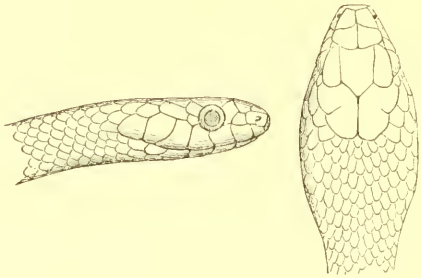
teeth are enlarged; but the hindmost of the upper jaw is distinctly the largest and grooved.



Upper parts greyish olive, with a blackish median line along the posterior part of the trunk and of the tail. A similar but less distinct line runs along the outer edge of the subcaudals and posterior ventrals. An oblique blackish line from the eye towards the angle of the mouth. Lower parts whitish; anteriorly with some blackish specks, which congregate and form a well-defined narrow black band along the middle of the belly and the tail.

One specimen from Eastern Betsileo is 31 inches long, the tail measuring 6 inches.

XXIX.—*Some Sponges from the West Indies and Acapulco in the Liverpool Free Museum described, with general and classificatory Remarks.* By H. J. Carter, F.R.S. &c.

[Plates XI. & XII.]

In the following report of Sponges from the West Indies and Acapulco, collected for the Liverpool Free Museum by the Rev. H. H. Higgins, M.A.*, and Capt. W. H. Cawne Warren respectively, I propose to identify those which are already known, and to name and describe those which hitherto have not been published, availing myself at the same time

* Mr. Reginald Cholmondeley, of "Condover Hall," Shrewsbury, having chartered the yacht 'Argo' for a cruise in the West Indies during the winter of 1876–77, kindly offered to take a naturalist with him on behalf of the Liverpool Free Museum, upon which the Rev. H. H. Higgins, M.A., solicited by the committee of the museum, undertook this office.

of this opportunity to couple with these descriptions general and classificatory remarks, aided by descriptions and references to species in the British Museum and elsewhere which will best illustrate the subject, thus endeavouring to heap up still more matter for some one to embody in a 'Manual of the Spongida,' based, if he should think fit, on my "Notes Introductory to the Study and Classification of the Spongida" ('Annals,' 1875, vol. xvi. p. 1, &c.), since it is useless for me to commence a work of this kind now, which I can never expect to complete. Had I had twenty years ago the amount of knowledge of the Spongida which the opportunities and time of the last twenty have given me, I might have done this myself, and more; but as it is, it must be left to the next generation.

I had hoped to find a "key" in the collection of sponges from the West Indies to those described and illustrated in the 'Spongiaires de la Mer Caraïbe,' published in 1864 by MM. P. Duchassaing de Fonbressin et Giovanni Michelotti (Natuurk. Verh. Holland. Maat. te Haarlem, vol. xxi. 4to, with twenty-five coloured plates); but that hope has not been realized, since the work is so full of errors, typographical and others, the descriptions so incomplete, and the representations so coarse, that I have hardly ever referred to it without vexation, still more increased by the evidence that its otherwise rich contents must thus, for the most part, for ever remain unavailable, just as many of the illustrations of the Spongida in Savigny's 'Zoology of Egypt,' which, although so exquisite that one can almost see in them the objects themselves, are, for want of accompanying descriptions, rendered utterly useless.

For instance, in the 'Spongiaires de la Mer Caraïbe' we have the generic term "*Thalysias*" spelt in four different ways, viz. as "*Talysias*" at p. 24, "*Halysios*" at p. 76, "*Thalisias*" at p. 82, "*Thalysias*" at p. 84; and after all, in Dr. de Fonbressin's pamphlet of 1870, entitled a 'Revue des Zoophytes et des Spongiaires des Antilles' (where we in vain look for an apologetic explanation of the unsatisfactory way in which their 'Mémoire' on the Spongida was published) the same term is spelt "*Thalysios*" (p. 38)*; while in no instance, beyond the term "aciniform," is the spicule either delineated or described, although the authors, in their historical sketch at the commencement of the memoir (p. 11), manifest

* Hereafter the two works of de Fonbressin and Michelotti above mentioned will be referred to under the abbreviations of "de F. et M." and "Revue" respectively.

an acquaintance with both Dr. Bowerbank's and Dr. Oscar Schmidt's works!

Now, as it is essential for recognition that the microscopy and spiculation of each sponge should accompany it, if not in illustration, at least in description, so it is evident that in the absence of this alone, to say nothing of the shortcomings of the publication generally, the 'Spongiaires de la Mer Caraïbe' must for ever remain a kind of "Eldorado," in which there are a number of good things, but no one can get at them.

Having thus introduced the subject, I will now proceed to a description of the sponges, which will be arranged in accordance with my classification, beginning with

Order I. CARNOSA.

Family 2. Gumminida.

Chondrilla nucula, Sdt.

This flesh-like sponge seems to grow most abundantly all over the West-Indian seas and upon every thing submarine with which it comes into contact. In many places, as at Puerto Cabello, the specimens have partly-enclosed fragments of sedge (*Spartina*), much as leaves of grass still green are seen to pass through the pileus of an agaric, thus indicating great rapidity of growth in either instance. Perhaps the most remarkable features in *Chondrilla nucula* are its contracting to a very small size when dried, and swelling out to a comparatively large one when soaked in water—a property in the officinal sponge with which we are familiar; but this is fibrous, whereas *Chondrilla nucula* when dry is nearly as hard as wood, and when wet presents the toughness, consistence, and elasticity of india-rubber, with the softness of gelatine; while, like the officinal sponge again, it may be dried and soaked repeatedly without apparently undergoing any deterioration in structure.

Order II. CERATINA.

Family 1. Luffarida.

Luffaria cauliformis, n. sp.

Cauliform, cylindrical, round, solid, long; simple or branched irregularly; erect, straggling, or repent; rising from a contracted base of attachment, terminating in a diminished round point, swelling out slightly between; uniting with each

other where in contact, and with all other kinds of objects in their course. Stiff, but fragile. Colour black. Surface uniformly reticulate in relief, covered with black dermal sarcode except where the vents, more or less linearly arranged in two rows, present themselves on opposite sides of the cylinder. Internal structure fibro-reticulate, tympanized with black sarcode in the interstices; fibre round, anastomosing, of a clear golden amber-colour, uniformly cored or axiated with a small but distinct pith of greyish-white microgranular substance; rigid but fragile, contrasting strongly in its bright colour with the black sarcode; diminishing in size as it extends upwards and outwards from the centre to the circumference, where it ends in simple branches, covered as before stated, unless waterworn by the dermal sarcode. Size of largest caulis or stalk about 18 inches long by half an inch in diameter in its widest part.

Hab. Marine. Attaching itself to all objects with which it may come into contact while growing.

Loc. Antigua, Nassau.

Obs. The black colour of the sarcode, rigid although fragile fibre, with its distinctly and uniformly axiated character, terminating on the surface in simple branches instead of knotted aggregations, chiefly separate the cauliform *Luffariæ* from those of the same form and appearance among the *Aplysinæ* that will hereafter be described.

Luffaria cauliformis, var. *rufa*.

The same as the foregoing, only of a light brown-red colour.

Loc. Antigua.

Luffaria cauliformis, var. *elongo-reticulata*.

The same as the last, but with the meshes of the fibro-reticulate skeletal structures more elongated and more obliquely directed upwards and outwards from the centre. Colour grey.

Loc. Nassau.

General Observations.

The cauliform species of *Luffaria*, like the "creeping *Cereus*" (*C. flagelliformis*), are all solid; and of course the vents appear on the surface, as in the cauliform digitate *Chalinæ*; while another kind, although not exactly "cauliform," is long, tubular, and hollow, ex. gr. *L. fistularis* auctt. and *L. Archeri*, Higgin, in which, of course, all the vents open

into the interior, which thus forms a "cloaca." I use the words "of course" advisedly, because the vents in all cases must open in these ways respectively.

Family 2. Aplysinida.

Aplysina aerophoba, Nardo.

Several specimens (see Schmidt, in Spong. Adriatisch. Meeres, p. 25, and type specimens in the British Museum).

Loc. Antigua.

Aplysina compressa, n. sp.

(Fragment.) Compressed, curved, flat, flabelliform, thinning out towards the upper or unbroken margin. Firm in the dried state, black and shining, like "satin." Surface wrinkled by irregular polygonal divisions, in which the ridges are much more elevated on one (? the outer) side than on the other (? the inner) one, where the vents are. Fibre concealed by the black sarcode, except at the broken edges and waterworn parts, where it presents an opaque yellow colour, contrasting strongly with the rest of the sponge. Size of the fragment $4 \times 2 \times \frac{1}{2}$ inch in its greatest dimensions.

Hab. Marine.

Loc. Long Key Island, Nassau.

Obs. This looks like a fragment of a once flabelliform or vase-like structure. As I have before stated, the chief difference between this kind of *Aplysina* and *Luffaria* is more or less empirical, being one of degree in which the core of the fibre of the former exceeds in thickness the wall of the transparent kerasine cylinder which surrounds it, while in the latter it is the opposite. Generally too, perhaps, the growth of this kind of *Aplysina* is more massive, sessile, and spreading, while that of *Luffaria* is more cauliform and ascendant. In the two species, viz. *A. carnosa* and *A. corneostellata*, however, and in the mixed form, *A. capensis* ('Annals,' 1881, vol. viii. p. 110), the surface is covered with minute hair-like filaments, which are the terminations of the internal fibrous structure. There is a quadrilateral compressed specimen of this kind (apparently a fragment too) in the British Museum (no. 177, "5 *c*"), where the vents, which are large and on the margin, represent a Pandean-pipe arrangement.

Aplysina cauliformis, n. sp.

Cauliform, cylindrical, round, solid, long; simple or branched irregularly; erect, straggling, or repent, rising

from a contracted base of attachment terminating in a diminished round point, swelling out slightly between; uniting with each other where in contact, and with all other kinds of objects in their course. Texture resilient. Colour light pinkish brown. Surface even or subpenicillate. Vents round, numerous, situated linearly or flute-like in two rows on opposite sides of the stem, or more or less irregularly scattered over it. Structure essentially fibrous; fibre simple, rather flaccid, with indistinct granular axis, reticulated, diminishing in size upwards and outwards from the centre to the circumference, where it is gathered together into subpenicillate projecting knots; void of foreign bodies throughout. Size of longest stalks, of which there are many, about 1 foot long and $\frac{1}{4}$ to 1 inch in diameter.

Hab. Marine. Growing upon hard objects, often in conjunction with *Polytherses* and *Luffaria cauliformis*.

Loc. Nassau.

Obs. The absence of foreign bodies in the fibre, flaccid character, and brownish-pink colour, so far unite this sponge to *A. carnosa*, Sdt., and *A. corneostellata*, Carter, that, however different it may be in other respects, these kinds of *Aplysinæ* appear to be its nearest allies; for, although the subpenicillate knot-like terminations of the fibre on the surface are without the "hair-like filament" of *A. carnosa* &c., still they are a nearer approach to it than those of the Luffarian species last described, where there are none. *Aplysina cauliformis* appears to be the same as *Callyspongia tenerrima*, de F. et M. (p. 57, pl. x. fig. 3).

Aplysina longissima, n. sp.

Whip-like, cauliform, cylindrical, round, solid, long; simple or branched scantily and irregularly; erect, rising from an expanded incrusting base, diminishing gradually to a round point. Very rigid and resilient. Colourless or grey. Surface uniformly even towards the free extremity or youngest part, becoming covered with star-like knots of the fibre, increasing in size and prominence towards the base, where this structure is strikingly beautiful. Vents large, round, and scattered over the expanded base, becoming less evident upwards. Structure essentially fibrous; fibre simple, rigid, stiff, with indistinct granular axis, reticulated, diminishing in size upwards and outwards from the centre to the circumference, where it is gathered together in the star-like knots mentioned; void of foreign bodies throughout. Size of largest specimen 27 inches long by half an inch in diameter: expanded or incrusting base about 2 inches square.

Hab. Marine. Growing upon hard objects.

Loc. Nassau.

Obs. The same remarks with reference to classification apply to this as to the last species, from which it differs chiefly in being much more rigid, colourless, and ornamented on the surface, especially towards the lower part, with a much more beautiful development of the star-like structure, in which the terminal knots of the internal fibre become absolutely conoidal from their prominence.

Aplysina (*Spongia*, de F. et M.) *fenestrata.*

Massive, sessile, lobate, hollow; lobes erect, amorphous or conical. Tissue flexible, resilient. Colour black, becoming brown where waterworn. Surface polygonally reticulated, tympanized with black glistening sarcode in the interstices, which are bordered by projections of the subdermal fibre. Vents large, on the prominent parts of the body. Internally fibrous, elastic, columnar, like that of honeycomb, irregularly prismatic, about half an inch thick, forming a perpendicular structure between the surface and the internal cavities, whose shape is therefore more or less indicated by the form of the mass externally. Fibre stiff, flexible, of a deep amber-colour, cored indistinctly with a granular axis, void of all foreign objects; forming a reticulated line in each angle of the prismatic structure, interunited by transverse filaments, which terminate on the surface in the way mentioned. Size of largest specimen about $6 \times 4 \times 2$ inches.

Hab. Marine.

Loc. Long Key Island, Nassau.

Obs. With kerasine flexible fibre void of all foreign objects in the core, which is indistinctly granular, we have no other order for the reception of this species but the Ceratina and the family Aplysinida; still, having evidently been described and figured by de F. et M. under the name of "*Spongia fenestrata*" (p. 36, pl. iii. fig. 7), their specific although not their generic name has been retained. British Museum, Nos. 179 and 484.

Order III. PSAMMONEMATA.

Family 1. Bibulida.

Spongia officinalis auctt.

Massive, sessile, globular, or lobed; lobes erect, conoid, each terminating in a large oscule. Texture resilient, firm. Colour purple-black above, becoming colourless below.

Surface uniformly and finely reticulated in relief, on account of the dermal sarcode subsiding on the subjacent fibrous structure. Vents numerous, large and scattered, chiefly on the prominent parts. Internal structure finely cellular, arising from the sarcode tympanizing the meshes of the fine skeletal fibro-reticulation; traversed by the branches of the excretory canal-system, which terminates in the vents mentioned; fibre for the most part tough, translucent, resilient, and yellowish in colour, terminating on the surface in pointed knots or tags, cored with a little sand, from which the psammonematous filament, otherwise difficultly distinguishable, may be traced internally. Largest specimen, which is the subglobular one, $6 \times 3 \times 5$ inches.

Hab. Marine. Growing on hard objects.

Loc. Puerto Cabello.

Obs. Having in my possession a specimen of the so-called "best Turkey sponge" of commerce, which was obtained in the Black Sea and preserved in spirit while fresh, I am enabled to compare it satisfactorily with the West-Indian specimens, of which there are both dry and fresh ones, and thus to state that there is no specific distinction between the two. The coarser forms from the Mediterranean, called in commerce "honeycomb sponges," are also to be found in the West Indies; and, indeed, the two kinds appear to me to occur together at the Cape, the Mauritius, in the sea around S.W. Australia, and all over the world; but not being so large, or so plentiful, or of such a convenient shape as in the Mediterranean, their occurrence for the most part is disregarded in a commercial point of view, although a good collection from different localities would form a most interesting zoological demonstration of their comparative differences. Meanwhile the vitality of these sponges is so great that they are now grown from "cuttings" in the Adriatic for commercial purposes. When a section of the West-Indian sponge in its dried state is made, the internal structure presents a light brown colour, which contrasts strongly with the dark purple-black thin layer of the dermal sarcode; and this is the case also with the coarser kinds. It is very probable that there are degrees of fineness between the "best Turkey sponge" and the "honeycomb" ones; but to describe these would be more troublesome than useful in a zoological point of view.

Family 2. Hircinida.

Hircinia caracasensis, n. sp.

Massive, sessile, globular, with a tendency to rise into

lobes. Texture firm. Colour dark purple above, becoming brown and colourless below. Surface uniformly reticulated, wherein the knots of the reticulation and the intervening lines of the subjacent fibro-skeletal structure are rendered more or less in relief by the extent to which the dark dermal sarcode subsides between them, thus presenting a polygonally-divided area, in which the larger divisions are marked by the salient points of the knots, often filamented, and a smaller structure of the same kind, but more delicate and soft, occupies the interstices. Vents numerous, large and small, scattered. Internal structure uniformly cellular, formed in the way stated in the last species; traversed by the branches of the excretory canal-system, which ends in the vents mentioned; fibre kerasine, resilient, cored to a great extent with foreign bodies (sand-grains &c.). Size of specimen, which is subglobular, about $8 \times 5 \times 4$ inches.

Hab. Marine. Growing on hard objects.

Loc. Puerto Cabello and Nassau.

Obs. By comparing this with the last species, we come to the conclusion that the chief differences arise from the fibre being coarser, more generally cored with foreign bodies (sand-grains &c.), and the structure less compact than that of *Spongia officinalis*, wherein the bibulous property on this account so far exceeds that of even the finest-structured *Hircinia* that the latter is of course never used for domestic purposes. It is possible that this species may be represented by de F. et M. in their figure 4, pl. iv., under the name of "*Spongia lacinulosa*," if the surface-filaments thereon delineated are to be identified with those often observed on the waterworn parts of *Hircinia caracasensis*.

Polytherses, de F. et M.

