insects? There is another reason for assuming
* H. larvata. They conceal the terminal hermaphrodites, and it is
sorely probable that many insects, if any, visit the flowers. In the
other two, many insects visit the flowers—so far as my observations
go, as many visit the H. arborescens without the attractive sepals, as
the H. quercifolia that makes such a show of them.

Turning to the minute fertile flowers on these two species, we
are struck by the immense number of stamens and the enormous
number of pollen-grains one of these racemose cymes gives us. I
estimated the number of stamens on one of H. quercifolia at 13,000;
shaken over a sheet of dark paper it completely whitens it. Its pollen
can be carried by the wind everywhere, why should it develop perigynal
sepals to attract insects? Both species have the odour of hawthorn,
but in addition H. quercifolia has an enormous yield of nectar, which
is apparently not abundant in H. arborescens. In spite of all of the
attractors, the perigynal sepals, the abundance of pollen, the delightful
fragrance, the superabundance of nectar, and the actual visits of
numerous insects, the flowers are self-fertilizing. The outer row of
five stamens mature pollen simultaneously with the expansion of the
petals, which falls at once on the receptive stigma, some hours after
the inner series mature, and ensures that self-fertilization which the
pollen from the first series may possibly have missed. The only possi-
ble aid insects can give is in self-fertilization.

It is broadly asserted that we owe to the existence of insects the
various forms and colours of flowers with their grateful odours and
sweet secretions. Here we have illustrations of the most dissimilar
and contradictory variations in a single genus, variations which
cover all the leading points called for by the insect-adaptationists,
and, so far as any argument in common use goes, could have oc-
curred with as much reason if not a single insect ever existed. The
facts are absolutely inexplicable on any theory of the survival of the
fittest in the struggle for life; but on my view of the absolute
necessity of variation for its own sake the explanation seems simple
enough.

Variation is inseparable from even the closest in-and-in breeding.
We are as fully justified in saying that nature abhors a perpetu-
ity of form as that she abhors in-and-in breeding, and we can just as
easily claim cross-fertilization as an agent in bringing about
variation for the sake of variety as for the reasons usually given,
and which we find we cannot apply with consistency in so many
cases.

That cross-fertilization aids variation we may well believe is a
sufficient reason for its existence, without assuming that it has no

IX.—Report on a Second Collection of Sponges from the Gulf of
and Assistant Lecturer in Biology in the University of
Melbourne.

[Plate III.—V.]

A LITTLE more than a year ago I published in this Journal
an account* of a collection of sponges made by Mr. Edgar
Thurston, Superintendent of the Government Central Mu-
seum at Madras, off the shores of the Island of Rameswaram
in the Gulf of Mannar. Shortly before leaving England I
received from Mr. Thurston a second collection, obtained in
the neighbourhood of the Tuticorin Pearl Banks. This
collection was of even greater interest than the first; and its
value was greatly enhanced by the fact that Mr. Thurston
had carefully preserved portions of nearly all the species in
spirit, and had also kept a record of the colours of the sponges
in the living state. Unfortunately my report on this col-
lection has been greatly delayed by pressure of other work,
and even now I feel that I have been unable to do full justice

to the material at my disposal. To illustrate the Report fully eight or ten quarto plates would have been required, and I was unable to make arrangements for obtaining these before leaving England. I have therefore thought it best, in preference to delaying any longer, to publish full descriptions of the species in this place, together with such illustrations as were practicable under the circumstances.

The pieces preserved in spirit proved of very great service and enabled me to investigate to a certain extent the minute anatomy of one or two of the species, and especially of *Spongionella nigra*, in the case of which it would have been quite impossible without spirit-preserved material to determine the true characters of the sponge. I hope that I may be able to make fuller use of the spirit-preserved material for anatomical investigation at a later date.

The collection comprises twenty-four determinable species, of which fourteen are new to science and two are represented by new varieties. Of the twenty-four species one belongs to the Tetractinellida, nineteen to the Monaxonida, and four to the Ceratozoa, and there is also an undetermined species of *Hericinida*.

Amongst the old species there are several forms of very great interest, chief amongst them being *Astinella tubulata*, a sponge hitherto scarcely known at all and whose peculiar characters, which were most curiously misunderstood by Dr. Bowerbank, are here shown to be due to the presence of a commensal tubicolous Annelid. Amongst the new species the most important is undoubtedly *Spongionella nigra*, of which I give a full account later on.

The colours of the sponges in life were, as usual, very varied and brilliant. Judging from what Mr. Biscoebridge Wilson, who has had great experience in dredging sponges in the neighbourhood of Port Phillip, tells me, I am inclined to believe that the colours of the living sponges will be found to be of great service in distinguishing the species. Some idea of the brilliance and variety of the natural colouring may be gained from the following complete list of the species in Mr. Thurston's second collection.

**Tetractinellida.**

*Tetilla hisuta*, n. sp. (No colour recorded.)

*Monaxonida.*

*Petrolia testudinaria*, Lamarck, sp. Pink.

*Reniera madrepora*, n. sp. (No colour recorded.)

**Ceratozoa.**

*Spongionella nigra*, n. sp. Black.


--- ?sp. Blackish grey.

*Aplysina purpurea*, Carter. Grey (in spirit, or, when dry, dark purple).

--- *fuscus*, Carter. (No colour recorded.)

Specimens of all these species, which I shall now describe, are in the British Museum, South Kensington. The apicular terminology here employed is that given in the "Challenger" Reports on Monaxonida and Tetractinellida.

**Tetractinellida.**

*Tetilla hisuta*, n. sp.

