

quantity during the male sexual maturity, and diminish subsequently in amount, not only relatively but absolutely. Nevertheless, I only wish to indicate a possibility; it seems a more probable supposition that these urinary concretions originate in the blood and are deposited in the wall-less blood-lacunæ, the most important of which indeed run along the intestine. The decrease of these pigment-secretions coincides with the commencement of the sedentary mode of life, and therefore also with the complete change of nourishment, and may consequently be caused thereby instead of by the disappearance of the fatty body.

That the rectal vesicle produces a strongly smelling substance, as Fraisse asserts, may be correct; but I cannot confirm it, as unfortunately (or shall I, as a zoologist, say fortunately?) I possess a very feeble sense of smell.

The other internal organs of the *Cryptoniscidæ* show no great differences from those of the *Bopyridæ*; what there is to be said about them and about the details of the external organization I reserve for my monographic publication.

II.—On the *Spongia coriacea* of Montagu, = *Leucosolenia coriacea*, Bk., together with a new Variety of *Leucosolenia lacunosa*, Bk., elucidating the Spicular Structure of some of the Fossil Calcspongiae; followed by Illustrations of the Pin-like Spicules on *Verticillites helvetica*, De Loriol. By H. J. CARTER, F.R.S. &c.

[Plate I.]

IN 1871 ('Annals,' vol. vii. p. 278) I gave a nomenclatural account of Montagu's *Spongia coriacea* = *Grantia clathrus*, Sdt., = *Leucosolenia coriacea*, Bk., = *Clathrina clathrus*, Gray, under the last name, which was subsequently changed by Hæckel into *Ascetta clathrus* ('Die Kalkschwämme,' vol. ii. p. 30), and now I propose to add the result of a structural examination, chiefly on living specimens, of this calcsponge from this place, viz. Budleigh-Salterton, South Devon.

In limine, however, it is necessary to clear up the confusion that has arisen from Hæckel having made a separate species of Schmidt's *Grantia clathrus* under the name of *Ascetta clathrus*, with a different form of spicule from that which Schmidt has given as characteristic of it (Spong. Adriatisch. Meeres, Suppl. p. 24, Taf. iii. fig. 3 a), and which accords with that

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of all the other authors mentioned but Hæckel, who, instead of an equilateral triradiate with straight arms, obtusely pointed, has given one with undulating rays, which are inflated at the ends (*op. cit.* vol. ii. p. 36, Atlas, Taf. v. figs. 3 *d-f*). Now had Hæckel offered any explanation of this with reference to Schmidt's original announcement, one could have understood the discrepancy; but he neither refers to Schmidt's characteristic figure of the spicule of *Grantia clathrus* (*l. c.*), nor does he use the specimens which Schmidt gave him in 1868 (*op. cit.* vol. ii. p. 32), but gives the result of his examination of those which he himself found in the spring of 1871 on the coast of the island of Lesina, in the Adriatic Sea, as typical of *Ascetta clathrus* (*ib.* p. 33). Thus we have to choose between Schmidt's published figure of his *own* specimen in 1864 and Hæckel's of *his own* in 1872, in which dilemma it is evident that the latter could not have been *Grantia clathrus*, and therefore that Hæckel had no reasonable grounds for making it so. Hence the species at Budleigh-Salterton, being the original *Spongia coriacea* of Montagu, must be viewed as Schmidt's *Grantia clathrus* of 1864, and *not* as Hæckel's *Ascetta clathrus* of 1872; while as Gray's genus "*Clathrina*" is founded on *Clathrina sulphurea*, = Schmidt's *Grantia clathrus*, which, again, is equal to *Leucosolenia coriacea*, Bk., and occurs here, as elsewhere, occasionally under sulphur-yellow and scarlet colours respectively, we must adopt Bowerbank's or Gray's names for the whole; and as that of the latter is most expressive of the anastomosing tubular structure of *Spongia coriacea*, Mont., while it does not indicate any particular colour or contain any other different structure, such as *Leucosolenia botryoides*, Bk., which is simply *branched* ('Die Kalkschwämme,' Atlas, Taf. ix. fig. 10), it is evident that "*Clathrina*" is the most preferable, as the original generic name of Montagu, viz. "*Spongia*," must necessarily be changed by some one.