There are several specimens of this so-called sponge, which, indeed, is no sponge at all, but a *Hircinia* in which the sarcode has been mysteriously replaced by the parasitic filament for which I have proposed the name of "*Spongiophaga communis*." I say "mysteriously," because no one yet has been able to follow the transformation or development of the parasite, or determine, if indeed conjecture, what it is; for an account of which, so far as is known, together with an illustration, I must refer the reader to my paper on the Parasites of the Spongida ('Annals,' 1878, vol. ii. p. 165).

It attacks *Hircinia* of different degrees of fineness of structure in all parts of the world, and so simulates the sponge itself that de F. et M. took it for one, and called it "*Poly-*

therses "—since it is exceedingly plentiful in the West-Indian seas, growing in some parts where the water is hardly a metre deep (de F. et M., "Revue," p. 37), and yet I found a specimen equally affected by it which was dredged near Cape St. Vincent on board H.M.S 'Porcupine' in 374 fathoms. Although, in most instances, the whole of the sarcode is destroyed, still in many this is only partially the case, while, of course, there are also many instances wherein there is no trace of the filament at all to be seen, and the *Hircinia* remains so far intact. Lastly, the transformation goes on so gently and yet so completely that the delicate white lace-like reticulation which is often seen in the dermal sarcode tympanizing the polygonal divisions between the projecting points of the fibrous structure on the surface of the *Hircinia* is frequently left when every particle of sarcode that was in contact with it has disappeared, thus remaining on a tympanizing membrane formed by the filaments instead of the sarcode. This lace-like reticulation arises from the delicate fibro-reticulation in the dermal sarcode, before mentioned, attaching to itself microscopic objects of all kinds, which sometimes goes on to such an extent as to produce a continuous incrustation, in which case, of course, the reticulated structure becomes obscured.

Group 16. Arenosa.

Dysidea tubulosa, n. sp.

Tubes erect, grouped in juxtaposition; fragile. Colour white, chiefly from being densely charged with a small white, filiform, branched coralline (*Jania*). Tubes $1\frac{1}{2}$ inch high and $\frac{1}{4}$ inch in diameter when dry.

Hab. Marine.

Loc. Nassau.

Obs. This, in description and figure, corresponds with de F. et M.'s *Terpios jania* (p. 101, pl. xxii. figs. 8, 9), in which the spicules are said to be "aciniformes," whatever this may mean; but it is not the case, in particular, with our specimen, where the variety of different forms of fragmentary sponge-spicules and other foreign bodies at once testifies to its nature; hence the name above given. As we cannot assume that the *Jania*, when growing by itself, has this tubular form, so we cannot assume that it belongs to the *Dysidea* alone; hence it may be produced by the two growing together *pari passu*; although another instance of this kind was dredged in the harbour of Acapulco by Capt. W. H. Cawne Warren, in which the sponge is *Reniera fibulata*, Sdt., in combination

with the same species of *Jania*, forming a *globular* sessile mass with large crevice-like vents.

Of course, there is no alliance between these specimens and de F. et M.'s species *Terpios fugax*, which will be described hereafter.

Order IV. RHAPHIDONEMATA.

Family 2. Chalinida.

Chalina rubens, Pallas.

Massive, lobate, sessile, erect or flat, convex, repent, incrusting, lobes often extended into long processes characterized by large round vents. Texture firm, resilient. Colour dark or light crimson-red, often reddish brown when fresh, light brown-grey to white after exposure on the shore. Surface covered with a fine fibro-reticulation interrupted only by the vents. Vents large, round, numerous, elevated at the margin, scattered generally over the mass, or more or less confined to particular parts, especially in the cylindrical erect forms, where they present a broken linear arrangement on opposite sides of the column. Internally composed of uniformly reticulated fibrous structure, much coarser but less dense than that of the surface; traversed by the branches of the excretory canal-system, which terminates at the vents mentioned; fibre resilient, kerasine, cored with proper spicules. Spicule of one form only, viz. acerate, smooth, slightly curved, fusiform, sharp-pointed, about 50 by $\frac{2}{3}$ 6000th inch in its greatest dimensions* (Pl. XI. fig. 7), more confined to the fibre than to the sarcode. Size of largest specimen about 9 inches high and 5 inches in diameter at the base, with lobes 1 to 2 inches thick.

Hab. Marine. Growing on hard objects.

Loc. Nassau. Long Key Island.

Obs. This sponge has been known for a very long time under the name of *Spongia rubens*, given to it by Pallas (Elench. Zoophytorum, p. 389. no. 238), = *S. digitata*, Esper, tab. 50, = *S. arborescens*, Lam. (An. s. Vertèb. vol. ii. p. 374, no. 98), and last? = *Amphimédon*, de F. et M. (p. 78). Variable, however, as the form and colour in different specimens may be, the prevailing character of the species, which appears to be very plentiful in the West Indies, growing especially about the branches of *Millepora alcicornis*, may be traced

* The measurements will be chiefly given in 6000ths of an inch, to accord with the delineations in the Plates. See "Note" at the commencement of the "Explanation of the Plates."

throughout, while the spiculation above stated is always the same.

It is often accompanied in its repent-incrusting form by *Thalysias carbonaria*, de F. et M.,=*Spongia carbonaria*, of Lamarck, who states that it is found "enveloppant de grandes portions du *Millepora alcicornis*" (vol. ii. p. 357. no. 20); but the friable structure of the latter, as well as its colour, although in every other respect like *Chalina rubens*, distinguishes the two; while the lighter-coloured species of *Thalysias* are still more compact and friable, although still with the same spiculation and structure. Yet *Thalysias* has been placed by me in the order Holorhaphidota, and *Chalina* in that of the Rhaphidonemata! simply because the absence of friability in the latter arises from the kerasine element in the fibre preponderating over the spiculiferous core, while in the Holorhaphidota it is the opposite.

This is the case with the British species *Halichondria simulans*, Johnst., whose varieties are so numerous that he calls it "polymorphous." Indeed *H. simulans* is not unlike a British representative of the West-Indian *Chalina rubens*. So it is with a sponge similar to *H. simulans* at Ceylon (? Hartog Is., W. Australia) and Port Elizabeth respectively, but with a bihamate flesh-spicule, in which the former has the resiliency of a *Chalina* and the latter that of an *Isodictya* (numbered respectively in the British Museum 106, registered 59. 2. 28. 36, and 202, registered 71. 5. 12. 1).

Chalina rubens also exists in the sea about S. Australia; but the specimen which I have is of a light yellow colour; however, it seems, like the West-Indian specimens, to come nearer to the British species *Halichondria palmata*, Johnst., which I have taken for the type of the group Palmata (viz. no. 2) in my order Rhaphidonemata.

Family 2. Cavochalinida.

Tuba lineata, de F. et M. (p. 74).

Vase-shaped, flabelliform, compressed or bivalvate, with the halves, which are thin and separate, in close approximation, but marginally united on one side only and at the base of the *Pecten*-like form. Size about 9 inches long by 6 inches high. (Spicule, Pl. XI. fig. 4.)

Loc. Dominica.

Tuba digitalis, de F. et M. (p. 49, pl. viii. fig. 2).

Vase-like or tubular, patulous, proliferous, consisting of several individuals of different sizes grouped together, so as to

form an irregular lobate mass. Orifice ciliated. Differing from the species last mentioned, viz. *T. lineata*, in the absence of the fine dermal reticulation usually characterizing these sponges, which is replaced by a penicillate surface formed of prolongations of the tissue, between which are an equal number of holes, now, like the vents, opening into the interior, but probably in the fresh state covered by a dermal fibro-reticulation supporting the sarcode in which the pores were situated. Largest specimen, which is that described, 4 inches high by 4 inches thick. (Spicule, Pl. XI. fig. 5.)

Loc. Nassau.

Tuba armigera, de F. et M. (p. 43, pl. viii. fig. 3).

Irregularly cylindrical, crooked, solid, repent, long, simple or branched, scantily furnished with prolongations of the tissue in the form of coarse spines. Surface covered with the usual fine, smooth, dermal fibro-reticulation. Vents large and numerous. Largest specimen about 8 inches long by $\frac{1}{2}$ to 1 inch in diameter. (Spicule, Pl. XI. fig. 6.)

Loc. La Guyra.

Obs. The group of sponges to which the foregoing three species belong appears to me to be more developed in the West-Indian seas than in any other part of the world, judging from the amount and variety of them in the British Museum. They are for the most part aculeated, and all hollow; all are composed of resilient fibre, and the fibre cored with a variable amount of spicules, in which, as in *Chalina rubens*, the kerasine element greatly predominates. The spicule is of one kind only in all, and this for the most part smooth, curved, fusiform, and sharp-pointed, viz. the typical "acerate," varying somewhat in size and form, although still always "acerate" (Pl. XI. figs. 4, 5, 6). The colour, when dry, is always tawny yellow, and the resiliency that of sponges in which the kerasine element preponderates over the amount of spicules, as just stated. To this group de Fonbressin and Michelotti have given the name "*Tuba*" (p. 44), but, as usual, have not made any allusion to the spicule; their division of it, however, into three sections seems to be so reasonable that I will here insert them, viz.:—

"Section 1.

"Orifice du Siphon fortement cilié.

"*a*. Tissu fin, surface extérieure munie de processus spiniform-encroûtés.

"*b*. Tissu grossier, surface extérieure hérissée de pinceaux de fibre non-encroûtés.

"Section 2.

"Orifice du Siphon plutôt frangé que cilié.

"Section 3.

"Orifice nu, c. a. d. n'offrant ni cils ni pinceaux bien formés, ni frangés."

To these sponges Schmidt has given the name of "*Siphonochalina*," and, after enumerating several of them (Spongf. Atlantisch. Gebiet. p. 34), adds that they present "an unbroken line of varieties."

The groups Spinifera, Aculeata, Subaculeata, and Ciliata, in my classification, were intended to receive the whole of de F. et M.'s genus *Tuba*; the three latter in the second family, viz. Cavochalinida, and the former in the first family, viz. Chalinida; hence *Tuba armigera*, being *solid*, should have been inserted next to *Chalina rubens* among the Chalinida, but has been placed here for convenience. A few words, however, will show how the solid form of *Chalina* may pass into the hollow one. Thus, when the cylindrical stem is solid and erect, the vents are on the surface or outside; while if the stem is repent and the vents grow upwards into hollow tubes at the expense of the repent portion, then the vents of the erect portions open into the interior or inside of the tubes, and the specimen thus becomes a *Cavochalina*; but if the vents of the repent portion do not grow upwards in this way, then the species remains solid, increases in size, and of necessity comes into the first family, or that of solid *Chalinæ*; hence our *Tuba armigera* falls into the group Spinifera.

Tuba acapulcaensis, n. sp.

Massive, globular, lobed, erect, consisting of a group of short branches anastomosing with each other as they grow up into the form mentioned, more or less extending beyond the circumference, aculeate, solid, or hollow. Consistence resilient. Colour different shades of fawn. Surface of the branches more or less aculeated, aculeations consisting of spiniform prolongations of the fibrous structure. Vents on the surface of the solid branches, opening into the interior in the hollow or tubular ones. Internal structure fibrous, resilient; fibre chiefly kerasine flexible, cored or axiated by the spicule of the species in different degrees of plurality. Spicules of one form only, viz. acerate, variable in size, chiefly confined to the fibre. Size of largest specimen, of which there are upwards of a dozen, about 6 inches in diameter; largest branches about one third of an inch thick.

Hab. Marine. Growing on hard objects.

Loc. Harbour of Acapulco, 4–9 fathoms.

Obs. The above name and description apply to a great number of specimens of *Chalina* dredged by Capt. W. H. Cawne Warren in the harbour of Acapulco and presented to the Liverpool Free Museum. One cannot help seeing at a glance that they are all a uniformly massive, sub-branched development of the genus *Tuba*, which so abounds on the other side of the Isthmus of Panama, in the West-Indian seas, under such a variety of definite and beautiful forms. Here, in the harbour of Acapulco, so far as these specimens inform us, the growth, although extremely exuberant and equally characterized by the spiniferous prolongations of the tissue, presents a sameness which is totally devoid of any striking form. For convenience, here also the specimens with tubular and solid branches respectively have been described together. In short, after all, they are but varieties of the same fabric.

Pseudochalinida (new family).

In my order Psammonemata I have proposed the family "Pseudohircinida" for receiving all sponges that, in addition to the sand-grains &c. (foreign microscopic objects) axiating their fibre, also present "proper spicules"—that is, spicules formed by the sponge itself; but as this mixture often occurs in adult sponge-forms which rather belong to sponges characterized by the "proper spicules" themselves than by the sand-grains, it seems to me desirable that each order should have a family of this kind for the adult forms which are most characteristic of it. Thus, two instances in sponges which evidently belong to the Rhaphidonemata have come to my notice, viz. one in the solid *Chalinæ*, which I have grouped under the head of "Digitata," and the other in the hollow *Chalinæ*, which I have named "Tubulodigitata;" these I will now briefly describe under the names of *Chalina digitata*, var. *arenosa*, and *Cavochalina digitata*, var. *arenosa*, respectively :—

Chalina digitata, var. *arenosa*, n. s.

Stipitate, quickly dividing pollachotomously into several cauliform branches; branches thick, round, even, solid, with vents plentifully scattered over the surface. Fibre kerasine, resilient, covered or axiated with acerate spicules, among which there are many microscopic foreign objects, sand-grains, &c. Size of specimen 15 inches long. (British Museum, no. 106**, registered 57. 1. 2. 9.)

Hab. Marine.
Loc. New Zealand and Australia.

Cavochalina digitata, var. *arenosa*, n. s.

Base of attachment irregular, subsessile, rising into a group of hollow knotted tubes, simple or branched, increasing in size towards the free ends, which are thus rendered patulous. Vents numerous, opening internally. Fibre kerasine, resilient, cored or axiated with acerate spicules, among which are many microscopic foreign objects, sand-grains &c. Size of group 10 inches high and $6\frac{1}{2}$ inches broad; free ends of tubes 1–2 inches in diameter. (British Museum no. 589, registered 72. 5. 21. 25.)
Hab. Marine.
Loc. Swan River, W. Australia.

Order V. ECHINONEMATA.

Family 1. Ectyonida.

Ectyon sparsus, Gray.

Of this sponge there are two specimens, of which the largest presents an irregular form about 6 inches in its longest diameter, growing upon a piece of an old coral detritus, covered with *Polytrema miniaceum*.
Loc. Antigua.
Obs. This species, which I described and illustrated under the above name ('Annals,' 1871, vol. vii. p. 270, pl. xvii.), is evidently the "*Ajelas*" of de F. et M. (p. 76, pl. xv. figs. 1 and 2), and so common in the West Indies that it would be hardly possible to find a collection of sponges from thence without it. I possess a species from the Mauritius, differing only in the larger size and still greater beauty of the ornamentation on the surface of the spicule. It appears to be represented in Europe by *Clathria coralloides*, Sdt. (Spong. Adriat. Meeres, S. 58, Taf. v. figs. 10 and 11). Representations of two different species are given by Dr. Bowerbank under the name of "West-Indian sponges" (Mon. Brit. Spong. vol. i. pp. 275, 276, pl. xvii. figs. 289 and 290), called afterwards respectively *Ectyon sparsus* and *E. fascicularis* by Dr. Gray in 1867 (Proc. Zool Soc. 1867, p. 515); while Schmidt, in 1870, enumerates several species from the West Indies under the generic name of "*Chalinopsis*" (Spongf. Atlant. Gebiet. S. 59 *et seq.*, Taf. v. figs. 2 *a*, *b*, spicules only). I have not yet seen specimens from any other part of the world, although

I can hardly doubt its existence generally under the same or other representative forms.

Order VI. HOLORHAPHIDOTA.

Family 1. Renierida.

In the West-Indian collection, the Amorphina are represented by the ubiquitous *Halichondria panicea*, Johnst. (spicule, Pl. XI. fig. 8); the Isodictyosa by the British species *Isodictya simulans*, Bk. (spicule, Pl. XI. fig. 9); and the Thalyosa by the West-Indian genus *Thalysias*, de F. et M., in a repent form of the white species *subtriangularis*. viz. *T. repens*, mihi, and the black one by *T. carbonaria*, before mentioned (spicules, Pl. XI. figs. 10 and 11 respectively).

Group 5. Fibulifera.

Fibularia massa, n. sp.

Massive, solid, lobate, beautifully reticulate, lobes ending in large vents respectively. Texture hard, but friable. Colourless when dry, ? pink or red when fresh. Surface even, regularly reticulate, interrupted only by the openings of the vents. Vents on the prominent parts large but not numerous. Internal structure also *evenly* reticulate throughout, like the surface; traversed by the branches of the excretory canal-system; fibre composed of the skeletal spicules of the species. Spicules of three kinds, viz.:—1, skeletal, acerate, smooth, cylindrical, curved, round at the ends, about 80 by 4-6000ths inch in its greatest dimensions (Pl. XI. fig. 13, *a*); 2, acerate, smooth, fusiform, nearly straight, in sheaf-like bundles when small, becoming dispersed when large; when hair-like in the form of "trichites," in bundles about 20-6000ths inch long, and when large and dispersed about 33 by 1-6000th inch in its greatest dimensions (figs. 13, *b*, *c*); 3, flesh-spicule, bihamate, smooth, simple, C-shaped, sigmoid, about 4-6000ths inch long (fig. 13, *d*). No. 1 is chiefly confined to the skeletal fibre; nos. 2 and 3 are abundantly dispersed throughout the sarcode. Size of specimen, which is only a fragment, about $4\frac{1}{2}$ inches long, 2 broad, 2 high.

Hab. Marine.

Loc. Long Key Island, Nassau.

