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THE EPIDEMIC OF TYPHOID FEVER AT ITHACA, N. Y.

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[Presented September 15, 1904.]

Mr. President, Ladies and Gentlemen of the New England Water Works Association, — The epidemic of typhoid fever which broke out at Ithaca in the winter of 1903 deserves to be regarded as one of the greatest outbreaks of this preventable disease which ever occurred in New York State. In the typhoid history of the whole country there have been few epidemics which have exhibited a larger number of cases.

Sanitary experts who visited Ithaca at the time of the epidemic were unanimous in their opinion as to its cause. Many who are familiar with the epidemiology of typhoid have said that seldom, if ever, has the danger of an epidemic been so unmistakably in evidence beforehand. Speaking now, more than a year after the outbreak, and with an intimate knowledge of the situation, it is difficult to understand why the city was not alive to the necessity of taking steps which would have rendered life and health secure. Apparently the people of this university town neither knew nor cared any more about the teachings of sanitary science than do the inhabitants of the scores of other cities in which epidemics occur. They were blinded to the dangers of the situation by the seeming healthfulness of the city's site, and so failed to establish those sanitary safeguards which are indispensable to every growing community.

STATISTICS OF THE EPIDEMIC.

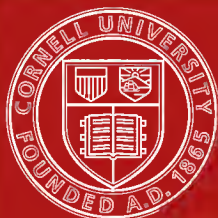
The consequence of this mistake was terrible. With a population given by the last United States census as 13 156, it is estimated that 1 350 cases of typhoid occurred, with 82 deaths, in little more than three months. No less than 522 homes were visited by the disease; in over 150 of these there were two or more persons attacked.

The onset of the epidemic was gradual. A few cases first occurred in all parts of the city. Later it was observed that there were more cases in the section occupied by the students of Cornell University than in any other. There were, at this time, connected with Cornell about 3 000 teachers and students.

One in every ten was taken with the fever, and one in every hundred died of it. It is probable that more typhoid occurred in the section occupied by the students than in other sections of the city because of the peculiar susceptibility of young people to typhoid and also on account of the fact that some of the students lived amid surroundings which were insanitary.

The epidemic is officially regarded to have begun on the 11th of January, 1903, and to have extended to the 1st of April of the same year. But in reality there were some cases before the date given, and there were many after it. Plate I is a map of the city showing the location of the typhoid cases during the first week of the epidemic.

What might be termed a long, low wave of typhoid appears to have set in about September, 1902, and continued until about January, 1904. In this whole period it appears that typhoid fever was somewhat unduly prevalent. It is impossible to state the facts. Under the most favorable circumstances nothing is more difficult than to obtain an accurate knowledge of the extent to which typhoid occurs in a community. Records of cases of typhoid fever were never accurately collected at Ithaca, and were gathered with difficulty during the epidemic. The official figures collected for the State Department of Health were made up with great care, but they are known to be defective. The total number of cases given above, which is the official figure of the State Department, was estimated from a large amount of data collected in various ways, and does not represent the number of cases actually reported by the physicians. The number so reported was much smaller.




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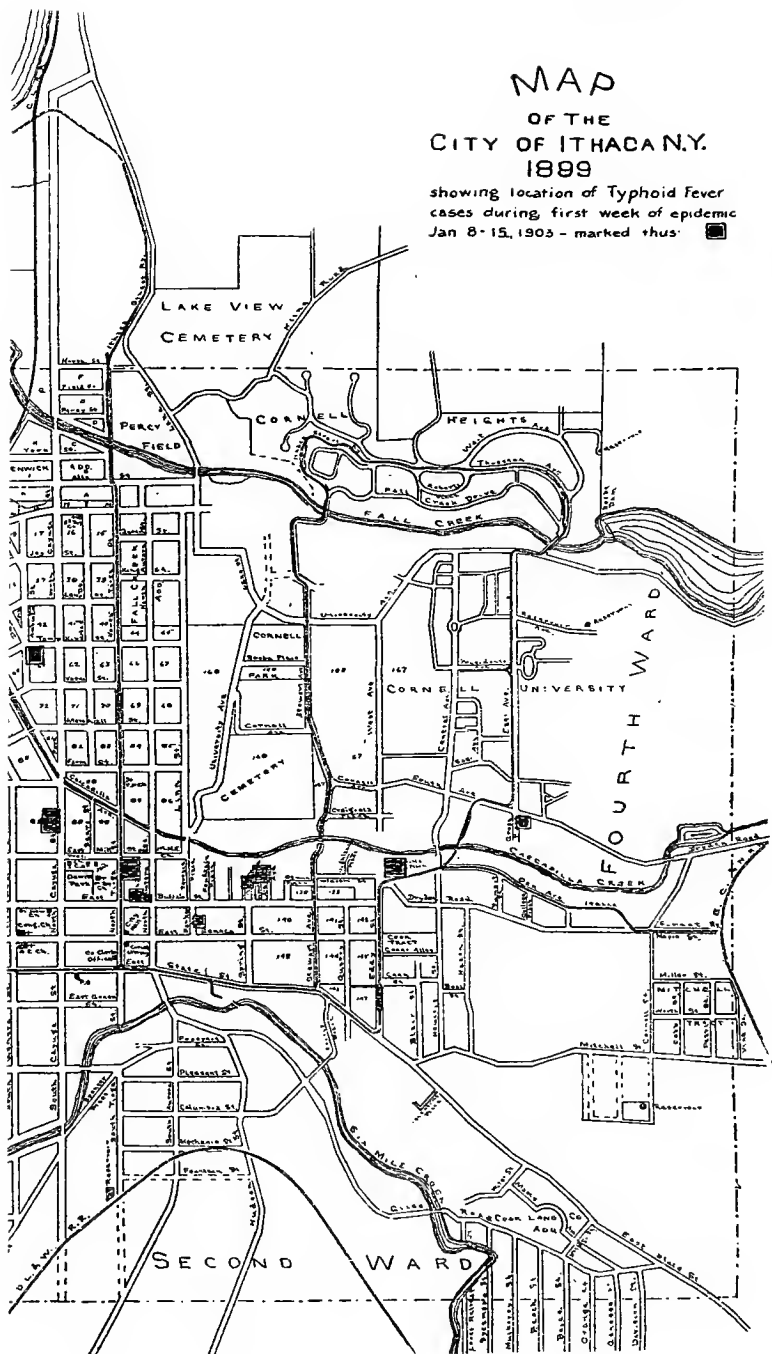
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PLATE I.

MAP
OF THE
CITY OF ITHACA N.Y.
1899

showing location of Typhoid Fever
cases during first week of epidemic
Jan 8-15, 1903 - marked thus: 



