JENK 2

PORIFERA.

III.—CALCAREA.

By C. F. Jenkin, B.A.

(12 Plates.)

PART I.

Introduction and Classification.

INTRODUCTION.

The preparation of the Report on the 'Discovery' collection of calcareous sponges was, in the first instance, entrusted to Professor E. A. Minchin. He had partially examined the *Homocoela* and made some drawings of them, when he was unfortunately obliged to abandon the undertaking, owing to the pressure of other duties. The collection was then entrusted to the author, who has had the advantage of using Professor Minchin's notes on the *Homocoela* and his lifelike drawings (Figs. 12 and 14), showing the habit of growth of the two new species of *Leucosolenia*.

The author desires to record his indebtedness to Professor Minchin for much valuable advice, to Professor Dendy for valuable suggestions as to the classification of the new genera, and for specimens of *Grantiopsis cylindrica*, to Mr. R. Kirkpatrick for constant help and particularly for permission to examine the British Museum collection of calcareous sponges, to Professor R. von Lendenfeld for specimens of *Sycon tenellum*, and to Professor Jeffrey Bell, to whose kindness he owes the privilege of undertaking this most interesting investigation.

The collection consists of 109 specimens. Of these, 39 belong to the grade *Homocoela*, and are divided among five species, of which two are new to science. The remaining 70 belong to the grade *Heterocoela*, and are divided among 18 species and one variety of an existing species, all of which are new to science.*

Of the five species belonging to the grade *Homocoela*, two belong to the genus *Clathrina* and three to the genus *Leucosolenia*.

Of the 18 new species of *Heterocoela*, five belong to the genus *Leucandra* and the remaining 13 are distributed among six new genera.

CLASSIFICATION.

The classification here used, which is shown in the following table, is that proposed by Poléjaeff (4) for the *Homocoela* and by Dendy (2) for the *Heterocoela*

* With the possible exception of three of the species, which can only be considered as provisionally settled.

and adopted with slight modifications by Minchin (1); it has been co
extended to include the new species. The last column in the table
number of species in each genus found in the 'Discovery' collection.

Families.	Genera.	Number of Specie in 'Discovery' Collection.
GRADE A.—HOMOCOELA.		
1. Clathrinidæ	Clathrina	2
	Ascandra.	
	Dendya.	
2. Leucosoleniidæ	Ascyssa.	
	Leucosolenia	3
		5 speci
GRADE B.—HETEROCOELA.		
1. Sycettidæ	Sycetta.	
	Sycon.*	
	Tenthrenodes	2
2. Grantiidæ	Grantia.†	
	Ute.	
	Sub-genus Synute.	
	Utella.	
	Anamaxilla.	
	Sycissa.	
	Leucandra	5 and 1 variet
	Lelapia.	
	Leucyssa.	
	Dermatreton	2
3. Heteropidæ	Grantessa.	
	Heteropia.	
	Vosmæropsis.	
4. Amphoriscidæ	Heteropegma.	
	Amphoriscus.	
	Syculmis.	
	Leucilla.	
5. *Chiphoridæ*	*Streptoconus*	1
	Hypodictyon	1
6 *Staurorrhaphidæ*	*Achramorpha*	3
	Sub-genus Grantiopsis.	
	Megapogon	4
		18 species a 1 variety.

In the above table the names of the new families and genera are print

* The genus *Sycantha* is omitted for reasons stated on p. 4.
† *Grantiopsis* is transferred to the family *Staurorrhaphidæ*.

This classification is based primarily on the arrangement of the spicules, as is shown in the following diagram, where the families are arranged in four columns to show their dependence on the spiculation. The families on the same horizontal line correspond more or less in their canal systems.

No Subdermal Spicules.		Subdermal Triradiates.		Subdermal Quadriradiates.		Chiactines.	
Family.	Genus.	Family.	Genus.	Family.	Genus.	Family.	Genus.
1. Sycettidæ	Sycetta. Sycon. Tenthrenodes	. . . . . .	. . . . . .	. . . . . .	. . . . . .	5. Chiphoridæ.	Streptoconus. Hypodictyon.
2. Grantiidæ	Grantia. Ute. Synute. Utella. Anamaxilla. Sycissa. Leucandra. Lelapia. Leucyssa. Dermatreton.	3. Heteropidæ	Grantessa. Heteropia. Vosmæropsis	4. Amphoriscidæ	Heteropegma Amphoriscus. Syculmis. Leucilla.	6. Staurorrhaphidæ	Achramorpha. Grantiopsis. Megapogon.

New Families.—The two new families, *Chiphoridæ* * and *Staurorrhaphidæ*,† are introduced to contain the 9 new species and 2 old ones which have chiactine spicules. The name *chiactine* ‡ is introduced to denote a special type of quadriradiate spicule which differs from the ordinary quadriradiates both in shape and in position in the sponge. The chiactine is a quadriradiate spicule lying with its basal ray directed radially outwards (centrifugally) and its apical ray, which is bent at its base so as to lie almost in line with the basal ray, directed radially inwards (centripetally) and projecting into the gastral cavity. § This type of spicule has hitherto been found in only 2 species of sponge, each represented by a single specimen, *viz.*, *Leuconia crucifera*, Poléjaeff (4) and *Grantiopsis cylindrica*, Dendy (7). The former is now included in the new genus *Megapogon*. The latter is transferred to the new family *Staurorrhaphidæ*, the generic name being retained. In order to make the present report a complete record of all species in the two new families, brief descriptions of *Megapogon crucifera* and *Grantiopsis cylindrica*, with drawings of the spicules, are included.

In some of the new species this type of spicule occurs in conjunction with the ordinary types, but in several it forms the whole gastral and body-wall skeleton, to the exclusion of the ordinary quadriradiates and triradiates; its importance, therefore, can hardly be over-rated, and fully justifies the formation of the new families. All the species containing chiactines might have been included in one family instead of two, but as they fall into two groups, which differ from each other in the same way that the *Sycettidæ* do from the *Grantiidæ*, it seemed better to divide them under two corresponding new families.

* χῖ, a cross; φορειν, to bear.

† σταυρός, a cross; ῥαφίς, a needle or spicule.

‡ χῖ, a cross; ἀκτίς, a ray.

§ For a detailed description of the chiactines see Part III.

New Genera.—The new genera, *Hypodictyon*,* *Dermatreton*,† and *Tenthrenode*
are introduced to contain the five new species which have "linked" flagellat
chambers. The term "linked" is here used to describe the peculiar arrangeme
of the flagellated chambers in an open network or honeycomb pattern, so that
large number surround each of the very large incurrent canals (intercanals).
Sycon and *Grantia* the incurrent canals are usually smaller than the flagella
chambers, and are each surrounded by only three or four flagellated chambers.

Three of the new species have freely projecting distal cones; two of these
included in the new genus *Tenthrenodes*, in the family *Sycettidæ*, and the th
which contains chiactines, is in the corresponding genus *Hypodictyon*, in the fan
Chiphoridæ. The two remaining species have distinct dermal cortices, and
therefore, included in the new genus *Dermatreton*, in the family *Grantiidæ*.
dermal cortex is not continuous, but takes the form of a network covering the
of the flagellated chambers, and is pierced by large holes corresponding to the sp
(incurrent canals) between those chambers.

The "linked" arrangement of the flagellated chambers appeared to resen
closely the "grouped" arrangement described by von Lendenfeld (6) as occurrin
Sycantha tenella. As doubts existed concerning the accuracy of some of the de
of this description, it seemed advisable to re-examine the specimens. The author
enabled to make this examination by the great courtesy of Professor von Lenden
who sent him all the remaining material he possessed. This materia
considerably macerated (as is stated by von Lendenfeld in his original descript
but is in quite good enough condition to allow the general structure to be ascerta
with certainty. The results of the author's examination show that all von Lenden
figures represent the structure correctly except Figs. 53, 54 and 56, which, th
no doubt accurately drawn, are quite misleading. The interpretation placed or
figures by him appears, however, to be erroneous, and would seem to be due to
unfortunate cross-section shown in Fig. 56. The true structure is best show
Fig. 57, representing a tangential section near the gastral cortex. This figure show
regular rectangular network formed by the chamber walls. The rectangles are altern
flagellated chambers and canals, arranged like a chess board, exactly in the m
shown in Haeckel's "Kalkschwämme," Fig. 13, Plate 60, as typical of his sub-
Sycocubus (sub-genus 3 of *Sycandra*). Haeckel's figure shows (correctly) the ar
ment of the flagellated chambers and inter-canals of *Sycon schmidti*; this arrang
only differs from that of *Sycantha tenella* in the shape of the flagellated chan
which in *Sycon schmidti* are approximately square (in tangential section), w
in *Sycantha tenella*, though still rectangular, they are much longer in one dir
(parallel to the axis of the sponge) than in the other (circumferentially). *Sy
tenella* is, therefore, a typical *Sycon*, remarkable for the size and regular arrang

* ὑπο, under; δίκτυον, a net. † δέρμα, skin; τρητός, holed.
‡ τενθρενωδης, honeycombed.

of the flagellated chambers. The flagellated chambers touch each other only at the corners and have no intercommunication canals. Serial tangential sections show that each flagellated chamber opens independently into the gastral cavity. (See Plate XXXVIII, Fig. 137.) This may also be inferred by comparing the distances between the openings into the gastral cavity, shown in von Lendenfeld's Figs. 56 and 58, and the distances between the flagellated chambers shown in Fig. 57 (remembering that the rectangles are alternately flagellated chambers and canals). The cross-sections made by the author correspond exactly with the structure above described. It is, therefore, evident that there is no similarity between *Sycon tenellum*, as it should now be called, and the new genera with "linked" chambers.

The new genus *Streptoconus*,* in the family *Staurorrhaphidæ*, corresponds with *Sycon* in the *Sycettidæ*.

The new genera *Achramorpha* † and *Megapogon* ‡ in the family *Staurorrhaphidæ* correspond with *Grantia* and *Leucandra* in the *Grantiidæ*.

Dendy's sub-genus *Grantiopsis* is transferred from the *Grantiidæ* to the *Staurorrhaphidæ*, because the only species (*Grantiopsis cylindrica*) contains chiactines.

Terminology.—The following terms are used to describe the different pores and passages by which the water passes through the sponge:—

Ostia.—The pores in the dermal membrane through which the water first enters the sponge.

Prosopyles.—The openings in the flagellated chambers by which the water enters them.

Apopyles.—The openings in the flagellated chambers by which the water leaves them.

Ports.—This is a new term used to describe the openings in the gastral membrane by which the water passes from the excurrent chambers into the gastral cavity.

Pore is only used in a general sense for any of the above.

Incurrent chambers.—The large spaces sometimes found under the dermal cortex. The water enters them by the ostia and leaves them by the incurrent canals.

Incurrent canals.—The passages by which the water reaches the outside of the flagellated chambers. They communicate with the outside water either through the ostia or directly.

Excurrent canals.—The passages by which the water, leaving the flagellated chambers through the apopyles, reaches the gastral cavity or oscule.

Excurrent chambers.—The spaces sometimes found outside the gastral membrane into which several excurrent canals or several apopyles open. The water flows out of them through ports into the gastral cavity.

Oscule.—The opening by which the water finally leaves the sponge. It may be at the end of one or more excurrent canals, or at the top of the gastral cavity.

Oscular collar.—A thin tubular extension of the body wall, without flagellated chambers, leading to the oscule.

The most interesting features of the collection are:—

(*a*) The large number of species (9) containing chiactine spicules.

(*b*) The five new species with "linked" flagellated chambers.

(*c*) A remarkable sponge, *Megapogon villosus*, with larger spicules than any hitherto recorded for a calcareous sponge. The oxea are upwards of 15 mm. long.

* στρεπτός, twisted; κῶνος, a cone. † ἄχρας, a pear; μορφή, form.
‡ μέγας, great; πώγων, a beard.

(d) The development of the gelatinous mesoderm in *Leucandra gelatinosa*.
(e) The duplicate ovum, apparently a new type of egg cell, in *Megapogon raripilus*.

Locality.—All the specimens were taken, at various dates, in Winter Quarters and most of them from shallow waters.

PART II.

Description of the Specimens with Definitions of the New Genera and Species.

Grade HOMOCOELA Pol.

Family CLATHRINIDAE Minchin.

Clathrina primordialis.

Ascetta primordialis Haeckel (3), Vol. II., p. 16.

There is one small broken specimen of this species in the collection. In colour it is yellow as preserved in spirits. The spicules agree exactly with Haeckel's description.

Clathrina coriacea.

Ascetta coriacea Haeckel (3), Vol. II., p. 24.

There are two small broken specimens of this species in the collection. In colour they are yellow, as preserved in spirits. The spicules agree exactly with Haeckel's description.

Family LEUCOSOLENIIDÆ Minchin.

Leucosolenia complicata.

Leucosolenia complicata Minchin (8), p. 360.

There are five pieces of sponges of this species in the collection. The spiculation agrees closely with the revised description given by Minchin.

Leucosolenia discoveryi.

(Plate XXVIII., Figs. 12–13.)

There are about twenty-five specimens of this new species in the collection. Its appearance and habit of growth are admirably shown in Fig. 12, drawn by Professor Minchin. Its colour is white as preserved in spirits. The oscular tubes in some specimens attain a length of 9 mm. and a diameter (flattened) of 1 mm.

Spicules (Fig. 13).

The following description is due to Professor Minchin :—

Oxea.—The monaxon spicules of this species are very constant and characteristic. They are divisible at the outset into (*a*) ordinary and (*b*) refringent monaxons :—

(*a*) The ordinary monaxons are curved and vary greatly in dimensions, from about 100 μ to 450 μ or more in length, and from 3 μ to 16 μ in thickness. Every possible gradation is to be found between the greatest extremes in size, so that it is not possible to divide these spicules into different classes. The shaft is thickest near the proximal end, which is also nearly straight for rather more than half the length; from this point the shaft curves evenly, and tapers slightly, towards the distinct lance-head, which usually shows very plainly the form of a double bend, especially in the smaller examples of this type of spicule. Among the ordinary monaxons there are always a very few Γ type monaxons: these are very rare, and only one or two are usually found in a whole spicule slide.

(*b*) The refringent monaxons are much scarcer than the ordinary type, but they are easily found, as their optical peculiarity makes it easy to distinguish them from the others, especially under a low power of the microscope. Like the ordinary monaxons, they show a wide range of variation in size, from small to very large. Their form is similar to that of the ordinary monaxons in a general way, but shows certain constant peculiarities; the shaft is very slightly curved, sometimes nearly perfectly straight; the proximal swelling of the shaft contrasts more sharply with the distal extremity, which is often very slender and tapers down rapidly about half-way from the proximal end; and the lance-head tends to be rudimentary or even quite absent. By these special features the spicules can easily be recognised as a distinct class, apart from their characteristic appearance under the microscope.

Triradiates.

(*c*) The ordinary triradiates are of fairly large size, in form very similar to those of *Leucosolenia complicata*, with the unpaired rays markedly longer than the paired rays. The unpaired ray is straight and slender, varying in length from about 110 μ to as much as 185 μ. The paired rays are generally slightly thicker than the unpaired, sometimes distinctly so; they curve symmetrically, first in a backward direction for the proximal two-thirds of their length, then forwards for the distal third; in length they vary from 100 μ to 145 μ, the average length being about mid-way between these two extremes. The anterior angle is an open one, but the lateral angles are always greater than right angles, the spicules never being T-shaped as in *botryoides.* In young specimens the triradiates are generally smaller and more slender than in the larger colonies.

Quadriradiates.

(*d*) These spicules are generally much scarcer than the simple triradiates, but can always be found. Their facial rays are similar to the triradiates, with perhaps slightly less tendency to elongation of the unpaired rays. The gastral ray is short or of moderate length, laterally compressed, and set well back on the unpaired facial ray; its proximal end runs straight upwards for about two-thirds of its length, then the shaft curves forwards, the distal extremity, however, being again nearly straight.

Spiculation of the Oscular Rim.

The skeletal spicules of the oscular rim appear to be quadriradiates alone. They are of relatively small size and slender dimensions; the lateral angles are very nearly or even quite right angles, so that the spicule is more or less T-shaped; the unpaired rays are always distinctly longer than the paired, the latter being strongly curved, and the gastral rays are relatively long.

The monaxons of the oscular rim are, with rare exceptions, of the smallest size. Both ordinary and refringent monaxons are found; the former differ from those in other parts in the slenderness of the shaft, the proximal end of which is scarcely or not at all swollen. The refringent monaxons in this region are also very slender and sharp.

Leucosolenia minchini.

(Plate XXVIII., Figs. 14–15.)

There are about eleven specimens of this new species in the collection, most of them being oscular tubes only, with very little root tube. Their appearance and habit of growth are well shown in Fig. 14, drawn by Professor Minchin. The oscular tubes, which are 3 mm. to 4 mm. long, are usually largest towards the middle of their length. Diameter, flattened, about 5 mm. The bulk of the skeleton spicules are triradiates, regularly arranged and often in rather open order, so that the walls have a transparent appearance. The oxea, which are small, usually about 90 μ long and never exceeding 160 μ, are usually scarce, and in some specimens almost, if not entirely, wanting. In the specimens with plentiful oxea there is a fringe round the oscule, see Fig. 15, but in the specimens with few oxea there is little or no fringe.

Spicules (Fig. 15).

Oxea.—There are two sorts of oxea, ordinary and refringent:—

(*a*) Ordinary oxea, straight or slightly curved, with a lance head which is usually bent slightly to one side, 60 μ to 160 μ long × 3 μ to 6 μ thick.

The commonest size is 90 μ long × 4 μ to 5 μ thick. In some specimens the maximum size is 90 μ long.

Among the ordinary oxea there are a very few Γ type oxea. It is uncertain whether these are always present. It seems probable that in those specimens in which the oxea are very scarce there may be none of Γ type.

(*b*) Refringent oxea, similar to the smaller and thinner sizes of (*a*) and usually nearly straight.

The *Triradiates* are of one sort:—

(*c*) Alate triradiates, with the basal ray longer than the paired rays. Basal ray straight, tapering, fairly sharply pointed, 90 μ to 140 μ long × 5 μ to 10 μ thick. Paired rays equal, bent very slightly downwards, tapering slightly for about two-thirds of their length, then fairly sharply pointed, 50 μ to 90 μ long × 5 μ to 7 μ thick; oral angle 130° to 140°.

The *Quadriradiates* are of one sort:—

(*d*) Alate quadriradiates, facial rays the same as the triradiates (*c*). Apical ray sharply pointed.

Oscular spicules:—

(*e*) Oxea from the fringe, like (*a*) but shorter, with bluntly pointed lance heads, 55 μ to 65 μ long × 5 μ to 6 μ thick.

(*f*) Quadriradiates from the oscular edge like (*d*), but of the smallest size, the paired rays rather more bent. Oral angle 160°.

Grade HETEROCOELA Pol.

Family SYCETTIDAE Dendy.

Tenthrenodes.

A Sycettid in which the radial chambers, with freely projecting distal cones, are "linked" so as to form a reticulated pattern round the large inter-canals.

This genus contains two species. In both these species the sponge is in the form of a tube, usually more or less bent, the cross-section being probably circular when alive, though it is considerably flattened in some of the preserved specimens. The diameter of the tube is greatest near the middle of its length. It tapers to the base, which is rounded off, and also to the top, which terminates in the oscule. The interior of the tube forms the gastral cavity. The inner or gastral layer is supported by a special skeleton of tri- and quadriradiates, the apical rays projecting into the gastral cavity. Outside the gastral layer stand the flagellated chambers, pointing more or less radially, and "linked" into a meshwork pattern. They communicate with the gastral cavity either in groups through excurrent chambers (*T. scotti*) or independently (*T. antarcticus*).

TENTHRENODES SCOTTI.*

(Plate XXVII., Fig. 9; and Plates XXVIII. and XXIX., Figs. 16–27.)

There are two specimens of this new species in the collection, the larger one perfect, the smaller one a broken fragment. Both were fixed in osmic acid and preserved in alcohol. The larger and perfect specimen is referred to in the following description.

The sponge as preserved is flattened so that the opposite walls are in contact. Its shape in this flattened condition is shown in Fig. 16. The length is 115 mm. and the diameter (flattened) 32 mm. The colour is brown, owing to the osmic acid, and was probably white in life.

The whole surface is covered with a conspicuous honeycomb pattern due to the linking of the flagellated chambers. When slightly magnified the pattern is seen to consist of a principal network of larger and deeper meshes divided by a finer network of shallower meshes (see Fig. 9). To the naked eye the meshes appear to be smooth. The pattern extends up to the oscular edge, the size of the meshes diminishing gradually from the middle of the sponge to the oscule.

Canal System.—The flagellated chambers communicate through contractile apopyles with excurrent chambers, which open through irregular ports into the gastral cavity. The canal system is extremely difficult to make out in this species, owing to the very irregular shapes of the flagellated chambers near their bases and the erratic way in which they are crowded together. The presence of the excurrent chambers can be ascertained most easily by examining the gastral surface under a low power. The ports in the gastral wall are large enough to allow the interiors of the excurrent chambers to be inspected and two or three of the apopyles to be seen in each. Sections cut either perpendicular or parallel to the axis of the sponge are almost useless for demonstrating the structure, but serial tangential sections enable the actual connections to be followed satisfactorily and bring out the peculiar "linked" arrangement of the chambers admirably. Figs. 17–20 represent corresponding parts of four tangential sections chosen for illustration from a complete series; Fig. 17 shows the ports in the gastral layer; Fig. 18 the grouping of the chambers in the sub-gastral layer; Fig. 19 the grouping higher up, where both large and small meshes occur; Fig. 20 the grouping on the surface, where only large meshes occur, the smaller ones not reaching so high; the section includes the tops of most of the chambers, but a few project further and therefore appear cut through. Several groups of cells are numbered, and may be followed from one section to another.

