Dec
   Newport-1798 " June " " Sept to Oct"
Peterborough view would entail that—good drainage of the subsoil would increase the amount of salinity, but this has not been found to take place. In connection with this, it must be borne in mind that it is not the ground water itself that is the cause of disease, but the inequalities in the soil which the varying level of the ground water helps to set in action.

(b) Action of localised saturation of tracts of land, either from overflow of river banks or along tidal rivers where high tides cause flow parts of the land. Newport is liable to the latter in a marked degree. The lower lying parts of the town being liable in the event of exceptionally high tides to be flooded than have their drains blocked. The lower parts of the town are so markedly more liable to epidemics that 86 per cent. of the cases notified in 1896 were from the low lying districts.

III. Temperature

(a) A general high temperature is necessary. The Bacillus can survive a low temperature but seems to lose its power of growth. Epidemics invariably occur in Summer Autumn.
(b) Local high temperature.
This is one of the causes of the almost indelible nature of the syphoid on the low-lying ground in Newport. The houses on this land are often built below very high tide level or on ballast obtained from a variety of sources, and some of it certainly contaminated with sewage material. When houses are built on such land, if insufficient means have been taken such as the absence of cement-ground floors to prevent the heat of the house drawing up the moisture from the underlying ground they are invariably found to prove unhealthy.

It is thus seen that the Bacillus is possessed of considerable vitality. It can live and probably grow in such a poor medium as water and can resist considerable variations of temperature, specially cold, also the action of various other Bacilli in putrefaction processes as also the action of the gastric juices. It is owing to this great power of resistance that it has been held by some, including himself, that the Bacillus is capable of forming spores.
In potato cultures Sphaerio-terminal globules can frequently be seen which gauphy mitred as spores but which observers have noted as never being present in cultures in other media - thus Buchner has been able to show that they only represent dissolution products. Klein in Shermon’s Studies on Hygiene & Public Health, Vol. II p.169 states that: “The Sphaerio Bacillus will survive a temperature of 60°C for five minutes. In this respect behaves in a manner totally different from spore bearing Bacilli”. The drying of a thin layer of a culture of this Bacillus in matter what age the culture, two matter what the medium whether grown on surface or in the depth kills the microbe.”  Delusion of the sages from contaminated severs with fresh air by action of sunlight markedly diminishes their virulence.

It has been proved that the Bacillus can remain guiescent in the ground for many months at least. Professor Delepine has been able to establish the Bacillus in an “infected area” that is in the Sord of a district where Sphaerio germ is prevalent – where it has shown
a tendency to produceizable cases from time to time even when all attempts are made to stamp it out permanently by securing good sanitary arrangements and disinfection. Dr. J. Robertson in the British Medical Journal of January 8th 1978 has shown that although he was not able to isolate the Bacillus in the soil taken from an "infected area" yet by experiments made he was able to note a marked increase in the number of the Bacilli placed by him in the soil of a field. He noted that the Bacilli which were not fed by bacillus gradually died out. Yet that the colonies "fed" increased and were present even after a rather severe winter. He states "they (the experiments) prove that the typhoid organism is capable of growing very rapidly in certain soils... a leaking or defective drain is constantly feeding with organic material the surrounding soil. In cases of typhoid fever are attributed to this drain & the leak repaired it is possible that a similar action will take place. So that which occurred in this soils which were not manured."

The Bacillus would seem to be widely distributed
4. To be present in almost all soil in a greater or lesser degree, a conclusion to which the following seem to point:

1. The occurrence of the disease in all climates
2. In sparsely populated as well as thickly populated districts
3. The marked influence of the very fall of ground water on the prevalence of the disease all over the world
4. The rapid production of the disease whenever accidental circumstances arise among an increased food supply to the Bacillus or providing it with the necessary moisture and heat for its growth.
5. The cases that have been noted where some old drain or cesspool has been opened within the control of producing Typhoid or some person engaged in the operation. Even though there has certainly been no recent injection of the drain or cesspool with Typhoid stools, there may have been a constantly varying amount of Bacilli in the soil--dying out--in one place for the want of proper food, moisture or heat--increasing rapidly in another on the accidental admission of suitable nutriment--to thus increase through the action of some vehicle producing an epidemic which, in its turn produces new contaminated areas.
Predisposing causes

Cholera fever occurs in all countries, but seems to be more prevalent in temperate than in tropical climates. It attacks all races impartially. It has been noted by some observers that it is rare among the adults of the native races of India and by some it has been described as a race immunity, while others state that it is merely an acquired immunity as the children are brought up under such conditions as to make it highly probable that many of them have a mild attack even in comparative infancy and thus acquire an immunity. In the British Medical Journal Aug. 15, 1897, Surgeon-Major Freyer has published the result of certain tests applied to children in India tending to show that the native is not born immune but has an attack frequently when back in life. Freyer then explains the increased prevalence of enteric in English soldiers in India stating that in the old days the soldiers went out to India from homes not much better in a sanitary sense than the homes of the natives. He was in fact, immune to enteric long before his arrival in India but that now a days with...
The great improvement in sanitary matters in this country he goes out to India to meet. At the very first he must fall a victim.

Among the Registrar General's returns there is no marked effect—although there is not the same marked preponderance of male cases that one finds in other diseases where males are more exposed to risk of infection. Age: 52 per cent of the cases occur in adolescence. It is very rare in children. Very persons over 45 yrs of age at least in this country. Some authorities among others Prof. Sir Grainger Stewart consider that infantile typhoid which has slight peculiarities in which the rash so frequently seen in adult cases is absent. Whether this is really so will soon be definitely shown by the application of Widall's test to all doubtful cases.

Occupation has no effect. It might be supposed that workers on sewage farms, sanitary officials, labourers employed in ventilating drains...
Nurses he would be more susceptible. But this has not been found to be the case. In the epidemic referred to in Newport only one man caught the infection. During the two years the infectious hospital has been open in Newport only one nurse has suffered from typhoid. In both these cases the possibility of direct infection through some slight carelessness in personal cleanliness could not be dismissed.

Insufficient ventilation, want of sunlight, crowding all predisposed as can readily be understood in the case of a Jew due to a Bacillus that deluged his cells. This shows the importance of cleanliness in the houses as the Bacillus may actually grow in the dirt between the boards of a floor or wall. A suddenly take on a virulent action under some special circumstances.

General ill health may predispose but not markedly.

