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A Report upon some Microscopical Organisms found in the New York City Water Supply.

Reprinted from
The Journal of Pharmacology.

A REPORT UPON SOME MICROSCOPICAL ORGANISMS FOUND IN THE NEW YORK CITY WATER SUPPLY.

By Smith Ely Jelliffe, A. B. M. D., and Karl M. Vogel, Ph G.*

During the years 1892–'93 one of the writers made an extended microscopical analysis of the Brooklyn water supply, the results of which were published with tables and illustrations in the *Brooklyn Medical Journal* for October, 1893, and October, 1894.

The following series of observations, along much the same lines, was begun upon the New York water in May, 1894, but for various reasons was carried on in an irregular manner; the results have, however, been included in the tabulations for the sake of future reference. From about the middle of November, 1895, the observations were made weekly upon the water delivered from the tap in the writer's residence, 231 West Seventy-first Street, New York.

The same two methods were employed as in the Brooklyn water research. The Sedgwick Rafter method was used as a means of control, while the writer's method of filtering through absorbent cotton for a definite length of time and consequent shaking out of the organisms was employed as a regular routine. Specimens were subsequently preserved in two per cent. formaldehyde for future study or corroboration.

Previous to the monumental work of the Massachusetts State Board of Health upon the water supplies of that State, there had been reported more observations upon the water supply of New York City than of any other city supply in this country: yet these reports were but fragmentary. Other cities in the Union were fortunate in having enthusiastic microscopists who devoted much time to the examination of their local water supplies; such men were Messrs. Vorce, Rafter, Thomas, Mills, Kellicott, and others. A full record of the work, whether fragmentary or exhaustive, that had been published up to that time may be seen by referring to the bibliography in the *Brooklyn Medical Journal*, October, 1894, p. 597, *et seq.*

Regarding the organisms of the New York water supply, that well-known and beloved botanist, Dr. John Torrey, was the first to publish anything upon the subject. In the annual report of the Croton Aqueduct Commission for 1859, he draws attention to the fact that at many times of the year a peculiar odor in the water was noted, which he compared to the odor of an old hydrant; this odor he believed to be due to vegetable organisms, one of which he described as a "small string of oblong, rounded cells with larger ones interspersed" (like a string of beads.) This form is to-day recognized from Torrey's description as an "anabæna," and is now definitely held to be the cause of unpleasant odors and tastes in drinking waters. He also described a form of nostoc which has a similiar unsavory reputation.

In 1869, two writers published some notes upon the subject—W. B. Lewis, M.D., and Fred. Kitton. The former, in a report to the Metropolitan Board of Health, gives a list of some species with some fifty figures, which were well executed. The

* Reprinted from the *New York Medical Journal*, May 29, 1897.

forms drawn by him are quite common at the present time; a point of historical as well as of sanitary interest. Kitton's observations were restricted to the diatoms. Many of the forms described by him are common at the present day, while others have not been observed by the writers.

C. F. Gissler, in *Contributions to the Fauna of New York Croton Water*, embodied the observations of about two years—1870, 1871—upon the animal forms. Gissler's phamplet is now quite rare, is full of interesting and scientific observations, and is well illustrated. Most of the organisms found by him are to be found at the present time; some are very common, while others are very rare. His list includes, of the animal organisms, at least one-half of those noted by the writers.

During a space of some ten to fifteen years or more, E. Waller, in the yearly reports of the board of health doles out a series of figures on the chemical composition of the water. In his report for 1876–'77 he makes brief mention of the fact that the cause of the disagreeable odors that were present in the water in those years might be due to the presence of vegetable organisms. Cœleosphærium and Anabæna are mentioned as particularly reprehensible.

R. Hitchcock, in the *American Monthly Microscopical Journal*, 1880, gives the best series of observations that up to this time had appeared. He makes the following interesting notes:

"*Croton Water in August.*—The croton water that is now supplied to the city possesses no offensive taste or odor, although there is a considerable amount of suspended matter to be collected by filtering it. This is another fact tending to prove that the peculiar odor sometimes observed is caused by certain plants which are not always present, and not by the decomposition of vegetable matter of all kinds. We have lately studied the algæ found in a few filterings, and although the list is not complete, it may still be of interest to observers in other cities."

Hitchcock's lists are the most valuable that we have for comparison and are here given as they stand, with such changes and omissions as a changing nomenclature permits.