In order to show the structure more clearly, the group of flagellated chambers com-

* This species, represented by the finest specimen in the collection, is named after the distinguished leader of the Expedition.

municating with the largest excurrent chamber in Fig. 18 is shown in Figs. 21–24 on a larger scale. Fig. 21 represents the subgastral structure, and shows the cells grouped round and partly over the excurrent chamber: the section includes the bottom diaphragms and apopyles of five of the flagellated chambers. The excurrent chamber extends below these apopyles, but exactly how far cannot be seen. The position of the port in the gastral layer, which is much smaller than the full extent of the excurrent chamber, is shown by the dotted line. Fig. 22 represents the next section higher, and includes the top of the excurrent chamber with one apopyle; the second apopyle belonging to flagellated chamber *K* cannot be clearly made out and has not been shown, though it must be present. Fig. 23 shows the same group of chambers higher up and Fig. 24 higher still.

Skeleton.—The gastral skeleton is a dense felt of large quadriradiates, with the basal rays pointing in all directions, though the majority point more or less towards the base of the sponge. The apical rays, which are very sharp, project into the gastral cavity. The arrangement of the spicules is shown in Fig. 26, which represents the same port that is shown in Fig. 21; in this drawing only a certain number of the spicules actually present are drawn. The large number of the distorted τ spicules is rather remarkable. The articulated tubar skeleton is formed of triradiates which are bent over the distal end of the chamber, forming a thick rounded end and not a cone. The tops of contiguous flagellated chambers are joined together by the fusion of their skeletons, which thus form a sort of dermal cortex, *cf.* Fig. 20, similar to that in genus *Dermatreton.* In the present species, however, the flagellated chambers are of different lengths, and consequently the dermal cortex is very irregular and not clearly defined, so that it seems advisable to include it in *Tenthrenodes* rather than *Dermatreton.* Round the distal ends of the chambers there are rings of oxea which project slightly.

The oscular skeleton differs very little from the normal gastral and dermal skeletons. The quadriradiates are rather smaller than the ordinary gastral quadriradiates. There is a thick fringe of hair oxea. The meshwork of flagellated chambers extends right up to the oscular edge, terminating in a scolloped edge. Fig. 25 represents a longitudinal section through the oscule at a point where the mesh reaches the edge.

Spicules (Fig. 27).

The *Oxea* are of one sort:

(*a*) Projecting oxea, $160\,\mu$ to $240\,\mu$ long $\times$ $10\,\mu$ to $15\,\mu$ thick, slightly and irregularly bent, thickest towards the outer end, which is bluntly pointed; the inner end is rather more sharply pointed.

The *Triradiates* are of one sort:

(*b*) Alate triradiates from the body-wall and dermal cortex. Basal rays straight, tapering to a sharp point, $90\,\mu$ to $330\,\mu$ long $\times$ $9\,\mu$ thick. Paired rays, unequal (appearing the more so owing to folding), bent slightly upwards, 80 μ to 150 μ long × 8 to 10 μ thick. Oral angle 110° to 125°. Occasionally a τ shaped variety is found.

The *Quadriradiates* are of one sort:

(*c*) Large alate quadriradiates from the gastral layer. Basal ray straight, tapering uniformly to a very sharp point, 420 μ to 680 μ long × 10 μ thick. Paired rays equal, bent slightly downwards near the centre, then straight, 330 μ to 380 μ long × 10 μ to 11 μ thick. Oral angle 140° to 150°. The τ shaped variety is fairly common. Apical ray slightly bent orally, sharply pointed, 50 μ long × 8 μ to 12 μ thick. Occasionally the apical ray appears to be wanting.

Oscular spicules.

(*d*) The oscular fringe consists of hair spicules over 400 μ long.

The triradiates are the same as (*b*); the quadriradiates are similar to (*c*), only much smaller. The projecting oxea are the same as the smaller sizes of (*a*).

TENTHRENODES ANTARCTICUS.

(Plate XXIX., Figs. 28–32.)

There are three specimens of this new species in the collection; they are easily distinguished by the naked eye from *T. scotti*, owing to their having bare basal tubes and bare oscular collars, so that the sponge presents the appearance of an oval ball pierced by a tube. The dimensions of the three specimens are :—

11 mm. long × 3 mm. diameter.
4 mm. ,, × 1·2 mm. ,,
10 mm. ,, × 1·6 mm. ,,

In colour they are white as preserved in spirits.

The flagellated chambers are branched near their proximal ends, and each opens directly into the gastral cavity through a contractile apopyle. They have articulated skeletons which terminate at the distal end in freely projecting cones of triradiates, amongst which are a few small oxea (see Fig. 28).

The gastral skeleton (see Fig. 29), consisting of large tri- and quadriradiates, extends the whole length of the tube.

The oscular edge has a very regular skeleton of small quadriradiates closely packed together, with a fringe of hair oxea (see Fig. 30). Unfortunately the specimens are not in a sufficiently good state of preservation to allow the exact structure of the basal tube to be made out. There are indications of a lining of flagellated cells in the basal tube, continuous with the lining of the lowest radial flagellated chambers. These chambers appear to arise as bulgings of the gastral layer.

It is unfortunate that this interesting structure cannot be made out with certainty. The origin of the flagellated chambers near the oscule can be seen clearly; an isolated group of flagellated cells forms outside the gastral layer, and over this a few triradiates and oxea grow (see Fig. 31*a*). As the flagellated chamber grows it tips up the triradiates and oxea, which thus begin to point outwards while they continue to grow (see Fig. 31*b*). At the oscular end of the sponge therefore the flagellated chambers do not grow as diverticula of the gastral layer, nor is there any lining of flagellated cells in this part of the gastral cavity.

Spicules (Fig. 32).

The *Oxea* are of one sort:

(*a*) Small projecting oxea, slightly irregularly bent, faintly hastate at the thinner end, bluntly pointed at the thicker end. 70 μ to 210 μ long × 6 μ to 10 μ thick.

Triradiates. The triradiates are of two sorts:—

(*c*) Alate triradiates from the gastral layer. Basal ray straight, tapering slightly, then pointed; maximum size 480 μ long and 12 μ thick. Paired rays unequal, slightly irregularly bent, maximum size 160 μ long × 12 μ thick. Oral angle 130° to 135°.

(*d*) Alate triradiates from the tubar skeleton. Basal ray straight, tapering slightly, then pointed, 100 μ to 140 μ long × 6 μ to 7 μ thick. Paired rays nearly equal, straight, 70 μ long × 6 μ to 8 μ thick. Oral angle 120° to 130°.

The *Quadriradiates* are of one sort:—

(*e*) Alate quadriradiates from the gastral layer. Basal ray straight, tapering slightly, then bluntly pointed, 320 μ to 480 μ long × 10 μ to 12 μ thick. Paired rays unequal, nearly straight, 140 μ to 240 μ long × 10 μ to 12 μ thick. Oral angle 130° to 140°. Apical ray bluntly pointed, slightly bent orally, 130 μ to 180 μ long, oval in section, 8 μ to 12 μ thick × 12 μ to 16 μ deep. In side view the apical rays sometimes appear swollen near the point, the depth being greater than at the junction with the facial rays.

Oscular spicules:—

(*f*) Quadriradiates from the oscular edge, basal ray straight or slightly bent backwards, 110 μ to 140 μ long × 8 μ thick. Paired rays about equal, bending downwards, bluntly pointed, 80 μ to 110 μ long × 10 μ thick. Oral angle 145° to 155°. Apical rays short and sharply pointed.

The triradiates in the oscular collar are similar to (*c*), but have longer paired rays.

The fringe consists of :—

(*g*) Minute oxea, 120 μ long × 1 μ to 2 μ thick.

Family GRANTIIDAE Dendy.

Leucandra Dendy.

The collection contains five new species and one new variety belonging to this genus.

The genus *Leucandra*, as defined by Dendy, is too comprehensive and needs subdivision. The minute structure of the species belonging to the genus has not been sufficiently examined; the wide variations in the development of the mesoderm, and also the arrangement of the incurrent and excurrent canals, require investigation. Some notes on these points are contained in Part III.

Want of accurate knowledge about the structure makes the classification of the species in this genus difficult and uncertain. The species *Leucandra frigida*, *Leucandra brumalis*, and *Leucandra gelatinosa* can only be considered as provisional; *Leucandra cirrata* and *Leucandra hiberna* are more definitely differentiated.

Leucandra primigenia, H. *var. leptoraphis.*

(Plate XXIX., Figs. 33–34.)

Leucetta primigenia Haeckel (3), Vol. II., p. 118.

There are two specimens of this new variety in the collection. The larger consists of an irregular mass of anastomosing branches (Fig. 33), dirty white in colour as preserved in spirits. The surface is mostly smooth, but in places is more open or spongy in structure. The branches have a very small gastral cavity running down them, ending in inconspicuous closed oscules. It agrees with Haeckel's description of *Leucetta primigenia* (*var. isoraphis*), except that the spicules are very much slenderer. Haeckel gives the ratio of length of arm to thickness as 10 to 12. Poléjaeff, for the 'Challenger' specimens of *Leucetta primigenia*, which he calls *Leucetta fruticosa*, gives the ratio 12 to 15. The new variety has the ratio 25 to 40. The spicules are shown in Fig. 34, with one of the 'Challenger' specimens of *Leucetta primigenia* for comparison beside them. Haeckel does not describe the alate oscular spicules, which, in the new variety, differ widely from the normal spicules, as will be seen from the figure. These spicules lie with the basal rays circumferentially round the oscule, and not, as might have been expected, symmetrically.

Poléjaeff's species, *Leucetta dura*, cannot now remain, since it is only based on the existence of an oscule which was supposed not to be always present in *Leucetta microraphis*.

Spicules (Fig. 34).

The *Body spicules* are of one sort :—

(*a*) Regular triradiates. Rays straight, very slender, parallel, bluntly pointed, 140 μ to 200 μ long × 4 μ to 7 μ thick. Ratio of length to thickness, 25 to 40.

The *Oscular spicules* are of one sort :—

(*b*) Alate triradiates, strongly folded. Basal ray straight, nearly parallel, bluntly pointed, 55 μ to 90 μ long × 7 μ to 8 μ thick. Paired rays nearly straight in facial view, and twice bent when viewed parallel to the basal ray. Tapering, moderately sharply pointed, 90 μ to 140 μ long × 8 μ to 10 μ thick. Oral angle 105° to 115°. Angle of fold 110°.

LEUCANDRA FRIGIDA.

(Plate XXVII., Fig. 6, and Plates XXIX. and XXX., Figs. 35–40.)

There are eleven specimens of this new species in the collection. They are all fig-shaped, with the oscule at the thick end (see Fig. 6). The surface is smooth, pure white and rather chalky in appearance. They vary in size from 10 mm. × 3 mm. to 30 mm. × 10 mm. (see Fig. 35). They are all solid to the touch, though they vary very much in texture when cut open. All but one of the specimens have the oscule completely closed, and its presence is only indicated externally by a slight protuberance. One specimen, 21 mm. long × 7 mm. diameter, has the oscule open ; it is 2 mm. in diameter, and is surrounded by a short spiculated membranous collar (see Fig. 39).

The canal system varies considerably in the different specimens ; in some there is a wide gastral cavity with large branching canals opening into it, while in others there is no gastral cavity, the excurrent canals all converging to the oscule. In cross-section the specimens differ less than might be expected, for the gastral cavity appears to be divided by delicate septa, which give the whole section a meshwork appearance even when longitudinal sections show a large cavity.

The excurrent canals are usually surrounded with a fairly distinct skeleton of triradiates, among which are a few quadriradiates.

The incurrent canal system is made up of a series of very irregular spaces leading from the surface into the rather more regular longitudinal canals ; these run parallel to the excurrent canals, from which they may be distinguished by their less pronounced skeleton, which never contains quadriradiates.

The bulk of the skeleton consists of regular triradiates ; the quadriradiates round the gastral cavities and excurrent canals are very constant in size. In some specimens they are so rare that they can only be found with great difficulty. The apical rays, which are slender and crooked, project into the canals.

Spicules (Fig. 40).

The *Triradiates* are of one sort :—

(*a*) Approximately regular triradiates. Rays straight, tapering, rather bluntly pointed, 130 μ to 310 μ long × 10 μ to 20 μ thick. One of the rays is occasionally rather longer than the other two, the maximum ratio observed being 5/4. Very rarely one of the rays is shorter than the other two, the maximum ratio observed being 3/2. The angles in all cases are almost exactly equal ; τ forms are occasionally found.

The rare *Quadriradiates* are of two sorts :—

(*b*) Approximately regular quadriradiates from the lining of the excurrent canals and gastral cavities. Facial rays straight, slender, slightly tapering, bluntly pointed, 160 μ to 200 μ long × 9 μ to 12 μ thick. Angles equal, 120°. Apical rays slender, wavy, sharply pointed, 280 μ long × 8 μ to 9 μ thick.

(*c*) Abnormal quadriradiates apparently due to the growth of a very short apical ray on one of type (*a*) triradiates.

Leucandra brumalis.

(Plate XXX., Figs. 41–43.)

There are five specimens of this new species in the collection. They have no very definite shape (see Figs. 41 and 42), but all are considerably longer than they are broad, and each has a single small gastral cavity, surrounded at the upper end by a small membranous collar about 2·5 mm. long. They are smooth and white as preserved in alcohol. The consistency of the sponge is fairly solid.

Canal System.—There are small incurrent chambers under the dermis, communicating with irregular, more or less radial, incurrent canals. The excurrent canals are also more or less radial, opening into the gastral cavity.

The Skeleton consists of slender regular triradiates with a few regular quadriradiates round the gastral cavity. The apical rays, which project into the gastral cavity, are very slender and crooked, the point being usually bent rather sharply.

This species resembles *Leucaltis pumila, var. Bleekii* (H), but the triradiates are much smaller and slenderer, while the quadriradiates are regular instead of irregular.

Spicules (Fig. 43).

The *Triradiates* are of one sort :—

(*a*) Regular triradiates, rays straight, tapering uniformly to a fairly sharp point, 170 μ to 180 μ long × 6 μ to 10 μ thick.

The *Quadriradiates* are of one sort:—

(*b*) Regular quadriradiates of varying size from the lining of the excurrent canals. Facial rays almost straight, tapering to a point 60μ to 180μ long $\times$ 4μ to 8μ thick. Apical ray very slightly wavy, sharply pointed. The point usually bent a little to one side, 50μ to 120μ long $\times$ 3μ to 4μ thick.

Leucandra gelatinosa.

(Plate XXX., Figs. 44–53.)

There are two specimens of this new species in the collection; one fixed in osmic acid, which is therefore brown, and the other in spirits, which is quite white. The consistency is firm and the surface smooth. The general shape of the larger specimen shown in Fig. 44 is irregular and contorted, suggesting a tuberous root; the oscule, which is entirely closed, is at the top of the dome-shaped end. The diameter of this part of the specimen is 11 mm.; the smaller specimen is in the form of a rod 24 mm. long, nearly straight, rounded off at the oscular end, which is 4 mm. diameter, and tapering gradually to the lower end, which is 2 mm. diameter.

The mass of the sponge is formed of the solid gelatinous mesoderm, which is remarkably developed in this species, and the incurrent and excurrent canals are reduced to definite pipes lined with epithelium in this jelly. There is no gastral cavity, the numerous excurrent canals converge to the oscule in the top of the domed end. These canals are regular circular pipes of small section lined with an extremely elastic epithelium, which has contracted to such an extent as to almost close the lumens of the canals (see Figs. 45 and 46).

The flagellated chambers are scattered throughout the body of the sponge and communicate with the excurrent canals by means of narrow outlet pipes. The outlet pipes from several flagellated chambers usually join together before they open into the main excurrent canals. These small outlet pipes are lined with elastic epithelium, which is continuous with the lining of the main excurrent canals, so that when the main canals close the small pipes are stretched out lengthwise in order to maintain their connection with the central lumen of the main canal (see Fig. 46).

There are a large number of small ostia (see Fig. 48), close together all over the dermal surface (see Fig. 47), which communicate through narrow passages (see Fig. 49) with irregular branching chambers under the dermal cortex; these in turn lead into the incurrent canals which run as irregular pipes radially inwards, and communicate with more regular circular canals running parallel to the axis of the sponge. These canals have not contracted. The flagellated chambers are often situated close against the incurrent canals, so that the communication is direct, presumably through a pore cell which, in the contracted condition of the sponge, is closed. When there is no incurrent canal near the chamber a narrow branch leads from the incurrent canal to the flagellated chamber (see Figs. 51, 52 and 53).

The Skeleton is built up almost entirely of regular triradiates, but among the triradiates lining the excurrent canals there are a very few regular quadriradiates with slender, wavy, apical rays projecting inwards.

The oscule is closed by the folding in of a thin oscular collar which, when open, probably stands erect as a short tube. The collar has a thin skeleton of triradiates.

Spicules (Fig. 50).

The *Triradiates* are of one sort :—

(*a*) Regular triradiates of widely differing sizes. Rays almost perfectly straight, but not quite, tapering moderately to near their ends, then sharply pointed, 140 μ to 320 μ long × 10 μ to 20 μ thick.

The rare *Quadriradiates* are of one sort :—

(*b*) Regular quadriradiates from the lining of the excurrent canals. Facial rays equal, straight, tapering moderately to near their ends, then sharply pointed, 110 μ long × 8 μ thick. Apical rays wavy, sharply pointed, 80 μ to 100 μ long × 3 μ to 8 μ thick.

Leucandra cirrata.

(Plate XXXI., Figs. 54–56.)

There are two specimens of this new species in the collection, one complete, the other much distorted, and possibly only a portion of a complete sponge. The following description applies to the complete specimen. The sponge is ovoid in shape, 8·5 mm. × 3 mm., and is white as preserved in spirits. It is completely covered by long, angularly bent projecting oxea, which to the naked eye give the surface the appearance of being covered with curling hair.

The structure of the body wall which surrounds a large gastral cavity is shown in Fig. 54. The gastral skeleton consists of triradiates and quadriradiates lying tangentially with their basal ray downwards; the body skeleton consists of sub-gastral triradiates and the inner ends of the projecting oxea; the dermal skeleton is strong, consisting of about eight layers of triradiates, irregularly placed. The oxea and sub-gastral triradiates are arranged in groups up which the body substance (flagellated chambers) creeps to the dermis, forming as it were columns supporting the cortex. Between these columns under the cortex is a large space forming an incurrent chamber which is continuous over the whole sponge.

There are only two or three layers of the flagellated chambers, which are roughly spherical, between the gastral and dermal membranes. The excurrent canals are short and simple.

The oscule has a fringe of stumpy oxea (Fig. 56); there is no diaphragm.

Spicules (Figs. 55 and 56).

The *Oxea* are of one sort :—

(*a*) Very large bent projecting oxea, of all sizes from 400 μ to 1,830 μ long, × 20 μ to 33 μ thick, pointed at both ends, usually straight for about two-thirds of their length, then bent at two or three points angularly, the end being often bent through a total angle of 125° from the axis of the straighter portion of the spicule. The points where the angular bends occur are often marked on the convex side by flattened areas, as if the spicule had been deflected by contact with a plane surface.

The *Triradiates* are of one sort :—

(*b*) Alate triradiates of very variable shape. There is no distinction between the gastral, body wall and dermal triradiates. Basal ray straight, tapering, sharply pointed, 190 μ to 360 μ long × 10 μ to 14 μ thick. Paired rays straight or bent slightly up or down, 160 μ to 220 μ long × 10 μ to 14 μ thick. Tapering slightly and rather bluntly pointed. Oral angle 110° to 145°.

Quadriradiates.—There is one sort of quadriradiate :—

(*e*) Alate quadriradiates from the gastral cortex, basal ray straight, tapering to a sharp point, 280 μ long × 12 μ thick. Paired rays equal, slightly bent upwards, 140 to 220 μ long × 10 to 12 μ thick. Oral angle about 130° folded backwards, *i.e.* away from the face bearing the apical ray. Angle of fold about 170°. Apical ray 40 μ long × 8 to 10 μ thick, sharply pointed, bent orally.

Oscular spicules.

(*f*) The oscular fringe consists of short club-shaped oxea tapering to a point at the inner end and bent near the outer end, which is rounded, 150 μ to 230 μ long × 12 μ to 45 μ thick. The thicker spicules are the commonest. The triradiates at the edge have an oral angle of nearly 180°.

Leucandra hiberna.*

(Plate XXXI., Figs. 57–58.)

There are two specimens of this new species in the collection, one straight, vase-shaped, 7 mm. × 1½ mm., the other bent through at right angle, 6 mm. × 1 mm. In colour they are dull yellow as preserved in spirits, and appear minutely hispid to the naked eye.

The structure of the body wall, which surrounds a large gastral cavity, is shown in

* Most of the specimens were collected at the 'Discovery's' Winter Quarters.

Fig. 57. The gastral skeleton consists of quadriradiates with the basal ray pointing downwards: the body skeleton consists of sub-gastral triradiates and the inner ends of the projecting oxea. Among the sub-gastral triradiates there are a very few quadriradiates exactly like the triradiates, except for the development of the apical ray, which is roughly perpendicular to the plane of the other rays, and does not project into the gastral cavity.

The dermal skeleton consists of a thin layer of triradiates with the basal ray pointing downwards.

The space between gastral and dermal membranes is filled up with three or four layers of spherical flagellated chambers between which are small incurrent and excurrent canals. There are no large incurrent chambers as in *Leucandra cirrata.*

The oscular skeleton consists of quadriradiates with an oral angle of nearly 180° and oxea. The dermal triradiates do not reach quite up to the edge. The thin oxea which form the fringe are straight, with hastate ends. Just below the oscule there are a few very short stout projecting oxea, similar in form to the longer ones lower down.

Spicules (Fig. 58).

The *Oxea* are of one sort:—

(*a*) Large projecting oxea, bluntly pointed at the inner end, hastate and sharply pointed at the outer end, nearly straight for about three-quarters of their length, then bent at the outer end, 260 μ to 670 μ long × 12 μ to 24 μ thick at the thickest point. The thickness varies irregularly along the length.