Obs. This in structure is a very beautiful species, on account of the uninterrupted regularity of its reticulation throughout, which literally is "isodictyal." The larger acerates are no doubt derived from the hair-like small ones, which, coming

from the sheaf-like bundles, thus testify to their original development in *plurality* in a cell, and subsequent enlargement in the sarcode. There is a specimen of this sponge in the British Museum, numbered 216, also supposed to come from the West Indies, which, from its weather-worn condition, appears in like manner to have been picked up on a beach. Its spiculation and structure entitle it, like the next species, to a place among the Fibulifera, the sheaf-like spicules being considered an adjunct.

Fibularia ramosa, n. sp.

Stipitate, subcylindrical, solid, simple or branched irregularly. Texture loose, light, fragile. Colour brown. Surface uniformly reticulate, ending towards the free extremity of the branches in little plumose tufts, which are the terminations of the fibro-skeleton. Structure internally plumose, radiating, fragile, composed of spiculo-fibre tympanized in its reticulation by the sarcode. Spicules of two kinds, viz. :—1, skeletal, smooth, acerate, curved, fusiform, pointed at each end, about 55 by $1\frac{1}{2}$-6000th inch in its greatest dimensions (Pl. XI. fig. 12, *a*); 2, flesh-spicule, bihamate, smooth, minute, C-shaped, sigmoid, about 4-6000ths inch long (fig. 12, *b*). No. 1 is chiefly confined to the fibro-skeleton, and 2 plentifully scattered throughout the sarcode. Size of largest stem, fragment or branch (for it is much broken up in pieces), about 7 by $\frac{3}{4}$ inch in its greatest dimensions.

Hab. Marine.

Loc. Puerto Cabello.

Obs. The delicate structure and spiculation of this species claim for it a place in the group Fibulifera, wherein the fibre is almost solely composed of proper spicules. Like the specimens of this species in the British Museum, viz. no. 206, reg. no. 41. 3. 16. 9, and no. 412, both of which come from the West Indies, it is plentifully infested by the isolated polyp (*Bergia*) on the surface.

Fibularia anchorata, n. sp.

Massive, leathery, lobed, sessile. Texture tough, resilient. Colour yellowish brown. Surface uniformly covered with a wrinkled dermal structure in relief, whose lines are rough and muricated, tympanized in the intervals by the dermal sarcode. Vents large, chiefly on the prominent parts of the lobes. Structure internally more or less cavernous, from the presence of large fenestral portions of membranous thick sarcode, which stretch across the intervals between the more compact parts; sarcode and fibre charged with the spicules of the species,

mixed with foreign microscopic objects, viz. sand-grains, fragmentary sponge-spicules, &c. Spicules of three kinds, viz.:—1, skeletal, acerate, smooth, curved, fusiform, pointed at each end, about 35 by 1-6000th inch in its greatest dimensions (Pl. XI. fig. 14, *a*); 2, flesh-spicule, bihamate, minute, simple, C-shaped, and sigmoid, about 4-6000ths inch long (fig. 14, *b*); 3, flesh-spicule, equianchorate, very minute, about $2\frac{1}{2}$-6000ths inch long (fig. 14, *c*, *d*). No. 1 is chiefly confined to the skeletal fibre, with no. 2 plentifully and no. 3 scantily dispersed throughout the sarcode. Size of specimen about 4 inches square.

Hab. Marine. Attached to *Porites furcatus*.

Loc. Antigua; Falmouth harbour.

Obs. The crumb-of-bread-like appearance and dermal structure of this species very much resemble those of *Halichondria incrustans*, while the presence of the equianchorate, which, although extremely minute, is in form also like that of this sponge, tends to increase the analogy; but the single acerate form of skeletal spicule, together with the abundance of minute bihamates, allies it more to the Fibulifera. From the variety of microscopic foreign objects present in the fibre and sarcode, it might at first be conjectured that the equianchorate, which is an exceptional occurrence, was a foreign object also; but there are several specimens of the same species in the British Museum, numbered 206 *d*, "*nn*," &c., from the West Indies, in which the same kind of anchorate is equally present; so we must conclude that it belongs to the species; and hence the designation.

The presence of foreign objects with the proper spicules gives this sponge a mixed character, which would claim for it a family, like that of the "Pseudochalinida" before mentioned, which, under like conditions, might be termed "Pseudofibularidina."

Reniera fibulata, Sdt.

Globular, massive, furnished with large patulous ereviee-like vents. Densely charged with the minute coralline, *Jania*, to which I have before alluded under "*Dysidea tubulosa*" (p. 275). Dredged in the harbour of Acapulco by Capt. W. H. Cawne Warren.

Obs. The type specimen of *Reniera accommodata*, Sdt., from Cette, in the British Museum, not only contains the usual bihamates but tricurvates also (Spong. v. Algier, p. 30).

Group 6. Halichondrina.

Halichondria isodictyalis, n. sp.

Massive, sessile, lobate. Consistence fragile. Colour light fawn. Surface uniformly reticulate in relief, except where interrupted by a vent. Vents scattered over the surface generally. Structure crumb-of-bread-like, reticulate, delicate, fragile, traversed by the branches of the excretory canal-system. Spicules of four forms, viz. :—1, skeletal, acuate, smooth, curved towards the blunt end, which is rather smaller than the rest of the shaft; gradually sharp-pointed, about 40 by $1\frac{1}{2}$-6000th inch in its greatest dimensions (Pl. XI. fig. 2, *a*); 2, subskeletal, a tibiella with slightly fusiform shaft and inflated ends, about 50 by $1\frac{1}{2}$-6000th inch in its greatest dimensions (fig. 2, *b*); 3, flesh-spicule, equianchorate, shaft simple, curved, arms slightly everted, about one third of the length of the shaft, 6-6000ths inch long (fig. 2, *cc*); 4, flesh-spicule, simple, C-shaped, sigmoid, bihamate, 4-6000ths inch long (fig. 2, *d*). Nos. 1 and 2, intermixed generally, are chiefly confined to the spiculo-skeletal structure, which is arranged isodictyally; nos. 3 and 4 are scattered more or less abundantly throughout the sarcode. Size of largest fragment, of which there are several (all of which appear to have come from the same mass originally, as they are all intermingled with the same species of coralline, viz. *Flabellaria opuntia*), $4 \times 3 \times 2$ inches.

Hab. Marine. Growing about and enclosing *Flabellaria opuntia* in the West Indies, or densely charged with miliary gravel at Acapulco.

Loc. Puerto Cabello and harbour of Acapulco.

Obs. The external appearance of this sponge, where it is most free from the objects among which it has been growing, is very like that of *Halichondria incrustans*; but the isodictyal arrangement of the spiculo-skeleton, the spineless acuate, and the shaft of the anchorate being simple instead of inflated above and below the middle (as in *H. incrustans*), are sufficient differences to establish a distinction, and to call for a different designation; hence the term "*isodictyalis*."

The specimens, which are charged with the miliary gravel among which the sponge has thus grown, were dredged in the harbour of Acapulco, in 4–9 fathoms, by Capt. W. H. Cawne Warren.

Halichondria pustulosa, n. sp. (Pl. XI. fig. 1, *a–g*.)

Erect, branched irregularly, branches nodose or knotted

and pustuliferous (Pl. XI. fig. 1). Consistence soft, friable. Colour faint white-yellow. Surface uniformly smooth, except where interrupted by the presence of little conical pustules puckered towards the apex (fig. 1, *a a* and *b*). Vents and pores respectively in the pustules, which are irregularly and plentifully scattered over the surface. Internal structure soft, compact towards the centre, becoming less so towards the circumference, where the pointed ends of the spicules penetrate the crust of the surface, but do not extend beyond it. Spicules of five forms, viz.:—1, skeletal, long, acuate, curved chiefly towards the blunt end, gradually sharp-pointed, spined chiefly towards the base, less so afterwards, 90 by 4-6000ths inch in its greatest demensions (fig. 1, *c*); 2, short, acuate, curved chiefly towards the blunt end, which is somewhat inflated, gradually sharp-pointed, spined throughout, spines towards the pointed end recurved, longest spines round the blunt end, about 45 by 4-6000ths inch in its greatest dimensions (fig. 1, *e*); 3, subskeletal, acuate, smooth, slightly curved, fusiform, head smaller in its transverse diameter than the shaft, which terminates gradually in a sharp point, about 90 by 2½-6000ths inch in its greatest dimensions (fig. 1, *d*); 4, flesh-spicule, equianchorate "angulate," very short and robust, shaft very much curved, arms thick, broad, and much expanded, about a quarter the length of the shaft, 7-6000ths inch long, shaft 1½-6000th inch in diameter (fig. 1, *f*); 5, flesh-spicule, bihamate, simple, sigmoid, and C-shaped, 10-6000ths inch long (fig. 1, *g*). Nos. 1 to 3 are confined to the axis and body; no. 4, in great abundance, forms a thick crust which is supported on the points of no. 1, while no. 5 is comparatively scanty. Size of specimen about 3 inches long, largest stem about 1 inch in diameter at the base; pustuliform eminences about 1-12th inch in diameter at the base, and about half as high, but very variable.

Hab. Marine, 50–70 fathoms.

Loc. Sea between Patagonia and the Falkland Islands.

Obs. This sponge, dredged by Capt. W. H. Cawne Warren in the locality mentioned, is a species of *Halichondria*, allied, although considerably different in the form of its spicules, to *Halichondria incrustans*. It is chiefly characterized by the presence externally of the little pustuliform eminences mentioned, which may be assumed to be the localities respectively of the vents and the pore-areas, since there is nothing else on the surface to represent these parts. At first they look very much like the insulated parasitic polyps *Bergia*; but being conical, closed, and puckered towards the apex, instead of open, cup-like, and shallow, connected with a canal beneath

instead of being confined to the dermal structure, and possessing neither tentacles nor thread-cells, they are thus satisfactorily distinguished from polyps. We already have an instance of this pustuliferous character in *Greyella cyathophora*, which I described and illustrated several years ago ('Annals,' 1869, vol. iv. p. 190, pl. vii.), if not in Schmidt's *Cribrella hospitalis* also (Spongf. Atlantisch. Gebiet. S. 56, Taf. iv. fig. 12). The parasitic polyp *Bergia*, with which alone this pustuliform eminence can be confounded, is merely located on the surface of the sponge as a commensal, while the "pustuliform eminence" is a part of the sponge itself, connected with the interior by means of a pore-area or excretory canal, like the heads of *Cliona corallinoides* &c., whereon, as in many sponges, the radiated arrangement of the spicules permits of their being closed or opened as required; but in *Greyella cyathophora* the pore-areas *alone* are confined to the pustuliform eminences, while the oscules or vents are present under the common form. Besides this striking character in *Halichondria pustulosa*, the thick incrustation and the extremely robust, obese form of the equianchorate of which the latter is composed are equally specific.

Reniera digitata, Sdt.

This appears to grow in great abundance about the wharf at Antigua, and when fresh to present a "red" colour, which in the dried state it still slightly retains. The spiculations respectively in the mounted type specimens of *Reniera digitata* and *Myxilla anhelans*, Sdt., in the British Museum are the same. (See Pl. XI. fig. 3, *a–c*.)

Phorbas amaranthus, de F. et M. (p. 92, pl. xxi. fig. 1).

Cauliform, irregularly compressed, repent, straggling, budding into a branch here and there most irregularly, twisting back upon itself and uniting where in contact, adhering to any foreign objects it may touch during its course of growth, in short, doing every thing but growing regularly. Consistence firm. Colour dark-red purple. Surface over the points of the branches or younger parts cancellous or irregularly reticulated in relief, with the lines of the reticulation serrate or jagged, becoming more compact in the older parts, where the dermal sarcode conceals the points of the serrations, so as to leave nothing but a smooth surface of rounded processes with a number of holes, most of which appear to be connected with the branches of the excretory canal-systems, which in accordance with the mode of growth, are numerous. Internal structure fibro-cellular throughout, becoming less compact

towards the circumference; sarcode deeply coloured by an abundance of diffused pigment, presenting an amaranthine or red-purple hue. Spicule of one kind only, viz. acerate, small, thin, smooth, cylindrical or subfusiform, slightly curved, and sometimes indistinctly inflated at the ends, about 50 by $\frac{1}{2}$-6000th inch in its greatest dimensions (Pl. XI. fig. 15), chiefly confined to the fibre, which, with a minimum of kerasine, is composed of them, and in a looser way dispersed throughout the sarcode. Length of main stem in the largest specimen about 21 inches, breadth 1 by $\frac{3}{4}$ inch in diameter.

Hab. Marine. Adhering to any object with which it may come into contact.

Loc. Nassau.

Obs. Such are the characters of this species, which are so like those of de F. et M.'s *Phorbas amaranthus* that I have described it under their name. In colour and structure it is so much like *Halichondria birotulata*, Higgin, from the same neighbourhood, that nothing but a microscopic examination of the respective spiculations can reveal the differences; and notwithstanding the extreme likeness to it of the sponges which, in my Supplementary Manaar Report, I have named *Axos anchorata* and *A. fibulata*, especially in the extreme irregularity of their growth ('Annals, 1881, vol. vii. pp. 382, 383, pl. xviii. figs. 3 &c.), I now think the whole should be relegated to the group Halichondrina; for the light which a general examination of the good specimens of *Phorbas amaranthus* from the West Indies has thrown on that of the "imperfect specimens" from S. Australia, above mentioned, not only proves to me that the latter belong to the same group as *Phorbas amaranthus*, but that they should be withdrawn from the genus *Axos*, and their generic name changed to "*Phorbas*." As *Halichondria birotulata*, Higgin, which is found with *Phorbas amaranthus* in the West-Indian seas, is also largely developed on the south coast of Australia, it is not improbable that the latter exists there also in addition to *Axos*, now *Phorbas anchorata* and *P. fibulata*, already described from thence (*op. et loc. cit.*).

Group 8. Esperina.

Although the name "*Esperia*" originated with Nardo ('Isis,' 1833), it was Dr. Oscar Schmidt who first defined it satisfactorily, in 1862 (Spongf. Adriat. Meeres, S. 53), adding just previously the literature of the subject, to which I cannot do better than refer the reader for every thing else in this respect. Having already taken the appellation for the basis of my group "Esperina" ('Annals,' 1875, vol. xvi.

p. 179, &c.), I have only to repeat here what the occasion seems to require.

Character.—The group Esperina is mainly characterized by the presence of the *inequi*anchorate, which occurs in no other to my knowledge, except that of Hyndmanina, where not only the dark brown colour of the sponge itself, but the unique form of one of its flesh-spicules (the "contort bipocillated bihamate" of Dr. Bowerbank, Brit. Spong. vol. i. p. 248, fig. 125) is also, to my knowledge, met with nowhere else. The largest inequianchorate known was found by Schmidt in *Esperia diaphana*, from Florida, which measured "0·65 millim.," about equal to 1-40th inch long, while the smaller ones, although still large, only reached "0·12 millim." =1-222nd inch, which accords more with those in his mounted type specimen now in the British Museum, where the largest I could find only amounted to a little more than the last-named measurement (Spongf. Atlant. Gebiet. 1870, S. 57, Taf. iv. fig. 13). Other flesh-spicules occur in *Esperia*, viz. bihamate, tricurvate, and the sheaf-like bundles of fine spicules termed "trichites" by Prof. Sollas; but the presence or absence (perhaps influenced by their scarcity) of one or all of these seems to be as accidental as unintelligible; so their value in specific distinction is not much: *ex. gr.*, in my mounted fragment of the type specimen of *Esperia* (*Raphiodesma*, Bk., 1870) *florea*, there is a tricurvate which no doubt belongs to the species; and in one of *Esperia* (*Rhaphiodesma*, Bk.) *lingua* there are sheaf-like bundles of trichites, neither of which are mentioned in the descriptions or illustrations of these sponges respectively by Dr. Bowerbank (Brit. Spong. vol. ii. of 1865, illustrated in vol. iii. of 1874).

Again, the skeletal spicule, although always acuate, is not simply so; for very often it is sub-pinlike and presents a peculiar elongated elliptical inflation, sometimes widened in the centre like a skittle or barrel; it is also always single—that is, unaccompanied by any other skeletal form; while the inflation may vary so as to pass from the simple uninflated acuate into the shapes mentioned, even in the same specimen; hence, if the illustration should be taken from the former it will be acuate, and, if from the latter, sub-pinlike. Thus, in Dr. Bowerbank's illustration of *Esperia* (*Rhaphiodesma*) *lingua*, the form is a simple acuate (Brit. Spong. vol. iii. pl. lxxvii. fig. 2), while in my mounted fragment of the type specimen in the British Museum it is sub-pinlike or elliptically inflated with a central swelling. Variable, however, as the shape of the obtuse end of the skeletal spicule may be, an average one may be obtained by extended observation, while the form

generally of the skeletal spicule is so far peculiar in itself that a practised eye can almost always recognize its Esperian character.

Size.—In measuring these spicules, again, great care should be taken; for here as well as elsewhere it should never be forgotten that things must be small before they are great; hence both skeletal and flesh-spicules of all sizes below the average largest may be present in the specimen; hence the necessity of finding out the *average*: thus, the so-called "tension-spicula," viz. figs. 16 and 3 in Dr. Bowerbank's illustrations of *Esperia* (*Rhaphiodesma*) *florea* and *lingua* respectively, appear to be only *small* forms of the skeletal spicules (figs. 15 and 2), which, as the dermal layer becomes part of the internal structure in the course of growth, become enlarged to the size of skeletal ones.

