THE HOMOCŒLA HITHERTO DESCRIBED FROM AUSTRALIA AND THE NEW FAMILY HOMODERMIDÆ.

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THE HOMOCŒLA.

The simplest of all Sponges doubtlessly, are the Asconidæ and the Physemaria.

The Sponge nature of the latter however, is not sufficiently acknowledged for them to be placed in the Class Spongiæ, and so those Sponges appear as the least developed, which possess a non-differentiated Entoderm, where flagellate cells cover the whole of the Entodermal surface.

I. SUBORDO HOMOCŒLA.

Polejaeff, 1884 (1.)

THE WHOLE OF THE INNER SURFACE COVERED BY THE SAME KIND OF FLAGELLATE CELLS, NO DIFFERENTIATION OF THE ENTODERMAL EPITHELIUM.

Polejaeff (l.c.) made this group, which I recognize here as a Suborder for the Asconidæ of Haeckel, because he justly considers the Lenconidæ, Syconidæ and Carter's Teichonellidæ much nearer related to one another than to the Asconidæ.

(1.) *N. Polejaeff.* Report on the Calcarea, Zoology of the Voyage of H.M.S. Challenger. Part XXIV., p. 22.

If we were not to attach great importance to the chemical nature of the skeleton we would have to place the Physemaria—those that are Sponges—in this Suborder because they resemble the Asconidæ very closely. I think it very probable that this will be done in future, when the Embryology of these doubtful organisms is better known.

1. FAMILY. ASCONIDÆ. Claus (1.)

HOMOCŒLA WITH A PLAIN POROUS BODY WALL, WITHOUT ANY COMPLICATION OF THE INNER SURFACE.

The Asconidæ are identical with Haeckel's (2) Asconcs. Polejaeff (l.c.), comprises all species in Bowerbank's (3) Genus Lencosolenia. Although the difference between the Genera of Haeckel may in many cases appear trivial, I shall nevertheless adopt them here. The soft parts of only very few have been studied, so that any classification must appear preliminary.

1. GENUS. ASCETTA. Haeckel, 1872.

Asconidæ possessing triradiate spicules only.

1. SPECIES ASCETTA PRIMORDIALIS. E. Haeckel.

Prosycum primordialis. E. Haeckel.
Prodromus eines Systems der Kalkschwämme. Jenaische Zeitschrift fur Medicin und Naturwissenschaft, 1870. Band V., Heft. 2, p. 236-257.

Olynthus simplex. E. Haeckel.
Prodromus, l.c., p. 237.

Leucosolenia dictyoides. E. Haeckel.
Prodromus, l.c., p. 243.

Soleniscus loculosus. E. Haeckel.
Prodromus, l.c.. p. 244.

Clathrina loculosa. E. Haeckel.
Prodromus, l.c. p. 245.

(1.) *C. Claus.* Grundzüge der Zoologie, IV., Anflage. Seite 221.
(2.) *E. Haeckel.* Die Kalkschwämme, eine Monografie. Band II. Seite 11.
(3.) *T. S. Bowerbank.* On the Anatomy and Physiology of the Spongiadæ. Transactions of the Royal Society of London. Vol. 152, p. 1094.

Auloplegma loculosum. E. Hackel.
Prodromus, l.c., p. 250.
Thecometra loculosa. E. Haeckel.
Prodromus, l.c., p. 254.
Ascetta primordialis, E. Haeckel.
Die Kalkschwämme Eine Monopraphie. Band II., p 16.

Triradiate spicules regular, with equal angles and rays; rays straight, slender conic or cylindrical proximally, distally semi-spindle-shaped, tapering from the middle; point of rays simple, sharp, without bulbous terminal extension (not inflated.)

Size of spicules very variable, generally the rays 0·1—0·15 x 0·008—0·012.

Special description and figures in Haeckel (Monografie der Kalkschwämme l.c.)

Colour: Generally white, sometimes yellowish or reddish, rarely pure sulphur yellow, gold yellow, menning red, crimson or brown.

Locality: Mediterranean, Nice, Naples, Messina, Gibraltar, Lesina, Haeckel; Adria, Zara, Sebenna, Lesina, Lagosta, Oscar Schmidt; Lesina, Heller.

