# STUDIES ON SPONGES.

(Plates 39-44.)

By R. von Lendenfeld, Ph.D.

## I.—THE VESTIBULE OF DENDRILLA CAVERNOSA. Nova Species.

Among the Australian Sponges which belong to the genus Dendrilla, there is one which is remarkable for the peculiar laxity of its structure. The sponge is digitate and of a dull yellowish colour. The skeletal fibres are dark brown to black. The sponge does not change its colour like some related species when exposed to the air. It attains a height of 400 mm., and the very irregular digitate processes average a width of 25 mm. The conuli on the outer surface are irregular, distant (average 8 mm.), and 2 mm.-4 mm. high.

Oscula are scattered over the surface. They are found on the sides of the digitate processes, but never appear situated terminally. The oscula are circular, 3 mm. in diameter.

The whole sponge appears, as mentioned above, to be entirely hollow. A large cylindrical cavity takes up the whole interior of each digitate process. The processes themselves hereby attain a tubular appearance.

Below, in the central, irregular mass from which the processes grow out, the cylindrical cavities of the digitate processes join (fig. 1), to form an extensive cavity traversed here and there by bridges of tissue. This whole cavity is a pseudogaster, no oscula are found in its surface; it is a vestibule belonging to the inhalent system.

Inhalent pores covered with the usual sieves are found throughout the surface of the Pseudogaster. These are perfectly similar to the inhalent pores on the outer exposed surface of the sponge.

These extensive lacunæ are not in direct communication with the outer world, we find moreover, at the distal terminations of the tubes in the digitate processes very fine and perforated membranes (fig. 1), dividing them from the water without.

It is easy to observe these membranes, which occasionally attain a size of 200 square millemeters, and we find that the pores in them may be so wide open that bridges as wide only as the pores themselvs are left between them. In other cases again the pores are found to be entirely closed, and every intermediate stage in the dilatation of the pores can be observed.

Two adjacent pores are always dilated nearly to the same width. It is never observed that one pore is nearly closed and the next one wide open. Generally we find the pores in these membranes on the terminations of some of the processes wide open, those in others nearly or completely closed. Occasionally I have also observed that the pores at one end of one and the same membrane are dilated much more than at the other. This however, is rare. If the sponge is killed rapidly by immersion in very strong spirits then the pores remain open. If however the sponge dies slowly by exposure to the air, or if it is placed in weak spirits then the pores are generally found closed.

There can be no doubt that the width of these pores is subject to very great variations, and that by means of these the current of water in the lacunæ can be regulated by the sponge.

The physiological value of these vestibule cavities divided from the outer water by membranes, with small pores, which can be dilated and contracted is not quite clear. At the breeding time of the sponge, from September to December (or longer), these cavities contain the embryos which swarm about in them in great numbers. Then they appear as breeding cavities. The mother sponge can let them out or keep them in, according to weather, the pores in the membranes are dilated or contracted. When the water outside is bad, it can be kept from the embryos by closing the pores, and in every way the whole cavity appears as an excellent nursery. It is, however, not often that one finds this cavity filled with embryos, generally there are no larvæ at all in it, and it seems that they are kept there for a short time only.

I am not inclined to believe that these cavities were originally produced to serve as a nursery, but we could easily understand how, after pseudoscula once had been formed by a process of secundary folding as in Halme and other sponges; (1) these had been turned into a nursery, and how a poresieve, similar to the structures covering the entrances of the inhalent system had been formed over it, so as to adopt it better to its new function.

But even if we attach less value to the breeding functions of this cavity, we still find that the formation of such a membrane was of great importance to the sponge, because it could by its means regulate the water current to a great extent.

Vestibule cavities belonging to the inhalent system and similar to those of our sponge have been described by me from Euspongia canaliculata (l. c.) These have no covering membrane, In several siliceous sponges belonging to the genus Syphonocholina I have found similar perforated membranes which are homologous to the membranes described above.