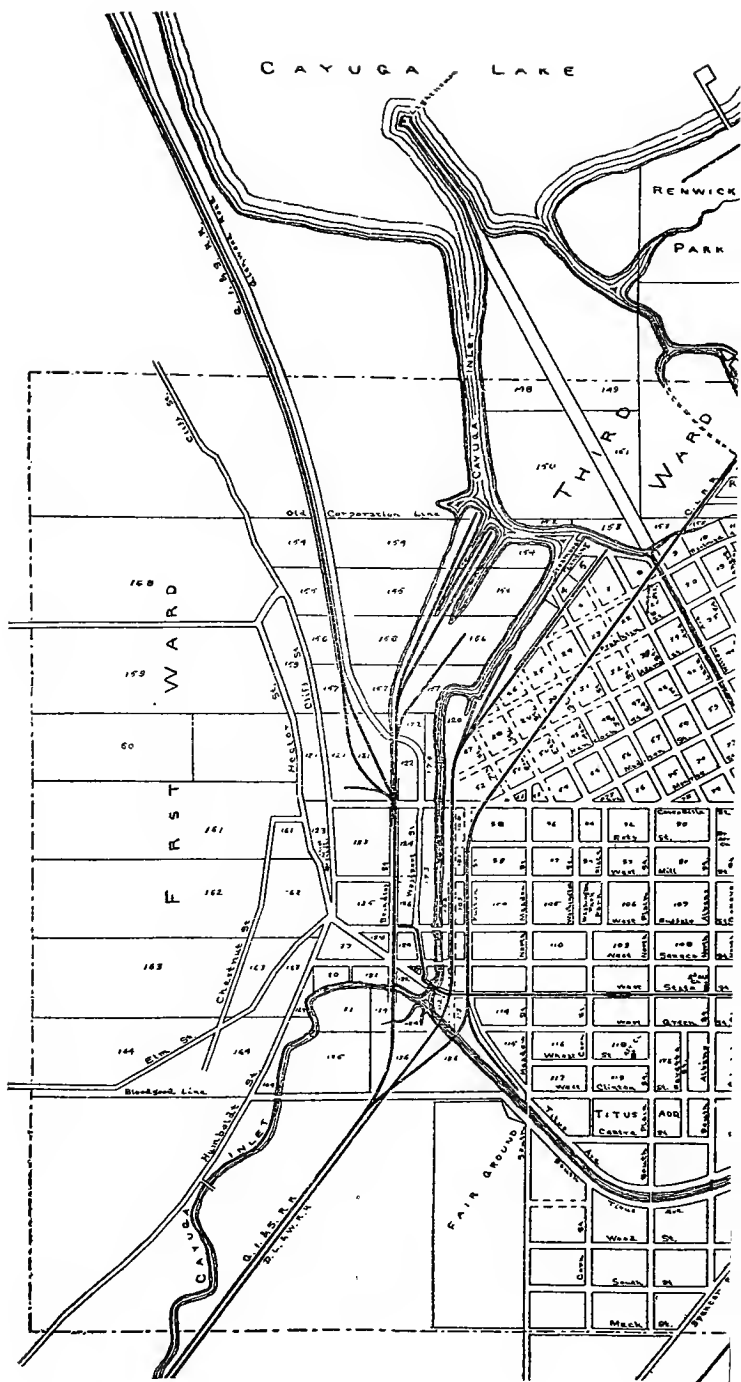


TABLE NO. 1.

Showing the number of cases of typhoid fever reported by the physicians of Ithaca, N. Y., from January 10 to April 1, 1903. (The actual number of cases was much greater and they were somewhat more regularly distributed.)

Date.	Typhoid Cases Reported.	Total Cases Reported for Week.	Date.	Typhoid Cases Reported.	Total Cases Reported for Week.	Date.	Typhoid Cases Reported.	Total Cases Reported for Week.	Date.	Typhoid Cases Reported.	Total Cases Reported for Week.
Jan. 10	0		Jan. 30	14		Feb. 19	13		March 11	3	
11	1		31	22—105		20	18		12	0	
12	3		Feb. 1	30		21	11—102		13	2	
13	1		2	37		22	19		14	1—18	
14	4		3	26		23	11		15	2	
15	5		4	19		24	5		16	0	
16	3		5	17		25	7		17	0	
17	4—21		6	19		26	7		18	1	
18	5		7	22—170		27	4		19	0	
19	6		8	26		28	6—59		20	0	
20	6		9	21		March 1	18		21	0—3	
21	6		10	19		2	3		22	0	
22	12		11	17		3	2		23	0	
23	10		12	21		4	1		24	1	
24	9—54		13	15		5	4		25	1	
25	11		14	18—137		6	2		26	0	
26	14		15	19		7	1—31		27	1	
27	13		16	12		8	2		28	0—3	
28	16		17	13		9	5		29	0	
29	15		18	16		10	5		31	0—703	

Total cases reported, Jan. 10—March 31, inclusive, 703.

The total number of typhoid fever cases which were directly or indirectly attributable to the outbreak at Ithaca will never be known, and cannot safely be estimated. If to the number which occurred in the epidemic, there were added those which occurred before and after it, and the cases which broke out in other places to which infection was carried by those who fled from the city, the total would be considerably increased.

ORIGINAL SOURCE OF THE EPIDEMIC.

In seeking to determine the cause of the epidemic, inquiry was directed to every conceivable quarter. As the infection was general, a common cause was naturally suspected. The city was not in an entirely sanitary condition, and it was appreciated that while certain features existed which were favorable to health,

there were others which favored the spread of the fever. Among the features favorable to health may be mentioned an excellent climate and an abundance of high ground. The unfavorable features included an incomplete sewerage system; a high ground water level in a large part of the city; an inadequate and polluted water supply; the presence of innumerable shallow wells; and an unusual prevalence of private cesspools and privies.

There is no room to doubt at the present time that the water supply was the original source of the disease, and that the fever spread through the city the more readily and became more securely established because of the insanitary conditions referred to, and carelessness and ignorance in nursing the sick.

The water supply, or supplies, of Ithaca were derived from three separate sources. Two of these sources were in the control of the Ithaca Water Company, while the third source was in the control of Cornell University. It has been claimed by the university authorities that no fever occurred among the people who used exclusively the university's water supply. This is true. The university's water was polluted, but was not infected, so far as I could find out. It was supplied exclusively to the campus. It seems certain that the infectious matter came to the city through one or both of the supplies of the water company.

The two water supplies of the water company are derived from creeks. The larger source, Six-Mile Creek, drains an area of country of about forty-six square miles. The run-off after storms is rapid, and the stream is subject to sudden and very decided fluctuations in volume. The dry weather flow is about one million gallons per twenty-four hours; the largest quantity of water that has been observed to flow in the creek was about three thousand times this volume. In short, Six-Mile Creek is a torrential stream, deeply eroded through soil and rock and carrying an immense amount of suspended matter, such as silt and sand, after rains and thaws.

On the drainage area of Six-Mile Creek there was a population estimated by the census of 1900 as 2 144, of whom 812 lived in villages bordering the creek. The nearest village, called Brookton, is five miles above the intake of the water works. No care

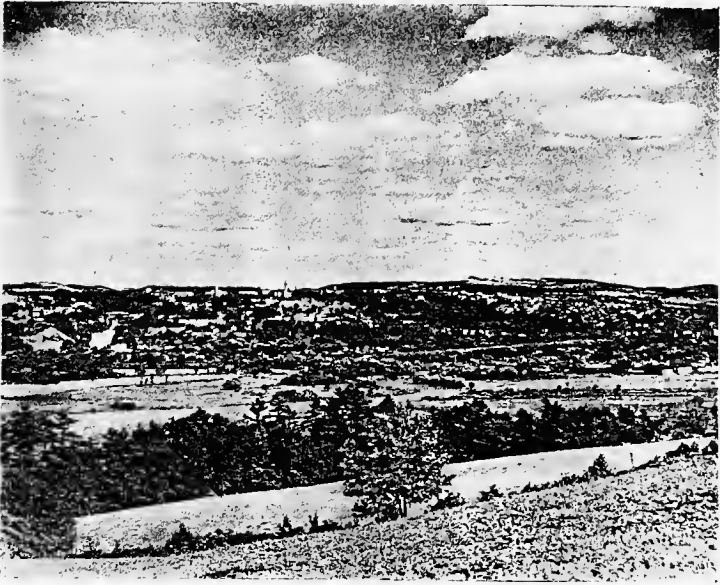


FIG. 1. — General View of Ithaca, showing Cornell University on the hill, student quarter on the right, and valley of Six-Mile Creek on extreme right.

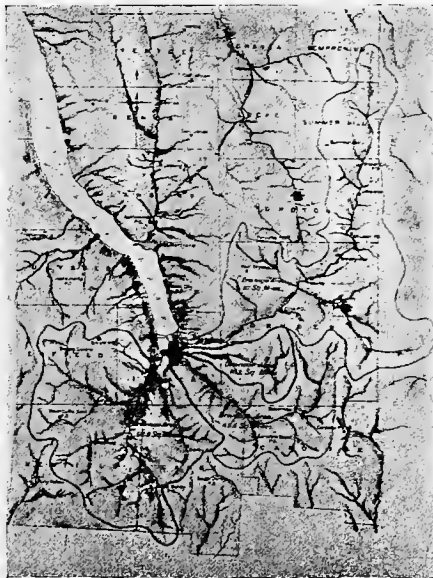


FIG. 2. — Map showing drainage areas of creeks near Ithaca.

whatever had been exercised for years to prevent drainage from entering the stream, although at one time, under different management, the protection of the drainage area is said to have been very carefully looked after. At the time of the epidemic numerous sources of pollution were evident. Representatives of the water company who were sent out at my request to inspect the drainage area brought in records of over one hundred nuisances. Within the very city of Ithaca, and but a few rods above the intake of the water works, there were located on the precipitous banks of Six-Mile Creek or its tributaries no less than seventeen privies.

