

INFORMATION FOR ALDERMEN.

Analysis of City Water Made by Distinguished Experts.

WHAT IS THE NEED OF ANOTHER ANALYSIS AT A COST OF \$250.

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Variety	Gas in Dextrose Broth	Indol Formation	Milk	Growth on Potato	Litmus Whey	Neutral Red Agar	Proskauer-Capaldi		Reaction with Anti-Typhoid Serum
							I	II	
T.C.	0 0	0	0	0	0	0	No growth, no change in reaction.	Growth, reaction strongly acid.	g g g g
1	g 0	0	0	0	0	0	Growth, reaction acid in 24 hrs. Acid 4 days.	Growth, reaction neutral or faint alk	0 0 0 0
2	0 0	0	0	0	0	0	Slight growth, reaction acid.	Growth, reaction strongly acid.	0 0 0 g
3	0 0	0	0	0	0	0	Slight growth, reaction acid.	Growth, reaction strongly acid.	0 0 0 g
4	g 0	C 2 dys	g 8	0	0	0			
5	0 0	0	0	0	0	0			
6	0 0	0	0	0	0	0			
7	0 0	0	0	0	0	0	Slight growth, reaction slightly acid.	Growth, reaction strongly acid.	0 0 0 0
8	0 0	0	0	0	0	0	Slight growth, reaction slightly acid.	Growth, reaction strongly acid.	0 0 g g
9	0 0	0	0	0	0	0			
10	0 0	0	0	0	0	0			
11	0 0	0	0	0	0	0			
12	0 0	0	0	0	0	0	Slight growth, reaction slightly acid.	Growth, reaction strongly acid.	0 0 g g
13	0 0	0	0	0	0	0	Slight growth, reaction slightly acid, later alkaline.	Growth, reaction strongly acid.	0 0 g g
14	g 0	C 2 dys	g 8	0	0	0	Slight growth, reaction slightly acid.	Growth, reaction strongly acid.	0 0 g g
15	0 0	0	0	0	0	0	Slight growth, reaction acid, later alkaline.	Growth, reaction strongly acid.	0 0 0 0
16	0 0	C 2 dys	0	g 0	0	0			
17	g 0	0	0	0	0	0	Growth, reaction acid.	Growth, reaction strongly acid.	0 0 g g
18	0 0	0	0	0	0	0			
19	g 0	0	0	0	0	0			
20	g 0	C.G.	0	0	0	0			
21	0 0	0	0	0	0	0			

Gas in dextrose broth

Indol formation in Durham's Solution tested after 5 and 10 days incubation at 37 C.

Milk

Potato

g—gas

0—no gas

D—Doubtful

g—indol reaction Litmus Whey

0—no reaction

0—no change, no gas, no coagulation

0—invisible growth (transparent film)

g—colored growth

0—very slightly acid.

g—marked acidity 10-30 per cent alkali to neutralize

Neutral Red Agar

Anti-Typhoid Serum

g—canary yellow, fluorescence, gas

0—growth, no change in color, no gas

g—agglutination

0—no agglutination

Following is the analysis of Fredericton city water, made by Prof. Harrison of the Ontario Agricultural College, Guelph, and Prof. Shutt, chemist of the Dominion Experimental Farm, Ontario:

F. C. Harrison, Ontario Agricultural College.

The city of Fredericton, N. B., is situated on the south bank of the St. John River, which at this point is about three quarters of a mile wide, with little current. The tide does not come further up the river than Gagetown, about thirty-five miles below Fredericton, there being a rise of an inch at high water and five or six inches at low water.

The city is built on sandy soil, with here and there layers or banks of clay. By digging down a few feet water may be reached at any time in the year, and the water level rises and falls according as the season is wet or dry. Every spring many cellars are flooded.

The city has no system of sewerage; but to some slight extent the drains are used as sewers. These flow into the river at different points along the river front. Nearly every house has one or more cess pools. The hospital is situated 100 feet above the pumping station, and 300 feet from the bank of the river. This bank is about 20 feet high, and there is a gradual incline from the hospital to the edge of the bank. Formerly, there was a sewer from the hospital to a place below the intake; this, however, became plugged, and for more than a year past the drainage from the hospital has emptied into a hole just behind the hospital and from that point is drained into the river. (The sewer is now used instead of the cesspool.)

The water supply for the city is taken from the St. John River, 150 feet from the shore and directly opposite the pumping station. The number of cases of typhoid fever officially reported in Fredericton (population 7,000) during the past few years are as follows:

The year ending October 31, 1899, 71 cases.

The year ending October 31, 1900, 21 cases.

The year ending October 31, 1901, 10 cases.

The year ending October 31, 1902, 33 cases.

The year ending October 31, 1903, 29 cases.

And the number of cases from November 1, 1903, to April 4, 1904, was 24. At this time of writing there are 15 cases in the hospital, and over 50 in the city. Besides the cases that are officially reported, the writer is informed that there are dozens each year that are cared for at home, and not reported. The cases are from all parts of the city supplied with city water. Across the river at St. Mary's, where artesian well waters are used, there have been no cases of typhoid this year, and none for several years past, except one or two, and these among those who work in Fredericton and drink Fredericton water. From a careful examination of the distribution of the cases, dissemination through infected milk from one or more milk dealers may be excluded.

On March 15th, 1904, the writer received from Fredericton two bot-

ties of water, well packed and in good condition. One of these samples was taken from the river at a point one mile above the city. The second sample was made up of water from running taps in three different parts of the city.

The chemical analyses of these waters were as follows:

River Water—City Water.

