The reproduction of Clathrulina elegans.

In *Science*, iii. 55, is published a *résumé* of Miss S. G. Foulke's remarks before the Philadelphia academy of natural sciences in reference to the reproductive methods of Clathrulina elegans; her statements being app rently confined chiefly to a process by quadruple subdivision of the body into uniflagellate organisms as observed by herself, with allusion to three additional processes as observed by others. In August, 1881, the writer repeatedly witnessed two forms of reproduction with this rhizopod, in some respects quite different from what was observed or mentioned by Miss Foulke.

The body of Clathrulina in no instance withdrew its rays before subdivision, but underwent transverse binary fission; each part, even after complete separation, retaining its pseudopodal rays fully extended. Soon after dividing, however, one part became perfectly smooth, having possessed up to this point a conspicuous pulsating vacuole, which now curiously contracted, and did not re-appear. The remaining half of the original body underwent no change except that caused by the protrusion of rays from the freshly divided surface.

The recently separated portion then slowly passed out of the capsule, forming, just before its escape, two vibratile flagella of unequal length. Its movements began immediately, being only moderately active, and continuing for less than two minutes, when it suddenly lifted itself upon the flagella-bearing end, and instantaneously collapsed into a shapeless mass studded with short blunt pseudopodia, which almost as quickly became filiform; and the zooid was an Actinophrys-like creature, with two flagella trembling at its front. The latter were soon lost among the rays, and the animal at once began to form the pedicle by a slow extrusion of the body-sarcode. The whole process consumed about three hours.

From the same gathering I was also fortunate enough to learn how Clathrulina produces the colonies occasionally met with. The process, up to the escape of the biflagellate zooid, even with the strange conduct of the contractile vesicle, was as just described. The longer of the flagella, however, terminated in a conspicuous bulb-like enlargement, which remained within, but was not attached to, the parent-shell. The vibrations of the short lash gave the zooid a rapid rotatory and oscillating movement, the anchoring bulb slipping freely from side to side of the opening in the lattice. Motion continued for perhaps five minutes. The obovate body then became rounded, the smooth surface roughened by irregular protrusions extending into filiform rays, until another flagellate Actinophrys-like creature appeared, loosely anchored to a Clathrulina lattice. It remained motionless on the extremity of the apparently rigid bulb-bearing lash, which I supposed would become the pedicle; but in a few moments an unusually thick pseudopodium was extruded, and attached by an expanded base to the capsule. On this the Actinophrys, with all its rays extended, was slowly lifted to the required distance above the parent; while the anchoring flagellum became more and more attenuated, the bulb less and less noticeable, until both finally disappeared.

It seems, then, that Clathrulina elegans has six reproductive methods, — "by self-division, by the instantaneous throwing-off of a small mass of sarcode, by the formation and liberation of minute germs," by the quadruple subdivision of the body into uniflagellate organisms, by the separation from the body of a free-swimming Heteromita-like zooid for the dissemination of the species, and by a similar body-fission whose resulting biflagellate organism is anchored to the parent-capsule for the formation of a colony.

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Formation of anchor-ice.

On the 17th of January, this year, I had occasion to cross the River St. Lawrence in one of the small Indian ferryboats which ply between the Indian village of Caughnawaga, on the south shore, and Lachine, on the Island of Montreal. The current of the river at this point flows at the rate of four or five miles an hour, I think, and never freezes over. The day was quite stormy, the thermometer indicated about 12° or 15° F.; and the river was pretty thickly covered with cakes and masses of porous or very snowy ice. But the most peculiar phenomenon was the sudden and almost incessant rising of dark, muddy ice from the bottom of the river. The formation of this ice so far below the surface of the water is supposed to take place in very cold weather, when large masses of snow, descending the river, become saturated with water, and are carried by the current to the bottom, where they stick to the rocks and stones, clinging more firmly and becoming more compact as long as cold weather continues. At least, this is the theory that the Indians advanced. The ice may be seen six or eight feet under water, and often accumulates until it forms miniature islands. When it rises, it often lifts considerable quantities of small stones and gravel to the surface.

Another peculiar circumstance is, that this rising of the ice from the bed of the river always occurs a day or two before the approach of mild weather; and the Indians regard this phenomenon as an infallible presage of milder weather within forty-eight hours. The cause is most likely atmospheric, but I record the observation with the hope that it may be a hint to some one willing to make a further study of the subject.

J. G. J.

Chateauguay Basin, P. Q., Canada.

Manayunkia speciosa.

In this worm, described and figured by Leidy (*Proc. acad. nat. sc. Philad.*, 1883), the tentacular crown, or branchial organ, is the feature of special interest.

According to Leidy, the tentacles present in an adult are eighteen in number, besides two larger and longer tentacles situated dorsally, midway between the two lophophores. These larger tentacles are conspicuous by their bright green color, and are, in fact, external continuations of the blood-vessels extending lengthwise throughout the body. In shape these tentacles taper from base to apex, are convex on the outside, but concave on that side facing the centre of the tentacular crown; so that a transverse section would present the shape of a crescent. The two longitudinal edges thus formed are fringed with cilia. When closely watched, the green tentacles are seen to pulsate with a rhythmical motion, contracting and expanding laterally. The pulsation takes place in each tentacle alternately. At the moment of contraction the tentacle turns slightly on its axis outwards, and towards the end of the lophophore on that side, at the same time giving a backward jerk, returning to its former position at the moment of expansion. By force of the contraction the green blood filling the tentacles is forced downwards, out of the tentacle, and flows along the blood-vessel on that

side of the body. On the expanding of the tentacle the blood instantly returns, and suffuses it; and thus the process goes on. The contraction and expansion occur at regular intervals, together occupying the space of two seconds. It is in this way that the blood is purified and the circulation controlled. The above observations were made with a seven-eighths inch objective, the subject being placed in a zoöphyte-trough.