Cyanophyceæ.—Dictyosphærium ehrenbergiana, Cœleosphærium dubium, Merismopedia glauca, Oscillaria tenuis, Oscillaria Froehlichii, Sphærozyga polysperma.

Chlorophyceæ —Palmodactylon varium, Rhaphidium polymorphum, Chlorococcus gigas, Polyedrium longispina, Scenedesmus caudatus, Pediastrum ehrenbergianum Pediastrum biradiatum (?), Pediastrum pertusum, Gonium pectorale, Cosmarium crenulatum, Cosmarium tetrophthalmum (?), Staurastrum læve, Staurastrum Sebaldii, Staurastrum gracile, Micrasterias truncata, Spirogyra nitida.

Numerous species of diatoms were found, but were not determined. Among other organisms were the following: *Amœba villosa, Difflugia globulosa, Difflugia corona, Arcella, Actinophrys sol, Ceratium, Brachionus Conium, Chætonotus, Rotifer ova.*

A. M. Edwards, M. D., gives in the *Quarterly Journal of Microscopical Science* (1881 (?)) a brief list of some diatoms found.

Finally, in the *Medical Record* for 1882, E. Cutter, M. D., in an article upon Suspicious Organisms in the New York Water, gives a list of ninety-six organisms,

most of which have been mentioned by previous writers, but, as this skilled microscopist includes in his list "skin of consumptive with yeast plants within," and figures a flat epithelial-like body with rounded masses included, we feel inclined to doubt his critical acumen. If the age and the sex of the afflicted persons whose skin had found its way under the doctor's microscope had been given we might have deemed his lists more reliable.

The objects of the present examination were three-fold :

1. To obtain an accurate knowledge of the microscopical (using the word in Professor Sedgwick's sense) forms that occur in the ordinary tap water, their kinds, comparative frequency, and seasonal distribution.

2. To ascertain whether any forms were to be found that are known or supposed to be obnoxious on account of their taste or odor, or prejudicial to the health of the community.

3. To observe whether there were any forms of living organisms or remains of dead ones that would indicate an unsanitary condition in the watershed.

Lists of tables have been prepared showing the various species of organisms that flourished naturally in the croton water. Their comparative numbers are expressed as abundant (A.), common (C.), few (F.), or scarce (Sc.). Such terms are necessarily relative, but are sufficiently accurate, in the writer's opinion at least, to make the observations of value in correlating the results with other tabulations. The figures thus broadly indicated are as follows : Sc., one to five to the cubic centimetre and less ; F., five to ten to the cubic centimetre ; C., ten to twenty-five to the cubic centimetre ; A., over twenty-five to the cubic centimetre.

Lists.—In all some hundred forms were found, of which about eighty-five were definitely determined. In general, it may be observed that there is a remarkable similarity in the organisms found when compared with those of the Brooklyn water supply, which fact would not appear at all strange were it not for the distinct differences in the geological formations of the respective watersheds. But, on the other hand, the forms observed are quite cosmopolitan, which again might readily bring the facts into correlation.

On going over the lists the fact of the constant presence of the class of algæ known as Cyanophyceæ is to be noted. It has frequently been stated that this class of organism is an undesirable one in water supplies, indicating as they do within general limits a medium of growth which is rich in organic matter. Two representatives of the class were constant throughout the entire time of examination, Oscillaria and Clathrocystis.

In the class of organisms closely allied, the diatoms, there is little new to be noted. Cosmopolitan forms were in abundance, while there were a few species typical to the supply. *Cyclotella crotonensis* being a notable example. *Stephanodiscus Niagaræ* is a form that is common in the region of the great lakes, but we did not find it in the Brooklyn supply. In all some thirty-five forms were observed, of which the only ones of interest from the sanitary side were Synedra, Tabellaria, Melosira and Asterionella. These organisms, presumably on account of the oil or fat found within their cytoplasm, are known to be responsible for distinct disagree-

able tastes and odors when their numbers become excessive. The former three yield the "grassy" odors, while the last give a fishy and aromatic odor. These organisms have been quite constant throughout the entire time of examination, Synedra and Tabellaria have been few to scarce, while Asterionella * and Melosira, during the month of December, were quite abundant. In the same time, 1896, Asterionella was rarer. This distribution is strikingly like the distribution of the same organisms in the Brooklyn supply and is probably associated with temperature changes. In point of number these organisms did not reach by one one-hundredth part the proportion necessary to make them noxious.

