NEW GENERA OF MONAXONID SPONGES RELATED TO THE GENUS *CLATHRIA*.

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(Plates xxxvi.—xl., and three Text-figures.)

The new genera proposed in this paper are *Dendrocia, Allocia, Isociona, Paracornulum, Megaciella, Tenaciella, Axociella, Isociella, Isopenectya,* and *Paradoryx.* Reference to the last-mentioned, which is for the reception of certain species formerly incorrectly assigned to *Clathria,* will be found below in my remarks on the genus *Dendrocia;* the others are dealt with, each under its own heading, in the order in which they have been enumerated.

Genus Dendrocia, gen. nov.

Definition.—Desmacidonidae in which the microscleres are isochelae palmatae (perhaps sometimes accompanied by toxa), the main skeleton is formed of dendritically ramifying spiculospongin fibres cored with smooth slender styli (tornostyli) and echinated by small acanthostyli, and the dermal megascleres also are tornostyli, identical in kind with those coring the fibres.

Type, *D. pyramida* Lendenfeld (13).

In addition to the type-species, originally described as *Clathria pyramida,* this genus will include also *Clathria alata* Dendy. The former is from the coast of New South Wales, the latter from Port Phillip (4) and Western Australia (9).

The reason for the exclusion of these two species from the genus *Clathria* I have already indicated in a previous paper (6). In all indubitable species of *Clathria* the styli coring the skeletal fibres,—the *principal* styli,—are different in kind from those occurring dermally and interstitially,—the dermal or *auxiliary* styli. The former spicules are almost invariably more or less curved and gradually tapering (i.e. somewhat conical in shape), whilst the latter, with rare exception, are straight and through-

out almost their entire length approximately cylindrical. In *Dendrocia,* apparently, it is the auxiliary styli which both core the fibres and occur dermally and interstitially,—the spicules corresponding to the principal styli of *Clathria* being altogether absent.

In the paper above referred to (6),—in which also a corrected description of *D. pyramida* is furnished,— I suggested that certain species previously admitted in the genus *Clathria,* but distinguished by their non-possession of principal megascleres, might provisionally be referred to the genus *Wilsonella* Carter. I would now, however, restrict the latter genus to comprise only its type-species, *W. australiensis.* For the species which I designated *W. curvichela, W. dura* and *W. oxyphila,*— the microscleres (isochelæ) of which are not of the palmate type,—a new genus is required for which I propose the name *Paradoryx.* In this genus also,—of which *P. dura* may be considered the type,—almost certainly should be included *Clathria piniformis* Carter (2) and *Clathria elegantula* Ridley and Dendy.

The species which I described under the name *Wilsonella conectens* may be assigned provisionally to the genus *Clathria.*

Genus Allocia, gen. nov.

Definition.—Desmacidonidae in which the microscleres are isochelae palmatae (perhaps sometimes accompanied by toxa), the skeleton is a regular reticulation of spiculo-spongin fibre cored by smooth slender styli and echinated by small acanthostyli, and the dermal spicules are smooth amphistrongyla.

Type, *A. chelifera* Hentschel; the only species.

The single species for which this genus is established has been recorded by Hentschel from Western Australia (9) and the Arafura Sea (10) under the generic name *Spanioplon.* Its retention in that genus, however, is surely inadmissible, inasmuch as in *Spanioplon fertile,* the species for whose reception Topsent (21) established the genus, the smooth megascleres of the main skeleton are oxea, the extra-fibral smooth megascleres are tylostyli occurring only interstitially, and microscleres are wanting.

Genus Isociona, gen. nov.

Definition.—Desmacidonidae in which the microscleres are isochelae palmatae (perhaps sometimes accompanied by toxa),

the main skeleton is a renieroid or sub-renieroid reticulation of small acanthostyli, and the only additional megascleres present are smooth dermal styli or tylostyli belonging to the category of *auxiliary* megascleres.

Type, *I. tuberosa* Hentschel (9); the only species.

The species for which this genus is proposed was referred by its author to *Lissodendoryx*. Its exclusion from the latter genus, however, is necessitated by the fact that its isochelæ are of the palmate type. In some other respects also it departs from typical species of *Lissodendoryx* considerably. The species is from Western Australia.

Genus Tenacia O. Schmidt.

Definition.—Desmacidonidae in which the microscleres are isochelae palmatae and toxa (the latter sometimes occurring in dragmata), the main skeleton is a reticulation of well-developed spiculo-spongin fibres echinated by acanthostyli, and the additional megascleres are smooth styli incompletely differentiated, chiefly as regards size and situation, into three sorts occurring respectively (i.) within the skeletal fibres, (ii.) interstitially and subdermally, and (iii.) at the surface, directed perpendicularly thereto, forming a dense dermal skeleton.

Type, *T. clathrata* O. Schmidt (18).

The genus which in a former paper (6) I defined under the name *Rhaphidophlus* Ehlers, I now consider to be more correctly designated *Tenacia* O. Schmidt. This is chiefly in view of the fact that, whereas the identity of the latter has been definitely established by the re-description of *Tenacia clathrata* furnished by Wilson (25), the identity of the latter,—concerning which we have no other information than is contained in Ehler's imperfect description of *Rhaphidophlus cratitius* (5),—is open to question. The original publication of both generic names was in the same year, 1870; and it is now difficult to ascertain which has the absolute priority. The evidence, however, is in favour of *Tenacia*, for, whilst Schmidt's paper was listed in the Zoological Record for 1870, that of Ehlers received first mention only in the Record for 1872.

In spite of the rejection of the genus *Rhaphidophlus* by certain authors, the right to recognition of *Tenacia*, as distinct from *Clathria*, seems to me beyond dispute. In *Clathria* the styli coring the skeletal fibres—the *principal* styli as they are

commonly termed—are phylogenetically widely distinct from the dermal styli,—the former undoubtedly having been derived from acanthostyli* cognate with those echinating the fibres, while the latter are just as certainly homologous with the megascleres which function as dermal spicules throughout the majority of Desmacidonid genera, and which I (6, p. 137) have termed auxiliary megascleres. In *Tenacia,* on the other hand, and in the closely related genus *Tenaciella* described below, the three sorts of smooth styli which are present are not perfectly distinct in kind, but are connected by an uninterrupted series of spicules of intermediate size and form, thus clearly revealing their common derivation from an originally single type of styli. Whether it is from principal styli they are derived, however, or whether from auxiliary, is not clear. Their curved and slightly tapering form inclines rather to that which is characteristic, in general, of principal megascleres; but also they are provided basally with a cap of spinules, and in this respect they display a feature which, in every other instance of its occurrence, appears to be exclusively a peculiarity of auxiliary megascleres. In the case of *Tenacia,* the analogy in spiculation which it bears to various other related genera, as provided by the fact that the styli occurring within the skeletal fibres are destitute of basal spinules,** led me originally to consider these intrafibral styli as homologous with the similarly situated principal styli of *Clathria.* The evidence afforded by *Tenaciella canaliculata,* however,—in which species the transition of the several forms of smooth styli one into the other is gradual and

* I have elsewhere already suggested (7, p.454) that evidence is not lacking which points to the possibility that the acanthostyli of the Desmacidonidæ originated from spirasters or forms related thereto. The opinion to which I am inclined to subscribe is that the Desmacidonidæ have evolved from ancestors not remotely related to certain genera at present included in the family Spirastrellidæ; and that the classificatory distinction between Tetraxonida and Monaxonida, as originally proposed by Sollas (20) is fundamentally correct. From this point of view the principal and the echinating megascleres of the Desmacidonidæ are primitively derived from spicules homologous with the microscleres of the Spirastrellidæ, while in all probability their dermal megascleres are derived from spicules homologous with the tylostyli of the same family.