This species is represented in the collection by two good specimens, each of which is spherical and attached to a stone by the base. The larger of the two specimens is 40 or 50 millim. in diameter. There is no record of the colour of the sponge in the living state, but in spirit the specimens are dark grey, almost black. The surface of the sponge is hisute, owing to the presence of long apicles projecting outwards and downwards in a thatch-like manner. The cou-
...timity of the surface is interrupted at irregular intervals by a number of pits or depressions, which form a very conspicuous external character. Some of the pits are shallow and hemispherical, others deep and tubular; some have in their floor the evident openings of a number of ocular tubes, while others are lined by a smooth continuous membrane which presents no openings to the naked eye. In sections the floor of a pit is sometimes seen to be perforated by a number of very small pores which are doubtless inhalant. I have not been able to work out in detail the arrangement of the pores and oscula; but from the examination of my sections I have come to the conclusion that some of the surface-pits are localized pore-areas, while others are ocular areas. This condition recalls that described by Professor Sollas in his *Cinachyra barbata*; but further investigations are required to enable one to say how far the resemblance holds good; in any case the two species appear to be quite distinct, and the arrangement of the oscula, although in both they are confined to special pits on the surface, appears to be different in the two cases.

The skeleton of the sponge is arranged in a perfectly typical radiate manner, the stout radiating fibres all starting from a dense central nucleus. There is no special cortical skeleton of radiately disposed oscula, such as occurs in *Cinachyra*.

**Spicules.**—(a). Megasclera.—(1) Very long, fusiform, straight oscula, tapering very gradually to a fine point at each end; size about 3.5 by 0.042 millim. (2) Protrirnes, with very long and very slender shaft and rather short, sharp-pointed cladi; length of shaft in a well-developed example about 0.46 millim., diameter about 0.014 millim.; length of cladi about 0.040 millim., diameter at base about 0.007 millim. These spicules are often of hair-like dimensions. (3) Astirirnes, with shaft perhaps somewhat shorter than that of the protrirne and often of hair-like thinness.

(b). Microsclera.—Very small slender signaspires, about 0.022 millim. long.

Concerning the details of the histology and canal-system of this sponge I am not able to give much information. It is difficult to work out, owing to the great development of spicules, and I have only the smaller of the two specimens at my disposal. The ecosome is fairly thick and gelatinous, with a tendency to become fibrous. The choanosome presents...
excoto to strongylote; they vary much in size, especially in diameter, the average measurements of a full-grown spicule being about 0.37 by 0.0175 millim.

My examination of a very fine series of specimens in the British Museum has shown me that the speculation of this species varies considerably; but I know of no tangible characters whereby the different varieties can be separated.

The specimen collected by Dr. Anderson in the Mergui Archipelago (fig. 2) resembles Mr. Thunberg’s specimen in texture and cup-like shape; but the surface-ridges are much more jagged and irregular and the spicules are rather larger.

Ridley’s cup-shaped specimen from the ‘Alert’ collection differs in its thin walls, tougher texture, and small size, but agrees pretty well in spiculation.

Lamarck says of his specimen:—“Cet aleyon forme une plaque elliptique, un peu convexe en dessus, concave en dessous comme s’il s’était moulé sur le dos de quelque crustacé, et rappelle la forme de la carapace supérieure d’une tortue.” Probably his specimen was only a fragment of the side of a cup. The fragment in the British Museum, purporting to come from Lamarck’s collection, agrees very well in general appearance with our present specimen, so far, of course, as can be judged from a small piece; the spicules measure 0.47 by 0.017 millim. and have well-rounded ends.

Renteria madreporea, n. sp. (Pl. IV. fig. 9.)

The single specimen in the collection is bushily ramose; it branches very freely, and the branches are short, subcylindrical, or somewhat flattened, and often anastomosed. The branching shows a decided tendency to become palmate and there is a short stout pedicel. The height of the specimen is 150 millim. and the greatest breadth a little more; the average diameter of the branches is about 8 millim. The oscula are small and scattered, chiefly on the inwardly-turned faces of the branches. The surface in the dry state is minutely hispid, the texture rather hard but brittle, and the colour dull orange. No record was kept of the colour in the living state.

The skeleton is arranged in the rectangular manner characteristic of the genus, with obvious distinction into primary and secondary fibres; but it is irregular, and, though dense, the spicules are loosely bound together and may occur scattered outside the true primary and secondary lines of the skeleton. In the centre of the branches the skeleton becomes very dense and irregular and contains a large amount of spongin.

The spicules (fig. 9) are slightly curved oxea, tapering gradually to a sharp point at each end. Average size of full-grown spicule about 0.175 by 0.007 millim.

This species resembles most nearly Bowerbank’s *Isodictya dichotoma*, but the growth is much more robust, the texture harder, the skeleton less regularly arranged, and the spicules longer than in that species, so that, taking into consideration the great difference in locality, I have thought it desirable to keep them separate.

*Pachychalina multiformis*, Londondell, sp., var. manaarensis, nov.


This variety is represented in the collection by fifteen dry specimens and two pieces in spirit. The sponge consists of erect, sessile, flattened lamellae, with irregularly undulating and frequently proliferating surface. The colour of the living sponge was in one case pale violet and in another light pink; when dry it was greyish yellow, orange, or pale violet, and in spirit greyish yellow. The largest specimen is 250 millim. wide and 175 millim. high and the thickness of the lamellae is about 5 millim. The texture of the dry specimens is tough and rather hard. The oscula are numerous and confined almost entirely to one surface of the lamellae; they are about 1 millim. in diameter and they have slightly raised margins.

The dermal skeleton is a close network of relatively stout horny fibres, containing spicules for the most part uniseriately arranged.

The main skeleton is a fairly regular rectangular network of stout horny fibres containing a great deal of spongin. The spicules are numerous in the primary fibres and few in the secondaries; they also occur outside the fibres.

The spicules are short slender oxea, straight or very slightly curved; the average size of a full-grown example is about 0.077 by 0.0033 millim.