Immunity. The fact of having had one attack does not necessarily imply that it is impossible for that person to have another.
but there seems to be some immunity for a little at least. It is rare to have a second attack, since Widal thought forward, his serum test. This immunity has come more prominently forward. It has been found that the serum of persons who have had typhoid does not lose its agglutination power for a long time. Otherwise it is more difficult to prove that persons whose serum gives the reaction although they are at the time in perfect health must at another time or another can suffer from typhoid fever. Myers and other observers in India have tested this and they found that many children from 2 yrs upwards for the reaction. Their conclusion is that the malar children are subject to typhoid at a very early age. Practically remain immune for a life time. If that is so it would seem as if Widal's test would be of little use in India to distinguish an attack from any other disease as the patient would give the reaction of immunity in any case. This does not seem to hold in this country.
Clinical History

In whatever way the Bacilli enter the System, whether by ingestion or inhalation, they require
1. To enter in sufficient number
2. To enter a System that will allow them to live.

These two requirements are so intermingled that it is impossible in any case to say which one it was that must have been wanting. It is well known that every person drinking contaminated water or milk or breathing the same sewer gas does not necessarily become a victim to the disease. In many cases the second requirement seems to be the important one. Thus in the smallpox of 1844 I attended Mr. B., who lived with her husband in apartments in this town. During that winter the water pipes all over the town became frozen in various parts. In this particular house they could obtain no drinking water from the ordinary water supply pipes. The householder obtained water from neighbours while Mr. B. who was a stranger did not like to ask but obtained her supply from a pump attached
To a well in a stable at the back of the house. Both she and husband drank this water but she only took typhoid fever. The water of the well was found to be contaminated with sewage in an extreme degree as the liquid filth of the stable could easily pass down the pumps. In the case of the milk epidemic already noted many customers must have drunk the contaminated milk without any bad result. It has been held by some that a person when intestinal tract is at all times overloaded is therefore habitually in a state of auto-intoxication and is more liable to infection. There is no doubt that the ingestion or inhalation of typhoid germs may produce certain symptoms such as diarrhoea and other gastrointestinal disorders without passing on to the actual production of typhoid. It is well known that an epidemic of typhoid is frequently preceded by an outbreak of diarrhoea as was noted in the recent severe epidemic at Maidstone in Kent. This diarrhoea or other gastro-intestinal disorders may be due to the bacillus itself or it is possible
To suppose that the Bacillus can produce something such as a phomaie which can act as an irritant without having the power to produce the typical ulcers or the alteration in the Sermum necessary to give the typical agglutination reaction as in Weisbeke’s test. It may thus be that cases of Infantile diarrhoea V.Simmermann are due to the influence of the Bacillus in an attenuated form or few in number into systems able to cope with them or to the influence of a product of the Bacillus.

In whatever way the individual may have caught the infection there follows a very definite train of symptoms. The serum remains in the system practically unchanged or at least without producing any marked symptoms beyond a slight impairment of appetite or a feeling of general malaise. Usually, for a certain time called the period of incubation, varying from 5 days (Smirnow, Y. V., Report on Hygiene Public Health, Vol II p. 318) to even 30 days. The average period being from 14 to 21 days, he may then complain of
Slight frontal headache & restless sleep. These symptoms become much more marked as the patient enters the period of involution. Up to this time he has on all probability been able to go about & attend to his work but now he becomes weak, unable to take his food - suffers from severe headache & sleeplessness. In the great majority of cases diarrhoea sets in but this symptom is sometimes absent throughout the whole course of the attack. The patient feels cold & chilly & may have profuse sweats. There is now abdominal pain referred generally to the right lower region but some times to the umbilicus. The abdomen is usually distended & one may on pressure elicit a gurgle in the right iliac fossa. The tongue is purplish, red & sticky looking at the edges, with the papillae very prominent. There is a tendency to vomiting. The diarrhoea is frequently marked but number of stools varying from 30 to 16 or 20 in the 24 hours. They are very liquid & full of offensive & fetid faeces. Consistency has been termed "pouring evacuations." Uniform
Throughout—when first passed, the separation on standing into an upper watery layer of a yellowish or brownish colour, containing albumen and salts in solution, the latter including chloride of lime and carbonate of ammonia, a lower layer of deposit consisting of the remains of food, small yellow flocculi, shreds of tough crystals of tricalcium phosphate (Roberts, Theory and Practice of Medicine, page 128). The blood at this stage is due to rupture of some of the mucous vessels in Payr's palate, which are acutely congested. The shreds of tough are only found in some of the evacuation first in the earliest. The urine contains urea, uric acid and excess in diminished amount of chloride of sodium.

In the early stages in few cases one may notice a slight red rash, with some throat irritation, which soon disappears. The pupils are as a rule dilated. Vomiting is frequently masked deafness. The pulse is steady, shows sometimes 100 or 120, in the meantime and is somewhat weak. The temperature also rises in a masked and characteristic manner—there is a rise of
2. Between morning and evening temperatures a drop of 1° or 1.5° between evening and morning. This clinical symptom is most important—so much so that one can certainly say that this characteristic chart—yet it is so frequently present as to be of the utmost value in diagnosis. Patients have frequently advanced to this stage before they apply for advice, specially among the working classes.

