most signally. Yet both acid and alkali decrease the power of resistance of Paramecia against this poison. Neither has alkali a favorable action in case of poisoning by veratrin, although this, like KNC and atropin, has an alkaline reaction.

We thus see that our theory also stands this test successfully. As alkalies and not acids have this property, it seems possible that the destructive substances formed by fermentation are acids. Whatever may be the real explanation, the fact remains true that Paramecia are able to endure lack of oxygen, high temperature and the action of poisons like KNC and atropin for a longer time in weak alkali solutions than in neutral or acid solutions.

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LEIDY'S GENUS OURAMŒBA.

HISTORY.

At a meeting of the Dublin Microscopical Club, February 15, 1866, Mr. William Archer exhibited specimens of *Amœba villosa* (Wallich), calling special attention to the presence of "a large and numerous tuft of very long prolongations issuing from just behind the villous patch. * * * He thought it could readily be seen that these curious fasciculi were not composed of foreign bodies either issuing from or penetrating into the *Amœba*, but were really linear prolongations of the sarcode itself. * * * This observation, *quantum valeat*, seems possibly to point to a still greater differentiation of parts than has yet been observed in this remarkable form."*

After nearly eight years, October 23, 1873, Mr. Archer again drew the attention of the Dublin Microscopical Club to the same condition in *Amœba*. He still considered the projections from the posterior end to be prolongations of the body substance, though the behavior (as regards flow of contents, locomotion, etc.) was quite that of an *Amœba villosa*.*

In May of the year following, Dr. Joseph Leidy, of the University of Pennsylvania, found in the vicinity of Philadelphia a singular amœboid creature carrying tufts of caudal filaments, and gave a brief description of it in the *Proceedings of the Academy of Natural Sciences of Philadelphia*, bestowing upon it the name *Ouramœba*, in allusion to its tail-like filaments, and distinguishing several forms.† An abstract of this paper published in the *Monthly Mic. Journal*, November, 1874, brought from Mr. Archer the citation of his original notice of 1866, both observers reaching the conclusion that they had lighted upon the same creature.‡ An illustrated notice of the form by Dr. Leidy appeared in the Philadelphia *Proceedings* of 1875.§ In 1879 the *Fresh-water Rhizopods of North America* was issued under the auspices of the U. S. Geological Survey. Dr. Leidy's final treatment of *Ouramœba* occurs in that sumptuous volume. The points which bear directly upon the thesis of the present paper may be briefly summarized:

1. The caudal filamentous appendages alone excepted, Leidy remarked no difference between *Ouramœba* and *A. proteus;* while Mr. Archer regarded the form observed by him as identical with *A. villosa*, the filaments excepted.||

2. "The mode of fixation of the caudal filaments is difficult to comprehend. In a detached tuft the root appeared to be continuous with a ball of homogeneous protoplasm."¶

*Idem, 14:212.

† Proceed. Acad. Nat. Sci. Phila., 1874, p. 78.

‡ In 1874 Mr. Archer doubted the validity of the proposed genus *Ouramœba*, although he thought the filaments retractile. See *Quart. Jour. Mic. Soc.*, 15 : 203; but compare Idem, 16 : 337.

§ Idem, 1875, p. 126 f.

|| Fresh-Water Rhiz. N. Amer., p. 68.

¶ Idem, p. 69.

*Quart. Journ. Micr. Soc., 6:190.

3. "In the movements of *Ouramœba* the caudal filaments were entirely passive."*

4. "When first seen I regarded the animal as an *Amœba proteus* dragging after it a bundle of mycelial threads [accidentally attached to it?]. * * * I came to the conclusion that the threads were parts of its structure. * * * The caudal filaments present so much resemblance to the mycelial threads of fungi that I have suspected they may be of this nature, and parasitic in character, due to the germination of spores which had been swallowed as food. * * * There is, however, perhaps an important objection to this view, and that is, the caudal filaments do not grow from a mycelium within the protoplasmic mass of the body of the animal. According to Mr. Archer, *Ouramœba* * * * may be only a varietal form of what I have considered to be *Amœba proteus*, but the solution of the question remains for future investigation."†

The next published allusion to this problematic creature was in 1885.‡ Dr. Gruber, in the description of his species *Amœba binucleata*, speaks of fungus filaments lying within the body, but which, in a chromic-acid preparation, issued in tufts and in some places covered the exterior. Confessing that he cannot explain this singular effect of the acid, he suggests that the coming-out of such fungus threads in the living animal might produce appearances like those figured by Leidy, and that the strange attachments to Leidy's *Ouramœba* are nothing but such fungi.

