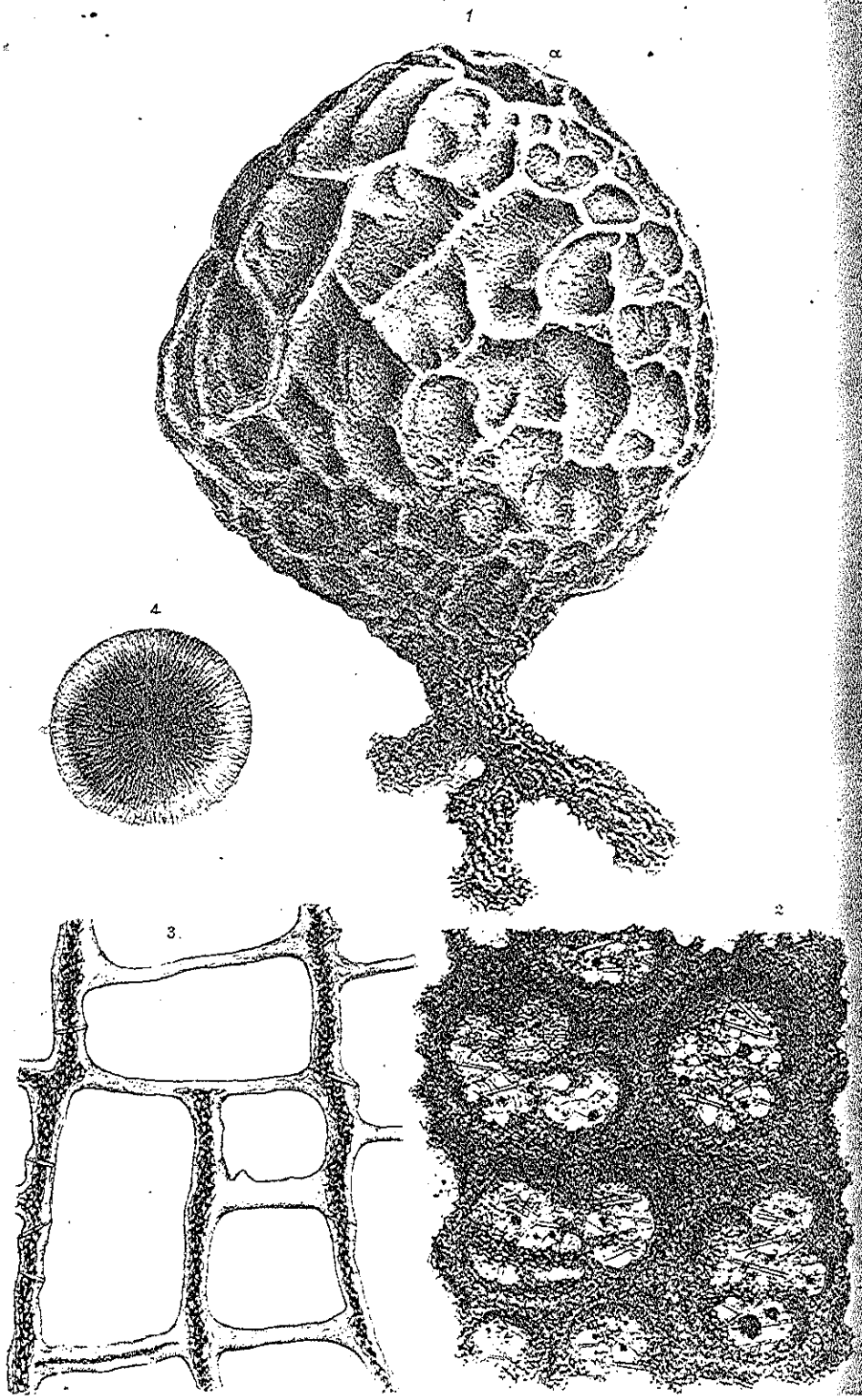


February 6, 1872.

R. Hudson, Esq., F.R.S., V.P., in the Chair.

The following papers were read :—

1. Contributions to a General History of the Spongiadæ. By J. S. Bowerbank, LL.D., F.R.S., &c.—Part I.

[Received January 15, 1872.]

