THE ANNALS

AND

MAGAZINE OF NATURAL HISTORY.

[FOURTH SERIES.]

"..... per litora spargite muscum,
Naiades, et circùm vitreos considite fontes:
Pollice virgineo teneros hìc carpite flores:
Floribus et pictum, divæ, replete canistrum.
At vos, o Nymphæ Craterides, ite sub undas;
Ite, recurvato variata corallia trunco
Vellite muscosis e rupibus, et mihi conchas
Ferte, Deæ pelagi, et pingui conchylia succo."
N. Parthenii Giannettasii Ecl. 1.

No. 61. JANUARY 1873.

I.—*Transformation of an entire Shell into Chitinous Structure by the Polype* Hydractinia, *with short Descriptions of the Polypidoms of five other Species.* By H. J. Carter, F.R.S. &c.

[Plate I.]

All who are acquainted with the Spongiadæ know that there are certain species which enter the substance of shells and there grow to such an extent that finally the whole shell which they inhabit may become absorbed or destroyed, and the sponge itself, thus left alone, become unattached; after which it may still go on increasing in size until, drifted about by the currents in the sea, it may at last in some storm be thrown ashore upon the beach. *Cliona celata*, which attacks the oyster-shell, is one of these, and after having absorbed the whole valve grows into a shapeless mass, which is brought up by the trawl- or dredge-net, or cast ashore, as before stated, in which condition it has been called "*Raphyrus Griffithsii*" by Dr. Bowerbank. *Halichondria suberea*, Johnst., is a species which attacks univalve shells—but often retains more or less of the outward form of the shell, and almost always that of the internal cavity; for a hermit crab (*Pagurus*) generally inhabits the latter, and so prevents the sponge from encroaching in this direction. Hence, if the outward form of the shell is lost, the internal one is, for the most part, so perfectly preserved that there is no difficulty whatever in concluding that it was

once a Gasteropodous shell, although not a particle of the calcareous matter may remain, and the whole be transformed into sponge-structure.

The same thing, *mutatis mutandis*, may take place with the flexible polype called *Hydractinia*, which for the most part also forms a parasitic crust on univalve shells.

Thus in the British Museum there is a specimen of *Hydractinia echinata* covering a whelk-shell (*Buccinum undatum*) both inside and out; and the same was tenanted by a *Pagurus*, now dead *in situ*; while the horny skeleton or incrustation of the polype, having shrunk by contraction on drying, has become cracked about the lip, and the pieces so curled up that their edges have become exposed, and thus show that, although the outer part presents its natural dark amber-colour, the inner one becomes gradually whiter, until it appears to differ very little from the shell itself.

Carrying on our examination with a simple lens, we observe that the pieces have brought away with them a portion of the shell-substance on which the crust grew; and when both their lower side and the corresponding surface of the shell are respectively examined, it will be found that the former presents a surface of whitish crystalline matter punctated by amber-coloured points, which are connected above with the horny structure of the *Hydractinia*, while the surface of the shell opposite presents nothing of the kind, and is therefore uniformly white,—thus showing that the horny or chitinous incrustation has brought away with it just so much of the shell-substance as the horny portion of the polype had penetrated.

Hydractinia echinata is so common on our coast that it does not seem necessary for me to describe here more than the part immediately connected with our subject, viz. the polypidom, which includes the transformation of the substance of the shell into the horny structure of the *Hydractinia*. For the rest I refer the reader to the ample descriptions, illustrations, &c. contained in Mr. Hincks's 'History of the British Hydroid Zoophytes,' vol. i. p. 19 &c., and vol. ii. pl. 4 (1868).

The skeleton or polypidom of *Hydractinia* consists of a clathrate mass of horny solid fibre (I use the word "horny" here synonymously with "chitinous," as the most expressive term, although chemically not so correct as the latter), which spreads horizontally in a thin layer over the shell on which the polype may be growing, rising above into a forest of pyramidal serrated spines, averaging about one sixteenth of an inch high, and descending below by simple advancement of the clathrate fibre into the shell-substance, as before mentioned.

The insterstices of the clathrate network are filled by the

granular plasma called "cœnosarc;" and the external parts of the skeleton serve to support the polype-mass; all of which, being extremely delicate, fail, after being once dried, to present under any circumstances a recognizable form.

