the thorax, convex above, distinctly punctate-striate, the punctures rather large, remote, angulated, the lateral interstices tuberculated, obsoletely rugose on the back, totally black and shining. Body black beneath, granulated and cinerco-pubescent anteriorly; abdomen punctulated. Legs rather long, stout, black; femora robust, clavate, simple; tibiae pilose; tarsi dilated, piceous, clothed beneath with a flavescent pulvillus. Length 5 lines.

This insect may be placed in the genus next to *Otiorhynchus tenebricosus*, to which it is nearly related.

I have a foreign specimen of *Ot. ebeninus* of Schönherr from Germer.

Four specimens of this insect, which is new to the British fauna, were found by Mr. R. N. Greville on the west highlands of Scotland, to whose liberality I am indebted for a specimen.

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### XXXI.—Notes on the Species, Structure, and Animality of the Freshwater Sponges in the Tanks of Bombay. (Genus Spongilla.) By H. J. Carter, Esq., Assistant Surgeon*.

There are four† species of Freshwater Sponges in the Tanks of Bombay, each of which is readily distinguished by the following characters:

Two are known from the other two by the peculiar form of the spicula which encrust their seed-like bodies.

1. Is darkly cinereous or mouse-coloured when dry, purplish under water when alive, encrusting, repent, spreading in circular patches when isolated; smooth or interrupted by gentle eminences on the surface, attaining the thickness of half an inch in the centre, oscula tending towards a quineumial arrangement; texture compact, fine, delicate; structure rectangularly reticulated; friable. Seed-like bodies spherical, 1-67th of an inch in diameter. Spicula of two kinds, large and small; large spicula smooth, slightly curved, pointed at each end, 1-80th of an inch long; small spicula straight or slightly curved, thickly spiniferos, 1-400th of an inch long.

2. Is of a faintly yellow or bright green colour, encrusting, repent, spreading in irregular patches on fixed bodies, globular when surrounding a floating nucleus; even or interrupted by gentle eminences on the surface when fixed, presenting meandering ridges and sulci when attached to floating bodies; attaining the thickness of half an inch when fixed, of two inches when floating; texture coarse and open, structure rectangularly reticulated with a suberose crust slightly tenacious. Seed-like

* Reprinted from the Transactions of the Bombay Medical and Physical Society of 1847, and communicated by the Author.

† See Postscript at p. 310.
bodies spherical, 1–36th of an inch in diameter. Spicula of two kinds, large and small; large spicula smooth, slightly curved, pointed at each end, 1–57th of an inch long; small spicula smooth or thickly spiniferous, slightly curved or straight, 1–200th of an inch long. Transparent portions of investing membrane abounding in the small spicula.

3. Is of a light yellow colour, massive, spreading, convex, with short irregularly formed conical projections on the surface, or meandering ridges with sulci between them, attaining a thickness of two inches; texture fine; structure fibrous, plumose, obliquely reticulated towards the base, rectangularly reticulated towards the circumference; friable. Seed-like bodies spherical and 1–40th of an inch in diameter. Spicula of two kinds, large and small; large spicula smooth, slightly curved, pointed at both ends, 1–57th of an inch long; small spicula composed of a straight portion, sometimes slightly spiniferous, terminated at each end by a toothed disc with its points recurved or horizontal; the central portion is 1–400th of an inch long, the discs 1–600th of an inch in diameter.

4. Is of a bright yellow colour, massive, spreading, horizontal on the surface, with projecting, plumose, irregular portions, attaining a thickness of about two inches; texture coarse, loose; structure fibrous, branched, plumose, obliquely reticulated; semi-friable, may be compressed with the hand in water without undergoing much injury. Seed-like bodies ovoid, 1–28th of an inch in their long diameter, and 1–50th of an inch in their short diameter. Spicula of two kinds, large and small; large spicula smooth, slightly curved, pointed at each end, 1–66th of an inch long; small spicula 1–300th of an inch long; consisting of a straight portion, terminated by a toothed disc at each end, with its points recurved or horizontal, 1–950th of an inch in diameter. Transparent portions of investing membrane abounding in little siliceous stellated bodies, their arms projecting from a central cell, tapering to a point which ends in a stellated circle of recurved spines; they are 1–600th part of an inch in diameter.