In the class of the Desmids fifteen forms were observed. This is a small list, but these forms are not common at this time of the year. The most constant forms have been Staurastrum and Closterium, but these have been very few in number at any one period of observation. Contrasted with the Brooklyn water there were fewer forms, and those present were scarcer. So far as is known these organisms are not deleterious in any way. It is stated that they can live only in pure water which has plenty of oxygen and sunlight.

Of the grass-green algæ, exclusive of the Desmids, two forms have been very commonly found, Scenedesmus and Rhaphidium, neither of which is of any hygienic importance.

Turning to the animal organisms, there were in all some thirty-five forms found in the period under consideration. Amœbæ were not found, but *Arcella vulgaris* and *Euglypha alveolata* were not infrequently observed.

The class of the Infusoria were not abundant. Dinobryon was the most constant Its distribution was quite similar to that observed in the Brooklyn water. It increased during the month of January and February, while the other organisms gradually disappeared. Dinobryon is an organism which, in numbers of from five hundred to one thousand to the cubic centimetre, would produce a very disagreeable water. We have rarely seen it over fifty to the cubic centimetre during the time under consideration.

Of the remaining animal organisms there is little to be recorded beyond that found in the tabulations.

Finally, with reference to the detritus. This was made up for the most part of the tissues of higher plants and was not very abundant during the earlier months, but with the increased moisture of winter and the frequent thawing, etc., it became quite noticeable, especially in the early spring months, February 14th to April 3d. In a few instances the peculiar stone cells characteristic of straw were observed, and quite frequently cells characteristic of animal epithelium were found. Whether these were from "flesh, fish or fowl" it would be unwise for us to hazard a diagnosis.

In conclusion, it would therefore seem that from the standpoint of the present examination the water is pure and wholesome. Its entire purity could alone be determined by the bacteriological analysis. Of this last class of work not enough

* It would appear from recent reports that this organism is in part if not wholly responsible for the disagreeable odor and taste of the Brooklyn water during the past two summers.