Triradiates.—There are two sorts of triradiates:—

(*b*) Sub-gastral alate triradiates. Basal ray straight, tapering uniformly to a sharp point, 160 μ to 200 μ long × 6 μ thick. Paired rays equal, more or less bent downwards, 80 μ long × 6 μ to 8 μ thick, nearly uniform in thickness all along, then bluntly pointed. Oral angle 135° to 150°.

(*c*) Dermal alate triradiates. Basal ray straight, occasionally shorter than the paired rays, 60 μ to 200 μ long × 8 μ to 11 μ thick, tapering slightly, then bluntly pointed. Paired rays usually differing slightly in shape and size; bent upwards in a wide sweep at the centre and then usually slightly downwards near the points. 100 μ to 140 μ long × 9 μ to 12 μ thick. Oral angle 105° to 115°.

The *Quadriradiates* are of one sort:—

(*d*) Gastral alate quadriradiates. Basal ray straight, tapering uniformly to a sharp point. 100 μ to 300 μ long × 8 μ to 12 μ thick. Paired rays equal, bending upwards in a wide sweep at the centre, outer half straight, 80 μ to

180 μ long × 9 μ to 13 μ thick. Oral angle 120°. Apical ray curved slightly orally, sharply pointed, 80 μ long × 8 μ thick.

Oscular spicules.

(*e*) Fringe oxea, slender, hastate, straight except for a slight bend at the junction of the spear-head. 160 μ to 240 μ long × 7 μ to 9 μ thick. The maximum thickness is just below the spear-head.

(*f*) Stumpy, stout, hastate oxea, from just below the edge, similar to (*a*) 140 μ to 160 μ long × 14 μ to 16 μ thick.

(*g*) Small quadriradiates from the oscular edge. Basal ray 180 μ or less × 8 μ to 10 μ. Paired rays equal, sharply pointed, bending slightly downwards, 70 μ to 100 μ long × 8 μ to 10 μ thick. Oral angle 155° to 160°. Apical ray short, sharply pointed, bent slightly orally.

Dermatreton.

Grantiids in which the radial chambers are "linked" so as to form a reticulated pattern round the large inter-canals, and are covered with a continuous reticulated cortex.

The definition of this new genus in the family *Grantiidae* corresponds to that of *Tenthrenodes* in the family *Sycettidae.*

The remarkable reticulated cortices of the two species in this genus are shown in Figs. 61 and 71. The importance of the "linking" of the flagellated chambers as a generic characteristic is emphasised by the fact that it produces a corresponding type of cortex. The cortical spicules have developed from the distal spicules of the tubar skeleton. In *Grantia* the inter-canals are small, and the skeleton bridges over them. In *Dermatreton* the inter-canals are too large to be bridged over, and a reticulated cortex results.

In both the species in this genus the sponge is in the form of a tube more or less bent, of circular cross-section, the maximum diameter being near the middle. The tube tapers gradually to the base, which is very small, and also to the upper end, which terminates in the oscule. The interior of the tube forms the gastral cavity. The inner or gastral layer is supported by a special skeleton of large quadriradiates regularly arranged, with the basal ray pointing downwards and the apical ray projecting into the gastral cavity. Outside the gastral layer stand the flagellated chambers, pointing radially outwards and linked into a meshwork pattern. They communicate with the gastral cavity either independently (*D. chartaceum*) or in groups through excurrent chambers (*D. hodgsoni*). The distal ends of the flagellated chambers are covered by a reticulated cortex, which follows the "linked" pattern of the chambers. Many of the dermal triradiates lie in inclined positions, more or less embracing the rounded tops of the flagellated chambers. It thus happens not infrequently that spicules may be found with one of the paired rays pointing almost radially inwards, and at first sight suggesting that sub-dermal triradiates are present (*cf.* Fig. 59). The peculiar shape of the dermal triradiates, however, makes it easy to prove that it is always a paired ray, and not the basal ray, which is centripetally directed.

Dermatreton chartaceum.

(Plate XXVII., Fig. 5, and Plates XXXI. and XXXII., Figs. 59–64.)

There is only one specimen of this new species in the collection. It was found at a depth of 180 fathoms. It is nearly straight, 23 mm. long × 3 mm. maximum diameter, quite white as preserved in alcohol, and has the appearance of a delicate paper tube (see Fig. 5). The walls are only 0·32 mm. thick at their thickest point. The reticulated pattern on the surface is too small to be readily seen with the naked eye.

The structure of the body wall is shown in Fig. 59. The flagellated chambers open directly into the gastral cavity through contractile apopyles (see Fig. 60). The skeleton of the flagellated chambers consists normally of a single row of sub-gastral triradiates, but there is occasionally a smaller triradiate half-way between the gastral and dermal layers. There are also fine hair oxea, not shown in the figure, surrounding the flagellated chambers. The distal ends of the flagellated chamber skeletons are strengthened by oxea, which project a short distance beyond the dermis. The distal ends of the chambers are covered by a reticulated cortex with a skeleton formed of curved triradiates (see Fig. 63).

The gastral skeleton (Fig. 62) is formed of large quadriradiates, among which there are a very few which appear to have no apical ray.

The oscular skeleton is shown in Fig. 61. The edge, which is slightly everted, is formed of small quadriradiates. There is a very short fringe of hair oxea, amongst which are a few stout oxea similar to those in the body wall. The dermal triradiates extend up to the edge.

Spicules (Fig. 64).

Oxea.—There are two sorts of oxea :—

(*a*) Projecting oxea, slightly crooked, slightly hastate, 130 μ to 270 μ long × 11 μ to 16 μ thick.

(*b*) Hair oxea about 1 μ thick.

Triradiates.—The triradiates are of two sorts :—

(*c*) Alate sub-gastral triradiates forming the tubar skeleton. Basal ray straight, tapering to a moderately sharp point, 320 μ to 700 μ long × 9 μ to 10 μ thick. Paired rays nearly equal, slightly crooked, 100 μ to 160 μ long × 9 μ to 12 μ thick, bluntly pointed. Oral angle variable from 170° to 120°; strongly folded; angle of fold 120° to 130°.

(*d*) Alate triradiates from the dermal cortex. Basal ray nearly straight, bluntly pointed, 80 μ to 140 μ long × 9 μ to 10 μ thick. Paired rays unequal, slightly curved upwards, often longer than the basal ray, 65 μ to 150 μ long × 8 μ to 10 μ thick. Oral angle 100° to 110°.

The *Quadriradiates* are of one sort:—

(*e*) Alate quadriradiates from the gastral layer. Basal ray straight, tapering uniformly to a sharp point, 500 μ to 700 μ long × 10 μ thick. Paired rays usually equal, slightly bent in either direction, 100 μ to 230 μ long × 8 μ to 11 μ thick. Oral angle 130°. Apical ray nearly straight, sharply pointed, 70 μ to 100 μ long × 6 μ thick.

Oscular spicules.—The fringe is formed of oxea of types (*a*) and (*b*).

The oscular edge is formed of small quadriradiates similar to (*e*), but smaller. Basal ray 100 μ long × 8 μ thick. Paired rays about 100 μ long.

Dermatreton hodgsoni.*

(Plate XXVII., Fig. 1, and Plate XXXII., Figs. 65–74).

There is only one specimen of this new species in the collection. It is bent and irregularly swollen (see Fig. 1), the length being 60 mm. and the maximum diameter 14 mm., tapering at both ends to about 3 mm. It is quite white as preserved in alcohol. To the naked eye the surface appears to be smooth and minutely reticulated The walls are delicate, only 1 mm. thick at their thickest point.

The structure of the body wall is partly shown in Fig. 73. The flagellated chambers open through contractile apopyles into excurrent chambers, three or four into each, and these in turn communicate with the gastral cavity through large irregular ports. The excurrent chambers have no proper skeleton, but are merely spaces left between the proximal ends of the chambers and the gastral layer. Four of the flagellated chambers opening into an excurrent chamber are shown in Fig. 66. The skeletons are drawn and the interior linings indicated by dotted lines. A cross section of the same excurrent chamber is shown diagrammatically in Fig. 67. The form of the excurrent chambers varies widely, they are often much deeper than the one illustrated. The flagellated chambers have ordinary articulated skeletons of many joints, strengthened at the distal ends by oxea, which project a short distance beyond the dermis, and also by long hair oxea, which project with the thicker oxea and extend inwards nearly to the gastral layer. The "linked" arrangement of the flagellated chambers is shown in Figs. 68, 69 and 70. Fig. 68 shows the ports in the gastral layer, Fig. 69 the flagellated chambers just above the gastral layer, and Fig. 70 the same chambers higher up, arranged in a "linked" pattern. All three figures are drawn

* The author ventures to name this species after Mr. T. V. Hodgson, the biologist of the Expedition, to whose untiring industry and ingenuity the magnitude of the collection is due.

from corresponding portions of a series of tangential sections. Several of the chambers are numbered, and may be traced from one section to another. The distal ends of the flagellated chambers are covered by a reticulated cortex with a skeleton formed of curved triradiates (see Fig. 71).

The gastral skeleton, formed of large quadriradiates, is shown in Fig. 72.

The oscular skeleton is shown in Fig. 65. The quadriradiates at the edge are smaller than the gastral quadriradiates. There are a few stout oxea and hair oxea projecting. The dermal spicules extend to the edge.

Spicules (Fig. 74).

Oxea.—There are two sorts of oxea :—

(*a*) Projecting hastate oxea, slightly crooked, 150 μ to 240 μ long × 12 μ to 16 μ thick, bluntly pointed at each end.

(*b*) Hair oxea of considerable length.

Triradiates.—The triradiates are of two sorts :—

(*c*) Alate triradiates from the tubar skeleton, of very variable size. The largest are in the proximal joint of the skeleton, and they diminish towards the distal end, where they change into type (*d*). Basal ray straight, sharply pointed, 330 μ long × 9 μ thick. Paired rays equal, straight, 120 μ long × 10 μ thick. Oral angle of sub-gastral spicules 160°. Oral angle of spicules from the middle of the tubar skeleton 125°.

(*d*) Alate triradiates from dermal cortex. Basal ray straight, bluntly pointed, 70 μ to 130 μ long × 10 μ thick, often shorter than the paired rays. Paired rays equal, straight or slightly curved upwards, bluntly pointed, forming a short curve in the centre where they join the basal ray, 130 μ to 140 μ long × 10 μ thick. Oral angle 105° to 110°, strongly folded ; angle of fold 116° to 130°.

The *Quadriradiates* are of one sort :—

(*e*) Alate quadriradiates from the gastral layer. Basal ray straight, tapering uniformly to a sharp point, 500 μ to 850 μ long × 10 μ to 11 μ thick. Paired rays sometimes very unequal in length, straight, or slightly curved downwards, 150 μ to 400 μ long × 9 μ to 12 μ thick, bluntly pointed. Oral angle, 135° to 145°. Apical ray sharply pointed, nearly perpendicular to the facial rays, slightly bent orally near the point, 7 μ or 8 μ thick.

FAMILY CHIPHORIDÆ. *nov.*

Definition.—Flagellated chambers elongated, arranged radially around a central gastral cavity, their ends projecting more or less on the dermal surface and not covered over by a continuous dermal cortex. The tubar skeleton is articulate, *the first joint being formed of chiactines.*

The above only differs from Dendy's definition of *Sycettidæ* by the addition of the words in italics.

Streptoconus.

Chiphorids in which the radial chambers are usually more or less united at places where they come in contact with one another, and are always crowned at the distal extremity with tufts of oxeote spicules. The tubar skeleton is articulate, the first joint being formed of chiactines.

The definition of this new genus in the *Chiphoridæ* corresponds to that of *Sycon* in the *Sycettidæ.*

Streptoconus australis.

(Plate XXVII., Fig. 3, and Plates XXXII. and XXXIII., Figs. 75–80.)

There are three specimens of this new species in the collection; all are small, shaped like a Florence flask and covered with long projecting oxea, see Fig. 3. They are white as preserved in spirits.

Their dimensions are between 7 mm. × 3 mm. and 10 mm. × 4 mm.

The gastral cavity terminates in a long oscular collar 2 mm. to 3 mm. long, with slightly everted edge crowned with a fringe of slender hastate oxea.

The body wall is made up of the radial flagellated chambers (see Fig. 75), which touch each other for most of their length and have large projecting distal cones crowned by tufts of long slightly bent hastate oxea; these oxea converge in cones over the chambers, and then, crossing spirally, spread out and interlace. Each chamber opens separately into the gastral cavity. In tangential section the chambers appear more or less regularly arranged as hexagons with triangular intercanals.

The Skeleton.—The whole gastral cavity and oscular tube is lined with a sparse layer of large quadriradiates (see Figs. 77 and 79), regularly arranged with the basal ray pointing downwards and the apical ray projecting into the gastral cavity; the apical ray is slightly bent orally. A few of these large radiates appear to lack the apical ray.

The radial chambers have articulated skeletons (see Fig. 75), the proximal joint consisting of chiactines, all of which have their apical rays turned towards the flagellated chamber, so that when looking at the gastral surface the apical rays appear to form a protection to the apopyle (see Fig. 79). The upper joints of the articulated skeleton of the flagellated chamber consist of triradiates of ordinary form. The unpaired rays of the outermost triradiates project, with the oxea, forming the bases of the large distal tufts.

The oscular collar has a very fragile skeleton consisting of large quadriradiates widely spaced (see Fig. 77). On the outside it is thinly covered with long oxea which project downwards and outwards at an angle of about 45° from the axis.

The rim of the tube is formed by a ring of small quadriradiates regularly and closely packed, with the unpaired ray downwards and apical ray inwards. The rim is crowned by a fringe of long nearly straight hastate oxea. (See Fig. 78.) The sharply defined line of the small quadriradiates forming the rim of the collar, standing above the widely spaced quadriradiates which form the lower part of the skeleton, produces the effect of a vacant space with no spicules between the two. The space is however no wider than between other rows of the collar skeleton, and occasionally one of the big quadriradiates is found in the rim itself. No diaphragm can be seen.

Fig. 80 represents a longitudinal section through the junction between the oscular collar and body. The gastral skeleton is continuous and the flagellated chambers grow outside it. The first is very minute, with no skeleton; the second is larger, with a primitive skeleton. The length of the chambers continues to increase down to the base of the sponge.

Spicules (Fig. 76).

Oxea. There are three sorts of oxea :—

(*a*) Stout projecting hastate oxea, usually straight, but occasionally bent sharply through an angle of about 120°, varying irregularly in thickness; 300 μ to 1,250 μ long × 9 μ to 15 μ.

(*b*) Thin projecting oxea, quite straight, faintly hastate, maximum size 1,020 μ × 6 μ.

(*c*) Small hastate oxea 140 μ × 8 μ.

Triradiates. There are two sorts of triradiates :—

(*d*) Large alate triradiates from the gastral layer. Basal rays straight, tapering uniformly to a sharp point from 190 μ to 300 μ long × 6 μ to 8 μ thick. The paired rays are nearly equal, nearly straight, from 80 μ to 150 μ long × 6 μ to 8 μ thick. Oral angle 130° to 140°.

(*f*) Small alate triradiates from the tubar skeleton. Basal ray straight, 100 μ × 6 μ, tapering to a sharp point. Paired rays irregularly bent, 70 μ × 6 μ. Oral angle 120° to 135°. Considerably folded.

Quadriradiates. There are two sorts of quadriradiates :—

(*g*) Large alate quadriradiates from the gastral layer. Basal ray straight, tapering uniformly to a sharp point, 230 μ to 430 μ long × 6 μ to 12 μ thick; the larger sizes occur in the oscular collar. Paired rays bracket-shaped, nearly equal in length, 140 μ to 215 μ long × 8 μ to 10 μ thick. Apical ray thin and sharply pointed, bent orally. Apparent size seen facially, 32 μ × 4 μ. Oral angle varying from 110 μ in body to 150° in oscular collar.

(*h*) Small chiactines from the tubar skeleton. Basal ray, 140 μ to 220 μ long × 4 μ to 6 μ thick, tapering uniformly to a sharp point, appearing straight in facial view, but often slightly bent in side view at a point a short distance from the junction with the paired rays. This bend is connected with the close manner in which pairs of these spicules lie together. Paired rays bent slightly downwards, nearly equal in length, sharply pointed, 70 μ to 110 μ long × 3 μ to 5 μ thick. Oral angle 140° to 150°. Folding considerable, angle of fold 115° to 125°. Apical ray thin, 50 μ to 65 μ × 3 μ, considerably set over out of line with the basal ray. Angle between apical and basal ray about 170°.

Oscular spicules. The fringe consists of :—

(*i*) Hastate oxea, nearly straight, 240 μ to 700 μ long × 5 μ to 8 μ thick.

The edge consists of :—

(*k*) Small quadriradiates. Basal ray straight, uniformly tapering to a sharp point, 110 μ to 170 μ long × 5 μ to 8 μ thick. Paired rays equal, considerably curved downwards, sharply pointed, 60 μ to 100 μ long × 8 μ thick. Oral angle about 160°.

Hypodictyon.

Chiphorids in which the radial chambers with freely projecting distal cones are linked so as to form a reticulated pattern round the large intercanals. The tubar skeleton is articulate, the first joint being wholly or partially formed of chiactines.

This new genus in the family *Chiphoridæ* corresponds to the genus *Tenthrenodes* in the family *Sycettidæ*.

There is only one species in this genus.

Hypodictyon longstaffi.

(Plate XXVII., Fig. 10, and Plates XXXIII. and XXXIV., Figs. 81–97.)

There are four specimens of this new species in the collection. All are in the form of longish tubes more or less bent, stouter in the middle and tapering towards each end; the upper ends terminate in short, smooth, oscular collars, and the lower ends are rounded off. The whole sponge, except the oscular collar, is covered by a meshwork of projecting spicules which give the surface a bristly honeycombed appearance (see Figs. 10 and 81).

The dimensions of the four specimens are as follows :—

Length.	Maximum diameter.
60 mm.	15 mm.
37 mm.	7 mm.
50 mm.	5 mm.
37 mm.	9 mm.

All the specimens are white in colour as preserved in spirits.

The body walls are formed of the long branching flagellated chambers (see Fig. 89), which are roughly oval at their proximal ends and are packed closely together on the gastral cortex; each chamber opens directly into the gastral cavity through an irregular apopyle. Following the flagellated chambers outwards by means of serial tangential sections (Figs. 83 to 87 and 92–97), it will be seen that the chambers usually divide into two branches close above the gastral layer, and that these branches often divide a second time near their distal ends. At the same time it will be seen that the irregular arrangement of the flagellated chambers on the gastral layer gradually changes till at the outer surface it assumes the regular linked pattern which is typical of the genus.

The Skeleton.—The gastral skeleton consists almost entirely of large tri- and quadriradiates irregularly arranged, with the basal ray pointing more or less downwards (see Fig. 91). In addition to these there are the paired rays of the chiactines which occur occasionally round the apopyles.

The gastral skeleton continues into the oscular collar and is modified near the oscular rim, as shown in Fig. 88. The junction of the oscular collar and body wall is shown in Fig. 82, in which the gradual growth of the flagellated chambers may be seen. Near the rim the triradiates almost or entirely disappear, and the quadriradiates are much smaller. There is a fringe of hair oxea (these are absent in one specimen) amongst which are a few stout oxea, apparently of the same sort as those on the distal ends of the flagellated chambers. There are a few thin bent oxea scattered irregularly near the edge.

The skeleton of the flagellated chambers is of the ordinary articulated type, consisting of small triradiates, which converge at the top of the chamber to form a point which is strengthened by a bundle of oxea of two types which project freely. Every here and there in the proximal joint a chiactine may be found replacing one of the ordinary triradiates; its apical ray projects diagonally into the gastral cavity and across the apopyle. It is the presence of these chiactines which has made it necessary to form the genus *Hypodictyon* for this species instead of putting it in the genus *Tenthrenodes*.

Spicules (Fig. 90).

Oxea.—There are two sorts of oxea :—

(*a*) Projecting oxea from the distal cones, slightly irregularly bent, some slightly hastate, from 100 μ long × 12 μ thick to 900 μ long × 26 μ thick.

(*b*) Hair oxea projecting with (*a*).

Triradiates.—There are two forms of triradiates :—

(*c*) Large alate triradiates from the gastral layer. Basal ray straight, tapering uniformly to a sharp point, maximum size, 800 μ × 10 μ. Paired rays, nearly straight, of uniform thickness all along, bluntly pointed, usually of unequal lengths, 180 μ to 430 μ long × 10 μ to 16 μ thick. Oral angle about 135°.

(*d*) Smaller alate triradiates from the tubar skeleton. Basal ray straight, tapering to a sharp point, 140 μ to 260 μ long × 8 μ to 10 μ thick. Paired rays nearly equal and straight, 80 μ to 150 μ long × 8 μ to 10 μ thick, slightly folded. Oral angle 130°.

Quadriradiates.—There are two sorts of quadriradiates :—

(*e*) Large quadriradiates from the gastral layer. Basal ray straight, tapering uniformly to a sharp point, maximum length 1,000 μ × 9 μ to 12 μ. Paired rays of unequal length, often slightly crooked, of irregular thickness, bluntly pointed, 220 μ to 420 μ long × 11 μ to 13 μ thick. Apical ray sharply pointed, bent orally, about 80 μ × 12 μ. Oral angle 128° to 138°.

(*f*) *Chiactines.* Similar to (*d*) with the addition of an apical ray 90 μ long × 6 μ thick, sharply pointed. These are not shown in the drawing of spicules.

Oscular spicules :—

(*g*) Fine straight oxea from the fringe, 3 μ to 4 μ thick. All are broken off, so their length is uncertain. Among them are a few stout oxea of the same sort as (*a*).

(*h*) Thin zigzag oxea lying tangentially near the oscule. 170 μ to 300 μ long × 3 μ to 4 μ thick, sharply pointed at both ends.

(*i*) The edge is formed of small quadriradiates. Basal ray straight, tapering to a sharp point, 130 μ to 200 μ long × 9 μ to 12 μ thick. Paired rays nearly equal, considerably bent downwards, 90 μ to 150 μ long × 9 μ to 12 μ thick. Oral angle 150° to 160°. Apical ray short and sharp, about 40 μ long.

