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ON THE GENUS ANCISTRUMA STRAND (ANCISTRUM MAUPAS)

I. The Structure and Division of A. Mytili Quenn. and A. Isseli Kahl

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Introduction

In 1867 Quennerstedt described a small ciliate from the mantle cavity of *Mytilus* under the name of *Opalina mytili*. Kent (1882) placed this form in the genus *Anoplophrya* and retained the species name given by Quennerstedt. Maupas (1883) redescribed this ciliate, calling attention to the presence of a mouth, which had been overlooked by Quennerstedt and Kent. He created the genus *Ancistrum* for the type species of Quennerstedt and described a second species, *A. veneris gallinæ*. Strand (1926), in reviewing the literature, finds the name *Ancistrum* preoccupied and therefore invalid. He proposes the name *Ancistruma* to replace the commonly employed one of *Ancistrum*.

It is the purpose of this paper to report some observations on two species of the genus *Ancistruma*, namely, *A. mytili* Quennerstedt and *A. isseli* Kahl.

In his excellent monograph on the Ancistridæ of the Gulf of Naples, Issel (1903) describes in detail an *Ancistrum* from the solitary mussel *Modiola barbata*. Although his findings were not entirely in accord with previous descriptions he believed this form to be identical to *A. mytili* and placed it in that species. Kahl (1931), however, called this form *Ancistruma isseli*. I am entirely in agreement with Kahl on this point, as will be brought out in the following pages.

This investigation was carried on at the Marine Biological Laboratory at Woods Hole, Massachusetts, and the Zoölogical Laboratories of Columbia University in New York City. I am indebted to the faculty of Columbia University for their generosity in providing me with research facilities. I am especially indebted to Professor Gary N. Calkins

for kindly advice and criticisms and to Ruth R. Kidder for technical assistance.

Material

Ancistruma mytili is found in great numbers in the mantle cavity of the salt water mussel *Mytilus edulis*. These mussels were collected from the pilings of the wharf at the Bureau of Fisheries at Woods Hole and from the rock breakwaters at Brighton Beach, Manhattan Beach, and Port Washington, Long Island. *A. isseli* is equally abundant in the mantle cavity of the solitary mussel *Modiola modiolus*. This mussel may be found half buried in the muddy flats at low tide. The *Modiola* used in this work were collected just north of the Coast Guard station at Woods Hole. Additional mussels of both genera were taken from Pelham Bay in New York City.

Technique

The mussels were brought into the laboratory and placed in large aquaria supplied with running sea water (Woods Hole) or a jet of air (New York). In this situation the ciliates remained alive and in good condition for months, *Ancistruma* proving to be much less sensitive to environmental changes than *Conchophthirius mytili* (Kidder, 1932). The ciliates were obtained for examination by opening the valves of the mussel and washing the contents of the mantle cavity into a Syracuse watch-glass. Under the dissecting microscope individuals were then selected and with a fine pipette placed on coverglasses for examination and fixation.

The fixatives and stains employed were: Schaudinn's, sublimate-acetic, Bouin's, Zenker's and Champy's fluids followed by Heidenhain's and Delafield's hæmatoxylins, the Borrel stain, and the Feulgen nuclear reaction. (The formulæ and methods for both the Borrel stain and the Feulgen reaction may be found in Calkins, 1930.)

The " silver line system " was studied by the silver nitrate impregnation method of Klein (1926*a*, 1926*b*, 1927) and also by a few modifications of it. The most useful modification was to kill the ciliate in osmic acid fumes (10 to 20 seconds). Before the organism became dry a drop of distilled water was added. This was drawn off with a fine pipette, and the process repeated a number of times. Thus the sea salts were removed and the formation of a heavy precipitate, upon addition of the silver nitrate, prevented. A 2 per cent solution of silver nitrate was added and the preparation exposed to the light. The time of impregnation varied with the length of time the organism was exposed to osmic fumes. By watching the process under the dissecting microscope

the reaction was halted when the ciliates had reached the desired darkness. The impregnation usually took from one to three hours. The advantage of killing in osmic vapor is that the shape of the ciliate is retained with very little of the distortion that occurs by simply drying.

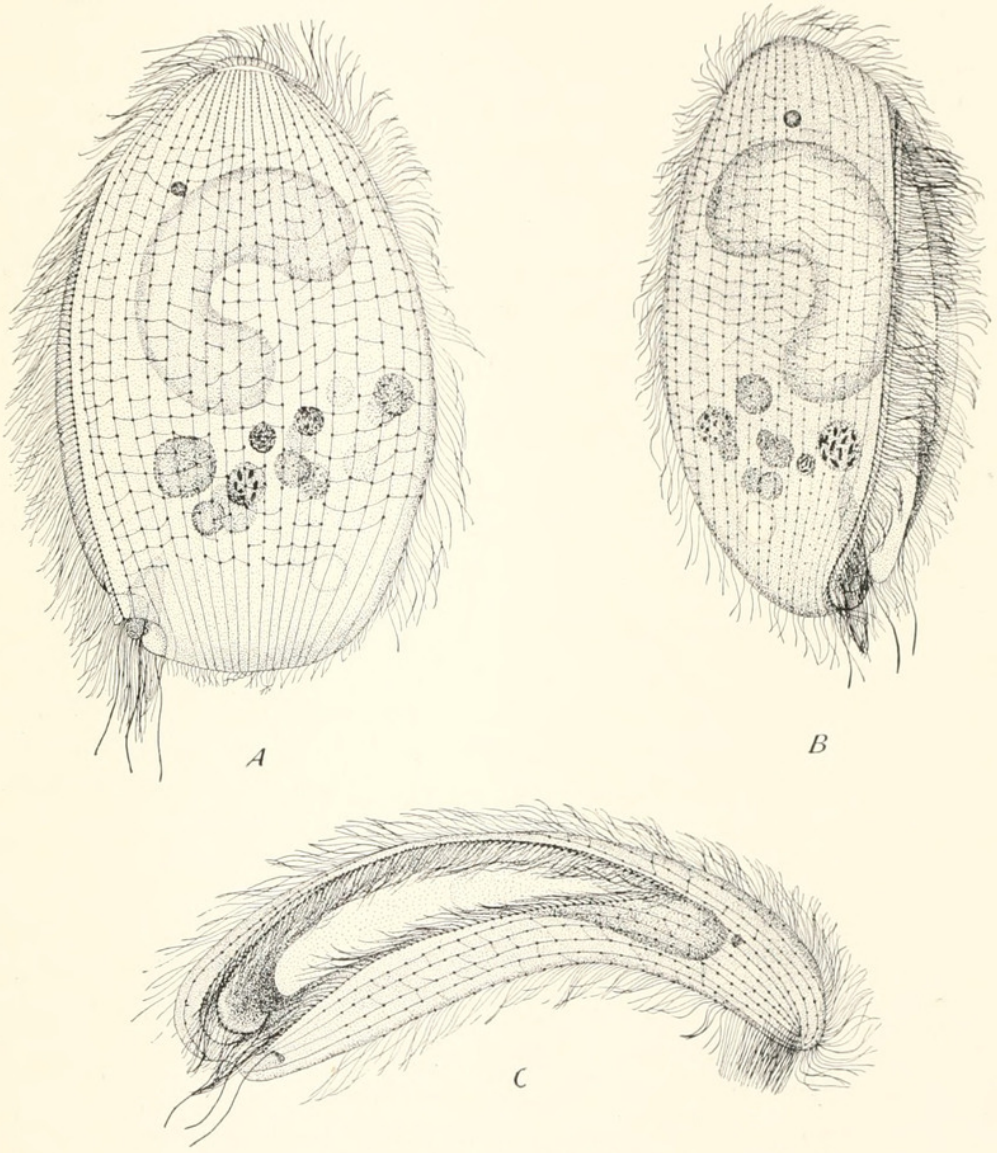

FIG. 1. *Ancistruma mytili.* Camera lucida drawings. × 1000.