If we now, with a very sharp and thin knife, cut off vertically a slice of the dried curled-up crust above mentioned (Pl. I. fig. 8) and place it under a microscope, we may see the white crystalline shell-substance (*d d*) gradually decreasing upwards among the interstices of the chitinous network, until it gives place entirely to the dark amber-colour of the latter and its granular plasma (*c*, figs. 8 & 9); while in the opposite direction the white substance increases to the confines of the lowermost layer of the network, until it can hardly be distinguished from the substance of the shell itself (fig. 8, *g*).

Again, if we put a similar slice (fig. 9) into dilute nitric acid, we shall not only observe an effervescence, but when this slice is placed under the microscope we may also observe that the whole of the white crystalline substance has disappeared (fig. 9, *d d*), leaving nothing but the clathrate fibre of the skeleton (fig. 9, *e*), of which the increasing thinness, pale colour, and wide interstices towards the shell evince its young or progressive stage of development.

It thus appears evident that *Hydractinia echinata* transforms the calcareous shell on which it may be growing into its own horn-like skeleton.

We have now to prove this more satisfactorily; and this can be done by another specimen in the British Museum, where the *whole* of the shell has become transformed into the horn-like skeleton of a *Hydractinia*.

The shell thus transformed was somewhat less in size than a *Buccinum*, but of a totally different family, as may be seen by the form of the aperture, which resembles that of some turbinated shell, though of course the species is now undeterminable, at least to one possessing such a limited knowledge of conchology as myself (fig. 1, *a*, *b*). Nor is the *Hydractinia* the same specifically as *H. echinata*; for all the spines are smooth (fig. 3), and not, as in the latter, serrated (fig. 4). Hence there is here a marked difference between the two polypes, although in every other respect the skeleton-mass or polypidom, which is the only part left in the transformed shell, is almost identical with that of *Hydractinia echinata*.

As the transformed shell now exists, it is empty and entirely composed of parallel layers of clathrate chitinous fibre (fig. 2, *a*, *b*). The internal cavity is smooth, and the columella preserved; so that we may fairly infer that the shell had been originally tenanted by a *Pagurus*, which had remained there

until the whole of the shell had become transformed into the chitinous skeleton of a *Hydractinia*, when, probably finding it too light for its purpose, the *Pagurus* betook itself to a heavier habitation.

Although the internal surface of the transformed shell remains smooth and perfect (fig. 2, *a*, *b*), the external surface has become changed into the peculiar growth of the *Hydractinia*, which presents a more or less irregularly tubercled appearance, each tubercle of which, being more or less separate from the rest and varying in size and shape, consists of a little monticule of clathrate fibre involving one or more of the smooth erect spines which characterize the species (fig. 1, *a*, *d*); whereas in *Hydractinia echinata* there are no such tubercles, the surface being for the most part even and equally spined throughout.

So much, then, for the internal and external surfaces respectively of the transformation; we have now to go to the layers of which it is composed. And these together present a thickness varying with that of the original shell, being in the section (which was made for the purpose, and forms part of the illustrations, fig. 2) 4-12ths of an inch thick at the base, and 2-12ths in the parietes. Moreover these layers show, by the presence of smooth spines upon them here and there (fig. 2, *d d*), that the growth of the *Hydractinia* had been outwards as well as inwards or towards the shell. Nor does it seem quite clear how much of the shell has been absorbed by the layer of the *Hydractinia* which lined its cavity (fig. 2, *e e*), since in the specimen of *Hydractinia echinata* before me the polype-crust, although smoothed by the *Pagurus* internally, covers the cavity as well as the exterior of the shell. At the same time, in the transformation, the presence and direction of the spines on its layers (fig. 2, *c c*) point out, to a certain extent, the limit of the crust vertically, leaving about one third of the thickness of the transformation inside it for what may have been effected by the lower part of the outer crust and that lining the cavity respectively. In this case the original shell could not have been very thick.

A microscopic examination of the structure gives the same results, minus the soft substance and presence of calcareous matter, as that of *Hydractinia echinata*; and thus it is satisfactorily proved that this kind of polype can effect a change in the composition of a shell analogous to that produced by the sponges mentioned.

This is a point of interest to know, inasmuch as it bears on fossilized as well as recent structure, and therefore every clathrate structure of this kind in a fossil shell must not be too hastily set down as sponge-transformation.

The transformed shell bears the museum no. "2461," which appears to me to be preceded by a P; and the former shows that it must have been in the museum for many years, since for upwards of twenty this kind of numbering has been discontinued.

In its maximum measurements it is about two inches long from apex to base, two inches broad, *i. e.* from left to right side, and one inch thick.