Family STAURORRHAPHIDÆ.

Definition.—There is a distinct and continuous dermal cortex, completely covering over the chamber layer and pierced by inhalent pores. There are no subdermal sagittal triradiates nor conspicuous subdermal quadriradiates. The flagellated chambers vary from elongated and radially arranged to spherical and irregularly scattered ones, while the skeleton of the chamber layer varies from regularly articulate to irregularly scattered, *but there are always regularly disposed subgastral chiactines.*

The above only differs from Dendy's definition of *Grantiidæ* by the addition of the words in italics.

ACHRAMORPHA.

Staurorrhaphids in which the elongated flagellated chambers are arranged radially round the central gastral cavity; they are covered over by a dermal cortex, composed principally of triradiate spicules, and without longitudinally disposed oxea. The tubar skeleton is articulate, the first (and sometimes only) joint being formed of chiactines.

The definition of this new genus in the family *Staurorrhaphidæ* corresponds to that of *Grantia* in the *Grantiidæ*, but omits the limitation introduced by Dendy, which transfers all *Grantiæ* with tufts of spicules, including *Grantia compressa*, to the family *Sycettidæ*. This limitation appears to be artificial and unsatisfactory.

The genus contains three species, *Achramorpha nivalis*,* *Achramorpha glacialis*,* and *Achramorpha grandinis*.*

In all the species the flagellated chamber skeleton consists of the basal rays of the chiactines. There is no gastral skeleton proper; the gastral layer is supported by the paired rays of the chiactines, except in the oscular tube, where there are quadriradiates lying tangentially in the ordinary position, *i.e.*, in the gastral layer, with the basal ray pointing downwards. At the junction between the oscular tube and the body, the quadriradiates lie at all angles intermediate between the centrifugal position and the tangential position. This remarkable change in position of the quadriradiates in passing from the oscular tube to the body, which is conspicuous in this genus, is discussed in Part III.

The skeleton of the dermal cortex consists of triradiates lying tangentially with the basal ray, pointing more or less downwards; there are also large projecting oxea. In one species there are also projecting hair oxea, and in the other two there are minute prickly hastate oxea projecting round the ostia.

In two of the species the skeleton of the oscular edge is well differentiated. It consists of a few rows of special quadriradiates closely and regularly packed, and partially hidden in the dense fringe of oxea. In the top row these quadriradiates have remarkably snub apical rays, which usually hardly penetrate through the fringe. From these apical rays springs the diaphragm which closes the oscule (Figs. 100 & 102). This diaphragm can be made out in some specimens, but not in others, probably owing to defective preservation.

In the third species, *A. grandinis*, the oscular skeleton is hardly differentiated from the body skeleton and there is no fringe.

In all the species the flagellated chambers open one or more together into small shallow excurrent chambers, which open into the gastral cavity through ports in the gastral membrane.

* *Ignis, grando, nix, glacies spiritus procellarum quæ faciunt verbum ejus.*

Achramorpha glacialis.

(Plate XXXIV., Figs. 98–102.)

There are six specimens of this new species in the collection. All are small, slender, vase-shaped Sponges, which when examined with the naked eye might easily be mistaken for Ascons. In colour they are white tinged with orange, as preserved in alcohol. The dimensions of the four perfect specimens are as follows: 9 mm. × 2 mm.; 4 mm. × ·75 mm.; 8 mm. × 1·5 mm. (flattened); 9 mm. × 1½ mm.

The structure of the body wall is shown in Fig. 101. The flagellated chambers often taper considerably at their distal ends, thus leaving rather large inhalent chambers under the dermal cortex. The hair oxea lie in the very thin mesoderm between the chambers and project beyond the dermal cortex. Neither they nor the large projecting oxea are arranged in regular tufts or cones, but appear to be irregularly scattered.

The structure of the oscule is shown in Figs. 100 and 102. The section shows the transition from normal to centrifugal position of the quadriradiates. It also shows the diaphragm.

Fig. 98 represents a view of the gastral layer. The section includes some of the gastral ports and some of the apopyles which lie immediately above the ports. There are a very few minute oxea lying radially in the gastral layer. One of these is shown in Fig. 102. In some specimens these minute oxea are scattered throughout the body wall. Several of the specimens contain ova of the usual form.

Spicules (Fig. 99).

Oxea.—The Oxea are of three sorts :—

(*a*) Stout projecting oxea, irregularly bent, sharply pointed at the inner end, and bluntly pointed at the outer end, 280 μ to 440 μ long × 12 μ to 24 μ thick.

(*b*) Minute, hastate, slightly bent oxea, some smooth, some spined, from the dermal layer, 35 μ to 40 μ long × 2 μ to 3 μ thick.

(*c*) Hair oxea, 400 μ or more long.

The *Triradiates* are of one sort :—

(*d*) Alate triradiates from the dermal cortex. Basal rays straight, tapering and sharply pointed, 200 μ to 380 μ long × 12 μ thick. Paired rays equal, nearly straight, 130 μ to 180 μ long × 10 μ to 14 μ thick. Oral angle varying widely, 110° to 160°. Folding very variable.

(*e*) *Chiactines.* Basal ray straight, tapering, sharply pointed, 340 μ to 400 μ long × 15 μ thick. Paired rays equal, 130 μ to 180 μ long × 16 μ thick, bent slightly irregularly. Oral angle, 145° to 165°. Angle of fold, 150°

to 160°. Apical rays sharply pointed, slightly irregularly bent, 70 μ to 100 μ long × 12 μ thick; set-off slight; angle between apical ray and basal ray 165°.

Oscular Spicules.—The fringe consists of hair spicules, and stout oxea of types (*c*) and (*a*):—

(*f*) Small quadriradiates from the oscular edge. Basal ray straight, tapering, and rather bluntly pointed, 100 μ to 120 μ long μ × 9 μ to 10 μ thick. Paired rays about equal, bent downwards, 50 μ to 100 μ long × 7 μ to 8 μ thick. Oral angle about 150°.

(*g*) The quadriradiates from the oscular collar are similar to (*f*), but much larger. Basal rays 220 μ or more long; paired rays up to 200 μ long; apical rays up to 120 μ long.

ACHRAMORPHA GRANDINIS.

(Plate XXVII., Fig. 4, and Plates XXXIV. and XXXV., Figs. 103–104.)

There is only one broken specimen of this new species in the collection; it consists of the upper part and oscular collar of a sponge which probably was of considerable size, judging by the size of the oscule (see Fig. 4). The specimen is straight, 18 mm. long, and circular in section, tapering from 4½ to 3 mm. in diameter at the oscular end. The lower part is covered by long oxea, which lie along the surface pointing downwards; the upper part is smooth and transparent. There is no fringe.

The structure of the body wall is the same as in the other species of this genus. There are no hair oxea, but there are a few small prickly hastate oxea in the dermis.

The oscule (see Fig. 104) differs considerably from the other two species. There is no fringe of hair oxea and no special ring of quadriradiates at the edge, the skeleton being made up of both tri- and quadriradiates lying tangentially. The transition from tangential quadriradiates to chiactines occurs in the same way as in the other species. The basal rays of the chiactines project a long way outside the dermis.

Spicules (Fig. 103).

Oxea. There are two sorts of Oxea:—

(*a*) Very large straight projecting oxea, size of longest fragments 3·5 mm. × 23 μ. Very sharply pointed at the inner end.

(*b*) Small hastate oxea, from the dermis. Slightly irregularly bent, some spined, some smooth, 65 μ to 120 μ long, 3 μ to 6 μ thick.

The *Triradiates* are of one sort:—

(*c*) Large, alate triradiates from the dermal cortex. Basal rays straight, tapering uniformly to a sharp point, 420 μ to 500 μ long × 12 μ to 15 μ thick. Paired rays usually equal, straight or bent slightly downwards, bluntly pointed, 220 μ to 260 μ long, × 12 μ to 14 μ thick. Oral angle 130° to 160°.

(*d*) *Chiactines.* Basal rays straight, tapering to a more or less sharp point, 450 μ to 550 μ long × 12 μ to 16 μ thick. Paired rays equal, straight, 240 μ to 270 μ long × 12 μ to 14 μ thick. Oral angle, 155° to 160°. Apical ray sharply pointed, maximum length 160 μ long × 14 μ to 16 μ thick. Angle between apical ray and basal ray, 165° to 180°.

Oscular spicules.

(*e*) *Quadriradiates* from the oscular tube. Basal rays straight, tapering uniformly to a sharp point, 650 μ long × 12 μ thick. Paired rays often unequal, maximum size 560 μ long × 14 μ thick, nearly parallel, bluntly pointed. Oral angle about 160°. Apical ray sharply pointed, curved orally, 120 μ long × 9 μ thick.

ACHRAMORPHA NIVALIS.

(Plate XXVII., Figs. 7 and 8. Plates XXXV. and XXXVI., Figs. 105–112.)

There are fourteen specimens of this new species in the collection. They vary considerably in shape, but are mostly more or less pear-shaped, with the oscule at the narrow end (see Figs. 7 and 8). In some specimens the neck of the pear is considerably extended, but the actual oscular collar (without flagellated chambers) is always quite short. There is a dense fringe of long shining silver-white hair spicules round the oscule, which sometimes attain a length of 2·5 mm. The whole sponge is covered with long projecting oxea which lie in all directions, giving it a very untidy appearance. The base of the sponge is rounded.

The dimensions of the perfect specimens are as follows:—12 mm. × 3 mm. 17 mm. × 3 mm.; 18 mm. × 9 mm.; 20 mm. × 8 mm.; 12 mm. × 4 mm.; 8 mm. × 4 mm.; 11 mm. × 5 mm.; 17 mm. × 8 mm.; 8 mm. × 2½ mm.; 26 mm. × 12 mm.; 29 mm. × 10 mm.

The structure of the body-wall is shown in Fig. 106, where the subdermal cavities and exhalent chambers may be seen. The small projecting oxea are mostly arranged round and over the ostia. This may be seen in Figs. 107 and 108 representing the dermal cortex in plan and section. The very large projecting oxea are scattered quite irregularly, and often project through the body-wall into the gastral cavity. The large oxea are all broken; the longest fragment found is 2·7 mm. long. They lie at all angles. Fig. 109 represents the gastral membrane as seen from inside.

Figs. 111 and 112 represent the oscular structure. The highest flagellated chambers are shown in Fig. 112, and the short oscular collar projecting about 1·3 mm. beyond them. Fig. 112 shows the junction of the oscular tube and the body to a larger scale. Above the last chamber the skeleton consists of quadriradiates and oxea only; the triradiates forming the dermal skeleton do not extend to 160°. Apical rays sharply pointed, slightly irregularly bent, 70 μ to 100 μ long × 12 μ thick; set-off slight; angle between apical ray and basal ray 165°.

Oscular Spicules.—The fringe consists of hair spicules, and stout oxea of types (*c*) and (*a*) :—

(*f*) Small quadriradiates from the oscular edge. Basal ray straight, tapering, and rather bluntly pointed, 100 μ to 120 μ long μ × 9 μ to 10 μ thick. Paired rays about equal, bent downwards, 50 μ to 100 μ long × 7 μ to 8 μ thick. Oral angle about 150°.

(*g*) The quadriradiates from the oscular collar are similar to (*f*), but much larger. Basal rays 220 μ or more long; paired rays up to 200 μ long; apical rays up to 120 μ long.

Achramorpha grandinis.

(Plate XXVII., Fig. 4, and Plates XXXIV. and XXXV., Figs. 103–104.)

There is only one broken specimen of this new species in the collection; it consists of the upper part and oscular collar of a sponge which probably was of considerable size, judging by the size of the oscule (see Fig. 4). The specimen is straight, 18 mm. long, and circular in section, tapering from 4½ to 3 mm. in diameter at the oscular end. The lower part is covered by long oxea, which lie along the surface pointing downwards; the upper part is smooth and transparent. There is no fringe.

The structure of the body wall is the same as in the other species of this genus. There are no hair oxea, but there are a few small prickly hastate oxea in the dermis.

The oscule (see Fig. 104) differs considerably from the other two species. There is no fringe of hair oxea and no special ring of quadriradiates at the edge, the skeleton being made up of both tri- and quadriradiates lying tangentially. The transition from tangential quadriradiates to chiactines occurs in the same way as in the other species. The basal rays of the chiactines project a long way outside the dermis.

Spicules (Fig. 103).

Oxea. There are two sorts of Oxea :—

(*a*) Very large straight projecting oxea, size of longest fragments 3·5 mm. × 23 μ. Very sharply pointed at the inner end.

(*b*) Small hastate oxea, from the dermis. Slightly irregularly bent, some spined, some smooth, 65 μ to 120 μ long, 3 μ to 6 μ thick.

The *Triradiates* are of one sort :—

(*c*) Large, alate triradiates from the dermal cortex. Basal rays straight, tapering uniformly to a sharp point, 420 μ to 500 μ long × 12 μ to 15 μ thick. Paired rays usually equal, straight or bent slightly downwards, bluntly pointed, 220 μ to 260 μ long, × 12 μ to 14 μ thick. Oral angle 130° to 160°.

(d) *Chiactines.* Basal rays straight, tapering to a more or less sharp point, 450 μ to 550 μ long × 12 μ to 16 μ thick. Paired rays equal, straight, 240 μ to 270 μ long × 12 μ to 14 μ thick. Oral angle, 155° to 160°. Apical ray sharply pointed, maximum length 160 μ long × 14 μ to 16 μ thick. Angle between apical ray and basal ray, 165° to 180°.

Oscular spicules.

(e) *Quadriradiates* from the oscular tube. Basal rays straight, tapering uniformly to a sharp point, 650 μ long × 12 μ thick. Paired rays often unequal, maximum size 560 μ long × 14 μ thick, nearly parallel, bluntly pointed. Oral angle about 160°. Apical ray sharply pointed, curved orally, 120 μ long × 9 μ thick.

ACHRAMORPHA NIVALIS.

(Plate XXVII., Figs. 7 and 8. Plates XXXV. and XXXVI., Figs. 105–112.)

There are fourteen specimens of this new species in the collection. They vary considerably in shape, but are mostly more or less pear-shaped, with the oscule at the narrow end (see Figs. 7 and 8). In some specimens the neck of the pear is considerably extended, but the actual oscular collar (without flagellated chambers) is always quite short. There is a dense fringe of long shining silver-white hair spicules round the oscule, which sometimes attain a length of 2·5 mm. The whole sponge is covered with long projecting oxea which lie in all directions, giving it a very untidy appearance. The base of the sponge is rounded.

The dimensions of the perfect specimens are as follows:—12 mm. × 3 mm. 17 mm. × 3 mm.; 18 mm. × 9 mm.; 20 mm. × 8 mm.; 12 mm. × 4 mm.; 8 mm. × 4 mm.; 11 mm. × 5 mm.; 17 mm. × 8 mm.; 8 mm. × 2½ mm.; 26 mm. × 12 mm.; 29 mm. × 10 mm.

The structure of the body-wall is shown in Fig. 106, where the subdermal cavities and exhalent chambers may be seen. The small projecting oxea are mostly arranged round and over the ostia. This may be seen in Figs. 107 and 108 representing the dermal cortex in plan and section. The very large projecting oxea are scattered quite irregularly, and often project through the body-wall into the gastral cavity. The large oxea are all broken; the longest fragment found is 2·7 mm. long. They lie at all angles. Fig. 109 represents the gastral membrane as seen from inside.

Figs. 111 and 112 represent the oscular structure. The highest flagellated chambers are shown in Fig. 112, and the short oscular collar projecting about 1·3 mm. beyond them. Fig. 112 shows the junction of the oscular tube and the body to a larger scale. Above the last chamber the skeleton consists of quadriradiates and oxea only; the triradiates forming the dermal skeleton do not extend beyond the last flagellated chamber. At the junction there are specially large quadriradiates lying diagonally, apparently strengthening the junction between the dermal and gastral skeletons. The basal rays of the chiactines are much longer than the thickness of the body in the upper part of the sponge and project, often half their length, outside the cortex. The regular arrangement of the oscular quadriradiates at the oscular edge is shown in Fig. 111. Side views of these spicules are drawn, showing the diminution in the length of the apical ray. These spicules lie in the middle of the fringe, so that they are almost hidden from both inside and outside. In the same figure is shown one of the large quadriradiates from the junction between tube and body.

There are numerous ova in some of the specimens.

Spicules (Fig. 105).

Oxea. There are three sorts of Oxea :—

(*a*) Large projecting oxea, straight, and pointed at both ends. Largest fragment found, 2·7 mm. long × 14 μ thick.

(*b*) Minute, spined, slightly crooked, hastate oxea from the dermal layer, 75 μ to 85 μ long × 5 μ to 6 μ thick.

(*c*) Rather longer, small, straight hastate oxea, 120 μ to 140 μ long × 4 μ thick.

The *Triradiates* are of one sort :—

(*d*) Alate triradiates from the dermal layer (these are probably the same as those occasionally found in the body-wall). Basal ray straight, tapering to a point, 200 μ to 380 μ long × 8 μ to 10 μ thick. Paired rays nearly equal in length, curving slightly upwards, forming a rounded bend at the centre 140 μ to 210 μ long × 8 μ thick. Oral angle 102° to 106°. There are a very few triradiates with an oral angle of 160°. It is doubtful where these come from.

(*e*) *Chiactines.* Basal ray straight in facial view, but bent slightly in side view, tapering to a sharp point, 400 μ to 600 μ long × 8 μ to 10 μ thick. Paired rays about equal, sharply pointed, nearly straight, 160 μ to 200 μ long × 8 μ to 12 μ thick. Oral angle 160°. One of the paired rays is sometimes deflected from its usual position into line with the opposite paired ray. (τ type of triradiate system.) Apical ray straight, or slightly bent, tapering uniformly to a sharp point, 110 μ to 130 μ × 8 μ to 12 μ thick. Set-over about equal to the thickness of the ray. Angle between basal ray and apical ray 150° to 155°.

Oscular spicules.

(*f*) Long, straight slender oxea forming the fringe, 2·5 mm. long × 6 μ or les thick, minutely hastate at the outer end.

(g) Large alate quadriradiates, lining the oscular tube. These are largest at the junction with the body-wall. Basal ray straight, tapering uniformly to a very sharp point. Maximum dimensions 850 μ long × 12 μ thick. Paired rays bracket-shaped, equal in length, 450 μ long, oval in section, 16 μ deep × 6 μ thick. Oral angle, 155°; folded angle, 150°. Apical ray curved orally, 100 μ long × 10 μ thick.

These get smaller up to the oscular edge, where their dimensions are as follows : basal ray, 150 μ long. Paired rays, which are bent downwards, 120 μ long × 10 μ thick. Apical ray reduced to a blunt cone, 20 μ long × 16 μ thick.

SUBGENUS GRANTIOPSIS Dendy.

The sponge has the form of a greatly elongated hollow tube whose wall is composed of two distinct layers of about equal thickness. The outer (cortical) layer is provided with a very strongly developed skeleton of triradiate spicules, and is penetrated by narrow ramifying incurrent canals. The inner layer is formed by elongated radial chambers arranged very regularly side by side. The skeleton of the inner layer is very feebly developed. The tubar skeleton is articulate and composed of very abnormal sagittal triradiates, whose paired rays are greatly reduced; *the inner joint of the tubar skeleton consists of chiactines.*

The above is slightly modified from Dendy's definition (7, p. 73).

The sub-genus contains only one species.

GRANTIOPSIS CYLINDRICA Dendy.

(Plate XXXVI., Fig. 113.)

Grantiopsis cylindrica Dendy (7), p. 90.

A single specimen of this species found in Australia was described by Dendy (7, p. 90), who called special attention to the chiactines in its skeleton. The structure of this species differs considerably from that of the other species in the genus *Achramorpha*, so that it seems advisable to retain the sub-genus, *Grantiopsis*, only transferring it from the *Grantiidæ* into the *Staurorrhaphidæ*.

The spicules, which have not hitherto been illustrated, are shown in Fig. 113; they differ widely from any found in the new species. The sponge is fully described in (7) and figured in (2).

MEGAPOGON.

Staurorrhaphids in which the flagellated chambers are spherical or sac-shaped, never arranged radially around the central gastral cavity, with which (or with the main excurrent canals derived therefrom) they communicate by a more or less complicated excurrent canal system. The skeleton of the chamber layer is largely composed of irregularly scattered radiate spicules, *but it always has regularly placed subgastral chiactines.*

The above only differs from Dendy's definition of *Leucandra* by an alteration in the last sentence.

This genus contains five species, four new, and Poléjaeff's "*Leuconia crucifera*" (*Megapogon cruciferus*), which is now transferred to it.

All the species have well-marked gastral cavities, but no gastral skeleton proper. The spiculation in all the species is very similar. The size and shape of the flagellated chambers is very variable; they are sometimes so long as to resemble the radial chambers typical of *Grantia* or *Achramorpha*, and at other times they are spherical.

The close similarity between *Megapogon cruciferus* found at the Azores and the new species from the Antarctic is remarkable. It is noteworthy that *Megapogon cruciferus* was dredged from a great depth, 450 fathoms. The temperature of the sea was not measured at the station where it was found, but judging from the temperatures measured at neighbouring stations it must have been about 47° F. at the bottom. It is possible that successive larvæ of this sponge may have travelled in cool water at great depths all the way from the Antarctic to the Azores.

MEGAPOGON CRUCIFERUS Pol.

(Plate XXXVI., Fig. 114.)

Leuconia crucifera Poléjaeff (4), p. 60.

The following description is abstracted from Poléjaeff's (4). Only a fragment of the inferior part of the sponge was found. The outer surface is bristly, the inner slightly roughened by the apical rays of the gastric quadriradiate spicules [chiactines]. These are all more or less cruciform, all the rays lying in the same or almost the same plane. By this characteristic the species can be very easily distinguished from all other *Leuconidæ*. *Leuconia crucifera* and *Leuconia blanca* are of peculiar interest, as forms inhabiting the greatest depth (450 fathoms) from which *Calcarea* have been hitherto obtained.