My own study of it began February 6, 1894. The specimen was taken three days before at Wake Forest, in a small stream but a few yards out of a spring. The current was checked by a luxuriant growth of a pond-weed here and there, so that a large brown *Oscillaria*, which abounded in the collection, had no trouble to keep its footing and thrive. This first specimen I had under observation from the 6th of February to the 22d of March, though after the first six days it was in the encysted condition represented in Fig. 7. At no other season of the year than February and March and in no other locality have I met with specimens.

* Fresh-Water Rhiz. N. Amer., p. 69.

†Idem, p. 69–70.

‡ Gruber, Zeitschrift f. Wissenschaft. Zool., 41:210, 211.

EXPLANATION OF PLATE.

Fig. 1. Filament of *Ouramœba* branched near peripheral end. *Free-hand.*

Fig. 2. Another mode of branching. *Free-hand.*

Fig. 3. Detached filament, sketched free-hand as it lay free in the water a few minutes after its separation.

Fig. 4. Cluster of detached filaments. *Free-hand.*

Fig. 5. A filament of a detached and somewhat disintegrated mass, showing connection with the spore.

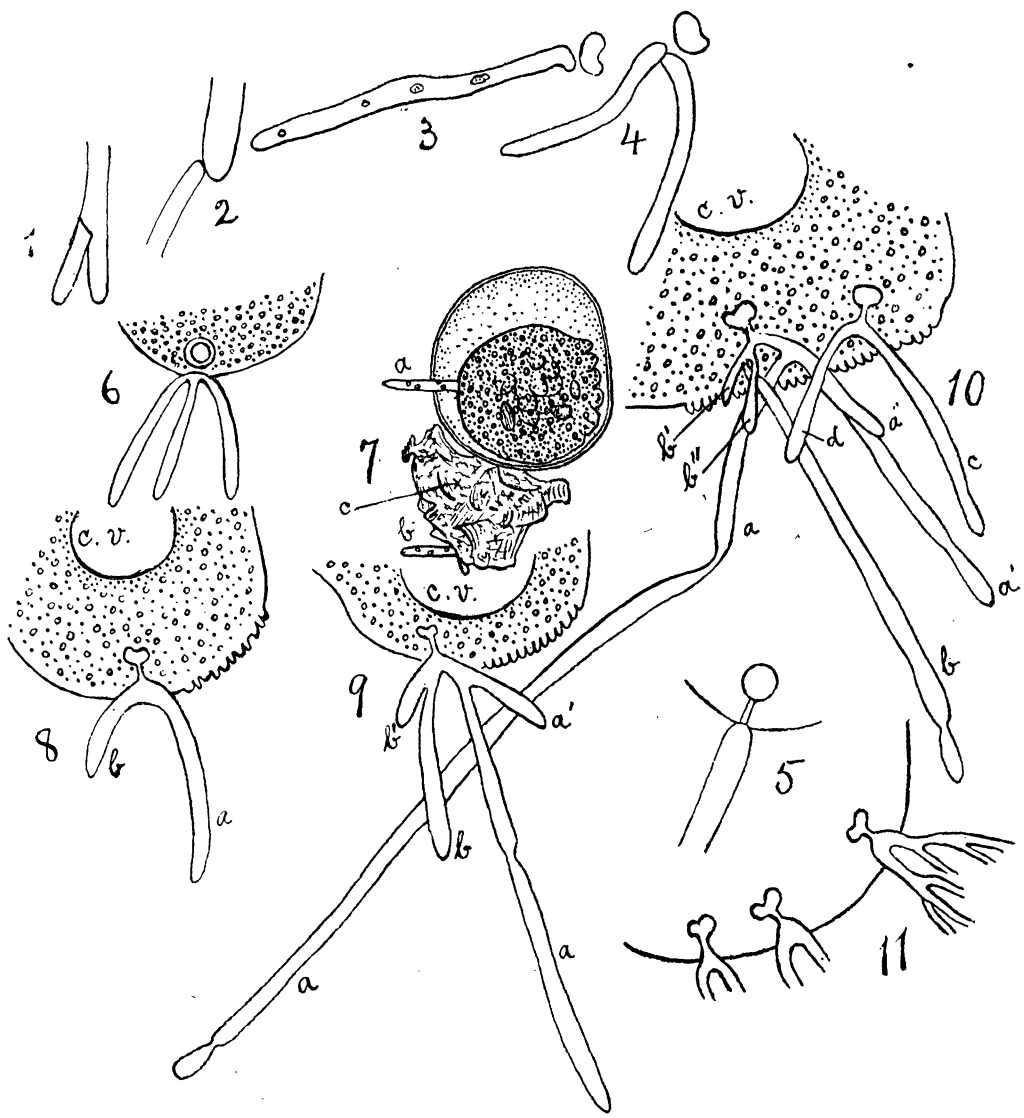
Fig. 6. A cluster of filaments springing from included spore whose wall is plainly distinguishable. *Somewhat diagrammatic.*

