

XXXIII.—*Contributions to our Knowledge of the Spongida.*
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[Plates XXV.-XXVII.]

THE following contributions to our knowledge of the Spongida consist of more or less illustrated descriptions of nineteen new species taken from one wet and eighteen dry specimens, together with the types of two new groups of flesh-spicules (viz. *Spinispirula* and *Sceptrella*) and a few of their varieties respectively.

Although the spiculation in most instances is exquisitely beautiful, as may be seen by the representations in the Plates, yet the soft parts of only one species, viz. *Axos spinipoculum*, from Australia, which was taken alive and immediately put into preservative fluid, have admitted description and delineation, whereby, however, not only features of unusual interest have been elucidated, but additional testimony afforded of how much more is to be gained by dissecting a specimen in this condition than after desiccation.

As regards the measurement of sponge-spicules, it should be remembered that they must be small before they can be large, and that therefore, as they are successively developed, there must be all sizes present; further, that the spicule generally loses in length what it gains in thickness, so that, in the matured forms, the thicker are shorter than the more slender ones; and, lastly, that the maximum size may differ with the specimen. Hence my measurements are taken from the *average* largest size in all respects of the specimen examined, and therefore can only be considered approximate.

In the matter of form, too, the terms "gradually" and "abruptly," applied to the pointing of the spicule, mean that in the former case it is gradual and in the latter sudden.

HOLORHAPHIDOTA, Cart.

Family 2. Suberitida, Cart.

Genus AXOS, Gray (1867).

In 1864 Dr. Bowerbank (*Mon. Brit. Spongiadæ*, vol. i. pl. x. fig. 197) gave a representation of a spicule which, at p. 260 (*ib.*), is stated to have come from a "very beautiful branching sponge from Nicol Bay, Australia," sent to him by Mr. George Clifton of Freemantle. To this sponge Dr. Gray, in 1867 (*Proc. Zool. Soc.* May 9, p. 546), gave the name of *Axos Cliftoni*, together with a short description of

the flesh-spicule *only*. In 1870, Mr. Clifton wrote from Portland (Engl.) to Dr. Gray concerning this sponge (I possess the note) as follows:—"Some I dredged up; and others I secured on the beach after heavy gales. They are very common, and in some instances are over 6 feet in length, and when alive of a bright red colour." Finally, in 1873 (Proc. Zool. Soc. p. 321, pl. xxix.), Dr. Bowerbank gave a description, with most accurate illustrations, of this sponge (having been drawn on stone by his faithful artist, the late Mr. Lens Aldous), under the name of *Dictyocylindrus dentatus*; but as Dr. Gray's name of *Axos Cliftoni* is more applicable than *Dictyocylindrus*, Bk., to the nature and structure of the sponge (simply because it is not a *Dictyocylindrus*, Bk.*), and possesses the priority of half a dozen years, I shall adopt Dr. Gray's name as the generic appellation of those new species which I am about to describe. But before doing this it is desirable, for comparison, that I should briefly allude to the figures of the skeleton and flesh-spicules respectively of *Axos Cliftoni* in the dried state (Pl. XXVI. figs. 5, 6, a-c).

Thus the skeleton-spicule (fig. 5) is long, acute, smooth, curved and sharp-pointed, 1-360th by 1-1800th inch in its greatest dimensions; and the flesh-spicule (fig. 6, a), which is stelliform and crucially sexradiate, has, when fully developed, a globular body surrounded by six thick short arms, equidistant from each other, and each arm terminated by four or more comparatively large spines, or with the arms thinner, expanded at their point of union in the centre, and terminated respectively at their free ends by a globular head, which is microspined (fig. 6, b)—both originating in small, simple, smooth-armed, sexradiate stars (fig. 6, c), from which every grade of development may be traced to the first-described form, which, in size, is 1-1200th inch in diameter, and, so far as is known, as remarkable as it is unique in figure.

Axos flabelliformis, n. sp. (Pl. XXVI. figs. 1-4.)

Flabelliform, plicate, papyraceous, sessile, aculeated over the surface, especially on the margin, which is undulating,

* The applicability of Dr. Gray's name in other respects may be learned from the following prefatory paragraph taken from his proposed arrangement of the Spongida, viz.:—"I may state that many of the names used for the genera have no derivations, but are mere fortuitous combinations of letters; so that compilers of indices of genera need not attempt to find derivations for them, or to correct the formation of some of them, as being more consistent with the derivations they may gratuitously assign to them, as has been done with some generic names of the same kind by Agassiz and others." (Gray, "Notes on the Arrangement of Sponges," P. Z. S., May 9, 1867, p. 500.)

convex, and plicate longitudinally. Colour white. Texture cork-like. Surface extremely irregular and pitted, which pits, in many parts, would be open fenestrations but for being tympanized with sarcode; thickly aculeated throughout (Pl. XXVI. fig. 1). Internal structure cellular or cavernous, influenced in the form of its cavities by the presence of a reticulated, anastomosing framework composed of a condensed sarcode (? chondroid when fresh) charged with skeleton-spicules, which extends into and forms the axial part of the spines respectively. Spicules of two kinds, viz.:—1, skeleton-, acute, smooth, sharp-pointed, 1-66th by 1-3000th inch in its greatest diameter (fig. 2); and 2, flesh-spicule, stelliform, crucially sexradiate, with the rays short and expanded at their point of union in the centre; globular and microspined at their free ends; size about 1-1714th inch in diameter (fig. 3). Skeleton-spicules chiefly confined to the framework and the flesh-spicules to the surface-layer on each side. Size of entire specimen $4\frac{3}{4}$ inches high, $4\frac{1}{2}$ inches wide, and papyraceous in thinness, except where thickened by the presence of the fibre composing the "framework."

Hab. Marine.

Loc. ? Australia.

Obs. Examined in the dried state. This specimen is in the British Museum, and, from possessing no number, must have been there for many years before the present "Register" was commenced. It bears the letter "c," and now has attached to it in addition my running-number, viz. 212, E, h, 20. The specimen is complete so far as the base or point of attachment and the circumference are concerned; while from the generally aculeated surface, form, texture, and spiculation, it may be seen to be chiefly allied to *Axos Cliftoni*; but the colour now is white or brownish, as it is in dried specimens of *Axos Cliftoni*, although in the fresh state it might have been "light red" like the latter as stated by Mr. Clifton.

Axos spinipoculum, n. sp. (Pl. XXV. figs. 1-9.)

Globo-cylindrical, oblong, massive, robust, thick, cup-shaped, excavated, sessile (Pl. XXV. fig. 1). Colour dark grey externally, whitish yellow within. Texture subcartilaginous and spongy respectively. Surface extremely irregular, deeply pitted here and there; thickly aculeated over the outside, less so over the surface of the excavation, which is deep, conical, and compressed. Aculeations short, thick, and stout, irregularly distributed, sometimes sharp-pointed, at others obtuse. Vents opening over the lower third of the outside, through simple holes in cribriform patches, chiefly in deep depressions

between the aculeations, the "patches" overlying a larger cavity beneath, into which many excretory canals may open; or opening singly into the bottom of an excavation. Internal structure composed of dense, soft, spongy or areolar sarcode of a yellowish-white colour, charged with spicules, and probably bearing the spongozoa (fig. 4, *aa*), traversed by the fibrous skeleton of the sponge (fig. 4, *b*) and branches of the excretory canal-system (fig. 4, *e*), altogether defined outwardly by a tough transparent cortex (fig. 4, *cc*). Areolar sarcode filling up the interstices of the fibroskeleton, whose larger branches, being composed of chondroid substance charged exclusively with the linear spicules (fig. 2) arranged longitudinally, contrast strongly from their transparency with the opaque yellowish-white colour of the areolar sarcode, which they permeate in all directions, finally terminating in the aculeations of the surface (fig. 4, *dd*), where they are covered by the cortex thinning out towards their extremities. The dark grey cortical layer, which, on its part, also contrasts strongly in translucency and homogeneous appearance with the yellowish-white areolar sarcode which it limits towards the surface, is 1-24th inch thick, composed of wavy parallel fibres about 1-6000th inch in diameter (fig. 7, *a*), arranged horizontally, and traversed by a minute white tubular (?) reticulation (fig. 7, *b*), which appears to pass inwardly into vertical lines (fig. 7, *c*), altogether indicative of pore-tubulation opening into the subdermal cavities; wavy parallel fibres, when teased out, often presenting an attenuated extremity (fig. 8), and found to be composed of extremely fine fibrillæ (fig. 8, *a*). Excretory canals furnished with transverse circular folds like the *valvulæ conniventes* of the small intestine, often uniting into a *rugæ*-reticulation (fig. 5, *cc*); composed of three coats, viz. an inner, a middle, and an outer coat (viewing the surface of the canal as the outside); the inner coat consisting of wavy, parallel, translucent fibres, like those of the cortex, arranged longitudinally and in contact with the areolar sarcode (fig. 6, *aaa*); the middle coat consisting of the same kind of fibres arranged transversely or circularly upon the last, and confined to the folds of the *rugæ* (fig. 6, *bbb*); and the outer coat of a mucous layer of cells and granular material (fig. 9), the cells in form frequently resembling those of the spongozoa, but *now* without the presence of the cilium (fig. 9, *a*). The longitudinal appear to be a little larger than the transverse fibres (that is, about as 1-6000th to 1-9000th of an inch in diameter), both being compounded of extremely fine fibrillæ like those of the cortex (fig. 8, *a*), of whose ultimate form I am ignorant; while the outer or epithelial layer, being apparently composed

of mucus *only*, suspending and holding together a number of cells and granular material, thus contrasts strongly with the fibre-layer beneath. It should also be observed that this layer is *exclusively* charged with the flesh-spicules (fig. 3). Spicules of two kinds, viz. :—1, skeleton-, long, more or less straight, acuate, smooth, more or less abruptly sharp-pointed, 1-92nd inch long, by 1-4000th inch broad in the centre, which is slightly larger than the blunt end (fig. 2) ; 2, flesh-spicule, consisting of a straight shaft, spined at each end and in the centre ; spines mostly recurved at the ends of the shaft, but often projecting in various directions, the terminal one frequently in a line with the shaft and the lateral ones recurved, thus hastiform (fig. 3, *a*), distributed generally about the centre of the shaft irregularly, but frequently aggregated into two circlets situated at equal distances from each other and the extremities (fig. 3) ; shaft, exclusive of the spines, about 1-375th inch long by 1-9000th inch broad. Skeleton-spicules chiefly confined to the chondroid fibrous skeleton ; flesh-spicules to the epithelial layer on the surface of the excretory canals ; both equally mixed in the arcolar sarcodæ. Size of entire specimen $5\frac{3}{4}$ inches high, 4 inches in diameter at the upper or free end, 2 inches in diameter at the lower or fixed end ; excavation conical, $3\frac{1}{2}$ inches deep ; orifice compressed, elliptical, elongate, 2 inches by $\frac{7}{12}$ inch in its greatest diameters. Thus the wall at the brim is an inch thick ; and increasing downwards, in accordance with the conical form of the excavation, just below the latter the sponge becomes at least 4 inches in diameter, continuing thus solid to the base. Hence the great general solidity and thickness characteristic of this sponge. The photographed representation, which has been lithographed (fig. 1), is about 4-6ths of the natural size.

Hab. Marine, on hard objects (fig. 1, *a a*).

Loc. Australia, Port Jackson.

Obs. Examined in the wet state. This remarkable sponge, now bearing the no. "619," came, as just stated, from Port Jackson, in Australia, and was presented to the British Museum by the late J. B. Jukes, Esq. It appears, from its present state, to have always been preserved in spirit as it now is, and thus rendered more satisfactory for examination than if it had been previously dried ; for such is the difference between a sponge taken alive, immediately placed in spirit and kept in this state, and one that has been dried, that, for the most part, it may be fairly stated to lose more than one third of its natural characters by the latter method of preservation ; while if it has been worn away by the action of the

waves, and washed about on a beach, perhaps for years, before it is picked up for our museums, as most of the sponges in our collections are and must necessarily be from their inaccessible habitations, it may be easily conceived how unsatisfactory species-descriptions of a great number of specimens must indefinitely remain.

The rigid, aculeated surface, the soft opaque granular character of the areolar sarcode, the hard chondroid tissue of the fibro-skeleton, and the spiculation generally, although slightly modified in form, ally this sponge equally to *Axos Cliftoni* and *A. flabelliformis*, while the thick fibrous cortex and general solidity of the body constitute differences as great as they are peculiarly characteristic, so far as is known, of *Axos spinipoculum*.