## Histological Structure.

I have examined the vestibule membrane, as I shall in future designate the structure here described, very minutely, and the results of a study of section series and surface views, are the following :—

Seen from the surface under a low power the membrane appears perforated by numerous circular holes which are distributed very regularly. (Fig. 2.) Their diameter is, as mentioned above, of course subject to very great variations. Their centres are on an

(1) *R. von Lendenfeld.* A Monograph of the Australian sponges, Part VI. Proceedings of the Linnean Society of N.S.W., Vol. X.

average 0·4 mm. apart. When fully dilated they reach a width of 0·2 mm. After staining every pore appears surrounded by a dark ring. (Fig. 2.) More highly magnified (fig. 3) this ring dissolves itself into a number of irregular roundish and multipular cells which are situated a little distance away from the free margin. Between the margin and these cells granular threads, vertical to the contour of the margin are found, some of these contain a highly stained slightly elongate nucleus. The nuclei of the cells which form the ring, always are spherical.

Behind the cells of the ring, spindle-shaped muscular fibres are found in abundance. They extend tangentally and often a number of them combine to form a regular bundle of parallel fibres.

Tranverse sections (figs. 4, 5) enable us to attain a clearer insight into these structures. The membrane has a thickness of 0·1 mm. The pores (fig. 4) are not cylindrical but conic holes. The diameter of the pore decreases towards the interior, and it is the lower side where the pores are closed when the muscular fibres in the membrane contract.

The whole of the membrane is covered by very low and flat epithelium cells. (Fig. 5.) These are doubtlessly ectodermal. The interior of the membrane is occupied by a gelatinous ground substance, in which cells of various kind are imbedded.

Just below the surface gland cells are met with. These are present in great numbers on both sides of the lamella. They are similar to the homologous elements in other species of Aplysillidæ described by me (1), contain a large spherical nucleus in their bulbous proximal portion, which is connected with the surface by a number of slender processes (fig. 5). These are simple or slightly ramified and always vertical to the surface. On the internal margin of the pore such gland cells are not met with. Here a different kind of cell is found below the ectodermal epithelium. These cells are slender and spindle-shaped and form a ring round the pore. In

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(1) *R. von Lendenfeld.* Ueber Cœlenteraten der Südsee II., Mittheilung. Neue Aplysinidæ. Zeitschrift für wissenschaftliche Zoologie. Band XXXVIII.

their shape they resemble those elements of other sponges and higher cœlenterates very closely which are considered as sensitive elements. The nucleus is different from the nucleus of the gland cell. It is oval and slightly smaller, 0·0038 mm. long and 0·003 mm. broad. The slender distal portion of the cell seems to project slightly beyond the surface. (Fig. 5.) In the centre the cell is barely thicker than the nucleus. Proximally it extends to form a process in the shape of a very fine granular thread. This becomes more and more indistinct the further we follow it down. I have, however, traced it to a distance of 0·03 mm. from the nucleus.

In the parts of the membrane, distant from the pores, amæboid wandering cells (fig. 5 *a*), and tangental muscular cells are found (fig. 5 *m*.) The latter extend in every direction and are always spindle-shaped.

The greatest interest attaches to the cells (fig. 5 *g*), which constitute the ring visible already with a low magnifying power.

The nuclei of these cells are regularly spherical and larger than the nuclei of the amœboid wandering cells measuring 0·004 mm., in diameter. The body of the cell is irregularly bulbous and extends in the shape of fine processes in every direction. It appears that some of these processes connect these cells with the spindle-shaped sensitive cells described above, they appear as nerve fibres. The cells themselves are situated very close together and their processes often touch. I consider them as ganglia cells, and the whole structure as a circular nerve or ganglion surrounding the pore.

Although the nuclei become very clearly visible after staining the protoplasmatic body of the cell always remains more or less indistinct, so that particularly the processes and outlines of the ganglia cells cannot be described with great accuracy.

It appears that changes in the water are perceived by the sensitive and ganglia cells round the pores, and that the latter under circumstances incite the muscular cells in the membrane to contract, whereby the diameter of the pore may be changed.

# II.—RAPHYRUS HIXONII.

## A NEW GIGANTIC SPONGE FROM PORT JACKSON.

In 1862 Oscar Schmidt described two sponges (1) as Papillina suberea and nigricans from the Mediterranean. In 1866 Bowerbank (2) described a sponge as Raphyrus griffithsii which has also been figured (3.) Oscar Schmidt (4), afterwards combined this Raphyrus of Bowerbank with his own Papillina suberea, an arrangement which has been also adopted by Norman. (5)

According to this the genera Raphyrus (Bowerbank), and Papillina (O. Schmidt), would appear identical. Among the Australian Sponges there are forms which doubtlessly belong to the genus Papillina (O. Schmidt), whereas others again appear very different from these and coincide with Bowerbank's Raphyrus. All however, contain besides the *bulb ac*, the pin-shaped spicules, also *tr. tr. sp.* I assume that these also occur in the European species, but escaped the observation of Bowerbank and O. Schmidt. I think that both these genera should be retained. In Papillina the internal cavities are irregular and large, in Raphyrus they are very similar to the cells of a honeycomb, smaller and very regular.