Rosettes.—The well-known "rosettes" which characterize the spiculation of *Esperia*, viz. the globular development of a multitude of *in*equianchorates (instead of a single one in a cell, as with the bihamates and tricurvates, &c.), which radiate from a common centre with their small ends inwards, is not always confined to the *in*equianchorate flesh-spicules; for the same kind of development may occur in *Desmacidon titubans*, Sdt., where the anchorates are equally developed at each end, as seen in Schmidt's mounted type specimen of this sponge in the British Museum (Pl. XII. fig. 24, *g*, *h*). No one, however, has described and illustrated the development of the "rosette"—that is, the *in*equianchorate in plurality in its cell; although singly it has been done by Schmidt and myself independently (Nord-See Exped. 1872, "Zoologie," Taf. i.; and 'Annals,' 1874, vol. xiv. p. 100, pl. x.).

Lastly, there is a characteristic dermal structure in *Esperia* which for uniformity and beauty of its stellification equals, if not surpasses, any other of the kind. This consists of a stelliferous lacework formed by intercrossing bundles of the skeletal spicules (whose interstices when fresh are tympanized by the dermal sarcode in which the pores are situated), supported by a more or less rigid spiculo-fibrous structure internally, that, especially when rigid, is equally characteristic of *Esperia*. Sometimes, however, the "lacework" structure of the surface seems, from some cause or other, to become a broken-down or confused layer of spicules, in which state the two conditions may be seen to pass into each other in the same specimens; or the dermal layer together with the softer structure filling the interstices of the rigid skeletal fibre may be washed away altogether, while the latter remains in a naked condition (see Schmidt's representation of *Esperia Contarenii*,

Spongf. Adrit. Meeres, Taf. v. fig. 2; and my own of *Esperia villosa*, 'Annals,' 1874, vol. xiv. pl. xiii. fig. 13, *a*); after which the soft structure may again spread partially or wholly over it, so that the specimens often present themselves with much of the skeletal fibre still, so to speak, unclothed. This, however, is only where the fibre-skeleton is very rigid, which is not the case in all instances, as in *Esperia* (*Rhaphiodesma*) *lingua*, and also in the West-Indian species about to be described, in which the difference in the structure is not so much marked. Indeed the type specimen of the former, viz. *Rhaphiodesma lingua*, Bk., seems to have been squeezed up together into its present "tongue-shape" by the hand, which does not seem improbable, seeing that the type specimen which Mr. Peach sent to Dr. Bowerbank from Shetland "was cut to pieces in the dredge and rotted in drying" (Brit. Spong. vol. ii. p. 190). Sometimes the lacework of the dermal layer of *Halichondria panicea* is so much like that of *Esperia* that, without microscopic examination of the spicules, the difference cannot be determined. We shall also find by-and-by that there is a still greater resemblance in this respect between *Esperia* and *Hymedesmia Johnsoni* of the following group. In the meanwhile I will describe the West-Indian specimen.

Esperia lævis, n. sp.

Massive, sessile, lobate. Consistence light, soft. Texture tomentose. Colour light brown, in some parts reddish. Surface irregularly lobate, uniformly covered by the dermal layer above mentioned, but with the stelliform arrangement of the spiculation for the most part reduced to an amorphous condition. Vents on the summits of the lobes. Internal structure more fibrous, but with the spiculation almost as much confused as in the dermal one. Spicules of five forms, viz.:— 1, skeletal, for the most part acuate, slightly curved, smooth, shaft fusiform, broader in the centre than the obtuse end, abruptly sharp-pointed, about 115 by 3-6000ths inch in its greatest dimensions (Pl. XI. fig. 16, *a*); 2, flesh-spicule, inequianchorate, about 18-6000ths inch long, head and naked part of shaft about equal in length, smaller and about one third of the whole, arms at their ends respectively equal in length (fig. 16, *b*); 3, flesh-spicule, bihamate, smooth, C-shaped, more or less sigmoid, about 10-6000ths inch long (fig. 16, *c*); 4, flesh-spicule, trichites, separate, and in sheaf-like bundles, about 16-6000ths long (fig. 16, *d*); 5, *minute* inequianchorate, in which the arms of the head nearly extend down to the lower or smaller end, and the latter presents an elongation of the shaft (?) into a pointed process about 5-6000ths long (fig. 16,

e, *f*). No. 1 is chiefly confined to the fibre, and the rest, of various sizes, more or less abundantly scattered throughout the softer substance, but especially abundant in the dermal layer, where the inequianchorates are present in the form of rosettes. Size of largest piece, of which there are several, about $5 \times 2\frac{1}{2} \times 1$ inch.

Hab. Marine. Growing over all kinds of objects in its course, which seems to have been vagrant about the sea-bottom, as some of the pieces, besides enclosing shells, present the waterworn appearance of having been subjected to attrition in shallow water, which may account for the pulpy amorphous condition of the dermal layer.

Loc. Puerto Cabello.

Obs. This sponge in structure and spiculation is very like *Esperia lingua*; only the smaller end of the large inequianchorate is proportionally longer in the latter, and not so round when viewed in front. Like *E. lingua*, too, the confusedness of the general structure in both species seems to have been broken down through some cause or other. With the exception of the pointed process at the small end of the *minute* anchorate, there is very little else to make it differ from *E. lingua*, whose representative it may be in the West Indies. Out of all my mountings (and I have several of different kinds of *Esperiæ* from different parts of the world), there is only one in which this character is present; and that is a small specimen in the late Dr. Bowerbank's collection, now in the British Museum, labelled "Comoro Is., Mozambique," wherein every other part so agrees with the West-Indian one that, without the labelling, I should have adjudged it to this locality; but, in Schmidt's report of the German expedition to the North Sea in 1871, there is a figure of this kind of process in a minute inequianchorate about "0·03 millim." (Taf. i. fig. 7)—that is, about 3-6000ths or 1-2000th inch in "*Esperia anceps*," = *Desmacidon anceps* (*l. c.*), which he considered a "variety." It is, however, *characteristic* of the inequianchorate in the Hyndmanina (see the illustrations of *Halichondria Pattersoni*, Bk., Brit. Spong. vol. iii. pl. xlvi. fig. 5, and Ridley, Proc. Zool. Soc. 1881, in *Alebion proximum*, p. 119, pl. x. fig. 8, *b*), where the latter is 6-6000ths inch long, or twice the size of Schmidt's and my own specimens.

Further Observations on the Esperina.

Having thus given a description of the specimen of *Esperia* obtained when the 'Argo' was at Puerto Cabello, I will now continue my observations on the group. Commencing with

Schmidt's numerous species (and we need not go further back, as it would only lead us into the region of doubt, which has been well summed up by Schmidt himself, as before stated), there are twelve species from the Adriatic, of which ten are in his publication of 1862, and the two others, with figures of the inequianchorate only of an "Indian species," in the 1st Supplement; three in the Atlantic sponges of 1870; three in the report of the expedition to the North Sea (Deutschen Meere) of 1871; two in that of the expedition of 1872 (Nord-See Expedition); and one in that of the summer expedition to the Baltic (Ost-See) in 1871 (Berlin, 1873, S. 148), viz. *Esperia lucifera*. Of these the figures of the anchorates of the "Indian species" and two of the Atlantic ones, viz. *E. diaphana* and *E. immitis* respectively, are the only ones which seem to me to possess an amount of difference in their inequianchorates respectively which renders them of any specific value; while all the rest are so much alike that the anchorate alone is of no utility for this purpose. My observations are taken rather from Schmidt's type specimens on the slides in the British Museum than from his published descriptions and illustrations, in which I find that *E. immitis* is my *E. socialis* of 1871, also from the West Indies ('Annals,' vol. vii. p. 276, pl. xviii. fig. 7, &c.).

Of the British species of *Esperia* represented by Dr. Bowerbank, viz. *Hymeniacidon subclavata* (B. S. vol. iii. pl. xxxvii. figs. 9–13) and *Rhaphiodesma floreum* (ibid. figs. 14–19), both on valves of a *Pecten*, the inequianchorates appear to be alike, although the skeletal spicules are so far different in the illustrations that the former is simply acuate, *i. e.* without terminal inflation, and the latter sub-pinlike; but this difference, as I have said before, is not of much specific value, as it is not more persistent than the absence or presence of the tricurvate, which also, as before mentioned, exists in *my* mounting of the latter. As for the anchorate of *H. subclavata* being "bidentate," this I regard as an ocular delusion, having *never* found less than *three* teeth or arms if carefully looked for, a fact which will be better understood by reference to my descriptive and illustrated anatomy of the inequianchorate ('Annals,' 1871, vol. vii. p. 277, pl. xvii. figs. 7, 8, &c.). Thus, if the anchorate be viewed *laterally*, only two arms will appear, viz. the anterior and the nearest lateral, giving a bidentate aspect, while if it be viewed in front all three will appear; but neither is so convincing as an end view, which can only be obtained when the anchorate is tilted upwards; and then the two lateral arms, one on each side the shaft, with the anterior arm in the middle supported on the "falcate" septum, become convincingly obvious.

The spiculation of *Hymeniacidon macilenta*, Bk. (which is also an *Esperia*), obtained from the most insignificant "fragments" in point of size, of which "the largest piece only slightly exceeded an inch in length, and was about three lines in width" (B. S. vol. ii. p. 176), such as I have often found here (Budleigh Salterton) about the roots of *Laminaria digitata*, seems to me but a variety of *Esperia* (*Rhaphiodesma*) *florea*, in which all three of the flesh-spicules are present, viz. inequianchorate, bihamate, and tricurvate (B. S. vol. iii. pl. xxxiii. figs. 7–13). "*Rhaphiodesma*" (Dr. Bowerbank's *last* generic name for Esperian sponges) *simplissimum* (B. S. vol. iii. pl. xc. figs. 1–3) is evidently from the spiculation no *Esperia* at all, while *Desmacidon rotalis* in the same plate (figs. 8–14) undoubtedly is one, and the great length of the head of the anchorate relatively considered (that is, in proportion to the size of the other parts) a characteristic feature, especially as the figure is that of a *full-grown* anchorate magnified upon the same scale as that of *R. floreum*, Bk., viz. "× 530 linear," and not a minute incipient form. Here again the skeletal spicule is simply acuate; and the structure represented in fig. 9 is evidently that of the lace-like dermal layer characteristic of an *Esperia*, to which I have alluded. In *R. sordidum* (pl. lxxvi. figs. 13–19) we seem to have an insignificant specimen, which is only a slight variety in spiculation of *R. floreum*, wherein the tricurvate has been more strongly developed, while *R. lingua* (pl. lxxvii.), in the comparatively greater length of the arms of the smaller end of the inequianchorate (fig. 4), *does* present a characteristic form, although the head of the skeleton-spicule (fig. 2) should instead of acuate be sub-pinlike, *i. e.* elliptic, inflated in the centre, skittle-shaped; for the *average* is so in the *type specimen*, which, as a whole, appears, as before stated, to derive its general tongue-shaped form from having been squeezed up in the hand after it was drawn on board in a comminuted state. Still, such is the rigidity of the fibro-skeletal structure in many instances, that if there had been any present some would have remained to testify to the fact; hence we may infer that the structure was always soft, as it now is, like that of the West-Indian specimen above described. Reviewing thus all that has been put forward by Dr. Bowerbank, together with my own actual experience, I see no indication, from the *spiculation*, of there being in his 'Monograph of the British Spongiadæ' any more than two well-characterized species of *Esperia*, viz. *Rhaphiodesma floreum* and *R. lingua*.

But that there are more British species of *Esperia*, my examination of the sponges dredged on board H.M.S. 'Por-

cupine' between the north of Scotland and the Färöe Islands will show ('Annals,' 1874 and 1876, vols. xiv. and xviii. pp. 215 and 316 respectively). In *Esperia cupressiformis* (vol. xiv. pl. xiv. figs. 16–19) the general form and spiculation will be found to be very remarkable; while in the variety *bihamitifera* (vol. xviii. pl. xiii. fig. 14) it is hardly less so. The species *E. borassus* (ibid. fig. 13) has hardly any thing to characterize it beyond the peculiar arrangement of its spicules, which have nothing remarkable in their forms beyond the common run. In *E. placoides*, however, we have all the common characteristics in spiculation, together with the rigid fibro-structure internally and the lace-like dermal layer in the grooves or "pore-areas" (fig. 12, *k*, *l*) between the placoid plates, while the latter in their structure give the species this striking peculiarity. But when we turn back to *E. villosa* (vol. xiv. pl. xiii. figs. 13–15), there we find an *equi*anchorate instead of the usual Esperian form (that is, with unequal ends), which makes one doubt the appropriateness of the generic term, as will be more particularly shown by the following observations, viz.:—

While engaged in looking over my slides of different *Esperiæ* for the present occasion, I recurred to that bearing the spiculation of the "Unknown Sponge," published in the 'Journal of the Royal Microscopical Society (1879, vol. ii. pl. xvii *a*, fig. 12), which, it may be remembered, was found in the form of a mere film on the foraminiferal test of *Aphrosina informis*, Carter, that, again, was on the branched coral *Amphihelia oculata*, Duncan, which had been dredged on board H.M.S. 'Porcupine' in the Atlantic Ocean, between the north of Scotland and the Färöe Islands, and I immediately saw that there existed a great resemblance—indeed, almost an identity, between it and the spiculation of *Esperia villosa*. It may be remembered also that, in both these instances, the bihamate was strikingly large—that is, in the former 82½-6000ths and in the latter 40-6000ths inch long, a coincidence of large sizes in these flesh-spicules which first attracted my attention to the respective slides, as in no other case has the bihamate been found so large. I have already stated that the anchorate was *equi*ended in *Esperia villosa*; and I might here add that it is of that shape which I have termed navicular or weaver's shuttle-like, thus totally opposed to the usual form in *Esperia*, viz. *ine*quianchorate, but precisely like that of the "*Unknown Sponge*." In the latter, being a mere film, there is nothing but the spiculation to judge from; but in *Esperia villosa*, which is comparatively large, the surface is totally different from that usually characteristic of *Esperia*, as may be seen

from my description and delineation (*op. et loc. cit.*), while the only things that are like *Esperia* are the skeleton-spicule in both the "*Unknown Sponge*" and *E. villosa*, and the rigid skeleton-fibre in the latter. Under these circumstances I propose to change the name of "*Esperia villosa*" to that of "*Esperiopsis villosa*," and for the present to place it in the following group, viz. Hymedesmina.

But lest it should be asked, "Why add it to Hymedesmina in particular?" it may be observed that the nearest known structures to *Esperia* have been placed in the Hymedesmina.

Thus, in one of the massive specimens of *Hymedesmia Johnsoni*, Bk., dredged on board H.M.S. 'Porcupine' between the north of Scotland and the Färöe Islands, which had grown upon a little stone, and which, being subcylindrical, is an inch long by half an inch in diameter, the same kind of stellificate lace-like dermal structure and the same kind of rigid spiculo-fibrous skeleton exists as in a similarly-constituted *Esperia*. Moreover, another but membraniform specimen that had grown over the surface of a *Stelletta* which had itself grown on the branch of a stony coral obtained from the sea about the island of Madeira (British Museum, no. 360 and 361, presented by the Rev. R. F. Lowe), is so like the dermal layer of *Esperia* that at first I took it for one, until convinced to the contrary by microscopical examination, when I found the skeletal spicule also to be almost identical in form with that of *Esperia*, accompanied, too, by a large tricurvate (Pl. XI. fig. 20, *a*, *b*) ; so that, but for the presence of that extraordinary form of flesh-spicule (fig. 20, *c*, *d*, *e*), to which I shall allude more particularly hereafter, these specimens might be taken for those of an *Esperia*. Hence, with the Esperian structure of the fibro-skeleton of *Esperia villosa*, now *Esperiopsis*, and its Esperian skeletal spicule, together with the extraordinary sizes of its flesh-spicules respectively (extraordinary for a *naviculiform* anchorate), its massive as well as membranous forms are better placed with the Hymedesmina than with the Esperina, where their anchorates, being equiended, would at once break down the main characteristic of our group.

It might be observed, too, that the forms *Esperiopsis villosa* and *Hymedesmia Johnsoni* respectively were brought up in the dredge together, or, at all events, at the same station, viz. "51 of 1869;" for they were in the same jar that bore this label.

This opportunity also might be taken of stating what is known of *Hymedesmia Johnsoni*, Bk., 1864, = *Desmacidon Johnsoni*, Sdt., 1870, as it has not been found to have grown

much beyond a membranous form on most occasions. In the first place, two species or one and a variety of it, occur, viz. *Hymedesmia Johnsoni*, which, in addition to the double-hooked "trenchant" flesh-spicule, common to both (Pl. XI. fig. 20, *c*, *d*, *e*), has a single form of *acuate* skeleton-spicule, viz. Esperian (Pl. XI. fig. 20) and a tricurvate flesh-spicule strongly developed (fig. 20, *b*); the *acuate* spicule clearly, from Dr. Bowerbank's illustration of a membranous growth from Madeira (B. S. vol. i. p. 35, pl. xviii. fig. 293), indicates that *it* is *Hymedesmia Johnsoni*, Bk., and has been found between the north of Scotland and the Färöe Islands, as above stated, also on a *Stelletta* coming from Madeira in a membranous form by myself; to which we may add the coast of Portugal probably (Schmidt, Spongf. Atlantisch. Gebiet. p. 54); as well as that from Shetland figured by Dr. Bowerbank in 1874 (B. S. vol. iii. p. 208, pl. lxxiv. figs. 1–3) under the name of *Halichondria falcula*, which is probably the largest massive specimen (being about 2 inches long and 1 inch broad) that has yet been obtained. Although the tricurvate spicule is only mentioned in the specimens from the north of Scotland and Madeira, the *acuate* spicule is sufficient for identification in the others.