	1895. Nov. 1.	Nov. 8.	Nov. 15.	Nov. 22.	Nov. 29.	Dec. 6.	Dec. 13.	Dec. 20.	Dec. 27.	1896. Jan. 3.	Jan. 10.	Jan. 17.	Jan. 24	Jan. 31.	Feb. 7.	Feb. 14.	Feb. 21.	Feb. 28.	March 6.	March 13.	March 20.	March 27.	April 3.	April 17.	April 24.	1895. May 1.	May 15.	June 1.	June 15.
VEGETABLE ORGANISMS.																												
Algæ, Cyanophyceæ.																												
Oscillaria Froehlichii	---	---	Sc	Sc.	Sc.	Sc.	Sc.	F.	F.	Sc	---	Sc.	Sc.	Sc.	Sc.	Sc.	Sc.	Sc.	Sc.	Sc.	Sc.	Sc.	Sc.	---	---	---	Sc.	Sc.	Sc.
Gleocapsa, sp	Sc.	---	Sc.	Sc.	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Anabæna, sp	Sc.	---	Sc.	Sc.	---	---	---	---	---	---	Sc.	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	Sc	---	---
Cœleosphærium, sp	Sc.	---	F.	F.	Sc.	Sc.	Sc.	F.	F.	Sc.	Sc.	Sc.	Sc.	---	Sc.	---	Sc.	Sc.	---	Sc	---	---	---	---	---	---	---	Sc.	---
Diatomaceæ.																												
Amphiprora ornata	---	---	---	---	---	---	---	---	---	---	---	Sc.	---	---	---	---	---	---	---	Sc.	---	---	---	---	---	---	---	---	---
Amphora ovalis	---	---	Sc.	Sc.	---	---	Sc.	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Asterionella formosa	C.	C.	C.	C.	A.	A.	A.	F	F.	Sc.	C.	C.	Sc.	Sc.	Sc.	Sc.	Sc.	F.	Sc.	Sc.	Sc.	Sc.	F.	Sc.	---	---	Sc.	Sc.	Sc.
Cyclotella crotonensis	Sc.	Sc.	Sc.	Sc	---	Sc.	---	---	---	---	---	---	Sc.	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Cocconeis pediculus	---	---	---	---	---	---	---	---	---	Sc.	Sc.	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	Sc.	Sc.	---
Cymatopleura solea	---	---	---	---	---	---	Sc.	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	Sc.	---
Cymbella cistula	---	---	Sc.	Sc.	Sc.	---	Sc.	---	---	Sc.	Sc.	Sc.	---	---	---	Sc	---	---	---	Sc.	---	---	---	---	---	---	---	---	---
Encyonema ventricosa	Sc.	Sc	---	---	Sc.	---	Sc.	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	Sc.	Sc.	---
Eunotia lunaris	---	---	---	---	---	---	---	---	---	Sc.	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	Sc.	---	---
Fragillaria capucina	---	---	F.	Sc.	Sc.	Sc.	Sc.	Sc.	---	Sc.	Sc.	Sc.	---	---	---	---	---	Sc.	Sc.	---	Sc.	---	Sc.	Sc.	---	Sc.	Sc.	Sc.	Sc.
Gomphonema capitatum	---	---	---	Sc.	---	Sc.	---	Sc.	Sc.	---	Sc.	Sc.	---	---	---	Sc.	Sc.	---	---	---	Sc	---	Sc	---	---	---	---	---	---
Melosira granulata	C.	C.	C.	A.	A.	A.	A.	A.	F.	Sc.	C.	C.	Sc.	F.	F.	F.	C.	F.	F.	Sc.	Sc.	Sc.	C.	---	---	Sc.	Sc.	Sc.	Sc.
Navicula cuspidata	---	---	---	---	---	---	---	---	Sc.	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
" dilatata	---	---	---	Sc.	---	---	---	---	---	---	---	Sc.	Sc.	---	---	---	---	Sc.	---	Sc.	---	---	---	---	---	---	---	---	---
" gibba	---	---	Sc.	---	---	---	---	Sc.	---	Sc.	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
" radiosa	F.	Sc.	---	Sc.	---	Sc	---	Sc.	---	---	---	---	---	---	---	---	---	---	---	---	Sc.	---	---	---	---	Sc.	Sc.	Sc.	---
" ryhncocephala	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	Sc.	---	---
" viridis	Sc.	---	---	---	---	---	---	---	Sc.	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
" sp. indet	---	Sc.	---	Sc.	---	Sc	---	---	---	---	Sc	---	---	---	---	Sc.	---	Sc.	---	---	Sc.	Sc.	---	---	---	---	Sc.	---	---
Pleurosigma Spenceri	---	---	---	Sc.	---	Sc	Sc.	---	---	---	---	---	---	---	---	---	Sc.	---	---	---	---	---	---	---	---	---	---	---	---
Stauroneis anceps	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	Sc.	---	---
Stephanodiscus minutus	---	---	---	---	---	---	---	Sc.	Sc.	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	Sc.	Sc	---	---
" Niagaræ	---	---	---	Sc.	Sc.	Sc.	Sc.	F.	F.	Sc.	Sc.	Sc.	Sc	Sc.	Sc	---	Sc.	Sc.	Sc.	Sc	---	---	---	Sc.	---	---	Sc.	---	---
Surirella elegans	---	---	Sc	---	---	---	Sc	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	Sc	---	---
Synedra pulchella	F.	F.	F.	A.	C.	C.	F.	F.	F.	Sc.	Sc.	F.	Sc	Sc.	F.	F.	F.	---	F.	Sc.	Sc.	Sc.	Sc	Sc	---	Sc.	Sc.	Sc.	Sc.
" ulna	F.	F.	C.	A.	C.	A.	C.	F.	F	Sc.	F.	F.	F.	F.	F.	F.	C.	F.	C.	F.	---	F.	F.	Sc.	---	Sc.	Sc.	Sc.	Sc.
" biceps	---	---	---	---	Sc.	C.	---	---	---	---	---	Sc.	---	Sc.	---	---	Sc.	Sc.	Sc.	---	---	---	---	---	---	Sc.	Sc	Sc.	---
Tabellaria fenestrata	Sc.	Sc.	---	Sc.	---	Sc.	Sc.	F.	F.	---	---	Sc.	---	---	---	---	---	---	---	---	Sc.	---	---	---	---	Sc.	Sc.	---	---
" flocculosa	---	---	---	---	---	---	Sc.	Sc.	Sc.	---	---	---	---	---	---	---	---	---	Sc.	---	---	---	---	---	---	---	---	---	---
Chlorophyceæ.																												
Dictyosphærium Ehrenbergianum.	Sc	Sc.	---	---	---	---	Sc.	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Pandorina morum?	Sc.	Sc.	---	---	---	---	---	---	---	---	---	---	---	---	---	---	Sc.	---	---	---	---	---	---	---	---	Sc.	Sc.	---	Sc.
Pediastrum boryanum	Sc.	Sc.	---	---	---	---	---	---	---	Sc	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	Sc.	Sc.	Sc.	Sc.
" Ehrenbergii	Sc	Sc.	Sc.	---	---	---	---	---	---	---	---	Sc.	---	---	---	---	Sc.	Sc.	---	---	---	---	---	---	---	---	Sc.	---	Sc.