There was no system of purifying the water, unless a primitive filter crib could be so called. The crib was located on a bank of the stream and was principally useful in excluding pebbles and leaves from the pumps. A small impounding reservoir had been formed by throwing a dam across the stream a short distance below the intake crib. Besides the intake crib, there were two other intakes; one above the impounding reservoir, and one below it. These were but little used, and all took the same water.

The water was pumped from the creek into a standpipe of small capacity, and flowed thence through the mains to the consumers.

A second source of supply of the water company was Butter-milk Creek, draining about twelve square miles of country. Here were duplicated, but on a smaller scale, the sanitary conditions of Six-Mile Creek. Most of the water which supplied the city came from Six-Mile Creek, but a general and uncertain mixture of the two took place in the pipes.

From what has just been said it will be apparent that the conditions were ideal for an epidemic. During periods of dry weather quantities of refuse of all descriptions accumulated on the banks of the creeks and their tributaries, to be scoured down into the water supply by the next rain or thaw.

In a very careful survey of the drainage areas which I made during the course of the epidemic, I was able to locate six cases of typhoid fever which had occurred in the twelve months preceding the outbreak at Ithaca. It is possible that other sources of infectious matter existed. For example, there was one hotel

on the upper waters of Six-Mile Creek which was frequented by people in search of health, and it is not impossible that some persons recovering from typhoid spent the summer or autumn there. Such people are as dangerous as those actually confined to their beds with typhoid, for in about twenty per cent. of all cases the germs of typhoid become established in the bladder and are given off in great numbers with the urine for weeks and sometimes months after apparent recovery.

If there was dangerous filth on the banks of the streams supplying Ithaca with drinking water, the weather conditions just previous to the outbreak of the epidemic were such as to wash this material into the creeks. The report for December, 1902, of the New York Section of the Climate and Crop Service of the United States Weather Bureau, says that December was noted for exceptionally heavy precipitation, the fall of snow and rain at Ithaca being more than twice as much as for any other December since the establishment of the station in 1879. General rains and thawing conditions prevailed from the nineteenth to the twenty-second, with very heavy falls on the thirteenth, sixteenth, and twenty-first.

If we assume that infectious material was scoured from the banks of the streams during these rains and thaws we must account for the fact that three or four weeks seem to have elapsed from the time when it was taken into the water works system to the beginning of the epidemic in the city. Theoretically, it would take only two or three days for the water to get from the creek to the consumer by way of the force mains, standpipe and distribution system, and we should expect the first cases of fever to develop within two weeks from this time. The actual time which elapsed was nineteen days; the outbreak was not in full force for several days after. The apparent delay in the appearance of the epidemic is probably due to the fact that the dates of the commencement of the attacks are in reality the dates when the physicians were first called; several days may have elapsed between the appearance of the first symptoms and the calling of medical aid.

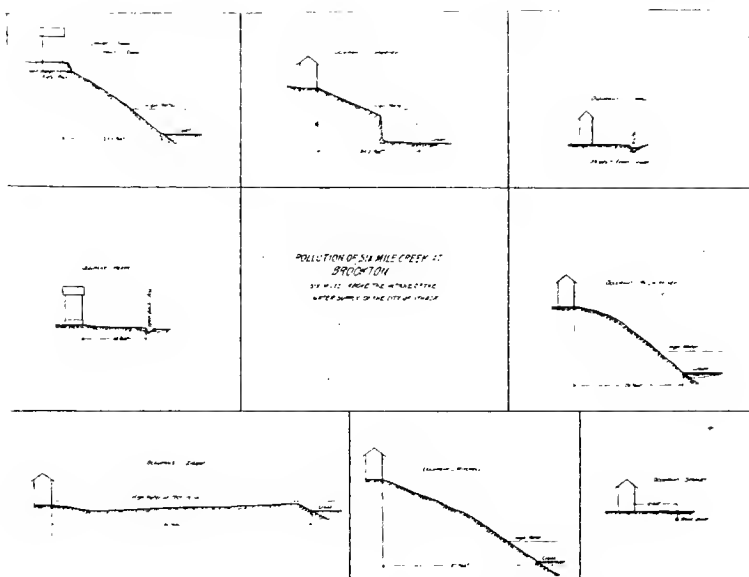


FIG. 1. — Some sources of pollution of Six-Mile Creek at Brookton.



FIG. 2. — Some sources of pollution of Six-Mile Creek at Brookton.

OTHER THEORIES OF THE CAUSE.

Before leaving our discussion of the cause of the epidemic it may be well to take account of a belief which was held by many that the outbreak was not due to pollution of the streams by permanent residents on the drainage areas but was caused by the offscourings of a gang of Italian laborers who were at work on the construction of a dam on Six-Mile Creek, a short distance above the water company's intake.

Careful investigation of the grounds of this theory was made without discovering, however, that excrement from this source had entered the stream, or that any of the laborers had been ill. It is, of course, conceivable that one or more of the laborers had recently recovered from typhoid and that their infected urine entered the creek, but the chance of such contamination seems remote.

The work was in charge of professional engineers of high standing, and precautions were apparently taken to prevent any polluting matter from entering the stream. A young man who had recently graduated in engineering at Cornell was especially detailed to look after this matter. There is little doubt that bad feeling between the citizens and the water company, caused by a dispute over the construction of a new dam, accounted in some measure for the mental attitude of some citizens on this point.

Another possible source of typhoid material existed on one of the tributaries of Six-Mile Creek within three miles of the water works intake. At this point a gang of laborers of mixed nationality but common bad character had been engaged in building an elaborate railroad culvert, through the late summer and early fall months. One "Toothless Ben," a member of this party, was taken with typhoid fever while on the work and was eventually compelled to leave it and go home to be nursed. I found ample evidence that these men had defecated on the banks of the stream, but whether infectious matter from "Toothless Ben" had been deposited here and had later been washed down into the water supply of Ithaca it was not possible to determine.

Finally, an irregularity in the operation of the pumps of the

water company remains to be mentioned as having a possible bearing on the cause of the epidemic. Owing to the expected need of an unusually large supply of water for some tests of fire apparatus, an extra, and generally idle, pump was set in operation for several days preceding December 25. The intake of this pump was in a penstock directly connected with Six-Mile Creek. The water was neither purified nor screened, but was forced directly to the standpipe which was, at the same time, being supplied by the regular pumps.

Whatever theory is accepted to account for the infection of the water, it seems necessary to conclude either that the germs multiplied after entering the distribution system, or that they were taken in during a period of several weeks. It is scarcely conceivable that a sufficient number could have been taken from the creeks at one time to last as long as the water remained infected. It is equally improbable that the germs multiplied in the pipes. It seems necessary to conclude that the impounding reservoir remained infected for several weeks. The whole water works system should have emptied itself in less time than one week.

The onset of the epidemic was very gradual. The first case required the services of a physician on January 11. Two new cases were seen on the next day. On the day following there was but one case. On January 14 there were four; on the 15th, five; on the 16th, three. Presently, the daily number of new cases largely increased. On the 22d there were twelve; on the 28th, sixteen; on January 31, twenty-two; on February 2, thirty-six. Thereafter the number decreased and increased alternately with a general declining tendency.

PREVIOUS HISTORY OF TYPHOID AT ITHACA.

In considering an outbreak of typhoid it is instructive to inquire whether the disease is new to the place or has existed previously. The value of such evidence depends upon its accuracy. Unfortunately the records of cases and deaths from the infectious diseases are not kept with sufficient accuracy even in our best regulated cities to enable a correct idea to be formed of the amount of typhoid which has been present.



FIG. 1. — Privy and Ditch at Brookton on Six-Mile Creek: said to have received typhoid dejections.



FIG. 2. — Six-Mile Creek between Slaterville and Brookton.

Previous to the epidemic, no records whatever had been made of the cases of typhoid fever which had occurred in the city at large. The best information that can be gained on this point is contained in the records of the principal hospital. These records show the comparative amount of typhoid which occurred from year to year.