Atlantic Ocean, Rio Janeiro, Wendt; Algoa Bay, Poehl; Cape Town, Wilhelm Bleek.

Red Sea, Frauenfeld, Mikluho.

Indian Ocean, Singapore, Putnam.

Coast of Australia, St. Vincent's Gulf, Wendt; Sydney, Sonder. Bass Straits, Wendt.

Pacific Ocean, Philippines, Semper.

Viti Islands, Graeffe.

Valparaiso, Trautmann.

2. SPECIES. ASCETTA POTERIUM. E. Haeckel.

Ascetta primordialis var poterium. E. Haeckel.
Die Kalkschwämme eine Monografie. Band II., Seite 17.
Clathrina poterium. Ridley.
Proceedings of the Zoological Society of London, 1881, p. 133.

Leucosolenia poterium. Poléjaeff.

Report on the Calcarea. Zoology of the Voyage of H.M.S. Challenger. Part XXIV., p. 35.

Spicules differentiated, of unequal size. The spicules on the surface form a dermal membrane, consisting of several layers of spicules, with thick rays, which are only 6-8 times as long as thick. The spicules of the inner surface with slender rays, which are 16-20 times as long as thick. The dermal spicules 1-2 times as long, but 3-4 times as thick as those near the inner surface. Gastral cavity not fan-shaped.

It appears in the Auloplegma form, and possesses peculiar triradiate spicules in the peristomial membrane.

Interior spicules with rays 0·12—0·18 x 0·006—0·01 mm., dermal spicules 0·3 x 0·035 mm. Some Sub-dermal spicules show an incipient fourth ray.

Special description and figures in Polejaeff, l.c.

Colour: White and yellowish.

Locality: Australia (St. Vincent's Gulf, Wendt? Sydney, Sonder? Bass' Straits, Wendt. Station 163, April 4, 1874. Lat. 36° 50′ S. long., 150° 30′ E., off Twofold Bay; depth 120 fathoms, Challenger); South America (Tour Bay, South-west Chili, Alert.)

3, SPECIES. ASCETTA CHALLENGERI. Von Lendenfeld.

Leucosolenia Challengeri N. Poléjaeff. Report on the Calcarea. Zoology of the Voyage of H.M.S. Challenger. Part XXIV., p. 38.

A special set of triradiate spicules covering the outer surface of the colony. These are all sagittal, while the triradiate spicules of the interior are all regular. Solemiscus form. The diameter of the tubes varies from 0·3—0·8 mm.; the pseudopores are still narrower, rarely exceeding 0·28 mm. in diameter; the Oscula sparsely scattered here and there possess the same dimensions, or they are slightly larger. The whole forms an irregularly oval body 30 mm. long and 20 mm. broad in its thickest part, presenting a compact web of minute tubes and terminating in a short (2 mm) peduncle, which is solid.

Skeleton: Two forms of spicules are to be distinguished, regular and sagittal.

The regular spicules possess slender rays, which are 0·18 mm. long and 16-20 as long as thick, cylindrical with rounded end.

The basal ray is sometimes rather longer than this, some of them show an incipient fourth apical ray.

The sagittal triradiate spicules are on an average of the same size as the regular; their rays, compared with those of the latter, are more conical, although there is no want of intermediate stages, they are not constant in their outline. With some of them the irregularity consists only in their not being flat, the point of meeting of the rays not lying in the same plane as their ends, the basal ray being in this case either of the length of the lateral rays or rather longer; but such a form is comparatively rare. The greater part also show variation in their angles; the angle formed by the basal, and each of the lateral rays varying from 120° to 92°; the length of the basal ray is in this case variable (0·12-0·25 mm.); it is either straight or undulating, the lateral rays being horn-shaped and curved, more or less, one towards the other. There exists also on the outer surface of the colony another constituent part of the dermal skeleton, namely, large regular triradiate spicules; each ray attaining a length of 0·8 mm. and a diameter of 0·06 mm; but these spicules are so extremely rare that they are of no importance.

Special description taken from Polejaeff (l.c.) where the Sponge is figured.

Colour: Yellowish.