The colour of the surface is now dark grey, as above stated, while that of *A. Cliftoni* and *A. flabelliformis* in the dried state respectively is white; but as Mr. Clifton has observed that "when alive" the former is "light red," this also may have been the case with *A. spinipoculum*; for it is worthy of notice that *Donatia* (olim *Tethya*) *lyncurium*, whose general structure and chondroid cortex closely resemble those of *A. spinipoculum*, is also light or orange red when alive, whether the specimen be British, Cape, or Australian, but loses this colour and becomes white or grey when dried or kept in spirit.

We thus analogically meet with the chondroid cortex of *A. spinipoculum*, so far as its cartilaginous nature goes, in *Donatia lyncurium*, which is also so nearly allied to the genus *Axos* in most other respects, that it seems necessary to place the latter in a neighbouring group. When portions of *A. spinipoculum* are dried, the cortex and skeleton assume the consistence and colour of dried glue, which is just the case with *Donatia lyncurium* under similar circumstances.

Nor should the striking likeness that exists between the aculeated surface of *A. spinipoculum* and the coarser forms of *Hircinia* pass unmentioned, from which, until the former is minutely examined, it might be very easily taken for the latter.

Another very striking character presents itself in the canals of the excretory system in *A. spinipoculum*, by which they are immediately distinguished from the branches of the chondroid skeleton in the midst of the areolar sarcode, viz. the transverse folds or *rugæ*, already described, which, but for the means of *touching* the branches (say with the point of a needle) when a section of the sponge is examined under water, would be sure to be taken for branched canals through

optical delusion, so transparent is the cartilage against its point of contact with the opaque areolar sarcode.

These "folds" and the composition generally of the "coats" of the canals forming the excretory system are well worth attention. In the first place, when at most only 1-48th of an inch in diameter (fig. 4, *e*), they may, with a common lens, be seen to commence in the subdermal cavities (that is, just inside the cortex), and, joining each other, thus to become enlarged and finally terminate in the vents above mentioned; while if the "vertical lines" of the fine reticulation which is seen in the translucent cortex under water (fig. 7, *c*) are pore-tubes, as above suggested, which extend from the pores themselves on the surface to subdermal cavities as in other sponges, corresponding to those of the "investing membrane" of *Spongilla* ('Annals,' 1857, vol. xx. p. 25, pl. i. figs. 1, *b b*, "Ultimate Structure of *Spongilla*"), then I have already figured and described an excretory canal commencing in this way with the same kind of "folds" in *Greyella cyathophora* ('Annals,' 1869, vol. iv. pp. 192, 193, pl. vii. fig. 5, &c.).

It may be questionable how far the longitudinal and transverse fibres of the excretory canal, together with those of the cortex, may not be the same—and the whole, bundles of muscular fibrillæ; for the fibres lie parallel to each other, and are not united as in "elastic tissue."

Lastly, it may be conjectured that the cells of which the mucous layer or epithelium is composed were once monociliated, and that, when living, the action of the cilia was to propel the contents brought in through the pores &c. towards the vents respectively, so as to keep up that aqueous circulation which appears, while it brings in nourishment, to be also the process by which the respiratory and excretory functions of the sponge are accomplished.

The cribriform patches of vents overlying a large cavity, which is the combined end of several excretory canals below, also seems to indicate that this arrangement was for the better closing of these vents—which in *Spongilla* I have shown to be the case, for a while, after taking food ("Ultimate Structure," *op. et tom. cit.* p. 30). We may assume this also from the diaphragm sphincter of transparent sarcodes often present and half-closed in the vents of the excretory canals of many sponges. As a necessary consequence, this should be attended by a closure of the pores also; and this, too, has been demonstrated in *Spongilla* (*loc. cit.*).

How delicate and transparent must be the muscular fibrillæ in these diaphragms, if such should exist here! and who can doubt it when observing the form and transparency of the

infusorium *Euplotes*, whose legs, being as numerous and active as those of a crab, must have their moving powers all regulated by similar contrivances? yet we might as well look for these as the structure in glass! To assume that such fibrillæ do not exist because they are not appreciable by our senses is to assume that the finite can comprehend the infinite.

Of course I can say nothing of the "ampullaceous sacs," which are made up of the spongozoa ("Ultimate Structure of *Spongilla*," 1857, *loc. cit.*), the "*Wimperkörbe*" and "*Geisselkammern*" of the Germans, as these delicate parts have long since passed out of sight with the freshness of the sponge; but it is desirable to state here that Dr. F. E. Schulze, in a preeminent paper on the recent species of *Spongelia*, *Nardo apud Schmidt* (Spong. Adriat. Meeres, 1862, p. 28, = *Dysidea*, Johnston), has observed that the ultimate branches of the pore-tubulation open through numerous small holes or fissures into the ampullaceous sac (*Geisselkammer*), and that the latter, on the other hand, opens by one large one into the excretory canal (*Zeitschrift f. wiss. Zool.* 1878, Bd. xxxii. p. 134). This is somewhat different from what I have stated of *Spongilla* in 1857 (*op. et tom. cit.* p. 27, &c.), and may be more to the purpose; at the same time, as it is so easy to grow the young *Spongilla* from the seed-like body in a watch-glass, and, feeding it with carmine, to observe what takes place with a high power ($\frac{1}{4}$ -inch objective), immersed, it would be desirable, since Dr. Schulze's description, although taken in part from living specimens, was not made under the same circumstances, to repeat the observations on *Spongilla* in the way that I have described (*loc. cit.*), always remembering that the soft parts of a sponge, being in their active state, ever changing in form like the *Amœba*, can apparently extemporize an aperture or close it, temporarily or permanently, wherever required. Dr. Schulze's paper and drawings are alike admirable, and the lithographed photographs a model for all time in the matter of sponge-representation.

Lastly, I would direct attention to the typical form given of the flesh-spicule of *Axos spinipoculum*, as a variety of that group which I propose to describe and illustrate hereafter under the name of "*Sceptrella*."

ECHINONEMATA, Cart.

Family 1. Ectyonida, Cart.

Genus TRIKENTRION, Ehlers.

In 1864, Dr. Bowerbank (*Mon. Brit. Spongiadæ*, vol. i.

p. 267, pl. x. fig. 234) gave a representation of a quadriradiate spicule, which is described as a specimen of a "spiculated inequiangulated triradiate" (?spined inequiangulated quadriradiate) spicule, with "cylindrical entirely spined radii" (?chiefly terminally spined), from "*Dictyocylindrus Vickersii*, Bk. MS." In 1877, Mr. T. Higgin, F.L.S. ('Annals,' vol. xix. p. 296, pl. xiv. figs. 9, 10), represented the same kind of quadriradiate accompanied by an acute spicule, which he found in small quantity on the piece of rock supporting his *Higginsia coralloides*, which was brought from the West Indies. To this I alluded ('Annals,' 1876, vol. xviii. p. 391), from a mounted specimen kindly sent me by Mr. Higgin. In 1878 I found, in the late Dr. Bowerbank's collection, a fragment of the sponge from which his figured spicule was probably obtained, with the following label on it, viz. "*Dictyocylindrus Vickersii*, West Indies;" but as the rest of the spiculation, together with the sponge itself, has never been described or illustrated, I now propose to do this from the fragment mentioned under Dr. Bowerbank's name, which, so far as the characters of his genus *Dictyocylindrus* (Mon. Brit. Spong. vol. ii. p. 6, type *D. hispidus*, Bk., = *Raspalia*, Schmidt) go, is well-chosen.

Dictyocylindrus Vickersii, Bk. (Pl. XXVII. figs. 5-8.)

Fragment thick, triangular, wedge-shaped, composed of branched columnar structure, radiating from the inner angle, indicative of its having been broken out of a convex radiated mass (Pl. XXVII. fig. 5); columns hollow, tubular, smooth within and rough without, wherein the spicules are implanted (fig. 8); branches terminating in lacinulated heads, which, in juxtaposition, form the convex or outer surface. Colour now black-brown. Texture loose, hollow, columnar, not fibrous. Surface of the columns setose from the projection of the long spicule (fig. 8, *a*). Wall of columns composed of dark brown areolar sarcode, charged, on the *outside*, with the spicules of the species. Spicules of four different forms, viz. :—1, long, setose, acute, smooth, slightly curved, sharp-pointed, 1-14th by 1-1800th inch in its greatest diameter (fig. 6, *a*); 2, short, thick, acute, smooth, slightly curved, towards the blunt end chiefly, sharp-pointed, 1-45th by 1-900th inch (fig. 6, *b*); 3, fine, acute, irregularly undulating, smooth, slightly inflated in the centre, sharp-pointed, 1-51st inch long and of extreme thinness (fig. 6, *c*); 4, echinating spicule, quadriradiate, arms cylindrical, more or less obtuse, for the most part equal in length, and radiating at nearly equal angles from each other, each spined, chiefly over the free extremity, about 1-360th

inch long by 1-1800th broad, the echinating arm a little longer than the rest, sharper, and standing out from the others at a greater angle (fig. 6, *d*, and fig. 7). Nos. 1 and 2 project obliquely upwards and outwards from the surface; no. 3 is sparsely mixed among them, and no. 4 very plentifully distributed about their fixed ends (fig. 8, *a, b, c, d*). No. 4 also is often quinquerradiate (fig. 6, *e*), and as often presents itself under the form of three- and four- smooth-armed radiates whose rays are sharp-pointed (fig. 6, *f, g*). Size of fragment about 1 inch long in the direction of the radiated structure (that is, vertically), and $\frac{1}{4}$ inch thick.

Hab. Marine.

Loc. West Indies.

Obs. Examined in the dried state. From the dirty and insignificant appearance of this fragment, which appears to represent the total vertical thickness of the sponge, it is not improbable that, growing on rocks in shallow muddy water in the form of a crust with plane and unbranched surface, it has often been overlooked. Nevertheless, from the above description, it is evidently very desirable that better specimens of it should be obtained; for being one of the Echinonemata in which *radiate* spicules at once like those of *Pachastrella* and those of the Calcispongiaë are present, it is important that this fact should be made public, as the two following sponges are, in spiculation, allied to it, and all might be confounded, in the fossil state, with the Calcispongiaë, if the latter were *alone* supposed to contain the triradiate and quadriradiate spicules, as Mr. Sollas's illustrations and descriptions of his fossil genus "*Catagma*" show ('Annals,' 1878, vol. ii. p. 353, &c.).

The splitting-up or subdivision of the columnar structure towards the surface into lacinulated heads is a common feature of *Dictyocylindrus*, but not less characteristic of the surface of many of the Echinonemata, where the projecting lacinula may vary in form from flat to round, being frequently spatulate or tongue-shaped with a caudate extremity.

Trikenrion muricatum, Ehlers, 1870.

(Pl. XXVII. fig. 13.)

In 1756 Pallas (Elench. Zoophytorum, p. 389. no. 237) described this sponge under the name of *Spongia muricata*, stating, on the authority of Seba, that it comes from "Guinea." In 1794 Esper (Die Pflanzenthierie &c. pl. 3) figured and described it under the same name from a specimen now in the museum at Erlangen, which, after microscopic examination, Dr. Ehlers, in 1870, considered it desirable to distinguish

by the generic name of "*Trikentrion*" (Esper'schen Spongien &c. in der zool. Samml. der k. Universität Erlangen). Finally, Mr. Sollas, in January last, published an account of it from a specimen in the Bristol Museum, under the name of *Plectronella papillosa*, as "a new Genus and Species of Echinonematous Sponge" ('Annals,' 1879, vol. iii. p. 17, pls. iv.-vi.).

Of this sponge there are several specimens in the British Museum, whose spiculation consists of tufts of smooth, curved, acerate spicules attached to indistinct or ill-defined fibre, echinated with triradiate spicules, one of whose arms is cylindrical, obtuse, spined especially over the free end, and three times the length of either of the other two, which are comparatively short, smooth, sharp-pointed, and fixed in the sarcode, the long, spined arm being the echinating one (Pl. XXVII. fig. 13, *a, b, c, d*).

All the specimens come from the western coast of Africa; and each bears my running no. 252, D, *h, 1*, also respectively the nos. 31 *a*, 41. 5. 13. 37, and 72. 10. 9. 1, to the last of which is added "Volta, Fantee, presented by Governor Ussher." With them will be found another but much smaller sponge, numbered 252 *a*, D, *h, 2*, and 48. 10. 4. 6, which, differing from the foregoing in spiculation and general form, though also from the west coast of Africa, claims the following distinctive appellation and description.

Trikentrion læve, n. sp. (Pl. XXVII. figs. 9-12.)