Were the death records accurate, some idea could be gained from them of this relation. The following letter, however, from one professor of Cornell to another shows the incompleteness of even this generally accepted source of information:

ITHACA, N. Y., March 12, 1903.

Dear Dr. T—, The death rate of Ithaca is something almost impossible to ascertain, owing to omissions in the record. Several years ago I had three students working on the subject for months and we reached the conclusion that the omissions from the record were 29.4 per cent. in one year, and 33 per cent. in another. On the basis of the corrected figures they established for 1892 and 1893, the true death rate was 16.5 instead of 13.4, which was claimed. Recent official figures are doubtless more accurate, owing to the changes made in the registration law about 1895.

That the records, however, are still incomplete is shown by the Twelfth Census. The registration record of the city for the census year from June 1, 1899, to May 31, 1900, shows 196 deaths; the census enumerator's returns, obtained by asking at each house in town whether any death had occurred in that family during the preceding twelve months, showed 100 deaths. Successive comparisons of these two lists, name by name, showed in the latter 17 names not in the former, giving a total of 213 deaths in the city for that year, as accepted by the Census Office, or a death rate for 1900 of 16.3.

Yours sincerely,

— — —

A report from Dr. F. C. Curtis to Dr. Daniel Lewis, State Commissioner of Health, gives the opinion of the medical expert of the State Department of Health on the previous history of typhoid at Ithaca. The report is dated Albany, February 7, 1903:

Sir,—The records show that for the past two or three years Ithaca has had an autumnal prevalence of typhoid fever. In 1900 and 1901, the mortality rate from this cause was about 40 per 100 000 population; and in 1902, however, there was but a single death.

The following table has been made out from data taken from the books of the Ithaca City Hospital:

TABLE No. 2.

Cases of typhoid fever and similar diseases treated at the Ithaca City Hospital from 1892 to 1902 inclusive.

	1892	1893	1894	1895	1896	1897	1898	1899	1900	1901	1902	Totals
Jan.	0	0	1	0	0	0	0	0	1	0	1	3
Feb.	0	0	1	0	1	0	0	0	2	2	3	9
March	0	0	0	1	1	0	0	3	0	1	2	8
April	0	0	0	0	0	0	0	0	0	1	4	5
May	1	0	0	1	0	0	0	0	1	0	4	7
June	0	2	1	0	0	1	0	0	0	0	0	4
July	5	0	0	0	0	2	1	0	0	0	0	8
Aug.	3	0	0	2	6	2	3	0	0	7	2	25
Sept.	10	3	3	2	4	9	1	0	7	10	3	52
Oct.	3	3	4	1	2	1	1	1	4	10	2	32
Nov.	0	2	3	0	1	0	1	1	9	3	0	20
Dec.	2	1	0	0	0	0	0	0	3	2	2	10
Totals	24	11	13	7	15	15	7	5	27	36	23	183

PUBLIC ALARM FOLLOWING THE OUTBREAK.

The outbreak of the epidemic caused a great deal of concern among the people who lived at Ithaca or who had sons at the university. It soon became known that the City Hospital was full to overflowing and that the Cornell Infirmary, where sick students were always treated, was becoming overcrowded. The hospital called for public aid to help meet the extraordinary expenses incurred in caring for so many of the sick, and subscriptions were opened to give similar help to the infirmary, where the students were being treated.

The local board of health, with the aid of its health officer, Prof. E. Hitchcock, Jr., and Profs. E. M. Chamot and V. A. Moore of Cornell, made some investigations as to the cause of the epidemic which disclosed the unsanitary conditions on the drainage areas from which the water was obtained, and pointed to the public water supply of the Ithaca Water Company as the probable source of the infection. The board promptly ordered that the city water be boiled before being used for drinking purposes.

It is important to state that Professors Moore and Chamot, in reports previously made to the local board of health, had warned that body that the water supply was polluted; and that the results of their analyses had been suppressed and kept from



FIG. 1. — Outlet of drain from Acetylene Plant at Slaterville Springs on Six-Mile Creek.

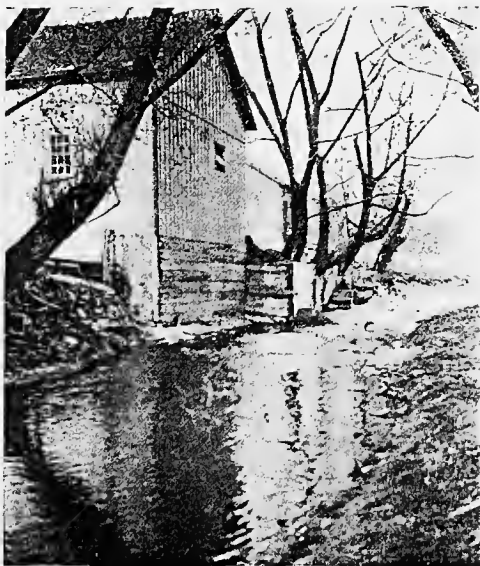


FIG. 2. — Six-Mile Creek at Slaterville.

the public press by the board for fear of alarming the people. These and other disclosures of real or imaginary delinquencies on the part of the local board of health, water company, and trustees of Cornell University gave the friends and foes of the university and city abundant food for criticism. The result was that more time was spent in trying to fix the blame for the epidemic than in bringing it to an end.

By this time the city was in a condition bordering on panic. New cases of fever were appearing at the rate of twenty or more a day and the epidemic was gaining headway rapidly. Hundreds of students were leaving the university, notwithstanding strenuous efforts to keep them in the city. The railroads brought no one to Ithaca but carried heavy loads away. Business was at a standstill. The public press throughout the country, making capital of the epidemic, gave the widest possible advertisement of the unfortunate situation.

When the number of cases had reached several hundred the State Department of Health sent a representative to Ithaca in the person of its expert on infectious diseases, Dr. F. C. Curtis. Dr. Curtis spent a day at Ithaca investigating the conditions, and a few days later forwarded a report stating that undoubtedly the disease was typhoid fever and that the water supply of the water company was to blame for the epidemic; the source of the infection was probably a gang of Italian laborers. He advised the people to boil the water, and prophesied that in a short time the epidemic would wear itself out.

But matters grew steadily worse and the Commissioner of Health of the State, Dr. Daniel Lewis, went to Ithaca to investigate personally. Consultations were held, public addresses were made and various measures of relief were recommended. Foremost among the instructions given by Dr. Lewis to the local board of health was to insist on thorough disinfection. This should include not only the disinfection of the stools, but also of the urine of the typhoid fever patients. It was desirable that household disinfection should be practiced also; and to insure that this should be properly done the commissioner recommended that competent medical inspectors be employed. Fi-

nally, but of the utmost importance, the local board of health was urged to compel physicians to report their cases of typhoid fever under the penalty of being fined from twenty-five to fifty dollars for each offence.

✓ But the people of Ithaca were beyond advice. Internal dissensions, and the utter demoralization of the commercial and educational interests of the city, not to speak of the spirit of apprehension which pervaded every household, made it impossible for them to unite on any form of local leadership to initiate the measures which were necessary to restore public confidence and put an end to the epidemic.

It was under these circumstances that I was requested by the State Department of Health to go to Ithaca and see if I could bring about relief. I arrived at Ithaca on March 4. Thanks to the energetic coöperation which I at once received from the officials and employees of the city government, the authorities and professors of Cornell University, the president and others of the Ithaca Water Company, and the citizens themselves, the difficulties of the situation cleared rapidly. Public health work of a kind seldom seen outside of military situations soon regained for the board its lost prestige. Public confidence was gradually restored. The authorities of Cornell, from being on the point of closing the university, decided to keep it open and to hold a summer session. ✓ The frightened students returned; business was re-established. By the 1st of April I notified the local board of health that I saw no further need of my services, and that I should return to New York, leaving the sanitary work in their hands. I was requested to remain and supervise the work of the board until September 1, 1903, taking up, at the same time, the study of means for improving the drainage of the city. Satisfactory arrangements were made for this work and I remained.

Throughout my residence at Ithaca my official position was that of representative at Ithaca of the New York State Department of Health. In this capacity I acted as expert advisor to the local board of health. The steps taken to extinguish the fever were carried out by the local board, acting, as a rule, upon suggestions from me.

