Endocarpon cinereum, Pers.

Saint Paul's Island, Behring Sea.

Verrucaria maura, (Wahl.) Nyl.

Fort Alexander, Cook's Inlet.

Spores simple, colorless, oblong, 12–15 mic. long by 6–8 broad.

Verrucaria ceuthocarpa, Wahl.

Fort Alexander, with the above species. Sterile.

Verrucaria intercedens, Nyl.

Cape Lisburne, Alaska.

"Paraphyses dissolving; gelatina hymenea vinous red with iodine. Spores 8, muriform, plurilocular, colorless, 23–32 mic. long by 11–13 wide."—WILLEY.

Verrucaria intermedia, (Th. Fr.)

"Paraphyses dissolving; gelatina hymenea vinous red with iodine. Spores 8, muriform, few-celled, 18–23 by 11–13 mic."—WILLEY.

ON THE CHLOROPHYLLOID GRANULES OF VORTICELLA.

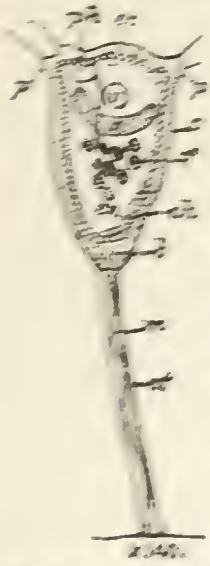
By JOHN A. RYDER.

In *Science*, No. 45, note 487, p. 772, the researches of Th. W. Engelmann, of Utrecht, are noticed and criticised. Having had occasion several years since to study one of our American forms of green *Vorticellæ*, which at the time was identified as *V. chlorostigma*, I would now take the opportunity to record what was then observed, inasmuch as the facts as interpreted by me seem to lead to conclusions differing very considerably from those reported by Professor Engelmann. Observations which I have made within the present year on the relations of the *Schizomycetes* to living and dead Protozoa, have also led me to conclusions at variance with that author's interpretations.

In order to understand the points in dispute, it will be necessary to describe the morphology of the form studied by the writer, as well as the position and relations of the included chlorophylloid granules, all of which may be more clearly comprehended by reference to the accompanying figure which shows the form in question enlarged 140 times, and taken from drawings made several years since from the living subjects.

The form was similar to other *Vorticellæ* in everything except the presence and orderly arrangement of the green granules. There was a hollow stalk, *st*, which ensheathed a muscle, *m*, which in turn was inserted into the very faintly striated base *b* of the body of the animalcule. There was, as usual, an outer cuticular layer, *c*, covering the body and continuous with the stalk *st*. Within the cuticle the ectosarc or ectoplasm *ec* formed the outer or cortical portion of the body of the ani-

matrix and in this the chlorophyllid granules were embedded with the most remarkable regularity, forming, indeed, a one-layered investment; the individual grains often being pressed into a distinctly prismatic form where they were much crowded together. Only now and then was it observed that there were spaces or areas of the ectoplasm in which none of these green granules were present. No chlorophyllid matter whatever was found in the endoplasm as after the most careful search for the same, and this indeed was also found to be the case with the free swarmers of the same species, which had the form of cylinders, truncated at both ends, but somewhat wider at the peristomal end and about three times as long as they were thick. An abundance of material kindly furnished me by Mr. W. P. Seal, and which that gentleman obtained near Woodbury, N. J., enabled the writer to study the form in question very thoroughly, and there remains no shadow of doubt as to the fact of the arrangement of the green granules as here described.



The tunnel-shaped pharynx ph led down into the endoplasm en in the usual way from the margin of the ciliated peristome p. p. At its lower end food-vacuole after food-vacuole was formed by the slow dilatation of this part into a bulbous enlargement by the force exerted by the band of pharyngeal cilia, and after the enlargement of the globular space at the lower end of the pharynx had proceeded up to a certain point, its connection with the pharynx would be suddenly broken and the food-vacuole would be thrust into the adjacent endoplasm by the bulbous enlargement of the lower end of the pharynx, where a second food-vacuole was forming, and which would press against the one previously formed and force it deeper into the surrounding plasma. It is the constant formation of food-vacuoles which is the cause, in part, of the movements of the food-vacuoles themselves. A large pinkish contractile vesicle or vacuole, v, was present near the upper part of the body of the host close to the wall of the pharynx. Just below the contractile vesicle the nucleus or endoplast n was placed, and had the sausage-shape so often noticed in this type of protozoa. Below and on either side of the endoplast the food-vacuoles f were abundant. (Only a few have been represented below the endoplast in order not to sacrifice clearness of outline.)

The existence of the green coloring matter in the ectoplasm of Infusoriana has already been noticed by Stein in *Stentor*, and my only reason for writing this notice is to call attention to the fact that in *V. chlorostigma*, at least, the green matter is not "diffuse" as stated by Engelmann in regard to the species studied by him, but is restricted with great regularity to individual granules as in plants, and that these

grains form an exceedingly well-defined one-layered stratum which is restricted to the ectoplasm alone.