Locality: Australia. Station 186, September 8th, 1874, lat. 10° 30′ S., long. 142° 18′ E.; Cape York, depth 8 fathoms. Coral sand, Challenger.

2. GENUS. ASCALTIS. Haeckel.

Asconidæ, with triradiate and quadriradiate spicules.

4. SPECIES. ASCALTIS LAMARKII. E. Haeckel.

Lencosolenia Lamarkii. E. Haeckel.
Prodromus eines Systems der Kalkschwämme, Jenaische Zeitschrift für Medicin und Naturwissenschaft, 1870. Band V., Heft. 2, p. 243.

Aulorhiza intestinalis. E. Haeckel.
Prodromus l.c., p. 250.

Ascaltis Lamarkii. E. Haeckel.
Die Kalkschwämme, Eine Monographie. Band II., p. 60.

Lencosolenia Lamarckii. Poléjaeff.
Report on the Calcarea. Zoology of the Voyage of H.M.S. Challenger. Part XXIV., p. 36.

Triradiate and quadriradiate spicules regular, with equal angles and rays. Some of the triradiate spicules much larger up to three times as thick and long as the quadriradiate spicules.

Forms irregular masses on seaweed, which attain a diameter of 5-20 mm., consisting of mouthless colonies, which are composed of a net work of tubes.

Skeleton.—The quadriradiate spicules possess straight, conic rays; the apical ray is as long or shorter than the facial rays. vertical to the plane in which they lie. Often slightly curved, Rays 0·08—0·12 x 0·004—0·006 mm.

The triradiate spicules are of two sizes, the smaller ones are regular with rays of equal length as in the quadriradiate spicules. The larger ones often form a membrane in the outer surface, their rays measure 0·2—0·3 x 0·015—0·02 mm., they are mostly regular, like the smaller kind, a few however have paired rays.

Polejaeff's specimens possessed spicules which showed a greater tendency towards sagittal differentiation. The rays of the large triradiate spicules attained a size of 0·5 x 0·06 mm.

Special description and figures in Haeckel (l.c., Monographie.)

Colour : White or red.

Locality : North Atlantic Ocean; Coast of Marocco (Magador, Haeckel); Gibraltar (Tenarifa, Haeckel); Florida (Alexander

Agassiz); East Coast of Greenland (North Shannon, Pansah.) Australia (163 A, off Port Jackson, depth 30-35 fathoms, bottom, rock, Challenger.

3. GENUS. ASCANDRA. Haeckel.

Asconidæ with acerate triradiate and quadriradiate spicules.

5. SPECIES. ASCANDRA DENSA. E. Haeckel.

Tarrus densus. E. Haeckel.
Prodromus eines Systems der Kalkschwämme. Jenaische Zeitschrift für Medicin und Naturwissenschaft. Band V., Heft 2, p. 244.

Nardopsis gracilis. E. Haeckel.
Prodromus l.c., p. 247.

Ascandra densa. E. Haeckel.
Die Kalkschwämme. Eine Monographie. Band II., p. 85.

Triradiate and quadriradiate spicules regular of equal size. All the rays straight and pointed, cylindrical; apical ray half as thick, straight. Acerate spicule straight, truncate at both ends; the exterior end thickened, club-shaped, three to four times as long and five to six times as thick as the rays of the triradiate spicules.

Colonies consisting of entwined tubes, 8—10 mm. in diameter in Auloplegma-form or with a proboscis to the mouth.

Skeleton: The greater number of spicules are triradiate and regular. The rays measure 0·1—0·12 x 0·006—0·008 mm.

The quadriradiate spicules are few in number, and of the same size and shape as the triradiate spicules, regular with slender rays.

The acerate spicules are large, 0·5—0·6 x 0·03—0·04 mm., and protrude from the outer surface their distal ends are thickened, club-shaped, and rounded.

Special description and figures in Haeckel (l.c. Monographie.)

Colour: (Dried) white.

Locality: South Coast of Australia (Glenelg? Schomburgk.)

2. FAMILY. HOMODERMIDÆ. Von Lendenfeld.

HOMOCŒLA, THE INNER SURFACE OF WHICH IS COMPLICATED SO AS TO FORM RADIAL SACK-SHAPED EXCRESCENCES SIMILAR TO THE RADIAL TUBES OF THE SYCONIDÆ. (CILIATED CHAMBERS.)