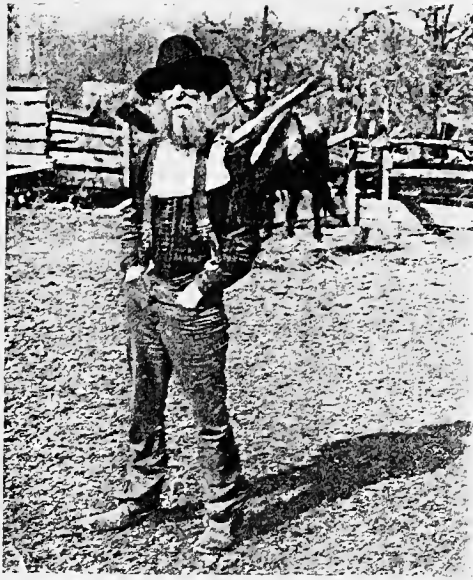


FIG. 1. — "Dirty Baker."



FIG. 2. — Home of "Dirty Baker," Buttermilk Creek drainage area.

THE SANITARY CAMPAIGN.

At the outset it was recognized that there must be money available for the sanitary work. The nature and extent of the preventive and corrective measures which were thought necessary were explained to the board of aldermen, who thereupon pledged to the board of health the credit of the city.

The first thing to be done was to determine the origin and extent of the epidemic. An investigation was begun to discover as nearly as practicable where each case of fever originated, and when and where it occurred. Statistical records were made embodying this and various other pieces of information connected with the identification and location of the fever victims. The work was carried on with extreme care, several men being engaged upon the records for many weeks.

In order to bring about harmony of action, numerous conferences with representatives of the principal interests at Ithaca were held. Some of these were of a public, and others of a private, nature. At a meeting of the board of health, at which representatives of the city government, of the water company, and of the university were present, all pledged themselves to harmonious action. At a meeting of the physicians of the city, various technical matters and many opinions concerning the epidemic were discussed. Public conferences in the form of lectures were held, at which the principles of disinfection and household sanitation were dealt with. In articles offered to the press, instructions were given in the use of various protective measures against the fever, and the sanitary ordinances of the city which had a bearing on the situation were dwelt upon.

It was found early that the disinfectants employed by the nurses were not of reliable quality, and, as good disinfectants were difficult to obtain, the city was advised to prepare and supply these necessities. The disinfectants chosen for distribution by the city were milk of lime and bichloride of mercury. These were supplied wherever a case of fever existed, four wagons being employed to make the rounds. The total quantity of milk of lime distributed was 23 231 gallons. The quantity of bichloride of mercury was 1 930 gallons.

An investigation was set on foot to determine the cause of the epidemic, and various important matters connected with this topic were soon discovered. There was no doubt that the drinking water supplied by the water company was the original cause of the epidemic, but it was evident that the disease was being transmitted from person to person through carelessness and ignorance in nursing the sick. The sanitary condition of the city, which had been somewhat improved within eight or ten years, was in need of improvement.

There were two obvious sources of danger in this direction. The city contained about 1 300 wells and nearly an equal number of privies. The latter were constructed without reference to seepage, unless a desire to have the liquid wastes escape into the ground might be so interpreted. It was thought advisable to clean and disinfect the privies and to analyze the waters of the wells. This work was undertaken in April and concluded in August.

The total volume of excrement removed was 418 193 gallons. The material excavated from the privies was taken into the country and plowed into the soil. Twelve acres of poor ground were used for the purpose. Later, a remarkably successful crop of corn was grown upon this ground. It is a satisfaction to be able to say that in this extensive and dangerous piece of scavenging work there was no sickness nor accident among the fifteen employees and eight horses continuously engaged.

As a result of the analyses of well waters, over 30 per cent. of the wells were condemned. The total number of waters analyzed was 946. It is interesting to note that whole portions of the city could be blocked out by the records of the well examinations. In some sections, the water of nearly every well was polluted, while in other sections the wells could all be depended upon as good. The good wells were in clay; the poor ones in fissured rock.

In order to determine the character of many suspected cases of fever, a large number of Widal examinations of blood were made. These proved of great value.

To make certain that the milk supplies did not become infected, careful inspections were made of all the dairies furnishing the



FIG. 1. — On the flats of Ithaca; flood due to high water in Cayuga Lake.



FIG. 2. — On the low lands of Ithaca.

citizens with milk. Other food supplies were examined into, and the quality and care of these important necessities were much improved.

The work on the statistics of the epidemic soon showed that a disproportionately large number of the students of Cornell University had been attacked by fever, and, in consequence of this fact, inspections of boarding and rooming houses occupied by the students were systematically made. Every point of sanitary importance connected with the living quarters of the students was carefully examined and recorded, as a result of which each house was given a sanitary rating. A list was published containing the address of every boarding house which passed the examination.

One of the most important measures adopted, and, it is thought, an innovation in the management of typhoid epidemics, was the use of urinary germicides to eliminate bacterial infection from the bladders of convalescents. As is well known, the bladder, in a large number of cases of typhoid fever, becomes infected and enormous numbers of the disease germs are given off in the urine. Analyses of urine were made to determine the existence of the *bacillus typhosus*. In the event of the discovery of this germ the patient was held under observation and given urotropin until the bacillus disappeared.

It was not long after the introduction of systematic measures for the suppression of the epidemic that public confidence began to be restored. The number of new cases of fever reported from day to day rapidly diminished, and although an occasional case appeared for several months, the epidemic ceased by April 1.

THE LESSON OF THE BARNES WELL.

It is proper to refer, before closing this account of the Ithaca epidemic, to an outbreak of fever which took place in one section of the city after most of the other cases had disappeared. This outbreak was the result of the contamination of a well on the property of a man named Barnes. The Barnes well had been famous; people who had learned to fear the city water went to the Barnes well with a feeling of perfect safety.

No one had ever been made sick from drinking this water. So great was the demand upon the well that the water was actually piped to another house.

It was the original intention of the local board of health to examine every well in the city, and had this plan been carried out, the Barnes well would have been found to be polluted in time to prevent the outbreak which followed. Unfortunately, in a moment of economy, the well examinations were stopped and the Barnes well was one of a very few not tested.

In about two weeks after the board of health stopped analyzing the well waters, many of the people who had been drinking from the Barnes well were taken ill. In all there were fifty cases of typhoid and five deaths traced to this well.

When suspicion was directed to the well, I visited it and had the drain pipe from the water closet in the Barnes house excavated. The drain ran within three or four feet of the well. When the laborers dug the earth from beneath the drain, they found that the joints had been scamped; that is, insecurely and improperly closed. When the water closet in the Barnes house was flushed, the water would run through the drain to a point about ten feet from the well, whence it would flow out into the porous soil through the leaky joint and so into the well. On analysis, the water of the well was found to be grossly polluted.

We needed, however, to find out how the drainage which entered the well had actually infected it. It was then discovered that Mrs. Barnes had suffered, some weeks before, with a mild attack of typhoid fever, which had been pronounced by her physician to be gripe. We proved the real character of her disease by taking a specimen of her blood and examining it in the laboratory. The dejecta from this patient passed down through the water closet without disinfection; it escaped from the drain pipe into the well and, as we have said, occasioned fifty cases and five deaths.

INDEPENDENT SANITARY MEASURES.

I have not mentioned all of the sanitary measures which were taken to suppress the epidemic of typhoid and guard against future difficulty, but have indicated some of the most important,



FIG. 1. — Conditions which added to the difficulty of sanitation on the low lands of Ithaca.

