

## APPENDIX.

NOTES on some SPONGES collected by Professor Herdman off the West Coast of Ireland from the "Argo."

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With Plates XI and XII.

THE Sponges dredged by Professor Herdman from the S.Y. "Argo" on the west coast of Ireland were only a few in number and small, but there were some very interesting forms amongst them, and all were in a state of splendid preservation. There were altogether ten species, five of which (including all the rarer forms) were attached to one small piece of rock dredged off the Arran Islands.

*Ascetta coriacea*, Fl., var. *osculata*.

The flat, encrusting form of *Ascetta coriacea*, with its beautiful basket-like structure, has long been known, and has been described by Montagu, Johnston, Bowerbank, and Carter. These authors, as well as Grentzenberg, in his recent paper,\* did not find any oscula in their specimens. This form is frequently met with in Liverpool Bay. Apparently much rarer is the erect variety of our species, with its comparatively large oscules placed upon distinct conules. It was first figured by Hæckel,† but as he has not given a special name to the variety, I propose to call it *A. coriacea*, var. *osculata*. The collection contains four or five small specimens, which were attached to

\* Die Spongienfanna der Ostsee. Inaugural Dissertation. Kiel, 1891.

† Hæckel, Die Kalkschwämme, vol. iii., pl 3, figs. 13, 16, 17, 19, 20.

a piece of rock dredged off the Arran Islands. The largest of the colonies is laterally compressed, measuring 14 by 3 mm. horizontally, and 10 mm. vertically. It bears seven oscula, with an average diameter of 1 mm. The conules are about 2 mm. in height. Its colour (in spirit) is a transparent white.

*Sycandra ciliata*, Fleming.

One specimen, on rock, Arran Islands.

*Halichondria caruncula*, Bowerbank.

A small erect specimen, dredged off the Arran Islands.

*Reniera (densa)*, Bowerbank, (?)

A small piece of a renierid sponge was dredged off Arran Islands, which may possibly belong to above species.

*Desmacidon fucorum*, Johnston.

A few small fragments were dredged off Arran Islands.

*Esperella sordida*, Bowerbank (Pl. XI, figs. 1-9).

*Rhaphiodesma sordida*, B., Brit. Spong., vol. iii., p. 230, pl. lxxvi..

This sponge has been described only by Bowerbank, who gave it the specific name on account of its poor and ragged outer appearance, but a more interesting and more beautiful aspect than that which the skeleton of this species offers can scarcely be imagined. The only specimen obtained is about half the size of a pea, and encrusted a piece of rock dredged off the Arran Islands. Its colour in spirit is straw-yellow. It is of a very soft consistency, and almost fell to pieces when touched. The megascleres in the specimen are styli, 0.26 by 0.0045 mm., whilst Bowerbank figures spicules of a more tylostylote character. The microscleres are of three forms: firstly, palmate anisochelæ, 0.032 by 0.0122 mm., which are mostly arranged in beautiful rosettes. The axes of the anisochelæ may either lie in one plane, occupying the radii of a circle (see Pl. XI, fig. 2), or they may lie in various planes, generally occupying the radii of a hemi-

sphere (or sphere?), similar to Bowerbank's\* figure of the rosette in *Esperella lingua*, B.; secondly, sigmata, 0.1 by 0.006 mm., generally simple, a few also contort; thirdly, toxa, varying greatly in size, from 0.1 to 0.25 mm. by 0.002 to 0.005 mm.

A number of most interesting embryos were found in this specimen. They are generally of an oval shape, 0.3 by 0.21 mm, the one pole (ventral) being slightly broader and more flattened than the other one (the dorsal pole). The outer wall, except on the ventral pole, consists of high and exceedingly narrow columnar cells (the ectoderm) with the nuclei quite at their bases. Since a section through such an embryo is bound to be thicker than the diameter of its ectodermal columnar cells, and since the embryo is round, we must of course expect to see several rows of ectodermal nuclei, which will be the more numerous the thicker the section is. This is shown in the section represented in Pl. XI, fig. 9. Cilia or flagella could not be detected on the ectoderm. The ectoderm is absent on the ventral pole of the embryo. The central mass of tissue which also forms the ventral pole of the embryo, seems to be gelatinous, and contains numerous nuclei which are larger, but less intensely stained than the ectodermal nuclei. This tissue also contains spicules and for this reason one is inclined to take it to be mesoderm; so what part of the embryo represents the endoderm is a mystery to me. These embryos already possess a skeleton, both megascleres and microscleres. The megascleres are styli, 0.184 by 0.0028 mm. They are arranged in a sheaf, converging with their pointed ends and directed towards the ventral pole of the embryo, and diverging with their blunt ends and directed towards and beyond the centre of the mesoderm (see Pl. XI., fig. 8).

\*Bowerbank, *British Spongiadæ*, vol. i., pl. xviii., fig. 297,

The microscleres are palmate anisochelæ, 0·023 mm. in length, which are not arranged in rosettes, and toxa, 0·112 by 0·002 mm. Most of the microscleres are found towards the dorsal pole. Sigmata do not seem to occur in the embryo. The embryos are enclosed in a loose membranous capsule which apparently is derived from the parent sponge.

From the foregoing it will be seen that the structure of the embryos of *Esperella sordida*, B, agrees almost completely with what Ridley and Dendy\* state in regard to the Halichondrina generally: "the embryo consists of a sac of small, probably prismatic, ciliated cells, enclosing a central mass of mesodermal (?) tissue containing the developing spicules. In some cases, perhaps in all"—— "the ectoderm appears to be absent from one pole at which the mesoderm comes to the surface." But although this description agrees very well with what I found in *E. sordida*, still Ridley and Dendy's figures show only a very slight similarity with mine. These authors had examined especially the embryos of *Esperella biserialis*, *Esperella mammiformis* and *Myxilla nobilis*, and they state that similar embryos had been found by Keller in *Chalinula fertilis*, by Carter in *Halichondria simulans* and *Esperella ægagropila*, by Marshall in *Reniera filigrana* and by Schulze in *Euspongia officinalis adriatica*. I have only been able to see Carter's† paper in which he figures living embryos with cilia dorsally and laterally and with a circle of flagella near the ventral pole. The embryo of *Halichondria simulans* is in shape somewhat similar to that of *Esperella sordida*, but differs from it in its quite

\* Ridley and Dendy, Report on the Monaxonida collected by H. M. S. "Challenger," p. liii.

† Carter, Annals and Magazine of Natural History, 4th ser., vol. xiv., pls. 21 and 22.

irregular arrangement of the spicules. Two germ-layers can easily be made out in it, but there is no clue as to the third one. An embryo very similar to that of *Esperella sordida* has recently been figured by Lendenfeld\* for *Phorospongia chaliniformis*. It also resembles it in the regular arrangement of the spicules, but differs from it in its cubical ectoderm. Lendenfeld calls the central portion of the embryo "endodermal mass," although it contains spicules and shows generally no great similarity to the endoderm of the adult sponge. It is certain that this embryonic stage has not yet been explained satisfactorily and that additional work is necessary.