The outer layer is rendered more or less green by the presence of the gonidia and thallus of a lichen, which here and there appears in little groups of gymnocarpous apothecia all over the surface. So it is just possible that, after the comparatively heavy calcareous matter of the shell had been replaced by the lighter chitinous structure, the *Pagurus*, as before stated, left his habitation; and the latter, having floated into an estuary, may have been left on its banks, where its surface became in time grown over by this lichen, and where, probably, it was found, unless all this took place on the sea-shore, or the *Pagurus* carried the transformed shell inland, as they appear to do in the island of Cuba (Sir C. Lyell, Princip. Geol. vol. ii. 1872).

The largest apothecia are about 1-48th of an inch in diameter, and more or less circular, the thalamium dark brown, and exciple white; the spores ellipsoid, generally eight in the theca, but varying in number, and for the most part confusedly arranged.

My attention was first called to the specimen of *Hydractinia echinata* above mentioned from its likeness to the figures of the sponge named "*Terpios echinata*" by De Fonbressin et Michelotti ('Spongiaires de la Mer Caraïbe,' p. 102, pl. xxiv. figs. 4 & 5, Haarlem, 1864). And then, when I observed coupled with it in the museum another shell like it, but *entirely* transformed into horny structure, I began to think that the skeleton of *Hydractinia echinata* must be a sponge, not being aware at the time that any organism but a sponge could effect such a transformation, and observing microscopically that the horny substance was formed of concentric layers. However, placing the specimens before my friend Mr. Parfitt for his opinion as to the habitat and species of the lichen, this intelligent naturalist immediately recognized *Hydractinia echinata*, and handed out from his cabinet a specimen dredged up off the Otter-mouth, close to the place where I am living. The nature of the organism on the whelk-shell thus having become known to me, that of the organism which had transformed the other shell still remained enigmatical, but was subsequently worked out in the way above mentioned.

It would appear from a section of the crust that the poly-

pidom of *Hydractinia echinata* is formed of horizontal layers (figs. 8 & 9), each of which is marked by a row of knots (*e*, figs. 8 & 9), which indicate the points of union of the clathrate chitinous fibre, corresponding to the knots in network; and, judging from a microscopic examination of the part advancing into the shell, it would also seem that these knots first appear in the form of separate cells (fig. 7, *d d*), which, generating concentric layers of chitine around them, may be termed "horn-cells." The horn-cell then sends off two sets of branches, one of which (fig. 7, *e e*) becomes the clathrate chitinous fibre, which is solid and formed of concentric layers, and the other set (fig. 7, *f f*) spread out into a chitinous membrane (fig. 7, *g*) on the same plane as the horn-cells, which membrane thus acts as a framework to the whole. These horn-cells appear as dark points in the last layer of shell-substance that is about to be absorbed, and which remains adherent to the contracted and curled-up fragments of the dried and thus broken-up polypidom, as above mentioned (fig. 5, *a*; fig. 8, *g*). The chitinous membrane therefore lies above this (fig. 6, *b*; fig. 8, *f*). But if a fragment of these two layers, viz. the chitinous and calcareous ones (which are of course *very* thin, but can be occasionally picked off together), be mounted in Canada balsam, it will be observed that the calcareous layer, which is the undermost, presents a worm-eaten appearance (fig. 7, *i*), as if it had been subjected to the dissolving influence of a surface formed of pseudopodial villi, about 1-6000th inch in diameter.

In the layer lining the cavity of the wholly transformed shell (fig. 2, *e e*), treated in a similar manner, we have the same characters, minus, of course, the calcareous layer, as in fig. 9, *g*,—that is to say, the chitinous membrane alone, in which are set the horn-cells and their clathrate structure, as in *a*, figs. 6 & 7.

How the absorption of the shell-substance is effected in *Hydractinia* is unknown to me; but (referring to like phenomena) when we observe that the protoplasm of the plant-cell can, as required, work its way through the thick cellulose cell (as in *Spirogyra* under conjugation), that the tender Amœba-like entophyte *Pythium* (also an inhabitant of the cell of *Spirogyra*) will do the same thing, &c., that the excavating sponges, whose sarcode is equally soft and delicate, will do the same in the oyster-shell as well as in limestone rock, it does not appear strange that the cœnosarc of *Hydractinia* should be able to perforate a whelk-shell under similar circumstances.