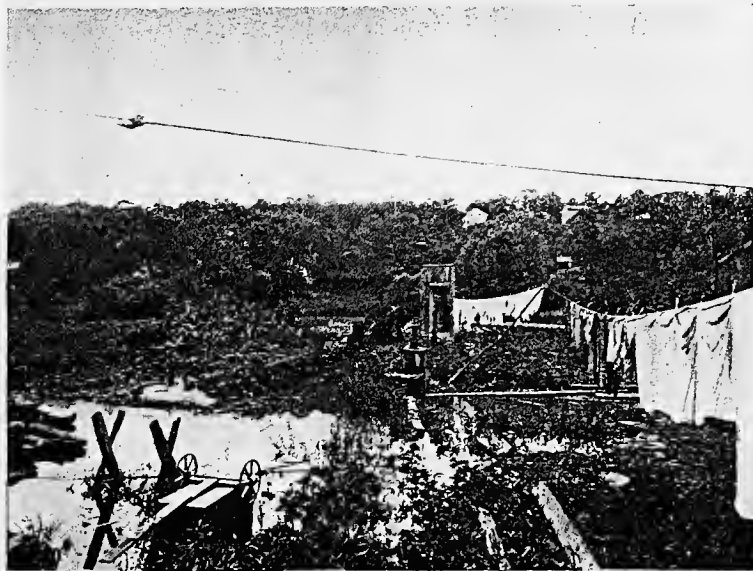


FIG. 2. — Celery and other vegetables growing in a back yard at Ithaca.

with the idea of furnishing examples of the work done by the local board of health, under my advice. Important things were done by the city, the water company, and the university, sometimes without formal coöperation with the health authorities. The water company constructed a municipal filter plant at a cost of something like seventy thousand dollars. The plant was designed by Mr. Allen Hazen and built under the supervision of Prof. Gardner S. Williams. This filter is now in operation, purifying the water of Six-Mile Creek, on the rapid or mechanical filter principle.

The water mains of the distribution system were flushed, the city being divided into sections for this purpose, and the whole work was carried on under the direction of Professor Williams.

✓ Rules were made and established legally for conserving the purity of the water of Six-Mile Creek and Buttermilk Creek. These rules included precautions to be taken in the construction and maintenance of privies, the disposal of sewage, stable wastes, etc., and forbade washing and bathing in the streams.

✓ The citizens undertook to find a new source of water supply which could not be contaminated, and sunk many wells in this undertaking. It is reported that their efforts have at last proved successful and that there is now an abundance of water available from the wells.

✓ New methods of cleaning the streets and disposing of garbage and other refuse were inaugurated. A cremation plant for the consumption of refuse was erected to meet the emergency of the epidemic. Although this plant was for temporary use only, it is said to be in operation still.

✓ A thorough municipal house-cleaning was instituted early in the spring. House-holders were induced to open up their hermetically closed dwellings to the free air and clean them out from attic to cellar. Back yards, forgotten alleys, and other unsightly places were cleaned up. The amount of rubbish brought to light was astonishing.

✓ The sanitary code of the city was enforced in a manner previously unknown. Emphasis was placed upon the necessity of boiling the city water before using it, but, strange as it may seem,

this precautionary measure was continually evaded. To further prevent the people from drinking this dangerous supply, water from a pure, free-flowing well was peddled from house to house at the nominal price of one cent per gallon.

COST OF THE WORK.

The total cost of the sanitary campaign was somewhat over \$108 000. This takes into account the cost of the filtration plant built by the water company. The board of health itself spent \$10 000. The privy cleaning cost \$5 000 more; the inspection and plumbing improvements of students' boarding houses are estimated to have cost about \$10 000 additional; the construction of the garbage destructor and improved collecting service cost \$3 000. Filters, which I have not before mentioned, constructed for the purification of the water supply of Cornell University, cost about \$10 000.

PRESENT OUTLOOK WITH RESPECT TO TYPHOID.

The history of typhoid at Ithaca from the end of the epidemic to the present time may be of interest. I have just been informed by the health officer that in the year ending September 1, 1904, there were in the whole city thirty-six cases of typhoid fever. Of these, twenty-eight occurred before the first of January and the remainder since. Those which took place from September to January are regarded by the board of health of Ithaca as due to the drinking of water from mains which had not been thoroughly cleaned.

It is doubtful if typhoid fever will ever gain a foothold in the city again. The work of extinguishing it was thorough and apparently complete. The record for the year following the epidemic is probably cleaner than any record would have been for many years, had the returns of cases been as accurately made. The site of the city is one of great beauty and natural attractiveness. It can, and probably will, be made one of the healthiest and best regulated cities in the world. If this is done, its destiny is clear. So long as the great university remains, Ithaca will be a city of homes, and the people will be intelligent and



FIG. 1. — Sewer manhole overflowing, during exceptionally high stage of Cayuga Lake.



FIG. 2. — Method of disposing of excrement removed from privies after the epidemic.

cultivated. They should now be far-seeing in sanitary matters. Seldom has so terrible a lesson of the consequences of sanitary neglect been given. That the world believes that this lesson has been well learned is evident by the fact that the prosperity of the city suffered no permanent impairment. The freshman class which entered Cornell in the autumn following the epidemic was the largest in the history of the university.

DISCUSSION.

MR. FRANK L. FULLER.* We have all been very deeply interested in what Mr. Soper has said, and I think we are greatly indebted to him. Those of us who have to do with water supplies ought to receive a new impulse to see to it that our supplies are carefully guarded from sources of pollution. It seems to me that this is the most vivid illustration of carelessness and poor management that we could have had brought before us.

There is one question I should like to ask Mr. Soper. He spoke about the cleaning of the water pipes during the latter part of the time of the epidemic, and I should like to ask what method was pursued in doing it.

DR. SOPER. The question was thoroughly considered, and it was proposed by Prof. L. M. Dennis of the Department of Chemistry of Cornell that the pipes should be disinfected. He wanted to send to Europe, I think, for a large quantity of permanganate of potash, and run it into the distribution system in some way and so destroy all the infectious germs. Professor Dennis thought this would not do any injury to the pipes or to the connections. It was finally decided, however, that it might not prove as effective as hoped, and that it might have this effect: If the pipes were not thoroughly disinfected a calamity might result, as the people would in all probability give up boiling the water if they thought the germs in the pipes had all been destroyed. Other methods of disinfecting the pipes were considered, and after a conference with representatives of the water company, and particularly with Prof. Gardner S. Williams, who was the engineer of the water company, it was thought best to flush out the mains as thoroughly as feasible, as

* Civil Engineer, Boston, Mass.

soon as the improved water supply was available, — that is, as soon as the filters were put in operation; and that was done by dividing the city into sections, and concentrating the pressure first in one quarter and then in another. I should not like to say that I considered that sufficient. I do not believe that Professor Williams did, and I do not believe any one would, but it seemed to be the best thing that was available at that time.

A MEMBER. What was the condition of the inside of the pipes? Were they smooth, showing the treatment which the pipes were originally subjected to, or were they covered with tubercles and was sediment deposited, or were they clean and bright?

DR. SOPER. I think there were many portions of them which were tuberculated, and there was considerable sediment, I think, in some of them.

MR. KENNETH ALLEN.* I think perhaps this is the most thorough investigation which has ever been made of a public water supply, and I think one of the interesting features of the investigation is the number of different points of attack that were developed, the many different sources of infection that were brought out. I would like to ask Dr. Soper if it was supposed that there was much infection through dust containing typhoid germs being blown about?

DR. SOPER. It did not seem to be so. You see it was so early in the season that there was little dust excepting in houses, but it was thought that dust might have played quite an important part in the houses.

MR. ALLEN. You spoke of the danger of infection from pig-pens and manure heaps. The original source, of course, would have to come from a typhoid fever patient, would it not?

DR. SOPER. The danger I referred to was this: In the epidemics I have investigated, I have invariably found that the male population of the farm uses the manure pile as a receptacle for their excrement. The women use the privy, and the men go out to the barn. Now, if a man has typhoid germs in his intestines and in his bladder and is throwing them off, he will throw them off into the manure pile.

MR. ALLEN. That is a very interesting point. Is it known

* Engineer and Superintendent, Water Department, Atlantic City, N. J.

or is there a preponderance of opinion one way or the other, as to the identity of the form of the typhoid bacillus?

DR. SOPER. That is, perhaps, one of the most vexed problems now before bacteriologists. One of the latest ideas I am almost afraid to speak about because it seems to tend to upset past theories which have been very carefully built up. But there is a young man who has made some observations in Strasburg who claims that the ordinary colon bacillus may, under some circumstances, be transmuted or transformed into the typhoid germ. But I think it is the prevailing opinion among conservative bacteriologists that we should regard that theory with doubt until the matter is more carefully investigated.

MR. ALLEN. I happened to be at Ithaca when Dr. Soper was making these investigations, and I can testify to the feeling of panic there was among the people there, especially the students.