Specimen a small globular bunch of short, cylindrical, obtuse branches, arising from the subdivision of a small, equally short, round stem. Colour now purplish. Texture loose, compressible. Surface even, reticulate, slightly setose. Structure throughout fibro-reticulate, charged with the spicules of the species (Pl. XXVII. fig. 10). Spicules of three forms, viz. :—1, long, setaceous, acute, smooth, curved, sharp-pointed, 1-33rd by 1-3600th inch in its greatest diameters (fig. 9, *a*); 2, short, acerate, smooth, curved, sharp-pointed (fig. 9, *b*), 1-120th by 1-3600th inch, sometimes bent in the middle (fig. 11, *a*), or inflated in the centre (fig. 11, *b*), occasionally acute (fig. 11, *c*); 3, echinating spicule, triradiate, arms cylindrical, obtuse, about 1-200th by 1-2000th inch in their greatest dimensions, for the most part equal in length and radiating at nearly equal angles from each other, the echinating arm alone spiniferous, chiefly over the free extremity, the two others smooth (fig. 9, *d*, and fig. 12, *a-c*), occasionally quadri radiate (fig. 12, *b, c*). No. 1 (fig. 10, *a*) projects setaceously from the midst of a tuft of very thin acuates

(fig. 10, *c*); no. 2 (fig. 10, *b*) chiefly forms the fibre; and no. 3 is the echinating spicule, plentifully distributed about the latter (fig. 10, *d*). Size of entire specimen about 1 inch, and the branches about 3-24ths inch in diameter respectively.

Hab. Marine.

Loc. West coast of Africa.

Obs. Examined in the dried state. This sponge, numbered as above mentioned, may be found in a little pill-box in the British Museum, and was presented by the Rev. Mr. Allen. To render it more easily recognizable, it bears on its surface the remains of a parasitic polype (*Palythoa*). Its spiculation is very much like that of *Triken-trion muricatum*, but has, in addition, the setaceous acute very common among this kind of sponges, although absent in *T. muricatum*. When, however, the general form and internal structure of *T. leve* is compared with *T. muricatum*, there is a still greater difference; for while the surface of the latter is covered with little conical processes of the sponge-substance (another common feature of many of the Echinonemata, particularly well-shown in Esper's and Mr. Sollas's representations of this sponge respectively), that of *T. leve* is even and setaceous, more like that of a *Dictyocylindrus* or *Axinella*, Sdt.; again, while the structure generally of *T. leve* is composed of loose or compressible, reticulated fibre, that of *T. muricatum* is just the opposite, viz. hard, dense, and compact, becoming still more so towards the axis of the branch—another character almost peculiar to many of the Echinonemata. These, together with other differences, viz. in size, colour, and general form, are ample for making *T. leve* a distinct species; but it is remarkable that both this and *T. muricatum* should come from the west coast of Africa, and that, as yet, they should not have been shown to have come from any other part of the world, even going so far back as Pallas in 1756.

DICTYOCYLINDRUS, Bk.

Order ii. Silicea, Suborder i., Genus 10 (pp. 3, 6,
op. et loc. cit.).

Allied to the genus *Triken-trion*, and typical of one of the groups into which the Pluriformia will hereafter have to be divided, is Dr. Bowerbank's genus *Dictyocylindrus*, which, so far as his diagnosis goes (*op. cit.* p. 6), is well defined, but would have been better if the echinating spicule, although very sparse in many species, had been mentioned, as this at once would have placed it in my order Echinonemata, under the family Ectyonida. My object, however, in introducing

the subject here is, first, to point out that the echinating spicule of *Dictyocylindrus* is the preceding grade in form to the more complicated one of *Trikentrion*—that is, while the former may be viewed as a single arm fixed to the fibre by an inflated and spined extremity (Pl. XXVII. fig. 14), the latter presents a more complicated one, in which this is effected by two additional divergent arms, making the spicule triradiate,—and, secondly, to take this opportunity of recording the descriptions, respectively, of two remarkable species of the genus illustrative of this, which were found by Col. Pyke (U.S. Consul) at the Mauritius, and sent to me by Dr. Dickie, late Professor of Botany in the College at Aberdeen, in 1872. For one of these I propose the name of *Dictyocylindrus laciniatus*, and for the other *D. Pykii*, commencing with the former first.

Dictyocylindrus laciniatus, n. sp.

(No figures are given of this and the following species, beyond the echinating spicule, which is the same in both.)

Hemispheroidal, lacinate, radiating, sessile. Colour light slate-grey. Texture tender, compressible. Pores and vents not visible, the latter probably from their smallness, owing to the excretory systems in this kind of sponges being much subdivided. Structure consisting of long spatulate laciniae, radiating from a basal point, dividing and subdividing upwards, proliferous, plicate, and slashed towards the surface; composed of indistinct, anastomosing fibre, charged with the spicules of the species; setigerous or hairy throughout from the projection of the long acuates, which will now be described. Spicules of three forms, viz.:—1, very long, setaceous, acute, smooth, curved, sharp-pointed, slightly inflated, pin-like at the base, 1-6th inch long by 1-750th inch broad in its greatest dimensions; 2, acerate, curved, smooth, sharp-pointed, 1-45th by 1-1500th inch; 3, echinating spicule, short, acute, conical, straight, inflated at the base, sub-pointed at the free extremity, spiniferous, spines most numerous about the extremities respectively, slightly recurved about the free end, 1-272nd inch long by 1-1500th in diameter at the inflated end. No. 1 is based in the indistinct fibre (which is chiefly formed of no. 2), and, projecting from the surface of the lacinia obliquely upwards, gives the latter, from its great length, a strongly setose character; while no. 3 sparsely echinates the fibre. Size of specimen 2 inches in diameter.

Hab. Marine, growing on hard objects.

Loc. Mauritius.

Obs. Examined in the dried state. This specimen had grown on a branch of decayed coral, and, from the quantity of sand in it, was probably picked up upon the beach. Its hemispheroidal form, long radiated laciniate structure, great length and projection of the long acuate, together with the light slate-colour mentioned, are its principal characters.

It is also remarkable for the presence of a number of malformations of the long setaceous spicule, consisting of globular and elliptic bodies composed of concentric layers, thus traceable through their elongated forms into the normal development. Not an uncommon occurrence.

Dictyocylindrus Pykii, n. sp.

Subglobular, clathrous, massive, sessile. Colour dark purple. Texture tender, loose. Surface uniformly composed of the ends of the clathrous structure. Pores and vents not seen, the latter for the reason just mentioned. Internally consisting of clathrous anastomosing branches, composed of indistinct fibre charged with the spicules of the species, and tympanized by the dark purple sarcode characteristic of the sponge. Spicules of three forms, viz.:—1, setaceous, acuate, curved, smooth, sharp-pointed, 1-18th long by 1-1800th inch in its greatest transverse diameter; 2, acerate, smooth, curved, sharp-pointed, 1-50th by 1-1800th inch in its greatest dimensions; 3, echinating spicule, acuate, conical, straight, inflated at the base, subpointed at the free extremity, spiniferous, spines most numerous over the extremities, slightly recurved about the free end, 1-272nd long by 1-1500th inch in diameter at the inflated end, the same in form as the last (Pl. XXVII. fig. 14). No. 1 projects obliquely upwards from the fibre, which is formed of no. 2, so as to give the surface of the clathrous structure a slightly setose character; while no. 3 in great abundance forms the echinating spicule. Size of specimen $3\frac{1}{2}$ inches high by 3 inches in diameter between the base and the summit, which is the largest part of the sponge.

Hub. Marine, growing on hard objects.

Loc. Mauritius.

Obs. Examined in the dried state. This sponge is chiefly remarkable for its deep purple colour, presenting, in this respect, the appearance of Mr. T. Higgin's *Halichondria birotulata*; but the clathrate structure and echinated fibre, together with the spiculation generally, at once point out the difference. The indistinctness of the fibre in this and the foregoing described species is chiefly owing to the projection of the long setaceous and echinating spicules. Still there is a great difference between the loose and the compact structure

respectively characterizing these echinated sponges, as seen between *Trikentrion leve* and *T. muricatum*, the latter resembling in its structure that density and hardness which seems to me, as before stated, to exclusively belong to some of the Echinonemata, while the looser structure is common to all orders of the Spongida.

Latruncula corticata, n. sp. (Pl. XXVII. figs. 1-4.)

Erect, solid, lobate, covered with a thin chondroid dermal layer, apparently (the point of attachment having been broken off) subsessile (Pl. XXVII. fig. 1). Colour now yellowish white. Texture chondroid on the surface (fig. 1, *a*); reticulated, stiff, gum-like internally (fig. 1, *b*). Surface smooth as varnish to the unassisted eye; but under the microscope presenting the pointed ends of the skeleton-spicules in groups, just projecting beyond the chondroid layer, which is papyraceous in thinness (fig. 2, *b*). Pores between the groups, now 1-1200th inch in diameter and about 1-333rd inch apart (fig. 2, *a*). Vents not seen, chiefly on account of the imperfect state of the specimens. Internal structure fibroreticulate, stiff, arranged so as to present a plumose appearance; fibre composed of the spicules of the species held together by the now dried, glutinous sarcode. Spicules of two kinds, viz.:—1, skeleton-, acerate, curved, smooth, sharp-pointed gradually, 1-60th by 1-4000th inch in its greatest diameters (fig. 3); 2, flesh-spicule, stout, straight or crooked (subspiral), spined, 1-857th inch long (fig. 4); spines grouped at the ends and on the shaft in two places respectively at equal distances from each other (fig. 4, *a*), or dispersed more or less generally over the shaft (fig. 4, *b*), or subspirally, giving the flesh-spicule a crooked form (fig. 4, *c*). Skeleton-spicules mixed with the flesh-spicules in the interior, the latter most abundant on the surface. Size of the largest specimen $3 \times 2\frac{1}{2}$ inches.

Hab. Marine.

Loc. Red Sea (so stated by the dealer).

Obs. Examined in the dried state. There are three fragmentary specimens of this sponge in the British Museum, which look as if they had all come from the same mass. Each bears my number 359 E, *h*, 23, and the register numbers 40. 5. 6. 56-58. Its generally stiff consistence, rendered flexible by soaking, makes it look very much like one of the Gumminida; while the transitional forms of the flesh-spicule (fig. 4, *a*, *b*, *c*) show how the shaft may be spiral like that of the spinispirular, or straight like that of the sceptrella, whose typical forms respectively will be pointed out hereafter.

Chondrilla sacciformis. (Pl. XXVI. figs. 9, 11, and 12.)

Saccular and cylindrical (Pl. XXVI. figs. 9 *a*, 9 *a*), or adnate and depressed (fig. 9 *b*); sessile, corticate. Colour dark brown. Texture stiff and hard externally, soft internally when dry, chondroid and flexible when wet. Surface even, formed of the globular spicules (fig. 12) arranged in a tessellated manner like shagreen. Pores uniformly present all over the surface between the globular spicules, provided respectively with a sphinctral diaphragm of sarcode, 1-164th inch in diameter and a little wider apart. Vents single and large at the end of the sacciform growth (figs. 9 *a*, 9 *a*), or numerous and scattered over the adnate portions (fig. 9, *b*, *c*), projecting and papillary when wet. Structure cortical and internal; cortex stiff and hard when dry, about 1-138th inch thick, chondroid and flexible when wet, charged with the globular spicule and traversed by the canals of the pores and vents, respectively ending in their apertures on the surface; internal structure compressible, tough, resilient, consisting of areolar sarcode charged with groups of brown pigment granules (which give the colour to the sponge) and the spicules of the species, traversed by the branches of the excretory canal-systems. Spicules of two kinds, viz.:—1, skeleton-, acerate, smooth, curved, sharp-pointed gradually, 1-25th by 1-900th inch in its greatest dimensions (fig. 11); 2, flesh-spicule, spherical, globo-stellate, moriform, 1-225th inch in diameter (fig. 12); granules arranged hexagonally (fig. 12, *a*), conoid, truncate, and spined over the extremity (fig. 12, *b*), or simply conoid (fig. 12, *c*). No. 1 (spicule) is confined to the internal structure, mixed with no. 2 in different stages of development; no. 2 in full development, exclusively to the cortex. Size of largest sacciform portion about 1½ inch long by ½ inch in diameter, that of the adnate portions various.

Hab. Marine, on hard bodies.

Loc. Mauritius.