I constitute this family for a small Sponge, which combines characters of the Syconidæ, with those of the Asconidæ. The whole of the Entoderm consists of flagellate cells, and we find the same Epithelium on the inner side of the Oscular tube, in the hollow peduncle and even in the Entoderm of the hollow stolons, which connect the different individuals of one colony; as in the sack-shaped excrescences, the homologa of ciliated chambers. Pores lead from the outer water not only into the radial tubes but also direct into the Gastral cavity.

I place this family in the group Homocœla, because I consider the "homodermic" character more important than the "asconic."

Haeckel (1) has described two Sponges, namely, Ascaltis canariensis and Ascaltis Lamarkii which show a similar structure of the body wall. He describes papillæ growing from it into the gastral cavity, papillæ into which the *outer* ectoderm is drawn and which are situated in longitudinal rows. It is evident that this complication is similar to the canal system of the Syconidæ. If these two species are not to be considered as Homodermidæ they are in any case transition forms between it and the Asconidæ proper, with a simple or irregularly folded gastral cavity.

GENUS. HOMODERMA (2). Nov. Gen.

Homodermidæ, with acerate triradiate and quadriradiate spicules.

HOMODERMA SYCANDRA. Nov. Spec.

Shape: From a creeping hollow stem homologous to the Hydrorhiza of Hydroids, tubes grow up which are about twice as

(1). From ὅμοιον δέρμα, the same kind of skin throughout.

(2). *E. Haeckel.* Die Kalkschwämme, eine Monographie. Band II., Seite 53-54 and 61.

thick in the middle than at either end, and which therefore appear spindle-shaped. These attain a height of 4 and a thickness of 1·5 mm., and possess two frills of acerate spicules round the mouth.

Viewed with the magnifying glass the outer surface presents a hairy appearance, and the Ocular frill is found to consist of two sets of spicules, one set longitudinal, parallel to the axis and the other set divergent.

The hairy appearance is caused by acerate spicules, which are situated in tufts, one tuft at the end of each of the numerous protruberances, which give the whole a papillate appearance.

These spicules are turned towards the Osculum, they are longest in the central part and shorter towards the narrow ends. The surface of the Spongorhiza, as I propose to call the creeping stems is covered with vertically projecting spicules, shorter than the others.

Structure: In the central part of the Sponge, where it is thickest, we find that tubes extend from the central Gastral cavity radially, perfectly similar to the ciliated chambers of the Syconidæ. On the dermal surface each radial tube is found to project a good distance. In the vaulted ends of these chambers, as well as in the body wall, where no chambers are developed, numerous pores can be detected.

One might from this be led to suppose that my Homoderma Sycandra is only a young Sycon.

I must state that I have examined a great many specimens of this Sponge, and that I never found any larger individuals than those of 4 mm., and that evidently this was the limit of growth, because the central ones of large colonies were all of this size throughout. I have repeatedly detected mature sexual products in these Sponges.

The Ocular tube is very wide, of the same diameter as the Gastral cavity; the walls of it are very thin, and the sarcode extends in good Osmic acid specimens far up the spicules of the two frills.

The ciliated chambers are simple sac-shaped, and in their proximal part cylindrical, and not contracted towards the circular opening into the Gastral cavity

The most interesting part of our animal is the Entoderm : It consists, as mentioned above, throughout of the same flagellate cells. This can be seen in the living Sponge, but still better in Osmic-acid specimens. The peculiar short cylindrical shape which the flagellate cells attain, when hardened, the large, highly colourable nucleus, and the regular network of boundary-lines between the cells is the same throughout the inner surface of the Sponge.

The cells correspond to the well-known shape of the flagellate, frilled Sponge cells.

It is particularly remarkable that the same cells also cover the inner surface of the Spongorhiza.

We find in our Sponge an Entoderm, which is not differentiated into different kinds of cells, whilst a higher development in the direction of the Syconidæ has already been attained by the Sponge, in consequence of the folding process which has produced the ciliated chambers. This would appear altogether exceptional. Generally the cells are differenciated first, *and then* Organs of a whole complex of such differentiated elements are formed.