The species to be described below, belongs to the latter genus, it is fairly abundant in Port Jackson. Numerous specimens measuring 20 x 30 C. m., have been dredged, their shape was bulbous and irregular; recently a specimen of unusual dimensions was brought up with the dredge. It is the largest Australian Sponge hitherto observed by me.

It is named after Captain Hixon, the President of the Marine Board.

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(1) *O. Schmidt*, die Spongien des Adriatischen. Meers 1862. Seite 69.

(2) *J. Bowerbank.* Monograph of the British Sponges. (Ray. Society.) Vol. II., p. 354.

(3) *J. Bowerbank.* Monograph of the British Sponges. (Ray. Society.) Vol. III., pl. LXIV.

(4) *O. Schmidt.* Grundzüge einer Spongienfauna des Atlantischen Gebietes, 1870. Seite 77.

(5) *A. M. Norman.* Monograph of the British Sponges, by the late J. S. Bowerbank. Ray. Society.) Vol. IV. Supplementary, p. 182.

## RAPHYRUS HIXONII. Nov. spec.

### Shape and Size.

The smaller specimens are irregular, bulbous, with several vents on the upper convex surface. The large specimen (fig. 6), is massive, expanded above and was attached to the sand of the sea bottom by a flat expanded base, measuring 300 mm. across. It extends above very much. The upper surface is uneven, and horizontal (fig. 6.) Seen from above the out-line appears very irregular with lobate projections beyond a circular circumference. The sponge measures about 600 mm. in width, and 350 mm. in height. There are massive semi-spherical projections over the sides and upper surface. The latter are particularly regular and well-defined These protruberances extend 50 mm. over the depressions between them and are 120 mm. wide. In the large specimen there are nine such protruberances on the upper side. In the centre of each a vent is situated. In the smaller specimens these vents are scattered over the smooth and uniform surface of the convex upper side. In the large specimen they are found in the centres of the upper protruberances.

These vents are not Oscula but only Pseudoscula. They lead into short conic tubes, pseudogasters.

In the large specimen (fig. 6), there are according to the above, nine such Pseudoscular tubes 260 mm. long and at the mouth 30 mm. wide. They are straight, but not regularly conic as occasionally there are extensions half-way down, whereby their diameter may be locally increased to 50 mm. All these tubes are vertical and open on the upper, laterally expanded surface (fig. 6), on the summits of the protruberances.

The sponge weighed when fresh, about 200 kilogramm. Now that it has been dried, it weighs about 14 kilogramm.

### Rigidity.

Alive in spirits and dry, the sponge is very hard, a pressure of 70 kilogramm in no way affects a surface of 50 ▭ C. m.

## Colour.

The colour in the living state is a very bright red, similar to Rosanilin-red. In spirits the sponge becomes pale flesh-coloured, and dried it appears brown. The spirits extract a deep orange-coloured pignut, very similar to that extracted by spirits from many other Monactinellidæ.

## Surface.

The surface is reticulated throughout in a very regular and uniform manner, and appears thereby similar to Bowerbank's Raphyrus Griffithsi, and also to some species of Halme among horny sponges. Young and old specimens always show the same reticulation on the surface, there seem never to be Papillæ in the place of the meshes, as it is the case in young specimens of the genus Papillina (O. Schmidt), which, according to that author, is identical with Raphyrus. As stated above, however, I consider these genera distinct.

The reticulation is produced by a very regular network of projecting lines on an average 2 mm. wide. In the meshes between these there are slight depressions, about 4-5 mm. deep. The meshes themselves have a width of 3-4 mm. The membrane which is thus expanded below the surface in the meshes is very soft, whereas the projecting lines are exceedingly hard. This membrane is also slightly concave. In it we find very small pores in groups, which are the commencement of the inhalent system.

This network covers the whole of the surface of the sponge and extends downwards into the conic pseudoscular tubes to their bottom.

