AN OUTBREAK OF TYPHOID FEVER DUE TO AN INFECTED PUBLIC WATER SUPPLY.

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My reason for reporting the following outbreak is that it seems to me to aid in establishing the fact that a single case of typhoid fever may so infect a large body of water as to reproduce itself among those dependent upon the same body of water for their public supply, even though said supply be taken at a point some distance from the point of infection.

Most of the well-authenticated outbreaks of typhoid due to infected water supplies belong to one of two classes:

First. In which the water infected is small in bulk.

Second. In which the infection is great and its action more or less continuous.

In the outbreak which I am about to report to you the bulk of water infected was large, its infection was sharply defined and its origin, I believe, was in one case of typhoid.

In Paterson, N. J., a city at that time of 103,000 inhabitants, there developed, between September 15, 1896, and January 1, 1897, two hundred and thirty-three cases of typhoid fever.

These cases developed as follows: During the last half of September, twenty-six cases; during October, forty-one cases; during November, one hundred and eight cases; during December, fifty-eight cases.

The typhoid rate had been normal before September 15, and immediately fell to normal after January 1, only seven cases developing during January and February. For the same period—September 15 to January 1—for the five years preceding 1896, the average number of cases had been fifty.

It is evident from the above that some special cause must have existed in order to account for this great, sudden and sharply defined rise in the typhoid rate.

A careful general investigation, as well as one of every individual case, was made, with the following results:

The disease was evenly distributed throughout the city, except in one district, containing about two thousand people, and among all classes of the inhabitants.

No particular neighborhood or special class of the population was affected.
The cases could not be divided into groups in any way.
There was no common milk, ice or food supply.
No possible common means of infection could be found except the public water supply, upon which all of those affected, with the possible exception of two or three, were dependent for at least a portion of the twenty-four hours.

It also appeared that the only section of the city which did not contain a single case of the disease was also the only section not furnished with the public water supply.

The condition of affairs existing in the city of Passaic, 18,000 inhabitants, situated about five miles below Paterson and supplied from the same intake and reservoirs, was investigated.

It was found that between September 15 and January 1 sixty-eight cases of typhoid had developed there.

The normal number for the same period would have been about ten.

The source of the water supply for both cities is the Passaic river, the intake being at the Great Falls, within the limits of the city of Paterson. From this intake are pumped daily about 20,000,000 gallons of water to the distributing reservoirs.

About 18,000,000 gallons are used in Paterson and 2,000,000 in Passaic. The average daily flow of the Passaic is about 500,000,000 gallons. The flow within the limits of the time specified was considerably above the average.

The current is about one-sixth of a mile an hour.

Beginning September 23, chemical and bacteriological examinations of the waters of the river were made with the following results:

Above Little Falls, a village situated three miles above the intake, the water was found to be of good character, showing chemically no evidence of harmful pollution, and bacteriologically no common colon bacilli and an average of three hundred bacteria to the c. c.

Below Little Falls, chemical evidence of harmful pollution was found, the average number of bacteria per c. c. was six hundred, and in ninety per cent. of the specimens examined colonies of the common colon bacillus appeared. On a specimen taken at the intake on September 23, Dr. Connolly reported as follows:

"Tests for typhoid bacilli revealed the presence of a non-liquifying active motile bacillus, which did not produce gas in the presence of culture media containing sugar, nor did it produce indol, and in other respects was identical with the typical bacillus of typhoid fever."

The chemical part of the above examination was made by Professor H. D. Cornwall, of Princeton University, and Mr. H. B. Baldwin, of Newark; the bacteriological part by Dr. R. N. Connolly, of Newark, and Dr. H. D. McCormick, of Princeton.
A careful investigation of all known cases of typhoid fever within the drainage area of the river, and a house to house inspection for the purpose of discovering unknown ones, showed only one possible source of the infection.

A resident of Little Falls returned from a summer resort ill with typhoid fever on the twenty-eighth of August. The fever subsided about the first of October, but a relapse followed, lasting from about October 8 until the end of the month, when final convalescence began. The water closet receiving the discharges of patient was connected with a series of cesspools, connected with each other by overflow pipes, and the last cesspool of the series discharged through a hidden pipe into the river. These cesspools, having thus become infected about the first of September, continued to receive fresh infection until about the first of November, when the patient was actually convalescent.

The conditions existing in the cesspools being favorable to the growth and development of the specific bacillus, such infection became more and more virulent, continuing after all fresh infection had ceased. Thus the river had been more or less continuously infected by these cesspools from about September 1 until November 24, when said discharge pipe was discovered and further infection from that source prevented. Not more than twenty-eight of our cases were infected after this date, and of the twenty-eight cases, eighteen were infected within the first week and seven within the second week after it.

Thus it appears that within two weeks of the shutting off of fresh infection, the typhoid bacilli already in the river had practically disappeared, owing to surrounding conditions not being so favorable as in the cesspools and to the effect of the downward flow of the current.

It seems reasonable to believe, however, that the infection of the river, with its attendant results, might have continued indefinitely, owing to the conditions favorable to bacterial life existing in the cesspools, had not those sources of infection been discovered and cut off.