I have noted that most cases seen late at where the patient has gone on working up to this stage, often become quickly very seriously ill, and the mortality is distinctly higher in these cases than in those cases where the early symptoms have caused the patient to apply for advice. All these symptoms become marked in the second week of the period of incubation. The diarrhoea is still marked. The stools contain blood in larger amount but this is now due to ulceration taking place in the ileocele valvae of the intestines. A much more serious symptom is the presence of a much more serious symptom that may be absent altogether or occur in large amount—seriously affecting the chances...
of the patient's recovery, at this time a rash appears chiefly on the abdomen sometimes also on the back but very rarely on the face. It is very rarely about in adults but may be so in children. When it occurs it consists of rose-coloured, circular, elevated spots scattered over the abdomen varying in number from 15 to 20 to a fairly well marked rash. These spots disappear on pressure. They come out in crops each lasting 2 to 4 days. The nervous symptoms now become more marked the patient becoming very delirious specially at night. This delirium is increased with the rise of temperature which may now reach 100° or even 106° at night although in the majority of cases the highest temperature does not exceed 104°. In children there is frequently an amelioration with ultimate recovery from this period but in adults the most critical period is now reached. In the third week of the period of invasion all the symptoms are at their height and any one of them may become so severe as to endanger life. The delirium is apt to pass
into somnolence & the patient-like taking
little or no heed of his surroundings, he
may pass urine & stools involuntarily. The
abdomen is not so tender but is usually
much distended. The urine is usually high
coloured & may contain albumen in fairly
large amount. The pulse is very rapid &
weak & shows signs of cardiac weakness.
By this time of course he has become ex-
travertly swelled & the muscles may
swell (Roberts, Theory & Practice of Medicine,
p.129) the peculiar swelling, on being gently
pressed with the end of the finger, called
myocedema which is due to muscular deg-
geration. The tongue is stiff cracked
sordes has collected on the teeth & the
is often great difficulty in feeding him.
It must be understood that the period
of invasion is not always divided into
three periods of seven days. Each of the
periods may vary specially the last
so much so indeed that although the
average duration of the period of invasion
is 21 days it may continue on to 60 days,
before the period of convalescence is entered
There is then a gradual amelioration of all the symptoms, a gradual fall of temperature indicated by a more marked morning remission followed by a fall of the evening temperature. Pain a very mark- ed morning remission of 2° or even 3°. The pulse becomes better, the tongue becomes moist and not so red, the patient may thus gradually recover but even in a mild case the convalescence may be much prolonged. The patient must be ex- tremely careful specially with regard to diet as a relapse, even more than once is by no means uncommon even when the greatest care is taken. A relapse is often more serious than the original attack as will be at once noticed by the rise of temperature, return of diarrhoea, abdominal pain. The disease may prove fatal at any period of its course. In the very early stages from acute poisoning of the poison - cold from some complication but more usually during the third week either as shown mentioned from severity of the symptoms or some complication. Death may thus occur from hyperpyrexia acting directly or indirectly, as by
increasing the delirium & producing coma or con-
sciousness also by increasing the muscular waste.
Fell death occurs from Cardiac Syncope.
Hemorrhage - from Intestine, lungs or nose.
Peritonitis due to the ulceration of Peyer's patches
extending through the muscular coat - usually
perforating the peritoneal & thus allowing escape
of the intestinal contents into the peritoneal cavity.
Severe & persistent vomiting. Paralysis of the bowel
blood changing, chiefly due to unfruitfulness due to
the secretion rendering contained sebile state.
During the whole course of the fever there is
liability to death from Complications such as
Pneumonia, congestion of the lungs (Acute & Passive)
Pneumonia, congestion of the lungs, Danys, Sanguine,
Brights disease of kidneys, inflammation of bladder,
urethra, pelvis of kidney, etc.
Enterotoxaemia, Bedsores, Sanguine,
Mania, Hemiplegia, Imbecility, Maniacus
Malaria. Interstitial Inflammation of lungs or brain.
Phlegmankia, Sanguine, Diseases of bones, joints, etc.
All of which have been noted. The lung com-
pliations are the most common, indeed a state
of severe congestion is almost invariably present.
only to the Cardiac weakness thus Temperature
for the same reasons the kidneys are frequently affected. The other complications are more uncommon. Dr. Welle of Lyons has noticed the frequency of desquamation consequent to typhoid fever. Widal (la medecine moderne 1897) states that the common complications are nearly always late, generally appearing in the first month following convalescence. It seems that in a subject已被半 contained by an attack of typhoid fever, Eberth's bacillus may still multiply at points where it has by chance been left. If the immunity is incomplete it is at least enough to give the body leisure space to resist the action of that bacillus within a local phlegmonous inflammation which manifests itself clinically as ostitis of various types. There are exceptions to every rule. One had recently a case of osteitis of the rib developed not during convalescence but in the course of a prolonged typhoid fever, an osteitis which, under well- restoration coincident with depression.

Many of the diseases mentioned as complications are of the nature of sequelae and may prolong the period of convalescence to a great length. Intercurrent diarrhea or may be affected this
in a case of typhoid fever, suppuration occurred in the cysts during the course of an attack of typhoid fever (verified by Widal's test). The man recovered from the fever but died later after the suppurring cysts were opened and drained from exhaustion. Typhoid fever may leave behind such an amount of disorganization and destruction of the glands in the intestine as to permanently impair the functions of the intestinal tract with the result of causing permanent ill health.

The clinical history given above is that of a typical case but there have been various varieties described such as

1. Mild including abortion in which the fever comes to a sudden and with recovery in 2-3 weeks some cases of gastric or delirious fever may be of this variety;

Infantile typhoid, which is held by some to be typhoid without a rash; latent or ambulatory in which the early symptoms are so slight that the patient walks about doing his work with no change in his usual food until the same time the ulceration process in the
While it is going on without causing much pain or discomfort, it is in these cases that perforation is most apt to occur and be very suddenly fatal.

2. Grave in which all the symptoms mentioned in the clinical history are masked.

3. Purlieus in which all the symptoms are very severe. The patient—even in the early stage—has marked delirium passing from wild restlessness into a low muttering condition. He lies indifferent to everything—especially becomes much unoccupied—lethargic and covered with spots of herpes labialis. Frequently present—urine may be present—Vomiting. The bowels are very loose, are passed involuntarily; while the urine tends to accumulate necessitating the use of the catheter. The heart becomes very feeble, the pulse can scarcely be felt. Bedsores are very apt to form. Passive congestion of the lungs occurs frequently. In these cases that the sequelae are apt to occur with a very prolonged convalescence of recovery take place but the majority of cases of this variety end fatally.
The **anatomical characters** as found post-mortem will of course vary with the stage to which the disease has progressed when death took place; the presence or absence of complications and immediate cause of death. If it occur during the first week, the only sign of disease will be in the intestinal tract—chiefly the lower part of the small intestine. Peyer's patches and the submucous glands will be found to be red, inflamed, and visibly prominent, with a smooth surface, surrounded by an inflamed area which may extend not only laterally but below the patch, through to the peritoneum. These glandular patches are filled with a soft material, which appears greyish white on a section, more or less, on examination after staining. The inflammatory process is seen to be due to the presence of a Bacillus (Eberth-Sappey) causing a proliferation of the cell elements, a deposition of granular material for globules in the glandular sacs whose lining membrane is thickened. These sacs may burst, and the contents infiltrate the mucous and submucous layers causing proliferation there, also masked congestion of...
The blood vessels, Involucron states that the deposition takes place on the first or second day, Roussame not till the fourth or fifth. The mesenteric glands are early affected being congested and swollen among most only to the irritation and inflammatory process in the intestinal fist to the actual presence of the Bacilli. The spleen shows the same process chiefly in the Kelpishan corpuscles where the Bacilli are found in abundance. The other organs of the body may be healthy as death-usually due to excess of the poison.

