

A TYPHOID FEVER EPIDEMIC TRACED TO CHEESE

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DURING the summer of 1917, a rural typhoid epidemic which presented unusual features and led to unique results was investigated by the Engineering Bureau of the Michigan Department of Health. Bath, an unincorporated village located about eight miles northeast of Lansing on the Jackson-Saginaw branch of the Michigan Central Railroad, was the center of the epidemic. The population of the village is estimated at about 350. The population of Bath Township was 1021 in 1910.

The surroundings of the village may be classed as high-grade agricultural territory. Because the town is situated so close to Lansing and has fairly good train service, retail business is somewhat restricted. The business places and public gathering places in the village are: Three general stores, one drug store, one barber shop, one hotel, one bank, one implement store, one blacksmith shop, one garage, one elevator and lumber yard, one schoolhouse, one railroad depot, one I. O. O. F. hall, and two churches.

A total of 51 cases occurred in and around the village from May 25 to July 11, resulting in four deaths. On June 6, the health officer of Bath Township, requested aid by telephone of the State Department of Health in suppressing typhoid fever within his jurisdiction. A doctor was at once detailed to make an investigation and at that time there were eight cases and one suspect visited. No common cause appeared and nothing further was done, until, on account of the gradually increasing cases, an extensive investigation was begun on June 22. On July 5, several cases were reported from Ypsilanti and Lansing, which subsequent study showed to be connected with the cause of the Bath epidemic.

At first the usual methods of procedure were pursued. Water and milk, as sources, were promptly eliminated be-

cause there was evidently no supply of either common to the majority of the cases. Infection by flies was given but little consideration because there were so few at that season of the year and particularly because the weather preceding had been so cold and damp.

Attention was directed toward the public gatherings that had recently taken place. These were three in number, as follows: May 11, "pot-luck" dinner on the school lawn; May 23, Bath High School reception at the I. O. O. F. Hall; May 24, a luncheon at the school house. A school teacher furnished the names of the persons attending two of these functions and a list of the articles of food served. At the "pot-luck" dinner there were sixteen persons present, six of whom contracted the disease. At the luncheon on the school grounds, thirteen were present, three of whom subsequently had typhoid. A list of those at the reception could not be obtained. The articles of food used at these gatherings included potato salad, fruit salad, fruit jello, cheese, pickles, cookies, ice cream, lemonade, hot chocolate, cake and coffee.

ICE CREAM

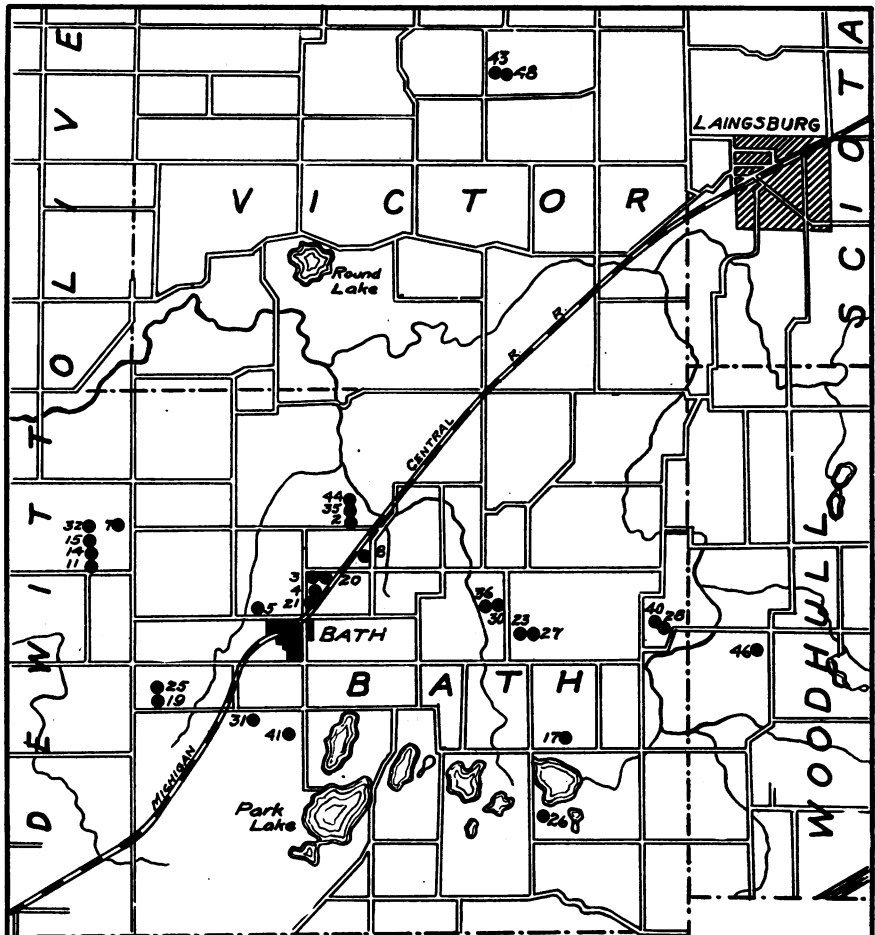
Suspicion was directed toward the ice cream and for a time the indications were that it would prove to be the cause. However, it was found that it was manufactured at Owosso, in a strictly modern factory which possessed all of the facilities which could be wished for to protect the quality of its products. The milk was pasteurized before coming to the factory and again before being made into ice cream. It was made in large batches and was handled exclusively by machinery. The company was furnishing ice cream to over 100 cities and villages during the period in which infection would have been distributed. As no typhoid appeared elsewhere traceable to the ice