The external form of this variety is characteristic and fairly constant. Six dry specimens of it also occur in Mr. Thunberg’s first collection, but are not mentioned in my Report; three of these are of a violet colour, and the other three are of

Mr. A. Dendy on Sponges from

a greyish-yellow colour. They exhibit a more strongly marked tendency to form digitate processes than do the specimens in the second collection.

**Pachychalina delicatula, n. sp.**

Sponge erect, sessile, bushy lamellar, with a slight tendency to throw off digitate processes. Very delicate in appearance. Surface smooth, covered by a very delicate dermal membrane. Texture open, resilient. Colour in the dry state light yellow. Oesula situated chiefly on the margins of the lamellae. The single specimen in the collection is 180 millim. high and 220 millim. in greatest breadth. The lamellae measure up to 21 millim. in thickness at the margin, but usually much less. The oesula average about 3 millim. in diameter.

The dermal skeleton is a close-meshed irregular reticulation of slender horny fibre containing very slender spicules arranged sometimes unserially and sometimes multiserielly. The main skeleton is a wide-meshed reticulation of very stout primary and secondary fibres. Both primary and secondary fibres are composed of a very great number of slender spicules packed close together all through the fibre and united by spongina. Both primary and secondary fibres average about 0·126 millim. in diameter. The wide interspaces between them are partially occupied by an irregular network of very much slenderer polytypical fibres about 0·0175 millim. in diameter, branching and anastomosing freely with each other and with the primaries and secondaries. Numerous spicules occur scattered outside the fibres.

The spicules are very slender slightly curved oxeas, measuring about 0·038 by 0·0035 millim.

**Pachychalina spinilamella, n. sp.**

Sponge consisting of erect, flattened, frondose or digitate thick lamellae. Both surfaces of the lamellae are covered with numerous short stout spines. The largest specimen is attached to a mass of nullipore; it is 160 millim. high and 185 millim. broad, while the thickness of the lamellae is about 18 millim. (Another specimen consists of a short stalk about 47 millim. high and 20 millim. in diameter, dividing into two upright flattened branches, one of which is hollow, penetrated by a wide, vertical, oesual tube; total height of specimen 135 millim.) The oesula are rather large, commonly about 4 millim. in diameter in well-grown specimens; they occur on one surface only of the lamellae and sometimes round the margin. The dermal membrane is distinct, with a well-developed reticulation of spongina-fibres.

The colour in life was pale yellow; when dry it is brownish yellow, and the same colour, only darker, in spirit. Texture in the dry state tough and hard, but rather open. When the sponge is held up to the light the primary skeleton-fibres are seen ramifying upwards in a dendritic manner and terminating in the oesula on the surface.

The dermal skeleton is a quite irregular network of very stout fibres, containing a great number of closely packed spicules whose meshes are subdivided by an irregular network of very slender fibres both uni- and multispiculous.

The main skeleton is also irregular and composed of very stout primary fibres about 0·18 millim. in diameter, rather slender secondary and slender tertiary, about 0·015 millim. in diameter. All the fibres contain a very great number of spicules, closely packed side by side, and occupying almost the whole thickness of the fibre; but there is plenty of spongina uniting them together. Spicules are abundantly scattered about out side as well as in the fibres.

The spicules are relatively long, very slender oxeas, usually slightly curved, measuring about 0·126 by 0·0017 millim. They are gradually and sharply pointed at each end.

There are in the collection four dry specimens of this sponge and a piece in spirit.

**Siphomochalina communis, Carter, sp.**


With this species I identify a single fine specimen attached to a fragment of rock, to which is also attached a small specimen of *Echinata claerata*. The sponge consists of a thin incrusting basal mass, spreading over the surface of the rock and throwing out abundant short, upright, tubular processes, each terminating in a single osculum. The tubes reach some 70 millim. in maximum height and the oscula average about 4 millim. in diameter. The tubes anastomose freely with one another and also branch to some extent; they average about 5 or 6 millim. in diameter.

The colour in life was bluish brown; in spirit it is yellowish brown, and when dry the same with a decidedly purplish
placed more or less at right angles to the long axis of the fibre, so as to obviate it, usually in irregular groups.

The main skeleton is a rectangular network of stout primary and secondary fibres, the primaries measuring about 0.14 and the secondaries about 0.084 millim. in diameter. Both primaries and secondaries consist of a large amount of clear transparent spongion, with an axial core of slender spicules multiserially arranged. The spicules are numerous in both sets of fibres, but more so in the primaries than in the secondaries. Numerous spicules occur scattered outside the fibres.

The spicules are slightly curved, slender oxeas, gradually sharp-pointed at each end, measuring about 0.034 by 0.0035 millim.

*Gellidiodes cariosa*, n. sp. (Pl. IV. fig. 7.)

Sponge erect, sessile, more or less lamellar, proliferous; sometimes rising into short tubular processes. The arrangement of the oscula and oscular tubes gives to the sponge a very characteristic appearance. The oscula are very numerous and occur chiefly on the margins of the sponge, but also on isolated papilles. They average 2 to 3 millim. in diameter and lead into long, narrow, vertical oscular tubes. The presence of these tubes causes the surface of the lamelle in which they lie to be more or less ribbed vertically, so that the course of an oscular tube can be traced for some distance by means of the rounded ribs on the surface. The largest specmen is 150 millim. high by 200 millim. broad. The thickness of the actual lamelle is about 6 or 7 millim.

The colour in the living state was grey and it is yellowish brownish grey when dry. The surface is smooth but uneven, with a fleshy appearance; in spirit it appears glabrous. The texture is tough and resilient.

The skeleton is very strongly developed, composed of a very close, more or less regularly rectangular reticulation of unusually stout horny fibre. The primary fibres have a multiserial core of oxeas spicules, while the secondaries have fewer spicules. In some parts the arrangement of the skeleton becomes less regular, but it is throughout characterized by a very strong development of spongion.