Fermentation tubes containing two per cent. glucose broth inoculated with $\frac{1}{2}$ c. c. of water gave no growth in the closed arm after 48 hours at 37 per cent. C.

Inoculated with $\frac{1}{2}$ c. c. water gave slight growth and cloudiness and 7 per cent. gas in 48 hours.

Carbolic broth (containing four c. c. of five per cent. solution of carbolic acid in 100 c. c. of beef broth) inoculated with $\frac{1}{2}$ c. c. of river water and incubated at 37 degrees C., gave no growth in 48 hours. Inoculated with $\frac{1}{2}$ c. c. water and incubated for 48 hours at 37 degrees C., no growth.

Two guinea pigs were inoculated. One, intraperitoneally with two c. c. of glucose broth from fermentation tube inoculated with $\frac{1}{2}$ c. c. water; and the other, intraperitoneally, with two c. c. of the carbolic broth culture inoculated with $\frac{1}{2}$ c. c. water. Both cultures had previously been incubated for 48 hours at 37 degrees C.

The results were nil; the animals remained well and healthy.

CITY WATER.

Total number of bacteria per c. c., 34,650.

Liquefying colonies, principally B. fluorescens liquefaciens, 3150 per c. c.

Non-liquefying colonies, 31,500 per (parts per million)

Solids at 212 F. ... 8. 72.

Solids after ignition ... 3. 32.

Loss on ignition ... 5. 40.

Free ammonia ... 0.09 0.015

Albuminoid ... 0.045 0.1875

Nitrogen in Nitrates and Nitrites ... 0.111 0.267

Phosphates ... free free

Chlorine ... 1.0 30.

The above analysis was made by Mr. F. T. Shutt, chemist of the experimental farm, Ottawa. Commenting on the above analyses, he stated that "It is to be regarded as a suspicious sign that the differences in the analytical data are to be observed, and that between the point where the sample was taken in the river and the mouth of the intake pipe the quality of the water was, for some cause, changed for the worse."

The bacteriological analysis were as follows:

RIVER WATER.

Total number of bacteria per c. c., 141,000.

Liquefying colonies chiefly B. fluorescens liquefaciens, 9000 per c. c.

Non-liquefying colonies, 132,000 per c. c.

Of these, a number looked like colonies of the colon bacillus.

Agar plates incubated at 37 degrees C. for 24 hours gave 16,150 colonies of bacteria per c. c. Colon bacilli were present in considerable numbers.

Fermentation tubes inoculated with $\frac{1}{2}$ c. c. water and incubated at 37 degrees C. gave 20 per cent. gas in

48 hours. Others inoculated with $\frac{1}{2}$ c. c. water gave 45 per cent. gas in 48 hours.

Carbolic broth tubes inoculated with $\frac{1}{2}$ c. c. water and incubated at 37 degrees gave considerable cloudiness in 24 hours.

Gelatin plates were made from the carbolic broth cultures and these plates gave practically a pure culture of colon-like bacteria. These plates were carefully examined and 21 colonies, that seemed to resemble the growth of B. typhosus on gelatin, were isolated and these sub-cultures were passed through a number of differential tests to see if they resembled the typhoid or the colon bacillus. These tests will be given in detail later on.

Animal inoculations—Two guinea pigs were inoculated with cultures obtained from the tap water. One guinea pig was inoculated intraperitoneally with two c. c. of a 36-hour old glucose broth culture inoculated with $\frac{1}{2}$ c. c. water. Eight hours afterwards the animal appeared drowsy, with labored breathing, the hind legs were partly paralyzed, general malaise, and the animal died 24 hours later.

Postmortem made directly after

Nos. 1, 2, 7, 15 and 18 gave slight growth with acid reaction. Nos. 13 and 18 gave growth with acid reaction later changing to an alkaline reaction.

Proskauer and Capaldi's Medium, No. 2.—Nos. 1, 2, 6, 7, 13, 15, 16 and 18 gave growth with acid reaction, resembling growth of the B. typhosus in this medium. B. coli gave growth with a neutral or faintly alkaline reaction of this medium.

Agglutination—The antityphoid serum used for this was obtained through the courtesy of the Park, Davis Company of Detroit. It was a very powerful serum. The agglutinating limit of this serum with my B. typhosus was not worked out. In a dilution of 1:250,000 it gave a marked agglutination with this culture. For the purpose of testing the various varieties, four dilutions were made up—1:100,000, 1:10,000, 1:1,000, and 1:500. Four varieties Nos. 8, 13, 15 and 18, gave complete agglutinations in dilutions of 1:1,000 and 1:500. No. 2 gave complete agglutination with dilution 1:500.

A glance at these results will show that a number of these varieties were very closely allied to B. typhosus, and showed greater resemblance to this organism than to the varieties described by Houston and Horrocks under the name of B. typhosus simulans. On the Proskauer and Capaldi's medium 1, the growth compared with B. typhosus was atypical. A guinea pig inoculated with $\frac{1}{2}$ of an agar culture of variety No. 18 incubated for 24 hours at 37 degrees, died in 36 hours. The bacteria present in the spleen and heart blood were similar to the organism inoculated.

It seems unnecessary to comment upon the condition of the water supply of Fredericton. The drainage of the city and some of its sewerage, the sewerage from the hospital and the drainage from the cemetery, all empty into the St. John River close to the shore, and these sources of contamination are both above and below the water intake, and there seems to be sufficient tide in the river to contaminate the water above the intake, with the sewage which enters the river from below the pumping station.

Note—The media used in this work were, unless otherwise stated, prepared according to the recommendations of the Laboratory Committee of the American Public Health Association.

All cultural tests were made in duplicate, some in triplicate.

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