Skeleton.—The skeleton consists of gastral quadriradiates [chiactines], of parenchymal triradiates [of minute spined oxea *], of dermal triradiates and of stout acerate spicules, piercing the parenchyma obliquely and projecting with their free end from the outer surface, and of slender acerate spicules scattered here and there on the outer surface in small bundles. The spicules (omitting the hair spicules) are shown in Fig. 114 drawn from spicule preparations made by the author. For description and dimensions see (4).

* These spicules were overlooked by Poléjaeff. They are included in the new drawing of the spicules.

Megapogon villosus.

(Plate XXXVI., Figs. 115–119.)

There are four specimens of this new species in the collection, but only one is perfect, the other three being broken pieces only. All are white as preserved in alcohol, and are covered with a dense mat of very long oxea. The following description applies to the perfect specimen (see Fig. 117).

The sponge is in the form of a nearly straight circular tube, a good deal distorted at the base, where it has its maximum diameter. It tapers gradually to the short oscular collar which terminates the large gastral cavity.

The structure of the body-wall is shown in Fig. 115 ; it gets gradually thinner towards the oscule.

Canal System.—The dermis is pierced by numerous ostia which lead into large incurrent canals which extend radially inwards nearly through the body-wall. The excurrent system consists of large radial chambers or canals which do not appear to be branched, each opening through a large port into the gastral cavity.

The flagellated chambers are very variable in size and shape; they are mostly more or less thimble-shaped, opening by apopyles directly into the excurrent chambers round which they are grouped. Some of the flagellated chambers are nearly spherical, some are so long that they reach almost across the whole thickness of the wall; these long chambers are often branched.

Skeleton.—The skeleton of the body-wall is made up of the chiactines which reach completely through it and often project, and a few scattered triradiates whose basal rays also often project. It is pierced at variable angles by the very long projecting oxea. All these oxea are broken in the specimens; the longest fragment measured is 15 mm. long. Chiactines occasionally occur at the top of the excurrent chambers, and may thus appear to be in the middle of the thickness of the wall. There is no gastral skeleton proper; the only supports to the gastral wall (see Fig. 118) are the paired rays of the chiactines, amongst which are a few minute oxea, some smooth and some spined. The dermal skeleton is formed of a thick layer of triradiates (Fig. 116) lying in all directions, with a few minute oxea standing semi-erect round the ostia.

Oscule.—The oscule is at the end of an oscular collar about 1 mm. long which has the appearance of a thin, almost transparent extension of the body. The skeleton of the oscular collar consists of quadriradiates lying tangentially on the inside, with the basal ray downwards and the apical ray projecting into the gastral cavity. Outside are triradiates, also regularly arranged, with the basal ray downwards. The edge is made up of both types of spicule, with a few special oxea which lie horizontally, but do not project beyond the edge, which has no fringe. The junction between the oscular collar and the body-wall is very similar to that shown in Fig. 110.

Spicules (Fig. 119).

Oxea.—There are two sorts of Oxea :—

(*a*) Enormous straight projecting oxea more than 15 mm. long × 36 μ to 43 μ thick. The inner end tapers gradually to a very sharp point, the outer end is hastate.

(*b*) Minute irregularly bent hastate oxea, some spined, some smooth, from the gastral and dermal layers, 80 μ to 160 μ long × 6 μ thick.

The *Triradiates* are of one sort :—

(*c*) Alate triradiates from the body-wall and dermal layer. Basal rays straight, tapering uniformly to a sharp point, 220 μ to 700 μ long × 10 μ to 16 μ thick. Paired rays equal, nearly straight, 170 μ to 300 μ long × 12 μ to 14 μ thick. Oral angle 135° to 155°.

(*d*) *Chiactines.*—Basal ray straight, tapering uniformly to a sharp point from 600 μ to 1120 μ long × 10 μ to 16 μ thick. Paired rays equal, straight, tapering to a sharp point, 240 μ long × 13 μ thick. Oral angle 155° to 160°. Slightly folded, angle of fold 175° to 150°. Apical ray straight, slender, sharply pointed, 140 μ to 220 μ long × 8 μ to 16 μ thick, set-off small; angle between apical ray and basal ray 170° to 180°.

Megapogon raripilus.

(Plate XXXVI., Figs. 120–124.)

There are three specimens of this new species in the collection. The natural shape appears to be that of a straight tube, enclosing the gastral cavity, slightly thicker in the middle and circular in section. The lower end is closed very squarely, and the upper terminates in an oscule without a collar. The largest specimen, which is much distorted, is 30 mm. × 11 mm.; the next, which has the shape described above, is 19 mm. × 4 mm., and the smallest specimen $2\frac{1}{2}$ mm. × 1 mm. They are white as preserved in alcohol, their surface is hispid.

The structure of the thick body-walls is shown in Fig. 122.

Canal System.—The stout dermal cortex (Fig. 124) is pierced by small ostia leading into small incurrent chambers, from these run incurrent canals branching and getting smaller as they approach the gastral cavity. The excurrent canals are connected in groups of three or four to excurrent chambers which open into the gastral cavity through large ports.

Skeleton.—The body skeleton consists of the chiactines, amongst which are a few large subgastral triradiates and a few scattered small triradiates; the basal rays of the latter often project beyond the dermis. There are also dense tufts of hair spicules with a few stout bent oxea among them, which project and make the surface hispid. There are minute spined hastate oxea scattered all through the body. There is no gastral skeleton proper; the gastral cortex is supported by the paired rays of the chiactines and subgastral triradiates (see Fig. 120). The dermal cortex is formed of a thick layer of irregularly scattered triradiates (Fig. 124).

The oscule is shown in Fig. 121. There is a ring of small quadriradiates lying tangentially round the inner edge, with short pointed apical rays from which springs the diaphragm. There is a thick fringe of hair oxea, outside which there is an open fringe of large oxea. The oscule is thick and the flagellated chambers reach almost to the edge. Near the oscule they are only in a single layer, but in the middle of the sponge they are ten or twelve layers thick.

Spicules (Fig. 123).

Oxea.—There are four sorts of Oxea:—

(*a*) Large projecting oxea, pointed sharply at the inner end, and very bluntly at the outer end, which is thicker. Curved all along, more sharply near the thicker projecting end. Length fairly constant about 700 μ, thickness 30 μ to 35 μ.

(*b*) Hair oxea, projecting in dense tufts, quite straight, length over 500 μ, thickness about 1 μ.

(*c*) Minute spined hastate oxea, scattered all through the body-wall. Slightly bent, with the largest spines in a ring round the "set-over" of the spear-head. Usual length 60 μ, occasionally 150 μ, thickness 4 μ to 5 μ.

(*d*) Small irregular oxea from the body-wall about 350 μ × 20 μ, often set-over in the middle of their length.

Triradiates.—There are two sorts of Triradiates:—

(*e*) Large alate subgastral triradiates. Basal ray straight, tapering uniformly to a sharp point, about 700 μ long × 16 μ thick. Paired rays equal, nearly straight, 200 μ to 320 μ long × 20 μ thick; oral angle 160°.

(*f*) Smaller alate triradiates from the dermal cortex (probably the same as the rare ones in the body-wall). These vary widely in size. Basal ray straight, tapering uniformly to a sharp point, 170 μ to 700 μ long × 10 μ to 18 μ thick. Paired rays equal, forming a rounded bend at the centre, but straight for the rest of their length, 120 μ to 270 μ long × 10 μ to 16 μ thick. Oral angle very constant, 108° to 112°.

(*g*) *Chiactines.* Basal ray straight, sharply pointed, 600 μ to 750 μ long × 14 μ thick. Paired rays bent more or less forwards, 200 μ to 280 μ long × 16 μ to 20 μ thick. Oral angle variable, 135° to 160°. Apical ray about 80 μ × 12 μ.

Oscular spicules.

(*h*) Large oxea like (*a*), but shorter; 380 μ to 480 μ long × 18 μ thick. These form an external fringe. The inner fringe is formed of hair oxea of unknown length.

(*i*) Small alate quadriradiates forming the edge. Basal ray 140 $\mu \times 8 \mu$, straight, tapering uniformly to a sharp point. Paired rays bent slightly downwards, about 70 $\mu \times 10 \mu$. Apical ray short and conical, 20 μ long $\times$ 8 μ thick at base, perpendicular to facial plane. Oral angle nearly 180°.

Megapogon pollicaris.*

(Plates XXXVII. and XXXVIII., Figs. 125–130.)

There are two specimens of this new species in the collection; the larger one is fixed in osmic acid and is consequently brown; the smaller one, which is fixed in alcohol, is white; both are hispid. The larger specimen is in the form of a flattened tube 15 mm. long. The diameter at the widest part near the middle is 3 mm. The smaller specimen is ovoid, $2\frac{1}{2}$ mm. $\times$ $1\frac{1}{2}$ mm. There is a large gastral cavity which terminates in the oscule, which in both specimens is bent to one side. The larger specimen has an oscular collar about 1 mm. long.

The structure of the body-wall is shown in Fig. 126. The space between gastral and dermal layers is filled up with three or four layers of flagellated chambers. Each flagellated chamber is surrounded by a slender skeleton of minute prickly hastate oxea (see Figs. 129 and 127); these oxea often lie together in small bunches of three or four, and as they may lie partly on one and partly on another chamber, they build up serpentine lines of minute spicules threading about between the chambers. Some of these minute oxea also lie in the gastral and dermal layers, and also in the columns supporting the dermis.

Canal System.—There is an incurrent chamber under the dermal layer which is probably continuous round the whole body of the sponge. The dermal layer is supported over this chamber by columns of spicules consisting partly of the basal rays of the chiactines and partly of oxea which project outside the dermis. The incurrent canals lead inwards from the incurrent chambers. The excurrent canals are connected in groups to excurrent chambers which open into the gastral cavity through large ports; these are more or less surrounded by the apical rays of the chiactines (see Fig. 125).

The Skeleton.—The dermal skeleton is formed by a dense layer, five or six spicules thick, of triradiates, pierced at intervals by the projecting bunches of oxea. The body skeleton consists of chiactines and a very few scattered triradiates. The basal rays of the chiactines are bunched more or less together at their distal ends and occasionally project through the dermal layer; with each bunch are grouped a number of the oxea, which project with their thicker bent ends about one-third of their length beyond the dermis. There is no special gastral skeleton; the gastral cortex (see Fig. 130) is supported by the paired rays of the chiactines, and a few minute oxea irregularly scattered.

* *Pollicaris* = "like a thumb," named from the shape of the oxea.

The oscular collar is thick and densely packed with spicules. On the inside are quadriradiates lying tangentially with the basal rays downwards, and outside are triradiates. The rim, which has no fringe, is formed of tri- and quadriradiates, with oral angles of nearly 180°. There is a diaphragm in one specimen.

Spicules (Fig. 128).

Oxea.—There are three sorts of Oxea :—

(*a*) Large projecting oxea, straight for about two-thirds of their length, then bending smoothly to one side. The inner (straight) end tapers gradually to a point. The outer end is blunt, shaped like the end of a thumb. Most of the oxea are about the same size, 460 μ long × 24 μ thick. Maximum size, 640 μ × 25 μ. There are a few smaller, imperfectly formed, possibly young, oxea.

The minute spined oxea scattered throughout the body and forming the flagellated chamber skeletons are of two forms :—

(*b*) Straight, refringent, thin, slightly spined, 50 μ × 2 μ.

(*c*) Curved, hastate, thicker and well spined, 50 μ to 60 μ × 2·3 μ to 3·1 μ. The junction of the spear-head is marked by a ring of four or more large spines.

The *Triradiates* are of one sort :—

(*d*) Alate triradiates from the dermal cortex and body-wall. These vary very much in size and proportions. Most have the paired rays only slightly shorter than the basal ray, but occasionally there is great disparity. Basal ray straight, tapering uniformly to a sharp point, 130 μ to 330 μ long × 8 μ to 15 μ thick. Paired rays equal, nearly straight, but slightly irregular, 90 μ to 320 μ long × 8 μ to 14 μ thick. Oral angle 108° to 115°.

(*e*) *Chiactines.*—Basal ray straight, tapering uniformly to a sharp point, 460 μ to 580 μ long × 14 μ to 18 μ thick. Paired rays straight, bluntly pointed, 160 μ to 280 μ long × 14 μ to 16 μ thick. Oral angle 160°. Angle of fold 155° to 165°. Apical ray nearly straight, pointed, 100 μ long × 12 μ thick. Set-over small. Angle between apical ray and basal ray 175°.

MEGAPOGON CRISPATUS.*

(Plate XXVII., Fig. 2, and Plate XXXVIII., Figs. 131–136.)

There are four specimens of this new species in the collection, all found together. The sizes are 9 mm. × 3 mm. ; 6 mm. × 2 mm. ; 6 mm. × 3 mm. ; 4 mm. × 2 mm. They are vase-shaped, white or pale orange as preserved in spirits, with a curly surface

* *Crispatus*, curly-haired.

due to the bent projecting oxea (see Fig. 2). The gastral cavity, which is nearly constant in diameter throughout its whole length, terminates at the oscule, which is at the top of an oscular collar about 1½ mm. long.

The structure of the body-wall is shown in Fig. 131.

Canal System.—There is an incurrent chamber under the dermal layer which is probably continuous round the whole body of the sponge. The dermal layer is supported over this chamber by columns of spicules, consisting partly of the basal rays of the chiactines, and partly of oxea which project in spreading tufts outside the dermis. The incurrent canals, which are small and irregularly branched, lead inwards from the incurrent chamber. The excurrent canals are large and extend radially from the gastral cavity nearly through the body-wall, often branching once. The flagellated chambers are grouped round these large excurrent canals, the larger number opening directly into them, the remainder being connected by short branches.

The Skeleton.—The skeleton of the body-wall consists of chiactines. There are also a few triradiates scattered irregularly, and numerous minute spined oxea. There is no gastral skeleton proper; the gastral cortex (see Fig. 132) is only supported by the paired rays of the chiactines. The dermal skeleton is made up of triradiates, which are approximately equiangular, and lie tangentially to the surface. There are also tufts of oxea which project for most of their length and give the sponge its characteristic "curly" appearance.

Oscule.—The thin oscular collar is about 1½ mm. long and the same diameter as the gastral cavity (see Figs. 133 and 134). On the inside are quadriradiates lying tangentially with the basal ray downwards, and outside are triradiates and oxea. There are numerous minute spined oxea scattered amongst the radiates. At the rim (see Fig. 131) the collar is slightly thickened. There is a ring of small quadriradiates forming the edge on the inside; they do not appear to be very closely or regularly packed. The diaphragm extends from the apical rays of these spicules. There is a scanty fringe of prickly hastate oxea of small size. On the outside the oscular collar is thickly covered by large bent oxea of the same type as those forming the tufts on the body, but shorter. They stick in the collar, often projecting through it into the interior, and are directed upwards usually at about 45° with the axis of the sponge; some lie tangentially along the surface.

At the junction of the oscular collar and the body the collar thickens, a few small flagellated chambers appear, the quadriradiates begin to turn their basal rays outwards, and the oxea project more radially, a few even pointing downwards.

Spicules (Figs. 135 and 136).

Oxea.—There are three sorts of Oxea:—

(*a*) Large projecting oxea, irregular but nearly straight for about three-quarters of their length, then bending (at the outer end) considerably to one side by two or three angular deflections. The inner end is sharply pointed and usually slightly bent to the opposite side from the outer end, giving the spicule an S shape. The outer end is slightly swollen and roughened. The thickness varies very irregularly throughout the length, 550 μ to 950 μ long × 20 μ to 28 μ thick. Many of these spicules have long flattened areas just below the outermost bend, looking as if the spicule had been diverted by contact with a plane surface.

There are minute spined oxea of two types :—

(*b*) Straight, refringent, and thin, 50 μ long × 1·2 μ thick.

(*c*) Curved, hastate, and thicker, 55 μ long × 4 μ to 5 μ thick.

The *triradiates* are of two sorts :—

(*d*) Approximately regular triradiates from the dermal cortex and body-wall with straight rays, tapering slightly to near their extremities, then sharply pointed. The rays and angles are nearly but not exactly equal. Rays 110 μ to 220 μ long × 8 μ to 12 μ thick.

(*e*) Large alate triradiates from the body-wall. Basal rays straight, tapering moderately, then fairly sharply pointed, 400 μ to 500 μ long × 12 μ to 14 μ thick. Paired rays nearly straight, tapering, then sharply pointed, 160 μ long × 12 μ to 14 μ thick. Oral angle 120° to 145°.

(*f*) *Chiactines.* Basal rays straight, tapering slightly to near the end, then sharply pointed, 300 μ to 500 μ long × 11 μ to 12 μ thick. Paired rays straight, 120 μ to 160 μ long × 10 μ to 12 μ thick. Oral angle 115° to 150°. Angle of fold very variable, 115° to 160°. Apical ray nearly straight, sharply pointed, 100 μ long × 8 μ thick. Set-off moderate. Angle between apical ray and basal ray 165°.

Oscular spicules.—Near the oscule type (*a*) spicules get smaller, 330 μ long × 20 μ thick.

(*g*) Straight, strongly hastate, thin, spined oxea forming the fringe, 100 μ to 200 μ long × 1 μ to 3 μ thick. The spear-head is swollen at the junction and very sharply pointed. These spicules are also found in the oscular collar a short distance below the edge lying tangentially and occasionally projecting.

(*h*) Small quadriradiates from the oscular edge. Basal ray straight, pointed, 50 μ to 90 μ long × 6 μ thick. Paired rays equal and bent slightly down, 30 μ to 60 μ long × 5 μ thick. Apical ray straight, pointed, 20 μ long × 5 μ thick. Oral angle 160°.

(*i*) Large quadriradiates lining the oscular collar. Basal ray straight, tapering uniformly to a fine point, sometimes bent backwards in side view. Length near oscular edge 200 μ, increasing considerably lower down. Thickness 7 μ to 9 μ. Paired rays equal, straight or slightly bracket-shaped, 110 μ

to 130 μ long × 9 μ thick. Oral angle 155° to 160°. Apical ray sharply pointed, 50 μ to 70 μ long × 10 μ to 13 μ thick, pointing considerably upwards. Angle with basal ray 130°.

PART III.

HISTOLOGY.

The specimens are not sufficiently well fixed to enable many histological details to be made out satisfactorily, but as most of them are unique, it seems advisable to record all that can be determined with reasonable certainty and accuracy.

Pores, Oscules, etc.

Several different methods are found among calcareous sponges for regulating the circulation of water and preventing the entry of dirt or enemies.

Ostia.—The admission of water to the incurrent canals is regulated in many species by the opening and closing of the ostia. These pores are inter-cellular, and are closed by the action of the surrounding cells. Fig. 48 shows a closed ostium at the end of the short passage leading through the dermal cortex into the incurrent chamber. The same passage is shown in tangential section in Fig. 49.

Incurrent Canals.—So far as the author is aware, there is no species in which the incurrent canals close.

Prosopyles.—It is probable that the prosopyles can be closed in all species. Considerable discussion has taken place as to whether prosopyles are inter- or intra-cellular. The explanation appears to be simple. The prosopyle is an opening in a pore cell * (intra-cellular) which leads into the flagellated chamber between the flagellated cells (inter-cellular). As, however, the flagellated cells are always much more conspicuous in a surface view than the epithelial cells, the pore when seen in this view presents the misleading appearance of being an inter-cellular opening.

In most of the *Heterocoela* (excepting some species of *Leucandra*) the gelatinous mesoderm is very little developed, so that the walls of the flagellated chambers appear to consist of epithelium lined with flagellated cells. The pore cells are special cells in this epithelium. In the *Homocoela*, where there is a certain thickness of mesoderm containing the spicules, Minchin has shown (1) that the pore cells reach through this to the level of the flagellated cells, thus forming pipes through the wall. In the very thin walls of the flagellated chambers of most species of *Leucandra* the pore cells have no appreciable length, the opening appearing as a hole through a thin membrane, see Figs. 36, 37 and 38.

In *Leucandra gelatinosa*, the gelatinous mesoderm is so much developed that the flagellated chambers appear as spherical spaces lined with flagellated cells, and situated

* *Vide* Minchin (1).

in the middle of a solid jelly. There is no epithelial sack, but the epithelium appears as the lining of the incurrent canals, which are more or less circular pipes through the jelly. The pore cells have not been made out with certainty in this species, but the cells lettered p.c. in Figs. 51 and 53 are probably the pore cells, which of course are closed.

Apopyles.—The apopyle usually has the appearance of an oval opening in a thin elastic membrane stretching across the end of the flagellated chamber. It is probable that the apopyles can be closed in all species.

Excurrent Canals.—In *Leucandra gelatinosa* the excurrent canals close by the contraction of the epithelial lining. When the canal contracts, the spicules are left in their normal position, and the lining cells stretch the gelatinous mesoderm behind them, so that it is drawn into the canal. The apical rays do not appear to interfere with this action. In cross-section the contracted canal, therefore, appears as an irregular ring of spicules filled up with jelly, in the centre of which lies the contracted group of lining cells (see Figs. 45 and 46). It is probable that similar contractility may be possessed by other species which have a strongly developed mesoderm; as a rule, however, the excurrent canals do not close.

Gastral Cavity.—In some *Homocoela* the gastral cavity can be closed solid.* The author does not know of any instance in which this occurs among the *Heterocoela*.

Osculum.—The osculum may be closed in a variety of ways:—

(1) By simple contraction of the surrounding mass (*e.g.*, *Leucandra primigenia*).
(2) By the folding inwards of the oscular collar (*e.g.*, *Leucandra gelatinosa*), etc.
(3) By means of a diaphragm across the mouth (*e.g.*, *Megapogon raripilus*).

Diaphragms have been found in several of the new species, but not in good enough preservation to enable their structure or method of closing to be investigated.

Spicules.