**Episcia** (a). *Megascler.:* Small, usually slightly curved, gradually sharp-pointed oxea (fig. 7, 9, 6), measuring about 0.126 by 0.006 millim. (b). *Microsclera:* Very small and very slender sigmata (fig. 7, 8, 6), about 0.017 millim. long; visible after soaking.
for some time in Canada balsam, when they appear abundantly.

This is a well-marked species with a very characteristic external form; there are five dry specimens of it in the collection, so that it would appear to be plentiful.

Istrocheta boscillera, Ridley, var. flabellata, Dendy *.

There are in the collection a single very fine dry specimen of this variety and two small pieces preserved in spirit. The dry specimen is shaped like the leaf of a Spanish chestnut, consisting of a single flattened frond which has grown up around the stem of some plant for an axis. It is 325 millim. in height and 130 millim. in greatest breadth; the thickness is variable, up to about 10 millim. along the margin, but much more in the centre. On either surface of the flattened frond irregular proliferations are given off. A noteworthy feature of this specimen is the presence of grooves on both surfaces of the sponge radiating towards the margin in an outward and upward direction, like the veins of a Spanish-chestnut leaf. Both dry and spirit specimens contain a large quantity of sand. The colour of the living sponge was black, when dry or in spirit it is dark purple. The texture when dry is very fragile, the sponge crumbling up between the fingers like a Dysidea; in spirit, however, it is fairly tough.

The specimen may possibly have grown erect; but from the difference in shade of colour between the two sides and from the somewhat worn appearance of the lighter one I am inclined to think that the latter was lowermost during life.

The oscula are rather small and occur chiefly along the margin.

Clathria indica, n. sp. (Pl. IV. fig. 10.)

Sponge erect, flabellate, consisting of a number of flattened, branching, and anastomosing trabeculae, fused together so as to form a more or less continuous frond; sometimes growing out into free digitate processes. Texture in the dry state coarse and hard, fibrous and tough, in spirit softer. Colour of the living sponge bright red when dry or in spirit yellowish brown. The oscula are apparently represented by very numerous minute openings thickly strewed over both surfaces of the sponge. An average-sized well-grown specimen measures about 150 millim. in height by 250 millim. in breadth, and the thickness of the trabeculae of which it is composed is about 4 millim. Sometimes, however, the sponge is taller than it is broad.

The skeleton is a very well-developed close-meshed network of stout horn-like fibres echinulated by spined styli. The distinction between primary and secondary fibres is not always very well marked, and the reticulation tends to become very irregular; the primary fibres, however, are more abundantly echinulated than the secondaries and they have also numerous spined styli in the axis of the fibre, which are absent from the secondaries.

The primary fibres measure about 0.07 millim. in diameter, but sometimes more and sometimes less, and the secondaries somewhat less.

Specula.—The megasclera (fig. 10) are of two kinds:—

1. Smooth slender styli (verging upon the tylosystyle form) or unequal-ended oxea, straight or slightly crooked, measuring about 0.14 by 0.003 millim., occurring abundantly scattered in the dermal membrane, but only sparingly in the choanosome.

2. Small, straight, entirely spined styli, gradually and sharply pointed at the apex, and frequently narrowing somewhat at the base; size about 0.004 by 0.007 millim.

I can find no microsclera, although I have searched very carefully for them, and this species therefore appears to be one of those aberrant members of the genus which are devoid of microsclera. The species appears to be abundant, being represented in the collection by eight dry specimens and a piece in spirit.

Clathria corallina, n. sp. (Pl. IV. fig. 8.)

Sponge sessile, usually lamellar, but proliferous. Consisting of a close reticulation of small, branching and anastomosing, irregularly cylindrical or flattened trabeculae, ramifying upwards and terminating on the surface of the sponge in short obtuse processes. The largest specimen is 265 millim. broad by 131 millim. high. The diameter of the separate trabeculae of which the sponge is composed averages about 2–3 millim. Texture in the dry state rather hard and brittle, in spirit tough, resilient. The living sponge was "red-coral" coloured; in spirit it is yellowish grey, and when dry the same, with rings of red here and there.

The reticulate or clathrous character of the sponge is not so well marked in spirit as in the dry condition, the festona-
tions being frequently filled up by delicate membranous tissue.

The arrangement of the horny skeleton agrees very well with that in Clathria indica, but the spicular element is more strongly developed, though scarcely at the expense of the horny fibre. There are an abundance of smooth styli enclosed in the primary lines of the skeleton.

Spicules.—(a). Megasclera.—(1) Smooth styli (fig. 8, a, b, c), straight or slightly curved, gradually sharp-pointed, and of two principal sizes—(a) stout and relatively short, averaging about 0.175 by 0.008 millim., abundant and occurring principally in the choanosome; (b) long and slender, sometimes becoming slightly tylotroctyle, averaging about 0.22 by 0.005 millim., occurring principally in the dermal membrane.

(2) The echinating spicules (fig. 8, d); these are short and relatively stout spined tylotroctyle, gradually and very sharply pointed at the apex, and narrowing somewhat towards the base, which is commonly expanded into a slight head; the spines are scarce or absent for a short distance above the base; size of spicule about 0.056 by 0.008 millim.

(b). Microsclera.—A few very minute slender isochelae of the usual Clathria type, about 0.014 millim. long. In an embryo enclosed in the sponge there are also some small and exceedingly slender toxas, and it is not unlikely that such may also exist in the adult sponge, where they might escape detection amongst the mass of larger spicules.

This species is represented in the collection by five specimens and a piece in spirit.

Rhaphidophius spiculose, n. sp. (Pl. IV. fig. 4.)