	1895. Nov. 1.	Nov. 8.	Nov. 15.	Nov. 22.	Nov. 29.	Dec. 6.	Dec. 13.	Dec. 20.	Dec. 27.	1896. Jan. 3.	Jan. 10.	Jan. 17.	Jan. 24.	Jan. 31.	Feb. 7.	Feb. 14.	Feb. 21.	Feb. 28.	March 6.	March 13.	March 20.	March 27.	April 3.	April 17.	April 24.	1895. May 1.	May 15.	June 1.	June 15.
VEGETABLE ORGANISMS.																												
Chlorophyceæ.																												
Pediastrum pertusum	Sc.	Sc.	Sc.	Sc.	Sc.	Sc.	Sc.	---	Sc.	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
" Sturmii?	---	---	---	Sc	---	--	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	Sc	---	---	---
Polyedrium longispina	---	---	---	---	---	---	---	Sc.	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Rhaphidium polymorphum	Sc.	F.	Sc.	Sc.	Sc.	Sc.	Sc.	Sc.	Sc.	---	Sc.	Sc.	Sc.	---	Sc.	---	---	---	---	---	---	---	Sc.	---	---	Sc.	---	---	Sc.
Scenedesmus caudatus	C.	F.	Sc.	Sc.	Sc.	Sc.	Sc.	Sc.	Sc.	Sc.	Sc.	Sc.	---	---	---	---	Sc.	Sc.	---	---	---	---	Sc.	---	---	Sc.	Sc.	Sc.	---
Spirogyra sp	---	---	---	Sc.	Sc.	Sc.	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Cœlastrum micoporum?	F.	-	---	---	---	---	---	---	Sc.	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	Sc.	---	---
Desmids.																													
Arthrodesmus incus	---	---	---	---	---	---	---	Sc.	Sc.	---	Sc.	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Closterium Dianæ	---	---	Sc.	F.	Sc.	Sc.	Sc.	Sc.	Sc.	---	F.	---	---	---	---	---	---	---	Sc.	---	---	---	---	---	---	---	Sc.	---	---
" ensis	---	---	---	---	---	---	---	Sc.	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
" rostratum	---	---	---	---	---	---	---	---	Sc.	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	Sc.	---
Cosmarium Beckii?	---	---	Sc.	Sc.	---	---	---	---	---	Sc.	---	---	---	---	---	---	---	---	---	---	Sc.	---	---	---	---	---	---	---	---
Desmidium aptogonium	Sc.	Sc.	---	---	---	---	---	---	Sc.	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Sphærozosma filiforme	---	---	---	---	---	---	---	Sc.	Sc.	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	Sc.	---	---
Staurastrum crenulatum	C.	F.	Sc.	Sc.	Sc.	Sc.	---	---	Sc.	Sc.	---	---	Sc.	Sc.	---	Sc.	---	Sc.	Sc.	Sc.	Sc.	---	---	---	---	Sc.	Sc.	---	Sc.
" gracile	---	Sc.	---	Sc.	---	---	Sc.	Sc.	Sc.	Sc.	Sc.	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
" polymorphum	---	---	---	Sc.	---	---	---	---	Sc.	---	---	---	---	---	---	---	---	---	---	Sc.	---	---	---	---	---	---	Sc.	---	---
Staurastrum sp	Sc.	---	---	---	---	---	---	Sc.	Sc.	---	---	---	---	---	---	---	---	---	---	Sc.	---	---	---	---	---	---	---	Sc.	---
Vegetable Detritus.																													
Plant parenchyma	---	---	---		---	C.	---	---	F.	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	Sc.	Sc.	---	---
Ducts and tracheids	Sc.	Sc.	---	-	---	---	---	---	F.	Sc.	---	---	---	Sc.	---	---	---	--	---	---	---	---	---	Sc.	---	Sc.	Sc.	---	---
Fibres	---	---	---	---	---	---	---	---	Sc.	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Trichomes	---	---	---	Sc.	---	---	---	---	Sc.	Sc.	---	---	---	---	---	---	---	---	---	---	---	---	---	Sc.	---	Sc.	Sc.	---	---
Spores, etc	Sc.	---	---	Sc.	---	---	---	---	Sc.	---	---	---	---	---	Sc.	---	---	---	---	---	---	Sc.	---	---	---	---	Sc.	---	---
ANIMAL ORGANISMS.																													
Rhizopods.																													
Actinophrys sol	Sc.	---	---	---	---	---	---	---	Sc.	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Arcella vulgaris	Sc.	Sc.	Sc.	Sc.	---	---	---	---	---	Sc.	---	---	---	Sc.	---	---	---	---	---	---	---	---	S	---	---	---	Sc.	---	Sc.
Difflugia sp	---	---	---	Sc.	---	---	---	Sc.	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Euglypha alveolata	Sc.	Sc.	Sc.	Sc.	---	---	---	---	Sc.	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	Sc.	---
Infusoria.																													
Ceratium Hirundinella	Sc.	---	Sc.	Sc.	---	Sc.	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Chilodon cucullatus	---	---	---	---	---	---	---	Sc.	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---