cream of this company, it seemed highly improbable that a single shipment to Bath could have become accidentally polluted. Not all of the cases could be shown to have eaten ice cream within the critical time. For these reasons, ice cream was eliminated as quite evidently not the cause of the epidemic.

With the rejection of these usual causes, the indications were that the search would be unsuccessful in locating the source of the epidemic.

CHEESE SUGGESTED

In questioning the wife of one of the cases, a farmer forty-seven years of age,



Note - 22 cases were in the Village of Bath.

**LOCATION OF RURAL CASES
TYPHOID FEVER INVESTIGATION
VILLAGE OF BATH, CLINTON CO.
MICHIGAN DEPT. OF HEALTH
BUREAU OF SANITARY ENGINEERING**

living one and one-half miles out of the village, attention was called to the fact that she had been away visiting and that during her absence, her husband had eaten considerable cheese, but no ice cream. The mother of another case mentioned cheese as an article of diet and wondered if it might be the cause. These hints led the way to the solution. A reconsideration of the histories, supplemented by additional questioning, developed the fact that nearly all of the primary cases had been eating cheese during the probable infection period, and were fond of it.

About this time, the investigator learned of the illness of a woman at Henderson, about twenty-five miles distant and he went to her home to obtain a history of the case. He found that she had gone to Bath on the noon train on May 15, having had her lunch at home before leaving. She visited several friends during the afternoon, but had nothing to eat nor drink until she took supper with friends and returned to her home on the evening train. It was found that cheese was served among other articles of food, at the evening meal. Both the husband and wife noticed how heartily their visitor had eaten of the cheese and remembered a conversation in which the guest had complimented its quality.

The case of a woman and her son from Oakley, employed with an extra working party on the Michigan Central Railroad, supplied additional information. The mother was the cook for the railroad gang and her son was one of the laborers. When the party stopped at Bath, cheese was bought at the village store. Both mother and son contracted the disease.

May 19, a birthday party was held attended by about sixty relatives. Each family brought various articles of food, no ice cream was served. Water was from a source above suspicion. Milk came from the family cows. One of the relatives brought cheese. At the "pot-luck" dinner at the High School, May

11, cheese was served. The possession of these items of information left little doubt that the cheese was the carrier of typhoid organisms.