Schmidt's form, on the other hand, was obtained from the coast of Florida, and from its possessing in addition to the trenchant anchorate an *acerate* skeleton-spicule, accompanied by a *bihamate* flesh-spicule *only* (Pl. XI. fig. 21, *a*, *b*), might be termed *Hymedesmia Schmidtii*. His specimen was membraniform (Spong. Atlant. Gebiet. p. 53); and this form and spiculation also occur among the dredgings of H.M.S. 'Porcupine,' as evidenced by a small fragment of a massive specimen obtained at the entrance of the English Channel in 725 fms. at Station 36; so that there are evidently two different spiculations of this sponge characterized by the same peculiar anchorate, however much alike the general forms may be.

At the conclusion of his article on *Desmacidon Johnsoni*= *Hymedesmia*, Bk., Schmidt states that the "trenchant" spicule (Bowerbank's term, because the inner edge of it is thinned off like a knife) with hook at each end is allied to a bihamate; but in *Hymedesmia Schmidtii* the other flesh-spicule which is so abundantly present is a *veritable* C-shaped and sigmoid *bihamate*, whose contrast in form with the early development of the great trenchant spicule when both are about the same size is most evident (Pl. XI. fig. 21, *a*, *b*, *c*). The reversed position of the hooks, viz. one turning right and the other left ("rechts und links"), like the ends of a bihamate, seems to have influenced him in this decision (figs. 20 & 21, *c*). But

setting aside for a moment the fact that in *Hymedesmia Schmidtii* the trenchant spicule is accompanied by genuine simple C-shaped bihamates, we find in the other sponge which I have placed in this group, viz. *Desmacidon titubans*, Sdt., that the central arm at both ends of the undoubted anchorate is similarly reversed and accompanied by an abundance of C-shaped bihamates, although of unusual size (Pl. XII. fig. 24, *c–h*). Comparing this anchorate, then, to the trenchant spicule of *H. Schmidtii* as well as to that of *H. Johnsoni*, which is the same, we must infer, I think, that this spicule represents an anchorate as I have called it, and not a fibula or bihamate.

Lastly, it has been generally supposed that no equianchorates are ever found in the "rosette"-form presented by the *in*equianchorates in *Esperia*; but in Schmidt's type specimen of *Desmacidon titubans*, in a slide at the British Museum, may be seen "rosettes" of the *equi*anchorate peculiar to this species and similar to those of *Esperia* (Pl. XII. fig. 24, *h*).

Returning now to the group Esperina, I have observed that in some species of *Esperia* there is a very minute *equi*anchorate of the navicular shape in great abundance and not more than $2\frac{1}{2}$-6000ths inch long (Pl. XI. fig. 19, *a*, *b*). This was first noticed in specimens belonging to the British Museum, viz. in nos. 123 and 286, both of which, unfortunately, are without locality, while the other figures on them are "28 *a*" and "68. 11. 26. 24" respectively; and just now I have found it in the mounting of a specimen from this beach (Budleigh Salterton) otherwise possessing a spiculation like *Esperia flocca*, Bk., but with the skeleton-spicule a simple acuate, *i. e.* without any inflation of the blunt end. It is also present in a specimen from the Mauritius (*E. plumosa*, mihi), to be hereafter mentioned. Schmidt also noticed this kind of minute equianchorate as a "variety," in the spiculation of his *Esperia anceps*, figured in his report of the sponges found by the 'Germania' in her expedition of 1871 to the North Sea (Taf. i. fig. 8), of which the measurement is given under its other name, viz. *Desmacidon anceps* (p. 432) as "0·03 millim.," which is much the same as that above stated, hence very minute. It certainly is more minute than the minutest *inequianchorates* visible in the same slides; and therefore the *in*equianchorate may possibly *begin* its development in this form. However, it does not appear in the ovular embryo of *Esperia*, while the *in*equianchorates do, as my representation will show ('Annals,' 1874, vol. xiv. pl. xxi. fig. 25). The specimen of *Esperia* from the Mauritius in which this minute equianchorate occurs was picked up by Col. Pike some years

ago when U.S. Consul there, and finally came to me through Dr. Dickie for examination. From its present feathery form, its spiculation may be briefly described under the name

Esperia plumosa, n. sp.

Skeletal spicule sub-pinlike, with the head much smaller than the thickest part of the shaft, 80 by 2½-6000ths inch in its greatest dimensions; inequianchorate 12 by 5-6000ths inch; a simple C-shaped bihamate 21 by 1½-6000ths, and a tricurvate 20-6000ths inch long; all of the ordinary forms; together with the minute *equi*anchorate 2½-6000ths long, in great abundance, but perhaps not more so than the minute bihamates and tricurvates; while the smallest *in*equianchorates are about 4-6000ths inch long.

Esperia obscura, n. sp.

Is a fragment of a massive specimen about 2 × 2 × 1 inch in its greatest dimensions, with all the characters of *Esperia*, viz. lace-like dermal layer, rigid interior fibre, and acuate (sub-pinlike) form of skeletal spicule, but with an inequianchorate about 5-6000ths long so transparent in its detail that all I can give of it are the representations (Pl. XI. fig. 18), in the hope that it might be thus recognized and finally illustrated anatomically.

Loc. Fremantle. Found in a *rotten* state in Dr. Bowerbank's collection.

Rhaphidotheca, Kent.

In the specimens of *Rhaphidotheca Marshall-Halli*, Kent, and *R. affinis*, Carter, both of which are *Esperia*, the anchorates differ so little that, unless the accurately delineated forms respectively are placed side by side as I have done (Journ. Roy. Microscop. Soc. 1879, vol. ii. pl. xvii. *a*, figs. 3 and 4), the differences are almost too slight to be of any specific value; and, after all, they may be only varieties; while the presence of the *pin-like* spicules in each, with their heads outermost, accompanied by their *spirular* flesh-spicules, has been shown to be adventitious (ibid. pp. 497, 498) or appropriated, having first belonged to another sponge. It is remarkable also that the specimens should come from parts wide apart, viz. *Rhaphidotheca Marshall-Halli* from the Atlantic on the coast of Portugal, and *R. affinis* from the Atlantic between the north of Scotland and the Färöe Islands, both upon closely allied forms of branched stony corals, in one of which my *Cliona abyssorum* with the same kind of smooth spirular flesh-spicule occurs.

Peculiarity in the Anchorate.

The only undescribed species of *Esperia* that I have examined, in which the inequianchorate possesses a decided peculiarity, is the following, viz.

Esperia Cunninghami, n. sp.

Massive, lobate, sessile. Colour now pale yellow. Surface undulating, rugose; dermal layer lace-like, formed of a stout reticulated structure, composed of smooth spiculo-fibre, underneath the interstices of which is a finer one of the same kind, whose interstices in the fresh state are tympanized by the dermal sarcode in which the pores are situated; supported internally by a rigid spiculo-fibrous skeleton, whose branches become thicker towards the older and first-formed parts of the structure, which is traversed by the branches of the excretory canal-system that open here and there in large vents on the surface. Spicules of five forms, viz.:—1, skeletal, acuate, almost cylindrical, smooth, curved, abruptly sharp-pointed, slightly constricted inside the head, or with the latter elliptically inflated, about 112 by 2-6000ths inch in its greatest dimensions (Pl. XI. fig. 17, *a*, *b*); 2, flesh-spicule, inequianchorate, 10–20-6000ths inch long, head oblong, narrow, a little longer than the rest of the body, anterior or petaloid arm a little shorter than the lateral ones, which are somewhat everted at the free end; anterior arm of the *smaller or lower end* prolonged upwards into a pointed conical process (fig. 17, *c*, *g*); 3, flesh-spicule, bihamate, very fine, back or shaft straight, suddenly curved in opposite directions at the ends, about 6-6000ths inch long (fig. 17, *d*, *h*); 4, flesh-spicule, simple, tricurvate, very small, bow-shaped, 10-6000ths inch long (fig. 17, *e*); 5, trichites in sheaf-shape bundles about the same length (fig. 17, *f*). No. 1 is chiefly confined to the dermal and skeletal structure; 2 is sparsely present, chiefly in the dermal layer, together with 3 and 4, which are extremely fine and scanty. Size of one of the largest of the pieces, of which there are many, all belonging apparently to the same specimen, which must therefore have been very large, 6 by 4 inches in its greatest diameter.

Hab. Marine.

Loc. Stanley Harbour, Falkland Islands, and Otter Island, Patagonia.

Obs. The "process" which is extended upwards from the central or petaloid arm of the lower end of the inequianchorate, and is a simple elongation of this tongue-like part (fig. 17, *g*), is the most distinguishing and striking character in this

species. Probably the larger size mentioned is the fully-developed form, although by no means the most plentiful. The bihamate is also peculiar, and so difficult to find from its fineness and scarcity that I do not place much dependence on the form and size given of it; hence consider that what I have stated requires confirmation. Possibly in some parts of the specimens which have not come under my observation the flesh-spicules may be larger, more marked, and more plentiful; but after a prolonged search I have not been able to find them. The skeletal spicule, as in most other species, varies in the form of the head, being in one part simply acuate and in another more or less inflated (fig. 17, *a*, *b*). The specimens, according to the label, were obtained by Dr. Cunningham, after whom the species is named, and found at the places mentioned. They are all in the British Museum, and, besides my running no. 441, bear the register nos. 68. 6. 29. 22 and 72. 4. 19. 3 respectively. Mr. Stuart Ridley has alluded to them (Proc. Zool. Soc. 1881, p. 117, pl. x. fig. 5) for comparison with his *Esperia magellanica*, the spiculation of which is of the common type.

Although *Esperia Cunninghami* is the only species in which I have found the "inequianchorate" to present the peculiar character above mentioned, there is another in which the *bihamate* equally possesses one; and that is the *serrated* form in *Esperia serratohamata*, found among the Gulf-of-Manaar specimens from Ceylon ('Annals,' 1880, vol. vi. p. 49, pl. v. fig. 20, *b*).

[To be continued.]

XXX.—*Report on the Nematodes in the Possession of the British Museum, with a Review of the Classification of the Order.* By Dr. L. Örley.

[Plate X.]

Since the year 1853, in which Baird's 'Catalogue of the Species of Entozoa contained in the Collection of the British Museum' appeared, the collection has been enriched by the addition of some interesting forms, the enumeration of which will afford matter of interest to those acquainted with the group. Our knowledge of the Nematodes has undergone such changes during the last thirty years, that a fresh survey of the collection was certainly desirable. Many species reputed

Length $6\frac{1}{4}$ inches, greatest diameter $3\frac{1}{6}$; aperture with the canal $3\frac{5}{8}$ long, $1\frac{1}{4}$ wide.

Hab. —— ?

This species has lately been purchased by the British Museum, and, although of large size, is apparently undescribed. It is a ponderous shell, in form not unlike certain species of the genus *Fasciolaria*, and well distinguished by the character of its sculpture. The uppermost of the spiral ridges forms the thickening beneath the sutural line; and the two beneath are a little finer than the three others upon the lower convex half of the whorls.

XXXVI.—*Some Sponges from the West Indies and Acapulco in the Liverpool Free Museum described, with general and classificatory Remarks.* By H. J. Carter, F.R.S. &c.

[Plates XI. & XII.]

[Concluded from p. 301.]

Family 2. Suberitida.

Group Laxa.

Cliona caribbæa, n. sp.

Sponge excavating; appearing on the surface of old coral (*Porites*) in irregularly scattered subcircular holes, varying in size under a quarter of an inch in diameter, which communicate through short channels with cavernous ragged excavations interiorly; channels filled with tubular processes of the sponge, open and marginated at the holes or closed by a perforated diaphragm, communicating internally with the sponge, which tapestries the cavernous excavations. Texture loose. Colour ochraceous yellow. Vents represented by the open holes; pore-area by the diaphragms. Spicules of two forms, viz.:—1, skeletal, pin-like, smooth, curved, consisting of a spherical head followed by a constriction and then a fusiform shaft, about as wide in the thickest part as the head, gradually terminating in a sharp point, length about 95 by $2\frac{1}{2}$-6000ths of an inch (Pl. XII. fig. 26, *a*); 2, flesh-spicule, a spinispirula, extremely slender, about 7-6000ths inch long, presenting five or six bends (fig. 26, *b*, *c*). Size of specimen indefinite and undeterminable, from the internal extent of the excavations being concealed.

Hab. Marine. Burrowing in hard calcareous objects.

Loc. Island of St. Vincent, West Indies.

Obs. The characters generally of this sponge are almost identical with those of our *Cliona celata*, when burrowing in calcareous objects; but the globular form of the head of the skeletal spicule, taken on an average, and the presence of the flesh-spicule cause it to differ. Whether or not *Cliona caribbæa* ever occurs in a *free* state analogous to *Rhaphyrus Griffithsii*, Bk., which is that taken by *C. celăta* after having completely destroyed the oyster-shell in which it may have been burrowing, must be determined by further research.

General Observations.

Here it may be stated that, without mounting a microscopic frangment of this sponge in balsam, the flesh-spicules, from their extreme delicacy, would pass unnoticed; and such is the case with many other sponges of this kind, in which the minute size and crooked spinispirular form of the flesh-spicule render the latter difficult of detection until the sarcode is made clearer and more homogeneous by drying and subsequently mounting in Canada balsam. At the same time it must be remembered that the flesh-spicules are chiefly confined to the surface in many instances, and therefore may not be seen in a fragment from the interior, also that they do not exist in all these sponges; hence the necessity of determining these points in the way that I have mentioned.

The spinispirula in the Suberite sponges, by which is meant those in the groups Cavernosa, Compacta, and Laxa, was first noticed by Dr. Bowerbank in 1864 (Mon. Brit. Spong. vol. i. pl. iii. fig. 72), when, together with an unspined spirula (*ibid.* fig. 71), it was found inadvertently in *Halichondria sanguinea*, Johnst. (*ib.* p. 239), where he considered them to be of "extraneous" origin; but when we remember that no sponge, in texture and spiculation, is more suberitic, *i. e.* cork-like, than a dried *H. sanguinea*, the presence of such spicules there does not seem strange; but it is strange that the *identical* form of this spinispirula should be repeated eight years afterwards (Proc. Zool. Soc. 1872, pl. xlix. fig. 7) as the type spicule of a large free massive Suberite of an ochre-yellow colour from Madeira, called by Dr. Bowerbank "*Hymeniacidon angulata*," when one from the sponge itself, with the slightest difference (for there are no two spinispirulas exactly alike), would have been much more satisfactory.

In 1864 also, Schmidt gave a good figure of a spinispirula (Spong. Adriat. Meeres, 1st Suppl. Taf. iv. fig. 12) from a "corticate" sponge (Rindschwamm) from the island of Cyprus, but without any further notice.

Meanwhile Albany Hancock (in 1867) found, described, and figured the spinispirula in several "Excavating Sponges" ('Annals,' vol. xix. p. 229, pls. vii. and viii.).

Again, in 1878 Schmidt figured the spinispirula of a sponge which he described under the name of *Spirastrella cunctatrix* (Spong. Küste v. Algier, S. 17, Taf. iii. fig. 8), likening it to the one from Cyprus, and also that of *Tethya bistellata* (Spong. Adriat. Meeres, S. 45, Taf. vii. fig. 1); lastly, in 1870 he gave this form for the flesh-spicules of his *Chondrilla phyllodes* and *Vioa Johnstonii* respectively (Spong. Atlant. Gebietes, Taf. vi. figs. 1 and 18). Here it might be observed cursorily that, however much the stellate and spinispirular flesh-spicules may be but transitionary forms of one another, as stated by Schmidt (*op. cit.* S. 5), yet the same cannot be said of the acerate and pin-like spicules which respectively characterize his *Vioa Johnstonii* of 1862 (Spong. Adriat. Meeres, S. 78, Taf. vii. fig. 17) and that of 1870 (*l. c.*), albeit both are excavating sponges, and both possess the same beautiful carmine colour. But neither colour nor habit are always of much value in a specific point of view; for the Australian species, viz. *Alcyonium purpureum* of Lamarck, which is also a Suberite, and another Australian species in the Liverpool Free Museum, although equally carmine in colour, are different in spiculation, if not in habit also, from the presence of the spinispirula in the former with a fine structure, and the absence of it in the latter with a gritty one of adventitious matter. Hence I should be inclined to change the name of Schmidt's *Vioa Johnstonii* of 1862 to that of *Vioa Schmidtii*, which in the form of its skeleton-spicule, viz. an acerate, agrees with my *Rhaphidhistia spectabilis* of the Mauritius ('Annals,' 1879, vol. iii. pl. xxvi. figs. 13 and 14). The spinispirula, under various forms, is so often combined with a pin-like skeletal spicule, and the latter is so generally characteristic of the Suberite-sponges, that we cannot help connecting them with this kind of spiculation; at the same time it is not *always* the case, as the occurrence of an acerate form in the instances just mentioned proves. To be able to demonstrate a *corky* texture in sponges which hardly exceed a mere film in thickness, as in *Rhaphidhistia spectabilis*, which possesses the longest and most beautiful spinispirula that I have ever seen, is of course impossible; hence the spiculation alone here remains for guidance.