To ascertain how long the cilia upon the tentacles would continue their motion after separation from the worm, both lophophores of an adult were cut off above their own junction. At first the tentacles remained closed: but soon they expanded, the cilia displaying active motion; and presently the two separated lopophores began to move about in the zoöphyte-trough. This motion was produced by the action of the tentacles, which bent in all directions, their tips touching the glass, and was not a result of ciliary currents. In a few minutes one lophophore had *crawled* in this manner quite across the trough, while the other remained floating in the water near its first position. Sometimes the motion was produced by ciliary currents, the tentacles remaining motionless; but this was quite distinct from the *crawling* above noted.

During this time the decapitated worm had sunk to the bottom, and, though twisting and turning a good deal, did not attempt to protrude the mutilated support of the lophophores. Its body was so much contracted that the segments were not above one-third their usual size.

At the end of five hours the worm was apparently dead; numbers of infusoria had collected to prey upon it; and the surface of its body presented a roughened appearance, as though covered with tubercles. The lophophores were still in motion. At the end of the eighth hour the lophophores had ceased to move, and were paler and more transparent; but the ciliary action, though feeble and uncertain, still continued. The body of the worm was then covered with a thick fungoid growth, consisting of transparent, rod-like filaments, three-sixteenths of an inch in length, some of the filaments having a beaded appearance. All motion of the cilia upon the tentacles had now ceased, and these latter were also the prey of infusoria.

The above experiment showed that the independent motion of the cilia continued about twice as long as the mutilated worm gave evidence of vitality. Several individuals of Manayunkia were observed to be preyed upon while still alive by large monads, embedded in one or more segments, which were sometimes excavated to a considerable degree.

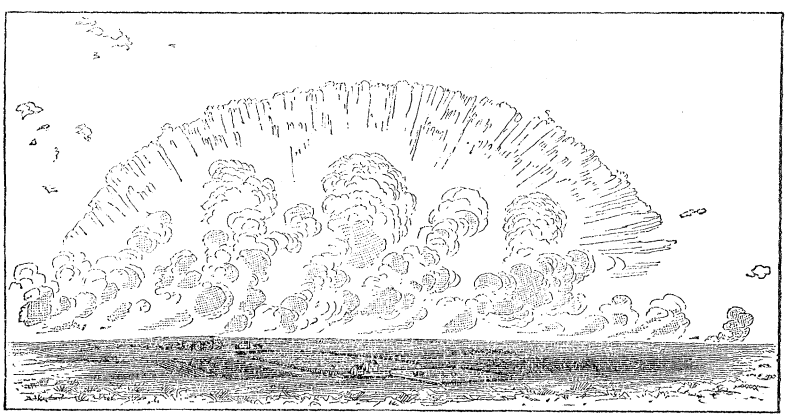
SARA GWENDOLEN FOULKE.

Appearance of the cyclone cloud at Rochester, Minn., 1883.

On Tuesday, Aug. 21, I left Minneapolis at three o'clock in the afternoon for Albert Lea, Io.

Late in the afternoon my attention was attracted to a remarkable storm-cloud that lay along the eastern horizon. As the sun grew low in the west, this cloud assumed most extraordinary proportions and colors; so much so, that it attracted almost universal attention. A strange, fan-like sheet of yellowish cloud, with broken but decided margin, rose above the centre of the storm like a great halo. It did not seem to stand in a vertical position, but projected above, toward the west, giving the effect of a huge funnel, viewed from below, on the exterior surface of which the descending sun cast shadows, and brought out a sort of radiate ribbed structure.

Beneath this was a great cluster of swelling cumulus 'thunder-heads,' whose bases were hidden by the horizon. Three of these, higher than the others, rose vertically from the centre of the mass; their magnificent fleece-like heads entering and apparently penetrating the yellow halo. These, especially the middle and largest one, glowed brilliantly in the strong sunlight, and cast long blue shadows down the inclined under-surface of the halo.



Encircling this brilliant mass were a number of enormous 'thunder-heads' of a most murky and forbidding appearance, that stood upright, like so many pillars of dense smoke. These upright clouds inclined a little to the east or south-east, indicating a movement in that direction.

There was a remarkable stability about the whole mass of clouds, and at sunset the effect was grand in the extreme. The sky about was clear, with the exception of isolated masses of cumulus-cloud.

I made a small pencil-sketch of the cloud-forms, with notes of color, and, since my return to Washington, have made a drawing in color.

I estimated that the cloud was from forty to fifty miles east of the railway, and, on studying the map carefully, became convinced that this was the cloud attending the great cyclone at Rochester. My attention was not called to the cloud until after five o'clock, at which time it was directly east of me, at Wilton. As the course of the cyclone was a little to the north of east, the movement was directly from me when the sketch was made.

The peculiar form of the halo, whether fan or funnel shaped, was doubtless, in a measure, the result of the movements of the storm-currents.

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