Of all the sponges growing on the rocks here that I have seen, no species is more strikingly beautiful than Montagu's *Spongia coriacea*, which, when fresh and extending over an area of about four square inches, presents itself under the form of a reticulated structure of an icy-white colour, in which the reticulation is only just visible to the naked eye, but, when magnified, contrasts favourably, as it veils the dark rock beneath with the most chaste and exquisite network that could be produced artificially. No representations of it hitherto do it full justice in this respect, least of all those of Johnston and Bowerbank.

This network is composed of a hollow anastomosing thread or fibre of variable diameter, whose interstices or meshes (for a parallel illustration of this meshwork see the body of *Leucosolenia lacunosa*, var. *Hillieri*, Pl. I. fig. 2, *a, f, g*) are subject to infinite variety both in size and shape throughout the specimen, which, when large, thins out from a massive variable amount of thickness in the centre, seldom more than 2 or 3-12ths of an inch, to a single reticulated layer at the circumference. These thickened centres are numerous in a specimen about the size mentioned, and form several little monticular elevations scattered over the surface, whose summits respectively end in a little short open tube with naked margin, which is continuous with the neighbouring branches of the hollow thread-work, and thus forms an osculum or vent to this part of the sponge (see also Pl. I. fig. 3), while the other ends of the thread are blind and attached to the rock over which the sponge may be growing. So that the hollow of the reticulated thread is homologous with the cloacal cavity of the other forms of Calcisponges.

If we follow the development of this structure from the youngest form that can be seen, viz. that which has just come from the embryo, it will be found to consist of a simple erect sac, whose upper end is open and whose lower one is attached to the rock on which it may be growing. This is the commencement of the hollow thread out of which the largest specimen is finally constructed. It may now be about 1-30th inch long by 1-120th inch broad, narrowing to a point at the fixed end. Such are the measurements of the smallest forms which are just now (April 10th) to be seen of all sizes and all stages of development on the rocks at "Straight Point" here, where the species grows abundantly. In the next stage the sac sends out a tubular bud, which may also descend to the rock, and then, as the individual grows upwards and outwards, other similar buds are put forth which either descend to the rocks for fixation or otherwise anastomose with each other, until at last the reticulated structure first described is attained; but how the anastomosis is effected, that is, how the loops are formed, I have not been able to perceive.

Thus the development is very simple, although the adult form appears to be so complicated, and the reticulated structure not by any means confined to *Grantia clathrus* alone, but common to a great many different species of Calcisponges, of which the beautiful little *Leucosolenia lacunosa*, Bk., of the British shores is a stipitate form and also of different spiculation; still, whatever the spiculation may be, the soft parts

appear to be similar in all. *Grantia clathrus* consists simply of the spicular structure, the spongozoa (Geisselzellen), and the granuliferous sarcode (syncytium, Häckel).

The form of the spicules or skeletal support, which are chiefly situated in the outer part of the wall of the hollow thread, is of one kind only, viz. equiangular and equiradiate, with simple straight rays, obtusely pointed, as already mentioned.

The spongozoa do not appear to differ in form from those of the other Calcispongiæ, but instead of being arranged in juxtaposition around the interior of globular or sacciform cavities, with their respective cilia projecting into the interior, they appear to form in juxtaposition a continuous layer throughout the inner surface of the tubular thread after this manner.

The "granules" of the sarcode, however, are very remarkable from their size and dominant presence; and although they accompany the transparent sarcode everywhere, they appear when *in situ* among the spicules and spongozoa to be loosely grouped around a delicate nucleated cell respectively, the "Kern" of Häckel.