Oscula are found scattered irregularly over the whole of the surface; they are circular and measure from 2-10 mm. in diameter. These oscula are as frequent on the exposed parts of the sponge as in the sides of the conic pseudoscula.

## Canal system.

The whole sponge consists like the Auleninæ described in Part V. of the Monagraph of Australian Sponges in the last number of the proceedings of this Society, of a reticulate structure in its interior. (Fig. 8.) Lamellous fibres, with an average thickness of 1 mm. form a network, which on any section appears very regular. These fibres consist of a very hard tissue, with few and small canals and a great abundance of spicules. In the meshes between them (fig. 8) there is a very much softer tissue with wider canals or irregular lacunes. Here only few and insignificant spicules are found.

Below the poresieves in the concave membranes which extend in the meshes of the surface-network, large irregular cavities (fig. 16) are met with. The pores are situated, as stated above, in small groups. The sieve membrane is very thin and delicate. The pores can apparently be entirely closed by the sponge. The sub-dermal cavity extends far down and gives off branches which ramify to supply the ciliated chambers or extend to form lacunæ in other meshes of the interior of the sponge. Most of the lacunæ found throughout the interior of the Sponge belong to the inhalent system. Some of the final ramifications of the inhalent system are met with in the fibres of the internal network.

The ciliated chambers are small and difficult to see, they are spherical and measure 0·02 mm. in diameter ; from the chambers very narrow canals originate and unite to form larger exhalent canals. The chambers seem to be situated in groups. Such groups occur only in the tissue of the hard fibres, as also in the soft pulpa which occupies the meshes.

The exhalent canals do not form extensive lacunæ at all. The larger branches and stems are found only in the soft tissue of the meshes. The oscular tubes follow the net-work in their lower part, and are therefore much curved. They are narrow and long and ramify in an irregular manner.

## Skeleton.

The skeleton consists of the *bulb ac.* and *tr. ac.* spicules already described by Bowerbank and O. Schmidt of their genera Raphyrus and Papillina, to which two other kinds of spicules, observed in our species, must be added.

## Surface Skeleton.

The surface of the hard projecting ridges in the surface net is occupied by a number of small spicules, which form a layer about 0·06 mm. thick. (Fig. 16.) These spicules (figs. 13, 14) are very variable in their shape, straight or curved, with large and irregular spines all over the surface and particularly at the ends. They could be termed *tr. tr. sp.* They are of very uniform size and measure 0·03 mm. in length and 0·007 mm. in thickness. Besides forming a dense armour on the projecting ridges they are found scattered also in the concave membranes of the meshes.

## Skeleton of the Hard Fibres.

The main support of the whole sponge is constituted by a reticulate mass of truncate and bulbous spicules, which are mostly situated longitudinally, and disposed in such a manner as to point towards the free surface (fig. 16) in the projecting ridges, or towards the pulpa in the meshes in the interior.

These spicules are not cemented together by any horny substance. They are very abundant, and form hard, dense masses (fig. 16) throughout the fibres of the interior. Scattered, these spicules are also found rarely in the soft pulpa of the meshes in the interior. These spicules are of uniform size 0·5 mm. long and 0·02 mm. thick. They are cylindrical and abruptly pointed (fig. 9.) The bulb of the majority of spicules measures 0·03 mm. in diameter. Sometimes it increases to a diameter of 0·0036 mm., and may have indications of points at its greatest diameter (fig. 10.)

One of these points may grow out to form a spine 0·09 mm. long (fig. 11.) This however, is rare.

On the other hand the bulb may be absent altogether. *Tr. ac.* spicules are not unfrequent.

## Skeleton of the Pulpa.

The soft tissue in the meshes contains besides scattered spicules of both the preceding kinds, also small clusters of very slender and gracefully curved *ac. ac. sp.* (fig. 15.) The clusters of these are found scattered irregularly throughout the soft tissue, and comprise from 7 to 12 spicules crossing each other in a perfectly irregular manner (fig. 16.)

These spicules attain a length of 0·2 mm., and a thickness of 0·003 mm. They bear short and sharp spines (fig. 15.)

## Histology.

In the soft tissue of the internal meshes, extraordinary granular cells are met with in great abundance (fig 17.) These are highly colourable and probably homologous to those elements, which I have described of Aphrodite Nardorus. (1) There we find likewise a great number of similar cells of a very peculiar appearance in the walls of the lacunes which belong to the inhalent system.