Having mounted fragments of many Suberites for the purpose of proving what I have above stated—that is, to see if they contained any flesh-spicule besides the pin-like skeletal one,—I will give a list of those that I myself have examined,

including such as have been found by others to present the spinispirula or any other form of flesh-spicule; in doing which, it will be best to divide them into the three groups mentioned in my Classification, viz. the Cavernosa, Compacta, and Laxa, typified respectively by *Rhaphyrus Griffithsii*, Bk., = *Cliona celata*, Johnst. (the free form of an excavating sponge!), *Suberites domuncula*, Sdt., = *Halichondria suberea*, Johnst., and *Cliona corallinoides*, Hancock. But to this I must now add a fourth group under the name of "Subcompacta," typified by *Suberites massa*, Sdt., because I find that it will be more convenient to limit the "Compacta" to the strictly compact forms, to keep the "Laxa" chiefly to the excavating Suberites, and to make the "Subcompacta" a group between the "Cavernosa" and "Compacta," since the coarser cellular structure of *Rhaphyrus Griffithsii*, *Rhaphiophora patera* (Neptune's cup), &c., which mostly have a grey or brown colour, cannot be so advantageously classed with the less coarse ones, which are chiefly of an ochraceous-yellow colour—all, however, having, like the "Cavernosa," that condensed structure on the surface which seems to have led Schmidt to place his *Spirastrella cunctatrix* among his "Corticatæ" ("Rindschwämme," Spong. Küste v. Algier, 1868, p. 17).

In giving this indication of the Suberites that I have examined (of course, all in the dried state) to see if they contain any flesh-spicule, it will also be desirable not only to catalogue them as above mentioned, but, in each group, to divide those which do *not* from those which *do* possess a flesh-spicule. Again, as the form of the spinispirula differs in different species, it will be desirable to add some note of this, in which the largest size is given respectively, remembering that they will be found in each instance in a fragmentary or less perfect state in all sizes below this. Lastly, as I shall have to introduce some hitherto undescribed species, it will be necessary, where possible, not only to name but to briefly characterize some of them at the same time.

List of Suberites with and without the flesh-spicule.

CAVERNOSA.

Without flesh-spicule.

Rhaphyrus Griffithsii, Bk., = free form of *Cliona celata*.

Rhaphiophora patera, Gray (Neptune's cup).

With flesh-spicule.

Spongia Dysoni, Bk. This is the name on the largest specimen of this sponge in the British Museum, presented in 1862. =*Hymeniacidon pulvinatus*, Bk., on a small specimen of the same species presented in 1872. At Belize, the locality of this sponge, an enormous specimen is said to have been found growing on a rock which could not be touched with the oar of the boat; and hence its head alone was taken off for preservation. It is still undescribed; but there are many specimens of it in the British Museum under my running no. 457, the two largest of which are flat pieces, registered nos. 66. 5. 24. 12 and -13, labelled "*Spongia Dysoni*," the former in size $20 \times 25 \times 4\frac{1}{2}$, and the latter $33\frac{1}{2} \times 27\frac{1}{2} \times 8$ inches in their greatest dimensions.—*Character*. Massive, convex. Structure cellulo-cavernous. Colour in the dry state grey-violet. Surface smooth, remarkably irregular from its nodular projections, furnished plentifully with isolated cribriform patches of vent-holes, which open into the cellular cavities beneath. Skeletal spicule pin-like (Pl. XII. fig. 25, *a*); flesh-spicule a spinispirula with five bends about 4-6000ths inch long (fig. 25, *b*, *c*).

Suberites capensis, mihi, n. sp.—*Character*. Massive, cake-like, flat compressed, semicircular. Structure cellulo-cavernous. Colour brown externally. Surface uniformly rough, and compact on each side, loose on the margin, which is semicircular and an inch thick, where the vents, which are large and numerous, are situated, Pandean-pipe-like. Skeleton-spicule pin-like; flesh-spicule a spinispirula with four bends about 5-6000ths inch long. In the British Museum labelled "Port Elizabeth," running no. 10, registered no. 71. 6. 5. 1. Size $14\frac{1}{2} \times 5\frac{1}{2}$ inches by 1 inch thick.

Subcompacta.

Without flesh-spicule.

Suberites antarcticus, mihi. British Museum, running no. 405, registered 44. 4. ?. ?. Dredged by Sir James Ross in $74\frac{1}{2}^{\circ}$ S. lat., in 206 fathoms (Expedition of 1841), undescribed. *Character*. Stipitate branched; branches digitate, nodose, pollachotomous; structure subcavernous; colour dark house-mouse; spicule pin-like, with large *spherical* head. Size of specimen about $5\frac{1}{2} \times 3$ inches.

Suberites, ? sp. Undescribed. Liverpool Free Museum. Structure charged with grit, ? sea-bottom detritus; colour deep carmine. Australia.

Suberites, ? sp. Undescribed. Mauritius. *Character*. Massive, growing into short branches on the surface; colour ochre-yellow. In my cabinet.

Suberites, ? sp. Undescribed. *Character*. Massive, growing into short branches; colour ochre-yellow. Coast of Portugal. Kent collection, British Museum, no. 4. Size $3 \times 4 \times 1\frac{1}{2}$ inches.

Suberites massa, Sdt. *Character*. Massive, sub-branched; colour ochre-yellow. Adriatic. Type specimen in British Museum.

N.B. The last three species will probably be found to be the same.

Suberites, ? sp. *Character*. Massive, growing among and enclosing shell-detritus; colour ochre-yellow. Tucacas, in "small lagoon." Expedition of the 'Argo.'

Obs. The habit of enclosing fragments of hard calcareous objects, which finally disappear among the substance, is very common among the Suberites, giving them a gritty character; but whether this be for the organic or mineral matter, or both, that they contain, I am not able to say; it may be for the carbonic acid with the lime; but be this as it may, *Suberites domuncula* is often found under a shell-like form, having thus destroyed the shell itself on which it grew, while the destruction of shell-tissue by the burrowing (excavating) sponges is notorious.

With flesh-spicule.

Spirastrella cunctatrix, Sdt. 1, Algiers, "im frischen Zustande wahrscheinlich violet oder roth." 2, Mauritius, ? violet or purple washed out. Bowerbank collection, British Museum. 3, Australia; colour the same; specimen rounded by attrition; surface rough, tuberculate; size $6 \times 4 \times 2$ inches. Bowerbank collection, British Museum. Spinispirula very stout, the largest and most perfect about 10-6000ths inch long.

Spirastrella cunctatrix, variety. Mauritius. On a little crab's back about half an inch in horizontal diameter. Liverpool Free Museum. *Character*. Amorphous; colour white. Spinispirula very short and thick, composed of two bends 11 by 9-6000ths inch in its greatest dimensions (including the spines). This appears to be a *monstrous* "variety" on account of the number of grotesque forms assumed by the skeletal spicule in which the spinispirula appears to take part.

Suberites, ? sp. Undescribed. *Character*. A group of obconical tubes united at the base, presenting a warty or tuber-

cular surface outside; colour ochre-yellow. Size $6 \times 4 \times 2\frac{1}{2}$ inches. Australia. Bowerbank collection in British Museum. Spinispirula stoutish, consisting of four bends 10-6000ths inch long.

Suberites, ? sp. Undescribed. Mauritius. *Character*. Massive; colour ochre-yellow. A fragment in my cabinet. Spinispirula thin, small, consisting of three bends 5-6000ths inch long.

Suberites, ? sp. Undescribed. Belize. *Character*. Massive, lobate; verrucose on the surface; colour ochre-yellow. Liverpool Free Museum. Presented by Dr. Archer. Spinispirula thin, but very perfect, consisting of four bends 10-6000ths inch long.

Suberites coronarius, mihi. Undescribed. Honduras, Jamaica, Bahama Islands. *Character*. Massive, lobate, verrucose on the surface; colour ochre-yellow. Bowerbank collection, British Museum. Spinispirula consisting of one bend, semicircular, with the spines on the outside and over the ends only; spines capitate and in single file. Size about 4-6000ths inch long (Pl. XII. fig. 27, *b*, *c*).

Suberites, ? sp. Undescribed. Trincomalee. *Character*. Massive, sessile, growing up into conical lobes, more or less rugose at the base, warty; colour dark yellowish brown. Size $3 \times 2 \times 1\frac{1}{2}$ inches. Bowerbank collection, British Museum. Spinispirula variable in size; the largest consisting of four bends, 8-6000ths inch long.

Hymeniacidon angulata, Bk. (Proc. Zool. Soc. 1872, p. 632, pl. xlix.), Madeira. Sessile, coating; ochreous yellow. Size of largest piece $12 \times 7\frac{1}{2} \times 2$ inches. Spinispirula "minute," variable in form. No measurement given.

Alcyonium purpureum, Lam. Australia. Colour a beautiful carmine. Spinispirula, like all the rest, very variable in form and size, the largest and most perfect consisting of one and a half to two bends, 5-6000ths inch long (Pl. XII. fig. 28, *b*, *c*).

Of this sponge I have only seen a small slice, about 3 inches long and 1 inch square, evidently cut out from a much larger specimen, and bearing the condensed surface, with the subcavernous or subcompact structure internally, common to the group. (British Museum, "Lamarck collection," nos. 46 and 42 together.)

Compacta.

Without flesh-spicule.

Hymeniacidon carnosa, Bk. British Seas, = *Halichondria carnosa*, Johnst. Also from Vancouver's Island, between tide-marks. British Museum, no. 317, registered 68. 8. 17. 26, labelled "J. K. Lord, Esq."

Suberites montiniger, Cart. Barents Sea. Colour greyish black ('Annals,' 1880, vol. vi. p. 256).

With flesh-spicule.

Halichondria suberia, Johnst., = *Suberites domuncula*, Sdt. British and other seas. Flesh-spicule a short curved cylindrical acerate with obtuse ends, inflated in the centre, microspined and about 8-6000ths inch long. (Bowerbank, Mon. B. S. vol. i. pl. iv. fig. 95.)

Halichondria ficus, Johnst. British and other seas. Flesh-spicule the same.

Suberites montalbidus, Cart. Barents Sea. Colour greyish white. Flesh-spicule the same, but *pointed* at the ends ('Annals,' 1880, vol. vi. p. 256). ? Equal to *S. Lutkenii*, Sdt., Greenland (Spong. Atlant. Gebiet. S. 47).

Laxa.

Without flesh-spicule.

Cliona celata, Johnst. British and other seas. Burrowing in hard calcareous objects, especially oyster-shells, also in limestone rocks.

With flesh-spicule.

Cliona northumbrica, spinispirula 1-1800th, *C. vastifica*, s. 1-2100th, *C. corallinoides*, s. 1-2000th, *C. gracilis*, s. 1-1500th, *C. Howsei*, s. 1-600th, *C. mazatlanensis*, s. 1-1300th, *C. lobata*, s. 1-500th of an inch long. (Hancock, 'Annals,' 1867, vol. xix. p. 229, pls. vii. and viii.)

Cliona vermifera. *Smooth* spirula, five bends, "scarcely" 1-400th inch long. (Hancock, *ibid.*)

Cliona abyssorum. *Smooth* spirula, eight bends, 1-300th inch long. (Carter, *ibid.* 1874, vol. xv. p. 249, pl. xiv. fig. 33.)

Obs. It is easy to learn by the "smooth spirula" how the addition of spines forms the "spinispirula."

Cliona mucronata. Spinispirula 0·0006 inch long. *C. ensifera*. Spinispirula the same. *C. subulata*. Spinispirula thinner and longer, measurement not given. (Sollas, *ibid.* 1878, vol. i. p. 54, pls. i. and ii.)

Vioa Johnstonii, Sdt. (Spong. Atlant. Gebiet. S. 5, Taf. vi. f. 8). Colour carmine. Spinispirula four bends, 10 to 15-6000ths inch long. Type specimen in the British Museum.

Vioa Schmidtii, Carter, = *V. Johnstonii*, Sdt. (Spong. Adriat. Meeres, S. 78, Taf. vii. fig. 17). Skeleton-spicule acerate; flesh-spicule stelliform.

Rhaphidhistia spectabilis, Cart. Mauritius ('Annals,' 1879, vol. iii. p. 300, pl. xxviii. figs. 13 and 14). Skeleton-spicule acerate; flesh-spicule a spinispirula of nineteen bends, 1-300th inch long. The longest and most beautiful that I have seen.

Vioa Carteri, Ridley (Proc. Zool. Soc. 1881, p. 129, pl. xi. figs. 2 and 2 *b*). Colour carmine. Spinispirula ·0412 millim. long = 8-6000ths inch. "Victoria Bank," off S. Brazil.

It must not be thought that the foregoing list embraces the whole of the Suberites proper (that is, the sponges which belong to the four groups above mentioned), but rather only a few of them, to show that the pin-like skeletal spicule is often accompanied by a spinispirular or other flesh-spicule, as well as often without it. There are, of course, scores of instances in which neither might be the case, ex. gr. *Suberites fistulatus*, in which the skeleton-spicule is inflated at both ends and the flesh-spicule an equianchorate ('Annals,' 1880, vol. vi. pl. v. fig. 22). Or the skeleton may be acerate (pointed at both ends) and the flesh-spicule a stellate, as just noticed in *Vioa Schmidtii*, Carter. Then, in general form, the species may be furnished with long tubular appendages, as in *S. fistulatus* also; or the colour may be soot-black, as in *S. fuliginosus* ('Annals,' 1879, vol. iii. p. 347, pl. xxviii. fig. 9). In short, there are so many more sponges already described, and so many more likely to be discovered which might be relegated to one of the four groups mentioned, that, although in my "Notes" &c. I have proposed to give a third part, in which these and every other published species of sponges would be catalogued, I must, for want of time, leave this useful compilation to some one else, and content myself with the few suggestive remarks (notes) that I am now making.

There is also the genus "*Latrunculia*" of Bocage, in which an acuate or acerate skeleton-spicule, as the case may be, is,

in several species, combined with the flesh-spicule that I have termed "sceptrella" ('Annals,' 1879, vol. iii. p. 358, pl. xxix. figs. 13–21), which so often passes into the "spini-spirula," that both forms may sometimes be found together in the same sponge, ex. gr. *Latrunculia corticata* ('Annals,' 1879, vol. iii. pl. xxvii. fig. 1, *a*, *b*, *c*).

Terpios fugax, de Fonbr. et Mich. (p. 102, pl. xxiv. fig. 6).

Laminiform, almost immeasurably thin, spreading over hard objects (*Porites*) in the manner of paint. Colour copper-green. Surface in form that of the object over which it may be growing. Consistence sarcodic (no fibre), charged with the spicule of the species, together with innumerable globular bodies (? cells), extremely minute and of a copper-green colour. Spicule of one kind only, viz. pin-like, smooth, very thin, slightly curved; head globular, acuminated terminally, followed by a thin shaft, which, after a short distance, gradually diminishes to a sharp point, about 70 by $\frac{1}{2}$-6000th inch in its greatest dimensions (Pl. XII. fig. 29), scattered plentifully and irregularly throughout the sarcodic film of which the sponge is composed. Size of the largest specimen about that of the branched one of *Porites furcatus* over which it has grown, about $3\frac{1}{2}$ inches in diameter.

Hab. Marine. Growing over hard objects.

Loc. Falmouth Harbour, Antigua.

Obs. This appears, from description and illustration, to be *Terpios fugax*, De F. et M.; but, from the form of the spicule not having been given, it is impossible to go beyond the description and representation for identification.

There is a species which grows on the rocks of this shore (Budleigh Salterton) in small patches, to which I have alluded in my paper on the "Parasites of the Spongida" ('Annals,' 1878, vol. ii. p. 164), chiefly to notice the presence of the parasitic oscillatorian (*Hypheothrix cærulea*, Carter) to which it owes its beautiful colour; but as I have never published any description of the sponge itself, I will now do it under the name of

Terpios cærulea.

Laminiform, almost immeasurably thin, spreading in little patches over the surface of the New Red Sandstone rocks here. Colour cobalt-blue when fresh, fading much on drying, but not disappearing altogether. Consistence sarcodic (no fibre), charged with the spicule of the species, and innumerable short parasitic oscillatorian filaments (*Hypheothrix*

cærulea, Carter), whose granules or cells bear the colouring-matter of the sponge (Pl. XII. fig. 30, *b*, *c*). Spicule of one kind only, viz. pin-like, smooth, slightly curved; head globular, acuminated terminally, followed by a narrow, annular inflation, and then a conical shaft, which, after a short distance, becomes diminished gradually to a sharp point; about 80 by 1-6000th inch in its greatest dimensions (fig. 30, *a*); scattered plentifully and irregularly throughout the sarcodic film of which the sponge is composed. Size of largest specimen seen about half an inch square.

Hab. Marine. Growing over hard objects.

Loc. Budleigh Salterton, S. Devon.

Obs. This appears to be an instance of what the Germans call "symbiosis." There is very little difference, except in colour, between it and the foregoing species, viz. *Terpios fugax*; hence I have adopted De Fonbressin and Michelotti's generic name for this kind of sponge. The form of the spicules appears to be the same, in so far as they are not fusiform, but diminish gradually from the head to the point, that of the British species being the largest. As regards the colouring material, this is situated in free granules (? cells) in *Terpios fugax*, which in *T. cærulea* are in short oscillatorian sheaths. Dr. de Fonbressin in his "Review" states that, as these sponges often penetrate into the cavities of marine objects (? *Vioa viridis*, Sdt.), the genus *Terpios* establishes "une véritable transition aux Éponges perforantes" (p. 49)—that is, the excavating Suberites in my group *Laxa*. Of the same character appear to be *Rhaphidhistia spectabilis* and *Hymerhaphia spiniglobata* (Annals, 1879, vol. iii. pp. 300 and 301, pl. xxvi. figs. 13 and 15, &c.).