Also, when it is observed that, in the excavations made by *Cliona celata* in the concretionary limestone formed and found about the rocks of the New Red Sandstone on the shore here, the siliceous grains which are mixed up with it still project

above the otherwise smooth surface of the excavation, it does seem (as my friend Mr. Parfitt has sagaciously observed) that these excavations are produced by an "acid or erosive agent" of a chemical rather than of a physical nature, which, not being able to dissolve the silex, thus leaves the grains of sand projecting into the excavation (Parfitt on the boring of Mollusks, &c., Trans. Devon. Assoc. for Advancement of Science, 1871).

May we not assume, then, that this process is one of animal chemistry like that of digestion (wherein the gastric juice will dissolve calcareous matter, but fails to affect a piece of glass)?—the action in *Hydractinia* being produced not by cells but by the intercellular sarcode, which, like that of the sponge, can prolong itself into villous pseudopodial processes (fig. 7, *c*, *i*), which possibly may be the pioneers of all vital changes of this kind, in exercising on their confines that catalytic power of which life alone is capable.

Indeed Professor Allman has long since demonstrated the existence of sarcode among the Hydroid polypes, which, to use his own words, "comports itself exactly like the pseudopodia of an *Amœba*, which it also resembles in structure" ('Annals,' 1864, vol. xiii. p. 204); so that the worm-eaten appearance presented by the lowermost layer of the crust of *Hydractinia echinata* (that is, in the calcareous surface of the shell just about to become transformed) may be produced, as before stated, by a villous layer of minute pseudopodial prolongations from the cœnosarc.

Lastly, as regards the power of animal chemistry in these operations, which is chemistry directed by an unknown agent, as the production of alcohol by the yeast-plant, &c., it signifies that there is an instinctive power acting here, which is far beyond any possessed by the highest cerebrated being, if I may use the expression.

When I observe the delicate mycelium of a minute fungus growing or creeping (for the terms are synonymous here) through the hard crystalline layers of the shell of a *Buccinum*—when I observe on the surface of a lancet which has been carefully protected by a layer of animal fat a similar kind of mycelium, which has wriggled its way not only over but *in* the surface of the polished blade by oxidation of the iron in its course, so as to leave a rusty image of itself—and when I observe a plant-like form of glauconite in the substance of an agate which has been formed in a geode of an igneous rock, so much like a Conferva that it might easily pass for one if not otherwise understood, to say nothing of the dendritic markings of rocks, &c.,—these facts, taken in connexion, seem

to signify not only that the law of form is the same both in the vegetable and mineral kingdoms at least (for the glauconite form in this respect is almost typically that of a Conferva), but that *vital* influence also is the *primum mobile* in all—that indomitable power which rules the world independently of man!

Having ascertained that the transformed shell, which had been thrown in among the sponges, had been produced by a polype and not by a sponge, I turned my attention to certain branched organisms, or rather their skeletons, which had also been placed among the sponges, and had therefore come before me for examination, when, noticing that they also possessed a clathrate chitinous structure closely allied to that of the polypidom of *Hydractinia* (fig. 9), while the characteristic feature of most sponges, viz. the branched system of canals terminating externally in large outlets or oscula, was absent from them, I submitted to microscopical examination a portion of the stem of a beautiful form from New Zealand, which had been presented to the museum by Sir G. Grey; and I found not only that it was identical with the structure of the polypidom of *Hydractinia*, but that attached to its fibre internally, where the water had failed to destroy the whole of the soft parts with which the clathrate structure had originally been filled and covered, a few thread-cells still remained. I then sought for the hydrothecæ, and found them also.

Next I took portions from two other species, which came from the Cape of Good Hope—and obtained similar results, so satisfactorily that in many of the thread-cells their contents had become half extruded.

Finally I examined the two species from Australia which Dr. J. E. Gray, under the family name of "Ceratelladæ," had described and figured provisionally as sponges in the 'Proceedings of the Zoological Society' for November 26th, 1868 (p. 575), designated respectively *Ceratella fusca* and *Dehitella atrorubens*; and here, again, I met with similar results.

Hence it becomes necessary for me briefly to describe all these polypidoms, beginning with that of the transformed shell, in order that henceforth they may be relegated to their proper place. Were they possessed of their soft parts, and perfect as the *Hydractinia* of our own shores when carefully dredged up from its natural abode can only be, I should have proposed their being handed over to some one more conversant than myself with this department of zoology: but who can say when perfect specimens of the polypidoms of these species, with all their soft parts recognizable, may be similarly taken, when those we have come from foreign shores, where they

have apparently been washed about in the surf for years before they were picked up for preservation? Meanwhile, as the description of a polypidom alone is comparatively easy, as it may be a long while before the soft parts can be obtained, and as it is desirable at once to separate these skeletons from the sponge-structures which I am examining, it is hoped that the following diagnoses may not be unacceptable.