The exception is, however, I think, not actual, but only apparent. I am inclined to believe that the *Mesoderm* is, in our case, the active part growing, more or less, in different parts, and so forcing the Entodermal layer to attain a complicated structure, which is not caused by the cells of the latter.

The Ectoderm consists of the ordinary flat cells, and is the same throughout.

The Mesoderm also presents no peculiar character.

The Skeleton consists of seven different kinds of spicules. 1. Gastric quadriradiates ; 2. Parenchymal Quadriradiates ; 3. Parenchymal triradiates ; 4. Dermal triradiates ; 5. Dermal acerates thick ; 6. Dermal acerates slender ; and 7, Oscular acerate spicules.

1. The gastric quadriradiate spicules are found all over the inner surface. Three tangental rays lie in one plane in the

surface which divides the Entoderm from the Mesoderm. They stand at equal angles, each ray measuring 0·04—0·05 x 0·004 mm. The fourth ray penetrates the Entoderm. and is situated radially. Like the former it is conic, and often slightly curved. The three tangental rays are at their base convex towards the axis, the radial ray concave towards the Osculum. The radial ray measures 0·02—0·04 x 0·0025 mm., and it is accordingly as long or shorter than the others.

2. The Parenchymal quadriradiate spicules are all parallel three short and equal rays tangental and one longer radial ray pointing outward. These spicules vary very much in size; the radial ray is straight, slender, and conic, measuring 0·03—0·05 x 0·002—0·003 mm. The tangental rays all have the same angle of 120° between each other, and are slightly curved at the base, the convex side towards the axis. They measure 0·0075—0·01 x 0·002—0·003 mm.; they are therefore much stouter than the radial ray.

These spicules are found throughout the Mesoderm, the larger ones towards the inner surface. In no case do they penetrate either the Entoderm or the Ectoderm.

3. The Parenchymal tri-radiate spicules are situated below the Ectoderm, and do not penetrate it. Their position is irregular, their rays lie at equal angles, and appear much curved and irregular, measuring 0·05 x 0·003 mm. These spicules are not nearly so numerous as the former.

4. The Dermal tri-radiate spicules are similar to the former in shape and size; the difference lies mainly in the fact that these always possess perfectly straight rays, one of which is always situated radially, and penetrates the Ectoderm. They are found in rings around the tufts of acerate spicules near the summit of the ciliated chamber, and also intermingled with the latter.

5. The thick Dermal acerate spicules in tufts of 15—25 on the summit of each ciliated chamber stand at an angle of 45 to the axis of the Sponge, and point upward toward the Osculum; they are pointed at both ends and spindle-shaped. The thickest part is nearer the proximal end, they measure 0·5—1 x 0·01 mm.

6. The slender Dermal acerate spicules are of the same length as the former, but only 0·003 thick. They are rare, and situated in the tufts between the others.

7. The acerate spicules of the Oscular frills are similar to those in the chamber tufts, but larger.

The upright ones are slightly curved, the convex side towards the axis; they are pointed at both ends, and measure 1·5—2 x 0·015—0·02 mm.

The lower frill is composed of spicules similar to the slender acerate ones of the tufts; these are slightly curved, the convexity towards the basis of the Sponge, and measure 0·5—1 x 0·004.

DEVELOPMENT.

I have traced the postembryonal development, or metamorphosis, as it may be termed, of Homoderma.

The young Sponge is cylindrical, with short acerate spicules distributed equally all over the surface, and presents, therefore, the same outer appearance as the Spongorhiza.

There is a slight trace of an Oscular frill visible.

It grows in size without changing its shape, but developes the two frills of the Osculum. All this time the inner surface is perfectly simple. Our Sponge is an Ascon.

With the development of the first excresences of the Entoderm, when in the centre of the Sponge, a few chambers make their appearnce; tufts of spicules also appear on the surface

More chambers and tufts are developed; the Sponge grows, and the Oscular frills attain the large size we find in the adult. The small, equally distributed spines of the young, are then only found in those parts of the Sponge which do not contain ciliated chambers.

The Sponge has attained the structure of the full-grown adult when it is 2 mm. high.

Colour: Light yellow.

Locality: South Coast of Australia, Port Phillip, Victoria.