The dimensions given for the spicules in the detailed descriptions of the several species in Part II. have generally been taken from the drawings, which were traced by camera lucida accurately to scale, and show as far as possible a representative selection; they must not be understood to be either limiting (maximum and minimum) dimensions or accurate average dimensions. To ascertain the true limiting and average dimensions would require a detailed examination of a large number of specimens and great care in the preparation of the spicule slides, in order to insure that all the spicules from each specimen were mounted. There appeared to be no advantage to be gained in the present instance by attempting such accuracy, which, indeed, would only have been possible in the few cases where a sufficient number of specimens existed.

When the facial rays of a triradiate or quadriradiate spicule are "folded," *i.e.*, do

* *Vide* Minchin (1).

not lie in one plane, foreshortening always produces an apparent distortion which affects both the relative length of the rays and the angles between them. No attempt has in general been made to correct the measurements for this; the figures given are the apparent lengths and angles as the spicules lie in various positions on the slide. The distortion is large in such cases as *Streptoconus australis*, where the folding angle is 120°.

The position of the spicules relatively to the other parts of the sponge body is of some interest. It may be stated as a general rule, and probably as a universal rule, that spicules do not pass through flagellated chambers. They usually lie entirely within the mesoderm, except such parts as project beyond the dermal or gastral layers. They occasionally project into, or cross, the incurrent and excurrent passages. They appear in these cases often to be surrounded by a considerable amount of body substance; if this is covered with an epithelial layer of cells the spicules, strictly speaking, still remain within the mesoderm. The minute spicules ("Mortar spicules," Haeckel), which in *Leucandra* often appear to be scattered irregularly through the whole body-wall, all lie in the mesoderm surrounding the flagellated chambers, and thus build up what may be described as a flagellated chamber skeleton (see Figs. 127 and 129). The very thin hair spicules, which extend in straight lines through the body-wall of some species, all lie within the mesoderm. The enormous projecting oxea, which pierce the body-wall at all angles in some species and appear to be quite independent of the flagellated chamber structure, all lie in the mesoderm between these chambers. Similarly the regularly arranged tubar or body skeleton lies in the mesoderm.

The complex adjustment between the different spicules and flagellated chambers must be arrived at during the growth of the sponge. It therefore seems probable that the longer spicules are formed before the flagellated chambers and are pushed about by the latter as they grow. The mortar spicules, on the other hand, are probably formed after or during the growth of the flagellated chambers.

τ *spicules.*—The Greek letter τ has been used to designate malformed triradiate systems in which the paired rays are in line.

Γ *spicules.*—The Greek letter Γ has been used to designate a type of oxeote spicule in which the end is bent over sharply through about a right angle.

The hastate ends of the oxea in *Leucosolenia discoveryi** amongst which Γ spicules are found are formed by two angular bends close together in the axis of the spicule. The Γ spicules may arise owing to the absence of the second bend.

Chiactines.—The facial rays of these spicules are very similar to those of ordinary quadriradiates. The basal ray, which is the longest, is usually straight, but sometimes bent slightly at a point not far from its junction with the paired rays (see Fig. 76) and is round in section. The paired rays are usually slightly curved and are often oval in section, being flattened in the facial plane. Viewed along the axis of the

* Γ spicules also occur in *Leucosolenia minchini* and *Leucosolenia lieberkuehni.*

sal ray, the paired rays are seen to be folded to one side; the fold appears in some ses to occur sharply near the base of the rays, which are otherwise straight; in other ses the fold is gradual, the rays being curved for the greater part of their length. he apical ray springs from the junction of the facial rays on the side to which they re folded, but is immediately bent down nearly into line with the basal ray. Viewed om the side the apical ray appears as a continuation of the basal ray, with a sharp set-over" at the junction. The amount of the set-over varies widely (see *Streptoconus ustralis* and *Megapogon cruciferus*). The axis of the apical ray is usually slightly nclined to the axis of the basal ray, sloping towards the side to which the paired rays re folded. In facial view the chiactine does not differ much from the ordinary quadriradiate, since the apical rays of the latter are usually curved orally, but in side view the difference is wide.

The ordinary position of quadriradiates in calcareous sponges is tangential to the gastral surface, with the basal ray downwards and the apical ray projecting into the gastral cavity, so that the paired rays lie circumferentially embracing the gastral cavity. In *Amphoriscus* and *Syculmis* there are quadriradiates which lie tangentially to the gastral surface with the apical ray pointing radially outwards, and in all the *Amphoriscidae* there are quadriradiates which lie tangentially to the dermal surface with the apical ray pointing radially inwards. The chiactines lie in a plane perpendicular to all these positions. Their basal ray is directed radially outwards, the paired rays lie in the gastral cortex and the apical ray points radially inwards and projects into the gastral cavity. The plane of the facial rays is therefore perpendicular to the gastral and dermal surfaces. The position of the paired rays is no longer fixed; they may lie circumferentially as before, but they may turn round the axes of the basal ray to any extent without coming out of the gastral cortex, and in fact they are found lying in all positions between circumferential and longitudinal.

The relation between the chiactines and the ordinary quadriradiates is an interesting problem. All the nine new species containing chiactines have ordinary quadriradiates lying tangentially round the oscule, and also lining the whole oscular collar, if any. In six* of the new species the ordinary quadriradiates cease entirely at the base of the collar and are replaced by the chiactines which form the body skeleton. At the junction between the oscular collar and the body-wall there is a short space in which quadriradiate spicules are found in every intermediate position between tangential and centrifugal. This fact suggests most forcibly that the spicules turn round. The top of the body appears to be the most recently developed, and the spicules formed in the oscular collar might be supposed to be turned round by the development of flagellated chambers under their basal rays. A very similar tipping up of dermal triradiates, due to the growth under them of the flagellated chambers, occurs at the base of the oscular collar in *Tenthrenodes antarcticus*. There is

* In three of the new species the ordinary quadriradiates in the oscular collar continue throughout the whole gastral cavity in conjunction with the chiactines in the body.

one serious objection to this theory. The apical rays of the ordinary quadriradiates would have to be bent down and straightened while the spicule turned round. The shape of the apical ray in the chiactines suggests that this does occur, but it is difficult to realise how an actually formed spicule can be altered in shape.

Hair Spicules.—In many of the new species there occur long straight spicules of extreme thinness, varying from about ·7 μ to about 2 μ in diameter; they are called hair spicules. Their length is always difficult to determine. When they occur in the oscular fringe the outer ends are usually broken; when they occur in the body-wall they are usually so crowded together that it is impossible to distinguish the ends of individual spicules. It is probable that they often attain to lengths of 500 μ or 1,000 μ. They often project from the body-wall with the ordinary thick oxea. The hair spicules are usually omitted in the drawings of spicules, since their thickness is too small to draw to scale and their length is uncertain.

Flattened Spicules.—In two of the new species (*Leucandra cirrata* and *Megapogon crispatus*) the large projecting oxea are marked near their distal ends by curious flattened areas situated on the convex sides of the curved ends. Their appearance might suggest that the spicule had come in contact with some flat obstruction which had diverted its growth and caused the mark. This, however, does not seem to be possible, and no explanation of the origin of the marks has been found.

Reproduction.

Larvæ similar to those of *Sycon ciliatum* were found in *Tenthrenodes scotti* and *Megapogon pollicaris*.

Ova of the ordinary type were found in *Hypodictyon* and in *Achramorpha glacialis*.

Duplicate ova of a remarkable type were found in *Achramorpha nivalis* and *Megapogon raripilus*; no satisfactory explanation of their structure has been found. They were in large numbers in three specimens of *Achramorpha nivalis*; the best preparations were made from one of the specimens which had been fixed in osmic acid. None of the specimens of *Megapogon raripilus* were as well fixed, nor could the structure of the ova be made out so satisfactorily; it appears to differ slightly from that of *Achramorpha nivalis*.

The following description applies to the ova of *Achramorpha nivalis*:—

Each ovum (Fig. 110) appears to be made up of two unequal parts; the larger part (*a*) is very similar to the ordinary large ovum cell and contains a large transparent nucleus (*b*) and small strongly staining nucleolus (*c*); the smaller part appears to be a multicellular structure, consisting of a large inner cell surrounded by a sheath of small cells (*d*); (but it is possible that it may be a single cell, the central portion (*g*) being the nucleus). The inner cell (*g*) contains two structures; one (*h*) strongly staining like the nucleolus of the larger part, the other a hyaline sphere (*i*) packed with about a dozen grains (k) of one colour and one odd one (b) (nucleus, nucleolus ?), which stains a different shade. The outer sheath of cells each has a small nucleus (e) and minute nucleolus (f). This sheath appears in some cases to surround the inner cell entirely, and in other cases only to surround the outer part, and not to exist between the inner cell (g) and the other half (a) of the ovum.

It is possible that the smaller half of the ovum may be a feeding cell, supplying nourishment to the larger half. The hyaline sphere of grains may be food material.

In the ovum of *Megapogon raripilus*, the smaller half has a somewhat different appearance, which suggests that it is made up of several concentric sheaths of cells round a central one. These ova, however, are not well enough fixed to repay detailed examination.

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DESCRIPTION OF PLATES XXVII. TO XXXVIII.

The figures on Plate XXVII. are reproduced from photographs made by the Author; the rest of the figures are reproductions of drawings made by the Author with the Abbe drawing apparatus. All the figures are reduced from these drawings, most of them to two-fifths of the size of the originals; the final magnification is marked on each figure.

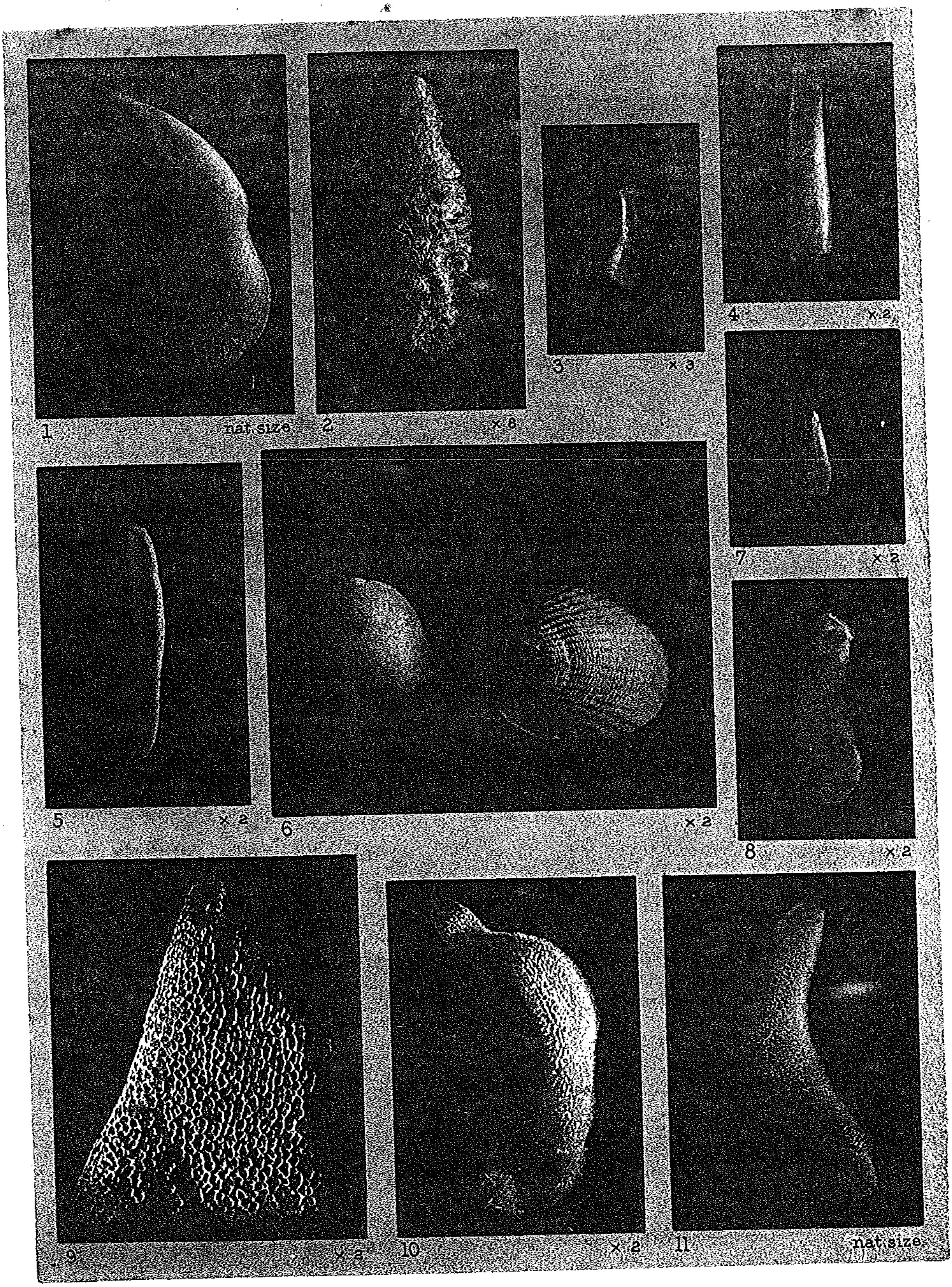
The letters on the Spicule drawings correspond with those used in the text to indicate the different sorts of spicules.

N.B.—Hair spicules, which occur in many of the sponges, are *not shown* in the figures.

The significance of the letters on the other drawings is given in the following list:—

ost.	Ostia.
pros.	Prosopyles.
ap.	Apopyles.
p.	Ports.
i. ch.	Incurrent chambers.
i. ca.	„ canals.
e. ch.	Excurrent chambers.
e. ca.	„ canals.
osc.	Oscule.
osc. c.	Oscular collar.
osc. e.	„ edge.
g. c.	Gastral cavity.
d.	Dermis.
fl. ch.	Flagellated chamber.
ov.	Ovum.
sp.	Spicule.
a. r.	Apical ray.

LIST OF FIGURES.



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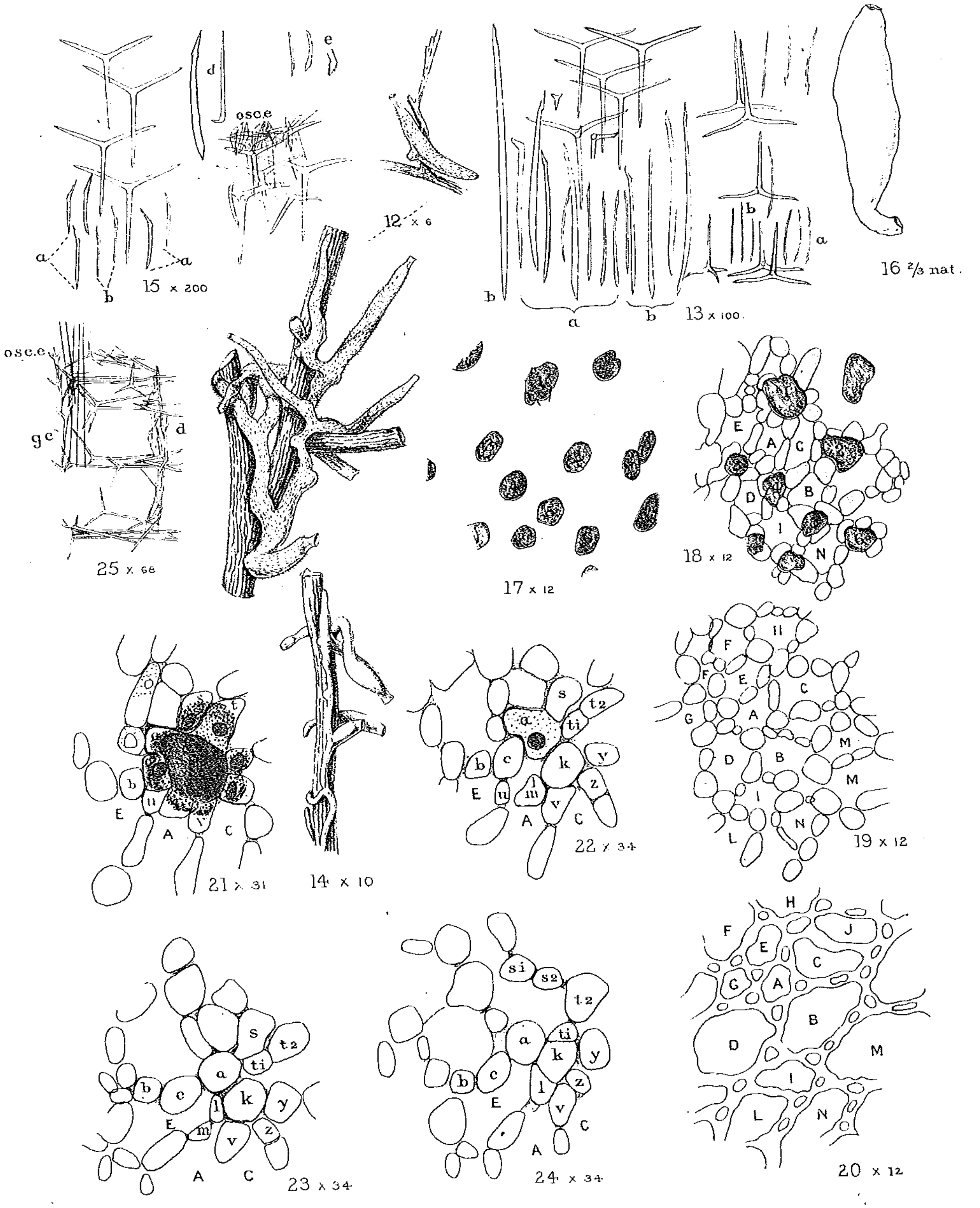

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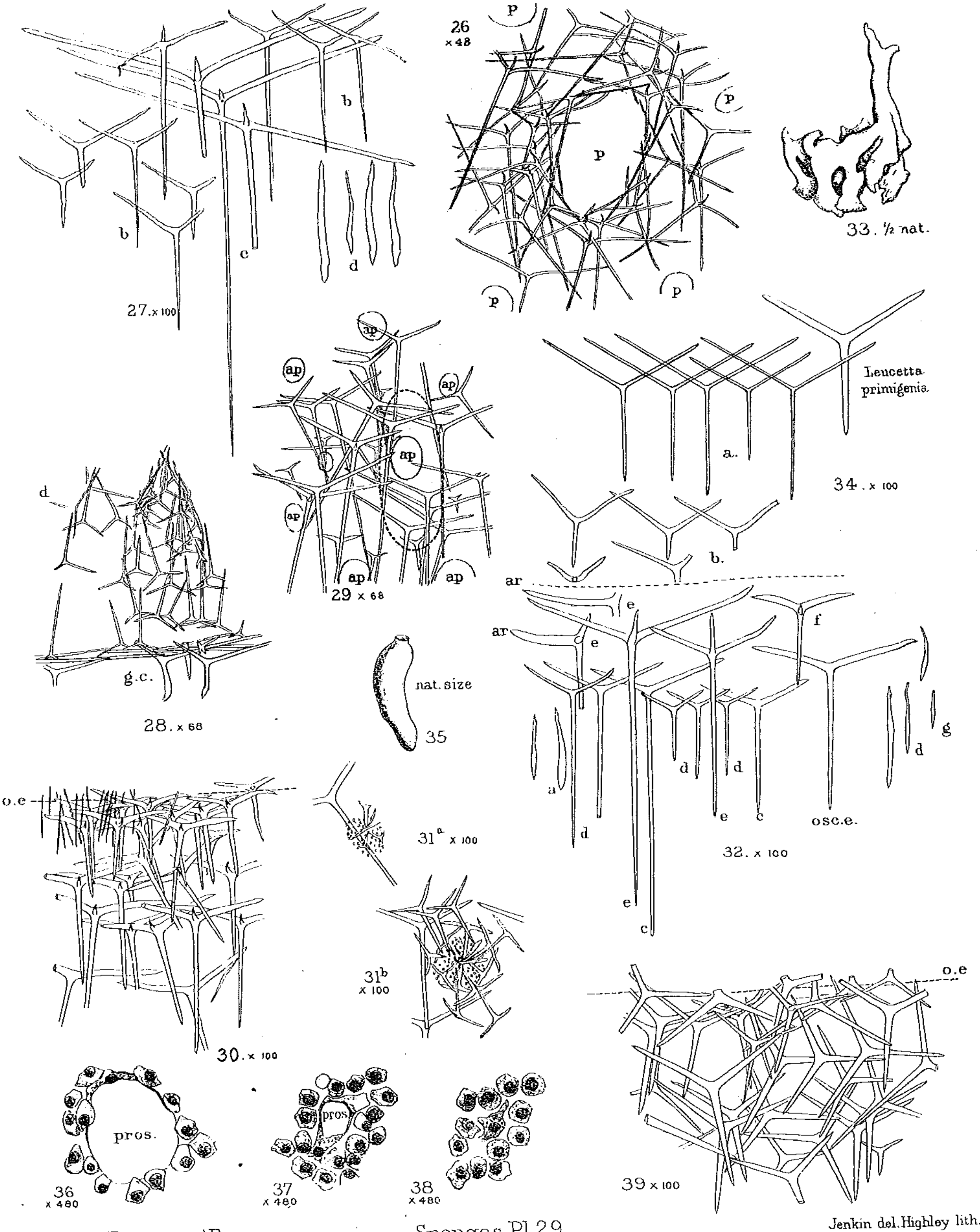