The shape of these elements in Raphyrus Hixonii, is subject to very great variations. The cells are spherical, about 90% of them, or irregularly lobate, 2%; or spindle-shaped, 6%; or also show indications of dividing as represented in the figure, 2% (fig. 17.) A nucleus is indicated by a more transparent patch in the centre, but not clearly visible. In coloured specimens the whole cell, or rather the granules take up so much colouring matter, that the whole structure is rendered intransparent. The reason that the nucleus in the fresh state and in spirit specimens appears light and transparent, is that the substance of the nucleus is free from granules.

The granules are large and refract the light very strongly. The differences in shape between these cells, lead me to assume that they are a peculiar kind of amœboid wandering cell.

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(1) *R. v. Lendenfeld.* A Monograph of the Australian Sponges. Part V. The Auleninæ. Proceedings of the Linnean Society of N. S. W. Vol. X., part 3.

I further assume that in this case, as also in Aphrodite, these cells are in connection with the digestive functions of the sponge, and take up and absorb microscopic food-particles, which may get into the lacunæ of the inhalent system, and there come in contact with the epithelium.

### Geographical Distribution.

East Coast of Australia, Port Jackson (Ramsay.)

### Bathymetrical Distribution.

40 metres.

The type specimens of this sponge are in the Australian Museum, Sydney.

## III.—HALME TINGENS.

### A SPONGE WITH REMARKABLE COLOURING POWER.

Among the sponges sent by Dr. Haacke from Thursday Island, is a new species of my genus Halme.

### Halme tingens. Nov. spec.

Sponge composed of reticulate lamella, massive 200 x 300 x 100 mm. large. No dermal lamella. Meshes on an average 12 mm. wide. Lamella curved 2-3 mm. thick, covered with small conuli. Very little sand in the skin. Skeleton composed of very distant fine fibres. Radial main fibres charged with foreign bodies and tangental connecting fibres free from such. Colour in spirits at first white, then violet.

The spirit extracts a yellow colour from the sponge, which appears to remain in solution in the spirits. This sponge was dredged by Dr. Haacke at Thursday Island.

It is an intermediate form connecting the sub-family Auleninæ with the genus Hippospongia.

Halme tingens is very peculiar inasmuch as it colours paper and other substances with a dark violet tint. If paper is inserted in a bottle containing this sponge and spirits, it will be found that the paper, after a day or two, is stained a deep violet blue. A colour which will not disappear when the paper is washed with water or ether. Concentrated acids and strong alkalis affect the colour. Acids make it red like litmus. Alkalis turn the red colour blue again.

I do not know anything about the chemical nature of the colour. It is very remarkable that the spirits are only stained light yellow by the sponge. It appears that the colour is precipitated on the paper, &c., after it has been extracted from the sponge by the spirits.

It appears that a great quantity of paper, &c., can be stained by a very small piece of the sponge, and I think that possibly this discovery might be turned to practical account for the purpose of dyeing blue-violet.

## IV. TWO CASES OF MIMICRY IN SPONGES.

In the cases in question two species of horny sponges imitate two species of Siliceous sponges. As both the two imitating and also the two imitated sponges are new species, it will be necessary to give a short description of them first.

### GENUS. CHALINOPSIS.

Sponges which belong to the family Spongidæ, sub-family Chalinopsinæ which imitate the shape of Chalinidæ, more or less closely, and which have a light and tender skeleton composed of radial main and tangental connecting fibres without conuli and without vestibule spaces. The skeleton is more or less grey in the dry state. Sponges of digitate shape.

### CHALINOPSIS IMITANS. Nova species.

Digitate processes regular smooth and cylindrical, very long and slender, slightly branched. Oscula very small. Digitate processes tapering to a more or less sharp point. The sponge is attached by a short thick stem.

Thickness of digitate processes 8 mm., length 600 mm. The whole sponge hard and elastic.

*Locality :* East Coast of Australia, Illawarra.

This species is represented in fig. 19.

### CHALINOPSIS DICHOTOMA. Nov spec.

Digitate processes cylindrical of not very uniform diameter, repeatedly branched in a dichotomous manner. The whole sponge attached by a thin stem.

Oscula large and very numerous. Digitate processes 12 mm. thick, tending to extend in one plain, particularly at the points of ramification. Irregular digitate and conic processes on the surface. Sponge 400 mm. long.