A. Ventral view. Schaudinn's: Heidenhain's hæmatoxylin.

B. Dorsal view. Mouth is seen to be slightly dorsal near the posterior end. Zenker's: Mallory triple stain.

C. Lateral view of the right side. At the anterior end may be seen the tuft of straight tactile cilia. Sublimate-acetic: Heidenhain's hæmatoxylin.

For the detailed structure of the ciliary insertions individuals were fixed in Zenker's and Champy's fluids and sectioned. These sections were then stained with Heidenhain's hæmatoxylin or crystal violet-sulph-alizarinate (Benda's alizarin method, Lee's Microtomist's Vade-Mecum, 9th ed., p. 335).

General Features of Ancistruma mytili

The following terms of orientation will be used in dealing with the members of the genus *Ancistruma*. The end directed forward in normal swimming will be called anterior. The concave surface always in contact with the substrate will be called ventral. (For a discussion of this question, see Kidder, 1932.)

The swimming movements of *A. mytili* are very characteristic. In the Syracuse dish the ciliates continuously leave the bottom of the dish and come to the surface film, then immediately return. During these flights they revolve rapidly on a diagonal axis, and have the appearance of moving in a series of jerky somersaults. They exhibit ceaseless activity and seldom remain at rest for more than a short period of time.

Size and Shape

Ancistruma mytili averages 67 μ (52 μ–74 μ) in length and 31 μ (20 μ–38 μ) in width. These measurements were made on fifty living specimens. Fixed material gives measurements of a considerably lower value. The organism is nearly oval in shape when viewed from the dorsal or ventral surfaces (Fig. 1, *A* and *B*). The left margin is slightly more convex than the right. In lateral view the ciliate is seen to be elliptical and bent into an arc, the ventral surface being deeply concave and the dorsal surface convex (Fig. 1, *C*). The extreme dorsoventral flattening has been accurately described and figured by Maupas (1883) and De Morgan (1925).

The peristomal groove starts on the extreme right margin near the anterior end and extends to the posterior end of the organism. It is narrow and pointed anteriorly and widens gradually toward the posterior end. It terminates in the wide mouth situated in a slightly dorsal position. The dorsal edge of the peristome swings down in an even arc about the mouth. The ventral edge, however, curves sharply to the left in an inverted arc, forming a pointed flap just under the mouth. This flap and the slightly dorsal position of the oral aperture make it exceedingly difficult to study from the ventral surface. The floor of the peristomal groove is thrown into a fold which has the appearance of a tongue and reminds one of the shelf in the peristome of *Conchophthirius mytili* (Kidder, 1932). This tongue extends to the oral aperture, becoming more protruding toward the posterior end (Fig. 1, *B*).

The body of the ciliate is covered with a thick elastic pellicle. No contractility is exhibited, but the whole organism may be bent by mechanical forces.

Peripheral Cilia

The peripheral cilia originate from rather large basal bodies arranged in longitudinal rows. These rows begin at the anterior field slightly back of the anterior extremity on the ventral surface. They pass backward and around the posterior end, returning on the dorsal surface and around the anterior end to the anterior field. The rows on the ventral surface are more numerous and much closer together than those on the dorsal. In sectioned material this relationship is clearly brought out (Fig. 2). The basal bodies are connected longitudinally by fine coördinating fibers.

The cilia are long and wavy with the exception of a single tuft of tactile cilia at the anterior end on the ventral surface. In this region the basal bodies are small and very numerous, and from each originates a single stiff cilium. The tuft of cilia may be seen easily from a lateral

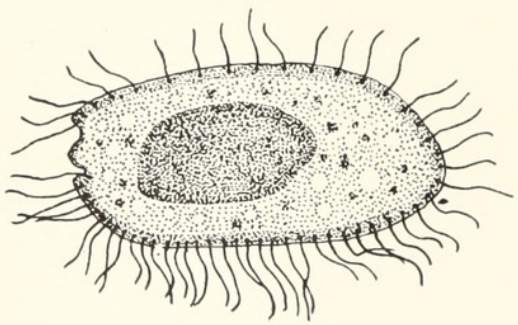

FIG. 2. *Ancistruma mytili.* Camera lucida drawing of a cross-section through the mid region looking from the anterior to the posterior end. Champy's: Crystal-violet. × 1000.

view (Fig. 1, *C*). It may also be seen in life when the organism attaches itself to the coverglass ventral side up. Then each cilium appears as a tiny point against the glass while the other cilia over the body continue to wave. This tuft of cilia is the attaching mechanism and is undoubtedly used in anchoring the organism to the mantle and gills of the host. It often attaches itself by this tuft to the bottom of the Syracuse dish or to pieces of debris.

Peristomal Cilia

Slightly back of the pointed end of the peristomal groove three rows of very long cilia originate. Two rows follow the dorsal edge of the peristome posteriorly and dip down in an arc behind the mouth. The other follows the ventral edge of the peristome and ends just over the point of the ventral flap. The cilia of these three peristomal rows are nearly twice as long as the peripheral cilia and are set exceedingly close

together. When the organism is in motion they are seen to move in waves like undulating membranes. At the posterior ends of these rows arise three still longer and heavier cilia. De Morgan (1925) figures and describes these three cilia. His observations of posterior lobes or dorsal ridges, however, I have been unable to verify in my material although I have looked for them repeatedly. The surface of the organism often does become folded and the lateral edges papillose after remaining on a slide for a short time.

Fibrillar System

The longitudinal coördinating fibers connecting the basal bodies are easily seen after Heidenhain's hæmatoxylin or Mallory's triple stain, but it is with reduced silver that they stand out with great clearness. Successful preparations of the silver line system are relatively easy to obtain using *Ancistruma* as material. The cytoplasm is yellowish and the basal bodies and fibers are black. I have found this method very useful in studying the fine details of the general morphology of this genus in addition to bringing out a system of fine fibers not demonstrated by any other technique.

The fibers are of three types in both *Ancistruma mytili* and *A. isseli:* the longitudinal coördinating fibers, the transverse or commissural fibers, and the net of fine fibers in the peristomal region (Fig. 3, *A, B,* and *C*).

The longitudinal fibers of *A. mytili* originate in a clear, bar-like area in the ventral anterior region, the anterior field (Fig. 3, *A* and *C*). This area does not appear to be fibrillary, as it remains unstained after all the methods I have employed. The basal bodies from which the stiff tactile cilia arise are small and very close together. Posterior to this region the basal bodies are larger and farther apart. The basal bodies of the three peristomal rows of cilia are large and numerous.