*Iophon hyndmani*, Bowerbank.

The specimen which I refer to above species, does not differ from the type described by Bowerbank except very slightly in the relative thickness of the megascleres, and I think it safe to include the two forms under a common name. The only specimen obtained is a minute fragment of brownish colour, about 3 mm. in diameter, which was attached to the piece of rock dredged off Arran Islands. The megascleres are of two kinds, viz:—Strongyla, 0.18 by 0.003 mm. Although slender, they are not so slender as those figured by Bowerbank.† Secondly: spined styli, varying greatly in size, from 0.088 by 0.0035 mm. to 0.28 by 0.006 mm. They are more slender than those figured by Bowerbank. The microscleres are also of two forms, viz:—bipocilli which are so characteristic of the genus, 0.0087 mm. in length, and palmate anisochelæ, 0.02 mm. in length.

Bowerbank described four species of this genus, *Halichondria pattersoni*, *H. hyndmani*, *H. scandens* and *H.*

\* R. v. Lendenfeld, A Monograph of the Horny Sponges, pl. xli., fig. 2.

† Bowerbank, loc. cit., vol. iii, pl. xlvi, fig. 2.

*nigricans*. Ridley and Dendy\* regarded these species, together with some other forms, merely as varieties of one type, *Iophon pattersoni*, B. Whether they are right in doing so, is doubtful. Certainly their table on p. 118, in which they wish to show the affinities of the so called varieties, is not quite free from error. For the tylota of *I. nigricans* are not, as these authors state, "very slender; heads barely visible, or absent, not spined," but on the contrary they are not very slender, heads spined. Further the "tylota" of *I. hyndmani* have not "very slight, faintly spined heads," but they have no heads at all and no trace of spines. These spicules should rather be called strongyla, as I have done above.

Better material than was found on this occasion was obtained from the West Coast of Anglesey, on the "Hyæna" cruise, of June, 1890, and probably I shall give a detailed description of it in a future report on the Porifera of the L.M.B.C. District.

*Suberites domuncula*, Nardo.

Several specimens were dredged in Killary Bay at a depth of 10 fathoms. They incrustated univalve shells, inhabited by hermit-crabs, as it is usually the case with this species. I take this opportunity of correcting an oversight in my "Third Report on the Porifera of the L.M.B.C. District," p. 215. I omitted there to mention the microcleres of this form which are centrotylote. Dr. Carter was kind enough to point out this error to me and also to send me a slide and specimens which showed their spicules exceedingly well. These spicules had not been mentioned either by Johnston or by Bowerbank, although, as Dr. Carter writes me, their type-specimens, now in the British Museum, contain these spicules plentifully. Nardo and O. Schmidt had also not seen them.

\* Ridley and Dendy, loc. cit., p. 117.

*Suberites ficus*, Esper.

Two specimens were dredged off Killybegs, August 10th, at depths of 5—15 fathoms.

*Aplysilla rubra*, Hanitsch (Pl. XII, figs. 1-6.)

*Halisarca rubra*, Hn., Trans. L'pool Biol. Soc., vol. iv., p. 196, pl. x.

The doubts which I expressed in regard to the systematic position of this form, when describing it for the first time, were not unfounded. The examination of additional and well-preserved material has convinced me that I must remove this sponge from the genus *Halisarca* to *Aplysilla*, a genus of the true Ceratosa. The skeleton of *Aplysilla*, Schulze, consists, according to Lendenfeld,† of "numerous, isolated, small, dendritically ramifying, upright fibres." In young specimens these fibres are simple, not branching, and arise about at right angles from the limiting membrane. I had noticed these fibres when describing the sponge in my "Third Report on the Porifera of the L.M.B.C. district," but I thought them to be hairs of *Mytilus*, on which the sponge was found encrusting. But the fact that the material dredged on the "Argo" expedition was encrusting a stone, and a more careful perusal of literature, have shown me that the fibres are essential parts of the sponge.

The specimen formed a small dark blood-red patch (3 mm. in diameter, 0·6 mm. in thickness) on the piece of rock dredged off Arran Islands. Its surface is raised into numerous sharp-pointed prominences, caused by the erect spongin-fibres projecting through and dragging upwards the neighbouring parts of the dermal membrane and other tissues. These fibres are isolated and simple, and spring about at right angles from the limiting membrane. Their diameter in the centre of the sponge is 0·007 mm. We

\* R. v. Lendenfeld, "A Monograph of the Horny Sponges, p. 698.

may expect that in large specimens these fibres would be branched, as is the case in other species of *Aplysilla*.

A vertical section through the sponge shows a well-defined dermal membrane, 0·024 mm. thick; large but flat subdermal cavities (0·25 mm. broad, 0·028 mm. deep). The floor of the subdermal cavities is frequently seen to be perforated and to open by a narrow passage into large cavities, the inhalent canals (this is not figured on Pl. XII). The subdermal cavities, therefore, seem to be distinct from the inhalent canals. The flagellated chambers are large and sac-like, somewhat irregularly oval (in cross sections, of course, more or less round), and may be simple or bilobed (see Pl. XII, fig. 1.) Their average size is 0·08 by 0·04 mm; but the large flagellated chamber on Pl. XII, fig. 1 measures 0·24 by 0·06 mm. They open directly with a wide mouth into the large exhalent canals. The chamber system is therefore eurypylous. The lining of the flagellated chambers consists of cells in the shape of truncated cones. In a few cases I could see something like highly transparent pointed projections in front of these cells. They might have been "Kunstprodukte," or amœboid processes, or, in fact, anything, but certainly they did not show the slightest resemblance to those notorious structures, the collars and flagella, which are so often met with in literature, and so rarely in reality. The endodermal lining of inhalent and exhalent canals is distinctly squamous epithelium.

The ground-substance of the mesoderm is probably hyaline. It is full of fibrous tissue, and contains numerous stellate (amœboid) cells and large gland cells. The stellate cells are met with in all parts of the mesoderm, but they are found most crowded along the spongin-fibres. They become elongated and finally thread-like, where the fibres project beyond the level of the sponge.



Also the gland-cells are not restricted to a special part of the mesoderm, but they are most numerous in the dermal membrane, just beneath the ectoderm. They are large, round, granular, with a small nucleus, and were often seen to project with a small pointed prominence (the mouth) beyond the ectoderm. They contain a varying amount of red pigment and seem to fulfil the double function of gland cells and pigment cells. In my former paper I described these cells only as pigment cells.