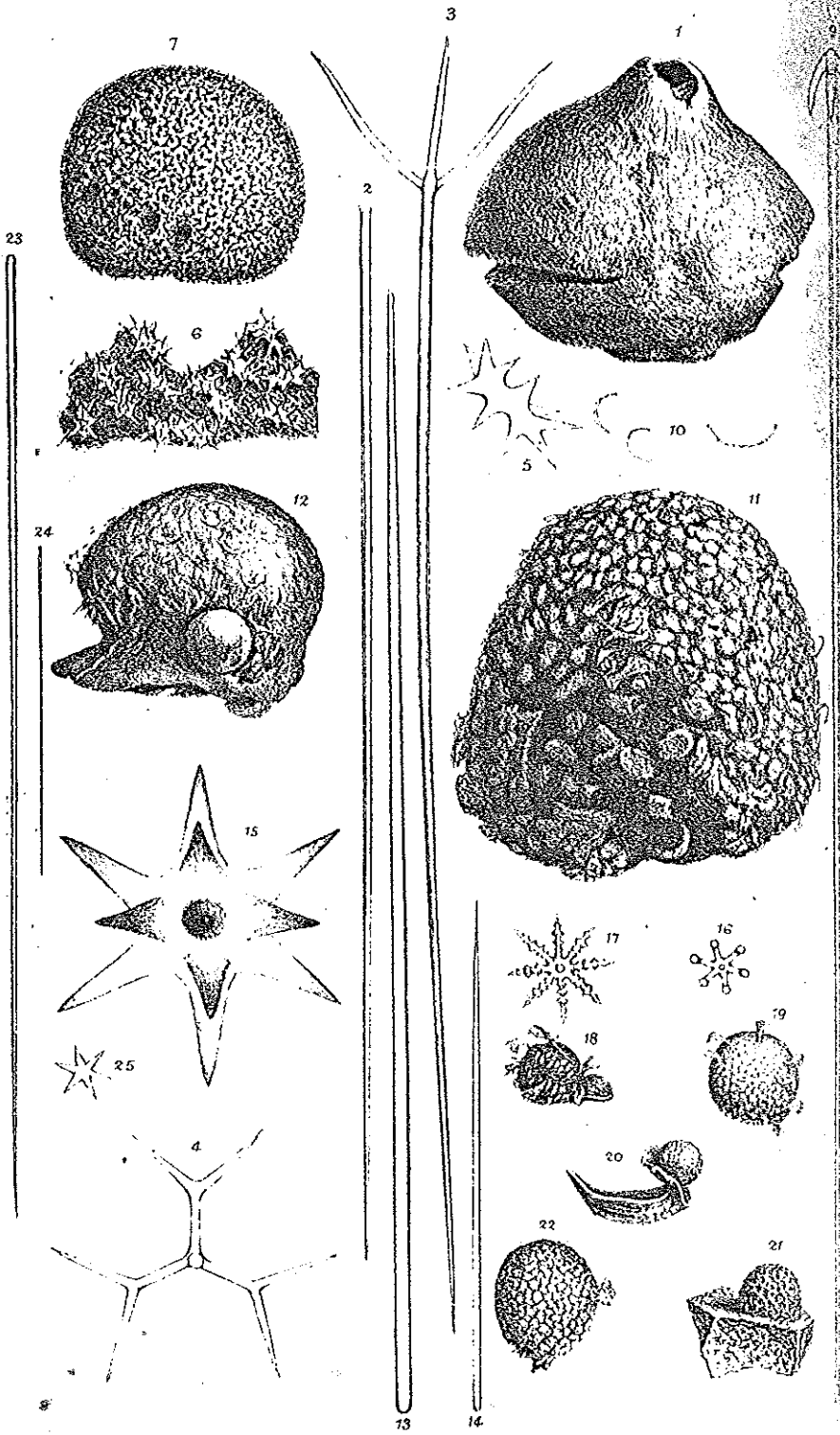
(Plates V. & VI.)

Genus Tethea.

Tethea is eminently a natural genus; the generic characters are well maintained in all the species with which I am acquainted. There is always the same radiation of skeleton-fasciculi from the base or centre of the sponge; and this radiation is rarely in a straight direction, but almost always in lines more or less curved, giving a greater amount of resistance to any attempt to rend the substance of the animal asunder. Their defences against the attacks of smaller enemies are also beautifully apparent and exceedingly varied, so as to enable us to discriminate species with certainty by the combinations of the various forms of their spicula, which are evidently designed by nature to offer a passive resistance to every class of enemies to which they may be exposed. Thus the powerful primary defensive spicula of the surface, bristling at every part to meet the attacks of their larger assailants, render them any thing rather than an agreeable prey to any fish disposed to make a meal off them. When the larger external defensive spicula are not present, their places are usually supplied by an abundance of large and strong sphero-stellate spicula with sharp and powerful radii, as in *T. Ingalli* and in our British species *T. lyncurium*. The innumerable small but acutely pointed stellate spicula usually imbedded in the dermis and scattered over the surfaces of the interstitial membranes provide in an especial manner against the attacks, both externally and internally, of the small annulate and other creatures that would otherwise be prone to feast on their membranes and sarcode. The beauty and completeness of these conservative contrivances of nature for the preservation of these inert and humble creatures are wonderfully illustrative of the wisdom and beauty of creation.

Tethea muricata, Bowerbank.

Sponge spherical, subconical, sessile; surface even, minutely hispid. Oscula terminal. Pores congregated; porous areas exceedingly numerous. Dermis thin, abundantly furnished with stout clongo-attenuato-stellate spicula. Connecting spicula attenuato-expando-ternate-simple and bifurcated, very large and long, numerous; also recurvo-ternate, long and slender, and, rarely, spiculated



Tethea muricata 1–6. T. unca 7–10.
T. Ingalli. 11–17. T. norvagica 18–25.

Del. et lith. W.L. Aldous

W. West & Co.

recurvo-ternate ones. Skeleton-spicula fusiformi-acerate, large and long, and the same form long and slender.

Colour in spirit dark dull green.
Hab. Hammerfest, 150 fathoms (*R. M'Andrew, Esq.*).
Examined in the wet state, in spirit.

I received this and two other species of *Tethea* from my friend Mr. M'Andrew in 1855 as a portion of the results of his dredging off the coast of Norway during that year. On examining and describing its structure I discovered in its dermal membrane the interesting and beautiful elongo-stellate form of spiculum which I subsequently figured in the first part of my paper "On the Anatomy and Physiology of the Spongiadæ" in the 'Philosophical Transactions of the Royal Society' for 1858, plate 25. fig. 18; and in the second part of the paper in the Phil. Trans. for 1862 I also figured a portion of the dermal membrane with the same forms of spicula *in situ* in plate 31. figs. 14 and 15, designating the sponge from which the figures were derived *Tethea muricata*.

The condition of this specimen is remarkable. It has two deeply incised wounds in a horizontal direction, the interior surfaces of which are healed and covered by a new portion of dermal membrane. The fractures are on two sides of the mass and are opposite to each other, as if an attempt had been made by a fish to tear it from the base on which it was seated, but, not liking the mouthful of sharp spicula, had abandoned the attempt. There are also two uninjured parts of the sponge-surface opposite to each other; the largest of the two is represented in Plate V., the smaller one on the other side does not exceed four lines in length.