MR. E. H. FOSTER. I should like to ask Professor Soper how near to the intake of the water company the first positively known source of pollution was, and how near it the culvert was where "Toothless Ben" was working.

DR. SOPER. I can answer the second question more briefly than the first. The culvert where "Toothless Ben" worked was within three miles of the intake, measured by the stream. The nearest source of pollution was, I should say, an eighth of a mile, and that was one which a superficial investigation might have hit upon as the cause of the epidemic. It was the residence of a woman of notorious character. Just prior to the epidemic she had been suffering from a disease which she herself pronounced unmistakably typhoid fever. Her physician did not call it that. He said she suffered from grippe. With a good deal of difficulty I got some specimens of her blood, and they did not give the positive result of typhoid. That, however, did not prove that the woman had not had it. There is no doubt that the waste from the house was thrown down the precipitous bank of the stream within an eighth of a mile of the intake of the water supply. It may be that this was the cause of the epidemic. I must say, however, that I have not in my own mind fixed upon the pollution of the water supply at any one specific point as the sole and sufficient cause of the Ithaca epidemic. Among such a large number

of sources of pollution as were obvious, it was difficult to discriminate. Any one of over a dozen might have been the cause.

MR. L. M. HASTINGS.* I suppose that what we have heard here to-day brings to the mind of every superintendent the possibility of the pollution of his own supply. When we have heard how great a result may come from a slight cause, it certainly is a matter for the gravest consideration and something to incite us to the closest examination of our water supplies. I remember a few years ago Professor Sedgwick spoke of the epidemic at Lowell, and he traced that, I think, to one solitary case of typhoid on a stream some miles from the city. Now, if that is the case, what protection have we against an epidemic from a cause which it is impossible to detect? If a single case of typhoid on a remote branch of the system may affect the whole system, it does seem as though our health and lives were in a pretty precarious situation.

There are some precautions which I suppose we can take to reduce the likelihood of infection. I suppose the first thing would be to make a sanitary survey of the whole watershed and locate the most dangerous points. That is most commonly done nowadays by a house-to-house visitation and abolishing as far as possible the points of contagion. In some cases where privies have existed before the taking of the water supply, it would seem as though the only thing to be done was to introduce some improvement, and I know that on the Cambridge supply where such danger has existed, the water board at its expense has abolished privies and open cesspools and substituted water-tight brick vaults. Those brick vaults are cleaned out by the water board. This is a precautionary measure against just such cases as Dr. Soper has referred to this morning. I don't know whether any method of disinfection by copperas or other chemicals would be sufficient, but it does seem to me that where such sources of pollution exist on the water supply or its branches, something of this sort would be efficient.

There is one matter the doctor spoke of which interested me. He said that young men are more subject to typhoid infection than old men are. I suppose in a generic way that that is true,

* City Engineer, Cambridge, Mass.

that all young men are more subject to fevers and older men are more subject to inflammations. I should like to ask the doctor if he knows of any reason why young men should take the typhoid fever more easily than old men.

DR. SOPER. No, I do not know of any reason. Of course, it is not young men only, but young women also. If you examine any exhaustive work on hygiene you will find tables showing the relative prevalence of typhoid among people of all ages. It seems that there is an age relation with many of the infectious diseases. Measles and other diseases that we commonly speak of as diseases of childhood attack young people more than old people, not because old people have had the diseases once and so are immune to them, but apparently for some other reason, children are more susceptible.

MR. EDWARD ATKINSON. I remember there was a serious epidemic at Windsor, Vt., a few years since. Desmond Fitzgerald was sent for in haste, and he went up there and found a single case of typhoid in a farmer's house which drained into the water supply, and from that single case the water supply of Windsor, which is one of the most healthy places in the country, had been infected and an epidemic had resulted.

PROF. E. G. SMITH.* I want to express my appreciation of what Dr. Soper has said this morning and of the very thorough way in which he has gone into the unearthing of the mysteries of the epidemic at Ithaca. Those of us who have had to do with this sort of a problem elsewhere realize very keenly the labor involved and the thoroughness with which the work has been done. I was much interested in the discussion of the cases, and I raised in my own mind the question of how many of them were due really to the water, and how many, or what proportion, of those 1 350 cases were due to what we call "contact infection" or "comrade infection." I don't know as the doctor has any data bearing upon that point, but it is certainly an interesting one. The fact remains, however, that the primary infection of that community was due to the impurity of the water and to the shocking conditions which existed above the intake of the public supply.

* Beloit, Wis.

I wish I had time to say something which would be corroborative, perhaps, of the line of work which has been carried out at Ithaca. There is another chapter there in this old, old story of the pollution of our supplies, our great supplies and our small supplies, by persons suffering from the acute stages of typhoid fever, or, indeed, from those often more dangerous cases of what are known as "walking typhoid." It has been my fortune to examine into some of the epidemics, large and small, which have prevailed in the Western states. I should like to go somewhat into the details of the epidemic at Rockland, Ill., which was directly traceable to the pollution of the water supply. Perhaps later when I may be in Boston, as I hope to be for a few months this winter, I may have the pleasure of speaking to you upon that epidemic, which certainly was a most remarkable one, and the history of which has not as yet, I believe, found its way into print.

I should like to speak of the epidemic at Baraboo, Wis., where we had direct proof that the outbreak was due to contamination of the water supply. It is a comparatively small town, two or three thousand inhabitants only, and there were not more than two hundred cases, with a death rate of perhaps one in thirty, and the evidence was as certain as anything which has been presented here regarding the outbreak at Ithaca. The town is situated on a river. The sewage passes into a canal, which is taken from above a dam below the city, and for some mysterious reason the water supply pipe was laid on the bottom of that canal, the supply being from wells on one side of the canal and the pumps being situated on the other. Why the pipe was ever laid there I cannot imagine, but worse than that, in the pipe was a T and valve so that an extension could be put on, and there were three joints. In consultation with Dr. Russell, of Madison, Wis., I was called on to find the cause of an outbreak of typhoid fever in the town, there being at that time about seventy-five cases. After beating around for three or four days we plotted out the cases as they were reported. We found that they would come in, one, two, three or four, and then suddenly there would be a rise to seven or eight cases; then the number would drop to two or three, and then in the course of twelve or fourteen days there would be another rise. That is, there were waves, as it

were, or periods when there were many more cases reported than at other times.

That led to an investigation as to what had happened on certain dates. Reckoning back to cover the period of incubation of typhoid fever, about fourteen days, we went down to the pumping station and asked them what they did on the date in question. "Did you take any raw river water from the canal that day?" "No, sir; the pumps were operated just exactly on that day as on other days." I asked the engineer, "What did you do on the thirteenth day of July?" reckoning back fourteen days. "We didn't do anything except to operate the pumps just the same that day as before." But somebody went out and came back in a few minutes and said, "Why, that was the day we started the steam pump." Well, on looking up the records we found that the thirteenth day of July was a very hot day, and the water power pumps were inadequate and the auxiliary steam pump had been started. Reckoning back fourteen days the other way we found that on the 27th of July the steam pump had been started again. I turned to the superintendent and said, "You go down and you will find that the packing is out of the joints in that pipe at the bottom of the canal, and that you have got leaks around the joints." Said he, "How do you make that out?" I replied, "I will tell you. Ordinarily the silt will settle down around the joints and the jar of the water pumps is not enough to start it, but the pulsation upon the main pipe when the steam pump was started has been sufficient to jar out the silt." So they drew down the water and found five leaks, one of which you could put your hand through. In other words, the lead had dropped away, the silt had taken its place, and the increased jar on the intake pipe had caused that silt probably to be sucked in and caused a leak, so that the dirty water from this canal could go through and find its way into the main. Fourteen days after that first starting of the steam pump the typhoid fever broke out, and fourteen days from the time the steam pump was started up the second time the fever increased. We ordered that pipe taken out altogether, so that the canal water could not find access at all to the mains, and the epidemic then died out.

I might go over the same story at Ashland, Wis.; I might go over the same story again at Duluth, Minn.; and I might go over the same story again in the city of Minneapolis, where there was a second outbreak this year. And so you will find it is the same story over and over again of the water supply being the primary cause of the outbreak of this dread disease.