** I have, however, recorded the occasional occurrence of basal spinules in the case of some of the intrafibral spicules of *Tenacia paucispina* var. *multipora* (6, p.185).

unmistakable—proves conclusively that this view is erroneous. Thus my suggestion that *Clathriopsamma reticulata* Lendenfeld might be included in the genus *Rhaphidophlus* (now *Tenacia*) becomes untenable, and I now propose to recognise the genus *Clathriopsamma* as distinct.

The species known to me which I consider to belong to *Tenacia* are those (excepting *Clathriopsamma reticulata* and very probably also *Clathria spiculosa* Dendy) of which I have already furnished a list (6, p. 227) in connection with my previous remarks on *Rhaphidophlus;* and, in addition, *Rhaphidophlus filifer* var. *cantabrica* Orueta (15), and *Clathria typica* var. *porrecta* Hentschel (10), of whose existence I had not, at that time, information. Since then, also, have been described by Hentschel (10) *Clathria nuda* and *Clathria frondifera* var. *dichela;* and so far as can be judged from their descriptions and figures, it seems to me very probable that they too belong to *Tenacia.* Whether *Tenacia arcifera* O. Schmidt is another species properly to be included in the genus, I am unable to say, not having seen its description.

Genus Clathriopsamma Lendenfeld.

Definition.—Desmacidonidae in which the microscleres are isochelae palmatae and rhaphidiform toxa (the latter typically indistinguishable from long slender oxea, and in part occurring in dragmata); in which the main skeleton is an irregular reticulation of spiculo-spongin fibres, of which the main (if not also the connecting) fibres are cored by foreign bodies and by smooth (principal) styli, and are echinated by small acanthostyli; and in which the auxiliary megascleres, occurring both dermally and scattered interstitially, are smooth slender styli or tylostyli, typically provided on the basal extremity with a cap of minute spinules.

Type, *C. reticulata* Lendenfeld; the only species.

Of the two species which Lendenfeld (6, p. 227) referred to his genus *Clathriopsamma,* the first-described, *C. lobosa,* is now known to be identical with *Wilsonella australiensis.* The other, *C. reticulata,*—of which I have already furnished a brief redescription in a former paper (6, p. 177),—possesses characters which appear to me sufficiently distinctive to warrant our retention of the genus *Clathriopsamma* for its reception.

Genus PARACORNULUM, gen. nov.

Definition.—Desmacidonidae typically of massive or encrusting habit, in which the microscleres, when present, are isochelae palmatae and (or) toxa, and the megascleres are of two kinds, viz., smooth amphistrongyla or amphitornota (perhaps always with spinulous extremities) forming the main skeleton, and small acanthostyli, acanthoxea, or acanthostrongyla occurring scattered.

Type, *P. dubium* Hentschel (10).

I define this genus to comprise, in addition to Hentschel's *Cornulum dubium* (which is from the Arafura Sea), two other species, both imperfectly known, viz., *Cliona purpurea* Hancock,—lately referred by Kirkpatrick (11) to his genus *Dyscliona,* but subsequently found by Topsent (22) to possess isochelae palmatae and toxa,—and *Suberites fuliginosus* Carter. The last-named (the locality of which is doubtfully given as Torres Strait) is possibly without microscleres, inasmuch as Carter makes no mention of their presence; nevertheless its considerable resemblance to the other two species—and more especially to *P. purpurea*—in the matter of megascleric spiculation, points to the probability of its close relationship thereto.

Paracornulum appears to stand in the same relation to *Cornulum* as *Histodermella* Lundbeck (14) to *Histoderma.*

Genus MEGACIELLA, gen. nov.

Definition.—Desmacidonidae in which the microscleres are isochelae palmatae and non-spinulous toxa (the latter in part attaining to extreme length), the main skeleton is an irregular and confused arrangement of very long smooth styli united by a minimal amount of spongin, and the only additional megascleres are dermal amphitylota, typically with spinulous extremities.

Type, *M. pilosa* Ridley and Dendy; the only species.

Amphilectus pilosus Ridley and Dendy (17) bears in many respects considerable resemblance to two species at present included in the genus *Artemisina,* viz., *A. annectens* Ridley and Dendy and *A. strongyla* Hentschel (11),—and, indeed, is especially distinguished from them only in the fact that its toxa are without spinulous extremities and are in part transformed into oxea-like spicules of extraordinary length. In view, however of the constancy of form maintained by the toxa through-

out the several species of *Artemisina*, it seems advisable to continue to regard them as an essential characteristic of that genus. Consequently, as there is no other established genus to which *Amphilectus pilosus* might be referred, a new one for its reception is required.

Genus Tenaciella, gen. nov.

Definition.—Desmacidonidae in which the microscleres are isochelae palmatae and toxa, the main skeleton is a reticulation of strongly developed spiculo-spongin fibre, and the megascleres are smooth styli incompletely differentiated into three kinds occurring respectively (i.) within the fibres, (ii.) interstitially and subdermally, and (iii.) at the surface, directed perpendicularly thereto, forming a dense dermal skeleton.

Type, *T. canaliculata* Whitelegge (23); the only species.

This genus differs in no essential respect, save in the absence of acanthostyli, from *Tenacia* O. Schmidt as defined above.

Tenaciella canaliculata Whitelegge.

(Pl. xxxvi., figs. 1, 2; Pl. xxxvii., fig. 1; Text-fig. 1.)

1906. *Esperiopsis canaliculata*, Whitelegge, Austr. Mus. Mem., iv., Part 9, p. 471, Pl. xliii., fig. 7.

External characters.—The sponge is erect, stipitate, ramose, with from few to numerous, cylindrical to irregularly subcylindrical, occasionally anastomosing branches, varying from 6 to 11mm. (but usually about 8 or 9mm.) in diameter (Pl. xxxvii., fig. 1). Of fifteen specimens available, the largest measures 195mm. in total height. The length of the branches seldom exceeds 100mm., and is usually less than 65mm.; and the stalk, which is no stouter or only slightly stouter than the branches, may reach a length of 60mm. The mode of branching is such that successive branches tend to be given off in the same plane, with the consequence that sparsely branched specimens are often somewhat flabellate. The consistency of the sponge in alcohol is tough, compressible and resilient, and the colour brownish grey; dry specimens are slightly brittle, and their colour on the surface is pale brownish or yellowish grey.

The dermal membrane is exceptionally well-developed, forming a firmly and closely adherent, not very tough skin, about $\frac{1}{5}$mm. in thickness. In dry specimens undamaged by macera-

tion it persists intact, with smooth, unwrinkled surface, and is of somewhat corky (rather than leathery) consistency. In spirit-specimens the membrane is rather fleshy in appearance, and the surface of the sponge is smooth, almost glabrous. The dermal pores cannot be discerned.

An especially distinctive external feature of the species is the presence, on each branch, of a more or less well-marked longitudinal groove, extending along the whole or greater part of its length. This groove marks the course of a main excurrent canal, which runs subjacent to it immediately beneath the dermal membrane. The groove, in all probability, is not a feature of the living sponge, but is due to collapse of the dermal membrane in consequence of contraction.