"Entz has discovered that he could cause colorless Infusoria to become green by feeding them with green palmellaceous cells, which, moreover, did not die after the death of their hosts, but continued to live, growing and developing within the latter until their total evolution proved them to be forms of very simple microscopic green algæ, such as *Palmella*, *Glœocystis*, &c. (E. P. Wright.) * * * There may be parasites such as observed by Dr. Entz, but, judging from their superficial position [in *V. chlorostigma*], their globular form, and behavior towards reagents, the absence of a nucleus, or of any cleavage stages, they must, it seems to me, be regarded as integral parts of the creatures in which they are found."

The above the writer quotes from a paper published by him two years since in Forest and Stream, and later in Bull. U. S. Fish Comm., I, 411, and in the interim no facts have been brought to his notice which have tended to shake his faith in the soundness of this view.

It is true that there are certain Infusorians in which a bottle-green tint is diffuse and not confined to distinct grains, as, for instance, in *Stentor Müllerí* and *Freia producta*, both of which the writer has studied, but in *Stentor polymorphus* and the green species of *Ophrydium* the color is confined to distinct granules, as in the species of *Vorticella* which I have figured. The uncolored species of *Ophrydium*, found in Frankford Creek, and which has been named *O. adæ* by Everts, does not differ much in other respects from its congeners, but the colorless *Stentor Rœseli* does differ considerably in form and details of habit from its allies. These are facts which, it seems to me, are almost fatal to the theory of the existence of green parasitic vegetable forms in Infusorians, the only facts favorable to the idea that the green color is due to algous parasites being those noted of *Ophrydium*, a genus which affords an instance of green and colorless forms, differing otherwise but slightly. In fact, individual zoöids of *Ophrydium* are sometimes met with which are only partly green, or have only one-half the body colored, while alongside of them in the same colony individuals are found which are wholly green. Then, again, how are the so-called red and dark-colored Stentors to be disposed of, both of which have been detected in the United States? For these, indeed, it may be claimed that degenerating chlorophyll would be capable of producing the red color of the first, and that feeding on very dark colored algæ might develop the latter. In spite of all this, however, there remains a residuum of facts which cannot be disposed of on any theory of symbiosis or parasitism, and this is especially the case with these forms which, as in *Stentor*, show three distinct types of coloration, viz. the diffuse bottle-green, that caused by colored green granules, and the colorless; all of these differences at the same time being indicative, together with other features, of very distinct species.

Finally, as to the aggregation and development of *Bacteria* about living Infusorians, this I have noticed in a colorless marine species, viz, *Zoöthamnium alternans*, and the same fact has been observed by Stein. Both Stein and myself have noticed *Bacilli* mostly in this relation to other living colorless Infusorians, but in the case of dead and colorless Infusorians the remains of the animals are usually attacked at one side and gradually invaded by *Bacilli* and *Micrococci*, and altogether independently of any peculiarly local oxygen-yielding source in the vicinity.

In conclusion it may be said that if there exist green *Vorticellæ* which have the green coloring matter arranged diffusely in the ectoplasm in one species, and in another confined to distinct granules as observed in the species here described, it is fair to presume that, as in the cases of the three species of *Stentor* alluded to above, that we also have to do here with two very distinct species of Bell-animalcules. It is also fair to assume that if the different species present their coloring matters in diverse conditions and modes of arrangement that such matters may have correspondingly different functions, and that it does not necessarily follow that the green granules even are a sure indication of the presence of true chlorophyll, though it may simulate that of the plant in its relation to the stratum of plasma covering the cell-wall. Why not suppose that some of these coloring matters of Infusorians have a function similar to hæmoglobin? It would, however, be much easier to suppose that the quasi-chlorophyll grains of *V. chlorostigma* were truly of the nature of chlorophyll than to assume as much regarding the diffuse green color as observed in the ectoplasm of a supposed variety or closely affiliated species of *V. campanula*, as has been done by Engelmann.

WASHINGTON, *December* 20, 1883.

A NEW GEOGRAPHICAL RACE OF THE MOUNTAIN SHEEP (OVIS MONTANA DALLI var. nov.) FROM ALASKA.

By E. W. NELSON.

During the course of my residence at Saint Michael's, Alaska, and subsequent travel along the Arctic coast of this Territory, between July, 1877, and September, 1881, hundreds of skins were seen of the Mountain Sheep, which I here designate as a new geographical race.

The types of the new race are two specimens brought me by Mr. L. N. McQuesten, a fur-trader living at Fort Reliance, on the Upper Yukon River, near the point where it crosses the British boundary line. These specimens were killed by the Indians on some mountains south of Fort Yukon, and on the west bank of the river.

From Mr. McQuesten, and various other fur traders along the Yukon and elsewhere, and my own observations, I learned that the range of