According to Lendenfeld two species of *Aplysilla* have been described as British: *A. sulphurea*, Schulze, found off the Shetland Islands; and *A. rosea*, Schulze, which Lendenfeld regards as identical with *Aplysina nævus*, Carter, dredged on the "Porcupine" expedition, 1869, between Scotland and Faroe Islands (345 fathoms) and north-west of the Shetland Islands (312 fathoms). *A. sulphurea* of course differs from my species in its colour. *A. rosea* comes much nearer to it, but it is very difficult to get a correct idea of the degree of its relationship with *A. rubra*, since, as far as I know, no sections of it have been figured. Carter gives only the figure of a spirit-specimen, Lendenfeld even only a figure of a dried specimen. However, as Lendenfeld states that in *A. rosea* "the pigment occurs in the shape of large red spherical granules which are found in the amœboid and collar cells," we may take this as distinguishing it from *A. rubra*, which contains no pigment in those cells, but only in the gland-cells.

## EXPLANATION OF THE PLATES OF APPENDIX.

## PLATE XI.

- Fig. 1. Style of *Esperella sordida*, Bowerbank,  $\times 400$ .  
 Fig. 2. Rosette of palmate anisochelæ of the same,  
 $\times 400$ .  
 Fig. 3. Isolated palmate anisochela,  $\times 800$ .  
 Figs. 4 and 5. Simple and contort Sigmata,  $\times 400$ .  
 Figs. 6 and 7. Toxa,  $\times 400$ .  
 Fig. 8. Embryo in optical section,  $\times 100$ .  
 Fig. 9. Vertical section through an embryo, enclosed by  
 membranous capsule

## PLATE XII.

- Fig. 1. Inner portion of a vertical section through *Aplysilla rubra*, Hanitsch, showing an exhalent canal with flagellated chambers opening into it,  $\times 120$ .  
 Fig. 2. Outer portion of a vertical section through the same, showing dermal membrane with gland-cells and subdermal cavities,  $\times 250$ .  
 Fig. 3. Outer portion of a vertical section showing one of the spongin-fibres projecting beyond the level of the sponge and dragging upwards the dermal membrane, etc.  $\times 250$   
 Fig. 4. Part of limiting membrane and spongin-fibre arising from it,  $\times 250$ .  
 Fig. 5. Flagellated chamber,  $\times 800$ .  
 Fig. 6. Diagrammatic vertical section to show arrangement of the spongin-fibres,  $\times 15$ .

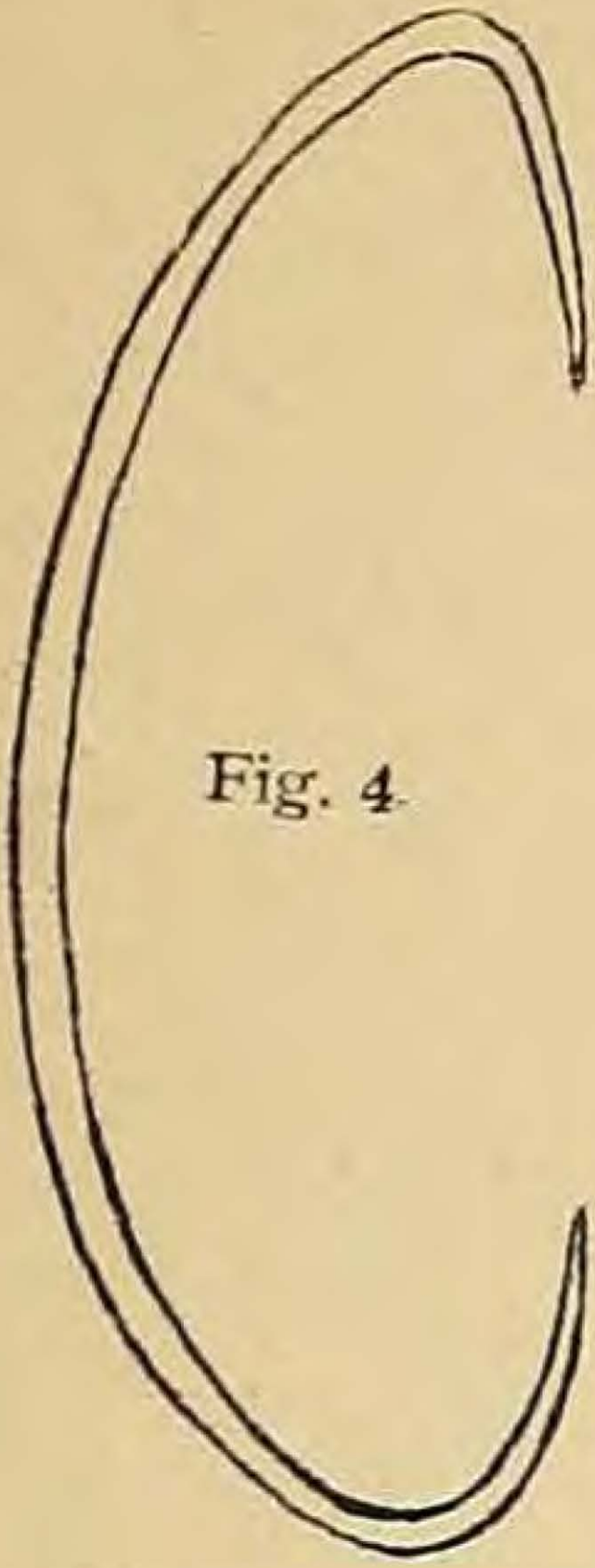


Fig. 4.