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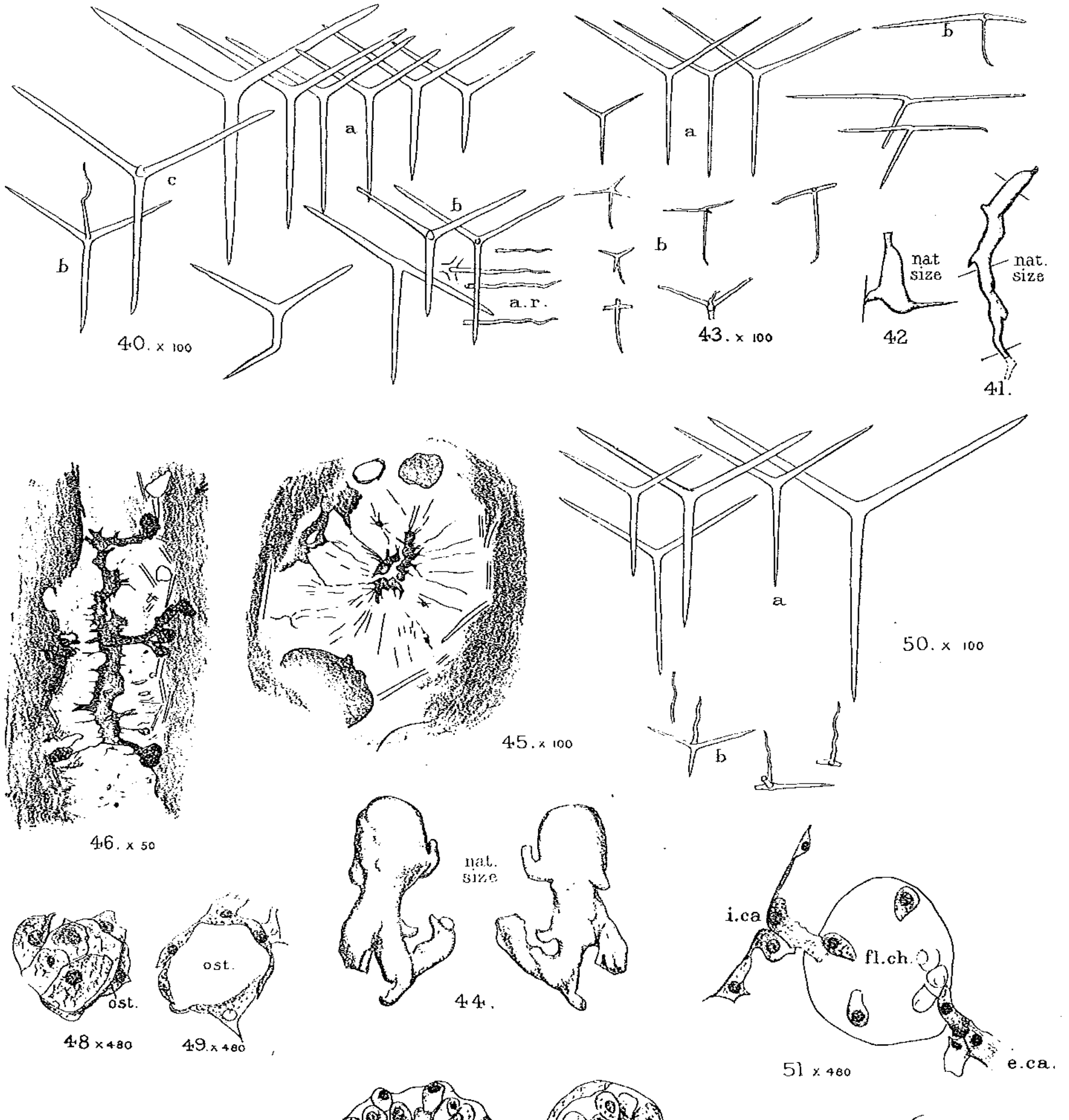

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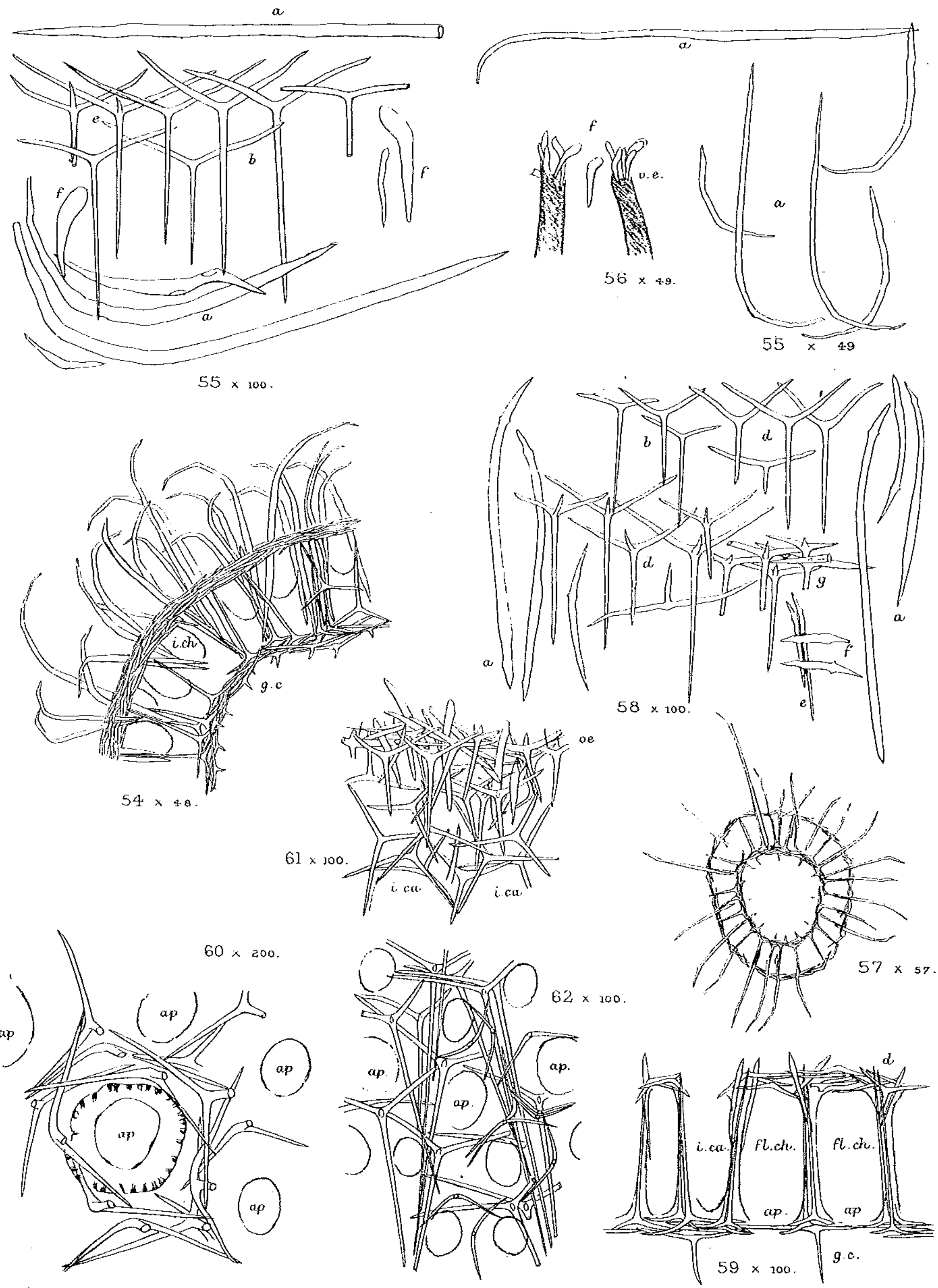
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55 x 49
54 x 48.
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61 x 100.
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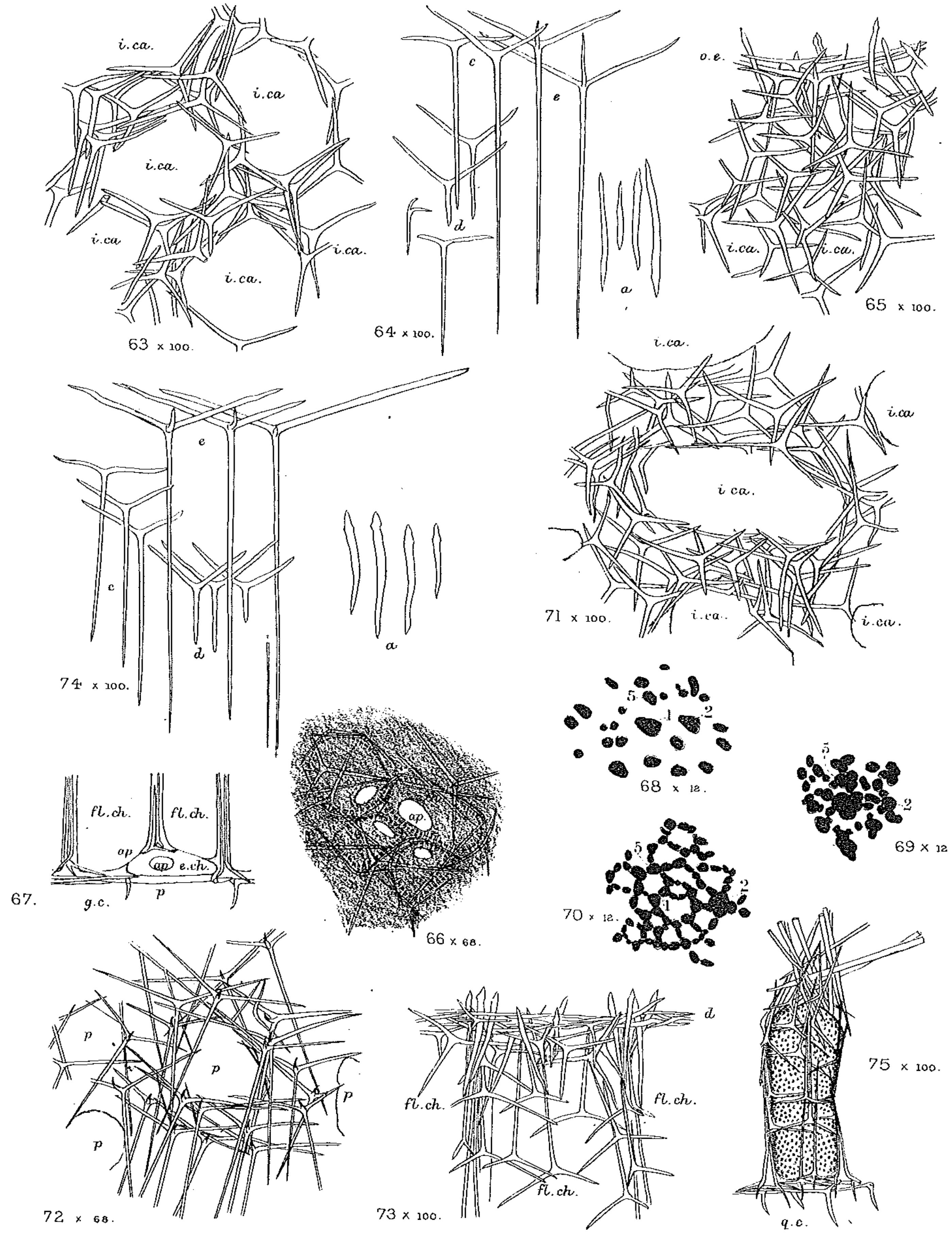
g.c
oe
i.ca.
ap
ap.
fl.ch.
g.c.



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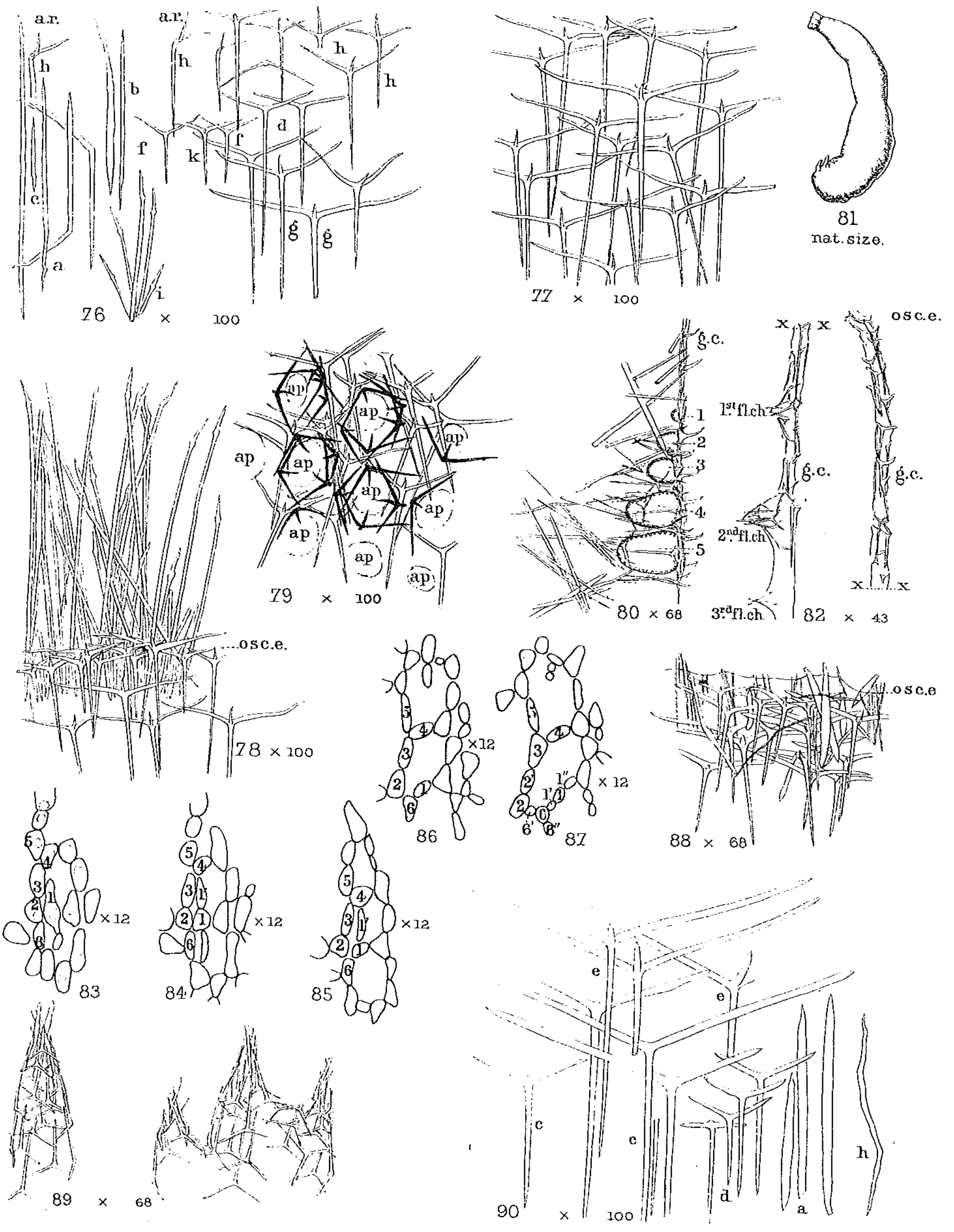

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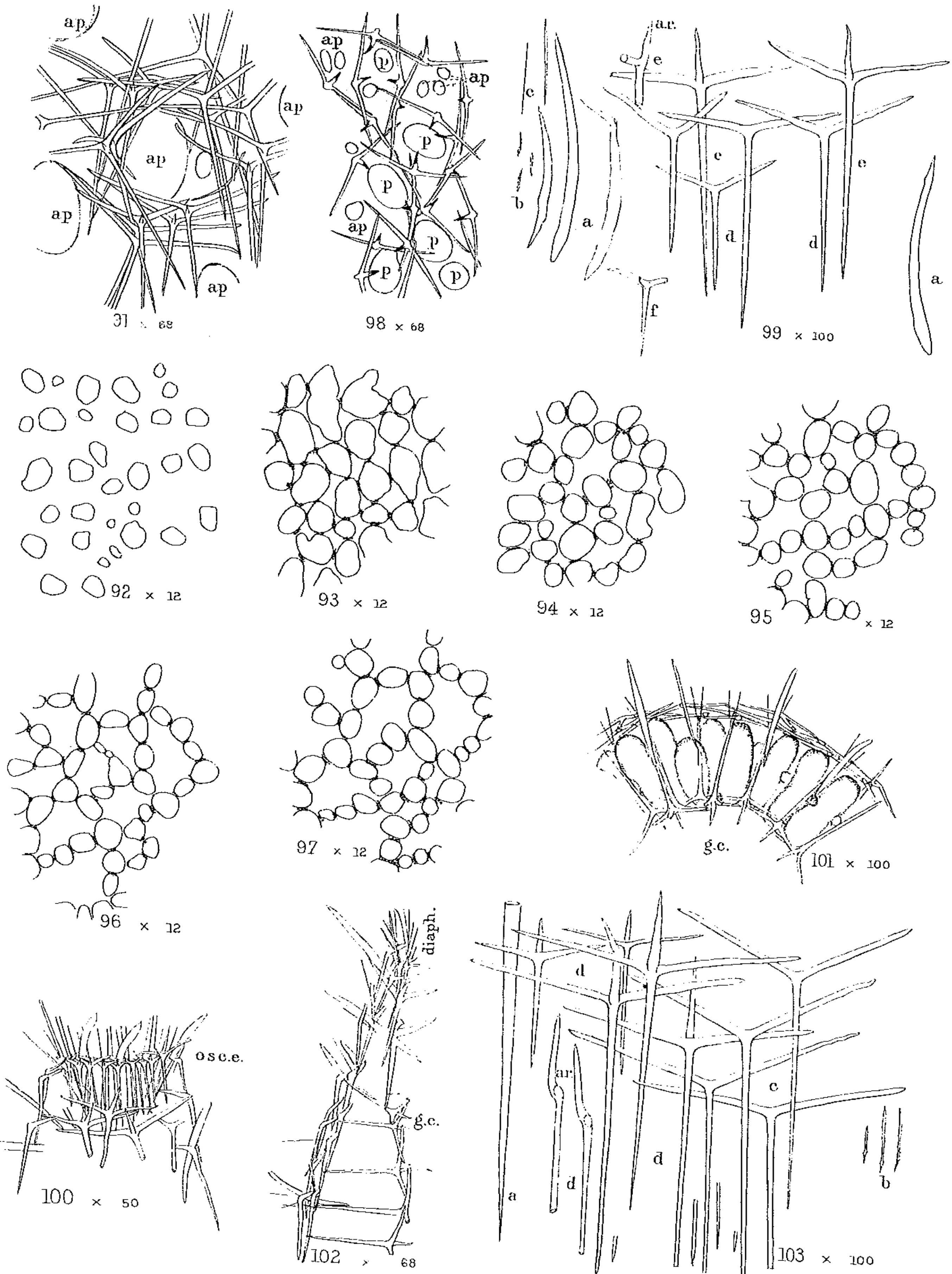

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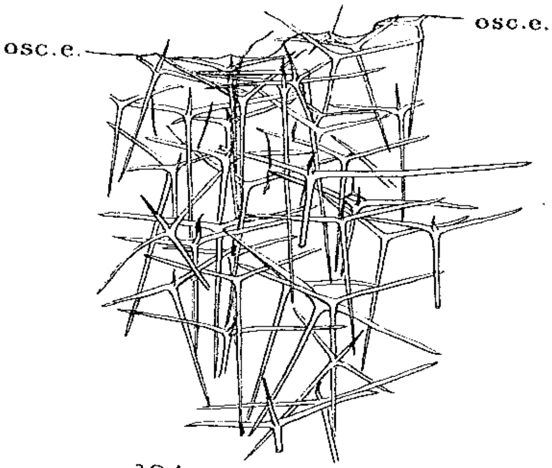

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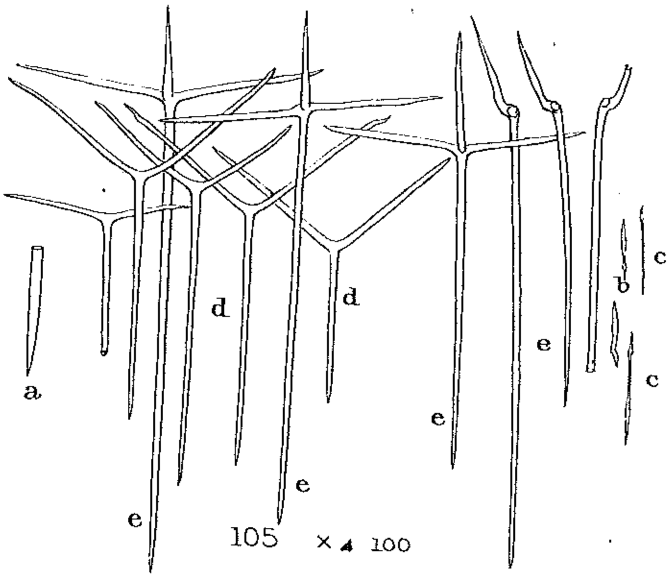

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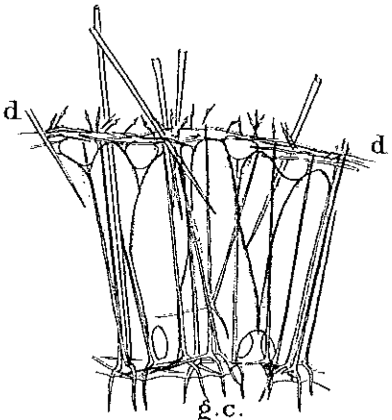

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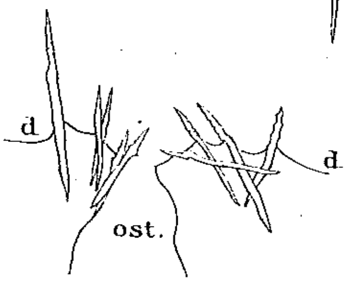

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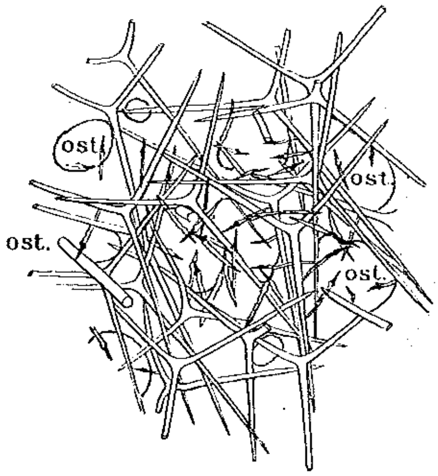