Obs. Examined in the dried state and after soaking in water. In the former it is stiff, hard, and corrugated, while in the latter it is soft, flexible, and smooth. The globo-stellate or moriform spicule, although a strikingly beautiful object *in situ*, and separate from its great size, is but an enlarged form of that of *Chondrilla nucula*, Sdt., which, together with *Chondrosia*, Nardo, also occurs at the Mauritius. *C. nucula* also grows in the West Indies and at the Molucca Islands, in the South Pacific Ocean, so that it probably has a world-wide extension in the warmer climates. The presence of the acerate spicule makes it differ from *Chondrilla nucula*,

and together with its erect growth, remarkably large globo-stellate spicules, and rich dark brown colour are its distinguishing characters. The specimens from which my description is taken, now in the possession of the British Museum, were presented to the late Dr. Bowerbank by Dr. Ayres, and bear my running no. 701. According to Dr. F. E. Schulze's arrangement (*Zeitschrift f. wiss. Zool.* 1870, Bd. xxix. p. 37, Separat-Abdruck), *Chondrilla sacciformis*, from possessing a cortex, would be one of his family "Chondrosiadæ." His recension of the species generally I commend to the student's notice, as well as all Dr. Schulze's papers on the Spongiadæ (*op. cit.*), as affording, so far as they go, some of the most valuable information that has ever been communicated on the recent sponges.

Schmidt has described and illustrated a sponge under the name of *Chondrilla phyllodes* (*Grundz. Spongienf. atlantisch. Geb.* 1870, p. 26, Taf. vi. fig. 1), with pin-like skeleton and spinispirular flesh-spicule, possessing a "violet-brown colour." A similar sponge occurs at the Mauritius, which, possessing none of the characters of a Gummina, I have set down as a Suberite—that is, belonging to the family Suberitida in my order Holorhaphidota. No doubt there are many species among these Suberitida which come very near to those that undoubtedly belong to the Gumminida in the order Carnosa, c. g. *Donatia lyncurium* &c. The preceding species, viz. *Latruncula corticata*, would, if the chondroid consistence were to be considered the distinguishing character of the Gumminida, be made one, like *Chondrilla phyllodes*.

The application of the term "spicule" to the globo-stellate seems ill adapted; but "body," which has often been used, is worse, as it conveys no idea of the *nature* of the object; while the term "spicule," if, apart from its derivation, applied to the siliceous elements of a sponge which have a definite form, whatever it may be, is readily understood. Otherwise a "globo-stellate spicule" would be as unintelligible as a "round square."

Rhaphidhastia spectabilis, n. sp.
(Pl. XXVI. figs. 10, 13, and 14.)

Lamelliform, extremely thin, sessile, taking the shape of the surface over which it may have grown, like a wet veil (Pl. XXVI. figs. 10, 10). Colour now whitish yellow. Texture delicate. Surface even, puckered here and there into little monticular projections (fig. 10, *a*), which appear to have been surmounted by the vents, otherwise (together with the pores) not recognizable. Internal structure loose, consisting

of delicate areolar sarcode charged with the spicules of the species. Spicules of two kinds, viz. :—1, skeleton-, acerate, long, curved, smooth, pointed gradually, 1-40th by 1-1800th inch in its greatest diameters (fig. 13); 2, flesh-spicule spinispirulate, straight or curved irregularly, variable in length and thickness, the longest averaging 1-300th by 1-3000th inch in its greatest diameters (figs. 14 and 14 a). Spicules of both kinds equally mixed throughout the structure. Largest specimen about 1 inch square and of extreme thinness.

Hab. Marine, on hard objects.

Loc. Mauritius.

Obs. Examined in the dried state. There are several patches of this sponge, of various sizes under that mentioned, on fragments of old reef-coral which bear the name "Dr. Ayres," in the late Dr. Bowerbank's collection; three of them are on that bearing the specimens of *Chondrilla sacciformis*, just described. Being loose and crumbling in its consistence, both when dry and after soaking in water, it fails to present the chondroid peculiarity of the Gumminida, while its Holorhaphidote character and spiculation seem to claim for it a place in the family Suberitida. The spinispirulate flesh-spicule is a common form under various phases among the Suberitida; and one of the average largest specimens in *Rhaphidhistia spectabilis*, presenting *ten bends*, has been represented under a highly magnified form, perhaps with a little more regularity than is natural, to show its elementary figure and composition (fig. 14 a). It is a strikingly beautiful object, separately or together, in *Rhaphidhistia spectabilis* when viewed under the microscope, and hence the specific designation. When alluding to the different forms assumed by the spinispirula hereafter, it will be more particularly noticed.

Hymenaphia spiniglobata. (Pl. XXVI. figs. 15, 16.)

Laminiform, immeasurably thin, taking the form of the object over which it may be growing. Colour pellucid white. Texture loose. Surface even, echinated with long spicules. Pores, vents, and internal structure not recognizable in the dried state, from the extreme thinness of the layer. Spicules two kinds, viz. :—1, skeleton-, pinlike, straight, fusiform, sharp-pointed gradually, 1-43rd by 1-1500th inch in its greatest diameters; head terminal, globular, a little larger in diameter than the shaft (Pl. XXVI. fig. 15); 2, flesh-spicule, spiniglobate or spiniglobospiral, the former about 1-857th inch in diameter (fig. 16, a, b, c, d). Skeleton-spicules projecting

from a thin layer of the flesh-spicules. Size of largest specimen 3-12ths inch in horizontal diameter.

Hab. Marine, on hard objects.

Loc. South Sea, on the older and deciduous parts of *Stylaster sanguineus*.

Obs. Examined in the dried state. The beautiful spiculation of this delicate little sponge is remarkable, when dry, for its pellucid white colour. It is so thin that much care is required in raising a portion for examination by the microscope, without which, even *in situ*, it can hardly be recognized. Answering to Dr. Bowerbank's characters of his genus *Hymenaphia* (Mon. Brit. Spong. vol. ii. p. 7), I have given it this appellation, together with the specific distinction of "spiniglobate," to mark the existence of a globular flesh-spicule with thin spines instead of thick conoid rays, like the "globostellate" of *Donatia lyncurium*, accompanied by the subspiral transitional form (fig. 16, *b, d*), which illustrates the connexion between the spinispirular (*Spiralstern*) and the stellate, noticed by Schmidt in accounting for the differences between his two figures of the spiculation of *Vioa Johnstonii* (Spongienf. d. atlant. Geb. 1870, p. 5).

EXPLANATION OF THE PLATES.

PLATE XXV.

- Fig. 1.* *Axos spinipoculum*, n. sp. (4-6ths of the natural size). From a photograph. *aa*, pieces of old coral detritus on which the sponge has grown.
- Fig. 2.* The same. Skeleton-spicule (scale 1-24th to 1-6000th inch). *a*, length on scale of 1-24th to 1-1800th inch, for comparison.
- Fig. 3.* The same. Flesh-spicule. *a*, occasional form of terminal spines (same scale).
- Fig. 4.* The same. Diagram of elementary parts, relatively magnified (on scale of 1-6th to 1-24th inch), showing:—*aa*, yellowish-white areolar sarcode; *b*, chondroid skeleton; *cc*, cortical layer, traversed by reticulation of ? pore-canals (fig. 7, *b*); *dd*, spines; *e*, portion of commencement of excretory canal, lined with transverse folds or rugæ.
- Fig. 5.* The same. Portion of commencement of excretory canal, much more magnified, showing:—*aaa*, wall of canal; *bbb*, openings into smaller branches; *ccc*, transverse folds or rugæ.
- Fig. 6.* The same. Inner layer of excretory canal, greatly magnified, showing that it is composed of:—*aaaa*, longitudinal fibres; *bbb*, transverse fibres, corresponding in position with the rugæ.
- Fig. 7.* The same. Cortical layer, much magnified, to show:—*a*, horizontal fibres; *b*, minute reticulation; *c*, vertical lines or straight portions of the same, terminating on the inner side.
- Fig. 8.* The same. End of single fibre, to show its pointed form, and that the fibre is made up of fibrillæ (*a*).
- Fig. 9.* The same. Epithelial or outer layer of the excretory canal, to

show that it is composed of a granular mucus charged with cells. *a*, cells, magnified, to show their prevailing shape.

PLATE XXVI.

- Fig. 1.* *Axos flabelliformis*, n. sp. (3-5ths of the natural size). From a photograph.
- Fig. 2.* The same. Skeleton-spicule (scale 1-24th to 1-6000th inch).
- Fig. 3.* The same. Flesh-spicule (same scale).
- Fig. 4.* The same. Length of skeleton-spicule on scale of 1-24th to 1-1800th inch, for comparison with fig. 7 of same Plate and fig. 2, Pl. XXV.
- Fig. 5.* *Axos Cliftoni*, Gray. Skeleton-spicule (scale 1-12th to 1-1800th inch).
- Fig. 6.* The same. Flesh-spicules. *a*, common form; *b*, less common form; *c*, ? embryonal form (scale 1-24th to 1-6000th inch).
- Fig. 7.* The same. Length of skeleton-spicule on the scale of 1-24th to 1-1800th inch, for comparison.
- Fig. 8.* Portion of coral detritus bearing *Chondrilla sacciformis* (9) and *Rhaphidhistia spectabilis* (10), nat. size.
- Figs. 9, 9, 9.* *Chondrilla sacciformis*, n. sp. (nat. size). *aa*, saccular forms; *b*, adnate form; *c*, vents, papillary.
- Figs. 10, 10.* *Rhaphidhistia spectabilis*, n. sp. (nat. size).
- Fig. 11.* *Chondrilla sacciformis*. Skeleton-spicule (scale 1-24th to 1-1800th inch).
- Fig. 12.* The same. Flesh-spicule (same scale). *a*, portion of the granular mulberry-like surface, more magnified, to show the arrangement and form of the "granules" *in situ*; *b*, lateral view of a single granule, showing spinous truncate extremity; *c*, the same, simple conical form.
- Fig. 13.* *Rhaphidhistia spectabilis*. Skeleton-spicule (scale 1-24th to 1-1800th inch).
- Fig. 14.* The same. Flesh-spicule (same scale). *a*, the same, much more magnified, to show the sinuous (spiral) form of the shaft and spiral arrangement of the spines.
- Fig. 15.* *Hymeraphia spiniglobata*, n. sp. Skeleton-spicule (scale 1-12th to 1-1800th inch).
- Fig. 16.* The same. Flesh-spicule. *a*, spheroidal or globular form, same scale; *b*, spiro-globular form; *c, d*, the same, more magnified, to show the spines and figures respectively.

PLATE XXVII.

- Fig. 1.* *Latruncula corticata*, n. sp. Natural size of specimen. *a*, chondroid layer or cortex; *b*, internal structure.
- Fig. 2.* The same. Surface of cortex, much magnified, to show:—*a*, pores; and *b*, points of skeleton-spicules, relatively situated.
- Fig. 3.* The same. Skeleton-spicule (scale 1-12th to 1-1800th inch).
- Fig. 4.* The same. Flesh-spicule (scale the same). *a, b, c*, the same, more magnified, to show the transitional forms present, viz.:—*a*, sceptrella; *b*, intermediate form between the sceptrella and (*c*) the spinispirular form.
- Fig. 5.* *Dictyocylindrus Vickersii*, Bk. Fragment. Natural size.
- Fig. 6.* The same. Spiculation relatively magnified (scale 1-24th to 1-1800th inch). *a*, long setaceous acute; *b*, thick short acute; *c*, undulating acute; *d*, echinating quadriradiate spicule; *e*, quinqueradiate form; *f*, smooth-armed triradiate form; *g*, the same, quadriradiate.

- Fig. 7.* The same. Echinating spicule, more magnified (scale 1-12th to 1-1800th inch). *a*, echinating arm.
- Fig. 8.* The same. Portion of *surface* of a "column," showing the spicules *in situ*. Diagram, much, but relatively, magnified. *a*, long setaceous acuate; *b*, thick short acuate; *c*, undulating acuate; *d*, echinating spicule.
- Fig. 9.* *Trikentrion leve*, n. sp. Spiculation relatively magnified (scale 1-24th to 1-1800th inch). *a*, long setaceous acuate; *b*, short thick acerate; *c*, fine acuate; *d*, echinating triradiate spicule.
- Fig. 10.* The same. Portion of fibre showing the spicules *in situ*. Diagram much, but relatively, magnified. *a*, long setaceous acuate; *b*, short, thick acerate; *c*, fine acuate; *d*, echinating triradiate spicule.
- Fig. 11.* The same. Different forms of acerate spicule, viz.:—*a*, bent; *b*, inflated in the centre; *c*, acuate.
- Fig. 12.* The same. Echinating spicule, more magnified (scale 1-12th to 1-1800th inch). *a*, normal form, triradiate; *b*, occasional form, quadriradiate; *c c*, echinating arms. For comparison with *figs. 7, 13 c*, and *14*, all of which are drawn on the same scale.
- Fig. 13.* *Trikentrion muricatum*, Ehlers. Portion of fibre, showing the spicules *in situ*. Diagram, but relatively magnified (scale 1-48th to 1-1800th inch, the same scale as *figs. 8 and 10*, for comparison). *a*, acerate spicule; *b*, echinating triradiate spicule; *c*, the latter more magnified; *d*, echinating arm.
- Fig. 14.* *Dictyocylindrus laciniatus*, n. sp., and *D. Pykii*, n. sp. Echinating spicule.