The measurements of the seed-like bodies and the spicula are taken from the average size of the largest of their kind.

*Habitat.*—On the inclined and under surfaces of rocks, or attached to floating bodies in the tanks of Bombay; never at the bottom, and sometimes so high up as to be only covered by water three or four months in the year.

*Investing membrane.*—The investing membrane of the Freshwater Sponge, like the skin and the mucous membrane in the human body, is continuous throughout; and, like a shut sac, surrounds the parenchymatous structure and spicular skeleton of the whole mass, without inclosing it. In some instances it
abounds in spicula, as in No. 2, where they are mostly spiniferous, and in No. 4, where they are of the curious stellated form described. There are also, in addition, little sac-like bodies which are ever changing their form and vibrating particles, both of which will be hereafter mentioned. If a portion of the membrane be carefully held before the blowpipe under a red heat, the animal matter may be driven off, while the forms of the bodies mentioned appear to remain unaltered; sometimes even a siliceous skeleton of the membrane itself may remain, so thoroughly does silex pervade every portion of its structure. But there is a transparent reticulated network (probably filamentous) which can only be seen when the membrane is fresh.

Spicula.—The smooth spicula and the spicula terminated by toothed discs are hollow. In the smooth spiculum the form of its cavity may be seen by charring the animal matter which lines its interior. It will be found to be wide in the body of the spiculum, and to terminate abruptly at each end in a linear continuation. I have not been able to see it in the spiniferous spicula, on account of the number of little spines which encrust them.

The small spicula in each species are principally derived from the crusts of its seed-like bodies. In all the species the spicula are siliceous, and the largest are so much alike that they are of no use as a specific distinction.

Seed-like bodies.—The seed-like bodies are spherical or ovoid, according to the species. They all present an infundibular depression communicating with their interior; when young they are transparent and filled with minute granules like the vibrating bodies to be hereafter mentioned; as they get older, a crust of siliceous spicula, arranged perpendicularly to their surface, is secreted from their external membrane; it is from this crust that the small spicula in the different species are principally derived. In Nos. 1 and 2 they are straight, or slightly curved, and spiniferous. In Nos. 3 and 4 they are straight, sometimes spiniferous, and terminated at each end by a toothed disc; the discs of their free extremities surmount little papillary projections on the surface of the seed-like body, and they present a hole in their centre, which communicates with the cavity of the spiculum on which they are supported; their fixed ends are applied by a similar disc to the silicifying or external membrane of the seed-like body. The latter is coriaceous, and presents a hexagonally tesselated appearance, on which rest the fixed discs of the spicular crust. I could not perceive any holes in the centres of these hexagonal divisions.

Before the seed-like body arrives at its state of maturity, it is filled with minute granules suspended in a viscid transparent
fluid; afterwards these are parcelled out into spherical transparent cells, equal in size and very numerous; what becomes of them then I cannot say; but I have often observed in the reticulated structure of the dried Spongilla, a group of the spicula of the seed-like bodies, thrown together in an irregular manner, and I would infer from it, that, when the young Spongillae are sufficiently advanced to be capable of supporting an independent existence, the seed-like body containing them is burst, and all traces of it disappear, except the group of spicula mentioned;—and, for the young Spongillae, it appears to me that, some time after they have been liberated, they become stationary, and passing into the form of a seed-like body, ultimately end in being the reproductive sacs of their own species.

Most of these seed-like bodies, although they have been exposed in a piece of sponge to the direct rays of a tropical sun for a whole year, on a black dry rock, will, on being cut open, present a fresh-looking, yellow, transparent, viscid granular matter in their cavities, not unlike the yolk of a hard-boiled egg. They do not appear to possess in themselves any power of locomotion, and their being transported from place to place, or their adhering to the perpendicular or inclined surfaces of bodies, may depend upon the presence of one or more of the little animals I am about to describe.