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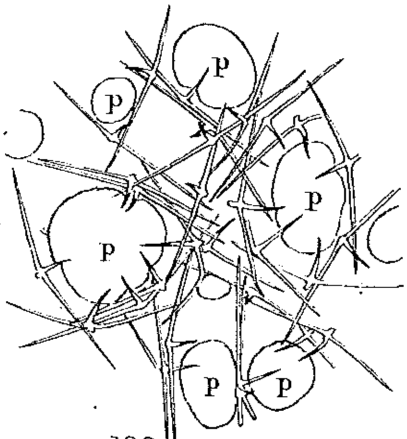

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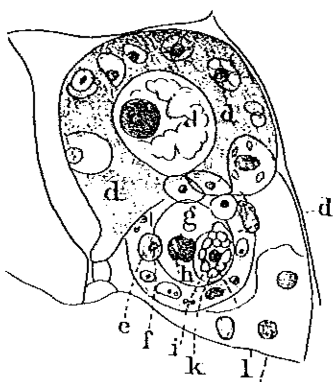

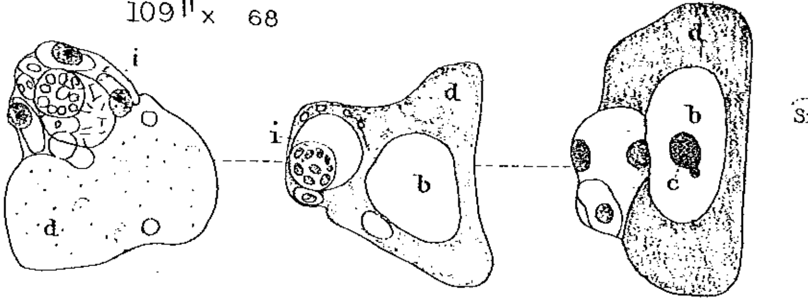

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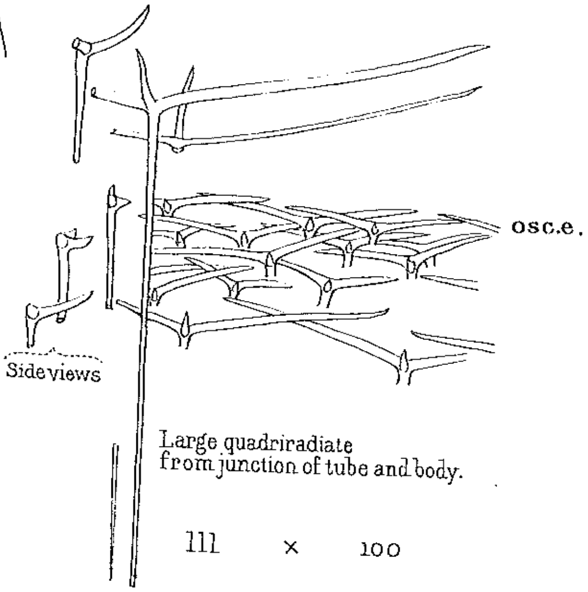

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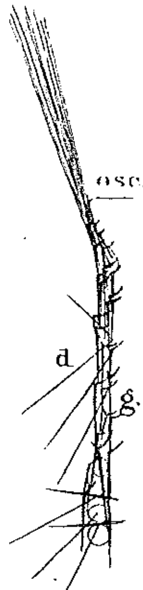

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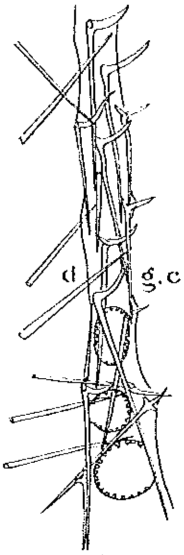

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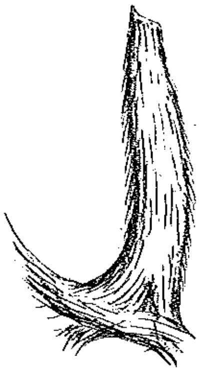
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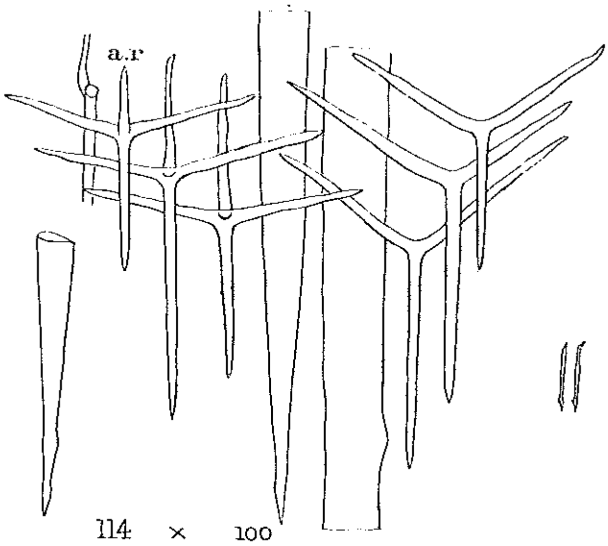

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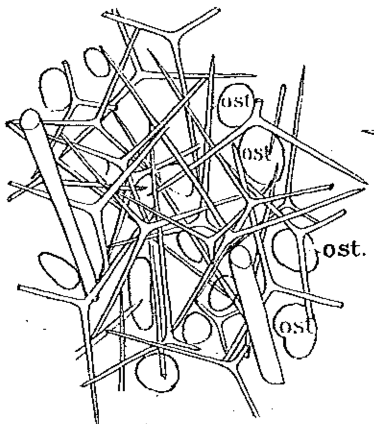

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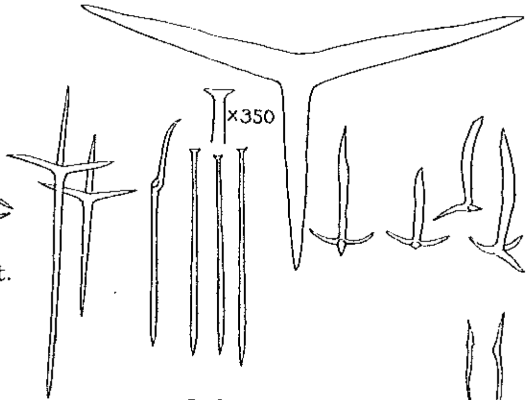

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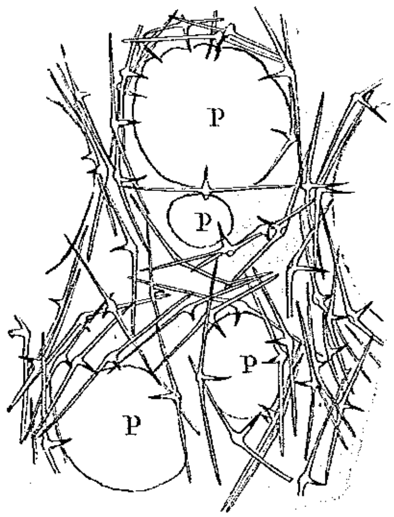

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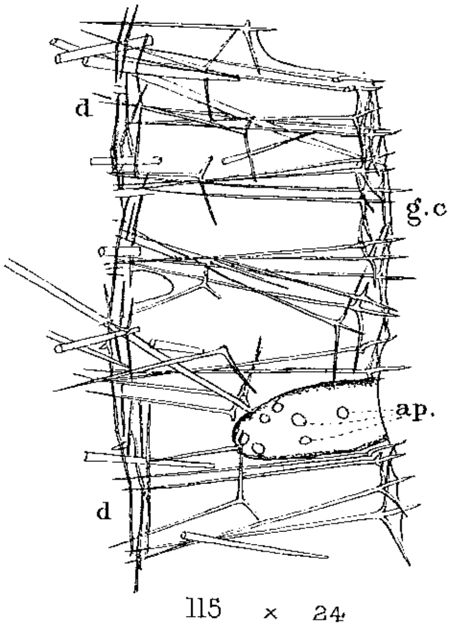

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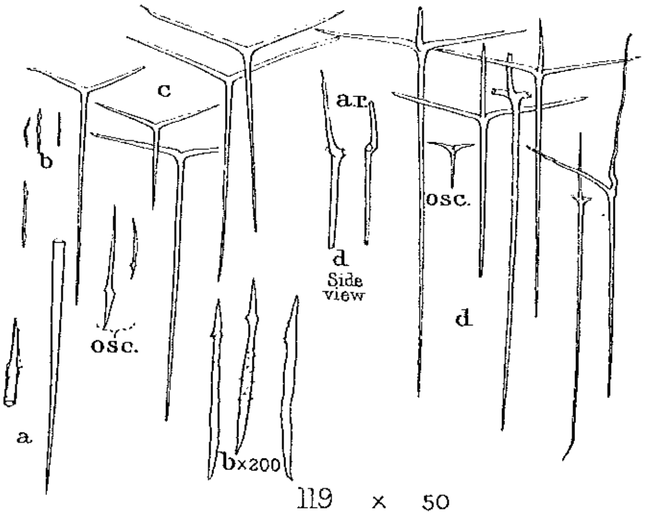

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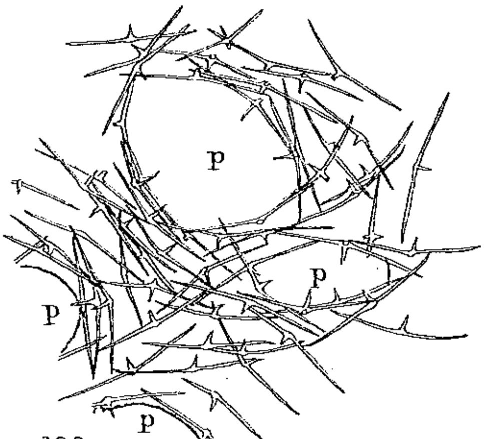

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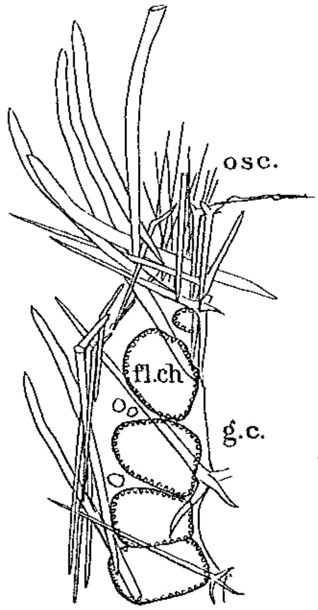

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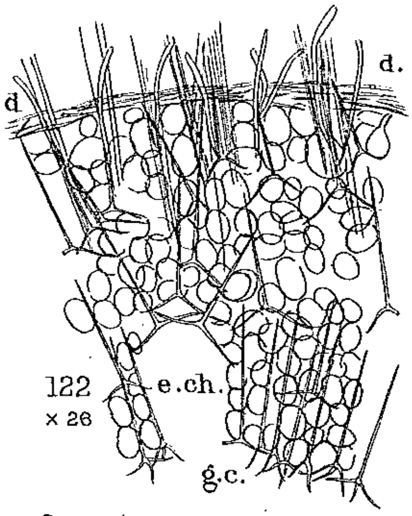

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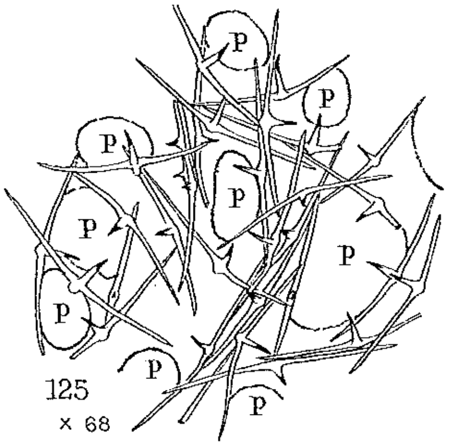

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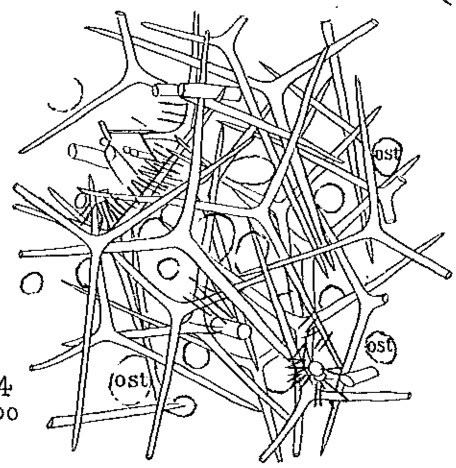

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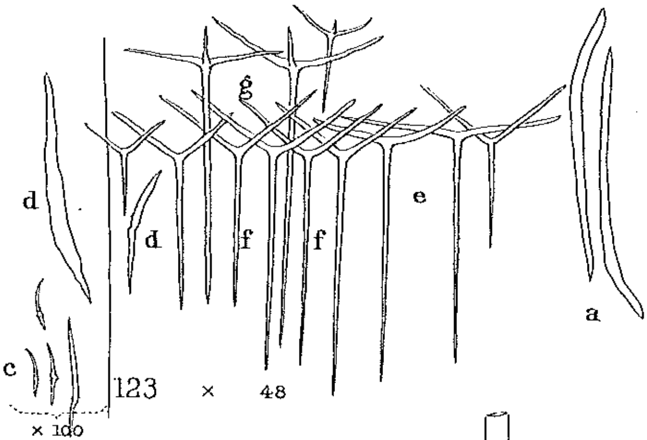

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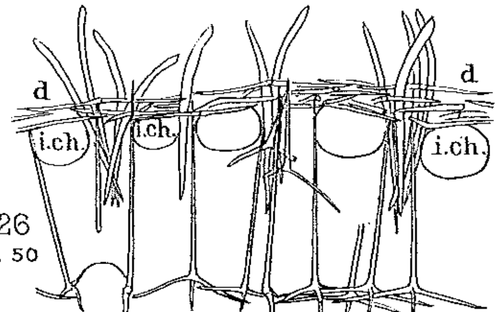

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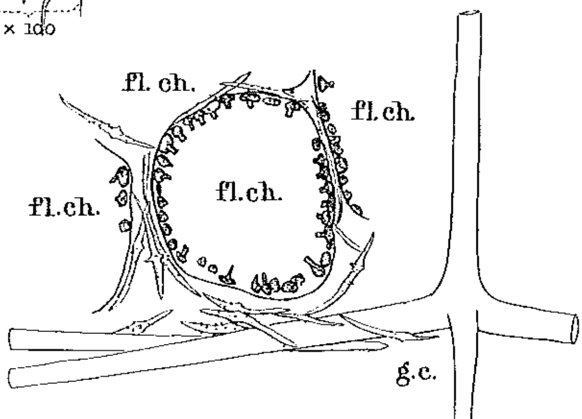

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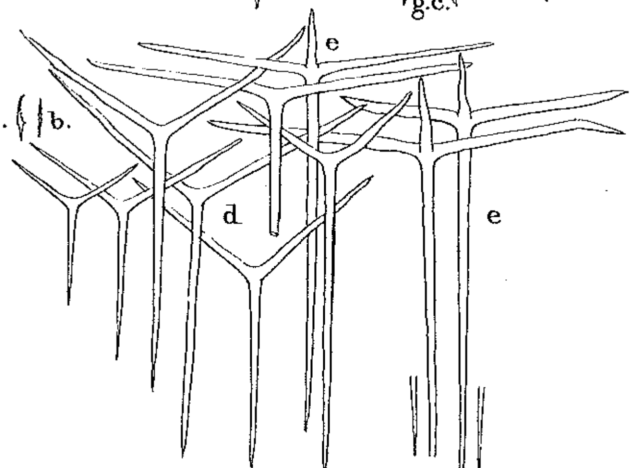

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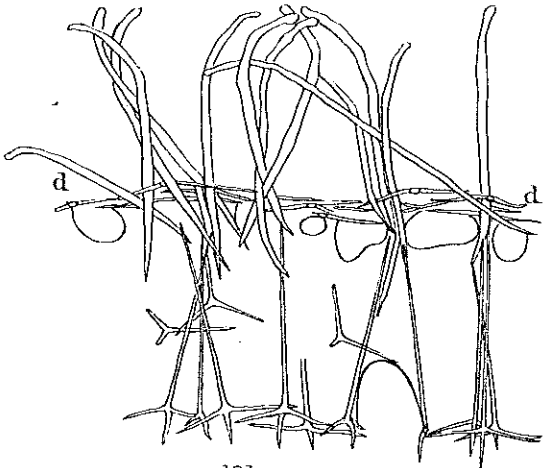
Antarctic (Discovery) Exp. Sponges Pl. 37. Jenkin del. Highley lith.



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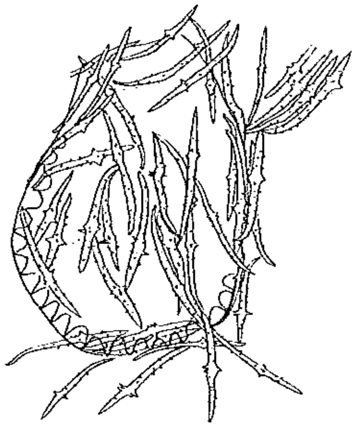
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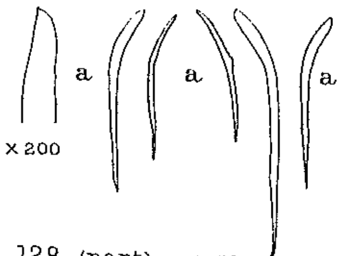

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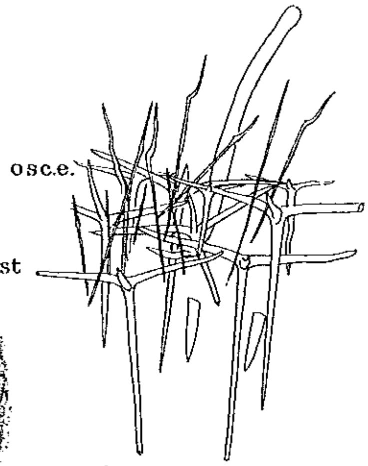

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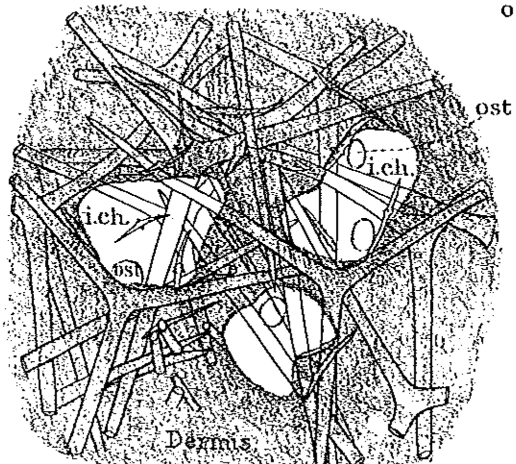

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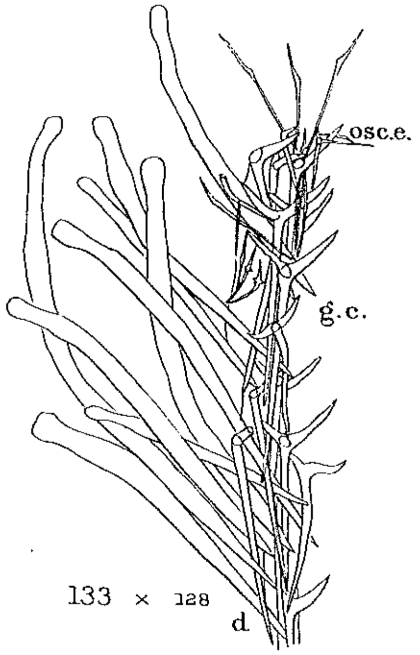

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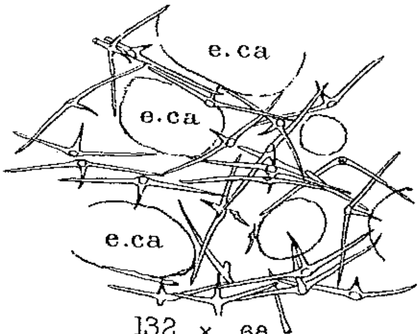

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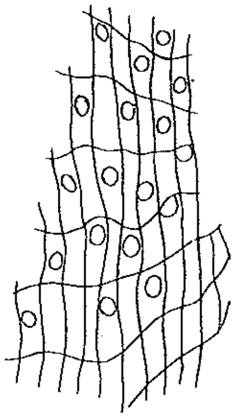
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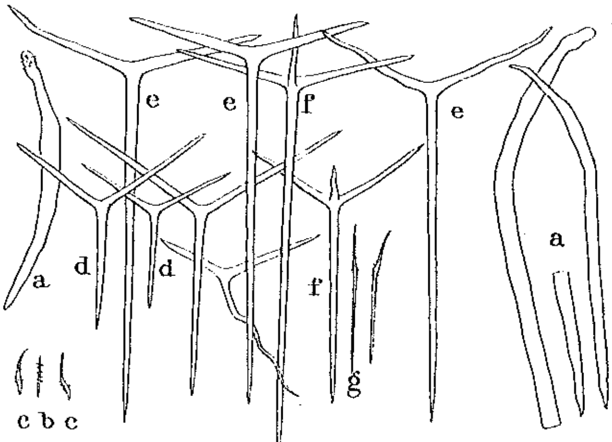

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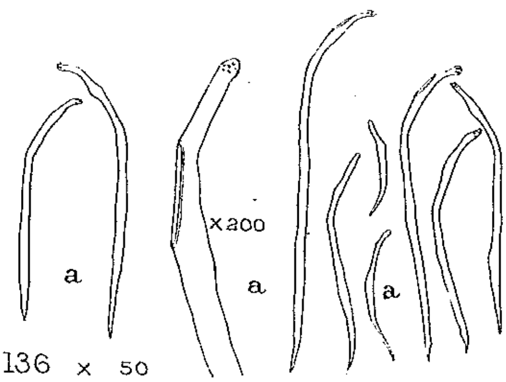

136 × 50

Jenkin del. Highley lith.

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