It is now thirty-five years ago that I gave an illustrated description of this granuliferous sarcode in *Spongilla* ('Annals,' 1849, vol. iv. p. 91, pl. iv. fig. 2, *a-f*) in the living state; and as this seems to apply very nearly to that of *Grantia clathrus* (so far as the dead state of the latter goes in a preparation to be presently mentioned), I will here quote the original paragraph, viz. :—

"If a seed-like body [statoblast] which has arrived at maturity be placed in water, a white substance will, after a few days, be observed to have issued from its interior through the infundibular depression on its surface, and to have glued it to the glass; and if this be examined with a microscope, its circumference will be found to consist of a semitransparent substance, the extreme edge of which is irregularly notched or extended into digital or tentacular prolongations precisely similar to those of the protean [*amæba*], which, in progression or in polymorphism, throws out parts of its cell in this way (pl. iv. fig. 2, *dd*). In the semitransparent substance may be observed hyaline vesicles of different sizes contracting and dilating themselves as in the protean (fig. 2, *ee*), and a little within it, the green granules so grouped together (fig. 2, *ff*) as almost to enable the practised eye to distinguish *in situ* the passing form [polymorphism] of the cells to which they belong; we may also see in the latter their hyaline vesicles with their contained molecules in great commotion, and

between the cells themselves the intercellular mucilage" [syncytium of Häckel].

One cannot help observing here that, as the illustration to the paragraph represents, the "granules" appear to have been dragged off their cells (Kerne), to become scattered in the pseudopodial sarcode, which thus also appears to be as homogeneous as that of an *Amœba*. Yet it seems questionable whether the cells from which this apparently homogeneous sarcode has been derived do not still retain their individuality, seeing that, in the conjugation (zygosis) of two Rhizopods, they with their granules appear to flow together as intimately as two drops of water, that is, their individuality becomes lost; they put forth their pseudopods afterwards as if thoroughly amalgamated; and yet, after a little while, they separate and appear to be the same in every respect as they were before the conjugation. Or, these cells and their accompaniments can unmake and remake themselves as the occasion may require and with the materials that are nearest,—so inexplicable are the phenomena manifested by polymorphic sarcode!

Such facts would lead us to infer that the syncytium is composed of a congeries of polymorphic cells, which thus simulate a homogeneous substance, just as Rostafinski, and previously to him his teacher, A. de Bary, I think, has stated respecting that wonderful moving fungus *Æthelium*, viz.:—That "the contents of the spores at the time of germination, give rise at first either to a naked zoospore provided with a nucleus, a contractile vacuole and long cilia [? two], or to an amœboid. These zoospores or amœbæ flowing together in masses give rise to mobile plasmodia" (Rostafinski, Dr. J., 'Monografia Sluzowce,' p. 83, in Polish, 1875; ap. Cooke, 'Myxomycetes of Great Britain,' p. 1); while in my observations on *Æthelium* at Bombay in 1861 these apparently homogeneous masses or plasmodia evinced, during the restless unceasing changes in form of the fungus, the power of moving about and running together like so much water, of constricting themselves isthmus-like almost to separation, of flowing back together again, of spreading themselves out dendritically, and finally of ending in a motionless, circular, convex mass, which soon became a heap of black-brown spores!

Returning to the syncytium of *Grantia clathrus* one finds the granules so much more strikingly developed relatively here than in the other forms of Calcisponges, that one cannot help questioning their nature and import.

Taking the granule singly, it is spherical, translucent, and glairy, glistening from refraction of light, of a faint yellow

tinge, and varying under 1-6000th of an inch in diameter, although rarely attaining this size in this state. They are, when *in situ*, congregated round a nucleated cell (the "Kern") which is often so indistinct here as to be very difficult to see, owing to its delicate (? polymorphic) structure and the opaque mass which the granules form when closely applied to it in juxtaposition; or they are scattered throughout the syncytium in the same way as in the Foraminifera, as the "preparation," to which I have before alluded, which was made after Schultze's method, described by him in his examination of *Euplectella aspergillum* ('Challenger' Reports, separate copy, p. 5), plainly shows, where the granuliferous protoplasm or syncytium can be seen in a reticulated branched form extending across the cavity of the tubular thread, very much like that of *Gromia oviformis*, represented by Max Schultze in his "Organismus d. Polythalamien" (1854, tab. i. fig. 1). So that one feels inclined to infer that, excepting for its spicules and the spongozoa, the sponge would be very nearly allied to a Foraminifer in this respect.