There is in the collection a single dry specimen and a piece in spirit. The dry specimen forms a flattened clathrous mass of branching and anastomosing flattened trabeculae. It seems to be a good deal shrunk up and measures in its present condition 109 millim. in length and 72 millim. in breadth, while the thickness of the trabeculae averages about 6 millim. It is impossible to say whether the species is erect or demuculent in life.

The colour of the living sponge was vermilion; when dry it is light brownish yellow, with occasional red tinges, and in spirit it is darker greyish yellow.

The texture in spirit is compact and cork-like. The oscula are minute and scattered, mostly on or near the margins of the flattened trabeculae. The surface of the sponge is very uneven, subglabrous in appearance in spirit, rough in the dry condition.

The main skeleton is a dense irregular reticulation of stout horny fibres, with rounded meshes. The fibres are about 0.1 millim. in diameter, but variable; they are abundantly but irregularly cored by long slender tylotroctyle and sparsely echinated by short spined tylosclere. Between the fibres of the skeleton the long slender tylosclere are very thickly but irregularly scattered through the soft tissues.

The dermal skeleton is well developed and consists of dense, close-set, radiating brushes of long slender tylosclere with their points projecting outwards.

Spicules.—(a). Megasclera.—(1) Long, straight, very slender tylosclere (fig. 4, a, b, c), sharply and gradually pointed at the apex, and with small oval heads at the base, which is sometimes very minutely spined; size of full-grown examples about 0.294 by 0.005 millim. (2) Short, stout, spined, echinating tylosclere (fig. 4, d, e), with rounded heads and very sharp points; the spines are arranged so as to leave the apex and a space immediately above the head free; average size of spicule about 0.07 by 0.007 millim.

(b). Microsclera.—(1) Very minute isochelae of the usual Clathria type, about 0.014 millim. long. (2) Very small, slender, apparently smooth toxas, about 0.008 millim. long.

Hymeniacidon (?) festida, n. sp. (Pl. IV. fig. 5.)

Sponge massive, sessile, slightly lobose. The single specimen in the collection measures 143 millim. in greatest breadth and 60 millim. in height. The oscula are of fair size and situate on the summits of the low lobes. Surface very distinctly reticulate. Texture in the dry state hard and incompressible, in spirit a little softer. Colour of the living sponge grey; when dry or in spirit the colour is dull blackish grey on the outside and lighter internally.

The main skeleton is a very dense irregular reticulation of large oxeas, sometimes aggregated in thick strands or fibres; the spongine is very feebly, if at all, developed. The dermal skeleton is a very close reticulation of stout bands of spicules. The meshes of the reticulation are very small and rounded, and the bands of spicules dividing them are irregular, but so strongly developed as to cover a greater superficial area than the actual meshes. The dermal, like the main skeleton, is composed principally of large oxeas, but there are also present

* That this flattening is normal is shown by the spirit specimen.
a few small styli arranged with their apices projecting at the surface of the sponge.

Spicules:—(1) Large, curved, gradually sharp-pointed oxea (fig. 5, b), measuring about 0.8 by 0.021 millim. (2) Small, slightly curved, smooth styli (fig. 5, a), evenly rounded off at the base and gradually sharp-pointed at the apex; commonly narrowing somewhat towards the base; size about 0.2 by 0.007 millim.

The specific name festiva has been given to this sponge on account of the abominable smell, resembling somewhat the smell of Valerian, given out by the dry specimen.

The presence of the small projecting styli in the dermal skeleton recalls the similar condition described by Ridley and Dendy in *Hymanoeidion (?) subacerbata*.

**Axinella labyrinthica**, n. sp. (Pl. V. fig. 12.)

Sponge forming sessile, low-growing, erect, branching and anastomosing lamellae. Surface uniformly covered with small, close-set, rather slender conuli, each about 2 millim. in height. Colour of the living sponge bright orange; when dry or in spirit yellowish. Texture (dry and in spirit) rather hard and fairly tough. Oscura minute, abundantly scattered between the conuli. The single specimen is 71 millim. in height and 200 millim. in greatest breadth; the thickness of the lamella is about 8 millim., including the conuli.

The skeleton is an exceedingly dense irregular network of spicules, in which it is very difficult to make out any distinct fibres; but stout columns of closely aggregated spicules may be seen running one into each of the surface conuli. The surface of the conuli is densely calcified by projecting spicules springing from these columns. We may imagine the whole skeleton derived from a typical axinellid form by excessive development of the spicules, which are closely united together.

Spicules:—(1) Smooth styli (fig. 12, b, c), usually more or less bent, especially towards the base, and gradually sharp-pointed at the apex; size usually about 0.42 by 0.016 millim. (2) Slender curved styli (fig. 12, a), as long as or somewhat longer than the styli, but slenderer.

This is a very beautiful species, with a well-marked and characteristic external form.

* Vide Report on the 'Challenger' Monaxondia, p. 100.

There are six dry specimens of this sponge in the collection and also two pieces in spirit. I have nothing further to add to the accounts given by Bowerbank and myself, excepting that Mr. Thurston again records the colour of the living sponge as orange.

**Axinella Donnani**, Bowerbank.*

This species is evidently very abundant in the Gulf of Manaar, being represented in the collection by six dry specimens and two pieces in spirit.

The sponge is massive and usually globular or subglobular in shape. The largest specimen in the collection, which is irregularly massive in form and rounded, is 105 millim. in height and 98 millim. in breadth. All the specimens have more or less flattened bases and appear to have been attached during life, and not, as Bowerbank supposed, freely floating. The surface of all the specimens is covered with small conical papillae whose size varies considerably in different specimens. Thus in one specimen they are comparatively large and isolated from one another, while in another they are small and run into one another in a meandriniform manner. The colour of the living sponge was pinkish red or red; in the dry state it is orange and in spirit pale yellow. The oscula are small and scattered and sometimes slightly prominent. There is a dermal membrane connecting together the surface conuli at a little distance below their summits. The texture is firm and hard in the dry state and softer in spirit.