The hispidation of the surface of the sponge is not apparent to the eye, but it is readily sensible to the touch of the finger. It is produced by the expanding radii of the large bifurcating ternate heads of the connecting spicula. These organs, which perform the double office of connecting and external defensive spicula, are, comparatively speaking, exceedingly large: they are from $\frac{1}{6}$ to $\frac{1}{5}$ inch in length, with a diameter near the head of $\frac{1}{250}$ inch; and the expansion of the ternate heads frequently exceeds $\frac{1}{12}$ part of an inch. These measurements apply to fully developed spicula; they vary to a great extent in size; and the mode and extent of the production of the ternate heads are also exceedingly variable.

There is one large terminal osculum, which appears to be permanently open, and beneath which all the excurrent canals are concentrated. The dermal membrane and the porous system are exceedingly interesting and beautiful. A small piece of the dermis is represented by fig. 6, Plate V. The areas of the dermal network are not open; they are each furnished with a very transparent membrane, upon which a few spicula may occasionally be seen. I could not detect any open pores. The elongo-stellate spicula are exceedingly numerous on the dermal membrane: there are also a few of them scattered on the interstitial membranes near the surface of the sponge; but they are of very rare occurrence on the deeper-seated portions of those

organs. The skeleton-fasciculi contain comparatively few spicula. They vary considerably in size; a portion of them are very large and long, frequently exceeding $\frac{1}{4}$ inch in length with a diameter of $\frac{1}{250}$ inch. The smallness of their number is compensated by the intermixture in their fasciculi of the stout long shafts of the ternate connecting spicula; and the interstices of these larger organs are frequently filled in with smaller and more attenuated skeleton-spicula, rendering the whole skeleton firm and compact.

The recurvo-ternate spicula are comparatively few in number; their apices rarely reach quite to the dermis; and, as in other genera in which they occur, their office appears to be to act as defences in the intermarginal cavities. The slender spiculated recurvo-ternate ones are of rare occurrence.

The basal portion of the sponge is furnished with a few soft flexible radical processes, about $\frac{3}{4}$ inch in length. They are apparently prolongations of the skeleton-fasciculi of the sponge, and are composed of the same description of spicula, but very slender in their proportions; among them there were a few small recurvo-ternate spicula, and their ternate heads were frequently in opposite directions. Apparently these spicula are thus present in accordance with the laws of production existing in the animal, and not to assist in any manner in the attachment of the sponge to the spot on which it is based. There were also a few very immature expando-ternate bifurcating spicula, apparently quite as much out of place as the recurvo-ternate ones. The same description of appendages, but stouter and stronger, are found at the base of *Tethea lyncurium* when the necessities of the animal require their presence.

Mr. W. Saville Kent has described a mutilated specimen of this species in the 'Monthly Microscopical Journal' for 1870, p. 203, under the designation of *Dorvillia agariciformis*. The upper portion of the sponge has evidently been torn away from its basal one, causing the part described to assume a form very much like that of an Agaric; and the under surface of the specimen, having secreted a new dermal membrane, has contributed greatly to the deception that it was a natural form of the animal. The perfect secretion of a new dermal membrane to cover the torn surface is a natural operation that in other sponges frequently takes place within twenty-four hours of the infliction of such a wound; and the new membrane in due course would secrete the stellate spicula which are natural to that organ. The filiform appendages at the base of the specimen figured by Mr. Kent have very much the appearance of being some of the skeleton-fasciculi of the sponge drawn out of the basal portion at the time of its mutilation.

In treating of the spicula, the author has fallen into the error of describing some of those organs that do not belong to the species under consideration. In the plate accompanying his paper the figures 1 to 9 and fig. 13 certainly belong to his *Dorvillia agariciformis*, fig. 13 being a tortuous specimen of a skeleton-spiculum, the normal form of which is straight or very slightly curved. The figures 10, 11, 12, 14, 16, 17, 18, and 19 are certainly extraneous

spicula, several of them apparently belonging to siliceo-fibrous sponges. The occurrence of extraneous spicula on such sponges is by no means an uncommon occurrence. On the piece of the dermis of my specimen I mounted for figuring in 1855 I found several extraneous spicula, of forms different from those figured by Mr. Kent, and one of the form represented in his plate by fig. 18.

It is a good rule never to regard any spicula that may be obtained by the dissolution of a piece of the sponge in nitric acid and mounting in Canada balsam as belonging to the species, unless they can be detected *in situ* in a thin slice of the sponge made at right angles to its surface and mounted in the same material. There are very few mountings of sponge-spicula from almost any species of recent sponge in which spicula not belonging to it may not be detected; and these are derived not only from the surface of the animal, but occasionally also from its interior, in which they have been imbedded in an early stage of its development; and in some genera naturally given to the appropriation of extraneous materials they are frequently very numerous.

TETHEA UNCA, Bowerbank.

Sponge spherical, sessile. Surface smooth and even, minutely dotted. Oscula and pores inconspicuous. Dermis thin, pellucid, furnished abundantly with very minute, simple, and contorted bihamate spicula, variable in size and form. Skeleton—spicula fusiformi-acerate, large, and long, and with attenuato-recurvo-ternate connecting and defensive spicula long and slender, and rarely with porrecto-ternate ones, very small and slender. Interstitial membranes—tension-spicula acerate, very slender, and often flexuous; retentive spicula the same as those of the dermis, very numerous.

Colour dull dark green.

Hab. Hammerfest, 150 fathoms (*Mr. M'Andrew*, 1855).

Examined in the condition it came from the sea.

This sponge (the only specimen of the species with which I am acquainted) was dredged at Hammerfest by Mr. M'Andrew during his excursion to the North Sea in 1855, and kindly presented to me, with many other interesting specimens, on his return to England.