Maceration of the sponge by means of caustic potash removes not only the dermal membrane, but also an additional layer of the sponge to a depth of about 1mm. from the surface. This is owing to the almost complete absence of spongin in the outer portion of the main skeleton. The skeleton which remains is a rather coarse-textured reticulation of yellowish-grey fibres, harsh to the touch; it shows no trace of the longitudinal groove which is so conspicuous a feature of the intact sponge.

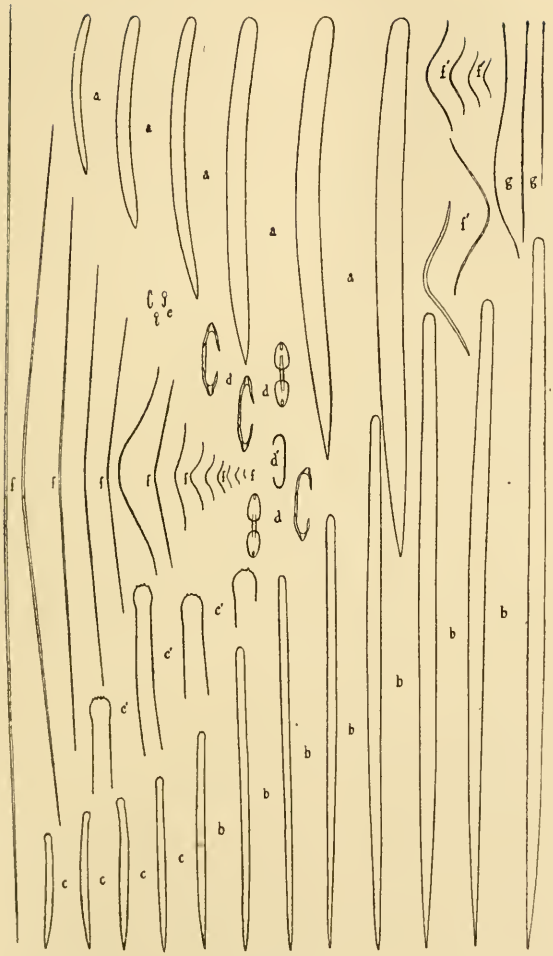
Skeleton.—Examined microscopically in longitudinal median section (of an unmacerated branch of the sponge) the main skeleton presents three usually fairly well-marked regions, viz., a central, an intermediate, and a subdermal. The central region (Pl. xxxvi., fig. 2), occupying the whole interior to within from 1 to 1.5mm. of the surface, consists of an irregular, rather wide-meshed reticulation of brownish yellow, multispicular spongin-fibres,—with the main fibres running more or less nearly longitudinally (the more peripherally situated ones, however, gradually trending surfacewards), and connected together, in irregular fashion, both by transverse fibres and by inosculation among themselves. From the outermost fibres of this region, short fibres branch off, which run directly outwards to the surface in a direction usually not far from perpendicular thereto; these, which may be termed the radial fibres, are (excepting for an extremely short distance beyond their origin) apparently entirely devoid of spongin; are unconnected by transverse fibres; and, after a short course (throughout which their spicules are arranged compactly side by side), subdivide to form each a widely-outspread, usually rather dishevelled

brush of spicules, the outer extremities of which impinge upon and sometimes slightly project beyond the dermal membrane (Pl. xxxvi., fig. 1). The brushes occur so closely situated that their spicules intercross with one another, and the latter are so numerous that collectively they produce an appearance as of a continuous, somewhat halichondroid layer of spicules underlying and supporting the dermal skeleton. The intervening zone between this subdermal layer and the central skeleton, traversed by the radial fibres, constitutes the second or intermediate region of the skeleton above referred to; and the subdermal layer itself, the third. It is these two regions of the main skeleton which, together with the dermal layer, are removed by the action of caustic potash.

The main longitudinal fibres of the skeleton range in stoutness from about 140 to 260μ, the connecting fibres between them from about 45 to 180μ. Their constituent spicules, as a rule, are not so aggregated as to form a compact axial core surrounded by a zone or sheath of spongin free from spicules, but tend to be dispersed more or less completely throughout the entire spongin substance. The radial fibres (which, as already stated, are composed solely of spicules) are scarcely less in stoutness than the main fibres. The connecting fibres, when shortest, are of a single spicule's length, and contain sometimes only three or four spicules; but more frequently they are longer, and occasionally the number of their contained spicules is such that they approximate in appearance to the main fibres. The irregular pattern of the skeleton-reticulation is due partly to the fact that the main fibres run rather crookedly (and, hence, at varying distances apart), and partly to the fact that the direction of the longer connecting fibres between them is usually more or less oblique. Between the fibres very numerous loose megascleres are scattered, the great majority of which are similar or nearly similar in kind to those composing the subdermal brushes; but amongst them there are also very many which are identical in shape and size with the dermal spicules, and also a moderate number similar in every respect to those of the fibres. The microscleres, both toxa and chelae, occur scattered everywhere in moderate abundance, except in the dermal layer. The chelae are of two kinds, but the smaller are very difficult to perceive, in ordinary sections, owing to their minute size.

Megascleres.—(i) The styli of the fibres (Text-fig. 1, *a*) are, almost without exception, more or less curved, and of nearly uniform diameter throughout the greater part (not less than two-thirds) of their length, tapering thence gradually to a sharp point; as a rule they are slightly stouter in the middle than at their base. Their curvature is generally greatest in the case of the shorter spicules, and is such that the summit of curvature is usually not very far distant from the mid-point of the spicule. They vary rather considerably in size in the same specimen, but not much as regards their maximum size in different specimens. In the particular specimen in which, of all those examined, the megascleres were of smallest dimensions, the range in size of the fibral spicules was from 130 × 6μ to 410 × 22μ while in the specimen with the largest spicules it was from 160 × 10μ to 465 × 26μ. The smallest of them, up to an observed size of 230 by 13μ, occasionally exhibit a faint spinulation on the summit of their basal extremity, similar to (but much less distinct than) that which is characteristic of the dermal spicules. Proceeding towards the outer extremities of the radial fibres, the fibral megascleres become gradually more uniform in size and of greater average length than in the more interiorly situated fibres of the skeleton, and finally, in the subdermal brushes, become indistinguishable from the next-described or interstitial styli.

(ii.) The styli composing the subdermal brushes and occurring also in great numbers scattered interstitially (Text-fig. 1, *b*), are invariably straight or nearly so; are usually considerably stouter near the middle than at the base; and taper (throughout more than one-third, at least, of their length) gradually to a sharp point. Amongst those occurring interstitially, however, there is comprised a complete series of forms, of progressively diminishing size, the smallest of which are identically similar in every respect to the dermal styli. Their maximum size varies in different specimens from about 520 × 13.5μ to 590 × 16μ. The smallest spicules of which the form approximates more closely to that characteristic of the largest interstitial spicules than to that characteristic of the dermal spicules are usually not much less than about 240× 10μ in size. Up to this size, almost without exception, the interstitial spicules are provided basally with a small cap of spinules; and even spicules of considerably greater length are often similarly pro-



Text-fig. 1.

Tenaciella canaliculata. *a*, styli of the fibres; *b*, interstitial and subdermal styli; *c*, dermal styli; *c'*, basal extremities of dermal styli, more highly magnified; *d*, larger isochelæ; *d'*, early developmental stage of a larger isochela; *e*, smaller isochelæ (some of which are contort); *f*, toxa; *f'*, smallest toxa, more highly magnified; *g*, megascleres of an embryo.

vided: the largest observed spicule with spinules measured 475 × 12μ.