By the second week, the deposit of material in the parotid patches solidifies glands within the inflammatory condition. Set up has produced a hyaline degeneration of the blood vessels of mucus infiltration into all the glandular spaces. Therefore a breaking down of the whole gland. The material undergoing degeneration may be thrown off gradually or through small openings on the mucous surface or may slough off later in one mass. The process in the mesentery glands and spleen is exactly similar except that the glands seldom suppurate to any great extent although small
ucleus may form in the substance of the
gland which are subsequently absorbed. By
this time there may be general semanation
and degeneration processes in other organs due
to the fever but not in a marked degree. Thus
the kidneys may be congested as well as the
lungs & liver. There may also be some con-
sumptive peritonitis without any perforation.
In the third week the ulcerative process
becomes marked - the whole patch may
break down & slough off leaving an ulcer which
may penetrate to the muscular coat or even
down to the peritoneum. The ulcers are typical having
dark, indurated or base but with overlying
edges & varying in size, as it is a Paget's patch,
non-ulcerated gland or a number of these combined
which have broken down. The mesenteric glands
are soft and inflamed with glutinous pus.
The mesenteric glands will also be affected if
there be ulcers in the colon. The spleen
shows swelling not only in the blood spaces
but also in the infarcts caused by the blocking of the blood vessels,
which break down. The liver also frequently
contains palerous of inflammation.


This is the stage at which death more commonly takes place. The following are the post-mortem appearances in a typical case, dying at the end of the third week of the period of incubation from &laquo;Lausanne.&raquo; Dr. aged 28 had passed through the early stages of an attack during which he had great delirium, much vomiting &amp; copious diarrhoea. During the third week the temperature ranged high necessitating daily sponging. Blood was passed in the stools necessitating ice cradle & other treatment. The symptoms became intense. The diarrhoea rather suddenly stopped before death. On post-mortem examination made the day after death—Post Mortem was well marked—blood fluid—great diarrhoea, but no edema. The large intestine was very much distended with gas. The peritoneal surface of the ascending colon was inflamed in patches—was dark coloured & almost gangrenous for about 4 in. in its length & at each in breadth along its free border. There was no purgation. There were numerous ulcers in the ileum—4 or 5 in the ascending colon corresponding to the dark coloured part of the peritoneum. The liver was
Enlarged, dark coloured. Vomited blood especially where it had been impinged upon by the distended haemorrhage colour. The spleen was much enlarged and pulp of dark coloured. The mesenteric glands were also enlarged. The heart was practically normal. The pleural cavity contained a small amount of fluid. The right lung was pressed upwards by the liver remained dark red patches of mottled areas. The brain was practically normal. There was no microscopic examination made of any organ except the spleen a section of which showed the Bacillus a typical growth was obtained both on serum 7 and sterile gelatine. During life the rats lost had been very well marked. In post-mortem of persons dying of intercurrent disease or complications of course evidence of that will be found. The typhoid Bacillus produces the typical lesions in the intestines the mesenteric glands the spleen but the appearances in other organs are due to other Bacilli entering the system partly by the ulceration produced on the intestines, and to the high fever and emaciation.
During the fourth week the ulcers create without any pricking or constriction and without any tendency to reproduction of glandular tissue. The mesenteric glands, spleen and other inflamed organs gradually return to their normal state and small purulent masses being absorbed.

Although the typical lesions in typical form are ulceration of Peyrer's palettes, inflammatory glands, infiltration and enlargement of the mesenteric glands and spleen, the ulcers may be confused in some cases to the solitary glands on the colon. Horner in the British Medical Journal 25th Dec. 1897 has reported a case after noting a number of cases previously reported before the bacteriological tests were so scarce he in a case in which careful examination of Peyrer's palettes by transmitted light failed to reveal the slightest lesion, he microscopically "sections of the small intestine including some of the solitary lymph nodules of Peyrer's palettes showed no lesions except desquamation of the lining epithelium probably an artifact. " While the colon was dilated and thickly studded with ulcers varying in
diameter from 2 to 15 mm. mostly circular in outline and having sharp edges vs. smooth bases. The ulcers were present throughout the entire length of the colon, except for the sigmoid flexure. I reclined "microscopically sections through some of the ulcers in the colon. Studies of hyperplastic lymphatic tissue about the edges will. inflammatory infiltration of their bases." From the spleen colonies were developed which showed all the biological character of Bacillus Typhosus. 

Diagnosis by the aid of clinical symptoms only is difficult during the first few days as is arrived at by noting the gradual onset, headache, progressive rise of temperature, affection of tongue, diarrhea and. There may be confusion with the following diseases chiefly Typhus fever in which the onset is abrupt. The rash comes out early and consists of a reticular motting or miliary spots on the face, forehead, 10. In Typhus intestinal palpation in which there is usually a history of exposure or digestion of diet. Sudden onset. The abdomen is tender all over, especially in right iliac fossa. Temperature not that of typhoid.
Acute Tuberculosis—in which although there is an evening rise of temperature, the progressive rise is wanting. The stools often contain a small quantity of blood, and there is no rash. They may find signs of tuberculous ulceration—tubercular meningitis—only point of resemblance is fever and headache—but the temperature is not that of typhoid fever. There is no rash.

Scarlatina. Cases of typhoid with a red rash and sore throat—i.e. the very early stage—have been taken for scarlatina. But the development of the characteristic symptoms of typhoid in a day or two will decide. A slight delay will diagnose simple continued fever from typhoid also. Alternatively consider the temperature. It serves to distinguish this. The ulcers are not typical.

Influenza. During recent years some cases of influenza show abdominal symptoms with fever and vomiting that are very similar to symptoms of conta-nnuing typhoid. This was particularly indicated in the epidemic of typhoid in Bristol in 1917 (due to milk). It would seem that—some cases there were so
Similar that the serum was not only

depressed one in the early stages.

During the two years the Infection Hospital

has been opened in Newport, the chief

disease erroneously notified as typhoid

has been pneumonia with high fever and

low muttering delirium. They gave a

negative result with the serum test. The

case of cancer of liver and one of abscess of liver

were notified as typhoid in which there

was abdominal pain and irregular temperature.

Both in their course indicated their true

nature. Both were verified by post-mortem

examination. As Newport is a seaport town

many of the cases are imported from foreign

ports. These cases have usually been ill

some days or some weeks before coming here.