Iodine does not turn them purple, nor does liquor potassæ dissolve them; but strong nitric acid appears to destroy their sphericity, which may be brought back again by the addition of liquor potassæ. This glairy refractive appearance gives them the aspect of fat or albumen; while, like the green granules in *Spongilla*, they appear in the sulphur-yellow and scarlet varieties of *Grantia clathrus* to be the seat of these colours respectively, when they might be termed "pigmental." It is possible that they grow into the larger cells of the protoplasm (the "Kerne"), from which they appear to be derived, when they may fulfil other offices; for Lieberkühn has long since shown that the "Körperparenchym," = syncytium, can enclose and extract nourishment from Infusoria in the same manner as "*Actinophrys sol*" (Müller's Archiv, 1857, Heft iv. p. 388). So the particles of wood taken into the plasmodia of *Æthalium* indicate the same consequence. But whatever the office of the granules may be no one as yet has demonstrated beyond conjecture what they are or what purpose they may subservise either in the sponges or in the Rhizopoda,—so they are still called "the granules."

The canal-system consists of the usual inhalant and excretory divisions: the former of minute pores which can only be seen by the microscope on the outside of a dried well-preserved specimen, where they are bordered by the granuliferous sarcode or *syncytium*; here, too, probably, in the living state, composed of a congeries of *distinct nu-*

cleated granular cells or bodies like the "investing membrane" of *Spongilla*, which in combination there appeared to me to have the power of opening and closing a pore wherever they liked (see "Ultimate Structure of *Spongilla*," 'Annals,' 1857, vol. xx. pp. 24, 25, pl. i. figs. 6, 7); the "Wanderzellen" or migrating, amœboid cells of Schulze (Zeit. f. w. Zool. 1878, Bd. xxx. S. 409 &c.);—and the latter or excretory division, consisting of the general tubulation of the reticulated thread, opening in the way and at the vents mentioned; homologous with the cloaca in the other forms of the Calcispongiæ, as before mentioned.

The process of reproduction by ova &c. is probably the same as that of the other Calcispongiæ; but in the hope of determining this as well as when the elements of reproduction begin to appear, I have gathered living specimens of *Clathrina coriacea*, *Grantia compressa*, and *Grantia ciliata*, var. *spini-spiculum* (being together), from the "Rocks" here every full moon (*i. e.* the "springs"), since the 11th of March last inclusive, at which time I could see no trace of these elements in either of these species. They began to appear in the two latter on the 10th of April, and were strikingly developed, especially in *Grantia compressa*, on the 12th of May, but not advanced then beyond the unsegmented stage. In *Clathrina coriacea* no trace had then appeared; nor is there any now on the 9th of June, although the fragments (taken from different localities) were placed in pure spirit directly they were taken off the "Rocks," which preserves the collar and the cilium of the spongozoa in their extended state. It is therefore plain that *Clathrina coriacea*, in point of time, does not develop its ova and spermatie cells so soon as *Grantia compressa* and *Grantia ciliata*, var. *spini-spiculum*. My observations on the former in this respect for the other summer months will be communicated hereafter.

