of money is thus opened. As nearly every neighborhood has semething in abundance which is more or less rare in others, this plan can not be wholly impracticable. (3) Along with this high grade material the station could send carefully prepared directions for study in order to insure the proper use of the material. (4) This central station, being under the immediate control of the Academy, would preclude the suspicion that there was a mercenary element back of the affair, and would come to the teachers or school authorities with the force and influence of the Academy itself. (5) It would furnish all material to schools at actual cost, which would make the expense to equip a botany or zoölogy class through the winter a very slight one. (6) It would be a central station to which regular collectors could send the surplus of their collections for free distribution, and so materially widen the value of their work.

[Upon motion, the Chair appointed a committee to investigate the desirability of such a plan; the committee consisting of L. J. Rettger, Dr. C. H. Eigenmann and W. P. Shannon.]

The Occurrence of Uroglena in the LaFayette (Ind.) City Water. By Severance Burrage.

It not infrequently happens, even with the best public water supplies, that the attention of the consumer is attracted by some peculiar taste or oder in the water. This is particularly apt to be the case when the supply is derived from a lake or pond, or if it has to be stored for any length of time in a reservoir. In such instances the superintendent or water commissioners receive complaints to the effect that the water has a very disagreeable taste and smell, and that there must be dead fish or eels in the pipes. Just such complaints were heard in Lafayette in the early part of October, and vigorous attempts were immediately made to get rid of the trouble by flushing the pipes at different points in the city. But there was not much improvement.

The city water supply is derived from driven wells in the vicinity of the Wabash River, and is a remarkably pure water, both from the chemical and biological standpoints. This water is pumped directly into the pipes. There is a reservoir situated on a hill some two miles from the pumping station, and it has been generally understood that the water stored there was only used in case of an emergency, such as a large fire. But upon inquiry it was learned that the pumps were not kept working all night. Thus, as the supply from the pumps was stopped, the reservoir water must work back gradually into the pipes, replacing

that used in the town after the pumping had ceased. Now if the trouble was in the reservoir water, we would expect to have the complaints made in the early morning, which would be the only time, as we have seen, that this water had access to the service pipes. And such was the case. All the complaints were made in the morning, and when the superintendent would go to investigate at this or that place late in the forenoon he could detect nothing wrong in the water. The pumps had started and forced the reservoir water back to a certain extent, fresh water from the wells taking its place.

All of this evidence, together with our knowledge of the natural history or biology of bodies of water exposed to the sunlight would point to the reservoir as the source of the trouble. A microscopical examination of this water was made, and it showed the presence, among other things, of the colony-building infusorial organism *Uroglena* in small numbers.

This Uroglena is well known in Massachusetts and Connecticut as having caused strong fishy tastes and disagreeable oily smells in many large water supplies, and in some cases in the very best ones. So that knowing the history of this organism, and finding it in the water of the reservoir, it was unnecessary to search further for the trouble.

This organism itself has been described by Ehrenberg[1], Bütschli[2], Stein[3], Kent[4], and Calkins[5]. It was first recognized in this country by Conn[6], who found it in the reservoir of the Middletown (Connecticut) waterworks. Since then it has been known to cause trouble in a large number of prominent Eastern water supplies.

The colonies in the LaFayette water were just visible to the naked eye, being considerably less than $\frac{1}{100}$ (one one-hundredth) of an inch in diameter, and spheroidal in shape. Each colony is made up of a delicate gelatinous matrix, in the periphery of which are imbedded two hundred or more individual monads, these monads having two flagella each, chromatphores, and, quite important to us in connection with water supplies, many oil globules variously distributed throughout the cell. It is supposed, and with good reason, that these are the direct source of the oily taste and smell in the water. When the colony is intact, in its normal condition in the water, very little if any odor can be detected; but let that water be disturbed in such a way as to rupture or disintegrate the colonies

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[1]Die Infusionsthiere als vollkomna Organismen. Leipzig, 1838.
[2]Zeitschrift für Wissenschaftliche Zoölogie. 1878. Bd. XXX, p. 265.
[3]Organismus der Infusionsthere, III. 1878.
[4]Manual of the Infusoria, I. London, 1881. (W. Saville Kent.)
[5]On Uroglena. G. N. Calkins, in Annual Report Mass. State Board Health, 1891.
[6]Report of Water Commissioners for 1889, Middletown, Ct.

and the odor becomes quite strong. This, of course, is what occurs when the water runs into the service pipes. The change of conditions causes the disruption of the colonies, and so we get the smell and taste in the hydrant water, but almost none in the water examined fresh from the reservoir.