The skeleton is composed of stout, irregular, branching columns, radiating towards the surface and terminating in the conuli. Each column is composed of various sizes of stylole and tylostyle spicules, arranged in the usual echinatating manner characteristic of the Axinellids, with their points projecting obliquely outwards and towards the surface of the sponge and their bases usually united together by spongite. Numerous spicules also occur scattered through the soft tissues of the sponge which cannot be assigned to any particular


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column, and it will be evident from the figure (fig. 11) that the columns are not very well-defined structures.

**Spiracles.**—These are of two kinds:—(1) Large smooth stylus, more or less curved, especially towards the well-rounded base, which is sometimes slightly swollen; gradually sharp-pointed at the apex; size when fully developed about 0.8 by 0.014 millim. (2) Small stylus, straight or bent near the base; with small subglobular heads and very gradually sharp-pointed at the apex; usually more or less covered with minute spines, which appear, however, to be always absent from the base. These spicules when fully grown average in size about 0.119 by 0.004 millim., the diameter being measured just above the head. It is unnecessary to give figures of these spicules, as this has already been done by Dr. Bowerbank (loc. cit.).

This sponge is remarkable for the presence in all specimens of numerous commensal worms. The worms are very small tubicolous Oligochaeta. Their tubes (fig. 11, a, b, c) are very slender, averaging about 0.3 millim. in diameter, and they radiate towards the surface of the sponge, opening at the level of the dermal membrane, in which they have minute circular pits easily visible when the surface of the sponge is examined with a hand-lens. Sometimes the margins of the tubes are a little raised, and the tubes usually appear close to the sides of the radiating skeleton columns. Fig. 11 shows portions of three of the worm-tubes, one of them (a) opening close to a surface-papilla and still containing the worm. The tubes sometimes branch; but whether or not the worm likewise does so I have been unable to determine.

It is very possible that the presence of these commensal worms has a good deal to do with the characteristic globular shape of the sponge, and one might almost regard the whole structure as a spherical mass of radiately arranged tubicolous worms in which the interstices between the individual tubes are occupied by a sponge. It would be interesting to know whether the worm and the sponge ever live separately or are always associated together.

The worm-tubes are also present in Dr. Bowerbank’s type of the species, of which I made a careful examination in the British Museum; but he laboured under a curious mistake as to their true nature, regarding them as a tubular skeleton proper to the sponge. This mistaken idea led him to give a most remarkable account of the species, for which I would refer the reader to his original paper *, as I have not space to quote it in this place.

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* Loc. cit.  

Dr. Norman was misled by Bowerbank’s account; and while he shows that the species cannot be assigned to the genus *Halichondria*, he proposes for it the new generic name *Aulospongus*. It is unnecessary, however, to erect a new genus for the reception of this sponge, which falls very well under *Actinella*.

We have here one of the most remarkable cases of commensalism known amongst sponges.

**Codecesta Tyleri, Bowerbank, var. manaeariensis**, nov.


Of this variety there are in the collection two good dry specimens and one of the digitate processes preserved in spirit. The external form of the specimens closely resembles Dr. Bowerbank’s figure. The surface of the digitate processes is much corrugated. The colour in the living state was white, and it is also dirty yellowish white in the dry state and in spirit. The taller of the two specimens is 55 millim. high and 47 millim. in diameter at the base, which is approximately circular; it bears about a dozen digitate processes, springing from the cushion-shaped base, and sometimes anastomosing, but never branching. The digitate processes are about 8 millim. in diameter at the base.

The skeleton is arranged as usual in the genus, with a dense central axis, from which arise short columns supporting the dermal membrane at their outer ends.

**Spiracles.**—Slightly curved and very gradually and sharply pointed oxeas, resembling those of *Halichondria panicea*; occasionally an odd stylite form may be observed amongst the larger ones. They vary very greatly in size; in the dermal membrane they are small and slender, measuring as a rule about 0.8 by 0.007 millim., but with a wide range of variation, though never attaining to nearly the dimensions of those in the central axis; in the axis also they vary greatly, measuring up to about 1.23 by 0.024 millim., though this extreme size appears to be reached only rarely, the average size of the full-grown spicule being about 0.8 by 0.011 millim.

This variety differs from the types of the species in the presence of the very large oxeas in the central axis.

The species has hitherto been obtained from Port Eliza-
Mr. A. Dendy on Sponges from South Australia, and the east coast of Australia.

Aulella aurantiaca, n. sp. (Pl. V. fig. 13.)

Sponge bushy, composed of short, branching and anastomosing, thick-walled tubes, frequently united laterally so as to form lamellae, like pan-pipes. Each tube is open at the top. The largest specimen is 85 millim. high and 105 millim. in diameter; the tubes are pretty constant in diameter, averaging about 6 millim. The surface is minutely hystid both when dry and in spirit. The texture in the dry state is hard and firm, in spirit softer. The colour of the living sponge was bright orange; in the dry state it varies from pale yellow to bright orange, in spirit it is greyish yellow.

The skeleton is very loose and irregular, consisting of stylote and oxeote spicules arranged partly in loose irregular wisps, which run upwards and outwards and terminate in projecting brushes at the surface of the sponge. These represent the primary lines of the skeleton; they are sometimes crossed more or less at right angles by individual spicules or by two or three together, which represent the secondary lines. The whole skeleton is, however, very confused, and spicules occur abundantly scattered through the choanosome which cannot be referred to either primary or secondary skeleton lines. There is a fair amount of spongian present.