Some of these may have been working all-

though ill almost up to time of falling into

the port. The diseases I have found most-

difficult to distinguish from typhoid are

depending if there is also agree (one has to

settle the diagnosis at once in these cases)

I cannot always see the stools which

in such a case would aid the diagnosis.)
Ulceration colitis, appendicitis, typhilitis, & perityphilitis. It is in such cases where all besides occurs that the serum test is so useful not so much that its absence is proof of the absence of typhoid as that its presence is a proof of the presence of typhoid. The extreme importance of an early diagnosis of typhoid has resulted in various tests & reactions being brought forward within recent years. One of these is known as Ehrlich's Diaczo Reaction. Ehrlich originally used two solutions (Charite Annalen VIII 1883) A. A saturated solution of Sulphanilic Acid & a 5% solution of Hydrochloric Acid B. A 0.5% aqueous solution of Sodium Nitrite. 40 parts of A are mixed with one part of B to form a test solution. Equal parts of this test solution of urine from the suspected case are mixed with the mixture rendered alkaline with ammonia. Normal urine gives a yellow or orange colour while the urine of typhoid gives a deep reddish colour very like that of port wine. On shaking the fluid becomes pink & on
Standing for 24 hours a greenish precipitate forms. Hewlett in the British Medical Journal 18th January 1916 noted that certain precautions should be taken. The solution of sodium nitrite should not be more than a day or two old; it is better to prepare it as required. The test-solution should be mixed at the time of use. Any excess of sodium nitrite must be avoided. In cases of a pseudo reaction, a haematinic may be obtained. The urine should be freshly passed voided. He gives the names of a very large number of substances listed by himself to others to see if they can give the reaction but with a negative result. He states he found that some substances gave a reaction at all resembling it was morphine and its salts. The nature of the substance that gives the reaction is still unknown. Cultures of Bacillus Typhi do not fail to give the reaction. The principal diagnostic point is the presence of the Ebner-Jaffé-Bacillus and taking into account the history of the case. Its chief characteristic is one that would naturally come to the experimenter as being certain to contain the Bacilli may specially...
in the Stools) thrown off from Peyer's patches.
Two methods may be used in the isolation of the Bacillus typhosus from Stools (Richards in
The British Medical Journal 25th December 1887).
In the new method, urine is made of a gelatinous
medium so combined with potato extract and
potash that the growth of all bacteria is
restrained except that of typhoid. Colon Bacilli and these two organisms grow in such
a way as to be easily distinguished.
Bapalde uses an agar medium upon which the
typhoid and Colon Bacilli grow in a
manner sufficiently characteristic. By this
method the only restraining influence is that
exercised by the temperature of the incubator
in which the organisms are grown. For
details see Zeitschrift fur Hygiene Vol.
xxii p. xxiii. It will be readily understood
that these methods are extremely difficult
of use. The differentiation of the Bacillus
mendesis from Stools is rarely attempted.
It is more easy to obtain the Bacilli from
parts of the mesentery stained with
methylene blue but
that one process is useful in cases that have
ended for
If without a definite diagnosis
Having been allowed 3--4 mos. specially when
on post-mortem examination, the intestinal
lesions are atypical.

The Bacillus Typhosus (Stevenson. 'Murphy Section
on Hygiene & Public Health. Vol ii p 168) consists of a
cylindrical rod of varying length, with rounded and
having numerous flagellae. Vi i. Huis mi. Vi fresh
State possessing of action locomotion. They grow well
at 16°-20° C on 9th gelatine 'butter of course at 25--
37° C e.g. in alkaline broth, on agar, in gelatine
on blood serum. On soluble potato at 35-37° C
they grow in a fairly characteristic manner
spawning in 1--2 transparent thin pellicle whose
thickness increases as the growth proceeds. On
the surface of gelatine they form colonies visible
after 36 hrs as translucent-banded dots which
during Vii 3 / 4 4 th days become flat translucent-
plaques with crenate outline; under the micro-
scope they are brownish in transmitted light.
Granular in streak cultivation. The line of
muculation becomes marked after 2--3 days
as a greyish translucent band with uneven
knobbed crenate outline; in State culture
the State after a few days is seen as a grey line
under the microscope, in transmitted light.
it is made up of light-brownish droplets; on the surface of the stab is a crenate thin grey plaque. On agar they form a rapidly growing, paint-like, cohesive greyish-white To light-brown pellicle; broth is made uniformly turbid after 48 hours a greyish powdery or flocculent pre- capitate, no distinct pellicle being formed. The broth culture gives no indol reaction, with sodium nitrate 4 Sulphuric Acid (Preliminary report on the growth of the typical Bacillus in soil by Sydney Martin M.D. 26th Annual Report of S. S. B. 1876-77 p 231). Bulk is not coagulated with a Shake gelatin culture no gas bubbles are formed. The Bacilli are facultatively aerobic but can be cultivated as an anaerobe 7 days in an atmosphere of Carbonic Acid. As regards resistance to external conditions it can withstand a great degree of cold for instance °C a week lower. It is also somewhat resistant to heat. It is closely related in this respect to the Bacillus coli communis which is on the whole more resistant than Bacillus typhosus. A method of differentiation between these two Bacilli by Dr. Hess is given in the British Medical Journal 1878 Dec 18.
other plate culture. The tube medium contains agar 5g, gelatine 80g, Bact. 5g, extract of beef (Liebigs) 5g, glucose 10g. To the tube 1% has a reagent indicating 1.5% of normal acid, phenolphthalein being the indicator. The plate medium contains agar 10g, gelatine 25g, Bact 5g, beef extract 5g and glucose 10g. This tube reacts 2% acid to phenolphthalein. The Bacillus typhosus alone, of all the organisms investigated during these experiments, has displayed the power of giving rise to thread forming colonies on the plate medium. When kept in a temperature of 37° C.

Hlein has found a Bacillus in the glands of a case of Summer diarrhoea of children extremely like typhoid Bacillus in all respects. The only difference he states is that the Bacillus of typhoid possesses a markedly lower resisting power to Perchloride of Mercury. The Bacillus of Summer diarrhoea grows fairly well though retarded as gelatine to which Perchloride of Mercury is added in the proportion of 150 000. While such an addition has a much more marked retarding power on the typhoid Bacillus (Sherron. Medical Journals on Hygiene and Public Health)
The Bacillus typhosus is extremely motile owing to the presence of flagellae. Its stain is not easy. The usual method used is Van Sprangen's. In the British Med. Journal of April 17 1877 McCorrie has published a method— he uses 10 c.c. of a concentrated alcoholic solution of "signet-blue" as an air-line blue.

+ 10 c.c. of 10 per cent solution of alum.
+ 100 c.c. of a 10 per cent solution of boric acid.

It will be readily understood that all these methods of differentiating the Bacillus take up a considerable time—time which, especially in the case of typhoid so of the intestinal— importance not only with regard to the future treatment of the case but to the early recognition of the source of infection. Charles Dodge Bacteriologist can be used early but it is not limited to typhoid only, a similar reaction having been found to take place in pneumonia, pyemia and some other diseases. It is on account of this that Wilder's sero diagnosis has become so important.