*Animality.*—As to the animality of the Freshwater Sponge, I think there can be no doubt whatever. Look, for instance, at a ragged portion of it, torn off with a needle (under a magnifying glass of one-tenth of an inch focus), and it will be seen gradually to assume a spheroidal form; and if there be a spiculum near, it will embrace it within its substance; it may be seen even to approach it, and as it were spit itself upon it: still watch it, and it may bear away the spiculum; and then regard its circumference, and on it will be observed little papillae, which gradually vary their form, extending and retracting themselves, until one of them may be seen to detach itself from the parent mass and go off to another object. This little animal, one of the group which it has left, may remain stationary on the second object, or descend to the watch-glass, assuming in its progress all forms that can be imagined, spheroidal or polygonal, while every point of its body appears capable of extending itself into a tubular attenuated prolongation. When dead and dry on the watch-glass, it is sometimes transparent, sometimes filled or surrounded by granular bodies, and though frequently irregular in shape, its natural form appears to approach nearest to that of a Florence flask, sometimes more, sometimes less globular; it is then (though its size varies with its age) about the one-thousandth part of an inch in diameter, not including the elongated portion, which in
length is about one quarter of the diameter of the body, and apparently corrugated like the neck of the entozoon *Cysticircus longicollis*. These transparent little sacs (the gemmules of Grant and Hogg?) are sometimes filled with green matter. They appear to be able to adapt themselves to any form that may be convenient for them to assume, and when forcibly separated from each other (by tearing to pieces a minute portion of the sponge under water in a watch-glass), the isolated individuals may be seen to approach each other, and to apply themselves together in twos and threes, &c., and so on, until, from a particle only discernible by the microscope, they assume the form of an aggregate visible to the naked eye, and such a portion, growing and multiplying, might ultimately reach the size of the largest masses adhering to the sides of the tanks at Bombay. They appear to belong to the genus *Amoeba* of Ehrenberg. Dujardin has recognized them, and they are correctly figured (as they appear under a lens of one-tenth of an inch focus) in Johnston’s ‘*British Sponges*,’ p. 61; — as well as certain filaments, which the day after a piece of sponge has been treated in the way which I have just mentioned, may be seen extended from them, terminating or not in little transparent bulbs; floating, or fixed by their extremities, branching irregularly, long or short, each branch terminating or not in a bulb, and presenting similar pedicellated bulbs here and there in its course; when fixed on the watch-glass, disposed irregularly in straight lines intersecting each other, — radiating from a common centre or bulb, or in the form of an areolar membrane; frequently moniliform, as if they grew by the addition of cells to their free extremities.

The aggregated position of the animals I have described, imbedded in the transparent tissue of the sponge, bears a great resemblance to that of some of the Compound Tunicated Animals; especially in their ultimate development into a mass, intersected in all directions by canals, to allow of the presence of that element which is necessary for their existence,—the freedom they possess in the early part of their life, of moving through the water or creeping over the surfaces of solid bodies, and their ultimate destination of becoming permanently fixed in a granulogelatinous mass, secreted or formed by themselves.

There is also a curious fact connected with the vitality of the Freshwater Sponges, and I think it also prevails with the Sea Sponges, for it was by observing the latter and their seed-like bodies, in the amorphous species, that I was first led to notice it. It is, that they may be taken out of their natural element, dried, and kept for months, without losing their vitality. This I have inferred from observing the sponges attached to the rocks on the upper parts of the tanks, which are uncovered for many months
of the year (indeed the greater part of it), to be now again in the full performance of all their vital functions. I have not yet been able to prove it entirely to my satisfaction by direct experiment, but, on the sides of a finger-glass in which I placed an old dried portion of No. 1, about a month since, changing the water daily, there are now growing atoms of new sponge visible to the naked eye, and there are large portions of the original mass adhering to other objects in the same vessel; but I have not yet been able to satisfy myself of the presence of new tissue in the latter.