Spicules.—These are of two kinds:—(1) More or less curved oxea (fig. 13, c, e), gradually sharp-pointed at each end, measuring about 0.28 by 0.041 millim., not nearly so abundant as the following. (2) Long, slender, very gradually sharply-pointed stylus (fig. 14, b, d), generally more or less curved or bent. As usual in the Axinellidae these spicules vary greatly both in actual size and in proportion of length to thickness; they are usually somewhat larger than the oxea, but sometimes extremely long and slender, measuring up to about 0.8 millim. in length.

There are four specimens of this very pretty species in the collection and also a piece in spirit.

The genus Aulella was founded by Schmidt for his...
rounded off at the base (or becoming tylostyloste), and very gradually sharp-pointed at the apex; size when full-grown about 1·2 by 0·011 millim. There are also a few cylindrical forms (strongyla) (fig. 6, z) and still fewer oxea (fig. 6, o); but these are probably only abnormal developments of the short stout styli such as are frequently found in Axinellids.

There are three dry specimens of this sponge and a piece in spirit.

CERATOSA.

Spongionella nigra, n. sp.

Sponge sessile, consisting of a number of vertical lamellae, branching and anastomosing with one another often in a very complex manner. The largest of the four dry specimens is about 250 millim. high and the same in breadth, and the thickness of the lamellae is about 5 millim. The colour of the living sponge is black, when dry dull black, and in spirit rather lighter blackish grey. Texture tough and resilient. Surface (dry and in spirit) granulated. The oscula are abundantly scattered, usually on the inwardly turned surfaces of the lamellae, and almost or quite confined to one surface of each lamella; they are about 1-2 millim. in diameter and are compound, each consisting of an aggregation of several smaller ones.

The dermal skeleton is a well-developed but irregular network of horny fibre with fairly wide polygonal meshes; the fibres averaging about 0·02 millim. in diameter.

The main skeleton is a rectangularely meshed network of very distinct primary and secondary fibres; the primary fibres average about 0·049 millim. in diameter and the secondaries about half as much.

All the fibres of the skeleton are composed of pale-coloured spongin without any trace of foreign enclosures. The fibres are solid and it is difficult to make out any distinct central granular core, though possibly such may exist, at any rate in some cases.

The ectosome is represented by the thin dermal membrane.

The choanosome is very delicate and gelatinous, containing a large number of amoeboid and stellate cells. The canal-system is eminently lacunar and the lacunae are very strongly developed. The flagellated chambers are irregularly sac-shaped and they vary in size, the full-grown chambers averaging about 0·07 millim. in diameter. They are not placed very close together and lie irregularly scattered through the choanosome, so as to leave frequent wide interpaces devoid of chambers. They open directly into the excurrent lacunae.

This is a very remarkable and interesting species, one of the most striking features of which is the large size of the flagellated chambers. These chambers are conspicuous objects even in unstained, hand-cut, rough preparations of ordinary spirit material.

The genus was founded by Bowerbank for his Spongi-

C. pinnata, a British species, and he afterwards described another species, S. Holdsworthii, from the Ceylon Pearl Bank. All his specimens of the genus appear to have been dry, and I am now able, from my examination of the spirit-preserved material sent by Mr. Thurstons, to amend his original diagnosis as follows:— "Genus Spongionella. Bower-

bank. Sponge consisting of flattened lamellae. Main skeleton of very distinct primary and secondary fibres without foreign enclosures, arranged so as to leave rectangular meshes. Ectosome a thin dermal membrane. Choanosome extremely delicate, transparent and gelatinous. Canal-system lacunar. Flagellated chambers very large, irregularly sac-shaped, opening directly into the excurrent lacunae."

The genus possibly finds its nearest ally in Spongilla, and would fall under Lendenfeld's subfamily Spongellina. It presents, however, very striking resemblances to the Chaliniae. These resemblances are most apparent in the general external form and in the structure and arrangement of the horny fibres (except of course as regards the total absence of spicules). The histological character of the choanosome also agrees with that found in Chaliniae; but the flagellated chambers are much larger, and this would appear to be an important distinction.

According to Vosmaer, Bowerbank's Spongionella is synonymous with Schmidt's Coccospongia. This is a difficult question, and in order to settle it we require a much more extensive knowledge of the anatomy of these forms. According to Lendenfeld, Coccospongia is one of those forms

which have "small, spherical, ciliated chambers and opaque ground-substance," and therefore it differs greatly from *Spongionella nigra*; but whether Dr. Bowerbank's two species of *Spongionella* agree in these respects with *Caecospongia* or with *Spongionella nigra* is at present undeterminable. As I cannot place my species under *Caecospongia*, I think it better to retain Dr. Bowerbank's *Spongionella* with emended diagnosis in preference to creating a new genus.

*Hircinia clathrata*, Carter *. *

This common Ceylon species is represented in the collection by two good specimens; unfortunately, however, there is no piece in spirit. One of the two specimens is remarkable on account of its large size and luxuriant growth; it measures 250 millim. in height and 250 millim. in greatest breadth. The other specimen, although smaller, is of great value in that it exhibits certain features not hitherto observed in the species. The specimen has been dried with the soft tissues on, and instead of being of the usual dull yellow colour, it has a distinctly purple tinge. In his original description of the species Mr. Carter suggested that "the sarcode of *H. clathrata* may have been so coloured," but he was unable to show that it was so from the material at his disposal. The particular specimen referred to also shows that the wide irregular openings on the surface of the sponge, which lead into the central cavity of the tubular branches, are normally tyermanized by a delicate translucent membrane, pierced in places by rounded apertures resembling oscula.

For the geographical distribution of this species the reader is referred to my previous paper †. I may add that there is in the collection of the British Museum a specimen § of a slight variety of the species from north-western Australia. This Australian variety differs from the Manuak specimens chiefly in the larger quantity of foreign matter present in the primary fibres.

*Hircinia (?)* sp.