	1895. Nov. 1.	Nov. 8.	Nov. 15.	Nov. 22.	Nov. 29.	Dec. 6.	Dec. 13.	Dec. 20.	Dec. 27.	1896. Jan. 3.	Jan. 10.	Jan. 17.	Jan. 24.	Jan. 31.	Feb. 7.	Feb. 14.	Feb. 21.	Feb. 28.	March 6.	March 13.	March 20.	March 27.	April 3.	April 17.	April 24.	1895. May 1.	May 15.	June 1.	June 15.
ANIMAL ORGANISMS.																												
Infusoria.																												
Coleps hirtus			Sc.	Sc.																								
Dinobryon Sertularia	Sc.	Sc.	Sc.	Sc.	Sc.			Sc.	Sc.	Sc.					C.	F,	F.	F.	Sc.	Sc.	Sc.	Sc.	Sc.		Sc.		Sc.	Sc.	Sc.
Euglena virdis															Sc.								Sc.						
" acus																Sc.	Sc.			Sc.	F.	F.	Sc.						
Gonium pectorale								Sc.	Sc.																	Sc.	Sc.		
Litonotus Fasciola																												Sc	
Paramecium Bursaria				Sc.																									
Paramonas globosa			Sc.					Sc.	Sc.						Sc.	Sc.											Sc		
Peridinium tabulatum						Sc.		Sc.	Sc.							Sc.					Sc.								
Phacus longicadis								Sc.	Sc.																	Sc.	Sc.	Sc.	
Pleuromonas jacaulans	Sc.	Sc.																	Sc.									Sc.	
Stylonichia sp			Sc.																Sc.										
Synura uvella			Sc.					Sc.	Sc.							Sc.													
Trachelomonas sp	Sc.																												
" cylindrica	Sc.		Sc.	Sc.		Sc.									Sc.	Sc.													
Vorticella communis								Sc.	Sc.						Sc.							Sc						Sc.	
Vermes.																													
Anguillula fluviatilis		Sc.					Sc.		Sc.	Sc.														Sc.				Sc.	
Rotifereæ.																													
Aneuria cochlearis	Sc.	Sc	F.	Sc.		Sc.	Sc.	Sc.	Sc.	Sc.		Sc.	Sc.				Sc.	Sc.	Sc	Sc.			Sc.				Sc.	Sc.	
Rotifer vulgaris							F.																Sc.						
Monostyla lunaris										Sc.																			
Polyarthra platyptera									Sc.							Sc.													
Ova	F.	Sc.		Sc.		Sc.			Sc.			Sc.		Sc.				Sc.					Sc.			Sc.	Sc.		
Crustacea.																													
Cyclops quadricornis									Sc.														Sc.				Sc.		
Daphnia sp			Sc.				Sc.									Sc.								Sc.				Sc.	
Bosmina longirostris	Sc		Sc.					Sc.	Sc.																	Sc.	Sc.	Sc.	
Miscellaneous.																													
Sponge spicules	Sc.	Sc.		Sc.																									
Epithelium?				Sc.						Sc.					C.														
Hairs, etc										Sc.										Sc.				Sc.		Sc.		Sc.	

has been done with our water supply. Many chemical examinations have been given us from time immemorial, and the New York City Board of Health weekly reports Complete Sanitary Analyses, which analyses are far from complete save in the chemical sense of the word. A good "complete sanitary analysis" of New York water has never yet been made, and it is a desideratum. This present communication is but a small step in the working out of such an analysis.