As before stated, the general structure of *Clathrina coriacea* = *Grantia clathrus* &c., that is, the reticulation formed by the continuous anastomosing of a hollow thread-like fibre or tube, is common to many Calcispongiæ, which Hæckel has divided according to their spiculations respectively, so that they appear in several genera of the first two families of his "natural system," viz. the "Ascones" and "Leucones;" but of themselves they equally form a natural group in general structure as distinct as it is totally different from that of the other Calcispongiæ, that is, the *anastomosing reticulation*. Moreover, the little Australian calcisponge which I have described and illustrated under the name of *Leucetta clathrata* ('Annals,' 1883, vol. xi. pl. i. figs. 13–17) must form the

type of a division of this family, in which the anastomosing thread-like fibre is *solid* instead of *hollow*—a form entirely absent in the “Kalkschwämme” of Hückel, but one of much interest, as I have heretofore shown, in elucidating the structure of some of the fossil Calcispongiae, which I hope to still further advance by a description of the following new variety of *Leucosolenia lacunosa*.

Leucosolenia lacunosa, Bk., var. *Hillieri*, Crtr.
(Pl. I. figs. 1-5.)

Small, stipitate, erect; body globular, obconic, rather compressed and turned to one side; stem cylindrical and long, rather bent upon itself and compressed in its upper part. Body not hollow, but composed throughout of massive clathrous structure; stem solid (Pl. I. figs. 1, 2). Colour pale yellowish white. Consistence firm, resilient in the head, hard and unyielding in the stem. Clathrous structure or network (fig. 2, *g*) consisting of a mass of reticulated anastomosing thread-like tube (fig. 2, *f*) issuing from the stem in several divisions (fig. 2, *d*), and terminating in the summit by a central dilatation into which the neighbouring branches of the reticulated structure are gathered together centripetally (fig. 3, *b*), finally opening by a single naked aperture more or less protruded, which is the osculum (figs. 2 *b* and 3 *a*). Pores minute, in the wall of the tubular structure. Stem consisting of a compact solid mass of spicules, compressed in its upper part, which is expanded scopiformly into the “divisions” mentioned (fig. 2, *d*), which, being solid like the stem at first, pass respectively by transition into the tubular form which characterizes the structure of the body (fig. 2, *a*), terminating below in a root-like expansion which is fixed to the object on which the sponge may be growing (fig. 2, *e*). Structure and composition of the wall of the reticulated fibre the same as that of *Clathrina coriacea* just mentioned, only the meshes of the network are elongated vertically, which of course is followed in direction by the branches of the tubular thread, *i. e.* from the stem to the summit. Spicules of three forms, viz.:—1. Triradiate, equiangular, inequiradiate, rays straight, smooth, rather obtusely pointed, the longest, which in the largest of these spicules is three or four times longer than either of the other two, directed backwards (fig. 4, *a*); the rest infinitely variable in size generally and in the unequal length of their rays, some nearly equiradiate (fig. 4, *b*); longest ray of the larger triradiates (fig. 4, *a*) about 48-6000ths inch long by 2-6000ths inch broad at the base. 2. Linear, acerate in appearance, but

consisting of two unequal portions divided by a slightly inflated *node* which belongs to the longest part, and is therefore a little excentric (fig. 5, *c*); divisions smooth, but more or less varying in thickness here and there, especially towards the ends, which are obtusely pointed; one division straight and the other a little curved so as to form a very slight angle with the straight one; largest average size about 91-6000ths inch long by 2-6000ths inch broad (fig. 5, *a*). 3. Linear-vermiculate, smooth, attenuated towards the extremities, which are pointed; divided like the foregoing by an excentric *node* (fig. 5, *cc*); amount of vermiculation and total length very variable, the smallest perhaps about 16-6000ths inch long by 1-6000th inch broad, but immeasurable generally, from the amount of contortion (fig. 5, *bb*); increasing in size and decreasing in vermiculation so as at last to reach an intermediate form (fig. 5, *d*). The triradiates are equally present in the body and stem; but the linear and vermiculate spicules are *exclusively* confined to the latter, where they form the *outer* layer and the triradiates the *axial* or internal structure; they do not begin to appear before the stem begins to divide into the branches leading to the head (fig. 2, *d*), and then go on increasing in number and robustness, although not in length, down to the root-like expansion or oldest part, as is usual in most sponges. Size of largest specimen (fig. 1) 9-12ths inch in total length, of which the body is 3½-12ths, and the stem the rest, viz. 5½-12ths inch; greatest diameter of the body about 3-12ths inch, that of the stem close to the body 1-12th, and that towards its base 1-24th inch.