[To be continued.]

XXXIV.—*Studies on Fossil Sponges*.—III., IV., V. *Monactinellidæ*, *Tetractinellidæ*, and *Calcispongiæ*. By KARL ALFRED ZITTEL*.

III. MONACTINELLIDÆ, Zittel.

In my memoir "Zur Stammesgeschichte der Spongien" †, I adopted the following orders of sponges, founded chiefly upon the grouping proposed by O. Schmidt (Atlant. Spoug. p. 83), namely:—1. Myxospongiæ, Hæck.; 2. Ceraspongiæ, Bronn; 3. Monactinellidæ, Zitt.; 4. Tetractinellidæ, Marsh.; 5. Lithistidæ, O. Schmidt; 6. Hexatinellidæ, O. Schmidt; 7. Calcispongiæ, Blainv.

To the Monactinellidæ I refer all sponges the skeleton of which consists of *uniaxial siliceous spicules*.

Of the numerous uniaxial siliceous spicules from Tertiary

* Translated by W. S. Dallas, F.L.S., from the 'Abhandlungen der k. bayerischen Akademie der Wissenschaften,' II. Classe, Bd. xiii. pp. 93-138.

† Festgabe der philosophischen Facultät zum 50-jährigen Doctor-jubiläum des Professor von Siebold. Munich, 1878.

West Lodge. It was chiefly from the foliage of the common bramble that I obtained it.

Mr. Barrett, who has kindly examined it, says that very likely this *may* be the var. *petrosana*; and indeed it agrees very well with Duponchel's figure of the latter on his sixty-fifth plate.

[To be continued.]

XXXVIII.—*Contributions to our Knowledge of the Spongida.*

By H. J. CARTER, F.R.S. &c.

[Plates XXVIII. & XXIX.]

[Continued from p. 304.]

Trachycladus levispirulifer, n. gen. et sp.
(Pl. XXVIII. figs. 1-5.)

Shrub-like, more or less compressed, stiff, consisting of a short irregularly round stem dividing at first dichotomously and then polychotomously into many branches, which terminate in digitations, more or less united laterally (Pl. XXVIII. fig. 1). Colour white on the surface, whitish yellow internally. Texture hard, dense. Surface reticulate, honeycomb-like, stiff, with small scopuliform processes along the lines of the reticulation, bearing a white incrustation composed of the flesh-spicules of the species. Internal structure of the stem and branches consisting of dense, compact, areolar sarcode, especially towards the centre, charged with the spicules of the species, expanding in lines from the axis of the branch upwards and outwards, so as to end in the little scopuliform processes mentioned. Spicules of three forms (viz. one skeleton- and two flesh-spicules):—1, skeleton-spicule, acerate, curved, smooth, pointed gradually, acutely or obtusely, sometimes acuate, 1-85th by 1-2400th inch in its greatest dimensions (fig. 2); 2, flesh-spicule, minute, filiform or vermiculate, consisting of an open spiral coil of one turn and half, smooth (that is, without spines), 1-1714th inch long (fig. 3); 3, flesh-spicule, bacillar, consisting of a short, thick, cylindrical, straight shaft, with rounded ends and narrow, linear, central inflation (fig. 4). The skeleton-spicules mixed with a few flesh-spicules of both forms are confined to the interior, while the white incrustation is exclusively formed of the flesh-spicules. Size of largest specimen $4 \times 3 \times 1\frac{1}{4}$ inches; stem about 1 inch long and $\frac{3}{4}$ inch thick.

Hab. Marine.

Loc. South Australia

Obs. Examined in the dry state. There are now two specimens of this sponge in the British Museum, one of which is extremely small and insignificant-looking, about $1\frac{1}{2}$ inch in diameter, and the other, that above described, which came from the late Dr. Bowerbank's collection. The former bears my running number 385, but no other, while the glue about its stem shows that it was once attached to a board, and therefore has been a very long time in the Museum; the latter, which was also without label, now bears my no. 695. The hard, dense structure of the stem, combined with the white incrustation over the honeycomb or reticulated stiff structure of the surface, are all as much characters of the Echinonemata as they are opposed to those of the Suberitida in the Holorhaphidota; while, if we regard the flesh-spicules as equivalent to the "echinating" spicules, it seems to me that a place for *Trachycladus* should be sought for in the family Ectyonida, among the groups now included under the provisional name of Pluriformia. The characters of the sponge above given, together with the flesh-spicules, are quite sufficient for recognizing the species. Especially characteristic are the spiral flesh-spicules of the incrustation, which, under the microscope, look like myriads of little worms broken into pieces. So far, however, as their spiral form goes, this occurs in a sponge of a very different kind, viz. *Suberites spinispirulifer*, to be described hereafter; but here it is not only much larger, but *spined* all over.

Amorphina stellifera, n. sp.
(Pl. XXIX. fig. 10, a, b.)

Massive, amorphous, lobate, pierced and suspended by the fine branches of the seaweed among which it has grown. Colour originally white, but subsequently rendered pink by the presence of a pink *Palmella*-like cell. Texture crumb-of-bread-like. Surface even, thickened by the accumulation of broken spicules and sand, probably from having been rolled about in the shore-waves. Pores in the sarcode tympanizing the intervals between the broken spicules, as well as between those which have not become broken. Vents in pit-like depressions of the surface. Internal structure consisting of areolar sarcode charged with the spicules of the species and traversed by the canals of the excretory system; of a light yellow colour. Spicules of two forms, viz.:—1, skeleton-, acerate, curved, smooth, sharp-pointed gradually, of various sizes, the largest averaging $\frac{1}{35}$ th by $\frac{1}{1500}$ th inch in its greatest diameters (Pl. XXIX. fig. 10, a); 2, flesh-spicule, very delicate, stelliform, composed of eight or more micro-

spined rays parting from the centre directly (that is, without inflation there), 1-1500th inch in diameter (fig. 10, *b*). Skeleton- and flesh-spicules scattered throughout the sponge generally, the latter rather sparsely. Size of largest specimen about $2 \times 1\frac{1}{4} \times \frac{3}{4}$ inch.

Hab. Marine, growing in the Laminarian zone.

Loc. South Australia.

Obs. Examined in the dried state. There are two specimens of this sponge now in the British Museum, almost exactly alike in every particular, viz. one labelled "69. 1. 22. 25, Van Diemen's Land," and the other from the late Dr. Bowerbank's collection without label, except that of "South Australia," on the box in which it was contained, both now bearing my no. 315 E, *h*, 19. But for the presence of the little, delicate, stellate flesh-spicule, there would be no distinguishing *Amorphina stellifera* from the worldwide *Halichondria panicea*, Johnst., perhaps the commonest sponge on the coasts of Great Britain. It is remarkable, too, that the pink colour should be owing to the presence of the little parasitic cell mentioned, apparently identical with that of *Palmella spongiarum*, Cart. (Ann. 1878, vol. ii. p. 165), which I found to be the origin of a similar colour in a specimen of *Halichondria panicea* picked up on this beach (Buddleigh-Salterton).

Besides the pink cell in *Amorphina stellifera*, both specimens are charged with one which I think it advisable to note for future reference, as I do not know what it is. This cell, which is much larger than that of the *Palmella*, is colourless and ovoid, measuring 1-875th inch in its greatest diameter, containing a transparent nucleus 1-2000th inch in diameter, and surrounded by a number of still smaller cells, each of which is 1-6000th inch in diameter, the transparent spherical nucleus in the centre contrasting with the translucent ones that surround it.

As these specimens of *Amorphina stellifera* have grown from an embryo attached to the seaweed, the branches of the latter have become enveloped by them respectively during growth, like bits of grass &c. in a Fungus, and thus they have become suspended.

Suberites spinispirulifer, n. sp.
(Pl. XXVIII. figs. 6, 7.)

Specimens solid, elliptical, probably having obtained this form by forced separation from the place of growth and subsequent rolling about on the beach in the midst of the waves. Colour now chiefly yellowish white, with patches of purple on the surface, indicating that this, if not the whole of the sponge,

was once so tinted. Texture loose, open, crumb-of-bread-like. Surface without cortex, corrugated. Pores not visible. Vents numerous among the corrugations. Internal structure consisting of light, loose, areolated, flaky sarcode charged with the spicules of the species and traversed by the excretory canals. Spicules of two kinds, viz.:—1, skeleton-, stout, pin-like, curved, smooth, and sharp-pointed; pin-like head chiefly produced by a circular inflation of the shaft just inside the blunt end, 1-45th by 1-1542nd inch in its greatest diameters (Pl. XXVIII. fig. 6); 2, flesh-spicule, filiform, consisting of an open spiral coil of one turn and a half thickly spined (but *not* spirally) throughout; coil 1-1714th inch long by 1-3000th inch broad (fig. 7, *a*, *b*). Both mixed together in the body of the sponge, the latter most plentiful on the outer surface and on the surface of the excretory canals. Size of largest specimen about 2½ by 2 inches in its longest diameters.

Hab. Marine.

Loc. Port Elizabeth, Cape of Good Hope.

Obs. Examined in the dried state. There are several specimens of this sponge in the British Museum, all bearing the register no. 71. 5. 12. 1, with my running no. E 13, *h*, 15. A more magnified view of the spinispirulate flesh-spicule has been given in fig. 7, *b*, to show its elementary composition, and the specific designation taken from its peculiar spiral form, which, together with the presence of the *spines*, affords a combination that I have not met with in any other kind of sponge, the spiral flesh-spicule of *Trachycladus* being smooth (that is, without spines). It should be observed that the spines are not arranged spirally on the shaft.

Suberites angulospiculatus, n. sp.

(Pl. XXVIII. fig. 8, *a*, *b*.)

Plano-convex, cake-shaped, elliptical, depressed, spreading, sessile. Colour dark brown. Texture fine, compact, cork-like. Surface uniformly dimpled, irregularly undulating, without cortex. Pores and vents not evident. Internal structure compact, cork-like, consisting of fine areolar sarcode charged with the spicules of the species and traversed by the excretory canals, which are small; colour internally tawny yellow. Spicules of one kind only (no flesh-spicule), viz. acerate, undulating, smooth, straight, sharp-pointed, gradually angulated in the centre (Pl. XXVIII. fig. 8, *a*), or larger and less angulated (fig. 8, *b*), the former 1-246th by 1-12000th, and the latter 1-25th by 1-1200th of an inch in their greatest

diameters respectively. Size of specimen $4\frac{1}{2}$ inches in its longest horizontal diameter by $\frac{1}{2}$ inch high.

Hab. Marine, growing on hard bodies.

Loc. Jamaica.

Obs. Examined in the dried state. The dark-brown colour of the surface appears to arise from the tendency of the sarcode superficially to a glutinous consistence. Internally it is precisely like that of *Halichondria suberea*, Johnst., = *Suberites domuncula*, Sdt., and but for the form of the spicules, which can only be determined by microscopical examination, might be mistaken for it. There are three specimens of this sponge in the British Museum, all of which come from Jamaica, viz. :— that above described, which is registered 43. 2. 13. 53, with my running no. E 55, h, 14; another about the same size on the back of a crab, numbered 707, which came from Dr. Bowerbank's collection; and a third about the size of a small hazelnut, growing round the stem of a zoophyte, registered 50. 5. 8. 35; also a minute white parasitic patch of it on the surface of an undescribed species of *Reniera* with nodular surface, large conical crateriform lobes and sausage-shaped spicule, registered no. 40. 16. 12. 49, and no. 504 E, c, 7 (? from Madeira), in which the angulated spicule attains the "larger size" mentioned (viz. fig. 8, b), and abnormally is often accompanied by a third arm growing out from the middle of the shaft at right angles, so as to give the spicule a triradiate form.

Suberites fuliginosus, n. sp.
(Pl. XXVIII. fig. 9, a, b.)

Massive, spreading, botryoidal, lobular, corrugated, sessile. Colour soot-black. Tissue cork-like. Surface uniformly subbotryoidal. Pores not seen. Vents numerous, scattered over the botryoidal elevations, often grouped. Internal structure composed of a multilocular or cellular labyrinthic skeleton, densely charged with the spicules of the species; the labyrinthic cavities filled with black sarcode also charged with similar spicules, contrasting strongly in the section with the lighter colour of the skeleton. Spicules of two forms, both skeleton-, no flesh-spicule, viz. :—1, straight or slightly curved, fusiform, smooth, inflated and spined at each extremity, 1-857th by 1-4800th inch in its greatest diameters (Pl. XXVIII. fig. 9, a); 2, cylindrical or acuate, thicker and shorter than the foregoing, spined all over, 1-92nd by 1-1500th inch in its greatest diameters (fig. 9, b). Both mixed together throughout the sponge, but the latter very sparingly. Size of largest

specimen 4 inches in diameter horizontally; highest lobe $1\frac{3}{4}$ inch.