The transverse fibers are delicate and only occasionally can be seen after hæmatoxylin stain. They stand out quite clearly after silver impregnation, however. They are very irregular in their distribution. I have never seen any in the region of the tactile cilia and only occasional pairs of basal bodies in the posterior region show cross connections. They are most numerous in the mid region of the body on both dorsal and ventral surfaces.

Figure 3, *A,* represents an organism in which the impregnation was exceedingly clear and delicate. In one region on the left side of the organism a few fibers are seen lying between the rows of basal bodies. These may represent the interstrial fibers described by Pickard (1927) in *Boveria teredinidi.* On the other hand, they may represent a deep-lying network of the same type regularly seen in the peristomal region,

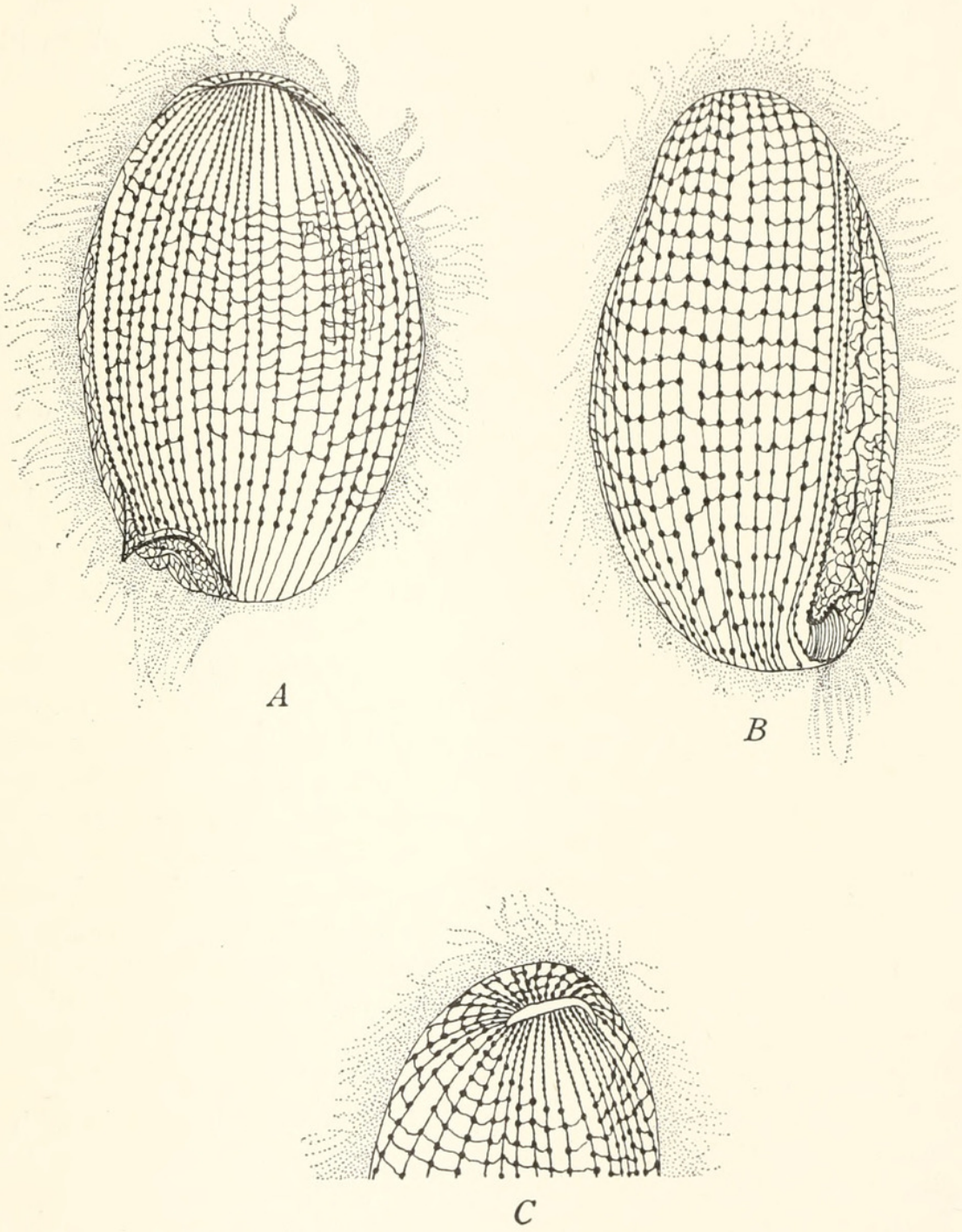

FIG. 3. *Ancistruma mytili.* Camera lucida drawings of organisms impregnated with silver nitrate. × 1000.

A. Ventral view. Note the fine interstrial (?) fibers appearing on the left side of the organism.

B. Dorsal view. The net of fibers in the peristome are readily seen in this view. Note also the row of fine fibers below the mouth.

C. Anterior end of an organism turned slightly on its right side. Note bar-like anterior field.

their presence being masked by the heavy pellicle in the body region so that they appear only under exceedingly favorable conditions.

The whole peristomal region, even into the mouth, is supplied with a net of very fine fibers. These fibers spread in all directions and seem to connect directly with the basal bodies of the peristomal cilia.

A number of fine fibers connecting the inner dorsal row of peristomal cilia to the outer dorsal row may be seen just posterior to the mouth. They seem to be quite distinct from the net system and probably are in the nature of concentrated transverse or commissural fibers (Fig. 3, *B*).

Nuclei

Ancistruma mytili contains one very small micronucleus located well up in the anterior end. It is spherical and, in the interphase, always stains intensely with any of the basic dyes. It is readily observed as the cytoplasm in the anterior region is very clear and free from food particles.

The macronucleus is relatively huge and very characteristic in shape and position. It is clearly visible in the living organism. It resembles a large, curved sausage, having its convex side always toward the peristome. In some organisms the degree of curvature is less than in others. Maupas (1883) and De Morgan (1925) both sketch the macronucleus of *A. mytili* entirely too small in proportion to the size of the organism. Moreover, De Morgan represented the convex surface as directed toward the left side instead of toward the peristome. I have never found this to be the case in my material.

The macronucleus of *A. mytili* in the resting stage is seen to be composed of very compactly placed chromatin granules. These take the Feulgen reaction intensely and stain clearly with any of the basic dyes.

Vacuoles

Many food vacuoles are found in the posterior portion of the body. These are filled with bacteria and small particles taken from the water brought in by the mussel. Many of the vacuoles contain algæ.

There is one contractile vacuole usually situated well to the left side near the posterior end. It is quite regular in its contractions, filling slowly and emptying rapidly. I have never been able to detect any definite and persistent pore in the periplast through which this discharge takes place. As the organism becomes enfeebled on the slide the rate of discharge decreases until finally it ceases and the vacuole reaches enormous proportions. This persists for one to three minutes before cytolysis takes place.