The texture of the sponge is very much softer and compressible than that of any other species of the genus with which I am acquainted, and its structure much more simple than is usual in other nearly allied species. The surface of the sponge is even, but is very minutely dotted all over by the slight projection of the extreme distal points of the skeleton-fasciculi beneath the dermal membrane; and in the midst of these fasciculi we frequently find one or two of the recurvo-ternate spicula projecting slightly beyond the others; but comparatively they are rather few in number. The dermal membrane is profusely furnished with the minute, simple, and contort bihamate retentive spicula, which are distributed rather evenly over the whole of its inner surface. These spicula are remarkable for their minute size; the contort ones appear usually to be the largest;

one of the best-developed ones *in situ* measured $\frac{1}{1500}$ inch in length, while a simple bihamate one of an average size measured $\frac{1}{8000}$ inch in length. The skeleton-spicula are large and strong, and frequently exceed $\frac{1}{8}$ inch in length; the shafts of the recurvo-ternate ones are quite as long as those of the skeleton-spicula, but very much less in their diameter. A very few porrecto-ternate spicula were detected; and these were very small, and were imbedded irregularly among the interstitial membranes. The interstitial membranes are abundantly supplied with the same forms of retentive spicula that abound in the dermal membranes, and they have also a considerable number of very slender flexuous tension-spicula.

The most distinctive specific character in this sponge is undoubtedly the minute bihamate spicula so abundant in the dermal and interstitial membranes; but it must be remembered that they require a power of six or seven hundred linear to render them distinct to the eye *in situ* when mounted in Canada balsam, and that when viewed in water they are totally obscured by the sarcode in which they are imbedded.

TETHEA INGALLI, Bowerbank.

Sponge sessile, spherical or oval. Surface variable, from smooth to strongly papillated; papillæ either acutely terminated or abruptly truncated. Oscula and pores inconspicuous. Dermal rind thick, furnished with innumerable, closely packed, large, subsphero-stellate spicula; radii acutely conical. Dermal membrane crowded with minute clavate subsphero-stellate spicula. Skeleton—radial fasciculi large and numerous, polyspiculous, emanating from a spherical polyspiculous centre; spicula fusiformi acuate, large, and long; apices frequently bluntly terminated. Interstitial membranes—tension-spicula of the same form as the skeleton ones, but smaller and slender; retentive spicula attenuato-stellate; radii minutely and entirely spinous, numerous. Gemmulation external.

Colour in spirit deep orange or dull red.

Hab. Fremantle, Australia (*Mr. George Clifton*).

Examined in the wet condition from spirit and from saturated salt water, 1855.

I am indebted to my late friend Mr. Thomas Ingall for my first acquaintance with this very interesting species. He presented to me a small dried specimen less than an inch in diameter, labelled "locality unknown." On examining and describing the sponge I obtained from it the type forms of the spicula represented in plate 25. figs. 12 and 14, 'Philosophical Transactions,' 1858.

I subsequently received from my friend Mr. George Clifton, of Fremantle, Australia, a jar full of these sponges preserved in spirit; the whole of them were in very fine condition. They varied in size from one about 9 lines in diameter to that represented in Plate V. fig. 11.

The normal form appears to be globular, but subject to very considerable variations. Among the eighteen specimens in my possession, some are nearly spherical, while others are much taller than

they are broad; and in one large specimen its breadth is nearly double its height. The surface-characters are also variable; sometimes, especially in young specimens, they are quite smooth, at others strongly, but irregularly papillated. The apices of the papillæ in some are round or flat, and in others they terminate in acute thread-like points. In fact neither the form nor the surface of the sponge affords any reliable specific characters. Some of the specimens attached firmly to fragments of shells were destitute of root-like appendages, and their bases were rounded off like the other parts of the sponge; others exhibited a broad base with one or two smooth impressions, threw out round their margins short hook-like fleshy claspers with expanded terminations, by which they secured a firm seat on the smooth bodies to which they fixed themselves. In one case the attachment thrown out was a fleshy cylinder an inch in length and 2 lines in diameter, with a flat termination nearly 4 lines in breadth.

These modes of locating themselves are not peculiar to this species, but may be observed in many others of the same genus in cases where they are needed.

When a section of a mature sponge is made, there is the appearance of a thick dermal rind, frequently 3 lines in thickness; it is composed of innumerable, closely packed, large, subsphero-attenuato-stellate spicula, the radii being acutely conical; and this form, in diminished quantities, is found in the interstitial membranes in all parts of the sponge.

The dermal membrane is thin; it is profusely furnished with minute clavate subsphero-stellate spicula, which are so numerous and so closely packed as completely to obscure their forms, *in situ*, excepting at the extreme edges of the piece of membrane under examination. No other forms of spicula could be detected in the membrane.

The skeleton-fasciculi radiate in compact curved lines from a central solid spherical mass nearly $\frac{1}{4}$ inch in diameter. It is composed of condensed sarcode in which is imbedded a large quantity of acuate spicula, smaller than those of the skeleton, but of the same form; they are disposed without any approach to regularity; and from the surface of this mass the skeleton-fasciculi radiate in every direction. The hemispherical bases of their spicula all either penetrate its surface for a short distance, or they are in close conjunction with it. The spicula of the skeleton-fasciculi are exceedingly numerous at their commencement at the basal centre of the sponge.