Supplementary note.—Since writing the above "Notes," I have had the pleasure of reading Mr. Hogg's "Observations on the Spongilla fluviatilis," &c., published in the Transactions of the Linnean Society, vol. xviii. part 3rd, wherein he advocates the opinion of its vegetable nature; but when, in support of his views, he quotes Dr. Johnston's remark on Dujardin's experiments, p. 396,—viz. that "locomotion is no proof of animality; several Algae are locomotive;"—it must of course mean such movements as do not appear to be directed by an instinctive power; for there are certain changes of form accompanying locomotion which convey an impression to the mind of the presence of a guiding influence, beyond anything that is met with in the vegetable kingdom, and which would seem to require no additional evidence to prove to the observer that he is regarding motions peculiar to animal life. Such appear to me to be evinced by the young Spongilla.

Moreover, I have ascertained by experiment, that when the transparent spherical capsules which contain the granules within the seed-like bodies (in No. 4) are liberated (by breaking open the latter under water in a watch-glass), their first act is to burst: this takes place during the first thirty-six hours; and their granules, which will presently be seen to be the true ova of a proteaniforminfusorium, varying in diameter from about the 1–4300th part of an inch to a mere point, gradually and uniformly become spread over the surface of the watch-glass. On the second or third day (for this varies), each granule will be observed to be provided with an extensible, pseudo-pediform base; and the granules, which will most of the largest may be seen slowly progressing by its aid, or gliding over the surface of the watch-glass in a globular form, by means of some other locomotive organs*. During the time that these changes are going on, the smaller granules, most of which also have an extensible base, amass themselves together in irregularly formed portions of granulo-gelatinous matter, while a few of the more matured animals, averaging 1–300th part of an inch in length when extended, may generally be ob-

* The same changes take place in the granular matter from the dried seed-like body.
served creeping about, singly or in pairs, with a number of globular bodies within them, varying in diameter from the 1–2150th to the 1–1075th of an inch; similar bodies also may be seen here and there, singly or associated together, fixed to the watch-glass by a plastic granulo-gelatinous matter, and bound down by filamentous threads (such as I have before mentioned) parting from them in different directions. After some days, from being nearly transparent in the first instance, the granular matter with which they are filled becomes more defined and evident, and as they enlarge, their circumference presents a cortical investment like that of the seed-like bodies; their colour also becomes brownish, and their circumference, from being at first smooth and defined, rough and irregular; they appear to be motionless in themselves, however much the matter contained within them may assume different shapes, and that peculiarity connected with their size and general appearance is quite sufficient to distinguish them from the granules of the matter in which they are imbedded. In the different stages of development I have mentioned, these bodies may be viewed, both within and without the more matured Protean, but, as I have not yet seen them deposited or fixed to the watch-glass by the animal itself, I am unable confidently to state that they contain its proper ova; should they prove to do so hereafter, the assumption that the animal itself ultimately passes into the form of a seed-like body may not be worth much.

The development of the ovum appears to take place in the following way:—When first liberated from the spherical cells of the seed-like bodies, it consists of an ovoid or globular sac of greenish homogeneous matter, surmounted by a red spot, and inclosed within a transparent envelope; the former then changes in shape, becomes granular, and its granules obtain a certain latitude of motion; thus transformed, it occupies and projects above the upper part of its transparent envelope, which in its turn enlarges and becomes spherical. Should the ovum in the commencement not have been firmly bound down by the filamentous structure to which I have alluded, the granulo-plastic matter, and the agglomeration of the minute vibrating bodies which accumulate around it, and which appear to be actively engaged in this part of the process, it may become vagrant; but if otherwise, it has probably become fixed for the whole period of its existence; unless, as I have observed in some gemmules when kept in distilled water, that the whole community appear to find it necessary to separate and forsake their spicular structure to go in search of food.