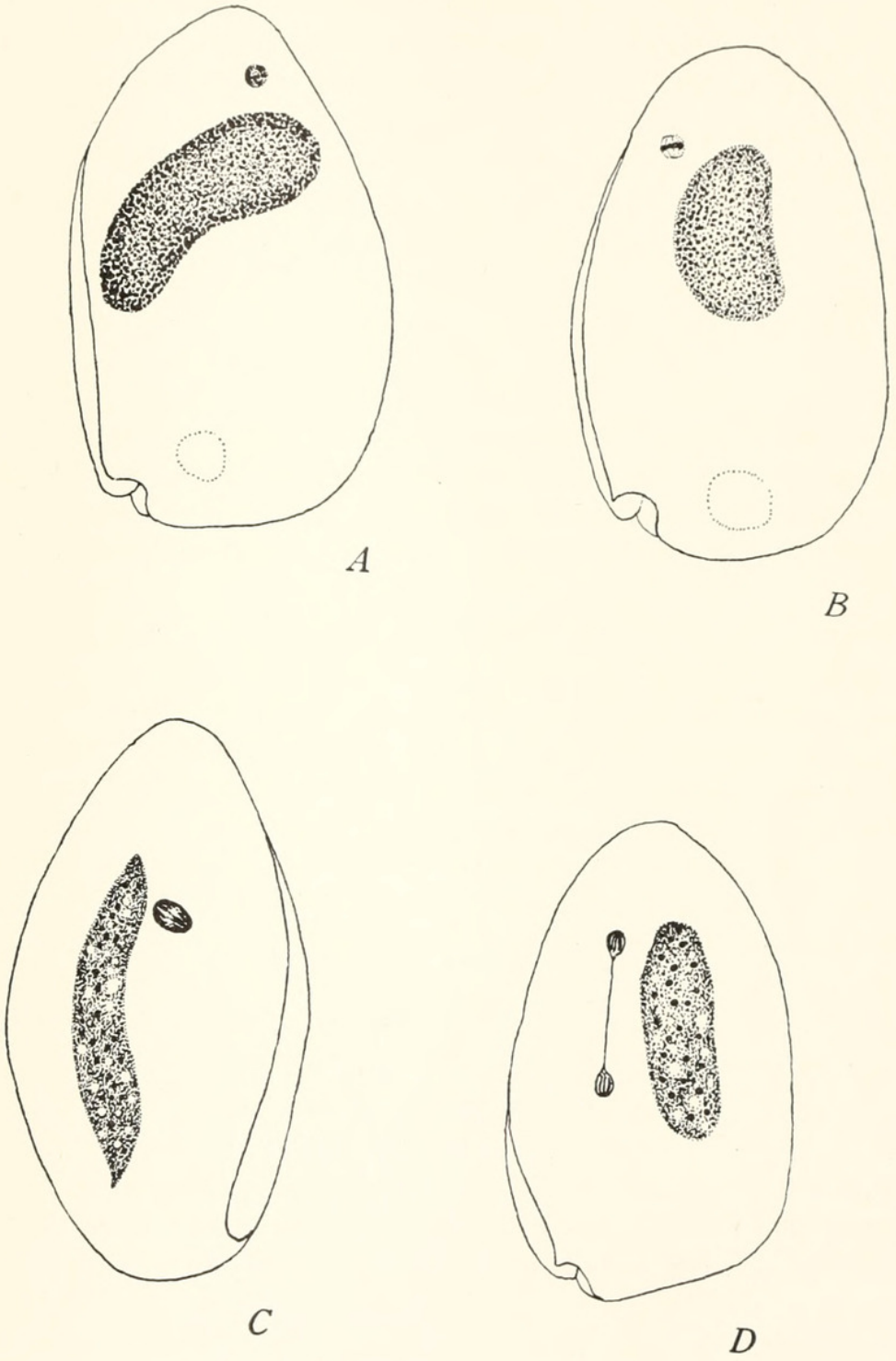

FIG. 4. Division of *Ancistruma mytili*. Camera lucida drawings. × 1000.

A. Micronucleus in prophase. Schaudinn's: Feulgen.

B. Metaphase. Macronucleus straightening. Zenker's: Feulgen.

C. Late anaphase. Macronucleus elongate. Schaudinn's: Heidenhain's hæmatoxylin.

D. Telophase. Schaudinn's: Heidenhain's hæmatoxylin.

Division of Ancistruma mytili

The division of *A. mytili* appears to be regular and of the usual ciliate type. The micronucleus is too small to allow detailed observation of inner structure. I shall outline the process briefly.

The micronucleus initiates fission. Its chromatin becomes less dense and appears as masses in a lightly-staining matrix. The macronucleus straightens out with its long axis corresponding to the long axis of the body (Fig. 4, *A*). There is very little swelling of the micronucleus and the metaphase is formed by an apparent condensation of chromatin into a plate (Fig. 4, *B*). This plate of chromatin divides and the two halves move to opposite poles of the then elongated micronuclear spindle (Fig. 4, *C*). The macronucleus lengthens considerably and becomes filled with deeply-staining granules and clear areas. This reminds one of the condition of the macronuclei of *Uroleptus halseyi* (Calkins, 1930). The micronucleus now divides, pulling out a long connecting strand between the two halves (Fig. 4, *D*). The connecting strand disappears and the two daughter micronuclei migrate to opposite ends of the cell. The macronucleus, meanwhile, begins to constrict and pull into a dumbbell shape (Fig. 5, *A* and *B*). In the clearer area between the dividing halves many large granules are regularly seen (Fig. 5, *B*), but as the separation proceeds these granules of chromatin are drawn up into the daughter halves. The separation of the daughter halves is clean, and the daughter macronuclei round up and become compact. The large granules and vacuoles disappear, and the ciliate undergoes plasmotomy (Fig. 5, *C*). The macronuclei of the daughter ciliates then elongate and assume their characteristic sausage-like shape.

General Features of Ancistruma isseli

A Syracuse dish containing the contents of the mantle cavity of *Modiola modiolus* is a scene of chaos, when viewed through the dissecting microscope. *Ancistruma isseli* exhibits more speed in swimming than does *A. mytili*. The ciliates are exceedingly numerous in most mussels and tend to swim in one direction, in contrast to the jerky flights of *A. mytili*.

Size and Shape

Fifty specimens of *Ancistruma isseli* gave an average length of 77 μ (70 μ–88 μ) while the average width was 42 μ (31 μ–54 μ). These averages are higher than those obtained for *A. mytili* although the ranges overlap.