The interstitial membranes are also abundantly supplied with spicula; the tension ones are rather few in number, but the retentive ones are very numerous. The retentive spicula of the interstitial membranes of most sponges are of the same form and size as those of the dermal membrane; but this is not the case in the sponge in course of description, in which they vary distinctly from the dermal ones, a very few of which may be occasionally detected dispersed on the membranes at no great distance from the dermal rind. In the deeply seated membranes they all appear to be attenuato-stellate

with their radii minutely and entirely spinous; they appear to be evenly dispersed on all parts of the deeply seated membranes. The strongly marked character of these spicula, combined with those of the dermal membrane, renders the retentive spicula of this sponge the most descriminative of all its specific characters.

I found but one instance of external gemmulation, that represented by fig. 12 (Plate V.) illustrating this paper.

TETHEA NORVAGICA, Bowerbank.

Sponge spherical, sessile. Surface papulous, even. Oscula and pores inconspicuous. Dermis thin and pellucid, furnished abundantly with minute subsphero-stellate spicula; radii conical, acute. Skeleton—radii abundantly spiculous, compact in the interior, radiating at their distal extremities; spicula fusiformi-acuate. Interstitial membranes—tension-spicula fusiformi-acuate, long and slender, very few in number; retentive spicula minute, subsphero-stellate, very abundant, and a very few large spicula of the same form near the dermal surface.

Colour light green, preserved in saturated salt and water.

Hab. From Drontheim to North Cape, from 20 to 200 fathoms (*Mr. M'Andrew*, 1855).

Examined in the condition in which it came from the sea.

I am indebted to the kindness and liberality of my friend Robert M'Andrew, Esq., for thirty-seven specimens of this interesting sponge. They range in size from 2 to 7 lines in diameter. Their substance is very firm, and they vary little from the regular spherical form. The general aspect of the surface is even to the sight and touch; but it is in truth formed of numerous flat-topped papillæ, each deriving its form from the radiation of the distal end of one of the stout skeleton-fasciculi, the terminal spicula of which are corymbose; and the whole of the terminations appear amenable to the same law. The inhalant pores are situated in deep depressions between the terminal papillæ; and immediately beneath them there are large and often tortuous intermarginal cavities. The dermal membrane is profusely furnished with the minute subsphero-stellate spicula; and this abundance of the spicula also obtains in the lining membranes of the intermarginal cavities; but beyond these parts the minute stellate spicula are distributed much more sparsely. Within this region of abundance there is also a dense accumulation of the sarcode, firmly cementing the distal terminations of the skeleton-fasciculi together, so as to form a stout dermal rind of comparatively considerable thickness. Within this thickened portion of the surface of the sponge a very few subsphero-stellate spicula of large size were found; but none of them could be detected among the deeply seated interstitial membranes. I could not detect the oscula in any of the specimens in my possession.

The skeleton-fasciculi radiate from the centre of the sponge; and the spicula composing them have all their hemispherical bases directed to that point. They are closely and firmly cemented toge-

ther, and remain so until they reach the point of their natural divergence immediately beneath the dermal surface, at which point they are usually closely broken off.

One of the most interesting subjects in the history of this little species is the mode of its propagation, which appears regularly to be by an abundant production of external gemmules.

Of the thirty-six specimens in my possession, twenty-two have more or less of gemmules attached to their surfaces. The largest number on any one sponge is eleven, on the little specimen represented by fig. 18, Plate V.

They are projected from all parts of the surface. The length of their fleshy thread-like attachments to the parent sponge varied considerably; and in one gemmule very perfectly developed, with a diameter of $1\frac{1}{2}$ line, the attaching filament was $\frac{1}{2}$ inch in length and very slender. On many of the mature specimens of sponges on which there were no gemmules remaining, there were short fleshy filaments which had every appearance of being the remains of the attachments of these little bodies which had separated from the parent sponge.

The attachments of the mature specimens are various, in accordonce with their necessities. Sometimes it is effected on smooth surfaces by a close adherence of the basal portion of the sponge, while in other cases they project short root-like appendages varying from one to four or five in number, the distal extremities of which frequently expand to a considerable extent over the rough surfaces of dead shells or other substances on which they have located themselves; and in one case of a *Tethea* thus located on a dead shell and having gemmules produced near its base, these little bodies, still attached to the parent sponge, had themselves projected small cords of attachment from the parts of their surfaces nearest the shell surface with the evident intention of securing a permanent attachment previously to separation from the parent.

The tension spicula of the interstitial membranes are very long and slender; they are mostly dispersed in lines more or less according with those of the skeleton-fasciculi.

Genus Halispongia, Bowerbank.

De Blainville, in his 'Manuel d'Actiuologie,' p. 532, proposed the name of *Halispongia* to receive all those sponges that Fleming and Grant had designated *Halichondria*. But as our recent and more extensive knowledge of British and exotic species comprised under the names of *Halichondria* and *Halispongia* has demonstrated their widely different skeleton-structures, it has become necessary to divide this very extensive group into a series of new genera in accordance with their organic structural affinities. I therefore proposed, in vol. i. p. 207 of 'Monograph of the British Spongiadæ,' to limit the genus *Halispongia* to such sponges among the kerato-fibrous suborder as agree with the following character:—

Skeleton kerato-fibrous. Fibres solid; primary fibres compressed,

containing an irregularly disposed series of spicula; secondary series of fibres unsymmetrical, cylindrical, without spicula.

With further experience of the sponges coming under this designation, I have in many cases found that the primary fibres frequently contained a mixture of spicula and sand, and that the latter often predominated in quantity as in the skeleton-fibre of the sponge in course of description. Hereafter perhaps, from the regularity of the fibrous skeleton structure and the prevalence of sand in its primary fibres, it may be advisable to refer it to a new genus; but for the present I have thought it as well to retain it in the genus *Halispongia*.

Halispongia choanoides, Bowerbank.