The form of the young Proteans from the granular matter taken from the seed-like bodies of Nos. 2 and 4 resembles P.
Mr. H. J. Carter on the Animality of Freshwater Sponges.

diffluens (Müller)*; that which chiefly accompanies No. 4 is of the figure given by Dujardin, to which I have already had occasion to allude; while the vibrating bodies themselves, when combined, take on the appearance of minute Proteans, and every particle of the fixed transparent granulo-gelatinous matter, which serves as a nidus for the whole, appears to be endowed with the power of continually extending, retracting, and altering its shape.

I have further observed, that the granulo-gelatinous transparent matter has in some places arranged itself into the forms of full-sized spicula, disposed in linear continuation, over-reaching each other side by side, just as they are seen in the fibrous structure of the old sponge; their surfaces however are not yet silicified; nor should I expect this to take place, as my experiments have been conducted with distilled water, had not Dr. Grant mentioned that siliceous spicula were formed in the gemmules of Spongilla which he nourished with rain-water.

Thus does every step towards the ultimate structure of the Freshwater Sponge, every form that is taken by the living matter of which it is composed, appear still more nearly to approximate it to the nature of the genera of Ehrenberg’s Pseudopodia.

In a subsequent communication received from the author, he observes, that he has confounded two species under the head No. 2, and that the bright green coloured species there mentioned is distinguished from all the rest by having a crust of double-pointed smooth spicula round its seed-like bodies. He supposes this to be Spongia lacustris (Linn.), Spongilla friabilis (Lam.).

Further, he observes respecting the animality of the Freshwater Sponges, that the animals of which they are but a congeries are identical with the infusorium Proteus; 1st, because they are composed of a semi-transparent gelatinous matter; 2nd, because this gelatinous matter is endowed with the power of altering its shape and of locomotion; 3rd, because in it are seen transparent cells (contracting vesicles) of various diameters from 1–9000th part of an inch to a mere point (which he formerly supposed to be sphinctral orifices), dilating and contracting themselves as in other animaleules; and 4th, because this gelatinous matter is provided with greenish yellow granules moving with, and especially characteristic of both the Proteus and the animal of the sponge.

He regards the Proteus as being more active in changing its shape, &c. than the animals of the sponge when first torn from each other, from the habits of the former having been vagrant

* Blainville, Manuel d’Actinologie (Atlas, pl. 11. fig. 12).
perhaps from the commencement and its full development thereby having been unimpeded, and states that the Proteus feeds upon its like as well as upon other matter, inclosing its food within its own substance after the manner of the Hydra.

While examining the transparent border of a portion of sponge growing from the seed-like bodies, he has observed the contracting vesicles distinctly, and a little within this, the animals themselves distinguishable, though amassed together and ever changing their form; but he does not appear to have ever seen them inclose an object within their substance after the manner of the Proteus.

In the development of the contents of the sporangia or seed-like bodies, he observes, that when the latter are opened under water in a watch-glass, the transparent cells within them, having been eliminated, swell and are bursted by the imbibition (endosmose) of that fluid; and that then the true ova of the Sponge with which they are filled, spread themselves over the surface of the vessel. Each ovum appears, not to be globular or ovoid as he formerly supposed, but discoidal, very much resembling in size and appearance the globules of the blood, it being only when they are turned on their edges that they appear ovoid. The red spot in their centre he also now thinks to be an optical illusion, while he has every reason to believe that the ovum retains its planiform state until its transparent vesicles and granules have become developed and the power of locomotion in it fully established.—Ed.

BIBLIOGRAPHICAL NOTICES.


[Continued from p. 139.]

The most interesting chapter in this interesting volume is that which narrates the history of the Hydra tuba. This marine animal is called a Hydra by our author because it has the form and the characters of the freshwater polypes, and possesses also their qualities—their greed of living prey (p. 87), their proliferous evolution of young, their endurance of privations, their power to recover from apparently immedicable wounds, and their strange germinations and monstrosities under the influence and direction of the experimenter (p. 93). This hydra is found attached to submarine bodies; the body is fleshy, inversely conical, encircled on the oral disc with