This matter of the cause of such odors and tastes in drinking waters has been the subject of much study by the Massachusetts State Board of Health[1], and I had the privilege of doing some work in that line in 1894, while connected with that Board. Most of the experiments were conducted on this Uroglena because it had such a strong and characteristic odor. Large quantities of water containing an abundance of Uroglena were filtered through cotton, and this cotton was immersed in ether and several other solvents of oil, particularly the volatile ones. Then the ether was allowed to evaporate, leaving an oily residue on the watch glasses which in some cases gave the characteristic odor, somewhat intensified. But in nearly all of the experiments trouble was caused by the ether itself leaving a noticeable residuary odor after evaporation, which was in some instances quite misleading. The Uroglena oil, however, was collected, and did to a certain extent have the sought for odor. Among the other solvents tried were carbon bisulphide and chloroform, with the same difficulty of the residuary odor.

The ordinary method of microscopical analysis (Sedgwick-Rafter) is practically useless in determining the numbers of Uroglena colonies in a given quantity of water, because of the readiness with which the organisms break up. The estimates consequently in such cases would be far too low. In the analysis of the water supply of Lafayette made last October the water was examined without making any attempt to concentrate the organisms. Cubic centimeter after cubic centimeter was examined directly with a small hand lens, and in no case were there more than twenty colonies per 100 cubic centimeters. The average was six per 100 c. c., but this was sufficient to give the offensive odor to the water when drawn from the faucet. As was found in other cities, and as we might expect to find in Lafayette, the water drawn from the housetops in the morning, while giving the odor, showed absolutely no Uroglena colonies.

The question naturally suggests itself, how did the reservoir get planted with this troublesome organism? Of course we can make no definite statement in regard to this, but an examination of the reservoir overflow, which forms a more or less stagnant pond just below the reservoir itself, showed a larger number of these Uroglena colonies per 100 cubic centimeters than the reservoir water, and it

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[1]Odors in Drinking Waters. G. N. Calkins. Mass. State Board of Health, Ann. Report, 1892, p. 355.

would not be very difficult to imagine that birds flying directly from the overflow to the reservoir might carry the organisms there.

To get rid of the trouble in this case was comparatively easy, because the reservoir was small and it was not a difficult matter to entirely change the water in the reservoir by keeping the pumps going full force day and night for a few days. In three weeks from the time my attention was first called to the matter, I was unable to find any Uroglena in the reservoir water, and I have heard no complaints since.

It is not known that the Uroglena, even in very great abundance in the water, causes any disturbance or inconvenience to our bodies. It is most important, however, that the city engineers and waterworks superintendents should know this, in order to so inform the people when they make their complaints. The suffering public under such circumstances are apt to imagine that all sorts of ills are caused directly by this to them unseen pest, and they are too prone to find fault with the water supply. While we can not prophecy when Uroglena may appear in or disappear from a water supply, we can state with much certainty that it is perfectly harmless, and that it does not necessarily indicate a bad condition of the water. The Lafayette water, for the past two years at any rate, has been absolutely free from all dangerous contamination, and the recent appearance there of Uroglena does not mean that the water supply is at all degenerating.

The Engineering Research Laboratory in Its Relation to the Public.

By W. F. M. Goss.

In the present era of the world's progress we hear much of our "material prosperity" and of the "development of our resources." Feeling sure that the earth was made for man, man is anxious to make his possession yield him its best. Nor is he contented with what his own immediate neighborhood can furnish. If there is anything in the ends of the earth, or in the air, or in the sea which is capable of making for his advancement, he rests not until he has secured it. The business of the world, therefore, increases with every hour, and its problems multiply.

In the midst of its hum and hurry, the engineer is a prominent figure. It is his province to study the properties of matter and to make them useful to man in structures and machines. He deals with the mining and reduction of ores, the chemical and physical properties of metals, and all the great variety of processes by which iron and steel are shaped for purposes of construction; with earth-work