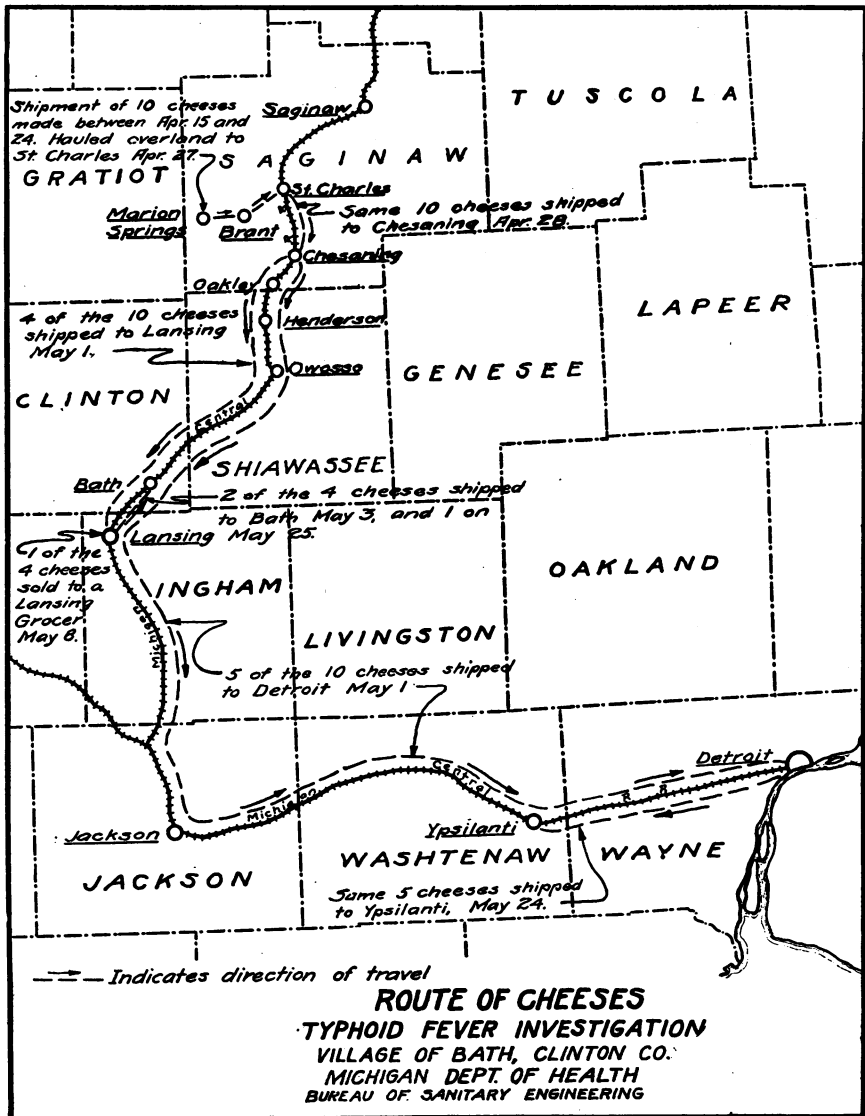
TRACING THE CHEESE

The real problem then arose; how was the cheese made? Was it infected, and if so, how? Inspection of the books of the two store keepers at Bath showed that each had bought two cheeses from a Lansing wholesaler, one each on May 3, and one on May 17, and one on May 25. No others had been purchased within that period. As the boxes had been destroyed, no evidence was available to show the brand, manufacturer, date, nor anything else, except where they were purchased. The records of the wholesale house were examined and it was found that two particular brands were being sold in and about Lansing and that they had purchased four cheeses on May 1, and 39 on May 10, from Chesaning, Michigan. This information was received on July 26. On that evening another department investigator returned from Ypsilanti where he had been studying a typhoid epidemic but had not been able to discover any connection between the cases. He immediately went back to Ypsilanti and began following up the cheese clue.

It was found that cheese from Chesaning had been sold to Ypsilanti by a Detroit jobber on May 24. This consignment was a sample lot of five cheeses, all of which were sold to the Ypsilanti grocer. Further investigation developed the fact that these five left Chesaning on the same day, May 1, as did those shipped to the Lansing wholesaler and subsequently sold to the Bath merchants. It was learned that the Chesaning Company bought cheese from a factory at Marion Springs. The books of the cheese factory showed that ten boxes of cheese shipped to Chesaning on April 27, were made between April 15 and 24. These goods, therefore, should be considered short-cured cheese. Short-curing re-

sulted in mildness which made them especially popular with certain retail buyers, and probably added to the amount which would be consumed at a given meal. The dates indicate that only about one month elapsed between the time that the cheese was made and the last date it was put on sale. The shortest time which elapsed between the date of manufacture and the time of retail sale was only about nine days.

During the summer of 1917, thirty-nine cases of typhoid occurred in Lansing. Thirteen of these which were taken sick between June 8 and July 17, were positively connected with the cheese from the same source as the others and sold by the Lansing wholesaler. Cheese shipments to the Lansing concern from other sources than the Marion Springs factory were investigated without disclosing any reason for suspicion.



CHEESE AS A CARRIER

Very little has ever been written regarding cheese as a carrier. It would be classed under the head of "foods" in the most common classification. We find quite a little written on the question of the influence of lactic organisms upon *Bacillus typhosus*, but experimenters do not agree on their results. Butter has been found to be a carrier of typhoid and several bacteriologists have investigated the longevity of the typhoid organism in butter. Cottage cheese has also been found to be one method of transmitting the disease.

From all information available, no typhoid fever epidemic has ever been traced to what is known as full cream cheese. However, after an extensive search through several libraries, the following notations were found:

- (1) "Pfuhl mixed typhoid bacilli with cheese and isolated the bacilli after 24 but not 26 days. Other workers found that the bacilli died out much sooner. Probably much depends on the type of cheese used for the experiment."
- (2) "As far as is known, cheese does not act as the carrier of pathogenic bacteria. Experiments have shown that the ordinary pathogens when introduced into cheese retain vitality for but a short time."