The shape of *A. isseli* is roughly similar to that of *A. mytili*, but the former is more pointed at both the anterior and posterior ends. The

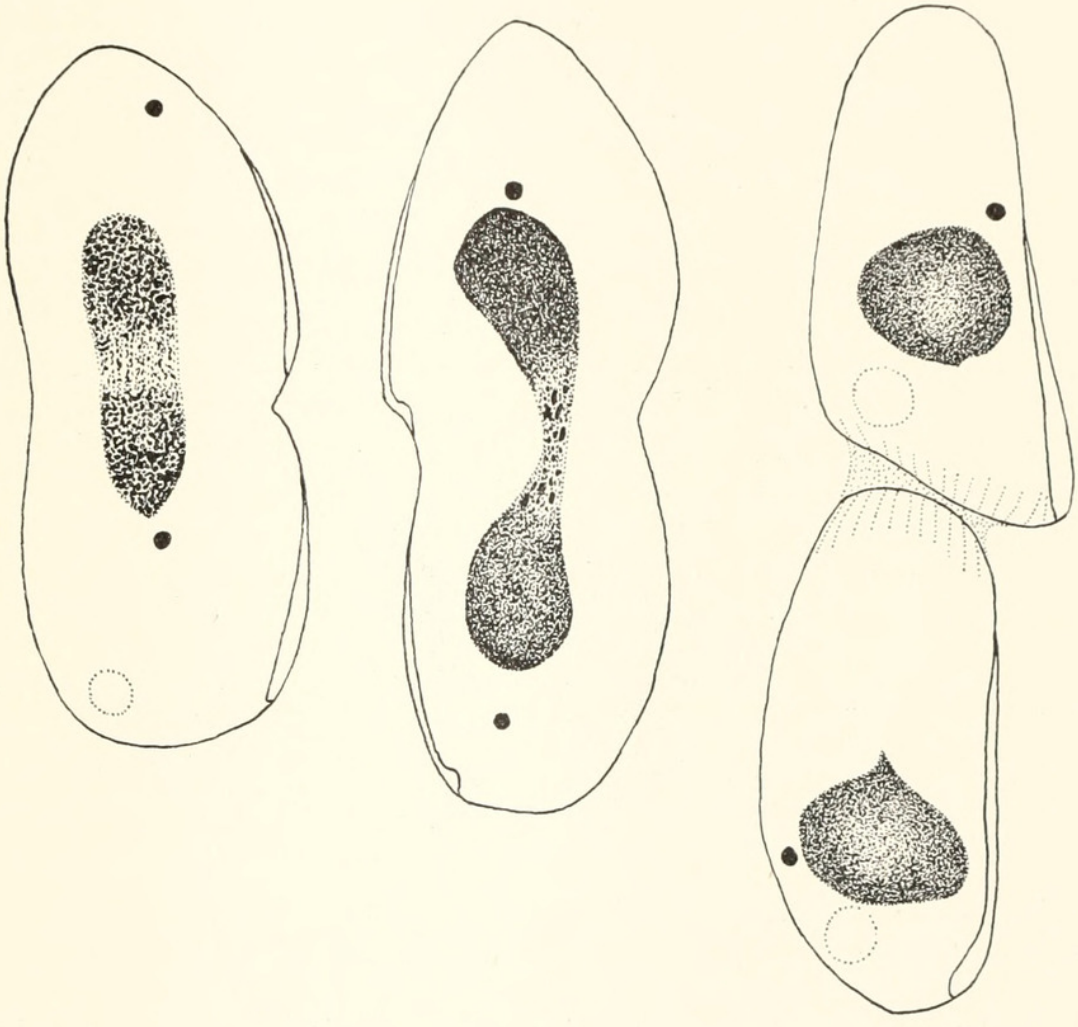

FIG. 5. Division of *Ancistruma mytili*. Camera lucida drawings. × 1000.

A. Daughter micronuclei are again compact and have moved apart. Macronucleus showing division plane. Reorganized peristomes visible. Zenker's: Feulgen.

B. A little later. Macronucleus dumb-bell-shaped. Schaudinn's: Delafield's hæmatoxylin.

C. Division of ciliate nearly completed.

right margin is only slightly convex while the left margin is greatly convex, the widest point being in the posterior third of the body (Figs. 6 and 7).

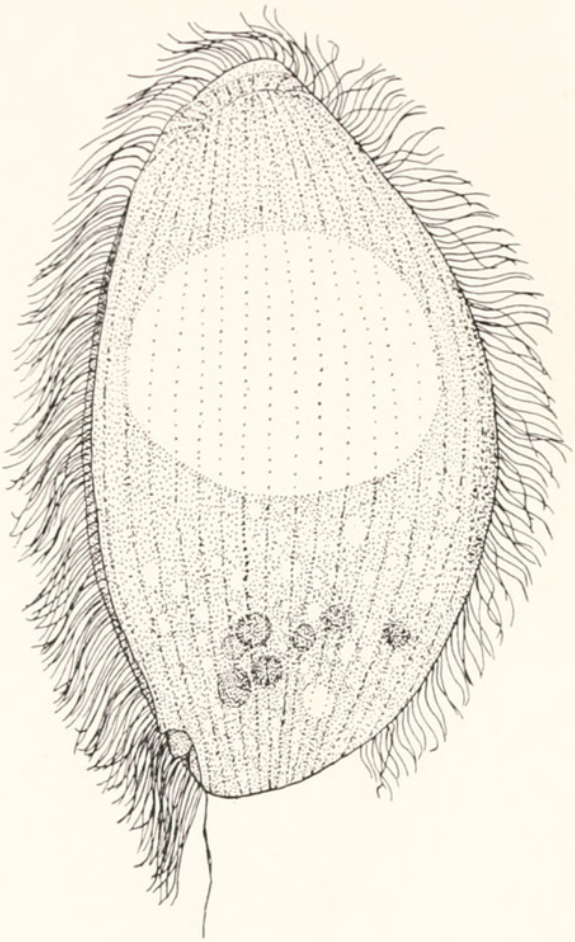

FIG. 6. *Ancistruma isseli.* Ventral view of organism drawn from life at approximately 1000 diameters. The macronucleus is extremely large and clear.

In lateral view *A. isseli* and *A. mytili* resemble one another closely. Both are dorso-ventrally flattened, concave ventrally, convex dorsally, and both possess attaching cilia. *A. isseli,* however, possesses a much enlarged anterior field, at the extreme anterior end. This field is in the form of a clear bubble in the periplast and is seen especially well when the ciliate is flattened under a coverglass. It is usually visible in fixed specimens (Fig. 8, *A* and *B*). The peristomes of the two species are very similar, the pointed flap under the mouth being less prominent, however, in *A. isseli.*

Cilia and Fibrillar System

The peripheral and peristomal cilia of *A. isseli* are long and wavy as in *A. mytili.* The tactile tuft is much less prominent and less extensive

in the former species. The ciliary lines do not pass completely about the posterior end but center at an easily visible suture. This suture is only observed from the dorsal side in organisms that are slightly flattened. After silver impregnation it appears as a black fiber (Fig. 8, *B*).