Hab. Marine; growing on hard substances.

Loc. Ramsgate pier, Ramsgate.

Obs. Independently of the interest attaching to this sponge as a variety of *Leucosolenia lacunosa*, Bk., it is still more interesting as presenting a spiculation and structure which reveal the nature of the "filiform spicules" and structure of the fibres in some of the fossil Calcspongiæ from the "Coral Rag" of Faringdon in Berkshire.

These spicules, although first represented by Zittel, in 1878, in *Peronella multidigitata* (Abh. k. bayer. Akad. d. W. ii. Cl. Bd. xiii. 2 Abth. Taf. xii. fig. 3), were just afterwards, that is in the same year, more particularly described and illustrated under the above name, viz. "filiform spicules," by Sollas ('Annals,' 1878, vol. ii. p. 356, pl. xiv. figs. 1-5); and subsequently described by myself ('Annals,' 1883, vol. xi. p. 22).

Until Zittel had kindly convinced me by a microscopic preparation of *Peronella multidigitata* from the Cretaceous

of Le Mans, that Calcsponges existed in a fossilized state, I was inclined to discredit the fact, as my actual experience of the delicate structure and perishable nature of the spicules of the Calcspongiæ then seemed to point out that their structure and spiculation was such that they must inevitably go to pieces immediately after death, and therefore that the probability of a Calcsponge becoming fossilized was very doubtful.

When, however, convinced of the error I fully expected that recent specimens would be discovered which would explain all the then anomalous structure and spiculations in the fossil ones; and the first that tended chiefly towards this was the discovery, by Dr. Hinde, that the fibre of his *Verticillites d'Orbigny* from the Upper Greensand of Warminster was composed of three- and four-rayed calcsponge-spicules, which were so far loosened by disintegration that they could be easily extricated entire, and thus viewed under the microscope, mounted in balsam or otherwise, indeed a simple lens is sufficient ('Annals,' 1882, vol. x. p. 192 *et seq.* pl. xi.). At the same time Dr. Hinde discovered in his *Sestrostomella rugosa* from the Cretaceous of Vaches Noires, near Havre (ibid. pl. x. fig. 4, and pl. xii. fig. 12, &c.), the two-pronged "tuning-fork"-shaped minute spicule first represented by Dr. Bowerbank (Mon. Brit. Spong. vol. i. p. 268, pl. x. fig. 237) from a recent calcsponge at Freemantle, in S.W. Australia, and subsequently by Hæckel in his *Leucetta pandora* from the Gulf of St. Vincent &c. in S. Australia ('Die Kalkschwämme,' Atlas, Taf. xxiii. fig. h). I was myself able also to confirm these observations respectively in *Verticillites anastomans* from the Coral Rag of Faringdon and in a specimen of *Sestrostomella* from the Jura, kindly sent me by Zittel, when I also published the illustrated description of the little calcareous sponge from Freemantle, in which the elathrous structure was shown to be formed by the reticulated union of a thread-like element similar to that of *Clathrina coriacea* and *Leucosolenia lacunosa*, but, as before stated, *solid* like the stem of the latter, and *not hollow* like the tubular thread of the head, being composed of a layer of small triradiates externally with a much larger and different triradiate-form axially or within ('Annals,' 1883, vol. xi. p. 33, pl. i. figs. 13-15); and now I have had the opportunity of describing one from the coast of England, in which the "filiform spicules," together with the *solid* fibre in the fossil species, also receive an explanation from a recent species.

The specimens of this sponge, which are in spirit, were gathered on the pier at Ramsgate by Mr. Hillier, after whom I have designated the variety, and presented to me by Mr.