Sponge massive, subspherical, pedicellate; pedicle short and stout, branching into radical processes. Surface irregularly and coarsely reticulated; rete forming large elevated ridges; areas deeply depressed and minutely reticulated. Oscula within a large cylindriform cloaca, extending from near the base to the apex of the sponge, terminating in a wide permanent simple orifice. Pores inconspicuous, congregated in irregular areas. Dermis coriaceous, stout; surface abundantly furnished with minute granules of sand; dermal membrane thin, pellucid. Skeleton symmetrical; rete stout; primary lines with axes of sand, spicula, and other extraneous matters; secondary lines without extraneous matters; areas square or oblong. Sarcode abundant, firm, and fleshy. Gemmules large, lenticular; nucleus radiated.

Colour in spirit dull purple.

Hab. Fremantle, Australia (*George Clifton, Esq.*).

Examined from spirit in the state in which it came from the sea.

I am indebted to my indefatigable and liberal friend Mr. George Clifton for this very remarkable specimen, which he sent in spirit from Fremantle. The skeletons of what are apparently various species of this genus are very common in collections of sponges from Australia; but the one in course of description is the only specimen I have seen in a state of perfect preservation as it exists during life. The form of the present specimen, closely approaching spherical, will probably be found hereafter to be subject to considerable variation, as this is the case with many of the closely allied specimens in the skeleton state, some being elongately oval and some inversely conical. The skeleton is formed of an open network of large and strong keratose fibres that are quite visible to the unassisted eye when separated from the abundant sarcode in which they are imbedded. The material imbedded in the primary fibres is very various, principally grains of sand, but frequently also fragments of spicula disposed at various angles to the axial line of the fibre. At first sight it would almost seem as if a discretion were exerted in the choice of the grains of extraneous matter imbedded; they are selected of such uniform size, and are disposed in the fibre with so much regularity. This is effected in the same manner as that de-

scribed in the account I have given of the construction of the sandy fibres of *Dysidea fragilis* in my paper "On the Anatomy and Physiology of the Spongiadæ" in the 'Philosophical Transactions of the Royal Society' for 1862 (pl. xxviii. figs. 3, 4, 5, p. 757). The mode of aggregation in the present case is well demonstrated in some of the young primary fibres of the sponge. A finely pointed purely keratose fibre is projected forwards, the termination of which is adhesive, and to which any small body touching it becomes cemented and is then speedily covered by a thin coat of keratode, the surface of which is not adhesive. The adhesive point continues its forward course continually, thus adding material to the arenaceous axis; while the successive developments of concentric keratose layers, destitute of adhesive power, surround and maintain the arenaceous axis in its proper position. The apparent discretion in sizing the selection of granular matter may thus be naturally accounted for; and it may be readily imagined that the slender adhesive advancing point of the fibre would not support and retain any larger material than that which we find it to have appropriated. The secondary fibres pullulating from the sides of the mature non-viscid primary ones are not adhesive, and are therefore free from arenaceous axes.

The dermis is very thick; and its strength is further increased by a very abundant imbedment in its substance of particles of sand and other small extraneous matters. This appears to be accomplished with great regularity, especially on its external surface, where all the prominent ridges of the great reticulations are as closely and regularly set with granules as if they had been the work of a lapidary. The internal surface of the coriaceous dermis exhibits the same structural peculiarities as the external one.

The porous areas are not simple, as we find such organs in other cases of their occurrence, where we have a thin pellucid membrane with a group of three or four pores. In the present case the porous area is large, thin, and transparent, and is more or less reticulated by fine thread-like lines of extraneous matter; and within each of the little areas thus formed there is a single pore. It is a remarkable circumstance that the boundaries of these minor areas are frequently determined by triradiate spicula of calcareous sponges imbedded in the surface of the membrane, the radii of the spicula forming more or less of the boundaries of three such areas. The great porous areas are frequently oval and of considerable size, containing as many as seven or eight of the small single pore-areas.

The sarcode in this sponge is remarkable for its substance and opacity; the nearest familiar representative of it is the boiled albumen of an egg. When a thin portion of it is mounted in Canada balsam and thus rendered transparent, a considerable number of comparatively large lentiform gemmules are to be seen imbedded in the interstitial membranes. They contain a more or less well-defined central nucleus with innumerable minute radial lines which reach to the extreme margin of the gemmule. They are certainly not spicula, but have every appearance of being minute tubuli.

This sponge is remarkable for being the living type of a well-known flint fossil from the chalk, named, figured, and described by Dr. Mantell, in his 'Fossils of the South Downs, or Geology of Sussex,' p. 179, pl. 16. figs. 19, 20, and 21, as *Choanites Kœnigii*. The author appears to have read off from his fossil specimens very correctly the former history of the structural characters of the sponge; and he has described its radical processes as they appear in numerous specimens of the fossils as well as in the recent sponge. The following is the specific character he assigns to the fossil.

"Inversely conical, externally marked with irregular fibres, some of which penetrate the substance and terminate in openings on the inner surface; central cavity cylindrical, deep, narrow; base fixed by radical processes."

With very slight alteration this description of the fossil would answer as nearly as possible for a specific description of the recent specimen.

I have several fine specimens of this fossil—one, a natural longitudinal section through the middle of the sponge, exhibiting the surface of the great cloacal cavity and the numerous fossilized canals radiating from it. Their entrances into the cloaca are covered by a thin layer of silex. In another specimen, which has no extraneous flint around it, the fibrous structure is indistinctly visible on the exterior of the mass; but on making a longitudinal section of it the fibres all round the distal end of the cloaca became beautifully visible, every fibre being covered by a thin layer of silex, while the interspaces were entirely free from that material. In a third specimen, two of these sponges have coalesced and become as one, following exactly the law that always obtains with recent sponges under such circumstances. On some parts of the external surface there appear doubtful traces of the remains of the dermal integument; and over all the other parts the interlacing skeleton-fibres slightly coated with silex are visible by the aid of an inch lens. I have never seen a specimen of this fossil which exhibited the fossilized dermal integument, excepting in a thin transverse section of one from apparently about the middle. It is a very regular oval of 3 inches by 2¾ inches; and in this the dermal integument is indisputably present. Unfortunately I could obtain no more of this beautifully illustrative specimen than the slice in my possession.