Appended is a chart of the more common forms observed during the period. For those interested it may be stated that the specific determinations were made by means of the best available monographs on the various groups: Bütschli, Kent, Hudson and Gosse, Potts, Leidy, Stokes, Wolle, Van Heurck, Wille, Rabenhorst and others, being the writers mainly consulted.

In addition, some fifteen to twenty forms were observed which could not definitely be determined.

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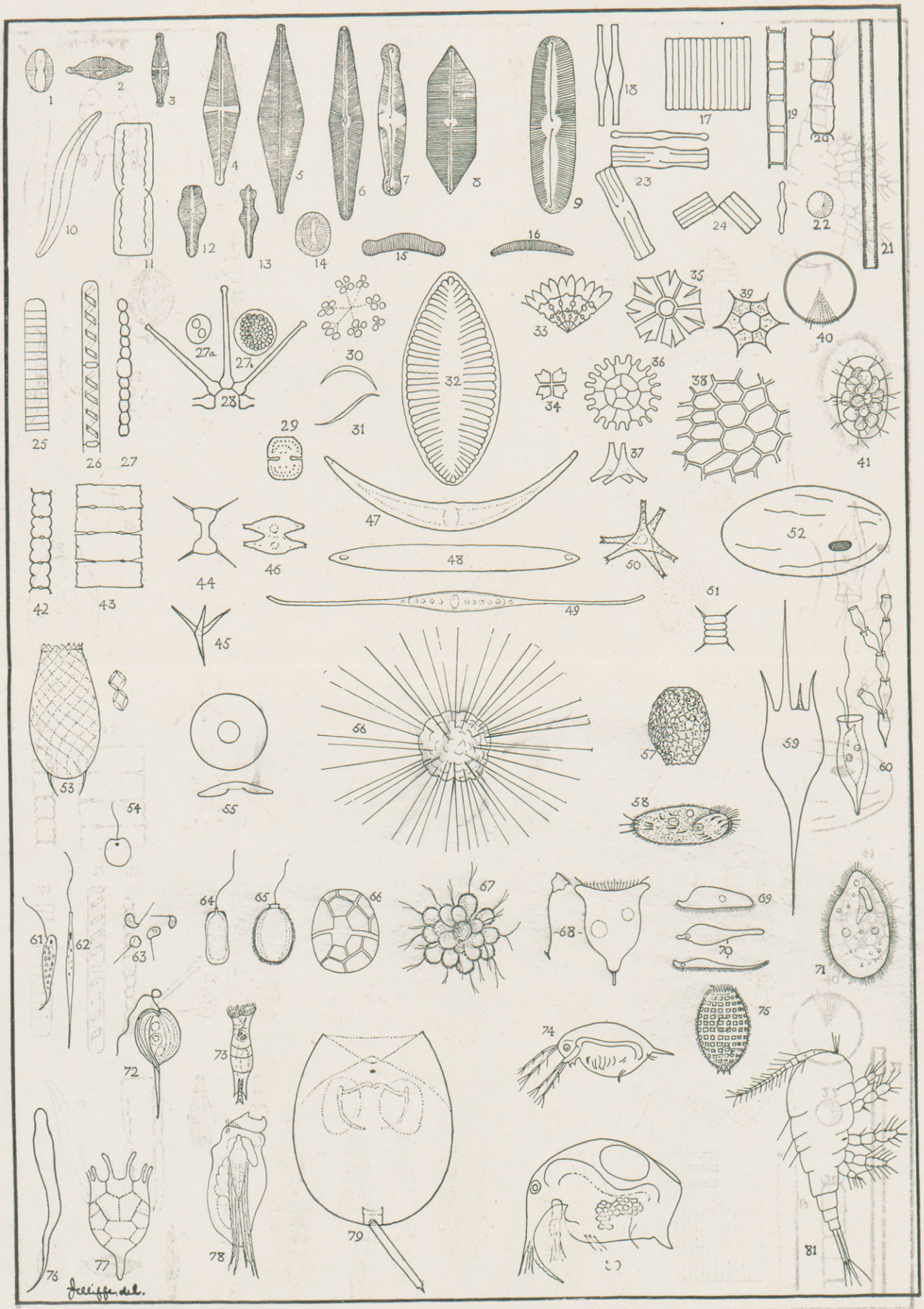
EXPLANATION OF FIGURES.