There are in the collection some pieces of a sponge which

† There is, however, a small specimen of *Hircinia clathrata* attached to the same stone as the specimen of *Aplysina purpurea* comm. and Mr. Thunen says that the colour of this small specimen in life was reddish brown.
‡ Loc. cit.
§ Registered 53. 2. 22. 19.

I refer provisionally to the genus *Hircinia*. They consist of branched digitate processes about 15 millim. in diameter, with strongly and regularly conulous surface. Colour of the living sponge blackish grey; in the dry state almost black, and its spirit dark grey. Texture in the dry state hard and incompressible, in spirit softer, compact, cork-like. In external appearance this species bears a most striking resemblance to a specimen of Schmidt's *Hircinia dendroides* * in the British Museum.* I have found the characteristic "filaments" only in one place.

*Apysina purpurea*, Carter.


The single dry specimen in the collection is conical in form, slightly flattened in one plane, with broad base and bluntly rounded apex. It measures 195 millim. in height and the greatest breadth of the base is about 110 millim.

The colour in the living state was grey; when dry it is a black-purple and in spirit a little lighter purple. The surface of the dry sponge is thickly covered with large conical projections, due to the ends of the stout compound skeleton fibres supporting the dermal membrane in a tent-like fashion. The dermal membrane is shrunk in between the projections, which are probably more prominent in dry specimens than in life; it exhibits only occasionally the minute reticulation mentioned by Mr. Carter.

The oscula vary in size and are irregularly scattered over the surface of the sponge; it is a rather curious fact that they are not more numerous at the apex of the sponge than elsewhere. Sometimes they are fairly large and single and sometimes they are small and grouped.

The structure of the dry sponge internally is very cavernous; the texture of the pieces in spirit is compact and cork-like.

The skeleton, as already described and figured by Mr. Carter, is composed of compound fibres. These compound fibres are, however, merely dense local aggregations of branching and anastomosing horny fibres accumulated along certain tracts so as to leave the remainder of the sponge free from skeletal elements. That this is the case appears from

* Registered 67. 7. 20. 79.
the fact that flagellated chambers occur scattered between the individual fibres in a compound fibre.

The compound fibres are very stout and very widely separated from one another, terminating in the surface conuli. Each compound fibre may be as much as 2 millim. in diameter in the dry condition.

Mr. Carter's first description of this species was very imperfect; the specimen upon which it was founded came from the Gulf of Manasar. His second description, founded on a specimen from Ceylon and one from Australia, leaves no doubt in my mind as to the correctness of my identification; but I think it very probable that the Australian specimen described by Mr. Carter belongs to a different species.

**Aplysina fusca**, Carter.

I refer three dry specimens present in the collection to this species. They are necessarily lobate or digitate, and the surface is beset with abundant small, sharp, conical eminences, between which the dermal membrane is shrunk down. The surface is glabrous or subglabrous, and the texture in the dry state is very hard and incompressible, membranous. Colour in the dry state dark brown. The largest specimen is 195 millim. high by about 160 millim. in greatest breadth. Two of the specimens are cavernous internally, while the third appears to be much more solid; I do not think, however, that there is any specific difference between them.

I have very little doubt that this is Mr. Carter's *Aplysina fusca* (especially as the type of the species came from the Gulf of Manasar), although I have not had the opportunity of studying the type, and the original description is too short to make an identification as reliable as might be desired. In Mr. Carter's second account of the species* very little is added to the first.

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**EXPLANATION OF THE PLATES.**

**PLATE III.**

**Fig. 1. Petrosia testudinaria**, from the neighbourhood of the Triticum Pearl Bank. Collected by Mr. Thurston.
**Fig. 2. Petrosia testudinaria**, from Padau Bay, Mergui Islands. Collected by Dr. Anderson.

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**PLATE IV.**

**Fig. 3. Petrosia testudinaria**, from the Straits of Malacca. Registered 8311.8.29 in the British Museum collection.

[All three figures are from photographs taken by Mr. Glegg from specimens in the British Museum, and they are all very much reduced.]

**PLATE V.**

**Fig. 4. Speculum of Rhaphidophalus spiculosis** (drawn under Zeiss E, Ocular 2, Camera). a, b, c, large tylostyle; d, e, small spined tylostyle.
**Fig. 5. Speculum of Hymeniacidon? ?actida** (drawn under Zeiss C, Ocular 2, Camera). a, small stylostyle; b, large exocoete.
**Fig. 6. Speculum of Aseptella Carteri** (drawn under Zeiss C, Ocular 2, Camera). a, exocoete; b, c, stylostyle; d, strongylostyle.
**Fig. 7. Speculum of Galiodes cornicosa** (drawn under Zeiss E, Ocular 2, Camera). a, b, exocoete; c, sigmata.
**Fig. 8. Speculum of Clathria cordifolia** (drawn under Zeiss E, Ocular 2, Camera). a, b, c, stylostyle; d, spined tylostyle.
**Fig. 9. Speculum of Bionassa mendipora** (drawn under Zeiss C, Ocular 2, Camera). a, b, c, exocoete; d, stylostyle (abnormal).
**Fig. 10. Speculum of Clathria indica** (drawn under Zeiss E, Ocular 2, Camera). a, b, tylostyle, varying upon unequal-ended exocoete; c, spined stylostyle.

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**X.—On a new British Species of Microciona, Bk., in which the ends of the Tricuriata are Spiniferous &c.** By H. J. Carter, F.R.S. &c., and R. Hope, F.Z.S.

[Plate VI.]

§1. By Mr. Carter.

This species was conjecturally referred by me to Microciona armata, Bk. (*Annals,* 1874, vol. xiv. pp. 456, 457), on the supposition that the spiniferous character of the ends of the tricuriata spicules had been overlooked by Bowerbank. I now find I was mistaken, on which account it has probably hitherto failed to be considered a distinct species, and therefore has been