(iii.) The dermal spicules (Text fig. 1, *c*) are slightly to moderately curved subtylostyli, with somewhat fusiform shaft, and invariably provided with a cap of spinules on the basal extremity. Those located actually in the dermal skeleton range from about 100 up to 165μ in length and up to 7.5μ in stoutness; but spicules of similar form, occurring scattered between the skeletal fibres, range in size up to occasionally as much as 240 × 10μ. In their earliest developmental stages the dermal spicules are extremely slender tylostyli, the smallest of which are only about 80μ in length.

Microscleres.—(i.) The larger isochelae palmatae (Text-fig 1 *d*,) are of the ordinary type occurring in *Clathria* and related genera, and measure from 14 to 22μ in length.

(ii.) The smaller isochelae palmatae (Text-fig 1, *e*), like those of *Rhaphidophlus typicus* Carter, are peculiar in being frequently asymmetrical with respect to their opposite extremities, —the asymmetry being such as would result through torsional rotation of one end of the shaft through an angle of 90°. They appear often to be somewhat abnormal in other respects also, but the details of their form are difficult to make out owing to their very minute size. They measure only from 4 to 8μ in length.

(iii.) The toxa (Text-fig. 1, *f*, *f*,) comprise an apparently complete series of forms, of gradually varying shape, ranging in length from less than 10μ up to occasionally as much as 800 μ The shortest and by far the most numerous,—seldom much exceeding 80 or 90μ in maximum length,—are more or less distinctly tricurvate; those of intermediate length have the arms straight or nearly so, and are bent in the centre somewhat angulately; and the longest are mostly quite straight, resembling extremely long and slender, rhaphidiform oxea. The last-mentioned,—although usually difficult to discover in sections of the sponge owing to the multitude of other spicules,—are in some specimens by no means rare; but in others they appear to be almost entirely absent. In one of the latter specimens, the longest rhaphidiform toxa that could be found measured only 360 × 2μ; whereas in the specimen in which they were most numerous, the longest one observed measured 810 × 4.5μ.

Embryos.—Most of the specimens contain not very numerous,

scattered embryos, the largest of which are more than 1mm. in diameter and are provided with irregularly scattered megascleres in the form of excessively slender, straight to flexuous styli (Text-fig. 1 *g*), mostly with a bead-like dilatation just above the basal extremity, and ranging in length from less than 80 up to about 200 μ. (The specimens were collected about the middle of the month of March.)

Loc.—Coast of New South Wales, off Wata Mooli (52-71 fms.), off Bulgo (57-63 fms.), and off Wollongong (55-56 fms.). "Thetis" Expedition.

Genus AXOCIELLA, gen nov.

Definition.—Desmacidonidae with isochelae palmatae and (or?) toxa as microscleres, and of erect lamellar or ramose habit: in which the main skeleton consists axially of a condensed reticulation of strongly-developed spiculo-spongin fibres, and extra-axially of strands or bundles of spicules (perhaps sometimes reduced to single spicules) directed radially; and in which the megascleres are smooth styli of three kinds, occurring respectively (i.) in the fibres of the axial reticulation, (ii.) in the radial strands, and (iii.) interstitially and dermally. Typically the fibral megascleres are scarcely different from those of the extra-axial strands except in being of smaller size, and are connected with them by intermediate forms; but the dermal megascleres are quite distinct, and belong to the category of auxiliary megascleres.

Type, *A. cylindrica* Ridley and Dendy; the only species.

I identify the type-species of this genus with Ridley and Dendy's *Esperiopsis cylindrica.* The sponge recorded by Whitelegge (23) under the same name is a quite distinct species, which it will be convenient to include provisionally in the genus *Ophlitaspongia;* and as the species is a new one I propose for it the name *O. thetidis.**

* In this species,—of which a figure illustrating the external form has been provided by Whitelegge (23, Pl. xliii., fig.6) and another (showing a much more profusely branched specimen) is given here (Pl. xxxviii.),—the skeleton is reticulate throughout, fairly regular in pattern, and scarcely or not at all condensed axially (Pl. xxxix., fig.2). The main fibres, which vary in stoutness from about 50 to 150μ, are only very sparsely cored with smooth stylote megascleres (ranging in size from less than 200 × 10μ to rarely upwards of 600 × 20μ) in the more interior

Axociella cylindrica Ridley and Dendy.

(Pl. xxxvii., figs. 1, 2, 3; Text-fig. 2.)

1886. *Esperiopsis cylindrica,* Ridley and Dendy (16), p. 340.
1887. *Esperiopsis cylindrica,* Ridley and Dendy (17), xx., p. 79, Pl. xix., figs. 2, 2*a*, 2*b*.

External features.—The single specimen (Pl. xxxvii., fig. 4) upon which the following description is based closely agrees in outward habit with the original specimen. It is a sparsely and dichotomously ramose sponge, with relatively long and slender, distally tapered, cylindrical branches, measuring up to 4.5μ in stoutness and up to 128mm. in uninterrupted length. In the present specimen the stalk is missing: that of the original example measured 187mm. in length, and had a flattened, branching base, 19mm. in diameter. The surface of the sponge is

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region of the skeleton; but on nearing the surface their spicules increase greatly in number and also rather considerably in average dimensions (attaining in some specimens to upwards of 800 × 30μ in maximum size) and assume a more and more plumose disposition, finally forming at the extremity of the fibre a scopiform tuft,—while at the same time the spongin-substance gradually diminishes in quantity to the verge of disappearance. The connecting fibres are of a single spicule's length, and contain only one or two spicules. The dermal megascleres proper are, apparently, relatively very few, but their true number and manner of arrangement cannot be ascertained, since, unfortunately all the specimens are in a dried and washed-out condition and entirely destitute of dermal membrane; they are straight to flexuous styli or subtylostyli, usually with a slightly truncated basal extremity capped with a few indistinct spinules, and ranging from 165 to 350μ in length and up to 5μ in diameter. In the peripheral region of the skeleton, lying between the main fibres, and directed parallelly thereto, there occur,—sometimes singly, sometimes several together in a parallel bundle (dragma),—long and relatively slender, usually symmetrically or flexuously curved, rhaphidiform oxea: these,—which presumably are derivatives of toxa,—appear to vary, both in number and in size, very considerably in different specimens, and are possibly sometimes very rare; in one of the specimens examined they ranged only from about 300 to (very rarely) slightly above 700μ in length and up to 5μ in diameter, whereas in another they were seldom less than 850μ long and attained a maximum size of 1280 × 9μ. Isochelae palmatae, 12 to 16μ long, and tricurvate toxa, ranging from 25 to rarely upwards of 130μ in length, and up to 4μ in stoutness, are scattered fairly abundantly through all parts of the interior.

finely hispid with the points of projecting spicules. The dermal membrane is thin and closely adherent; the dermal pores could not be discerned. Oscula are apparently absent. In alcohol the colour is yellowish-grey, the texture dense, the consistency fairly firm and tough; the branches, however, are lax, not stiff. The original specimen apparently was more rigid, since its consistency has been described as hard and tough. As a result of maceration (by means of caustic potash) a thin superficial layer of the sponge, of softer consistence, disappears, and there is left a dense, solid-looking core, the surface of which presents a somewhat bristly appearance due to the stubs of radially-directed, detruncated spicule-strands.