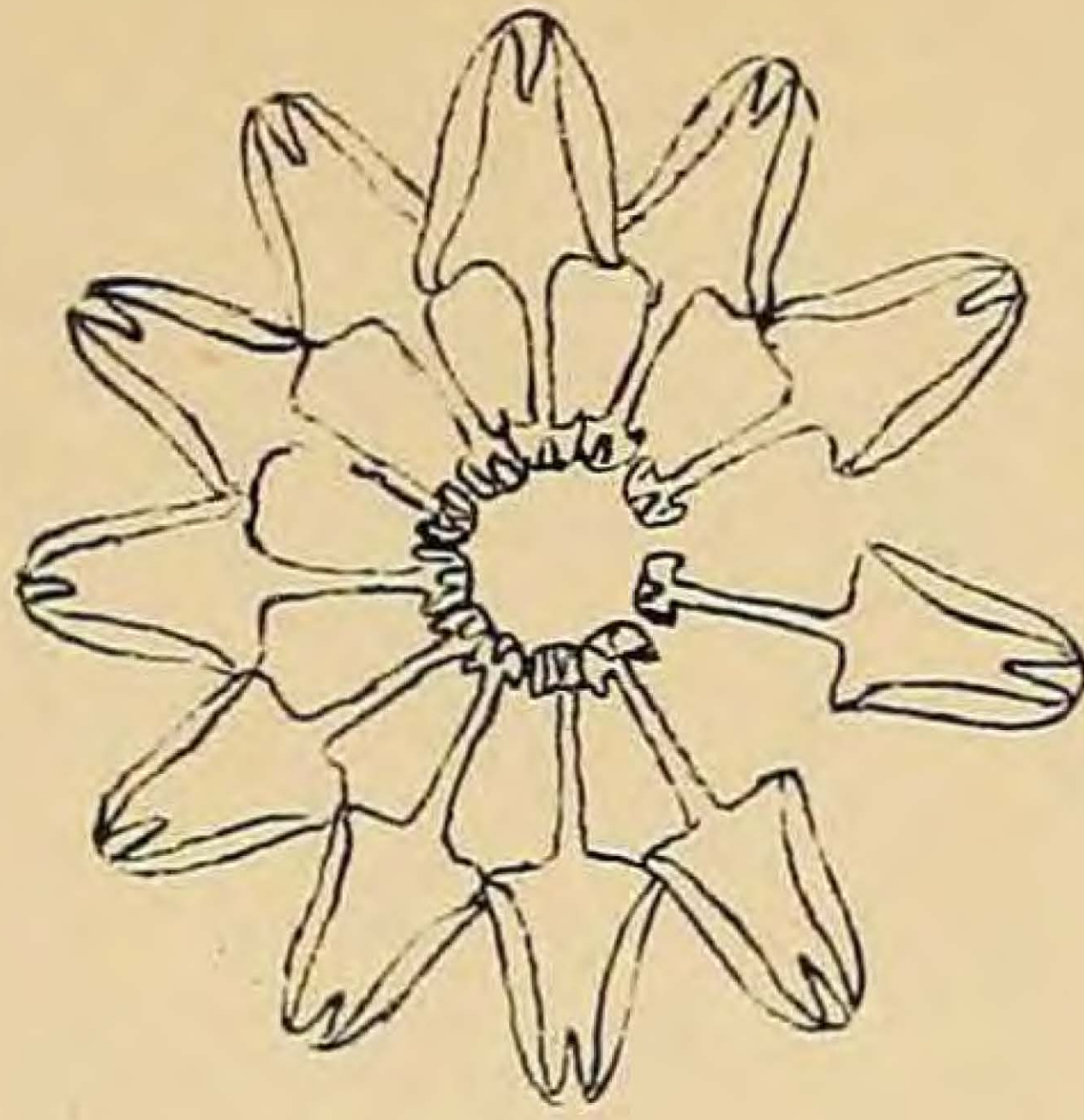


Fig. 2.

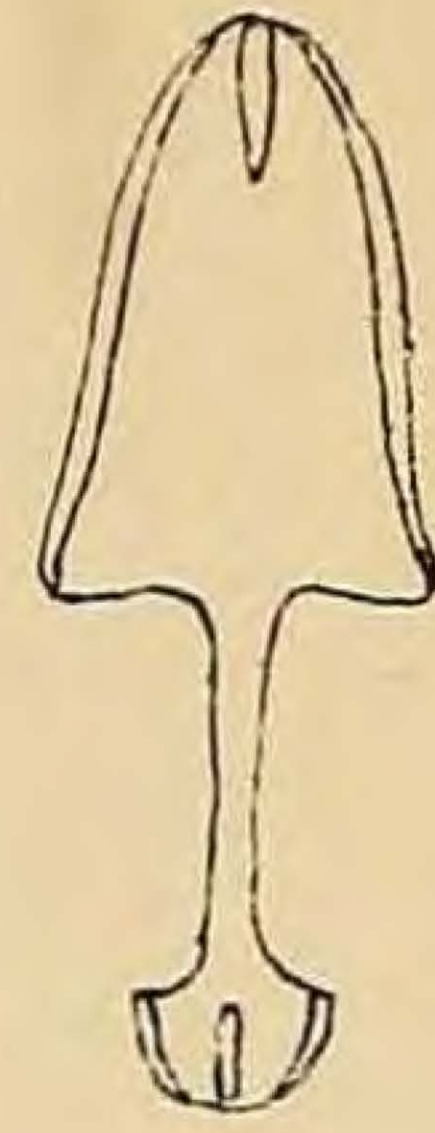


Fig. 3.



Fig. 1.

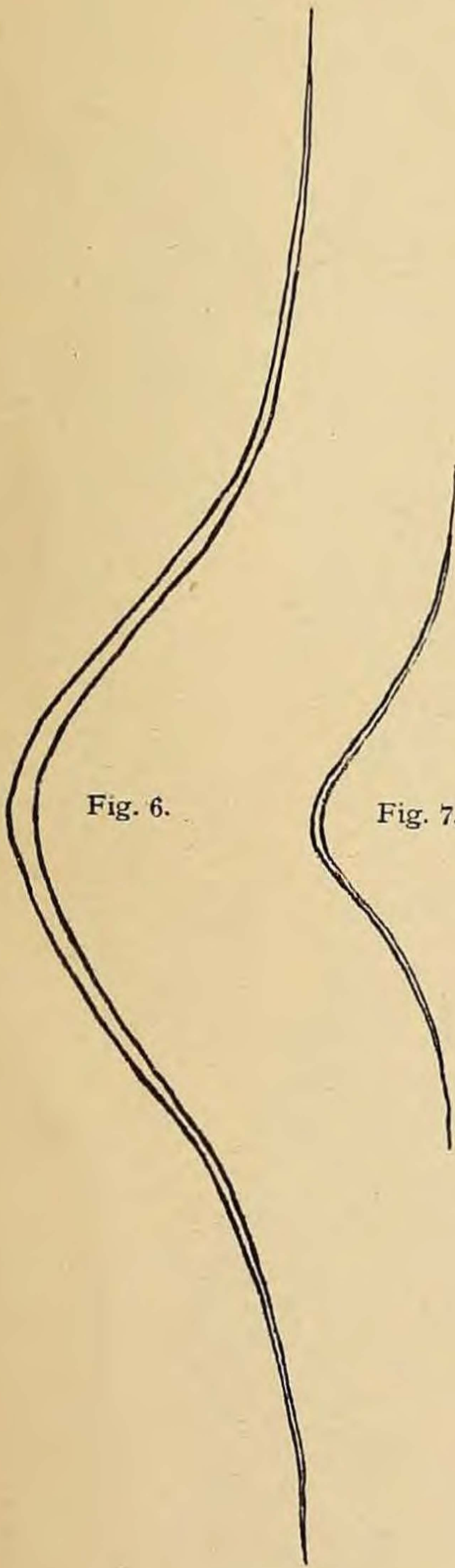


Fig. 6.

Fig. 7.