Hab. Marine.

Loc. ? Torres Straits.

Obs. Examined in the dried state. This is a very remarkable sponge, chiefly on account of its "soot-black" colour, but not less so in its spiculation. In structure and consistence it is almost identical with the type of my group *Cavernosa*, viz. *Rhaphyrus Griffithsii*, = to the free form of *Cliona celata*, and thus like *Spongia Dysoni*, Bk., from Belize (the largest sponge on record, of which the specimen is in the British Museum). While, however, *S. fuliginosus*, like *Rhaphyrus Griffithsii*, has no flesh-spicule, it nevertheless more nearly represents *Spongia Dysoni* (whose form of flesh-spicule is given in Plate XXIX. fig. 11) in the nodular surface and cribriform grouping of the vents over the nodules, if not in the colour also, which appears to have a slight tinge of purple, allying it to the lilac tint of the dried specimens of *Spongia Dysoni*. There are two pieces of *Suberites fuliginosus* in the British Museum, bearing the register no. 46. 8. 5. 8, with my running no. 379 E, h, 13. They were presented by the late J. B. Jukes, Esq., and, both being alike, probably form parts of one original mass.

Stelletinopsis corticata, n. gen. et sp.

(Pl. XXVIII. figs. 10-15.)

Globular, smooth, corticate, broadly sessile (Pl. XXVIII. fig. 10). Colour yellowish grey. Texture hard on the surface, soft internally. Surface smooth and even; cortex thin, hard when dry, fleshy when wet, about 1-48th inch thick, presenting a uniformly granular surface composed of minute convolutions of the dermal sarcode, like in form to those of the brain (but of course microscopic), charged with flesh-spicules of the species and grains of quartz sand (fig. 15, c, d, e). Pores in the grooves between the convolutions. Vents chiefly congregated about the summit of the sponge (fig. 10, a), twelve or more in number, of different sizes, the largest 1-6th inch in diameter, each partly closed by a thick, opaque, sphinctral diaphragm of sarcode in radiating folds surrounded by a raised margin (fig. 15, a, b). Internal structure cancellous in the section, subradiating from a more condensed centre, increasing in the size of its areolation towards the circumference, where it becomes continuous with the cortical layer; composed of areolar sarcode densely charged with the spicules of the species, altogether very like the interior of *Gredia* and *Stelletta*. Spicules of three kinds (viz. one skele-

ton- and two flesh-spicules), to which must be added the foreign material, viz. the quartz grains:—1, skeleton-spicule, acerate, long, smooth, curved, sharp-pointed gradually, 1-22nd by 1-1800th inch in its greatest dimensions (fig. 11); 2, flesh-spicule, stelliform, very minute and delicate, composed more or less of eight rays, radiating from the centre direct (that is, without inflation there), 1-2000th inch in diameter (fig. 12, *a, b*); 3, flesh-spicule, bacilliform, straight, cylindrical, obtuse at the ends, spined all over, about 1-666th by 1-6000th inch in its greatest dimensions (fig. 13, *a, b*); 4, quartz grains, variable in size, about the diameter of the flesh-spicules (fig. 14). No. 1 is confined to the interior, mixed with a few of the flesh-spicules; nos. 2 and 3, together with the quartz grains and a few fine acerates, are more abundant in the cortex. Size of specimen $1\frac{1}{8}$ inch high by $1\frac{1}{2}$ inch in transverse diameter about the middle, and 1 inch at the base.

Hab. Marine, on hard objects.

Loc. Port Adelaide, Australia (*Cuming*).

Obs. Examined in the dried state and after soaking in water. This specimen is in the British Museum, and bears the register no. 55. 3. 14. 8, with my running no. E, 301 *h*, 18. It has grown upon the outside of the flat valve of a large *Pecten*, where, at first, it looks very much like a specimen of *Hulichondria ficus*, Johnst. On examining it, however, more attentively and after soaking, it is found to have a fleshy cortex not unlike that of the Gumminida in consistence; in form and structure it is like *Geodia*, and its *internal* spiculation is like that of both *Geodia* and *Stelletta* so far as the *acerate* spicule goes; but there is *no trifold* spicule, and no zonular arrangement, of course, at the circumference. With all these characters it is impossible to assign it to either; and therefore a new genus has been made for it under the name of *Stellettinopsis*, after *Stelletta*, whose spiculation generally, minus the trifold forms, its spiculation so nearly resembles that at first sight there appears to be no difference. Its place should, perhaps, be in the order Holorhaphidota, among or after the Suberitida, and before the Pachytragida.

Stellettinopsis simplex, n. sp.

(Pl. XXVIII. figs. 16-18.)

Massive, convex, lobate, sessile. Colour tawny brown. Texture loose. Surface firm, even, irregularly undulating, without cortex. Pores not seen. Vents grouped in a depression on the lower aspect. Internal structure confused, consisting of open areolar sarcode, crumb-of-bread-like, charged with spicules of the species, and traversed by the excretory

canals. Spicules of three forms (viz. one skeleton- and two flesh-spicules) :—1, skeleton-, large, acerate, curved, smooth, sharp-pointed gradually, 1-19th by 1-900th inch in its greatest dimensions (Pl. XXVIII. fig. 16); 2, flesh-spicule, stellate, very variable in form, from the variable number and irregular position of the rays, from two to twelve, arising from a slight central inflation—very variable also in size, from 1-1200th to 1-428th of an inch in diameter (fig. 17, *a, b*), rays microspined (fig. 17, *c*); 3, flesh-spicule very minute, sceptrelliform, consisting of a straight shaft, spined at intervals, viz. at the ends and at two points on the shaft, all equidistant, but very variable in this respect, 1-1500th inch long (fig. 18 *a*). Skeleton-spicules, with a few flesh-spicules, generally distributed throughout the mass; the latter most abundant on the surface. Size of specimen $2\frac{1}{2}$ inches long and 1 inch high.

Hab. Marine, on hard objects.

Loc. Freemantle, Australia.

Obs. Examined in the dried state. This specimen, now in the British Museum (numbered 691), came from the late Dr. Bowerbank's collection, and is labelled "Thomas Ingall," in addition to the locality. I also possess a mounted fragment, taken from a specimen from Hayti belonging to the Liverpool Free Museum, which was sent to me by Mr. Thomas H. Higgin for examination. In spiculation *S. simplex* is so much like *Stellettinopsis corticata* that I have placed it in the same genus, assuming that the sceptrelliform flesh-spicule is but another form of the entirely spined bacillar one of the latter; the large size of the acerate, however, renders it still more like that of the acerate body-spicule of *Stelletta*.

In the Haytian specimen (which is attached to the base of one of *Luffaria fistularis*) the spiculation, generally, is a little larger, the spination of the sceptrella more irregular than that of the Australian one, and the rays of the stellate slightly inflated elliptically at their free ends.

Samus anonyma, Gray. (Pl. XXIX. figs. 1-4.)

Minute amorphous masses of dry contracted sarcode, furnished with filiform extensions, and charged with spicules of the species, in cavities formed by an excavating *Cliona*. Colour now like that of dried sarcode, *i. e.* yellowish. Texture also that of dried sarcode, viz. gum-like. Pores, vents, and internal structure not visible, from the dried state and minuteness of the specimens. Spicules of three forms, viz.:—1, very large, consisting of a short, stout, smooth, subtriangular shaft, terminated at each end by a similar development,

viz. three divergent smooth arms, each ending in three smooth prongs, nearly on the same plane, one of which is central and in a line with the arm, and the other two lateral, viz. one on each side divergent, 1-150th to 1-90th inch long by 1-225th inch across the head (Pl. XXIX. figs. 1, 2), subject to great variation in size and form of the terminal elements in the same and different specimens; 2, small, consisting of a short shaft, similar in form to the last, with a similar development at one end, but with only three undivided arms at the other end (fig. 3, *b*), all except the shaft minutely spined and showing the central canal very plainly, 1-600th inch in diameter across the large head (figs. 3, 3 *a*); 3, flesh-spicule minute, bihamate (*fibula*), **C**- and **S**-shaped, microspined, 1-3000th inch in diameter (figs. 4, 4 *a*). No. 1 is the largest and staple form, no. 2 smaller and less plentiful, no. 3 very abundant. Size of specimen varying with the size of the excavation of the *Cliona*.

Hab. Marine, in cavities of old stony coral excavated by a *Cliona*.

Loc. West Indies and Australia, in *Millepora alcicornis*; and in old *Stylaster sanguineus*, South Seas.

Obs. Examined in the dried state. Wherever I have found this sponge it has been in the said excavations *in company* with *Cliona mucronata*, Sollas ('Annals,' 1878, vol. i. p. 54), *but separate*. Hence, as *Cliona* is the only excavating sponge with which I am acquainted, I conclude that *Samus anonyma* is not a *Cliona*. The filaments that are appended to the little masses of dried sarcode appear to be portions of the latter, which originally occupied the finer passages of the *Cliona*, drawn out by the contraction of the mass now occupying the excavated chamber. The specimen from Australia, to which I have alluded, was in the late Dr. Bowerbank's collection now in the British Museum; it bears my running no. 699, and came from a box of specimens labelled by Dr. Bowerbank "From Mr. Ingall, Australia."

Heretofore I have found a spiculation like that of *Dercitus niger*, Cart., = *Battersbya Bucklandi*, Bk., in the cavities of *Cliona mucronata*, as indicated by the presence of the latter with it, in old coral from the island of Cuba; and having often observed this *black* sponge (*D. niger*) here, at Budleigh-Salterton, growing into the minute crevices of the red rock, it seems, from its gummy sarcode and confused spiculation, to be not only allied to *Samus*, but to the Gumminida also. No. 2 spicule (Pl. XXIX. fig. 3) is very like that of a *Corticium* ('Annals,' ser. 4, vol. xii. p. 19, pl. i. fig. 5, &c.). But, be this as it may, the "large spicule" was first figured by

Dr. Bowerbank (Mon. Brit. Spong. vol. i. p. 234, pl. ii. figs. 41, 42), who merely states that the sponge producing it was found lining the tortuous tube of an Annelid in soft limestone (? *Millepora alcicornis*), like *Hymeniacidon celata*, Bk. (1866), = *Cliona celata*, Grant (1826), and *Vioa*, Nardo (1839); it should be remembered that Dr. Bowerbank considered the excavations of *Cliona* to have been formed by an Annelid (Mon. Brit. Sp. vol. ii. p. 220),—after which Dr. Gray proposed the generic name "*Samus*" for the kind of sponges producing this spicule, and *S. anonyma* for the species (Proc. Zool. Soc. 1867, p. 526). My dear old friend was wrong, however, in allying it to *Axos Cliftoni* or to any of Duchassaing's species of *Vioa*, if the inference of the nature of *Samus* above given be correct.

This brings us to the question whether Hancock, in his first excellent paper on the Excavating-powers of *Cliona* &c. ('Annals,' 1849, vol. iii. p. 321), has not based his genus "*Thoosa*" (ib. p. 345) upon spicules belonging to a *Samus*, seeing that those represented by him (ib. pl. xii. figs. 10, *b*, and 11, *a, b*) are essentially like the spicules of *Dercitus* and *Samus* respectively, while there is a total absence of the *pin-like* spicule, which appears to me to be invariably the form of the skeleton-spicule of the Clionidæ.

Further corroboration of this view seems to be derived from the fact that, in the mountings of the minute detritus of the root-bunch of *Euplectella cucumer* from the Seychelles, which present an innumerable variety of sponge-spicules, the large ones of *Samus anonyma* are present, together with a still more complicated and beautiful form, and a flesh-spicule (Pl. XXIX. fig. 21) almost identical with that which is figured by Hancock as characteristic of both species of his genus "*Thoosa*" (pl. xii. fig. 10, *a*, and pl. xiii. fig. 2, *b*); while of the spicule referred to *Thoosa cactodes*, to which I have before alluded (viz. pl. xii. figs. 11 *a* and 11 *b*), Hancock has stated (p. 347) that he was not able to determine whether or not it belonged to the species, although he felt inclined to the affirmative.

It might be urged against my view that the representation of *Thoosa cactodes* (pl. xiii. fig. 1) is evidently that of a *Cliona*. But then, as *Samus anonyma* fills the cavities of *Cliona*, it, of course, would present the same shape; while the absence of the pin-like spicule here, and the presence of *Samus* together with *Cliona mucronata* in the instances that have been mentioned, show that both may be in the same excavation, and, from the inference that the excavation was made by the latter, that *Samus* is not a *Cliona*.