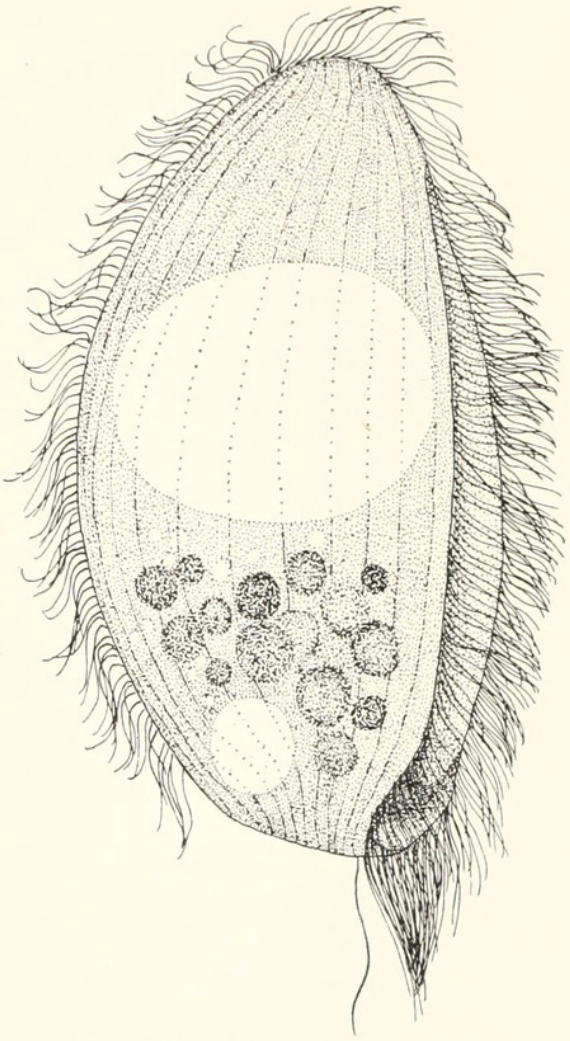

FIG. 7. *Ancistruma isseli.* Dorsal view of living organism at approximately 1000 diameters. Mouth, contractile vacuole and macronucleus visible.

The network of fibers in the peristomal region is much coarser and less extensive than in *A. mytili* and I have never observed any fibers (interstrial?) between the lines of cilia on the body surface. The fine fibrillar connections between the outer and inner dorsal rows of peristomal cilia seem to be lacking in *A. isseli.* Instead the outer dorsal peristomal fiber dips down and forward to join the end of the inner dorsal peristomal fiber just ventral to the mouth.

The fibers of the ciliary system seem to be all interconnected in *A. isseli* through the peristomal net system. The whole fibrillar organiza-

tion is certainly very similar to that described by MacLennan and Connell (1931) for *Eupoterion pernix*.

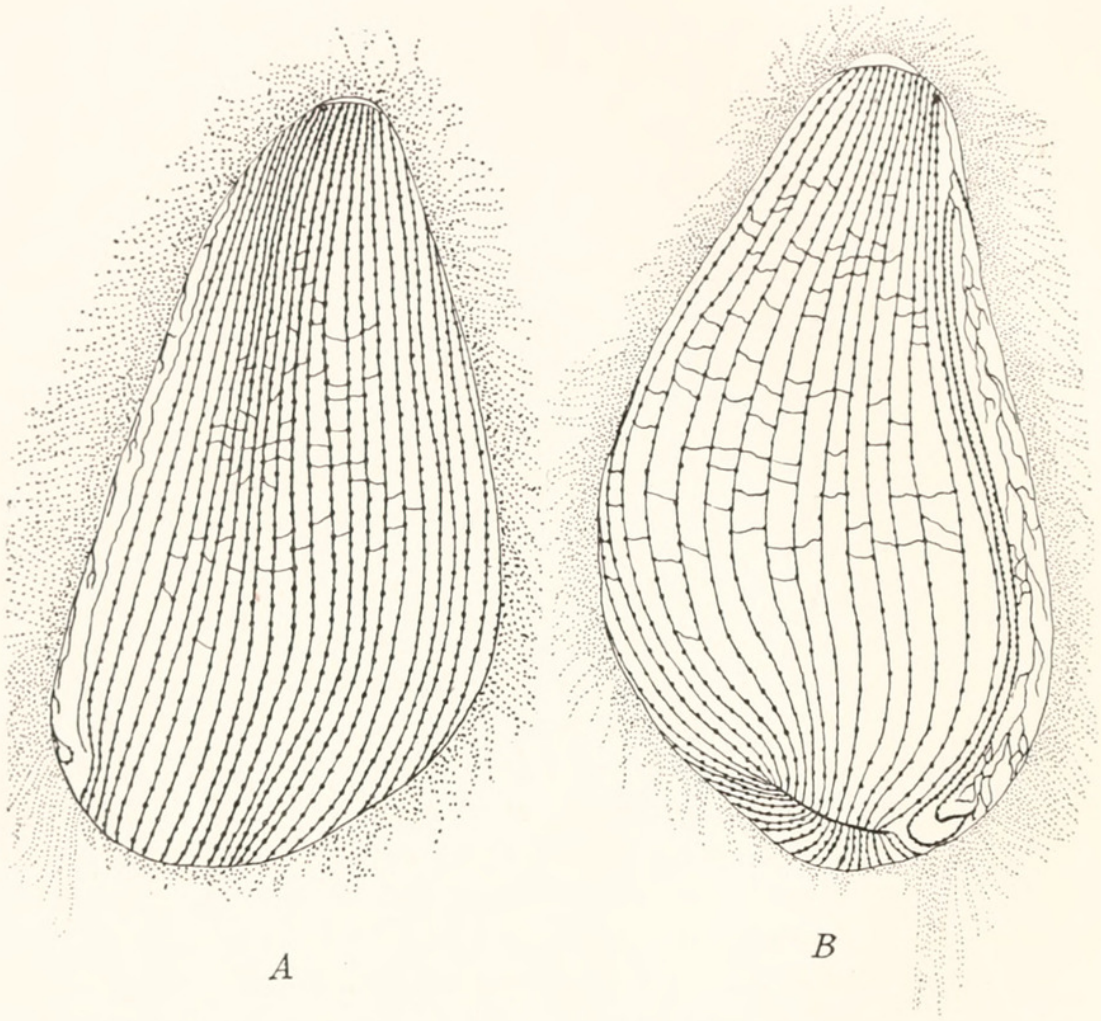

FIG. 8. *Ancistruma isseli*. Silver nitrate impregnations. Camera lucida drawings. × 1000.

A. Ventral view.

B. Dorsal view showing posterior suture. Note also the clear bubble-like anterior field.

Nuclei and Vacuoles

The micronucleus of *A. isseli* is a small sphere situated in the anterior fourth of the body. It is identical with the micronucleus of *A. mytili* as far as can be determined. The macronucleus of *A. isseli* is very distinctive, however. It is clearly visible in life as an enormous sphere occupying the center of the body (Figs. 6 and 7). Some shrinkage in the size occurs upon fixation. The macronucleus is of the massive type but it possesses many spherical deeply-staining chromatin granules among the smaller packed granules (Fig. 9, *A*).

Issel (1903) reports the macronucleus to be fragmented at times into two to seven parts. I have evidence that the spheres so often found in both *Ancistruma isseli* and *A. mytili* are not the result of fragmentation but the reorganization of an ex-conjugant. I shall present this evidence with a discussion of the question in the second of this series of papers.