Fig. 7. Encysted *Ouramœba: a*, filament still attached to the protoplasm, which is contracted from cyst-wall; *b*, shed filament in mass of débris, *c*, attached to cyst. *Cam. luc.* × *95.*

Figs. 8–10. The same cluster of filaments in three successive stages of development, the stage in Fig. 9 being one day older than that of Fig. 8, and Fig. 10 two days later than Fig. 9. *a* and *b* are the original branches of the germ-tube; *a'*, *a''*, primary and secondary branches of *a; b'* and *b''*, primary and secondary branches of *b; c. v.*, contractile vacuole. *After tracings of Mr. Martin F. Woodward's camera lucida drawings.* × *800.*

Fig. 11. Portion of a large specimen, showing attachment of three clusters of filaments. *After Mr. Martin F. Woodward.* × *800.*

In a note published in *Nature* for May 24, 1894 (Vol. 50, p. 79), I announced the conviction that the filaments are a parasitic fungus growing upon the genus *Amœba*. Early in 1896 Mr. Martin F. Woodward, of the Royal College of Science, London, wrote me that he entertained the same view. Later, with signal generosity, he forwarded to me notes of his own observations with tracings of his original drawings. I wish to make the fullest recognition of this courtesy, with sincere acknowledgment of my obligations to him. I am indebted, furthermore, to Mr. Irving Hardesty, of the University of Chicago, and Dr. C. L. Felt, of Philadelphia, for assistance upon the literature of the form.



THESIS.

Leidy's genus *Ouramœba* was erected upon insufficient data and must be abandoned.

The filamentous appendages, which constitute the only peculiarity of the form, are not, as he and Archer supposed, extensions of the body-substance; they are, on the contrary, mycelial hyphæ, commonly unseptate, which spring from a spore lying in the endosarc, and which stand in a semi-parasitic relation to the genus *Amœba*.

The facts which I submit in support of this thesis are both morphological and physiological.

1. *Morphological.*—It may be remarked at once that Dr. Leidy's text description and plate delineations represent, with life-like precision, the general features of the structure, and make it unnecessary to set forth forth here what has already been done so admirably. I mention only what he omitted to notice or failed to see the exact significance of.

a. The single or tufted filaments arise invariably from a spore. See Figs. 3, 4, 5, 6, 10. In Dr. Leidy's Plate IX., Fig. 11, there is a suggestion of this structure, but the text reference to it shows that he did not recognize the spore.* In the specimens which I studied it was usually conspicuous, though the structural continuity of spore and filament could not always be made out, even when the filaments were detached. Cf. Figs. 3, 4 and 6. In this case, however, the spore came away with the filaments.

This would seem to be decisive of the fungoid nature of the filaments. Leidy's already quoted objection, viz., that the filaments do not grow from a mycelium within the body of the animal, becomes groundless when it is seen that the filaments are themselves the branched mycelium resulting from the germination of the spore. The fact that the mycelium, instead of ramifying through the protoplasmic mass, issues at once into the water, suggests that this fungus does not subsist at the expense of the *Amœba*, but upon organic substances dissolved in the water. Some of these are doubtless contributed by the contractile vacuole, which, as I observed, always lies in the neighborhood of the filaments; in at least one case I saw it discharge its contents among them. If this be true, we may accordingly mention two advantages which the fungus secures by its association with the *Amœba*: first, a food-supply in the wastes of the *Amœba*; second, change of location with consequent improvement of 'pasturage.'* And so I have spoken of the dependence as semi-parasitic.

b. The structure of the filaments is that of unseptate hyphæ, not that of pseudopods. An occasional septum at the origin of a branch makes the pseudopod interpretation impossible. It must be said, however, that the characteristic mode of branching is peculiar among the fungi.

c. After separation from the *Amœba* the filaments maintain in all respects their specific structure and relations. In some cases I saw tufts of filaments, each with its spore, come away from the host, for no apparent reason, as it moved through the water. At other times, by pressure upon the cover-glass, the filaments were forcibly separated. In all cases the filaments were unaffected by the change, and the *Amœba* showed no sign of his loss in either his structure or his movements.