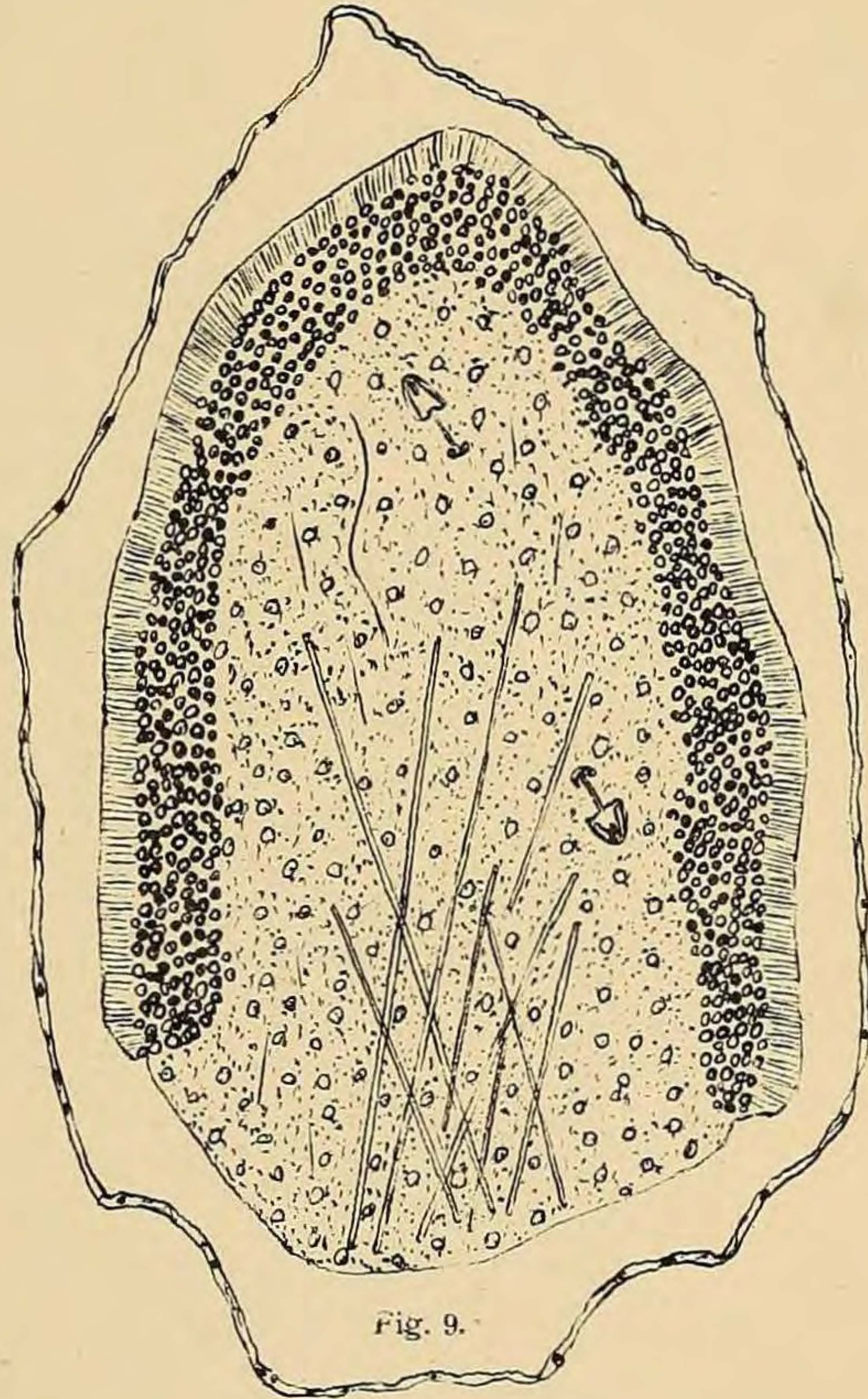


Fig. 9.

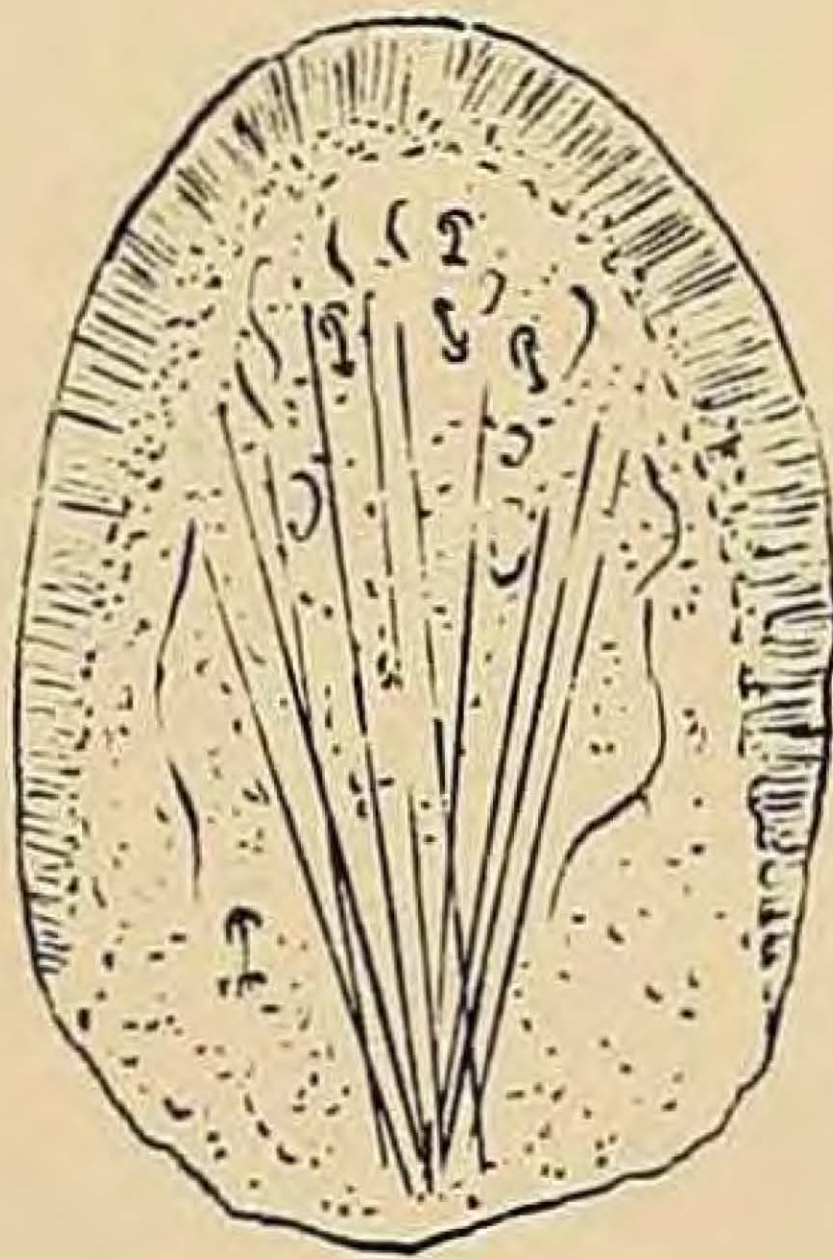


Fig. 8.



Fig. 5.