Hydractinia levispina, n. sp. (Pl. I. fig. 1, *a*, *b*.)

Zoophyte incrusting and eroding univalve shells. Polypidom formed of clathrate, subrectangularly meshed chitinous fibre (as in fig. 9), solid, concentrically laminated, surmounted by smooth, erect, conical spines (figs. 3 & 1, *b*, *e*), grouped together in the midst of proliferous tubercles (fig. 1, *d*, *e*), scattered more or less over the surface. Increasing by layers, so as finally to absorb the whole of the shell on which it grows (fig. 2, *a*, *b*). Height of transformed shell 2 inches from apex to base; extreme breadth, viz. from left side to margin of outer lip, 1½ inch. Spine variable, about 1-30th inch high by 1-60th inch diameter at the base.

Hab. Unknown.

Loc. Unknown.

Obs. This specimen, which is in the British Museum, bears the number "2461," which mode of marking, as before stated, shows that it has been there for a very long time; the number also appears to be preceded by a "P." There is no further history attached to it than that which its own structure reveals. It evidently grew on a shell a little less in size than a *Buccinum*, but of a totally different species, as the margin of the aperture is continuous like that of the Turbinidæ. While there it gradually transformed the whole of the shell into its own chitinous polypidom; meanwhile a *Pagurus* or hermit crab inhabited the interior and so preserved the form of this part. Subsequently it probably got into some tidal estuary, where, having been left high and dry on its banks, a gymnospermous lichen took up its habitation on its surface, and, spreading its thallus throughout the external layer of the imperishable chitine, at last threw up the groups of shield-like conceptacles (apothecia) now scattered over the greater part of the shell-like polypidom. Of course this might also have taken place on the sea-shore, or the *Pagurus* itself might have carried it inland.

Hydractinia levispina differs from *H. echinata* in the tubercled state of its surface, but especially in the smoothness of its spines (fig. 3); the latter possesses a more or less even surface with serrated spines (fig. 4).

Ceratella fusca,

Gray, Proc. Zool. Soc. Nov. 26, 1868, p. 579, fig. 2.

"Coral expanded, fan-shaped, forming an oblong frond; branches divergent from the base, with numerous lateral, subalternate, subdichotomous branches; similar but smaller lateral branches.

"*Hab.* Australia, New South Wales, at the head of Bondy Bay."

Dehitella atrorubens,

Gray, Proc. Zool. Soc. Nov. 26, 1868, p. 579, fig. 1.

"Sponge or coral dichotomously branched, expanded, growing in a large tuft from a broad, tortuous, creeping base, of a dark brown colour, and uniform hard rigid substance. Stem hard, cylindrical, opake, smooth; branches and branchlets tapering to a point, cylindrical, covered with tufts of projecting horny spines on every side; those on the branches often placed in sharp-edged, narrow, transverse ridges; those of the upper branches and branchlets close but isolated, and divergent from the surface at nearly right angles.

"This genus is distinguishable from *Ceratella* by the greater thickness and cylindrical form of the stem, by the more tufted and irregular manner of growth, and by the tufts of spicules (oscules or cells) being more abundant and equally dispersed on all sides of the branches and branchlets."

The above descriptions are copied from Dr. J. E. Gray's excellent account of these two organisms, published in the 'Proc. Zool. Soc.' for November 26, 1868 (p. 575), to which the reader is referred for more extended descriptions of them, and for equally excellent illustrations, which, being almost typical forms of the following species from the Cape of Good Hope, will, until the latter are also illustrated, very well serve for their identification.

It will be observed that Dr. Gray was by no means satisfied that they belonged to the Spongiadæ, and therefore only provisionally placed them among the sponges. Had he been aware of what I have above stated, his views probably would have been different, and the real nature of these organisms would have been then told by him at once; and but for his encouragement now, it would most probably have never been elucidated by myself.

Ceratella procumbens, n. sp.