B. W. Priest in September 1882, when I thought, from their resistance and apparent durability on being handled, that had I been acquainted with them earlier I should never have discredited the fact that a calcisponge could be fossilized. Thinking, however, from their resemblance that they were specimens of *Leucosolenia lacunosa*, I put them aside under this belief; but lately I have had to examine them in connexion with the foregoing species, viz. *Clathrina coriacea*, and then I perceived that the solidity of the stem and its spicular composition were like the fibre of *Peronella multi-digitata*, Zittel, of ?*Scyphia perpleca*, Quenstedt (tab. 125. fig. 63), and of *Manon peziza*, also Quenstedt (t. 132. fig. 30), respectively; that is, that it was composed of triradiates in the centre faced by a layer of linear and vermiform spicules, each of which indicated by the kind of *node* mentioned (Pl. I. fig. 5, *c c c*) near the centre, which slightly projects, that it represented the aborted state of a third ray, and thus a modification of the triradiate.

Now, when we consider that the stem, as it approaches the body (Pl. I. fig. 2, *d*), divides into a multitude of branches, each of which, although *solid* in the first instance, becomes transformed into a *tube* to form the tubular thread of the body (fig. 2, *f*), which by branching and anastomosing produces the clathrous structure in which the linear and vermicular spicules are *entirely absent*, and that the linear and vermicular spicules thus cease to appear *where the transformation takes place*, it follows that had the branches continued *solid* like the thread of the clathrous structure in *Leucetta clathrata*, Crtr. (*op. et loc. cit.*), they would have been *identical* in spicular composition and arrangement with the fibre of the fossils mentioned, where, on account of their contortion being perhaps more generally greater than that in *Leucosolenia lacunosa*, var. *Hillieri*, the extreme thinness of the microscopic slice cutting off the bends above and below, seldom allows one to be seen entire. Indeed the more contort ones in *Leucosolenia Hillieri* during the boiling out in liquor potassæ, from this together with the brittleness of the material, for the most part, come out broken. Thus the "filiform spicules" of the fossil Calcispongiæ seem to be elucidated.

Pin-like Spicules (? parasitic) on *Verticillites anastomans*
and *A. helvetica*. (Pl. I. figs. 6-10.)

At the conclusion of my paper on the Fossil Calcispongiæ of Faringdon ('Annals,' 1883, vol. xi. p. 33) I had only just time to mention Dr. Harvey B. Holl's discovery of pin-like spicules in that variety of *Verticillites* designated "*helve-*

tica” by De Loriol; so I returned to the subject (*ib.* vol. xii. p. 26), when by having made and mounted microscopic sections myself, I was enabled to give a more detailed description of the fact, and to announce that such spicules also existed in the same position in my specimens of *Verticillites anastomans* from Faringdon; but on neither occasion had I time to illustrate this interesting discovery, which is so likely to pass unnoticed without representations, that I have availed myself of the present opportunity to fill up a vacant space with these, taken from my own preparations (Pl. I. figs. 6–10).

EXPLANATION OF PLATE I.

Fig. 1. *Leucosolenia lacunosa*, var. *Millieri*, n. var. Natural size.

Fig. 2. The same, magnified 3 diameters, to show:—*a*, body, composed throughout of massive clathrous or reticulated structure. Body not hollow. *b*, vent or osculum; *c*, stem; *d*, scopiform expansion of stem into reticulated structure of body; *e*, root-like attachment; *f*, tubular thread-like fibre; *g*, meshes of clathrate structure.

Fig. 3. The same. Summit more magnified, to show the continuity of the vent with the reticulated tubular structure of the body. *a*, vent; *b*, tubulated thread or fibre; *c e*, meshes or interstices of the reticulated structure.

Fig. 4. The same. Triradiate spicules of the body and centre of the stem respectively. *a*, largest form; *b*, smallest; *c*, dotted line, illustrative of the inequiradiate forms.