Skeleton.—The skeleton (Pl. xxxvii., fig. 3) presents, in each branch of the sponge, a very dense axial region, or core, occupying from about one-third to somewhat above one-half the diameter of the branch, and composed chiefly of longitudinally-running, closely apposed, sponginous fibres containing each a fairly compact core of moderately short and slender, slightly curved styli. These main fibres are connected, partly by very short and inconspicuous, aspicular to paucispicular, transverse fibres, and partly also by occasional inosculation with one another, to form an indistinct reticulation with elongated, very narrow meshes. Also participating in the formation of the axial skeleton are rather numerous slender straight styli, similar in every way to those composing the dermal spicule-bundles. These auxiliary, extra-fibral styli are directed parallelly to the main fibres, and are aggregated for the most part into bundles and strands. In the youngest portions of the sponge, towards the extremities of the branches, spongin is developed only to an extremely slight extent (Pl. xxxvii., fig. 2); but in the older portions it increases in quantity till finally the interstices of the axial skeleton are entirely obliterated. The outermost fibres of the axial skeleton, however, remain always comparatively scantily provided with ensheathing spongin; and the pattern of the peripheral zone of the axial skeleton is generally somewhat irregular and confused.

From the outermost fibres of the axial skeleton there proceed outwards to the surface, perpendicularly or nearly so thereto, numerous short, non-plumose paucispicular columns of comparatively long and stout styli—the points of the (slightly divergent) terminal ones of which impinge upon, or project

slightly beyond, the dermal membrane. These radial columns are usually not much longer than the largest spicules composing them,—thus approximating in character rather to bundles or tufts; are unconnected by transverse fibres or spicules; and are entirely unprovided with spongin except proximally for a short distance beyond their origin from the longitudinal fibres. Outside the axial skeleton, in a narrow zone immediately surrounding it, there also occur numerous long slender auxiliary styli directed longitudinally. The dermal skeleton is composed of numerous parallel or slightly penicillate tufts of the same spicules, the extremities of which usually project somewhat beyond the surface.

The microscleres are numerous isochelae palmatae and scarce toxa, the former occurring most abundantly in the superficial layers of the sponge and only very sparsely within the interstices of the axial skeleton, whilst the toxa are almost entirely confined to the latter region of the skeleton.

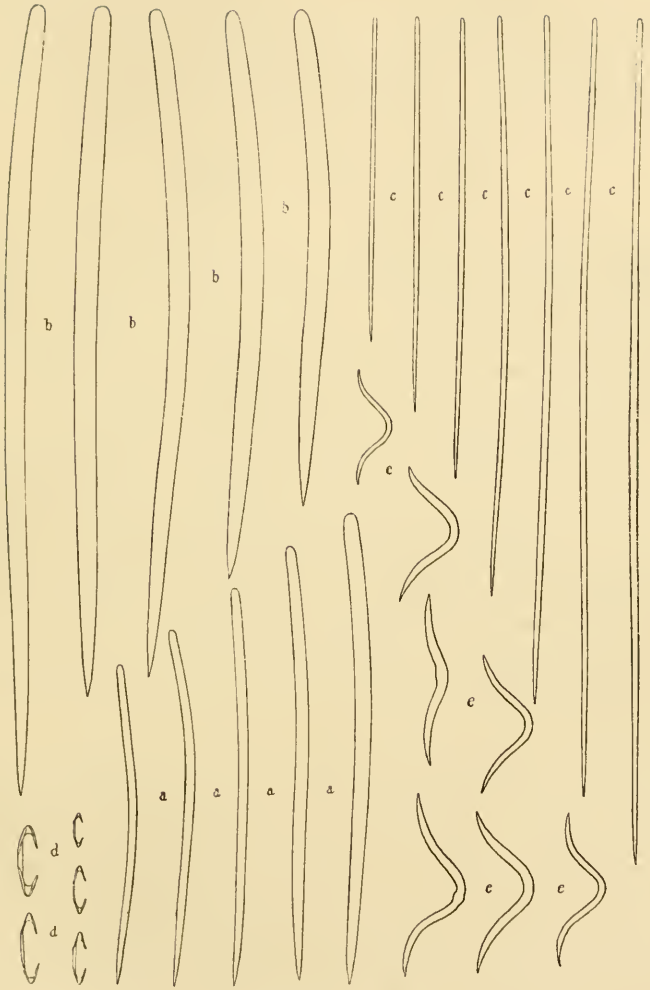
Megascleres.—(i.) The styli (Text-fig. 2, *a*) which core the fibres of the axial skeleton are slightly curved, and of nearly uniform diameter throughout the greater part of their length, tapering thence gradually to a sharp point. They range in size from about 260 by 7μ or less to occasionally slightly upwards of 375 by 15μ. The largest of them approximate closely both in form and size to the smallest of the "radial" styli.

(ii.) The styli (Text-fig. 2, *b*) composing the radial columns range in size from rarely less than 400 by 16μ up to 690 by 24μ. They also are slightly curved and gradually sharp-pointed, but they differ from the preceding styli in being usually more or less narrowed towards the base.

(iii.) The auxiliary or dermal styli (Text-fig. 2, *c*) are mostly straight or nearly so, somewhat gradually sharp-pointed, and also slightly attenuated towards the base. They range in length from about 250 to 710μ, and in diameter up to 9.5μ.

Microscleres.—(i.) The isochelae palmatae (Text-fig. 2, *d*) are of the usual *Clathria* type, and measure from 9 to 24μ in length. They are very nearly divisible into two groups with respect to size—individuals between 15 and 18μ in length being extremely rare.

(ii.) The toxa, which are rather scarce, are of the form shown in the figure (Text-fig. 2, *e*). They are characterised by the great degree of their bending, and by the not uncommon occur-



Text-fig. 2.

Axociella cylindrica. *a*, styli of the fibres; *b*, styli of the "radial columns"; *c*, dermal styli; *d*, isochelæ, *e*, toxa.

rence of a slight dilatation at or near their centre. They range from very rarely less than 60 up to about 110μ in length and from 2 to 6μ in diameter. The occurrence of toxa in this species was not definitely recorded by Ridley and Dendy, by whom they probably were overlooked owing to their scarcity.

Loc.—Port Jackson.

Genus Isociella, gen. nov.

Definition.—Desmacidonidae in which the microscleres are isochelae palmatae (perhaps sometimes accompanied by toxa), the skeleton is a sub-renieroid reticulation of smooth, typically curved styli mostly free or nearly free from spongin except about their extremities, and the only additional megascleres are smooth slender styli (tornostyli), belonging to the category of auxiliary megascleres, and occurring chiefly dermally.

Type, *I. flabellata* Ridley and Dendy; the only species.

The name originally bestowed on the species for which I establish this genus was *Phakellia flabellata;* but subsequently Dendy (4), finding that the same name had previously been given by Carter (2) to a Port Phillip sponge, proposed that the specific name be changed to *jacksoniana.* In view of the fact, however, that Ridley and Dendy's species should never have been assigned to *Phakellia* (and, indeed, would not have been, had not its microscleres been overlooked), and the fact that Carter's species also is not now considered to belong to *Phakellia,* it seems to me better that the original name be adhered to.

Isociella flabellata differs only in one important respect from certain species at present included in the genus *Ophlitaspongia,* namely, in its non-possession of well-developed reticulating spongin fibres. From the majority of the species of the latter genus it further departs in the fact that its fibres are not echinated; but this latter point of difference is probably one of only minor importance. Whether, when the very needful revision of the genus *Ophlitaspongia* is made, certain of its species will not require to be associated with *I. flabellata* in one and the same genus is perhaps open to question. It is beyond doubt, however, that *I. flabellata* and the typical species of *Ophlitaspongia* can never be so associated.