Upon first thought, we might think that the five cheeses going to Ypsilanti would cause as much or more typhoid than the four cheeses going to Lansing. However, those going to Lansing were sold to the retailer as follows:

May 3	Two cheeses	Bath.....	51 cases
May 25	One cheese	Bath	
May 8	One cheese	Lansing.....	13 cases

This cheese was used by the consumer from two to three weeks after being made. The shipment to Ypsilanti was invoiced May 24, at Detroit, so it was not eaten until the last week in May and the first week in June. In one case, the cheese was relatively fresh and the organisms probably quite plentiful, while in the other case the cheese was older and more of the organisms had died. This also shows that the organisms lived longer than Pfuhl or any of the other experimenters found, for this cheese was made sometime between April 15 and the 24th, and was not used for over a month afterwards.

Shipping records indicate that a considerable quantity of the cheese was shipped out of the state. Letters were sent out to the boards of health in these states but no typhoid was found; probably on account of the cheese being too old by the time it reached the consumer.

One of the peculiar things about the epidemic is that the incubation period varied from 14 to 37 days. Water, milk or oyster-borne epidemics have an incubation period of from 7 to 28 days, with a maximum number of cases at 14 days.

MANUFACTURE OF CHEESE AT MARION SPRINGS

During the month of April, the Marion Springs cheese factory had 42 milk patrons. The milk is delivered to the factory and placed in large vats. The temperature is then raised gradually to 102° F., which is slightly above blood heat, or incubation temperature. The milk is stirred and a curd soon forms. The whey is drained off and the curd worked and salted and then pressed into cakes. Contamination might result: (1) if the cheese maker was a carrier, (2) if the water used at the factory was contaminated, (3) if the milk patrons were carriers, (4) if water used at the dairies was contaminated.

If the cheese maker was a carrier he could very easily contaminate the cheese while making the curd. Water used in washing the vat and utensils could also contaminate the cheese. If one of the milk patrons was a carrier and one can of milk was infected, this would be mixed with all the other milk in the vat and when the temperature was raised the bacteria would tend to multiply very rapidly and the whole batch of cheese would be infected.

SEARCH FOR TYPHOID CARRIERS

With these ideas in mind, an investigation was started. It was found that the cheese maker had never had typhoid fever and a Widal test showed negative.

The water used for washing at the factory came from a flowing well 200 feet deep, so it was considered beyond question.

The records in the office of the State Department of Health showed 23 cases of typhoid reported from the vicinity of Marion Springs, in the past few years. However, upon inquiry in the community, it was found that there had been quite a number of cases in the past three years. Dr. B. had a large practice in this territory and had a record of all of the typhoid cases. He said that all the cases had been reported to the township health officer. The health officer at that time was a layman, 74 years old, who evidently knew little regarding the laws governing the reporting of communicable diseases.

Arrangements were made with Dr. B. to collect Widal specimens from all persons in any way connected with the dairies furnishing milk to the cheese factory in April. These specimens were tested in the laboratory of the State Department of Health. Of the 116 specimens collected, 108 were found negative, 5 doubtful, and 3 positive. There were 16 other individuals from whom Dr. B. wanted to take specimens but two had moved, two refused and 12 happened to be away from home when he called.

A few of the 116 specimens were taken from people who were not connected with dairies that sent milk to the Marion Springs cheese factory, but who previously had typhoid and wanted to know if they were carriers.

In the list of "Doubtful Widals", Jennie O. worked for Mr. John B., who

sent milk to the cheese factory. She was very sick with typhoid fever about ten years ago. Tine P. is a housewife on a farm sending milk to the cheese factory, but neither she nor any of the family had ever had typhoid fever.

Of the "Positive Widals" Inez B. and Annie M. were both housewives on farms, but neither of these farms furnished milk to the cheese factory. Inez B. had never had the fever, but her husband had it in 1914, a daughter had it in 1915, and a son in 1912. Annie M. had typhoid fever in 1915, but no one else in the family had it.

The other "Positive Widal" was from Leonard H. who worked for Mr. Ben B. who sent milk to the cheese factory. He had typhoid fever in October, 1914. There were six cases in the H. family, but Leonard was the only one that a specimen was taken from, as he worked for Mr. Ben B.

CONCLUSIONS

On a basis of these results, it looked as if Leonard H. had contaminated the milk sent to the cheese factory by Ben B. and that *possibly* Jennie O. had also contaminated the milk sent by John B. Both parties were informed of the condition, and also the cheese maker, who agreed to accept no more milk from these families as long as the aforementioned hired help had anything to do with the dairies.

Special credit is due Assistant Engineer Albert H. Jewell, who conducted the investigation, for the thoroughness and persistence he displayed in continuing his efforts beyond the point where a solution seemed highly improbable.



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at Boston, October 8th to 13th***