1. Amphora ovalis Ktz.
2. Encyonema ventricosa Ktz.
3. Stauroneis anceps Ehr.
4. Stauroneis phœnicenteron Ehr.
5. Navicula cuspidata Ktz.
6. Navicula radiosa Ktz.
7. Navicula gibba (Ktz) Ehr.
8. Navicula dilatata Ehr.
9. Navicula viridis Ktz.
10. Pleurosigma Spenceri W. S.
11. Amphiprora ornata Bailey.
12. Gomphonema capitatum Ehr.
13. Gomphonema acuminatum Ehr.
14. Coconeis Pediculus Ehr.
15. Eunotia tridentula Ehr.
16. Eunotia lunaris (Ehr) Grun.
17. Fragilaria capucina Desm.
18. Synedra pulchella Kg.
19. Melosira granulata (Ehr) Ralfs.
20. Melosira varians Ag.
21. Synedra ulna (Nitz) Ehr.
22. Stephanodiscus minutus Grun.
23. Tabelleria fenestrata Kg.
24. Tabellaria floculosa (Roth) Kg.
25. Oscillaria Froehlichii Kg.
26. Spirogyra tenuissima Kg.
27. Anabæna sp.

27*a*. Gleocapsa sp.

27*b*. Cœleosphærium kutzingianum Naeg.

28. Asterionella formosa Hass, a portion only.
29. Cosmarium Beckii Wille (?)
30. Dictyosphærium ehrenbergianum Naeg.
31. Rhaphidium polymorphum Fres.
32. Surirella elegans Ehr.
33. Pediastrum pertusum Kg.
34. Pediastrum Ehrenbergii (Corda) A. Br.
35. Pediastrum Ehrenbergii var.
36. Pediastrum boryanum (Turp.) Men.
37. Staurastrum crenulatum (Delp) Naeg.
38. Plant parenchyma.
39. Pediastrum Sturmii Reinsch.
40. Stephanodiscus Niagaræ Ehr.
41. Pandorina Morum Bory.
42. Sphærozosma filiforme Rab.
43. Desmidium aptogonium Breb.
44. Arthrodesmus incus (Ehr.) Hass.
45. Polyedrium longispina (Perty) Rab.
46. Staurastrum polymorphum Breb.
47. Closterium Dianæ Ehr.
48. Closterium ensis Delp.
49. Closterium rostratum Ehr.
50. Staurastrum gracile Ralfs.
51. Scenedesmus caudatus Corda.
52. Parenchyma cell of plant, not unlike large epithelial cell.
53. Euglypha alveolata Duj.
54. Paramonas globosa From.
55. Arcella vulgaris Ehr.
56. Actinophrys sol Ehr.
57. Difflugia globulosa Duj.
58. Stylonichia sp.
59. Ceratium Hirundinella (Müll.) Bergh.
60. Dinobryon Sertularia Ehr.
61. Euglena viridis Ehr.
62. Euglena acus Ehr
63. Pleuromonas jaculans Perty.
64. Trachelomonas cylindrica Ehr.
65. Trachelomonas piscatoris Fisher.
66. Peridinium tabulatum Ehr.
67. Synura uvella Ehr.
68. Vorticella communis Ehr.
69. Chilodon Cucullulus Müll.
70. Litonotus fasciola Ehr.
71. Paramecium Bursaria Ehr.
72. Phacus longicaudis Ehr.
73. Rotifer vulgaris Ehr.
74. Daphnia Pulex (L.) Müll.
75. Coleps hirtus Ehr.
76. Anguillula fluviatilis Ehr.
77. Anurea cochlearis Gosse.
78. Polyarthra platyptera Ehr.
79. Monostyla lunaris Ehr.
80. Bosmina longirostris (Müll.) Bd.
81. Cyclops quadricornis Müll.



"MICROSCOPICAL ORGANISMS OF CROTON WATER SUPPLY."