Isociella flabellata Ridley and Dendy.

(Pl. xl., figs. 1, 2; and Text-fig. 3.)

1886. *Phakellia flabellata,* Ridley and Dendy (16), p. 478.
1887. *Phakellia flabellata,* Ridley and Dendy (17), p. 171, Pl. xxxiv., figs. 2, 3, 3a; Pl. xl., figs. 6, 6a.
1897. *Phakellia jacksoniana,* Dendy (4), p. 236.
1907. *Phakellia jacksoniana,* Whitelegge (24), p. 507.

External characters.—With respect to external features, the previous description (17) of the species, based upon eleven specimens, requires but little to be added to it. The sponge (17, Pl. xxxiv., figs. 2, 3) is erect, flabelliform, with a rather short, cylindrical stalk terminating below in a flattened base of attachment, and above expanding, usually more or less suddenly, into a single, entire or lobately subdivided, vertical frond varying from 2 to 3 mm. in thickness. Not infrequently the frond presents one or a few, usually more or less elongated, open spaces or fenestrae, mostly of inconsiderable size, which are evidently due to an incomplete concrescence of originally separate lobes; and sometimes (though very exceptionally) the lamella remains subdivided into separate lobes almost to the apex of the stalk. Of the specimens so far obtained the largest measures 180mm. in total height; the greatest breadth which the frond attains in any specimen is 125mm.; and the stalk varies in different specimens from 4 to 8.5mm. in greatest diameter and up to 40mm. in length. Invariably the surface, on one side of the frond is thrown into more or less prominent, rather irregular, longitudinal furrows and ridges (the latter, in part, sometimes discontinuous, and replaced by a succession of low hummocks), while on the other it is comparatively smooth and bears numerous minute oscula (rarely exceeding 0.5mm. each in diameter) disposed in subcircular groups, with about from 8 to 12 oscula in each group. The subcircular areas occupied each by a group of oscula vary from 4 to 6 mm. in diameter and from 6 to 10mm. in distance apart measured from centre to centre; are usually slightly depressed below the general level of the surface; and are fringed each by a series of more or less distinct, radiating, short, shallow grooves, which give to them a stellate aspect (17, Pl. xxxiv., fig. 3a). The dermal membrane—according to the previous description of the species—is thin and trans-

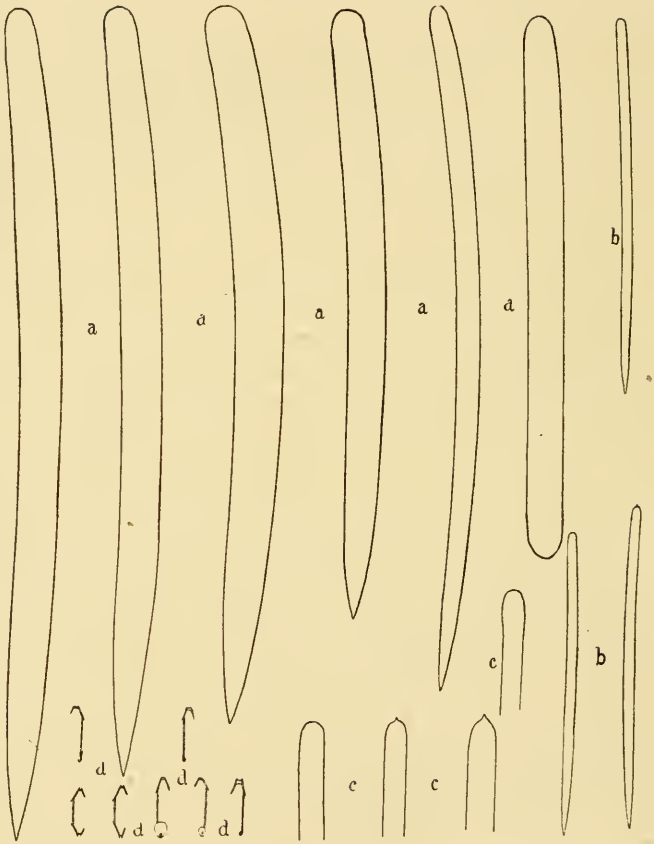
parent; and the dermal pores (described as round or oval openings about 70 to 100 μm diameter) are very abundant on the surface which bears the oscula ("occurring in small groups over the ends of the inhalant canals, where they reduce the dermal membrane to a mere network"), but are extremely scarce or absent on the opposite side of the sponge. In the specimens upon which the present description is based,—four in number and, with one exception, in a dried state of preservation,—the dermal membrane is wanting, and the surface opposite to that on which the oscula occur is closely dotted with numerous pin-hole-like perforations,—only slightly smaller in diameter than the oscula themselves,—which are the openings of the inhalant canals: as a consequence the dry specimens, when held between the eye and the light, present a minutely perforate appearance. Also clearly visible, when the sponge is thus examined, are stout, branching veins radiating upwards through the frond, from stalk to margin, at a distance apart varying from about 5 to 10mm. On careful desarcodisation of the sponge by means of caustic potash the skeleton is obtainable intact, and the "veins" are then very conspicuous—appearing as stout, spongious, dark yellowish or brownish-coloured fibres (Pl. xl., fig. 1); whereas the rest of the skeleton, owing to its extreme deficiency in spongin-cement, appears almost pure white. The colour of the sponge in alcohol is greyish yellow, and the consistency rather soft and brittle; dry specimens are crisp to the touch, inelastic, and very easily crushed.

Skeleton.—Exclusive of the very few stout spiculo-spongin fibres forming the "veins" above referred to, the skeleton (Pl. xxxix., figs. 1, 2) consists of pauciserial lines of (smooth stylote) spicules—or, strictly speaking, spicule-fibres extremely scantily provided with spongin,—united together, for the most part, by single transverse spicules entirely free from spongin except at their extremities. Not infrequently, however, the distance between adjoining spicule-fibres is greater than (sometimes nearly as much as twice) a spicule's length and the interconnecting spicules then form between them an irregular unispicular meshwork. In either case the connecting spicules are very numerous, and are inclined to the direction of the fibres at very varying angles; and always a small proportion of them—through failure to effect connection apically—appear simply to project from the fibres in the manner of echinating spicules. The spicules form-

ing the fibres are disposed parallelly to the direction of the fibres, and their number in a cross-section of a fibre at any point is usually about 4 or 5—though varying from 2 to (very rarely) upwards of 8 or 9. Immediately beneath the dermal membrane,—occurring about the extremities of the fibres, and also scattered in between,—are bundles of short and slender auxiliary (or dermal) styli. Auxiliary styli, in small number, also occur scattered singly in the interstices of the main skeletal reticulation.

As seen in thin, or moderately thin, longitudinal sections perpendicular to the plane of the sponge-frond,—owing to the fact that in such sections, as a rule, many or most of the fibres are intersected by the plane of section,—the skeleton often appears as if irregularly isodictyal in pattern, with triangular and quadrangular meshes the sides of which are of a single spicule's length; and sometimes, in its denser and more irregular portions, it appears somewhat halichondroid. The true conformation of the skeleton is generally more plainly and immediately apparent in sections parallel to, and in, the mid-plane of the sponge-frond (Pl. xl., fig. 2); and such sections, also, display best the structure of the "veins." The pauciserial spicule-fibres originate as branches from the stout fibres forming the "veins," and, proceeding therefrom in a more or less obliquely ascending direction, pass upwards in the mid-plane of the sponge and outwards to the surface, continually multiplying by dichotomy as they proceed. The veins would thus appear to constitute the primary axes of the growth of the sponge. Each vein is composed of several fibres united both by occasional anastomosis and by (numerous) connecting spicules. These fibres,—which attain a diameter of over 400μ in the oldest portions of the skeleton, gradually diminishing to less than 150μ at the margin of the sponge,—are densely sponginous, and are filled with closely packed styli (similar to those occurring elsewhere in the main skeleton) the apices of which, almost as frequently as not, are directed towards the base of the sponge.