2. We may attend now to certain *physiological* facts bearing upon the thesis of this paper.

a. As noted above, the form on which these fascicled hyphæ were found by Mr. Archer in Ireland was *Amœba villosa*. Mr. Woodward informs me that the same is true of his specimens, found, I presume, in the neighborhood of London. If I have correctly interpreted Dr. Gruber, he found

* Fresh-Water Rhizopods, p. 68. Cf. Proceed. Acad. Nat. Sci. Phila., 1874, p. 78.

* Gruber (loc. cit.) suggests the advantage of oxygen supply from ingested algæ.

these structures on his species *A. binucleata* in Germany. But the host form in this country, according to Leidy's observations and my own, is *A. proteus*. As Mr. Woodward suggests, this fact of itself creates a presumption of the fungoid nature of the filaments.

b. The occurrence of the form at a limited season of the year is in keeping with the plant nature of the filaments. While one of the specimens of Mr. Archer appears to be an exception, all the others were found, I infer, in the early part of the year, from January to May. My own were taken in February or March of three successive years. The same locality was searched for them at other seasons in vain, though uninfested *Amœbœ* were found.

c. The hyphæ take no part in the movements of *Amœba*. If they bend or diverge, such movements are entirely passive, being due to contractions of the protoplasm to which their bases are attached. This is the explanation of what Archer interpreted as the creature's power of bending and quickly again erecting the filament at the point of constriction.* All observers agree that they are non-retractile. Cf. Fig. 7, *a* and *b*.

d. The progressive development of a single tuft is sufficient of itself to establish the main point of the thesis. It is clearly indicated in Figs. 8, 9 and 10, which are three of a series of five drawings representing as many stages of development of the same cluster. The fourth and fifth are not shown. Mr. Woodward tells me that after the first week the cluster of filaments became too complicated in its branching to draw, "although they always retained their original character of springing from a basal U-shaped filament and not branching near the distal extremities." Furthermore, Mr. Woodward observed on the same slide with this large specimen a number of small ones which "only after a week were found to possess any filaments."

* *Quar. Journ. Micr. Soc.:* 6, 190.

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An interesting inquiry remains to be made into the life history and relationships of the fungus itself, but upon that inquiry I cannot enter now.

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NEW NAMES FOR SPERMOPHILUS BREVICAUDUS, CANIS PALLIDUS AND SOREX CAUDATUS MERRIAM.

Three names given by me to new species of mammals prove to be preoccupied and are here replaced.

Spermophilus chrysodeirus brevicaudus Merriam (Proc. Biol. Soc. Wash. VIII., 134, December 28, 1893), from the San Bernardino Mountains in California, is preoccupied by *Spermophilus brevicauda* Brandt (Bull. Acad. St. Petersburg, 1844, II., 369) from the southern Altai. I propose in its stead *Spermophilus* (*Callospermophilus*) *bernardinus*.

Canis pallidus Merriam (Proc. Biol. Soc., Wash., XI., 24, March 15, 1897), from the plains of Nebraska, is preoccupied by *Canis pallidus* Rüppell (Atlas zu Reise in Nördl. Afrika I., 33, taf. 11, 1826) from Kordofan. I propose in its stead *Canis nebracensis*.

Sorex saussurei caudatus Merriam (N. Am. Fauna, No. 10, p. 84, Dec. 31, 1895), from Reyes, Oaxaca, Mexico, is preoccupied by *Sorex caudatus* Hodgson (Horsefield's Catal. Mammals Mus. East India Co., p. 135, 1851), from Sikkim and Darjeling, India. I propose to replace it by *Sorex saussurei mutabilis*.

C. Hart Merriam.

A NEW NAME FOR MICROTUS INSULARIS BAILEY.

In a preliminary paper describing several new Voles (Proc. Biol. Soc. Wash., XII., 86, April 30, 1898) I gave the name *Microtus insularis* to a species from Great Gull Island, N. Y. This name proves to be pre-