For some years numerous observers (Chapin, Douglass, Hanoff, Riffuer with Metchnikoff and Mabel) have noted that the serum of an animal unvaccinated against some particular Bacillus...
Exercised a peculiar action on cultures of
that particular Bacillus causing the Bacilli
to rapidly form masses or clumps. Widal was
the first to show that this reaction occurred
long before the stage of immunity was reached.
It took place in the case of typhoid at a very early
day in the course of the fever. The procedure
usually carried out is as follows. A small quantity
of blood is drawn off the suspected case usually
from the finger into a glass capillary tube or
filled into a tube of medium which has been heated
drawn out into a pipette. The tube is carefully
sealed up. Five loops-fulls of a 24 hour bouillon
culture of similar Bacillus is placed on a slide
and five drops-fulls of serum from the pipette, now
of course broken. These five loop-fulls are
mixed advantageously under a microscope. A
positive reaction consists in the Bacilli almost
at once forming clumps by leaving clear spaces
between. The Bacilli in the clumps have lost all
movement. The important points to notice
are (1) The culture and must be constant —
show no signs of clumping — Alternated cultures
will clump with almost any strept —
(2) A 1 in 9 dilution of the strept is usually
and but 1 to 2 may be used as a check.

(3) It is necessary to have a limit. Most observers hold that half an hour is a sufficient interval.

(4) The nature of the clumping must be typical being well marked and rapid. With an almost absolutely clear field between the clumps of motionless bacteria.

It has been found that dead bacteria also give this reaction but Smeaton states that the reaction is not so typical but so good as the clumping is not so defined their tubes spaces not so clear.

A great deal has been written lately on this reaction and I would refer especially to a paper on "The Technique of Serum Diagnosis with special reference to typhoid fever" in the British Med. Journal April 17th 1897 by Professor Delahaye and a paper by Tison in the same Journal of July 31st 1897 on "Weibel's sero-diagnosis of typhoid fever" both of whom give numerous references at the end of their respective papers showing the evolution of this method which as it is diagnostic during the first week of the fever is now very commonly employed.
Prognosis

The mortality varies consider-
ably in different epidemics from 15 p.c
to 25 p.c. The mortality in Newport in 1896
of all notifications of typhoid was 21 p.c. 1
in 1897, 11.05 p.c. In the Infectious Hospital
in 1896 the mortality was 13.3 p.c. 1 in
1897 it was 19.6 p.c. but it must be remembered
that all the worst cases go to the Hospital
all the Ship's cases; the patients from the
poorly-paid part of the town I one would naturally
expect the mortality to be high.

It has been stated that persons who have been
living exposed to the possible causes of typhoid such
as drinking from a sewage contaminated well
for some time are more liable to a violent
attack should the water become infected with
the definite germs. There is no marked difference
in the mortality in men or women on account of sex.
Of course old age is unfavorable—

During the course of the disease the Chief
points unfavorable to prognosis are Cardiac
weakness, shown by the scheme weakness of
the pulse; 2 great prostration; 3 some abdominal
pain—some diarrhea with excessive
hemorrhage—symptoms of peritonitis—
Excessively sympaties which seems to point to paralysis of the large intestines.
The most important guide is the temperature.
A very high temperature is unfavorable—a gradual fall frequently denotes haemorrhage if accompanied by acute abdominal pain and collapse points to perforation, which is an extremely serious complication. A rapid rise would point to the onset of some complication such as pneumonia. If it is unfavorable, it has been noted that in mild cases the temperatureUntitled page
Treatment

Prophylactic or Sanitary.

It is within late years that the effect of efficient sanitation has been able to point to typhoid as a disease that can at least be kept within bounds if not eradicated by cleanliness and good water supply. This is well seen in the maps and charts placed between pages 106-107 in the supplement containing the Report of the Medical Officer - Twenty fourth Annual Report of the Local Government Board 1896-97. In the chart by Dr. Bulstrode it is shown that in South Wales (of which Coalfield Newport is an outlet) in the decade 1871-80 the annual death rate from Enteric (with Cholera) from was 5.8 per 100,000 living whereas in the decade 1881-90 it had been reduced to 2.9 per 100,000 or exactly one half. From this it will be seen that it is extremely important that:

1. The drainage of the land should be thorough so that the subsoil water shall be kept as much on a level as possible.

2. The land on which houses are built, especially on the outskirts of large towns should be sodded. If the land be alluvial clay
as it is in Newport-on-Heath and Wavering.

1. Unvallast ed the floors should be raised from the surface of the ground by a damp proof layer formed as of cement on the part the house is to stand on as well as damp proof courses on the walls.

If the land is vallast ed the same should be done but there is less chance of damp. It is more important that the composition of the vallast should be noted that it is not contaminated with human refuse.

3. The excreta of cattle from the houses should be removed quickly and efficiently. In this respect the removal by the agency of water is the best provided it is done in a proper way. If it is imperfectly done it is absolutely injurious and previously shown a most efficient way of propagating the disease. It is in this respect that the greatest advance has been made. It has been noted that it is essential to have

(a) The sewers wide, light, large and well ventilated. Of course the sewers are perfectly airtight so large that the section at Gravelin is more than the sectional
character of the combined drains running into the sewer, which the siphon wall at an
opening an would blow away provided
there was sufficient fall. But this appears
impossible in practice. The result being
that the air in the sewer leads to flow
against the current of sewer in sewers
where there is little fall and seek the highest
corps to flush out. The pipe apt to pass any defective
traps.

(6) No soil pipes or drains should be laid under the floors as it is well known that
the upper surface of these pipes tends to
corrod. The drains should have a trap in
their course on immediately leaving the
house. A ventilator between the trap
in sewer. They should not by any chance
have any connection through a trap or
otherwise with the system of drinking water
cases have been known where such traps
have been accidentally sucked dry with the
result of the drinking water being contami-
nated —

The Bacilli have not yet been found in
sewer gas but various epidemics such as
The one notion here would tend to force that there was something in the gas which could propagate the disease. In the discussion on sewer ventilation reported in the British Med. Journal of August 31st 1895, Barry Laws stated that experiments showed that "it is extremely difficult to find any evidence of the presence of the typhoid from bacillus in ordinary sewage. That instead of sewage being a favorable soil for its indefinite multiplication as stated by many advocates it gradually but surely exterminates it." He therefore considered that sewer gas produces bad effects "from the presence of some volatile and highly poisonous compound or compounds possibly of an alkaloidal nature."