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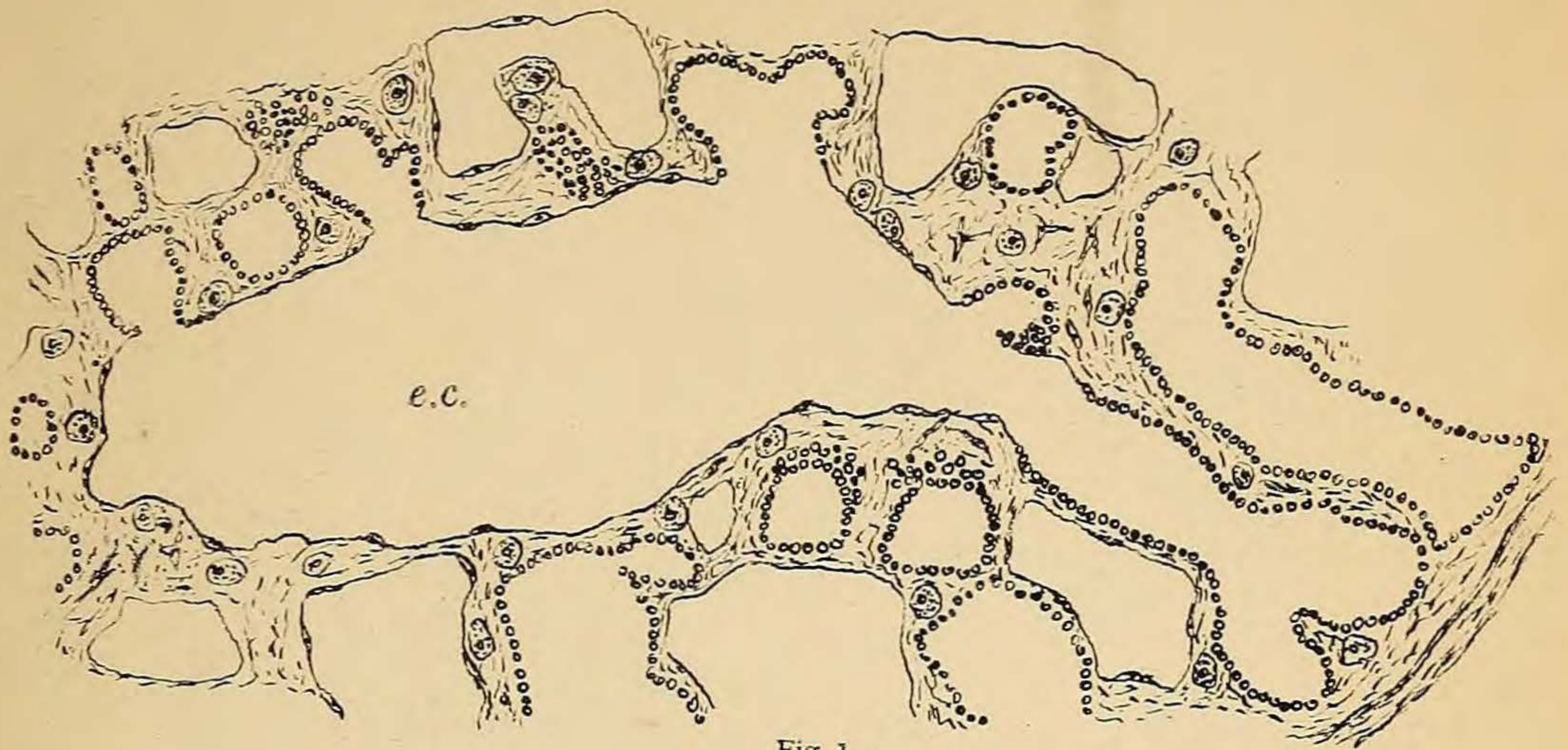


Fig. 1.

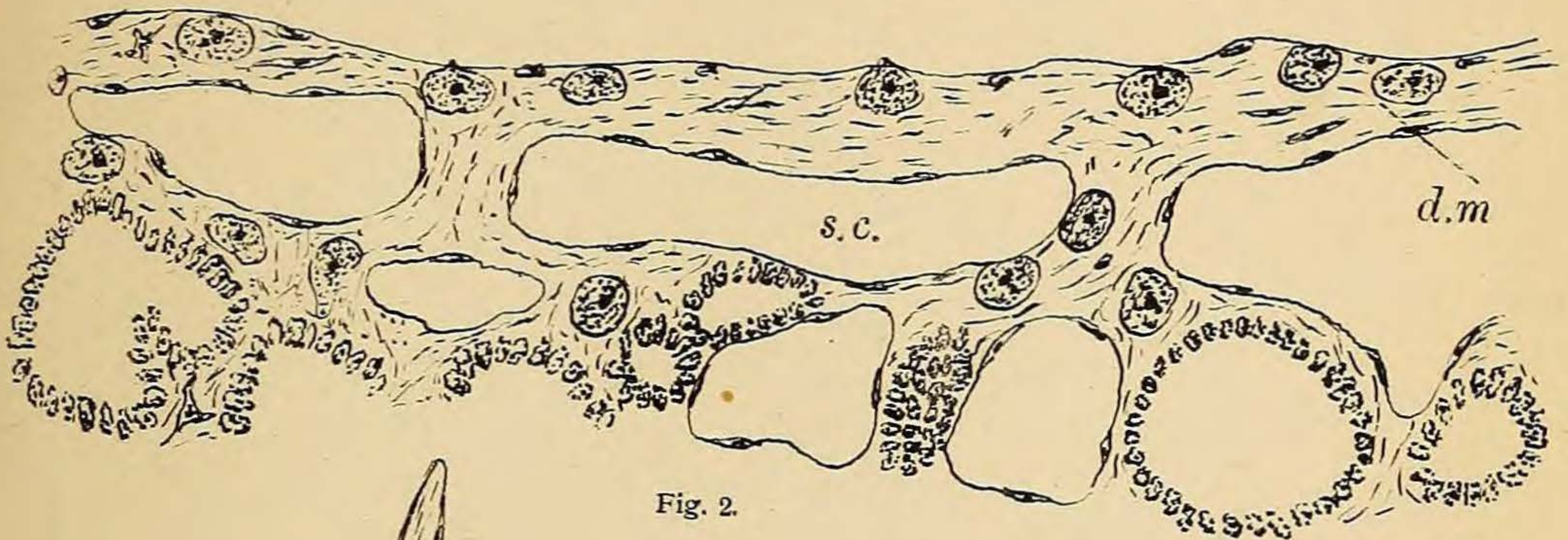


Fig. 2.