I have entered thus minutely into the comparison of the fossil with the recent sponge, as it appears to afford strong additional evidence of the great antiquity of the land- and water-productions of the southern portions of our globe still above the sea-level; and it appears, from the similarity of the recent productions of that portion of our earth, that they are very closely allied to the fossil productions of the chalk period of our part of the world. The same course of reasoning may be applied to the London-Clay period; among the fruits and seeds of that formation their nearest allies were almost invariably to be found among the fruits and seeds of our Australian colonies.

HYMENIACIDON PULVINATUS, Bowerbank.

Sponge sessile, massive. Surface smooth, tuberculated. Oscula simple, numerous, dispersed, small. Pores inconspicuous. Dermal membrane thin, abundantly spiculous; spicula closely and irregularly felted together, fusiformi-spinulate, as large as those of the skeleton. Skeleton arranged in large, thick, sinuous, irregularly formed plates of skeleton-tissue, running in various angles towards the dermal surface, separated from each other by very large interstitial cavities disposed in the same direction as the skeleton-plates; spicula fusiformi-spinulate or subclavate.

Colour in the dried state ochreous yellow.

Hab. Calibert Quay, twenty miles due east of Belize, in 8 feet water *(Mr. Dyson)*.

Examined in the dried state.

This sponge is, I believe, the largest recent species known to naturalists. Two specimens of it were found by Mr. Dyson at Calibert Quay, in the neighbourhood of which he was collecting specimens of natural history. He told me that the summit of the largest specimen was just below the surface of the water, and that he passed one of the oars down by the side of the sponge and found that it was 8 feet in height, and that they chiselled off the top of the sponge with the oars and cut it into three pieces for the convenience of packing it. What the diameter of this enormous mass was in the living state he did not tell me; but in its present dried condition its greatest diameter is 34 inches, and its lesser one 29 inches. The second specimen, which appears to have been very little inferior in size, has a diameter of 27 by 21 inches. The surface is smooth but abundantly tuberculated; the tubercles are small and depressed, rarely exceeding an inch in diameter, and are less than an inch in height. The oscula are numerous and small, rarely exceeding 2 lines in diameter; they are simple orifices of a circular or oval form. The dermal membrane is crowded with spicula so thickly felted together that their forms can scarcely be determined even when mounted in Canada balsam, excepting at the thin edge of the specimen; if there be any difference between them and those of the skeleton, it is that they are rather less in size.

The interior mass of the sponge is formed of thick, sinuous, irregularly shaped plates of skeleton-structure, all more or less disposed in the direction of the external surface, where they expand beneath the dermal membrane; and over these expansions the pores are situated. The plates of skeleton-tissue are separated from each other by very large interstitial spaces, each one being lined by an interstitial membrane. These large spaces accompany the skeleton-plates in their progress to the dermal surface; and immediately above their terminations the oscula are found, varying in number from one to two or three.

The structures of the skeleton-tissues are quite in accordance with those of numerous other species of *Hymeniacidon*; for it must be remembered that, however large or small a sponge may be, the anatomical proportions of its essential organs never vary. The fusiformi-spinulate skeleton-spicula vary somewhat in size; and while some of the spinulate bases are globular, others are more or less clavate. An average-sized spiculum measured $\frac{1}{60}$ inch in length, and greatest diameter $\frac{1}{2143}$ inch.

The history of this sponge has more than usual interest, as it tends to reconcile and explain difficulties in our knowledge of the ancient sponges, many of which in the lower beds of the Portland Oolite have evidently been of enormous size. Among the débris of the cliffs of Portland not very far on the shore, beyond the little village of Fortune's Well at the head of the great Chesil bank, I recollect seeing one mass more than a yard square that had evidently been one large sponge, with numerous anastomosing branches, each 4 or 5 inches in diameter, of silicified matter, with the large interstices between the ramifications filled up with pure Portland Oolite. And during the excavation of the great dry cutting that encloses and protects the fortifications I observed that they had cut through numerous masses of flint, many of which were from 7 to 10 feet in length and 2 or $2\frac{1}{2}$ feet thick at the middle, gradually thinning away towards their margins. I examined fragments of many of these, and found them quite as full of the remains of sponge-tissues, Polythalamia, fragments of minute corals, and other extraneous matters as the smaller flints of the same oolitic beds, the greensand, and the chalk flints. From the great size of *Hymeniacidon pulvinatus* among living sponges, we may well imagine that the fossil siliceous masses in the lower beds of the Portland Oolite may have been in their day what *Hymeniacidon pulvinatus* at Calibert Quay, near Honduras, now is in those seas.

It has been said by eminent naturalists that there appears to be no known limit to the increase in size of the large crocodilian reptiles; and the same may well be said of many of the sponges. Their organic structures (young or old, large or small) never vary to any appreciable extent in size or form; and the vast difference in those respects that frequently exists in two individuals of the same species is due only to a multiplication of their internal organs. I have other specimens of *H. pulvinatus* in my possession—one 12 or 14 inches in diameter, 8 or 9 inches in height, and a smaller one, not exceeding 6 inches in diameter by about 4 inches in height. All of the specimens are of the same massive cushion-like form.

DESCRIPTION OF THE PLATES.

PLATE V.

Tethea muricata, Bowerbank.

Fig. 1 represents the type specimen of the species, of the natural size, from Hammerfest.