The food vacuoles are numerous and situated in the posterior third of the body. They are usually filled with the yellow, granular pigment of *Modiola.*

The contractile vacuole is identical in size and position with the contractile vacuole of *A. mytili.*

Division of Ancistruma isseli

The micronucleus of *A. isseli* in division resembles that of *A. mytili.* It is too small to observe with certainty the details of any internal structures. The general sequence of its activity may be seen in Figs. 9, *A, B, C, D, E, F,* and 10, *A, B,* and *C.*

The interesting feature of division is to be found in the macronucleus. As the micronucleus is dividing the macronucleus pulls out into an elongate mass. As this mass begins its constriction two light areas may be seen appearing on either side of the center. These areas are to become the planes of fission of the macronucleus, the heavily-staining mass between them becoming extrusion chromatin (Fig. 9, *D* and *E*). As the two constrictions increase the extrusion mass becomes spherical (Fig. 9, *F*). The two daughter macronuclei now draw apart and round up, pulling out the macronuclear membrane into a long tube flared at the center to accommodate the residual chromatin (Fig. 10, *A*). Very soon the connections between the daughter nuclei are severed and the residual mass contracts (Fig. 10, *B*). The daughter macronuclei round up and plasmotomy proceeds. The residual mass, meanwhile, becomes very loosely granular and loses its staining capacity. By the time the daughter organisms are ready to separate this mass, now in the cytoplasm of one of the daughter organisms, has nearly disappeared (Fig. 10, *C*).

This type of macronuclear action almost exactly parallels that found in *Conchophthirius mytili* (Kidder, 1932) and is quite different from that of *Ancistruma mytili,* described above. The relative amount of chromatin cast out at each division is more than in *Conchophthirius,* but the method of disintegration and absorption into the cytoplasm is the same.

Discussion

Issel's (1903) description of a commensal of *Modiola barbata* under the name of *Ancistrum mytili* was not wholly satisfactory to him. He

states that he had some doubts about its identity with the *Ancistrum mytili* of Maupas, mainly because of the spherical macronucleus. But after examining some ciliates from a number of *Mytilus edulis* (obtained from a merchant) he found all gradations from the sphere to the bent type described by Maupas. He attributed this bent appearance to the beginning of fragmentation.

Kahl (1931) recognizes the distinct difference between the two types and names the ciliate from *Modiola barbata, Ancistruma isseli.* From the present study I think it possible to establish the correctness of Kahl's statements, and the validity of his species, as I believe the ciliate here described from *Modiola modiolus* to be identical with the ciliate from *Modiola barbata.*

The main points of difference between *Ancistruma mytili* and *A. isseli* are as follows: (1) Size: *A. isseli*—average 77 $\mu \times 42\ \mu$; *A. mytili*—average 67 $\mu \times 31\ \mu$. (2) Macronucleus: *A. isseli*—spherical; *A. mytili*—sausage-shaped. (3) *A. isseli* has posterior suture; *A. mytili* has no posterior suture. (4) Division: *A. isseli* casts out a mass of macronuclear chromatin at division; *A. mytili* divides sharply with no chromatin extrusion.

The genus *Ancistruma* shows many affinities to the Conchophthiridæ. The peristome of *Ancistruma* is like *Conchophthirius mytili* in that it possesses a shelf or raised portion which protrudes between the rows of peristomal cilia. The motor organization is similar to that of *Eupoterion* as described by MacLennan and Connell (1931). In fact, the main distinctive difference between the members of the Conchophthiridæ (*Conchophthirius, Cryptochilum,* and *Eupoterion*) and the genus *Ancistruma* is the possession of the tactile tuft of cilia by the latter.

The "silver line system" first described by Klein (1926) was thought by him to represent a system of nervous connections and coordinating controls. It is evident from the present study that fibers generally thought to be coördinating or conductive in function (longi-

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FIG. 9. Division of *Ancistruma isseli.* Camera lucida drawings. $\times 1000$.

A. Interphase showing compact micronucleus and large spherical macronucleus. Sublimate-acetic: Heidenhain's hæmatoxylin.

B. Micronucleus in metaphase of mitosis. Sublimate-acetic: Heidenhain's hæmatoxylin.

C. Telophase. Sublimate-acetic: Feulgen.

D. Daughter micronuclei drawing apart. Macronucleus elongating. Sublimate-acetic: Heidenhain's hæmatoxylin.

E. Later stage. Note two constrictions in the macronucleus. These represent the division planes while central mass is the residual chromatin. Gilson-Carnoy's: Borrel.