*Locality :* West Coast of Australia, Western Australia.

This sponge is represented in fig. 21.

## GENUS. DACTYLOCHALINA.

Sponges belonging to the Monactinellæ. Skeleton composed of a hexactinellid network of horny fibres. Meshes pretty small. An extremely fine network of slender threads with very small meshes on the surface.

Very small and slender spicules *ac. ac.* straight or slightly curved are found in the axis of the horny fibres. These spicules are not numerous. They are more scarce in the connecting than in the main fibres. They are found also in the fibres of the fine surface-net.

Sponges with digitate processes.

### DACTYLOCHALINA CYLINDRICA. Nov spec.

Digitate processes nearly straight, slightly branched, growing in a penicillate manner parallel from the expanding branches at the base. They coalesce here and there, where they accidentally touch. They are slightly undulating, regularly cylindrical and 7 mm. thick. They terminate with rounded ends. Oscula small, common stem short and thick. Length of sponge 500 mm.

*Locality* : East Coast of Australia, Port Jackson.

This sponge is represented in fig. 20.

DACTYLOCHALINA RETICULATA. Nov. spec.

Digitate processes irregular, repeatedly branched and anastomosing, 12 mm. thick, more or less cylindrical, with an uneven surface, and much curved. Tapering at the tips to a pointed terminus. Length of the sponge 200 mm.. Oscula large, scattered over the surface.

*Locality* : East Coast of Australia, Port Jackson.

This sponge is represented in fig. 22.

When working out the sponges I was so deluded by the external similarity of these sponges, as actually to put Chalinopsis imitans and Dactylochalina cylindrica, and also Chalinopsis dichotoma and Dactylochalina reticulata specimens together. Only afterwards I ascertained by examining sections of different specimens under the microscope, that I had confounded sponges belonging to two different orders with one another.

All the representatives of my sub-family Chalinopsinæ of the family Spongidæ, are more or less similar to species of Chalinidæ-Monactinellid sponges. The most striking similarity however, is shown by the four species described above.

The similarity could be accounted for in various ways. We might assume that the Chalinopsidæ where the links connecting the Ceraospongia with the Monactinellidæ. In this case we would have to assume that either the horny sponges have descended from the silicious, and that the Chalinopsinæ were horny sponges which had been just produced by the loss of the silicious spicules in the fibres of the similar Chalinidæ, or that *vice versa* the Chalinidæ are descended from horny sponges, and that these forms are the ones just commencing to obtain spicules. We might also assume that these sponges were not at all related with each other.

I have some years ago advocated the view, that silicious sponges descended from horny ones, the evidence however, which has since then been brought forward seems to indicate that the silicious sponges are the ancestors of the horny ones, a view advocated by Vosmær and Poléjaeff.

I think that the Chalinopsinæ are very nearly allied to the Chalinidæ, but I do not think that they are so nearly related to each other as the similarity of their outer appearance would indicate. It seems most probable that the two species of Chalinopsis described above are descendants of digitate Chalinidæ, they have lost the defensive spicules which are no doubt of great value to Dactylochalina, but they have retained the outer appearance. It is probable that the Dactylochalina species have undergone changes since then, and that these species of Chalinopsis have had to change their own shape accordingly so as always to remain similar to a defensive sponge. I would therefore call the similarity in these two cases, although it has originated in true relationship, Mimicry, because the structure of the important internal organs has changed, whilst no difference is perceptible in the outer appearance which is so very variable in sponges.

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## EXPLANATION OF PLATES.

### Plate, 39.

Fig. 1.—*Dendrilla cavernosa.* R. v. L.
Section through the sponge.
$\frac{1}{5}$th of the natural size.

Fig. 2.—*Dendrilla cavernosa.* R. v. L.
Pore membrane covering the vestibule lacunæ. Seen from the surface.
1:20 magnified.
Alcohol, Hæmatoxylin specimen.

Fig. 3.—*Dendrilla cavernosa.* R. v. L.
Pore membrane covering the vestibule lacunæ. Seen from above. Margin of one of the pores.
1:20 magnified.
Alcohol, Hæmatoxylin specimen.

Fig. 4.—*Dendrilla cavernosa.* R. v. L.
Transverse section through the pore membrane. Showing one pore.
1:80 magnified.
Alcohol, Hæmatoxylin.