Fig. 2. Half of one of the large fusiformi-acerate skeleton-spicula, magnified 36 linear.

Fig. 3. One of the simple attenuato-expando-ternate connecting and defensive spicula, magnified 36 linear.

Fig. 4. Distal termination of one of the attenuato-expando-ternate bifurcating connecting and defensive spicula, magnified 36 linear. This figure represents one of the most regularly developed heads of this form of spiculum, and by no means one of the largest of them. They vary in the mode and extent of the development of their radii to a very great extent.

Fig. 5 represents one of the stout elongo-stellate defensive spicula of the dermal membrane, magnified 308 linear.

Fig. 6. A small piece of the dermal membrane with the elongo-stellate spicula *in situ*, magnified 183 linear. The recurvo-ternate spicula of *Tethea muricata* are accurately represented by fig. 9, although the spiculum figured does not belong to that species, but to *T. unca*.

Tethea unca, Bowerbank.

Fig. 7 represents the type specimen, of the natural size.

Fig. 8. One of the fusiformi-acerate skeleton-spicula, magnified 36 linear.

Fig. 9. A recurvo-ternate connecting and defensive spiculum, magnified 123 linear.

Fig. 10. A group of three of the minute bihamate spicula from the dermal membrane, magnified 530 linear.

Tethea ingalli, Bowerbank.

Fig. 11 represents one of the largest and best-developed specimens, from Fremantle, Australia. Natural size.

Fig. 12. A younger specimen of the same species, from Fremantle, Australia, with a gemmule attached to it. This sponge is smooth over nearly the whole of the surface; and it has an expanded concave base, having been apparently attached to a smooth convex surface. Natural size.

Fig. 13. One of the large fusiformi-acuate skeleton-spicula bluntly terminated, magnified 80 linear.

Fig. 14. A small fusiformi-acuate spiculum from the central mass of the sponge, whence the skeleton-fasciculi emanate, magnified 80 linear.

Fig. 15 represents one of the large subsphero-stellate spicula from the rind of the sponge, magnified 530 linear.

Fig. 16. One of the minute clavate subsphero-stellate spicula from the dermal membrane, magnified 530 linear. This figure represents a very perfectly formed one; they vary considerably in shape and in the clavation of their radii.

Fig. 17. An attenuato-stellate spiculum with the radii entirely and strongly spined, magnified 530 linear. These spicula vary in the number of their radii and in the degree of spination to a very considerable extent.

Tethea norvagica, Bowerbank.

Fig. 18. A small specimen of the species based on a fragment of shell, with eleven gemmules in various stages of development attached to its surface, natural size.

Fig. 19. A well-developed specimen with six gemmules attached to it, natural size. There is no apparent attachment to this sponge.

Fig. 20. One of the smallest specimens in my possession, attached to the remains of the shell of a small *Balanus*, natural size.

Fig. 21. A small well-developed specimen broadly based on the surface of a small stone, natural size. This sponge has thrown out broad, thin, adherent plates on the surface of the stone, but they are not visible without the aid of a 2-inch lens.

Fig. 22 represents the largest specimen of the species in my possession, natural size. The small mass at the base is the remains of a shell to which it has apparently been attached; the mass on the right-hand side of the figure consists of two gemmules closely pressed together.

Fig. 23. One of the skeleton-spicula, magnified 80 linear.

Fig. 24. One of the tension-spicula of the interstitial membrane, magnified 80 linear.

Fig. 25 represents one of the minute subsphero-stellate spicula of the dermal membrane, 530 linear.

PLATE VI.

Fig. 1. *Halispongia choanoides*, Bowerbank. From Fremantle, Australia. Natural size. (*a*) the terminal orifice of the great cloacal cavity.

Fig. 2. A portion of the dermis mounted in Canada balsam, exhibiting the inhalant areas and their pores in an open condition, magnified 36 linear.

Fig. 3. A small portion of the skeleton-structure, showing the primary fibres containing their characteristic axial line of sand and other extraneous matters, while the secondary ones are free from such materials, magnified 14 linear.

Fig. 4. A representation of a well-developed gemmule as it appears in Canada balsam, attached to the surface of the sarcodous membranes, magnified 80 linear.

2. Notes on *Rhinoceros sumatrensis*, Cuvier.

By JOHN ANDERSON, M.D., Calcutta.

[Received January 13, 1872.]

Having had an opportunity of examining a living specimen of this species, I have drawn up the following remarks, which may prove of sufficient interest to merit a place in the Society's 'Proceedings.'

The specimen examined is a young female that strayed into Chittagong in February 1869, when it was captured, and where it has remained till within the last few weeks. It has been brought to Calcutta by Mr. Jamrach of London, to whom I am indebted for my examination of this interesting animal. Mr. Jamrach has purchased it in the hope of being able to take it to London alive, where, if he succeeds in his endeavour, it will doubtless attract much interest, as no living example of this species, that I am aware of, has hitherto reached England. The uncertainty, however, of this enterprise induces me to forward to the Society these notes, together with an unquestionable representation of the external characters of this species.

There is no previous record of this Rhinoceros having been found so far west* as Chittagong, about 92° E. long.; but I see nothing remarkable in this, as the fauna of Eastern Bengal is pronouncedly Malayan. It is also probable, as Blyth observes, that it ranges into Assam, because, while at Bhamô in Upper Burmah, I was informed by an intelligent native that two-horned Rhinocerotes are found in the Mogonny district, which is close to the confines of Assam, and as far north as the twenty-sixth degree of north latitude. This same informant also assured me that he had seen at Mogonny a Rhinoceros-head with three horns.

The female which forms the subject of these observations is about

* In the 'Mammals of India' it is stated to have been shot at as high a latitude as 23° N., near Sandoway, which, however, lies only between the 18th and 19th parallels N.