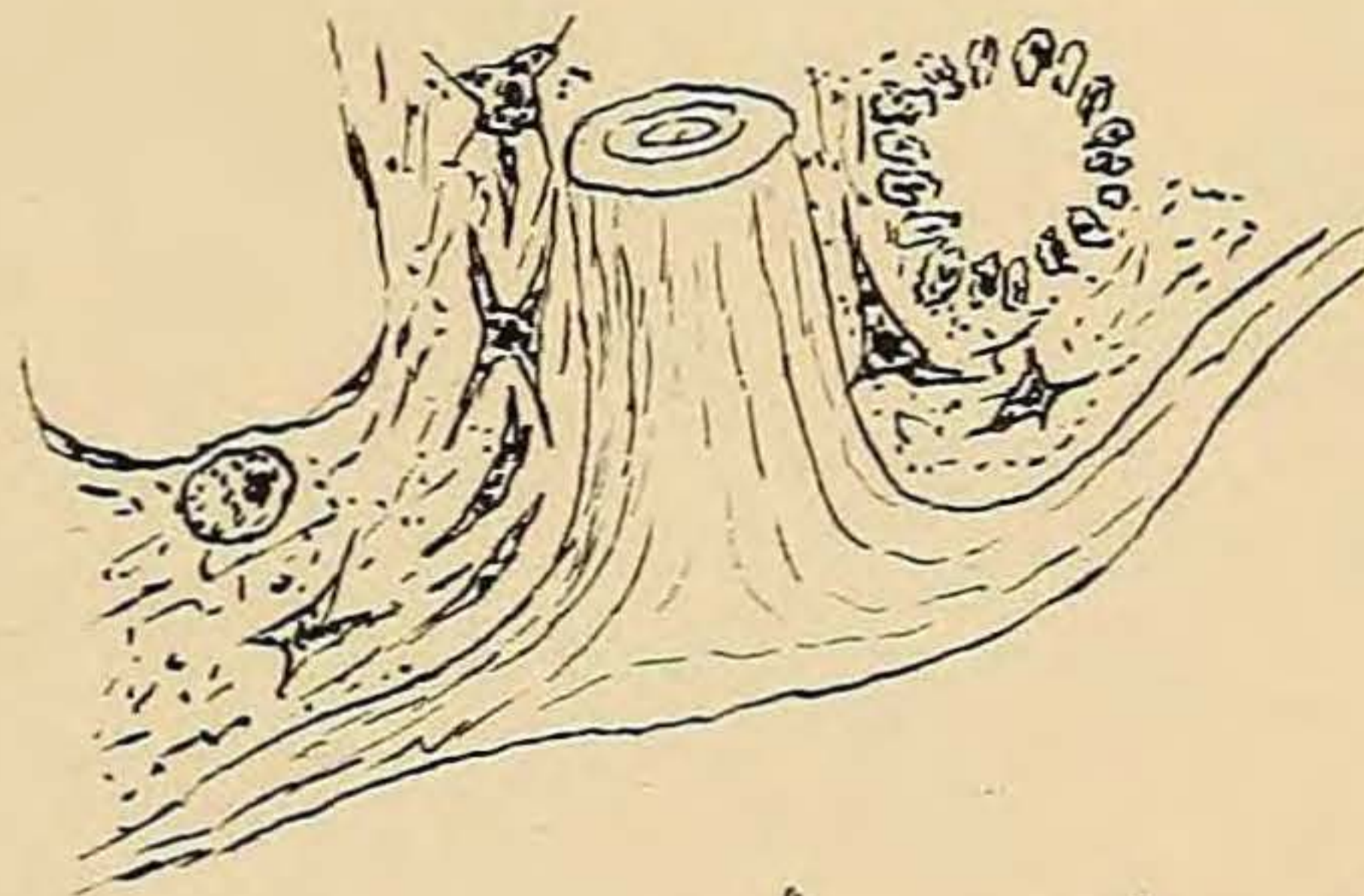


Fig. 4.

Fig. 3.

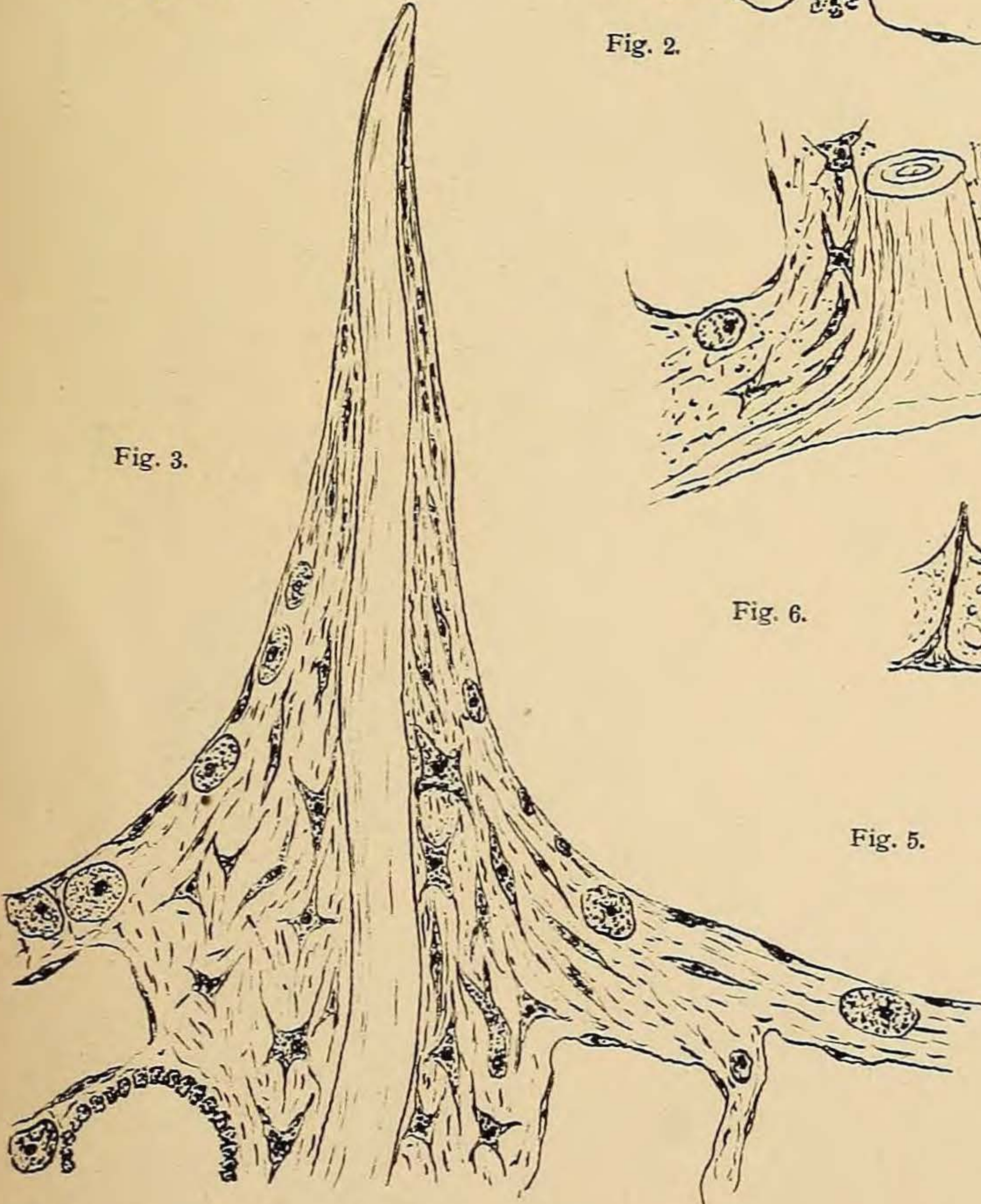


Fig. 6.