Megascleres.—(i) The principal or skeletal styli (Text-fig. 3, *a*) are smooth, slightly curved, and of nearly uniform diameter usually throughout about four-fifths of their length, tapering thence to a sharp point. As a rule they are very slightly stouter in the middle than at the base. They range from 350 to 530μ in length and up to 31.5μ in diameter; indi-



Text-fig.3.

Isociella flabellata. *a*, skeletal styli; *b*, dermal styli; *c*, basal extremities of dermal styli, more highly magnified; *d*, isochelæ, often more or less contort, and frequently passing into anisochelæ.

viduals less than 400μ in length or less than about 15μ in stoutness are scarce. Among the styli, occasional modifications thereof in the form of strongyla occur; these are of lesser average length than the styli—the shortest one observed measuring only 290μ long.

(ii.) The auxiliary or dermal styli (Text-fig. 3, *b*) are smooth, almost invariably quite straight, and (like the principal styli) somewhat abruptly sharp-pointed; and are frequently provided with a minute mucro on the basal extremity (Text-fig. 3, *c*). They range from 155 to 250μ in length and from 3.5 to 7μ in diameter.

Microscleres.—The only microscleres (Text-fig. 3, *d*) are moderately scarce, extremely slender chelae of the palmate type, measuring from 11 to 15.5μ in length, and peculiar in the fact that the flukes at one extremity (more especially the median fluke) usually exhibit some degree of atrophy—occasionally being reduced almost to the verge of disappearance—and frequently are disposed asymmetrically relatively to those at the opposite extremity, by rotation about the shaft amounting sometimes to as much as 90°. The flukes are relatively small—even the median one seldom exceeding 4μ in length.

Loc.—Coast of New South Wales, in and near Port Jackson.

Genus Isopenectya, gen. nov.

Definition.—Desmacidonidae without microscleres, in which the skeleton is a renieroid reticulation either regularly isodictyal throughout and composed entirely of spongin-ensheathed acanthostyli of a single kind, or also sparsely traversed by paucispongin fibres containing, in addition, smooth styli of a form that suggests their original derivation from the acanthostyli; in either case the acanthostyli are replaced in the outermost region of the skeleton by the smooth styli, which project from the surface of the sponge. Also present are megascleres of a third kind, in the form of smooth slender styli, occurring dermally and interstitially. Typically the amount of spongin in the skeleton is comparatively small.

Type, *I. chartacea* Whitelegge (24); the only species.

In the absence of microscleres the affinities of this genus are somewhat uncertain. In certain respects, including the pattern of the skeleton, it shows some degree of resemblance to *Suberotelites demonstrans* Topsent (21), but in the latter species the acanthoscleres are tylostrongyla, and auxiliary megascleres are wanting. The existence of species like those of *Suberotelites* suggests that the correct position of the genus *Metschnikowia* Grimm,—placed by Lundbeck in proximity to *Reniera*,—is likewise in the family Desmacidonidae.

In conveying the impression that the acanthostyli of *I. chartacea* occur as echinating spicules, and that spongin is developed in connection with the skeleton-reticulation in considerable amount the original description of the species,—as I have already indicated (6, p. 208),—is in error.

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DESCRIPTION OF PLATES XXXVI.—XL.

Plate xxxvi.

Fig.1.—Moderately thin transverse section of a branch of *Tenaciella canaliculata* Whitelegge. The very dense peripheral layer is formed by the dermal skeleton and the subdermal brushes. The central region of the skeleton is relatively sparse and not displayed to advantage; but the intermediate zone between it and the peripheral layer, consisting of the radial fibres, is well shown. (x 12½).

Fig.2.—Longitudinal section of the main skeleton of a branch of *Tenaciella canaliculata* Whitelegge. (x 15).

Plate xxxvii.

Fig.1.—Entire specimen of *Tenaciella canaliculata* Whitelegge.

Fig.2.—Longitudinal section of the skeleton, in proximity to the tip of a branch, of *Axociella cylindrica* Ridley and Dendy. (x 12½).

Fig.3.—Longitudinal section of the skeleton of an older portion of a branch of *Axociella cylindrica* Ridley and Dendy. (x 12½).

Fig.4.—Portion of a specimen of *Axociella cylindrica* Ridley and Dendy.

Plate xxxviii.

Entire specimen of *Ophlitaspongia thetidis* sp. nov.

Plate xxxix.

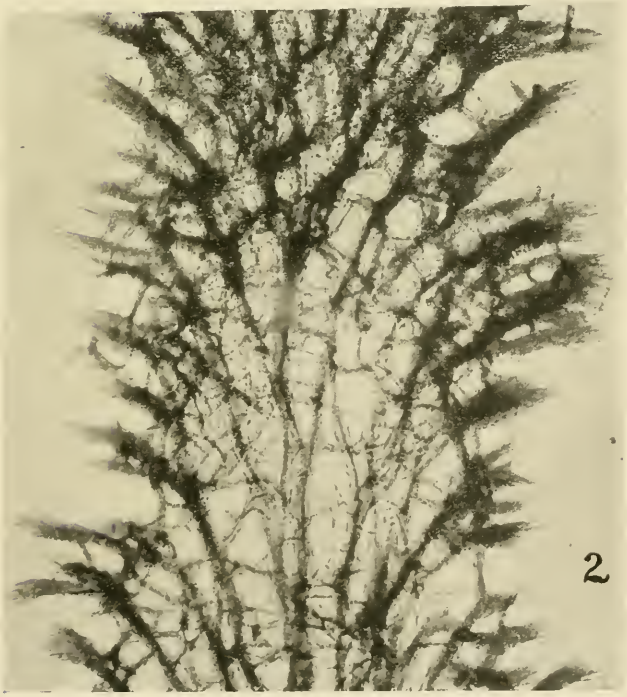
Fig.1.—Portion of a section of the skeleton of *Isociella flabellata* Ridley and Dendy, taken from near the outer margin of the sponge—the plane of section being approximately parallel to the mid-plane of the sponge-lamina. (x 12½).

Fig.2.—Portion of a longitudinal section of the skeleton of *Isociella flabellata* Ridley and Dendy, taken at some distance from the margin of the sponge—the plane of section being perpendicular to the mid-plane of the sponge. The stouter fibres appearing in this section are exceptional; they are "veinlets" which here and there proceed off from the stout "veins" shown in Pl. xl., fig.1. (x 12½).

Plate xl.

Fig.1.—Portion of a longitudinal mid-plane section of the skeleton of *Isociella flabellata* Ridley and Dendy, taken from an older portion of the sponge at some short distance above the stem; showing the stout ramifying "veins" or "funes." (Owing to the extreme fragility of the skeleton the section is not intact). (x 5).

Fig.2.—Longitudinal section of the skeleton of a branch of *Ophlitaspongia thetidis* sp. nov. (x 12½).



Tenaciella canaliculata Whitelegge.