This may be so but as in the epidemic above noted it is impossible to ignore the fact that the sewer gases played in the dissemination of the disease. It would seem as Hill pointed out in the discussion just alluded to that purification was required which does not usually take place in sewers but in the drains. The epidemic at Durness.
Street Map of Newport.
Showing Locality of Infectious Diseases, Year 1897

SCARLET FEVER —
TYPHOID FEVER — *
DIPHTHERIA — X
distinctly pointed to the initial cause—being the contamination of certain of certain house drains & mains the main sewers by emanations from Hydro’s patients who were infected by drinking sewage containing & diet water from wells—i.e., the disease was carried into various houses & persons were infected in those houses in which insanitary house drains were faulty—

that the opening of ventilators into the sewers on the street-level allowing of the escape of pent-up gases & the admission of fresh air (oxygen) in large volume into the sewers at once cut short the epidemics.

Allowing that exhalations from contaminated & infected air produce the disease by placing the method of street-infection as stated by Breckley, Medical Officer of Health, London in the British Med. Journal of Aug. 31st 1845 In which, the contaminated parts either not disinfected at all or imperfectly disinfected were the mediums of infecting numerous persons even though there was no actual contact—by these persons with the
fields, in the pails. The difficulty in such outbreaks being of course to prove that there could not have been any personal contact with the contaminated field.  

4. The drinking water should be pure. To obtain this the drainage area supplying the drinking water requires investigation periodically, that it may not be contaminated by decomposing animal matter - in this respect upland grazing land is better than land with cultural ed manured. The water itself requires periodical testing although unfortunately this does not mean absolute safety as the contamination may be as in were transitory or on the other hand so slight as not be able to be detected yet produce the disease. Any well bed requires careful attention. The pipes carrying the water must be tested to be certain that contamination can occur in them. All persons should be supplied from some public source that is under proper control and should not be allowed to use water from wells that can be contaminated by surface drainage or are liable to contamination from a distance through.
porosion through the soil. Water is without doubt the chief method of dissemination, owing to the small relative amount of contamination required and the large number of persons usually using the water supply. Furthermore, the chief danger in the propagation of dysentery.

(5) The milk supply should be under control

(a) with regard to the cleanliness of the cows' houses & of the cows themselves

(b) with regard to the water used in the cleansing of the utensils used. No wells or cisterns should be utilized for this purpose, unless the water from it has been boiled for a considerable time.

(6) The cleanliness & ventilation of the dwellings of the poor. Especially in populous districts they should be under strict control as ward of Union certainly assist in the propagation of the disease. Not only by the very fact of dirt being a nidus for the bacilli but because such surroundings render the inhabitants more liable to any disease. Fresh air & sunlight has been found to have a marked effect on the prevalence of the germ.
Personal & therapeutical treatment.

When a case of typhoid has been diagnosed it is best if possible to remove the patient, isolate him & place him under the care of trained nurses. Amongst the poor this care only can be done in an Isolation Hospital.

The good nursing of a typhoid patient is of much more importance than the medical treatment. The importance of getting the case under efficient care in an early stage is well known.

If the patient has to be treated in his own house all the usual steps should be taken to place him in a large airy bedroom from which everything has been removed except what are absolutely necessary. He should be kept closely in bed from the first - he should not be allowed even in the mildest cases to get up to evacuate or than his bed made. An attempt should at once be made to trace the source of infection attention being especially given to the drains, water supply & milk supply & whether the patient's habits the onset & eating some special articles of diet such as oysters, ice cream, his weakness & if so whether these cause it.
The medium of carrying the germ.
The greatest care should be exercised by all those coming in contact with the patient to remove all excreta at once, desconfining linen with 1-20 carbolic or 1-800 formalin. The same care should be taken with the surrounding. The nurses' hands should be carefully cleansed after any contact with the patient or soiled linen. All utensils used by the patient should be carefully cleansed. Bedclothes should be changed frequently with all soiled linen placed at once in some disinfecting fluid.

The diet is most important. It should always be light and easily assimilated. Therefore milk and soups are usually the artistic word. I only allow milk with a small amount of stimulants at first, but some allow a large amount of beef tea. The amount of milk varies on the slightest sign of flatulence. At first, milk in the Wacalatins, the amount is reduced. It is given often in small quantities alone or with lime water. Especially when there is any tendency to vomiting, some advise the addition of ice to sterilise the milk but if the
milk is really good, I assure suspicion feeling it does little good. I have given small quantities of some of the essence with advantage. I have found great benefit from giving some spirit, usually Brandy, from the early stages. Increasing the amount of the lead shows any signs of failing. In some cases, until complete restoration is Pulse, extremely from where there has been considerable hemorrhage. During the third week I have increased the amount to 16-20 oz. in 24 hours continued for 3-4 days with the result of saving the patient over the critical period. The Brandy does not produce any of the usual symptoms of intoxication but makes the patient queasier. Certainly thickens the pulse. The regular feeling careful avoidance of all solids is most important, even after the patient has become convalescent. Nothing will bring on a relapse quicker. With more certainty than injudicious feeding a large proportion of third cases will pass through an attack of fever excellently under careful nursing.feeling only of the majority of practitioners seem to recognize this. I only
use medicinal treatment as symptoms call
thus if the case be an ordinary mild attack a simple Fever mixture only is given such as
Ac. Sulph. dil. 3 IV
Lun. Sulph. 80 VI
Syr. Aurant. 3 VII
Ag. Arsen. ad 3 VI.
Sig. 3 No. in water every 3-4 hours
If the case is one in which there is complication the exhibition of Colomel 80 IV to VI alone or with Pulv. Galap 30 X every second day will do good & is generally preferable to frequent enemata or the use of Suppositories.
Should the bowels move 4 or 5 times in the 24 hrs there is no use of any astringent—but if the diarrhoca be excessive the following is useful.
Syr. Met. Calcarea 90 30-60
Syr. Effiri 30 X
In 1 Cret. Fil. 30
Sig. 3-4 Times a day—
or may use R. Cup. Sulph. 80 1/2
Ag. Arsen. ad 2
Sig. 3 or Somat. every day.
Sometimes find it very useful to give Harsh enemata not too large.
Hyperpyrexia is treated by quinine in doses of 20-xx-xxx or Salicylate of Soda in xxx form usually with Brandy. If the high temperature continues use an ice bag or the suspended from a cradle, cold sponging or cold pack in which the patient is enveloped in a sheet-worming out of cold, sometimes ice cold, water foot, and then in blankets, or place the patient in a bath in which the water is lukewarm 4 to which cold water is added until the patient's temperature is brought down to about 100°F. These measures are enumerated in order of severity. If this fails should only be used as a procedure of emergency.