Fig. 5.—*Dendrilla cavernosa.* R. v. L.
Transverse section through the pore membrane showing the margin of a pore.
1:800 magnified.
Alcohol, Hæmatoxylin specimen.

*(a.)* Amœboid wandering cells.
*(m.)* Muscular cells.
*(g.)* Ganglia cells.
*(d)* Gland cells.
*(s.)* Sensitive cells.
*(p.)* Flat epithel cells.

PLATE 40.

Fig. 6.—*Raphyrus Hixonii.* R. v. L.
Photographed from life.
En profil.
$\frac{1}{3}$ of the natural size.

PLATE 41.

Fig. 7.—*Raphyrus Hixonii.* R. v. L.
Transverse section through the outer portion of the sponge
1:50 magnified.
Alcohol, Hæmotoxylin.

Fig. 8.—*Raphyrus Hixonii.* R. v. L.
Some of the digestive amœboid wandering cells in the soft tissue of the internal meshes.
Spirit specimen.
1:400 magnified.

PLATE 42.

Fig. 9.—*Raphyrus Hixonii.* R. v. L.
Transverse section through the outer portion of the sponge.
1:15 magnified.
Alcohol, Hæmatoxylin.

Fig. 10.—*Raphyrus Hixonii.* R. v. L.
*Bulb ac.* spicule.
Most frequent shape in the supporting skeleton of the network.
1:150 magnified.

Fig. 11.—*Raphyrus Hixonii.* R. v. L.
*Bulb ac.* spicule. The head showing a spine.
1:250 magnified.

Fig. 12.—*Raphyrus Hixonii.* R. v. L.
*Bulb ac.* spicule, with a large spine. The head.
200:1 magnified.

Fig. 13.—*Raphyrus Hixonii.* R. v. L.
*Bulb ac.* spicule, the truncate end showing the extended terminus of the axial canal.
1:500 magnified.

Fig. 14.—*Raphyrus Hixonii.* R. v. L.
*Tr. tr. sp.* spicule of the dermal armour. Straight kind.
1:700 magnified.

Fig. 15.—*Raphyrus Hixonii.* R. v. L.
*Tr. tr. sp.* spicule of the dermal armour. Curved kind.
1:700 magnified.

Fig. 16.—*Raphyrus Hixonii.* R. v. L.
*Ac. ac. sp.* spicule of the soft tissue.
1:400 magnified.

Fig. 17.—*Raphyrus Hixonii.* R. v. L.
*Tr. ac.* spicule.
150:1 magnified.

PLATE 43.

Fig. 18.—*Chalinopsis imitatus.* R. v. L.
Photographed from a skeleton.
⅓ of the natural size.

Fig. 19.—*Dactylochalina cylindrica.* R. v. L.
Photographed from a skeleton.
½ of the natural size.

PLATE 44.

Fig. 20.—*Chalinopsis dichotoma.* R. v. L.
Photographed from a skeleton.
½ of the natural size.

Fig. 21.—*Dactylochalina reticulata.* R. v. L.
Photographed from a skeleton.
⅓ of the natural size.

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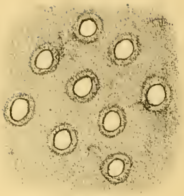

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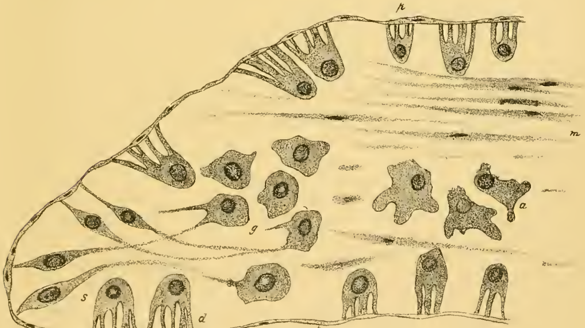
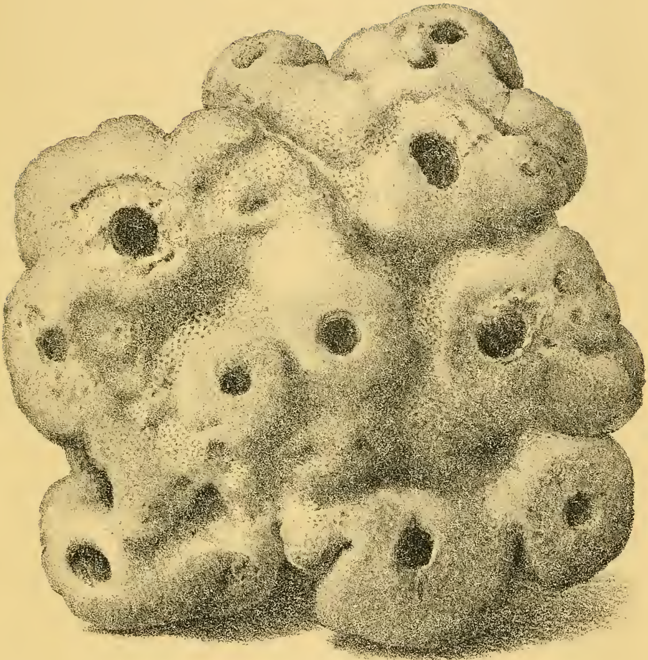