2

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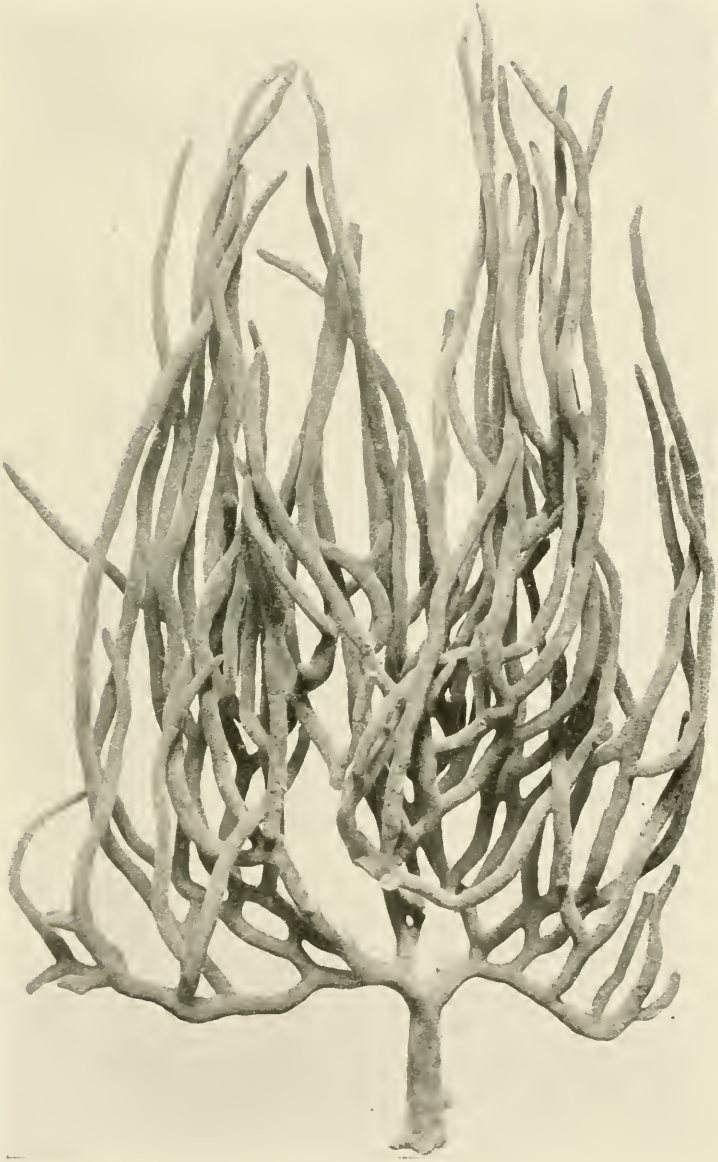
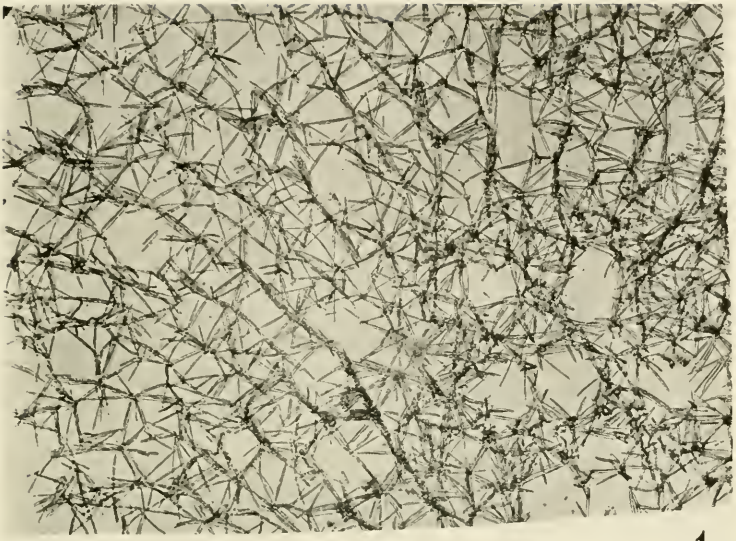
3

4

1. *Tenaciella canaliculata* Whitelegge; 2-4. *Axociella cylindrica* Ridley and Dendy.



Ophlitaspongia thetidis, n.sp.



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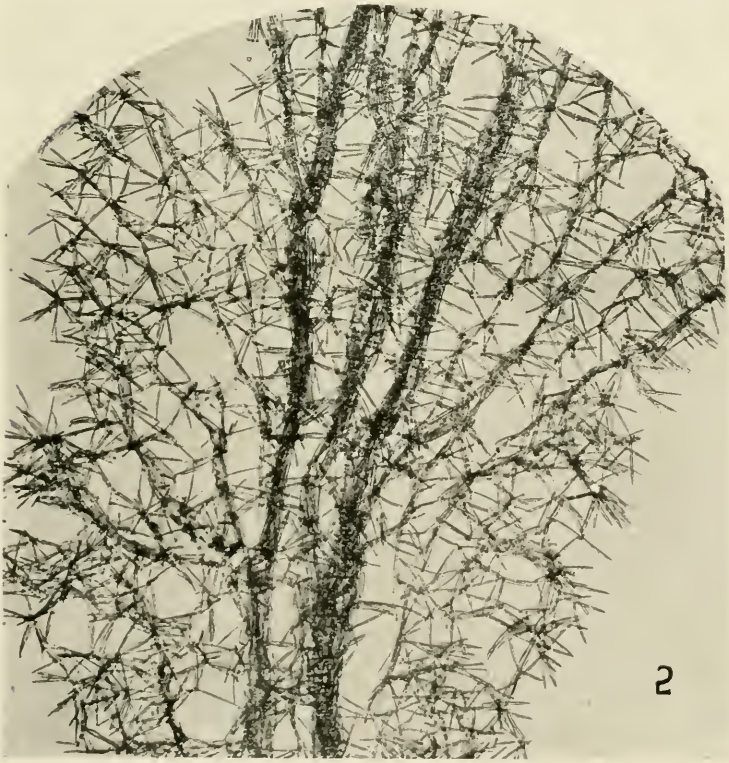
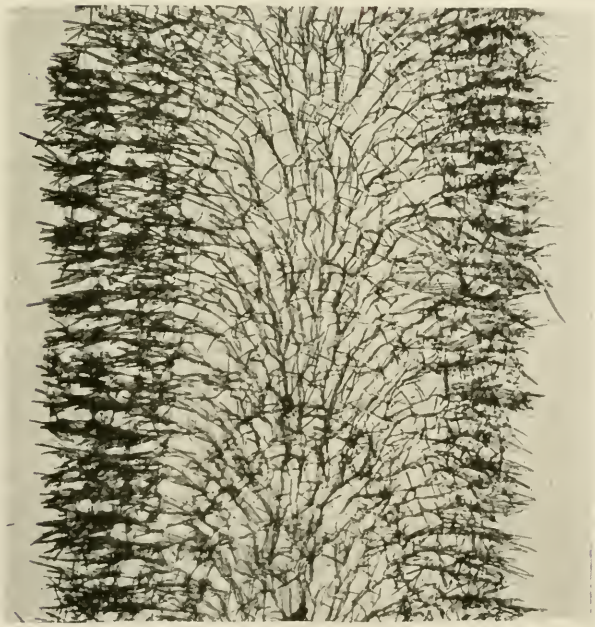


2

Isociella flabellata Ridley and Dendy.

1

2



1. *Isociella flabellata* Ridley and Dendy.
2. *Ophlitaspongia thetidis*, n.sp.