Corticium Wallichii, Cart. (1874).

(Pl. XXIX. figs. 5-9.)

Minute, amorphous, laminiform. Colour that of dried sarcode, *i. e.* yellowish. Texture like dried sarcode—that is, gum-like. Pores, vents, and internal structure not visible, from the minuteness and dryness of the specimens. Spicules of two kinds, viz. :—1, skeleton-, large, acerate, curved, tubercled throughout in twelve longitudinal lines (Pl. XXIX. fig. 5); tubercles alternate in adjoining rows, constricted in the centre, expanded at the free ends, the latter circular and convex (fig. 5, *aaa*), extended over the extremities of the spicule so as to give them an obtuse irregular form. Central canal bent angularly in the middle towards the convexity of the spicule, undulating afterwards towards the extremities (fig. 5, *b*), 1-31st by 1-200th inch in its greatest diameters, including the tubercles—or the same spicule in an earlier stage of development, without tubercles, and with an angular projection in the centre of the convexity (fig. 6), opposite the bend in the central canal (fig. 6, *a*); 2, flesh-spicule, sceptrelliform (fig. 7), consisting of a straight shaft, abruptly pointed at each end, and microspined throughout, except in the middle (fig. 8, *a*), provided with two circles of horizontal rays, separate from each other, and a little nearer one end of the shaft than the other (fig. 8, *bb*), rays eight or less in number, straight, smooth, capitate, each terminated by a globular inflation, shaft 1-1000th inch long, circle of rays 1-3000th inch in diameter (fig. 9, *a, bb*). Skeleton-spicule in different degrees of development, mixed together with the flesh-spicule in the sarcode. Size that of the excavated cavity in the piece of *Stylaster* where it was found, viz. about 1-18th inch in diameter.

Hab. Marine, in the cavities of ? *Chiona mucronata* in dead old *Stylaster sanguineus* (coral).

Loc. South seas.

Obs. Examined in the dried state. In 1864 Dr. Bowerbank (Mon. Brit. Sp. vol. i. p. 270, pl. xi. fig. 244) gave a figure of the skeleton-spicule of this sponge that had been frequently found in the washings of *Oculina rosea* = *Stylaster sanguineus*, from the South Seas, noting that the sponge itself from which it came had “never been determined.” In 1871 Dr. G. C. Wallich kindly sent me some of his “dredgings” on the Agulhas Shoal, Cape of Good Hope, made in 1857; and among these I found and mounted a spicule of this kind, from which the description and figure were taken (‘Annals,’ 1874, vol. xiv. p. 252, pl. xv. fig. 46), when I proposed for the

sponge producing it the name of *Corticium Wallichii*, conjecturing that, hereafter, the latter might be found to belong to the Gumminida. (Here I may observe that the characters of the Gumminida are not absolutely like gum, but like gum or glue only when dry, and when wet flexible and insoluble like india rubber.) Subsequently, in going through the late Dr. Bowerbank's collections for the British Museum, I found a piece of *Stylaster*, and examining it, under the microscope, by chance met with a small excavation in the dead or older part, lined with the specimen of *Corticium Wallichii* above described, also a few of its characteristic spicules in another part. Finally I found one of the fully developed skeleton-spicules in some of the minute detritus which came from the root-bunch of the specimen of *Euplectella cucumer* from the Seychelles. Hence *Corticium Wallichii* may be fairly inferred to exist at least in three distinct localities, viz. the South Sea, the Cape of Good Hope, and the Seychelles.

Owing to the smooth acerate form of the earlier stages of development of the skeleton-spicule, it is almost impossible to detect the presence of this sponge unless the fully matured tubercled spicule or peculiarly shaped flesh-spicule is witnessed.

Occurring, too, in the midst of the excavations of *Cliona mucronata*, like *Samus anonymus*, it is difficult to decide whether, like the latter, it be a follower of the former, or its own excavator, because, as yet, the presence of *Cliona mucronata* in the same excavation has not been observed. Again, *Corticium Wallichii* has hitherto been found to line the excavation, instead of being contracted into the centre of it like the specimens of *Samus anonymus*. But both these circumstances may be accidental; and therefore nothing but a further observation of *Corticium Wallichii* can determine its real nature. The creeping into small cavities is rather a habit of the Spongida generally than of any particular species.

Proposed Names for two new Groups of Flesh-spicules in the Spongida, viz. SPINISPIRULA and SCEPTRELLA.

In my "Notes Introductory to the Study and Classification of the Spongida" (Ann. 1875, vol. xvi.), at pp. 30-34 I have given a short account of the "flesh-spicule," with illustrations of a few of the commonest types, to which I now propose to add two more under the names respectively of "*Spinispirula*" and "*Sceptrella*," as a more extended knowledge of the Spongida shows this to be desirable, if not necessary.

Varieties of both these types are represented, in Dr. Bowerbank's 'Monograph of the British Spongiadæ,' as "defensive spicula"—the former under the designation of "spinulo-multiangulated cylindrical" (vol. i. p. 239, pl. iii. fig. 72), and the latter under that of "vertically-spined cylindrical" (ib., ib. fig. 69).

Each type, like those already mentioned in my "Notes, &c.," presents itself under a great variety of forms; and although it is necessary to remember these forms in connexion with the species to which they belong, yet it is equally necessary that the respective typical ones upon which each group is constructed should be first understood.

The SPINISPIRULA.

Spinispirula, as its etymology indicates, is a spiniferous, spirally twisted spicule (*ex. gr.* Pl. XXVI. fig. 14, *a*, and Pl. XXIX. fig. 11), which may be long or short, thick or thin; thus in *Rhaphidhastia spectabilis* (Pl. XXVI. fig. 14, *a*) it is long and thin; while in the Suberite from the crab's back to be hereafter mentioned (Pl. XXIX. fig. 12) it is short and thick. Again, the spines may be long and thin, as in *Dactylocalyx Masoni*, Bk. (Proc. Zool. Soc. 1869, pl. vi. fig. 4); or long and thick, as in *D. Bowerbankii*, Johnston (ib. fig. 8, *b*), or obtuse (ib. fig. 8, *a*). The spines may be arranged on the spicule in a spiral line, corresponding with that of the shaft, as in *Rhaphidhastia spectabilis* and *Spongia Dysoni*, Bk. (*l. c.*), or they may be scattered over the shaft less regularly,—in all cases over the extremities, and sometimes entailing an elongation of the surface of the shaft (Pl. XXIX. fig. 11). Lastly, the shaft may consist of many or be reduced to one spiral bend only, as in *Rhaphidhastia spectabilis* and *Hymenaphia spiniglobata* (Pl. XXIX. figs. 14, *a*, and 16, *d*) respectively, when the latter may pass into a globular form, hence Schmidt's name "Spiralstern" (Spong. Küste Algier, p. 17).

To convey an idea of the plan upon which the *Spinispirula* and its varieties are formed, let us conceive a thin globe of india rubber over which a number of spines are arranged in a spiral or less regular manner, the spiral line having its poles opposite each other; now let the globe be more or less elongated in the direction of its axis, and at the same time twisted, when it will be possible to represent thereby most of the varieties of the *Spinispirula*. In many instances, the transparency of the spicule allowing all its spines to be more or less seen at once, it will be necessary to study their arrangement carefully by altering the focus of the magnifying-power, when the

optical delusion will be discovered and the spiral arrangement in most instances satisfactorily recognized.

I have already noticed the *smooth* form of this spirula under the name of "sinuous subspiral" ("Notes," &c. p. 32), which is well seen in *Cliona abyssorum* (Ann. 1874, vol. xiv. p. 249, pl. xiv. fig. 33).

As regards the extent to which the *Spinispirula* under various forms occurs among the Spongida, I have as yet not seen it in any of the orders but that of Holorhaphidota—and here confined to the families Suberitida, Pachytragida, and Pachastrellida, where it is very common among the groups *Cavernosa*, *Compacta*, and *Laxa*, and also in *Placospongia melobesoides*, which may have to come into the same family; rarer in the Pachytragida, where its great abundance, though, and almost peculiar form, in *Tethea muricata*, Bk. (= *Wyvillethomsonia Wallichii*, Wright), becomes a character, as first shown by the late Dr. Bowerbank (Phil. Trans. 1862, pl. xxxi. figs. 14, 15)—used again by him as an illustration of this kind of spicule, described and represented under the designation of "elongo-attenuato-stellate" (Mon. Brit. Sp. vol. i. p. 233, pl. i. fig. 35); also abundant, but in a minuter form, in *Stelletta aspera* (Ann. 1871, vol. vii. p. 7, badly illustrated). Minute, although constant and varied in form, in the Pachastrellina, and present also in some of the Corallistes, *ex gr. Dactylocalyx Masoni*, Bk. (*l. c.*).

As the C-shaped bihamate flesh-spicule or *fibula* is contortly subspiral, and not simply bent upon itself, which may be seen by viewing it on a flat surface, while the S-shaped form is still more spiral, the latter when spined throughout, as in some species of *Tethyina* (Ann. 1876, vol. xviii. pl. xvi. fig. 49), literally becomes a *spined spire*; but for memory's sake the line of distinction must be drawn somewhere, and therefore this had better be still considered as a variety of the bihamate rather than one of *Spinispirula*; so should the spiniferous coil or open spire, represented by the flesh-spicule of *Suberites spinispirulifer* (Pl. XXVIII. fig. 7), whose spines cover the spiral shaft uniformly—that is, without any *spiral* arrangement.

In noticing the transition of the stellate to the spinispirula in *Vioa Johnstonii*, Schmidt (Spongien d. atlant. Gebietes, p. 5) alludes to his *Spirastrella cunctatrix* and *Chondrilla phyllodes*. The former was "violet or reddish," and the latter "violet-brown" in colour, together with identical spiculation; but, from the spinispirula (flesh-spicule) in the latter being a little shorter and its consistence gelatinous, especially in

the cortex, *Chondrilla phyllodes* seems to have been placed among the Gumminida, and *Spirastrella cunctatrix*, on account of its crust, among Schmidt's Corticatæ (Spongien von Algier, p. 17).

Now precisely the same species in point of spiculation occur at the Mauritius and on the south coast of Australia, as I learn from specimens in the late Dr. Bowerbank's collection and that of the Liverpool Free Museum respectively. In all there is the usual condensed layer of flesh-spicules on the surface; and all present the fine crumb-of-bread-like consistence (areolated sarcode) observed in *Halichondria suberea*, Johnst., = *Suberites domuncula*, Nardo. But while the former possess spinispirulate flesh-spicules like those of *Spirastrella cunctatrix*, represented by Schmidt (Spongien, 1. Suppl. Taf. iv. fig. 12, and Spong. von Algier, Taf. iii. fig. 8), that of the specimen in the Liverpool Museum, which has grown on the back of a little crab, is, together with the skeleton-spicule, a little shorter and stouter (Pl. XXIX. fig. 12). Indeed there is much the same difference between the two as there is between Schmidt's illustrations of the flesh-spicule of *Spirastrella cunctatrix* and *Chondrilla phyllodes* respectively, all having the same pin-like skeleton-spicule.

Hence it becomes questionable, with such varietal differences *only* in the spiculation, whether the difference in consistence may not be local, viz. gelatinous in *Chondrilla phyllodes* from the Antilles, and crumb-of-bread-like in the Suberite on the crab's back from the Mauritius.

There were five of these little crabs from the Mauritius sent for examination, each of which was about half an inch in diameter, and each overgrown by a different organism. Thus they bore respectively *Halichondria incrustans*, *Isodictya*, the white Suberite mentioned, *Chondrilla nucula*, *Chondrosia*, sp., and a calcareous white compound tunicated animal; so that I had ample means of contrasting the friable consistence of the Suberite with the gelatinous one of the Gumminida; while the spiculation of the former only differing from the other Suberites in the way above mentioned, led me to regard the whole as specimens of Schmidt's *Spirastrella cunctatrix*, one of which, viz. that from Australia (Freemantle), now numbered "708," measures 6 × 4 × 2 inches in its greatest dimensions. Both this and those from the Mauritius, although dry, still present the remains of the violet-red colour which they had when fresh, together with some great variety in the length, size, and general form of the flesh-spicule; while that on the crab's back is white and the spiculation more robust.

THE SCEPTRELLA.