Fig. 5. The same. Substraight linear and linear contort spicules of the stem. *a*, substraight linear; *b b*, linear contort; *c c c*, nodes; *d*, intermediate form.

N.B.—All these spicules are drawn to the scale of 1-24th to 1-6000th inch.

Illustrations of the Pin-like Spicules (? parasitic) &c. on Verticillites.

Fig. 6. *Verticillites helvetica*, De Loriol. Horizontal section of the wall of a cylinder at the inflation, magnified 4 diameters, to show the structure of the wall and its hourglass-shaped openings or canals. *a*, cavity of inflated chamber; *b*, wall, apparently composed of little oval and quadrangular elements, because, in some instances, the section has passed through the hourglass-shaped canals, and in others not. Diagrammatic.

Fig. 7. The same. Vertical section of part of the wall of a cylinder at the inflation, viewed from the *inside*; magnified on the same scale, to show the structure of the wall and its hourglass-shaped openings in *this* view. *a*, wall, *now* seen to be continuous and not formed of separate elements, as the foregoing figure apparently represents; *b*, inner opening of the hourglass-shaped canals, with a dot in the centre, to represent the narrow part. Diagrammatic.

Fig. 8. The same. Horizontal section of two of the so-called “oval elements” with the hourglass-canal between them filled with sand; magnified on a scale of 1-24th to 1-1800th inch. *a*, outside of inflation; *b*, inside; *c c*, so-called “oval elements,” composed of homogeneous crystalline calcite, with minute fibrous

structure (? product of fossilization); *d*, hourglass-shaped canal filled with grains of quartz-sand; *eee*, pin-like spicules in the "calcite," arranged around the funnel-shaped openings of the hourglass-canals outside respectively, as will be better understood by the next figure, but here only seen in the section, where they may be observed to slope inwards with the *head externally*; *ff*, row of triradiate spicules in the "calcite" within the pin-like spicules. Diagrammatic, with the detail relatively magnified.

Fig. 9. The same. Pin-like spicule, more magnified, to show its shape and relative proportions.

Fig. 10. The same. Vertical section of a portion of the wall at the inflation, viewed from the *inside*, magnified to the same scale (see a less magnified portion, fig. 7). *aa*, wall composed of the homogeneous crystalline calcite with minute fibrous structure before mentioned; *bbb*, constricted parts of the hourglass-shaped canals, respectively filled with quartz-sand, also as before mentioned; *ccc*, position of the triradiate spicules in the wall around the hourglass-canals, shown by their truncate ends; *d*, part of the slice where the layer of triradiates has been ground off, showing that *eee*, the cross-sections of the pin-like spicules, are in circles, indicative of their infundibular mode of arrangement around the external openings of the hourglass-shaped canals. Diagrammatic, with the detail relatively magnified.

III.—*Some Remarks upon the Variability of Form in Lubomirskia baicalensis, and upon the Distribution of the Baikal Sponges in general.* By Dr. W. DYBOWSKI*. With P.S.S. by H. J. CARTER, F.R.S. &c.

[Plate II.]

DURING the printing of my memoir on the sponges of Lake Baikal †, I received from Irkutsk, from my brother Dr. Benedict Dybowski, a photographic representation, prepared by him, of *Lubomirskia baicalensis*, and also a communication upon the general occurrence and distribution of sponges in Lake Baikal. These notes possess no little scientific interest, and may therefore serve to complete my memoir, so that I regard it as advisable to publish them as a brief supplement to my work above cited.

* Translated from a separate copy, communicated by Mr. Carter, of the paper published in the 'Bulletin de l'Académie des Sciences de St. Pétersbourg,' tome xxvii. pp. 45-50.

† W. Dybowski, "Studien über die Spongien des russischen Reiches mit besonderer Berücksichtigung der Spongien-Fauna des Baikal-Sees," in Mém. de l'Acad. des Sci. de St. Pétersb. sér. 7, tome xxvii. no. 6 (1880).