Donatina.

Turning our attention to the remaining group in the family Suberitida, viz. "*Donatina*," we find its subdivision already foreshadowed by the number of different sponges hastily, and therefore *provisionally*, inserted under this heading ("Notes," &c., p. 198).

Thus all the species from *Suberites appendiculatus* to *Trachya pernucleata*, with their like, might be included under a group named "Polymastina," as stated in the 'Annals' of 1876 (vol. xviii. p. 392), which group might be again subdivided into two sections, one of which presents a delicate structure and is well represented by the British species in Dr. Bowerbank's third volume, ex. gr. *Polymastia robusta* (Mon. B. S. vol. iii. pl. x. fig. 5, 1874), and the other just the opposite, viz. an *intensely compact* and hard structure,

well represented by the Cape species briefly described in the 'Annals' (*l. c.* p. 393), for which I would now propose the name of *Trachya durissima*, as the genus was characterized in 1870 ('Annals,' vol. vi. p. 178, pl. xiii. figs. 11–16). The spiculation in both sections is the same, viz. a stout skeletal spicule radiating from the centre, faced by a minute one which, inserted between the pointed ends of the former, gives a compactness to the surface; both spicules are for the most part acuate or pin-like, although the skeletal one in *Trachya pernucleata* (*op. et loc. cit.*) happens to be acerate; while the extreme compactness of the genus *Trachya* makes it resemble *Donatia lyncurium* so much that the Cape species of Polymastina (viz. *Trachya durissima*) might be easily mistaken for it at first sight. Keller's *Tuberella*, found in the Bay of Naples, appears to me to belong to this section (Archiv f. mikroskop. Anatomie, Bd. xviii. S. 276, Taf. xiv. 1880).

For *Axos Cliftoni* I have provisionally proposed a group under the name "Axona" ('Annals,' 1881, vol. vii. p. 381); but, as already stated, the examination of the species *Phorbas amaranthus*, de F. et M., from the West Indies, has thrown so much light on the Australian species *Axona anchorata* and *A. fibulata*, which were described from very "imperfect specimens" ('Annals,' *l. c.* pp. 382, 383), that I would now relegate them to the group Halichondrina under the generic name of "*Phorbas*."

Xenospongia.

For *Xenospongia patelliformis*, from Torres Straits, and *Halichemia patera*, Bk., a British species, there might be a group named "Xenospongina," =Xenospongiadæ, Gray ("Arrangement of Sponges," Proc. Zool. Soc. 1867, p. 547). See spiculation (Pl. XII. fig. 32, *a–c*).

Placospongia.

Again, for *Placospongia melobesioides*, from Borneo, Ceylon, and South America, there might be a group named "Placospongina," = Placospongiadæ, Gray (*op. et loc. cit.* p. 549), in which the skeleton-spicule is pin-like (Pl. XII. fig. 33, *a*, *b*), combined with a spinispirular flesh-spicule, like that of a Suberite (fig. 33, *c*, *f*, *i*), *faced* and *axiated* (for the sponge is branched) by a massive aggregation of elliptical siliceous balls like those of a *Geodia* (fig. 33, *c*, *g*), or mixed with a small spherical subspined one like that of *Chondrilla nucula* (fig. 33, *d*, *h*)—thus uniting in spiculation two groups, viz. the *Suberites*, as above divided, and *Geodina*, in which the spicular characters of the former preponderate.

Donatia.

Lastly, we come to the only remaining species in "Group 14," viz. *Donatia lyncurium* (after which it was named "Donatina"), which, being a corticate sponge with a peculiar structure and spiculation still allied to the family Suberitida, will be best left where it is.

Hence the emended classification would stand thus:—

Order VI. Holorhaphidota.

Family 2. Suberitida.

Group 1. Cavernosa.	Group 5. Polymastina.
2. Subcompacta.	6. Xenospongina.
3. Compacta.	7. Placospongina.
4. Laxa.	8. Donatina.

It must not be considered that these are all hasty speculations, which have only to be read and forgotten, but rather that they are attempts to reduce to useful classification a number of objects which, although a part of Nature's creation, have hitherto been almost contemptuously disregarded, not so much perhaps from their having passed unnoticed, as from the question whether they belong to the animal or vegetable kingdom having been undecided. But now that they have been admitted to belong to the former, the subject must be seriously grappled with by the comparative anatomist, and a classification developed for aiding the memory, which, as in other instances of the kind, can only be produced by time, thought, and experience extending over many generations, like that of botany.

Returning to a description of the sponges belonging to the Liverpool Free Museum, I have now to add that of a curious variety of *Donatia lyncurium* dredged by Capt. W. H. Cawne Warren in the harbour of Acapulco, after which a brief history of the species of *Donatia* will be given.

Donatia multifida, n. sp. (Pl. XII. fig. 22, *a–e*.)

Membraniform, lacinulate, expanded, flat or erect, fan- or vase-shaped, proliferous. Texture hard, tough. Colour now pinkish. Surface even, presenting white lines radiating from the excentric expansions to the circumference, which is fimbriated by irregular lacinulate processes of variable length, ending in thin expansions of attachment, by which they become adherent, like the tendrils of a scandent plant, to

the hard objects (empty shells, &c.) among which the sponge may be growing (Pl. XII. fig. 22); terminal expansions of the processes charged with the flesh-spicules of the species, into which the "white line" in the process, consisting of a bundle of skeletal spicules, is spread out. Spicules of four kinds, viz.:—1, skeletal, acuate, smooth, straight or very slightly curved, obtuse and almost imperceptibly inflated at the big end, then as slightly constricted and followed by a fusiform shaft, which terminates gradually in a round point in the largest and in a sharp one in the rest, about 138 by 2½-1800ths inch in its greatest dimensions, but of all sizes under this measurement; 2, flesh-spicule, globostellate, 4-1800ths inch in diameter; 3, flesh-spicule, stelliform, 3–6-radiate, rays long, straight, or crooked, branched or spined irregularly, parting from each other directly (that is, without nucleus or body in the centre, thus opposed to the "globostellate" form), about 10-6000ths inch in diameter (Pl. XII. fig. 22, *d*); 4, flesh-spicule, minute, sexradiate, body globular, rays straight, ending respectively in globular inflations, which are microspined, about 3-6000ths inch in diameter (fig. 22, *e*). No. 1 is chiefly confined to the radiating bundles which form the skeleton; nos. 2 and 4, in great abundance, chiefly to the circumference, among which no. 3 is sparsely scattered. Size variable, according to extent of development; the largest specimen about an inch in diameter exclusive of the circumferential filaments.

Hab. Marine. Growing plentifully among the detritus of the sea-bottom in 4–9 fms.

Loc. Acapulco.

Obs. This sponge in structure, spiculation, and colour is precisely like *Donatia lyncurium*, but differs from it in its mode of growth, which looks like a globular form that had been shattered by some explosive force in the centre (Pl. XII. fig. 22, *a a*). Frequently it presents a floral or cup-like form, erect or inverted, with a naked central portion like a pistil in the centre (fig. 22, *f*). The filaments from the circumference seem to serve the purpose of propagation as well as attachment.

General Observations.

As *Donatia lyncurium* appears to be a world-wide species, for I have myself had specimens from Great Britain (this place), the West Indies ('Argo' expedition), the Cape, Mauritius, and South Australia, independently of the other places in which it has been found, whose differences in hardly any instance are sufficient to justify a multiplication of species, although they may

require a different nomenclature, I will here briefly state its history.

Dimly introduced among his "Alcyones" about 1725 by Marsigli, we are chiefly indebted to Donati for the first good description and figure of this sponge, in 1750, under the name of *Tethya spharica* (Storia nat. marin. Adriatic. Venet. pp. 60–64. n. 1, 2, tab. x.). Lamarck called it *Tethya lyncurium* (An. s. Vertèbres, 1816, vol. ii. p. 386). Montagu, in 1818, was the first to call it *Spongia*, and place it among the species of British sponges then known (Wern. Mem. vol. ii. p. 117, pl. xiii. figs. 4 and 5). In 1833 Nardo gave it the name of *Donatia lyncurium* ('Isis,' p. 522, Spongiariorum Classificatio); and Johnston introduced it into his 'History of British Sponges,' &c., under Lamarck's name (p. 85 &c. pl. i. figs. 9 and 10). In 1862 Schmidt, thus following Johnston and Lieberkühn (Spong. Adriat. Meeres, S. 44), and Bowerbank in 1866 (Mon. B. S. vol. ii. p. 92), used the same appellation.

Now came the time for separating the "*Tethyæ*" of Lamarck; and thus we find the late Dr. J. E. Gray, in his "Notes on the Arrangement of Sponges" (Proc. Zool. Soc. 1867, p. 492), making *Tethya lyncurium* of Lamarck the type of the first division of his family Tethyadæ under Nardo's name "*Donatia*," and *Tethya cranium*, Lam., that of the ninth division under the name of *Tethya* (*op. et loc. cit.* pp. 541 and 543 respectively).

The necessity for this separation became much more evident to me when I described and illustrated side by side *Donatia lyncurium*, from this place, and *Tethya arabica*, which I found *in situ* growing on a rock on the south-east coast of Arabia ('Annals,' 1869, vol. iv. p. 1, pls. i. and ii.). So that in 1875, when my "Notes Introductory to the Study and Classification of the Spongida" were published, I found it advisable to place *Donatia lyncurium* in the second family of my Holorhaphidota under the name of "*Donatina*," and *Tethya cranium* in the third or following family in the "Pachytragida" under the heading of "*Tethyina*;" thus it is to be hoped these two incongruous species may never again be brought together.

In 1872 the late Dr. Bowerbank described and figured a *Donatia* from S.W. Australia, which he called *Tethea Ingalli* (Proc. Zool. Soc. p. 119, pl. v. figs. 11–17); and the following year two other specimens which came from the same locality were named respectively *Tethea robusta* and *T. Cliftoni* (*ib.* pp. 10 and 16, pls. ii. and iii.); while in 1879 Dr. Béla Dezsö, of Kolozsvar, aided by Prof. F. E. Schulze's prepara-

tions, published two memoirs entering far more satisfactorily than any one who had preceded him into the general description of the microscopic characters and reproduction of *Tethya* (*Donatia*) *lyncurium* (Archiv f. mikroskop. Anatomie, Bd. xvi. S. 626, Taf. xxx.–xxxiii., and Bd. xvii. S. 151, Taf. xii.).

But in no instance has that spiniferous character of the ray been particularly noticed which is represented in my figure from a specimen of the British species found at this place ('Annals,' 1869, *l. c.* p. 27, pl. ii. fig. 6, *b*), to which I would now call attention, because its pointed and spinous form if enlarged would be analogous to that of no. 3 in *Donatia multifida* (fig. 22, *d*), and to that which we shall see hereafter becomes a character in the Cape species or variety. Sometimes the spines in the British species cover the end of the ray in the small staple stellate to such an extent as to simulate the presence of a globular inflation, which is actually the case in the Adriatic form (Béla Dezsö, *op. cit.* Bd. xvi. fig. 4), also in the Australian ones, as I learn from Dr. Bowerbank's figures (*loc. cit.*) as well as my own slides, and, indeed, in *Donatia multifida* (Pl. XII. fig. 22, *e*). But it is in the Cape species, which is more robust than any of the rest in its adult state as well as in its spiculation, that the three forms of flesh-spicules mentioned in *Donatia multifida* become most distinct, where "no. 2" (referring to the numbers in the description of *D. multifida*), the largest, viz. the globostellate, measures 30-6000ths, "no. 3," the stelliform, with spiniferous rays, 12-6000ths (Pl. XII. fig. 23), and "no. 4," the minute sexradiate, 3-6000ths of an inch in diameter respectively. In the specimen from Mauritius "no. 3" is only 5-6000ths inch in diameter; so that after all the *differences* are only in degree, and those only sufficient to form a variety. Still, hitherto it does not appear to me that this third form of flesh-spicule, viz. no. 3, so characteristically developed in the Cape species (fig. 23), has been publicly noticed.

Respecting varieties in spiculation, however, it should always be remembered that our observations are necessarily very limited, on account of their having to be made on perhaps only one or two fragments of the entire specimen, and that specimen perhaps the only one that can be obtained from the locality; whereas, if our observations had been extended further, our statements might have had to be modified, and therefore should always so far be considered provisional. Perhaps, too, for the same reason, the fragments examined by two individuals respectively might not contain exactly the same form of spicules.

Here I would also notice that the "globostellate" ("Notes,"

p. 33, *l. c.*) which comes nearest in form to that of *Donatia*, where the body is large and the spines short, is that of *Chondrilla nucula*, while that of *C. sacciformis*, Carter, from Mauritius, in size and figure is almost identical with it. Moreover there is a great resemblance in structure and spiculation between *Donatia lyncurium* and *Axos Cliftoni*, wherein the small flesh-spicule, viz. "no. 4" in the former, is almost identical in form with a similar one in the latter; and the globostellate of *Donatia lyncurium* only a modification of the sexradiate cross-like one with multifidly-spined rays in *Axos Cliftoni*, as may be seen where the *central part* or body of the latter is much enlarged.

Family 3. Pachytragida.

Group Geodina.

Geodia tumulosa, Bk., Proc. Zool. Soc. 1872, p. 628, pl. xlvii.

On an agglomeration of two large pebbles &c. a foot in diameter, bearing two specimens of *Polytherses*, *Cliona caribbæa* in *Porites*, and four species of sessile stony corals, all of considerable size, (the largest *Polytherses*, which is conical, being 5 inches high and the same in diameter at the base), together with a large piece of wood *artificially squared* and somewhat eaten by marine animals, but by no means in a state of decay, is a specimen of *Geodia tumulosa*, Bk., which has grown over nearly one third of the mass, which was found at Puerto Cabello, in the Caracas. The specimen of *Geodia* is well characterized in Dr. Bowerbank's representation of this species, the localities for which are stated to be "Honduras and Jamaica," and therefore requires no description of my own beyond the above, which is given in detail, to show by the present state of the *wood* in the conglomerate with what rapidity these marine animals grow and thus firmly cement together such large detritus.

There is another, small, thin specimen, about 2½ inches square, that had also grown between stones at the island of St. Vincent, and seems to be De F. et M.'s *Geodia caribbæa*, in which the surface-character is different from that of the foregoing specimen (apparently their *G. gibberosa*, Lam.), but which I shall presently endeavour to show is but a variation of *G. tumulosa*, Bk., and, finally, *G. gibberosa*, Lamarck.

The spiculation is the same in both the specimens from Puerto Cabello and St. Vincent: that is to say, the zone-spicule in each consists of a long shaft, terminated by three simple arms expanded laterally and a little advanced (Pl. XII.

fig. 31); the forks and anchors, being the (so to speak) "grappling"- spicules, are of course always concomitants, although not always seen; while the large acerate body-spicule and the flesh-spicules, viz. the siliceous balls accompanied by the minute stellates, are also the same. Such is also the spiculation in the six species from the West-Indian seas described and illustrated by Dr. Bowerbank (Proc. Zool. Soc. 1872, '73, and '74), while there is such a sameness in other respects, that if nothing but the form of the specimens is to determine the species, so little dependence is to be placed on this that they may all be set down as the same, subject to variation.

General Observations.

The Geodina, like the Esperina, have in most instances so little that is different in their respective spiculations, that by this alone it is impossible to distinguish them. Size goes for nothing, since a large specimen may have large spicules and a small specimen smaller ones, while in both the *forms* are the same. Again, if we search for specific differences in general development and surface-characters, the same species under certain circumstances may assume different forms; so that, in fact, we have nothing to do but to consider them all as belonging to one species, whatever names may be used for the varieties. Thus the two specimens just mentioned have the same kind of spiculation, although the external or surface-characters differ in the way to which I shall more particularly allude presently. As already stated, the six species from the West-Indian seas, described and figured by Dr. Bowerbank (*op. et loc. cit.*), have the same kind of spiculation among themselves, and the same as those from Puerto Cabello and St. Vincent respectively. But Dr. Bowerbank has stated that the porous areas in his *G. tuberculosa* "appear like a series of impressions made by the point of a pin," while each of the porous areas in *G. tumulosa* presents a plurality of pores (P. Z. S. 1872, pp. 627 and 629 respectively); hence, if we combine the pinhole pores of *G. tuberculosa* with the adult form given by Dr. Bowerbank of *G. tumulosa*, we shall have just what is to be found in our species from Puerto Cabello, while the plurality of pores in the areas of *G. tuberculosa* may find its analogy in the specimen from St. Vincent. These facts seem to be repeated in the West-Indian specimens described and illustrated by De F. et M., inasmuch as it is stated of *G. gibberosa*, Lam., that the pores are "punctiformes" (p. 105, pl. xxv. fig. 1 *a*), and that in their *G. caribbea* the porous area is "finement réticulée" (p. 106, pl. xxiv. fig. 8). With refer-

ence to the former of their specimens, therefore, I cannot help identifying it with our specimen from Puerto Cabello, and the latter with that from the island of St. Vincent; for *both kinds* of pores *exist* on the surface of the latter. Thus Dr. Bowerbank's *G. tuberculosa* and *G. tumulosa* appear to me to be the same as Lamarck's *G. gibberosa*, which also came from the West Indies.