Cardiac depression when the pulse although rapid becomes soft and imperceptible is treated by ipecac digitalis in 5-10 drop doses, Stephanius (tinct.) in 3-8 drop doses, Ether sulph 1 in 15, Brandy in varying amount but not less than 3fl oz every 3 hours. Strychnine is also very useful usually given hypodermically 1-80°-1-100° of a grain.

Haemorrhage from the nose may require plugging from the bowel is best treated by strong suspension internally in 31 doses or by
Lei. Ferri per os. In 2-4 days, the use of the ice bag or cradle is also useful. Sympathectomy may be treated by suspension of the colon, an omentum, or by passing a long tube into the descending colon. The intravenous administration of 1/2 or 1 hour of thiopentone or the same drug intraperitoneally is useful. Acute abdominal pain may be alleviated by hot compresses on the abdomen, the addition of Belladonna and Epsom salts, or gauze. Peritonitis is treated with a hot bag of fine gauze applied locally.

Perforation of the colon or the stomach to perforation having occurred then the question of surgical interference must arise. Some cases may certainly show all the typical symptoms of perforation, yet recovery is certain. Time is always a considerable factor in operating except as a last chance. The mortality after operation is extremely high, which one can hardly understand. Must in the case of an operation performed as the last hope of saving life, where when one operates on perforation may be found there is certainly...
That another dose not already exist or will subsequently be produced. Some cases of
undoubted peritonitis are very capably in
others the amount of extravasation is small
and sets up an adhesive inflammatory action
shewing together the coats of intestine Vallowing
the extravasated material to work up to the
abdominal surface in the effort to discharge
itself without setting up any general
peritonitis. I have operated in one such case
only. J.G. aged 24 yrs a marine engineer
was admitted into Hospital on the 29th June
1897 from a ship on board which he had been
feeling ill with headache, slight diarrhoea for
three weeks, yet he so little realized the
seriousity of his illness that having been told
that the ambulance would be sent to the
Dock for him in an hour or so he got up &
dressed & Mandy to be ready. On admision he
had all the symptoms of typhoid except that
there was rather a tendency to constipation,
on the 1st July he had sharp abdominal pain
a marked drop of temperature from 102°7 to 98°7
He vomited frequently, there was sharp diarrhea
& the lymphatics slight on admision, bowels—
marked. The pulse rate rose from 60 to 96 in
the minute. This was probably the period
of perforation. Next day his temperature
rose to 101° and he had paroxysmal pain in the
abdomen with slight tenderness in the right-
lobe fossa could be detected with slight dull-
ness and localized tenderness. The stools were
very offensive and contained small clumps. There
was profuse sweating and the urine contained
a trace of bile. For the next four days he
remained in status quo but after that he
became markedly weaker and the localized
dullness and tenderness in the right flank region
became more marked so much so that on
the 14th July I decided to operate. On making
an incision through the peritoneum over
the centre of the dull area I opened at once
into a collection of very offensive pus which
was completely shut off by adhesions from
the general peritoneal cavity. I washed out
the cavity which passed downwards and
backwards towards the cæcum, with
sterilised water. Upon a drain I did not con-
consider it advisable to break down the strong
adhesions and find the perforation. He stood the
operation well but there was no permanent improvement in the symptoms. On 12th July the vomiting recommenced; even though the discharge from the wound was free it contained faeces. The urine had a continuous of wine and became delirious. The comatose and died on the 16th July.

The abscess cavity led to a perforation about the size of a shilling in the descending colon. There were other ulcers in the colon which had penetrated to the peritoneum but not through. Had the patient relapsed into delirium I should have thought that the symptoms at the time of perforation hardly warranted operation. I tendered to adhesions forming to stuff off the extravasated blood, matter from the general peritoneal cavity. This certainly did happen but the opening of the abscess cavity thus formed of draining it had not a happy result. It would certainly be better if one could be perfectly certain of perforation to operate at once but the symptoms sanguine, desire of perforation so markedly some times and yet there is recovery that one is apt to hesitate. This patient's brother had been operated on in America for perforation with success.
Based on the medicolegal origin of the form, some authorities have advocated the injection of drug that would aid in rendering the intestines aseptic. This is, of course, by no means an easy matter as the drug would have to pass through the stomach. The greater part of the small intestines before it reaches the affected part. Carbonic acid in 1–2 drops doses has been used. One of the latest reports on this treatment is contained in the British Med. Journal of May 29, 1897 by Phaeten who gives the result in 23 cases treated by carbonic acid in 3 m doses well diluted as 4/3 per cent. of water

Salol has also been used with the idea of getting rid of the poisonous material thrown off into the intestine as quickly as possible. A saline purge has been given at the beginning of the attack followed up by Colonol or grey powder in small doses alone or combined with an antispasmodic during the course of the attack. The Colonol of course acting both as a slight purgative or antispasmodic. This form of treatment is useful in the cases where there is consciousness but requires careful watchful when hemorrhage present
Some authorities have advocated the treatment of all cases of typhoid. In this method the patient is kept constantly immersed in a bath kept at an equal temperature. Its advocates state that the results are good that the patient feels extremely comfortable and that there is less risk of hepatic, cerebral, and cardiac disability, and also of perforation, than in any other form of treatment.

Within late years Typhoid treatment has been brought forward in the case of Typhoid as in all diseases due to Bacillus a serum. Ernest Steele has reported a case in the British Medical Journal of April 17, 1897, in which he attributes the favourable result to this treatment.

In the preceding pages, I have endeavored to state briefly the present position of Typhoid fever.

There are still many points of utmost importance not definitely settled such as whether the path is the natural habitat of the Typhoid Bacillus or whether the Bacillus known by that name is not simply a depauperate form.
of a bacillus normally present in the human intestine in a harmless state. It is not intended to show that this theory is probably correct.

The action of the typhoid bacillus on human blood has still to be determined as although the serum has not been found in the food itself yet it produces some profound change in the serum. That is shown by the action of that serum on cultures of the bacillus.

The method of injection without direct personal contact with typhoid excretions is still in a doubtful stage. What it is that is in serum gas that can produce typhoid has yet to be definitely settled. The growth of the bacillus in certain soils is still under investigation and the importance of this is very great especially with regard to the eradication of the disease. There is no doubt that better treatment, better nursing, better methods of isolation has resulted in reducing the mortality rate on the last 20 years. But still it is certain that the chief factor in the improvement has been improved sanitation in its broadest sense.

The growth of the bacillus in certain soils
increases the work of the sanitary authorities as those so-called infected areas will have to deal with. If typhus is to be relegated to the position of an almost unknown quantity as typhus fever has been by similar methods.