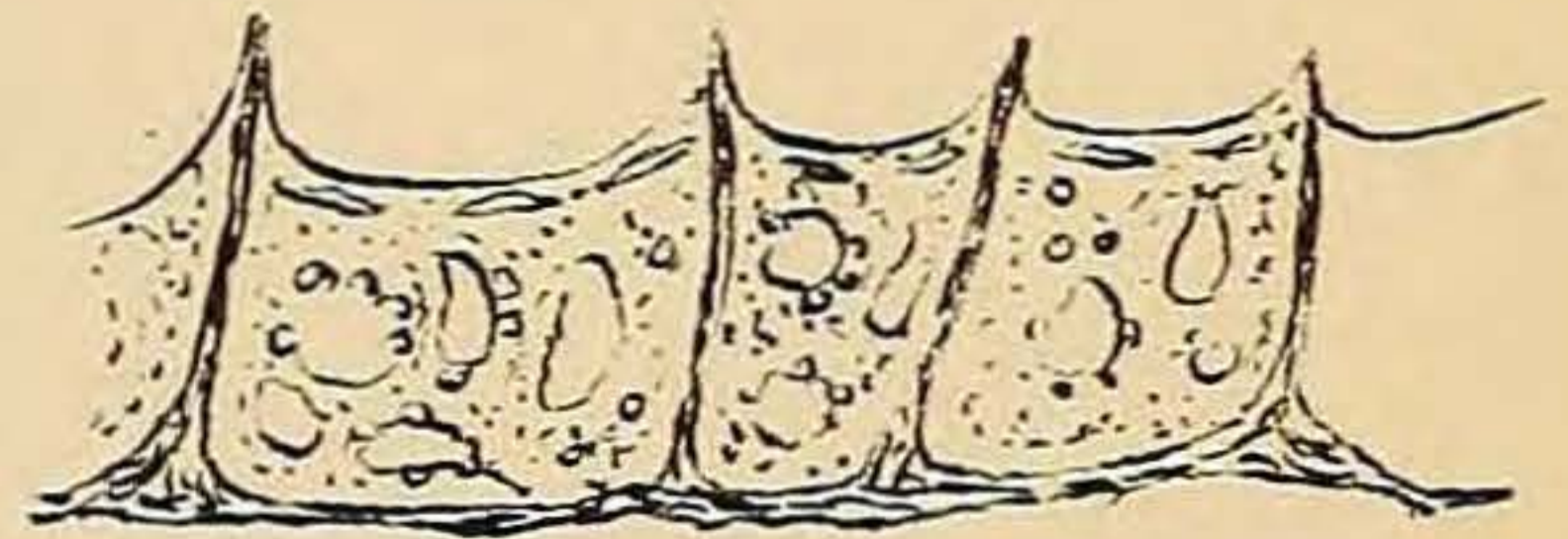
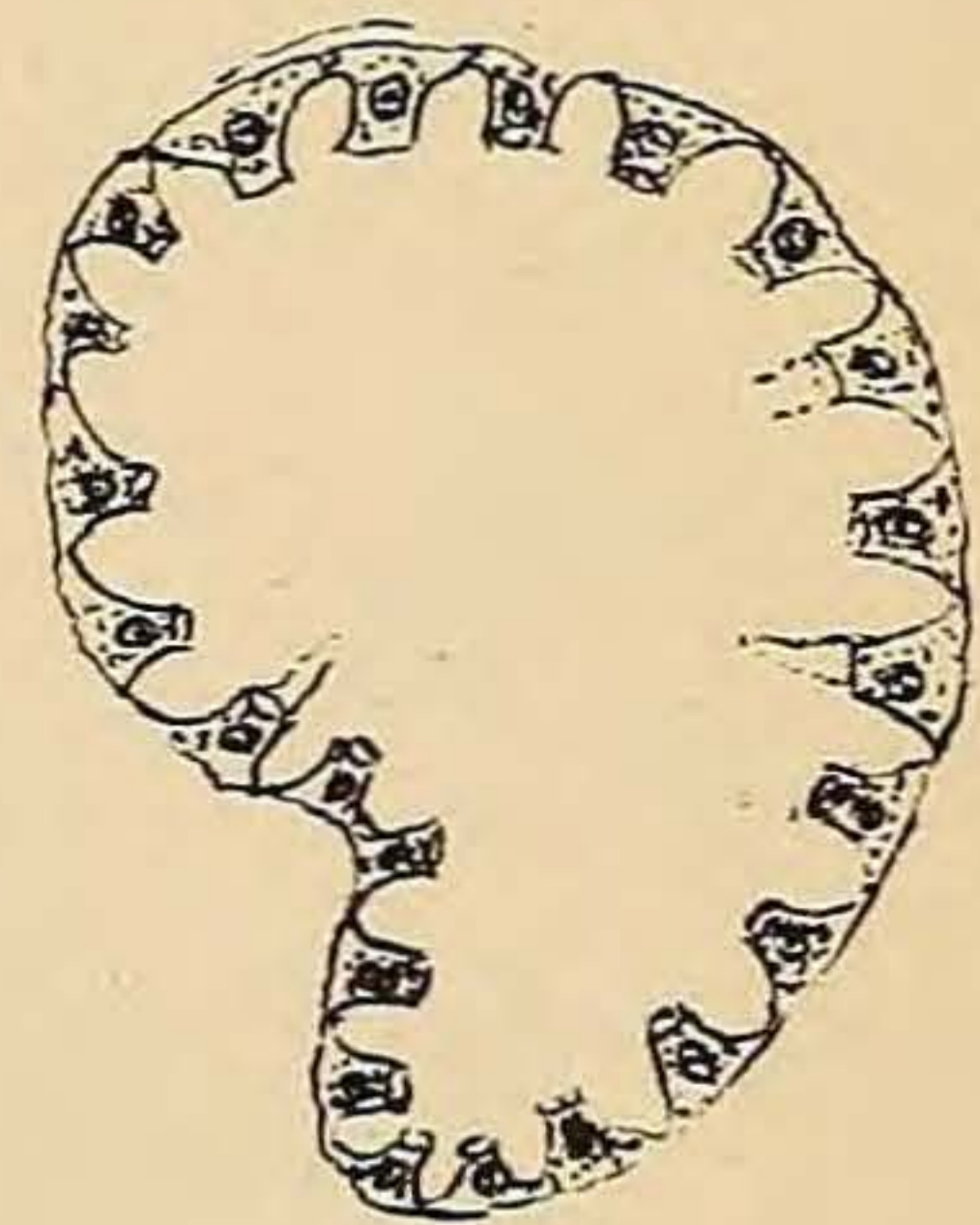


Fig. 5.



R. H., del.

APLYSILLA RUBRA, HANITSCH.