Now I have just boiled out in nitric acid fragments of both our specimens, viz. that from Puerto Cabello and that from St. Vincent. But for the spiculation generally of the latter being a little smaller, the two are identical; and yet the surface of the former is covered with pin-holes regularly and quincuncially arranged in a thick crust of siliceous balls, &c., while the latter is for the most part covered by a dermal reticulation in which the interstices are cribbled with pore-holes in a thin one.

This discrepancy I will now endeavour to explain. It may be remembered, 1st, that in many sponges, especially among the Holorhaphidota (ex. gr. *Halichondria panicea*, Johnst., *Esperia*), the pores are situated in plurality in the delicate films of dermal sarcode which tympanize the interstices of the skeletal reticulation, thus rendered cribriform; 2ndly, that in the Psammonemata, where the dermal sarcode is thicker and the interstices (that is, the polygonal divisions on the surface) much larger, the tympanizing sarcode is again divided by a minute subreticulation of soft colourless fibre, which appears in relief on the surface of the polygonal divisions respectively, and presents one or more pores in each of its interstices; 3rdly, that in many *Hircinia* this reticulation becomes still more evident by the addition of minute microscopic objects (sand-grains, fragments of sponge-spicules, &c.), which give it a strikingly beautiful lace-like appearance, especially from its whiteness when dry; 4thly, that this addition of foreign objects often goes on to such an extent as to thicken the lines of the reticulation into a continuous incrustation, leaving only the openings of the pores.

Now we have only to apply this to *Geodia*, in which the siliceous balls and their accompanying minute stellates represent the "minute foreign objects," to understand how, in the specimen of *G. gibberosa* from the island of St. Vincent, we have a plurality of pores in the interstices, and in that from Puerto Cabello single ones, like pin-holes, in the thickened crust. Indeed, as before stated, the two conditions exist together in the specimen from St. Vincent, and therefore prove that these differences only depend on degree of development.

Thus we are led to the conclusion that in the selection of material from foreign sources by the *Hircinia*, and in the supplying of it from itself by the *Geodia*, the sponge evinces the power not only of selection, but of transporting from place to place with definite arrangement what it requires, together with the power of producing this material itself when it cannot obtain it from other sources.

Addendum.

Insert immediately after "Family 2. **Cavochalinida**," p. 277, *antea*, the following :—

Patuloscula procumbens, n. sp.

Cauliform, rhizomatous, procumbent, solid, throwing up thumb-like hollow processes, or simply branched, with large patulous vents ; processes short, erect, annularly inflated, increasing in size upwards, and somewhat contracted at the orifice, which is large and circular. Texture resilient. Colour pale amber or deep dark amber, bordering on purple, which is probably the real colour when fresh. Surface smooth, even. Composition fibrous, resilient. Spicule of one form only, viz. acerate, smooth, curved, fusiform, sharp-pointed, 20 by $1\frac{1}{2}$-6000ths inch in its greatest dimensions, small, and scanty. Size of specimen $5\frac{1}{2}$ inches high by $1\frac{1}{2} \times 7$ inches square.

Hab. Marine.

Loc. West Indies, Grenada.

Obs. The light amber colour which gives this specimen such a beautiful appearance seems to have been produced by cleansing with acids, since some specimens of the same species in the British Museum still retain a trace of the "purple colour" common to this kind of *Chalinæ*. Besides a similar specimen to that in the Liverpool Free Museum, which was presented to the British Museum by Mr. T. H. Higgin, F.L.S. (reg. no. 77. 3. 9. 3) there are others in the latter, viz. no. 140, registered 45. 5. 12–20 and –21, and no. 264, registered 45. 5. 12–13, –15 and –16. It is some time since I gave the above name to this species, which will illustrate the group "Tubulodigitata" in my classification ; and at the suggestion of Mr. T. H. Higgin, F.L.S., I now add the description.

To the above may also be added two very fine specimens of the same family from Grenada, and in the 'Argo' collection, viz. *Tuba plicifera*, de F. et M. p. 53, pl. x. fig. 2, and *Tuba* (*Callispongia*) *Eschrichtii*, de F. et M. p. 56, pl. xii. fig. 1. The former illustrates group 8, viz. "Ciliata," in my Classification ; and as the latter (which is more or less covered

with the usual aculeations) belongs to the genus "*Tuba*" as much as the former, I have given this generic name to it, but would place *this* in the 6th group, viz. "Aculeata." The specimen of *T. plicifera* is composed of thick ridged fibre, with a circular fringed orifice, about 10 inches high by 5 inches in diameter; and that of *T. Eschrichtii*, which is long and trumpet-shaped, is more or less covered with a remarkably irregular form of the outgrowth mentioned, about 16½ inches high and 3½ inches in the longest diameter at its orifice, which is elliptical and *not* fringed. All three specimens have the same light fawn-colour, and all three the same kind of acerate spicule; that of *T. plicifera* is 18 by ⅔-6000ths inch, and that of *T. Eschrichtii* 18 by ½-6000ths inch, in their greatest dimensions respectively, so that it is finest in the thickest fibre, but very scanty in all three.

Each specimen presents a young one at its base, which is *blind* at the free end (that is, without orifice).

List of part of the Sponges from the West Indies in the Liverpool Free Museum collected by the Rev. H. H. Higgins, M.A., labelled "Argo Expedition, 1876," *submitted for examination in the month of November* 1881.

CARNOSA.

Chondrilla nucula, *Sdt.*, p. 268.

CERATINA.

Luffaria cauliformis, n. sp., p. 268.
—— ——, var. rufa seu fusca, n., p. 269.
—— ——, var. elongoreticulata, n., p. 269.
Aplysina aerophoba, *Nardo*, p. 270.
—— compressa, n. sp., p. 270.
—— cauliformis, n. sp., p. 270.
—— longissima, n. sp., p. 271.
—— fenestrata, *de F. et M.*, p. 272.

PSAMMONEMATA.

Spongia officinalis *auctt.*, p. 272.
Hircinia caracasensis, n. sp., p. 273.
Polytherses, *de F. et M.*, p. 274.
Dysidea tubulosa, n. sp., p. 275.

RHAPHIDONEMATA.

Chalina rubens, *Pallas*, p. 276.
Patuloscula procumbens, n. sp., p. 365.
Tuba lineata, var. flabelliformis, *de F. et M.*, p. 277.
Tuba digitalis, *de F. et M.*, p. 277.
—— armigera, *de F. et M.*, p. 278.
—— plicifera, *de F. et M.*, p. 365.
—— Eschrichtii, *de F. et M.*, p. 365.

ECHINONEMATA.

Ectyon sparsus, *Gray*, p. 281.

HOLORHAPHIDOTA.

Halichondria panicea, *Johnst.*, p. 282.
Isodictya simulans, *Johnst.*, p. 282.
Thalysias repens, *de F. et M.*, p. 282.
—— carbonaria, *Lam.*, p. 282.
Fibularia massa, n. sp., p. 282.
—— ramosa, n. sp., p. 283.
—— anchorata, n. sp., p. 283.
Halichondria birotulata, *Higgin*, Ann. 1877, vol. xix. p. 296.
—— isodictyalis, n. sp., p. 285.
Reniera digitata, *Sdt.*, p. 287.
Phorbas amaranthus, p. 287.
Esperia lævis, n. sp., p. 291.
Suberites ? sp., agglomerated with shell-detritus, p. 350.
Cliona caribbæa, n. sp., p. 346.
Terpios fugax, *de F. et M.*, p. 355.
Donatia lyncurium, *Nardo*, p. 359.
Geodia gibberosa, *Lam.*, =G. tumulosa, *Bk.*, p. 362.

List of Sponges dredged by Capt. W. H. Cawne Warren in the Harbour of Acapulco &c. in 4–9 fathoms, July 1880, *submitted for examination at the same time.*

Tuba acapulcoensis, n. sp., p. 279.
Reniera fibulata, *Sdt.*, p. 284.
Halichondria isodictyalis, p. 285.
Halichondria pustulosa (South Atlantic Ocean), n. sp., p. 285.
Donatia multifida, n. sp., p. 358.

EXPLANATION OF THE PLATES.

Note.—All the spicules, with the exception of figs. 31 and 32, are drawn to a scale of 1-48th to 1-6000th of an inch, that their relative sizes may be seen; but figs. 31 and 32, being of a much larger size, are, for convenience, drawn to a scale of 1-48th to 1-1800th inch. The "more magnified" views of the smaller spicules are upon no scale at all, but intended to show in a larger form that which cannot be well shown in a smaller representation.

PLATE XI.

Fig. 1. *Halichondria pustulosa*, n. sp. (nat. size). *a a*, pustuliform eminences; *b*, the same, more magnified; *c*, skeletal spicule, long; *d*, subskeletal spicule, smooth; *e*, subskeletal spicule, short, spined; *f*, anchorate, front and lateral views; *g*, bihamate.
Fig. 2. *Halichondria isodictyalis*, n. sp. *a*, skeletal spicule; *b*, tibiella; *c*, anchorate, front and lateral views; *d*, bihamate; *e*, anchorate, more magnified, front and lateral views.
Fig. 3. *Reniera digitata*, Sdt. *a*, skeletal spicule; *b*, tibiella; *c*, microspined acerate.
Fig. 4. *Tuba lineata*, spicule of.
Fig. 5. *Tuba digitalis*, spicule of.
Fig. 6. *Tuba armigera*, spicule of.
Fig. 7. *Chalina rubens*, spicule of. *a*, point, more magnified.
Fig. 8. *Halichondria panicea*, Johnst. (*Amorphina*, Sdt.), spicule of.
Fig. 9. *Isodictya simulans*, Bk. (*Halichondria*, Johnst.), spicule of. *a*, point, more magnified.
Fig. 10. *Thalysias repens*, var. nov., spicule of. *a*, point, more magnified.
Fig. 11. *Thalysias carbonaria*, Lam., spicule of. *a*, point, more magnified.
Fig. 12. *Fibularia ramosa*, n. sp. *a*, skeletal spicule; *b*, bihamates.
Fig. 13. *Fibularia massa*, n. sp. *a*, skeletal spicule; *b*, small acerate; *c*, bundle of trichites; *d*, bihamates.

ig. 14. *Fibularia anchorata*, n. sp. *a*, skeletal spicule; *b*, bihamates; *c*, anchorate; *d*, the same, more magnified, lateral view; *e*, sand-grains.

Fig. 15. *Phorbas amaranthus*, spicule of.

Fig. 16. *Esperia lævis*, n. sp. *a*, skeletal spicule; *b*, inequianchorate, front and lateral views; *c*, bihamate; *d*, bundle of trichites; *e*, minute inequianchorate; *f*, the same, more magnified, to show the sharp process of the shaft extended downwards.

Fig. 17. *Esperia Cunninghami*, n. sp. *a*, skeletal spicule; *b*, variously formed head in the same; *c*, inequianchorate, front and lateral views; *d*, ? bihamate; *e*, tricurvate; *f*, bundle of trichites; *g*, more magnified view of lower end of inequianchorate, to show extension of petaloid arm upwards into a sharp process; *h*, more magnified view of ? bihamate, to show its shape.

Fig. 18. *Esperia obscura*, n. sp. *a*, inequianchorate; *b*, the same, more magnified, in different views, to show its enigmatical appearance.

Fig. 19. *Esperia*, minute *equi*anchorate in several species of, *a*; *b*, more magnified view, to show its shape.

Fig. 20. *Hymedesmia Johnsoni*, Bk. *a*, skeletal spicule; *b*, tricurvate; *c*, "trenchant" anchorate in natural position, lateral view; *d*, the same, diagrammatic, to show its shape; *e*, earliest visible form.

Fig. 21. *Hymedesmia Schmidtii*, Carter, n. sp. *a*, skeletal spicule; *b*, bihamate; *c*, *d*, *e*, the same as just mentioned, this form being common to both species.

Plate XII.

Fig. 22. *Donatia multifida*, n. sp., natural size. *a a*, sponges; *b b b b*, tendrils of attachment; *c c*, bivalve shells, covered with a melobesian incrustration; *d*, spiniferous stellate; *e*, small sexradiate stellate; *f*, pistil-like process of the centre.

Fig. 23. *Donatia*, Cape species. Spiniferous stellate.

Fig. 24. *Desmacidon titubans*, Sdt. *a*, skeletal spicule; *b*, subskeletal spicule; *c*, bihamate; *d*, anchorate; *e*, *f*, *g*, different views of the anchorate, more magnified, to show its *equi*terminal shape, &c.; *h*, rosette form.

Fig. 25. *Spongia Dysoni*, Bk. *a*, skeletal spicule; *b*, spinispirula; *c*, the same, more magnified.

Fig. 26. *Cliona caribbæa*, n. sp. *a*, skeletal spicule; *b*, spinispirula; *c*, the same, more magnified.

Fig. 27. *Suberites coronarius*, n. sp. *a*, skeletal spicule; *b*, spinispirula; *c*, the same, more magnified.

Fig. 28. *Alcyonium purpureum*, Lam. *a*, skeletal spicule; *b*, spinispirula; *c*, the same, more magnified.

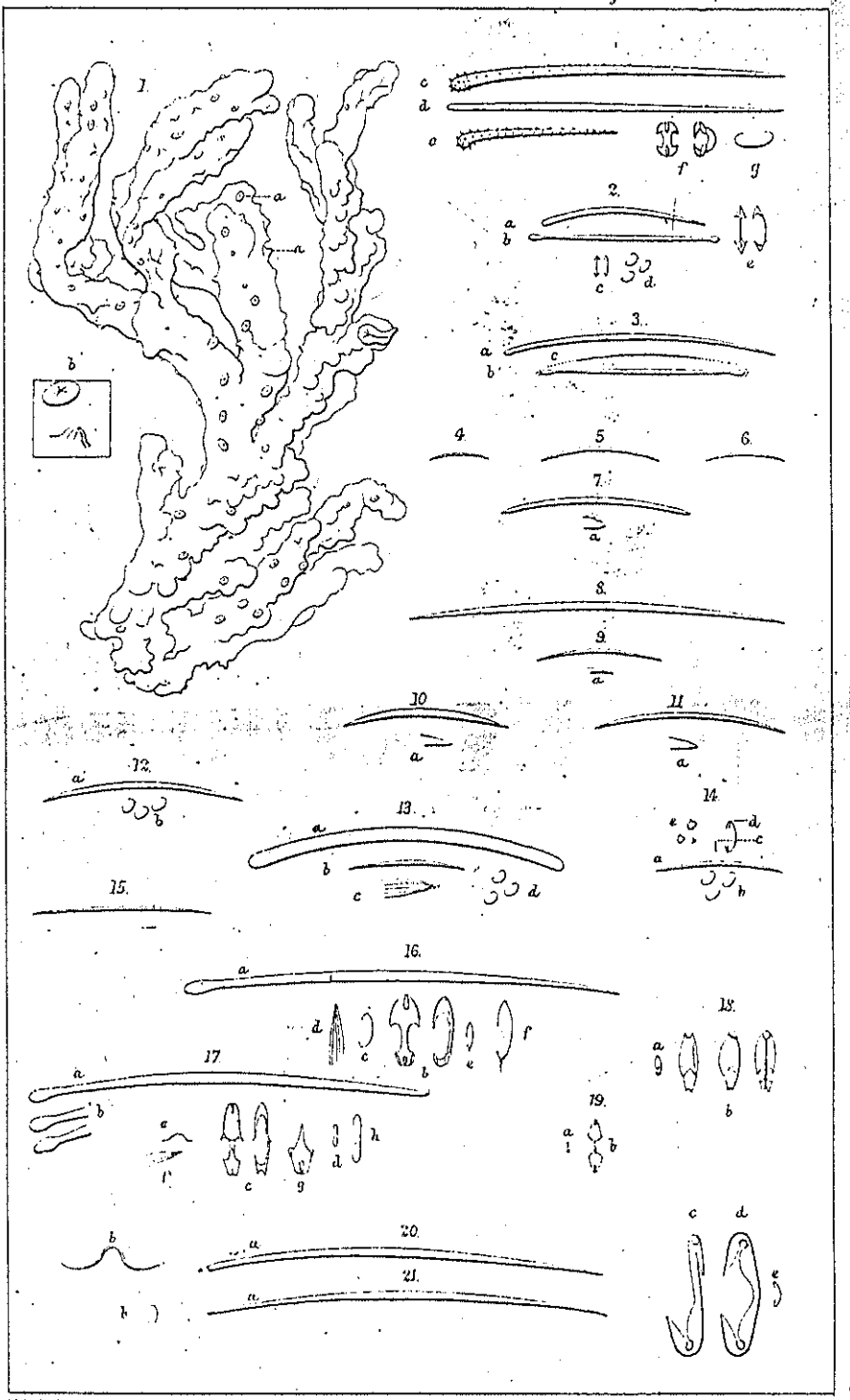
Fig. 29. *Terpios fugax*, spicule of.

Fig. 30. *Terpios cærulea*, n. sp. *a*, spicule of; *b*, Oscillatorian filament; *c*, the same, more magnified.

Fig. 31. *Geodia gibberosa*, Lam. Zone-spicule of.

Fig. 32. *Xenospongia patelliformis*. *a*, skeletal spicule; *b*, stelliform flesh-spicule, largest size: *c*, the smallest size seen.

Fig. 33. *Placospongia melobesioides*. *a*, skeletal spicule; *b*, head of same, of a different form; *c*, large siliceous ball, elliptical; *d*, small siliceous ball, spherical; *e*, *f*, spinispirulas; *g*, surface of large siliceous ball when fully developed, much magnified; *h*, spherical ball, more magnified; *i*, spinispirula, more magnified, to show its spines &c.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