A friend back here (Mr. Hastings) asks how we are going to prevent it. The only way is by eternal vigilance. I was called upon to make an investigation of the Denver supply. What did we find? At a point sixteen miles above the lake we found a brother and sister sick in bed with typhoid fever, and the dejecta from those patients were thrown out, without any disinfection whatever, into Bear Creek and found their way to the city. The health commission went up and bought that house and took the sick people—it was in warm weather—out into a tent which was erected temporarily, and burned down the house, cleaned up the débris and covered the spot with loam. To-day if you went out where that house stood you would find a bright, green grass plot.

Eternal vigilance, watching the plant continually and keeping after it, is the only recommendation I have to make to those who have to do with the operating of public water supplies, for it is only in that way that they can be certain of guarding against not only the open causes which everybody knows about, but the far more insidious causes that the public never will know about till the dire result of some great outbreak follows.

MR. M. N. BAKER.* It is certainly appalling to think that such an epidemic, caused by conditions such as have been described, could have occurred so recently; and it is all the more appalling when we realize the fact, as we must, that there are hundreds of other communities that have the danger of the same kind of epidemic, of equal severity, impending at the present moment. As many of you doubtless remember, during the past winter we had a large number of outbreaks, and one or two epidemics which rivaled in importance that at Ithaca. Those outbreaks attracted a great deal of attention, and I think they have

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done a great deal to arouse the public mind to the necessity of guarding against them in the future.

The precautions which can be taken against such outbreaks naturally divide themselves under two heads. One of them, and the first, concerns more particularly an association like this, composed of water works superintendents and engineers. The duty of a water works superintendent and of a water board is, of course, to do all that is possible, first to prevent the pollution of the water, and second, to make sure that the water when necessary is purified before it is delivered to the consumer.

Now, in view of the almost insurmountable difficulties in preventing occasional pollution in sparsely populated drainage areas, and the general apathy and indifference of the public, whose interest and support is necessary to prevent contamination, both in the rural districts and in the districts nearer the cities, I think we may say the time has come when we in the United States will have to do as is done in Great Britain and Germany, and begin to make our plans to effectually purify all water derived from surface sources. That subject, of course, might be dealt with at length, but as the time is short, I wish to pass on to the precautions of the other line.

Those are more general in their nature, but as the water works superintendents and other officials have such a great burden of responsibility upon them, I think that they must try to arouse the public, the various municipalities and municipal authorities of the country, to the necessity of a thorough reorganization of the work of the local boards of health. Here is where the trouble arises. Scarcely any of the cities of the United States, to-day, large or small, are taking effective precautions through their local boards of health to protect the purity of their water supplies and to prevent these epidemics of typhoid which arise, not always from water supplies, but from many other sources.

It is for the interest of water works authorities to have the necessary work done to prevent the spread of typhoid through other causes than the public water supplies. Many epidemics, mild outbreaks generally, but sometimes quite considerable ones, come through the milk supplies. The protection of the milk supply is a rural question, and it comes in naturally and is closely

related to the protection of surface water supplies. Now, I venture to say that with efficient board of health work, with sufficient registration of vital statistics, such epidemics as occurred at Ithaca, and more recently at Butler, Pa., and a number of other places, could never have attained the importance that they did. They would have been stamped out long before so much mischief was done; and ordinarily the secondary infection would be prevented by proper board of health work.

There are a few questions which it would be very interesting indeed to discuss at greater length and to have the author of the paper answer, but in view of the lateness of the hour, perhaps the answers to those questions might be given in writing in closing the discussion. There is one thing, however, which vitally concerns us all in view of the educative value of such a study as was made at Ithaca and has been presented in outline here. Why was not that report, which was worked up with great care, and which would have been of inestimable service in carrying on the campaign against the spread of typhoid fever throughout the country, made public? Why has it been suppressed? The report, as I understand it, was completed practically a year ago. The study was made by the Department of Health of the State of New York at great expense, and that report should have been published in a large number of copies and circulated broadcast throughout the state of New York, in order to arouse other communities to the necessity of carrying on preventive work.

Another question is, How could such conditions as existed at Ithaca have arisen in a university town? Now, that is rather a delicate question and opens up an opportunity for a very great deal of discussion. I thought, at the time, a great deal about it, and this thing came to my mind among other things: Philadelphia, for instance, in which is located the University of Pennsylvania, a university city, has been suffering through these many years from a very large number of cases of typhoid fever. The University of Pennsylvania, so far as we know, did comparatively little, but there the problem was so great and so far beyond the influence of the university that we might not expect it could do much except through the individual efforts of some of the members of the staff. I think as a matter of fact that some of them did

have a very great influence in the early days upon the protection of the Schuylkill. But in a smaller place like Ithaca, and like Beloit and many other places where there are universities, the teaching staff of the university can have and should have a very great influence in the protection of the public health. I think that is worthy of reflecting upon, at least. Has Ithaca an efficient board of health to-day? Is it in a position to keep down these dangers along the same line? I have understood that, notwithstanding its severe lesson, politics and a multiplicity of conflicting interests of one sort and another have prevented the carrying out of efficient work.

One of the greatest difficulties which any local board of health has to contend with in trying to put the municipality under its care in proper condition to-day is the finding of the proper sort of men to carry on the work of inspection and protection of the public health. There is not in the United States to-day any means of providing the training which is necessary for an executive health officer or health inspector, and we are continuously confronted in the community in which I live — Montclair, N. J. — with that fact. Every few years we have to go through the finding of a new man to occupy the position of executive health officer. We are in that position to-day. We had in Montclair a few years ago an outbreak of typhoid fever which resulted in something over eighty cases, — a milk epidemic — due to a mild case of typhoid in the family of a milkman. It was the case of a young man who worked in the dairy and who went to a privy which was located a little higher than a well, from which water was drawn to wash the milk cans, etc. We had, as I say, in Montclair some eighty cases, and they were all on one milk route. And this illustrates the fact that the burden of this responsibility for typhoid does not all rest upon the water works men, although water is generally at the bottom of the matter. That epidemic aroused public interest so much in Montclair that they have backed up the work of the board of health ever since, and we have had almost without exception during the last eight or ten years a trained man as executive health officer in the town. We have generally gone to Professor Sedgwick at the Massachusetts Institute of Technology

and asked him to find some man for us, because the course there and the work under Professor Sedgwick and formerly under Professor Drown seemed best to fit men for that position. But every two or three years the man we get becomes so valuable that he is sought for other lines of work elsewhere and given greater compensation. We have just lost a man who has gone on to the United States Geological Survey to assist in the work of the investigation of water supplies and their pollution. And so we are again confronted with the necessity of finding a competent man, and there is no place to go where we can find a number of men to draw upon for that work.

This Association and its members have an opportunity for a great deal of usefulness in bringing the attention of the public authorities to these other phases of water pollution resulting in typhoid fever epidemics, and also in bringing home to our educational institutions their duty towards the smaller communities in which they are located, and the need of courses in all of our leading institutions of learning which shall fit men to carry on the health protective work of our cities and towns.

PRESIDENT BROOKS. I have noticed that that old fallacy which was advanced by Franklin years ago in England as to the ability of running water to purify itself by oxidization in going a certain distance seems to have more vitality than any error I ever knew of. People living on water drainage areas discharge their filth into the water supply with the idea that it will become perfectly harmless by running a short distance. Do you not find that idea to exist quite generally, Dr. Soper?

DR. SOPER. I do, indeed.

PRESIDENT BROOKS. It seems to be something which has become thoroughly instilled in the minds of many people, especially those living in the rural districts; they seem to feel that filth can be cast into a running stream with perfect impunity. I might say also, in connection with what Mr. Baker has said in regard to the coöperation of local boards of health, that we find it very difficult to interest the boards of health of adjoining towns in the welfare of their neighboring cities. They may be interested in their own affairs, but if our water supply is collected in their towns they take very little interest in preventing its pollution.

We may say to them that their people visit us, and that our people visit them, and that there is an intimacy between the people of the different communities which makes it incumbent upon them to guard our supply as jealously as their own, but that does not seem to have any force with them. Here in New England, where our milk supply comes from adjoining towns, our local board has nothing to do with the conditions under which the milk is furnished, and it really seems sometimes as though if any really efficient work is to be done, it will devolve upon the state to do it.