5

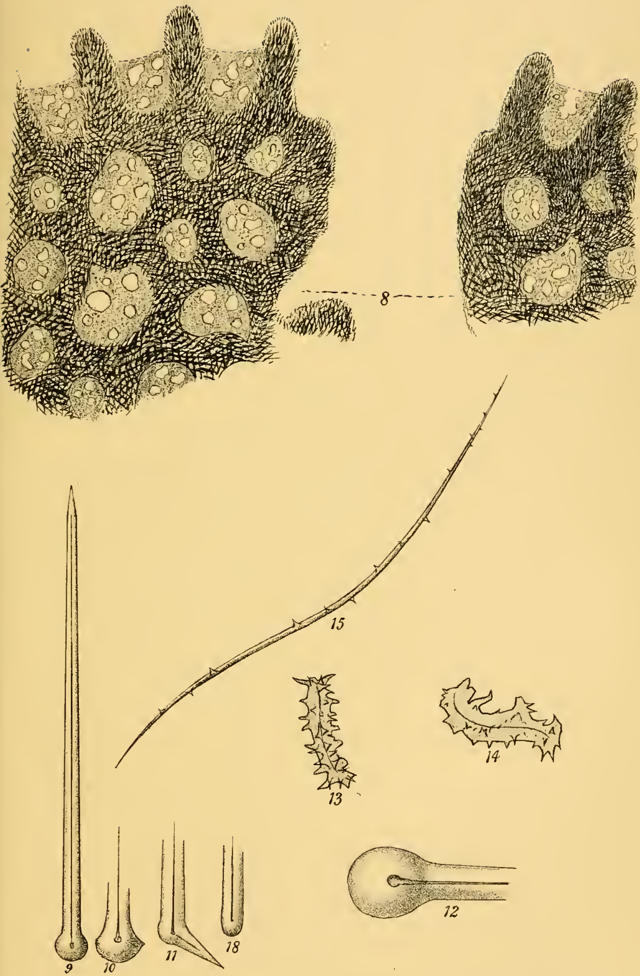
v. Lendenfeld del. S. Sedgfield lith.



7.

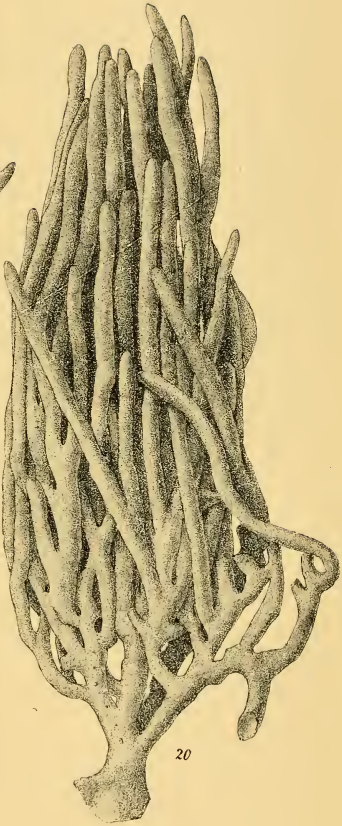
S. Sedgfield lith.


v. Lendenfeld del. S. Sedgfield lith.




v. Lendenfeld del. S. Sedgfield lith.

19



20

S. Sedgfield lith.


S. Sedgfield lith.