F. Later stage in division of macronucleus. Gilson-Carnoy's: Feulgen.

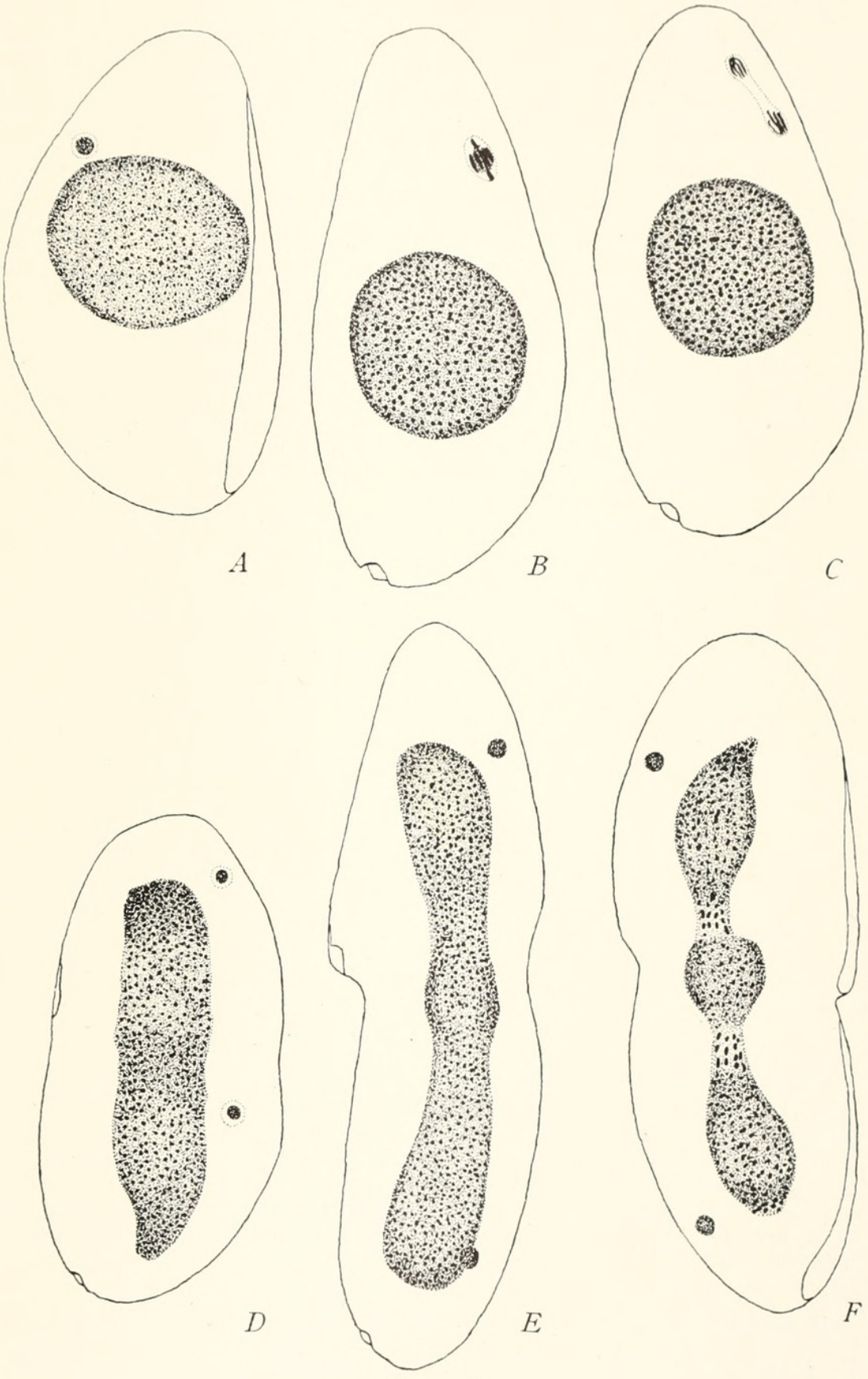

FIGURE 9

tudinal fibers) are stained by the reduced silver after this method. It seems logical to suppose that the network of fine fibers in the peristomal region of *Ancistruma* is conductive and serves to connect this sensitive area with the organelles of locomotion.

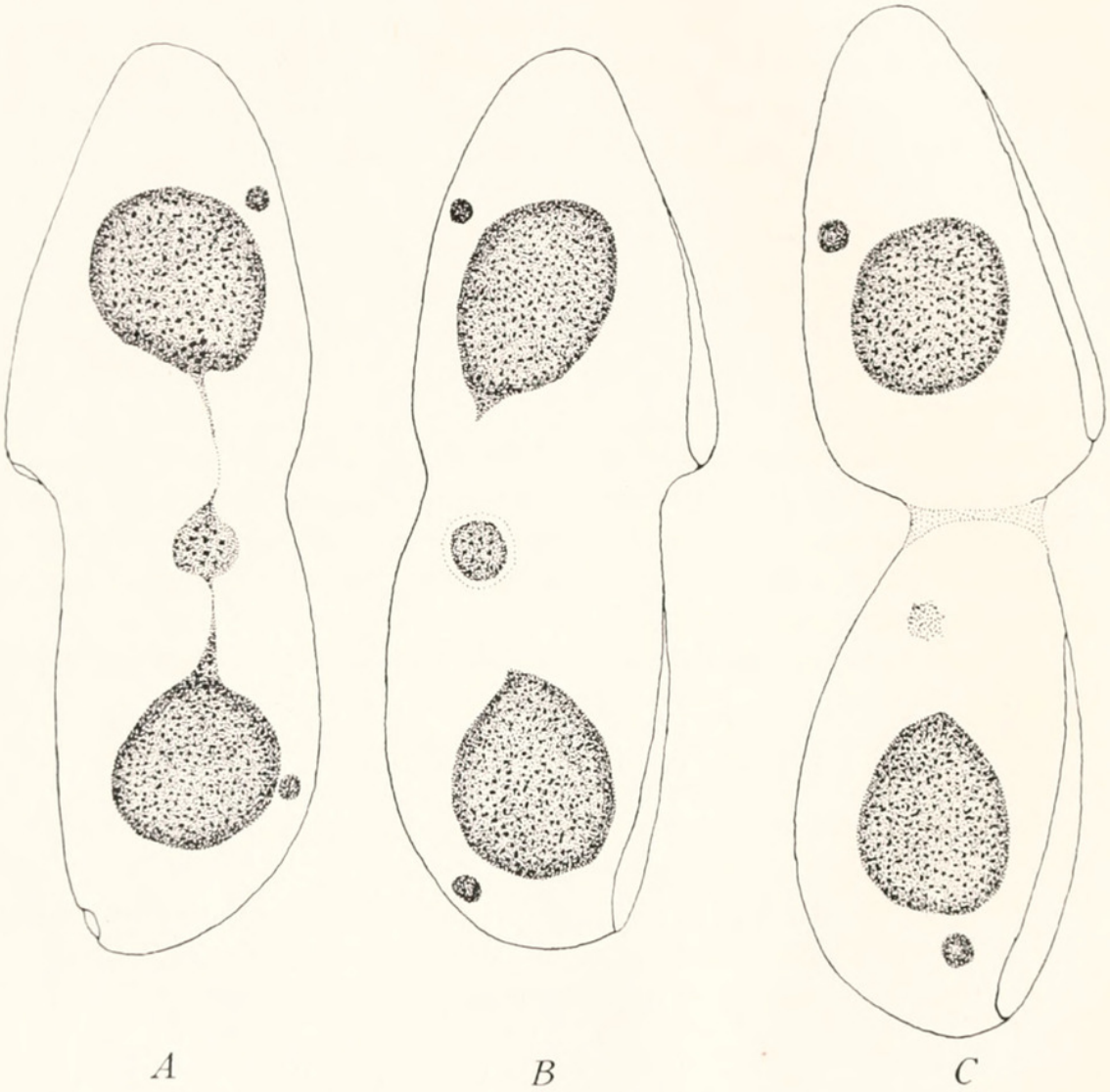

FIG. 10. Division of *Ancistruma isseli*. Camera lucida drawings. × 1000.

A. Late division of macronucleus. Extrusion chromatin still within macronuclear membrane. Gilson-Carnoy's: Borrel.

B. Later. Daughter macronuclei separate. Residual mass of chromatin free in cytoplasm. Sublimate-acetic: Feulgen.

C. Daughter macronuclei rounding up. The residual chromatin is being absorbed into the cytoplasm of posterior daughter organism. Sublimate-acetic: Feulgen.

It seems strange that two such similar forms as *Ancistruma mytili* and *A. isseli* should show such a decided difference in macronuclear division. If this chromatin elimination is a purification process as sug-

gested by Calkins (1930), then there must be some fundamental difference between the two species in the chromatin reorganization during division. *Ancistruma mytili* must be able to eliminate its nuclear waste products gradually or at least in a manner as yet impossible of visual detection. Whether or not this process of chromatin elimination has any phylogenetic significance is unknown. Perhaps some light may be thrown on this question when sufficient data have been collected and analyzed. The Conchophthiridæ and the Ancistridæ seem to be the most favorable material for such a study.

Summary

1. *Ancistruma mytili* Quenn., a holotrichous ciliate commensal in the salt water mussel *Mytilus edulis,* and *Ancistruma isseli* Kahl, a holotrichous ciliate commensal in the solitary mussel *Modiola modiolus* are described.

2. Observations are made from both living and fixed material.

3. The motor system of each consists of long peripheral cilia, a tuft of tactile cilia, and three rows of peristomal cilia all supplied with interconnected basal bodies. Net-like systems of coördinating fibers occur in the peristomal regions.

4. Each species possesses one micronucleus, which is small and compact.

5. The macronucleus of *A. mytili* is sausage-shaped while that of *A. isseli* is spherical. Both are very large.

6. During division the micronuclei divide in the usual manner. They are too small to allow observation of detail.

7. The macronucleus of *A. mytili* divides evenly and cleanly, while that of *A. isseli* eliminates a large ball of chromatin at each division.

8. The differences between the two species are discussed.

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