Sceptrella, meaning a little sceptre, differs from *Spinispirula* in having a cylindrical, straight shaft with its spinal developments arranged in groups circularly about the ends, and at more or less equal distances on the shaft. The spines may be smooth and simple, as in *Podospongia Loveni*, Bocage (Journ. d. Sci. Math., Phys. et Naturelles, no. iv. Lisbonne, 1869, pl. x. fig. 1, &c.), or microspined, as in *Sceptrella regalis*, Sdt. (Spongien d. atlant. Gebietes, p. 58, Taf. v. fig. 24, a); or the groups on the shaft may be transformed into circular plates with serrated margin, as in *Latruncula cratera*, Bocage (*op. et loc. cit.*, pl. xi. fig. 2, c, d, e); for illustrations of these respectively see Pl. XXIX. figs. 13, 14, and 15; or the plates round the shaft may be cup-shaped (figs. 16, 17, and 18), or the shaft stout with few and large spines (fig. 19), or the circular plates inflated on the margin and, together with most of the shaft, uniformly covered with minute spines (fig. 20); or, finally, the shaft may be almost obscured by the groups at the extremities being transformed into a single globular inflation, and those on the shaft into four or more such globular inflations, all microspined (fig. 21); the latter is almost a fac-simile of one of the spicules characterizing Hancock's genus *Thoosa* among the excavating sponges, to which I have already alluded. All the illustrations of the sceptrella are drawn on the same scale for comparison; and figs. 16 to 21 inclusive are present in greater or less number among my mounted specimens of the minute detritus from the root-bunch of *Euplectella cucumer*, obtained at the Seychelles, in which the number of known and unknown forms of spicules of the Spongida is truly wonderful, to say nothing of the other siliceous organisms, viz. the Radiolaria and Diatomaceæ, all of which, having been boiled in nitric acid, are preserved (at the expense, of course, of the calcareous Foraminifera), mixed up with gold dust and blue sapphire, &c.

As regards the extent to which the sceptrella under various forms occurs in the Spongida, I have never seen it in any species but those which I should be inclined to place among the Suberitida in the order Holorhaphidota, viz. those above mentioned, i. e. *Axos spinipoculum*, *Stellettinopsis simplex*, and perhaps *Corticium Wallichii*, together with the sponges from which the sceptrellæ in the mounted detritus from the root-bunch of *Euplectella cucumer* came, a few only of the forms of which have been briefly described and added to the illustrations of this beautiful flesh-spicule.

Schmidt's *Sceptrella regalis* seems to me to be an anomaly, since there are anchorates of both kinds present, viz. equi- and inequianchorates. May not these be adventitious?—just as we find the skeleton- and smooth spirular spicule of, to me, Hancock's *Cliona northumbrica* (Ann. 1867, vol. xix. p. 237, pl. vii. fig. 1) mixed with or appropriated by an *Esperia*, forming part of Kent's *Rhaphidotheca Marshall-Hallii* (Ann. 1870, vol. vi. p. 222, pl. xv. figs. 3 and 6).

It remains to be seen whether *Corticium Wallichii*, which I conjectured, from the form of the skeleton-spicule only, to belong to the Gumminida, does so or not.

That *Sceptrella* may be a *Spinispirula* under another form, the flesh-spicules of *Latruncula corticata* (Pl. XXVII. fig. 4, *a*, *b*, *c*) plainly demonstrate.

EXPLANATION OF PLATES.

PLATE XXVIII.

- Fig. 1.* *Trachycladus lævispirulifer*, n. sp. (natural size). *a*, stem; *b*, branches.
- Fig. 2.* The same. Skeleton-spicule (scale 1-24th to 1-6000th inch).
- Fig. 3.* The same. Flesh-spicule, spirular (same scale).
- Fig. 4.* The same. Flesh-spicule, cylindrical (same scale).
- Fig. 5.* The same. Length of spicule on scale of 1-12th to 1-1800th inch, for comparison.
- Fig. 6.* *Suberites spinispirulifer*, n. sp. Skeleton-spicule (scale 1-12th to 1-1800th inch).
- Fig. 7.* The same. Flesh-spicule, spinispirulate. *a*, same scale; *b*, more magnified, to show the spination.
- Fig. 8.* *Suberites angdospiculatus*, n. sp. *a*, smaller and more angulated form; *b*, larger and less angulated form. Scale 1-24th to 1-6000th inch.
- Fig. 9.* *Suberites fuliginosus*, n. sp. *a*, smooth skeleton-spicule; *b*, spinous skeleton-spicule. Scale 1-24th to 1-6000th inch.
- Fig. 10.* *Stellettinopsis corticata*, nov. gen. et sp. (nat. size). *a*, vents; *b*, base.
- Fig. 11.* The same. Skeleton-spicule (scale 1-24th to 1-1800th inch).
- Fig. 12.* The same. Flesh-spicule, stellate. *a*, on scale of 1-48th to 1-6000th inch; *b*, the same, more magnified.
- Fig. 13.* The same. Flesh-spicule, bacilliform, spinous. *a*, on scale of 1-48th to 1-6000th inch; *b*, the same, more magnified.
- Fig. 14.* The same. Quartz grains in the cortex.
- Fig. 15.* The same. Vent and portion of the surface, magnified respectively and relatively, to show:—*a*, aperture in the centre of the sphinctral diaphragm; *b*, elevated border; *c*, form of the convoluted dermal sarcode; *d*, the same, more magnified, showing the position of *c*, the quartz grains.
- Fig. 16.* *Stellettinopsis simplex*, n. sp. Skeleton-spicule (scale 1-24th to 1-1800th inch).
- Fig. 17.* The same. *a*, flesh-spicule, stellate (scale 1-48th to 1-6000th inch); *b*, the same, more magnified; *c*, arm, still more magnified, to show the microspination.
- Fig. 18.* The same. *a*, flesh-spicule, sceptrella; *b*, the same, more magnified. Scale 1-24th to 1-6000th inch.

PLATE XXIX.

- Fig. 1.* *Samus anonymus*, Gray. Skeleton-spicule; end view (scale 1-12th to 1-1800 inch).
- Fig. 2.* The same. Skeleton-spicule; lateral view (same scale).
- Fig. 3.* The same. Flesh-spicule, (large) spined; end view (same scale). *a*, more magnified, to show the spined surface as indicated by the serrated margin; *b*, end of shaft, with smaller and unbranched arms.
- Fig. 4.* The same. Flesh-spicules (small), bihamate (*fibula*). Scale 1-12th to 1-1800th inch. *a*, one more magnified, to show the microspination.
- Fig. 5.* *Corticium Wallichii*, Cart. (1874). Skeleton-spicule (scale 1-6th to 1-1800th inch). *a a a*, tubercles; *b*, central canal.
- Fig. 6.* The same. Skeleton-spicule without tubercles, early stage of development. *a*, central canal. Same scale.
- Fig. 7.* The same. Flesh-spicule, sceptrellate (same scale).
- Fig. 8.* The same. Flesh-spicule, more magnified (scale 1-6th to 1-6000th inch). Lateral view. *a*, shaft; *b b*, radiated disks.
- Fig. 9.* The same. Flesh-spicule, radiated disks of; end view. *a*, shaft; *b*, capitate radii.
- Fig. 10.* *Amorphina stellifera*, n. sp. *a*, skeleton-spicule; *b*, flesh-spicule, stellate. Scale 1-24th to 1-1800th inch.
- Fig. 11.* *Spinispirula*. Flesh-spicule of *Spongia Dysoni*, Bk., much magnified (scale 1-4th to 1-6000th inch).
- Fig. 12.* The same. Flesh-spicule from *Spirastrella cunctatrix*, Sdt., mihi, from the variety on the crab's back (scale 1-12th to 6000th inch).
- Fig. 13.* *Sceptrella*. Flesh-spicule of *Spongia Loreni*, Bocage.
- Fig. 14.* The same. Flesh-spicule of *Latruncula cratera*, Bocage.
- Fig. 15.* The same. Flesh-spicule of *Sceptrella regalis*, Sdt.
- Figs. 16-21.* The same. Various forms from the minute detritus of deciduous sponge-spicules in the root-bunch of *Euplectella cucumer* from the Seychelles. *Fig. 16.* End view of one, so situated in the detritus.
- N.B. All the figures from 16 to 21 respectively are drawn to the same scale, for comparison, viz. 1-12th to 1-6000th inch.

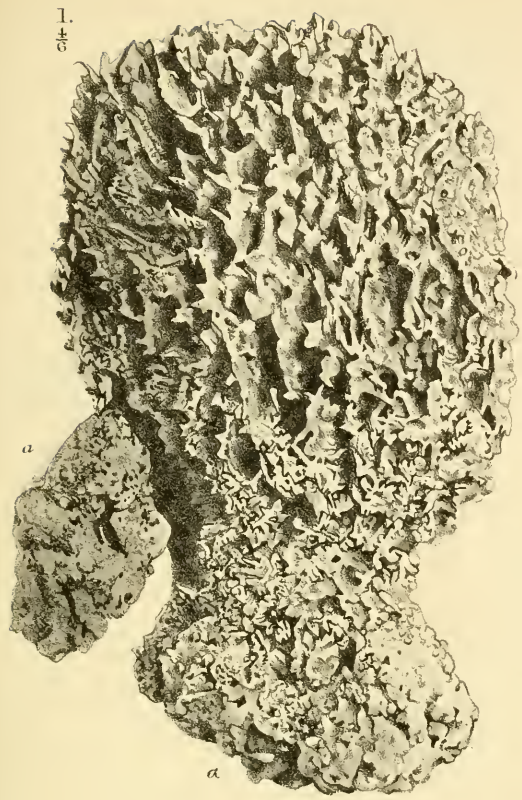
XXXIX.—*An Account of a small Series of Coleoptera from the Island of Johanna.* By CHARLES O. WATERHOUSE.

A SMALL series of Coleoptera has recently been added to the British-Museum collection from the island of Johanna. The specimens were collected by Mr. Bewsher; and among them I have detected three species new to science, for one of which I propose to establish a new genus. The following species were obtained:—

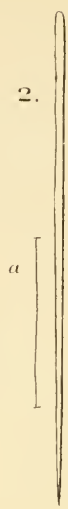
1. *Cicindela melancholica*, Fabr.

Three examples of this widely distributed species.

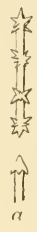
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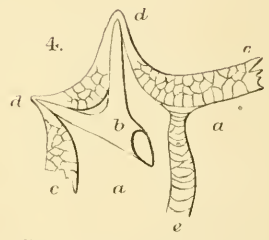
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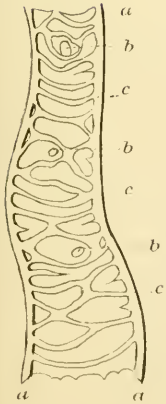
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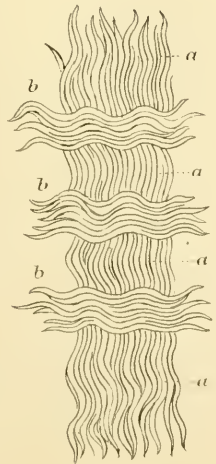
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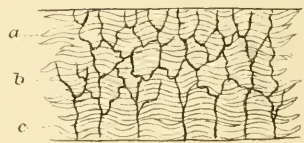
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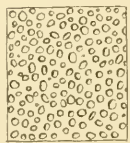
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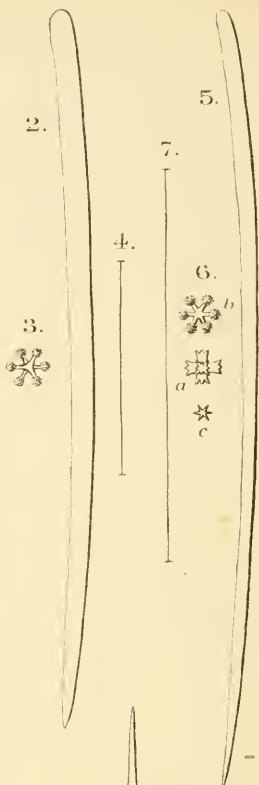


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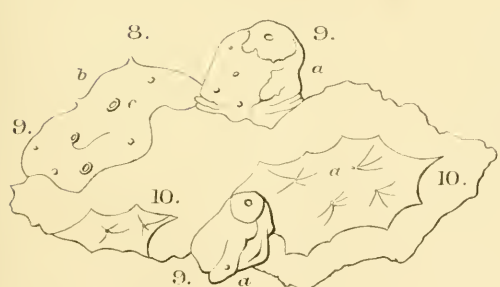


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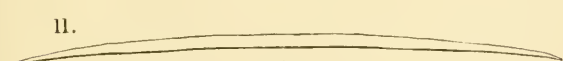
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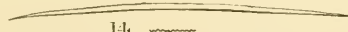
11.



12.



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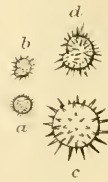


14.



a

16.



c