Zoophyte procumbent, compressed, thickly branched on the same plane; the larger stems chiefly on one (the lower) side,

hard, flexible, of an ochre-brown colour, tinged here and there with purple. Trunk short, solid, compact, compressed vertically, soon dividing irregularly or subdichotomously into round branches, which are confined to the lower surface, ending in branchlets with subclavate ends, that appear on the upper or opposite side, not reuniting or anastomosing. Hydrotheca consisting of a little semitubular plate, extending outwards and forwards from the side of the stem on the proximal border of an aperture in the latter; scattered thickly over all the branches, but most prominent on the branchlets; frequently represented by the little hole alone in the stem where the projecting portion has been worn off; scanty on the lower side of the main stems. *Minute structure*: composed of clathrate chitinous fibre throughout, whose meshes are subrectangular; hydrotheca formed of the semitubular scoop-like plate mentioned, supported on its proximal side by an extension of the clathrate structure of the stem, and bordering the little hole also above mentioned, which extends into the centre of the stem; surface of the larger stems bluntly microspined. Size of largest specimen 11 inches long by 5 inches broad, and about 1 inch thick, or vertically.

Hab. Marine; procumbent.

Loc. Cape of Good Hope and Port Natal.

Obs. There are five specimens of this species in the British Museum, viz. one with no. 67. 3. 22. 1, and "Cape of Good Hope" written on it, and the others ticketed no. 72.8.1.1, and "Port Natal." Friction among the sand and waves has worn down some of them so much as to leave nothing but the foramina in the stems; whereby the most worn might be looked upon as a different species, did not the gradation from the more perfect ones point out that this is not the case, and thus that they all belong to one and the same species. Some parts still retain a purple colour both externally and internally, showing that, as with the other species in some parts also, this has for the most part been washed out, and that the brown colour has been derived from the chitinous fibre alone. In most of the specimens thread-cells are numerous in the clathrate tissue, especially towards the centre of the stems, where they can not only be distinguished by their subconical form from other globular and nucleated cells present (which appear like ova), but, by the addition of liquor potassæ, may be made to extrude the thick portion of the thread. Their procumbent habit has been inferred from the main stem and its branches being flattened on one side, while the branches and hydrothecæ are chiefly on the other—much in the form of a wall fruit-tree, viz. with a flat back.

Ceratella spinosa, n. sp.

Zoophyte procumbent, thickly branched, hard, flexible, of a dark rich red-purple colour. Main branches round, brownish, covered with small, smooth, often subspatulate, erect spines. Stem dividing subdichotomously into purple branchlets, which terminate in abruptly pointed extremities. Hydrothecæ the same as in the foregoing species; most prominent over the round branchlets, to which they give, *en profil*, a serrated, somewhat Sertularian, appearance, the teeth of which are inclined forwards. *Minute structure*: main stems composed of clathrate chitinous fibre, of which the meshes are more or less oblong, passing into prominent longitudinal lines on the branchlets, where they terminate on the backs of the semitubular plates which respectively form the floors of the hydrothecæ, to which they thus give support. Size of specimen, which is merely a branch, 4½ inches long by 2 broad.

Hab. Marine; procumbent.

Loc. Port Natal.

Obs. The spines on the surface distinguish this from the foregoing species, add to which its longer and more pointed branches, longitudinally ridged clathrate fibre, and rich red-purple colour. It bears the no. "72. 8. 1. 17, from Port Natal."

In Dr. Gray's two Australian species there are no actual spines independently of the projecting portion of clathrate structure on the proximal sides of the hydrothecæ, and the "spinulose" little knobs on the surface of *Ceratella fusca*.

The hydrotheca in *Dehitella atrorubens* is formed of a simple scoop-like projection of the subrectangular clathrate structure of the stem, stopped at the bottom by a septum of the same; there is no decided hole there larger than the diameter of the common mesh, for the cœnosarc of the interior to communicate with the sarcode of the polype, as in the Cape species; while in *Ceratella fusca*, which is almost as delicate in its branches as a *Sertularia*, and not unlike it in the alternate, but here spiral not opposite, position of its hydrothecæ, the latter are formed by a projection of the clathrate tissue in the shape of a clam-shell, whose ribs, extended beyond the margin, end respectively in an inflated tubercle of the same kind as that which characterizes the surface of the stem, rising up like little knobs on the knots of the clathrate network, to which Dr. Gray (*l. c.*) has appropriately applied the term "spinulose;" the bottom of the hydrotheca is filled up with a clathrate septum, in which there is no decided hole present as in the foregoing species; and in this way both of these from Australia differ from those of the Cape of Good Hope.

Chitina ericopsis, n. gen. et sp.

Zoophyte erect, bushy, fragili-flexible, fawn-coloured. Trunk long, hard, irregularly round, composed of many stems united clathrately and obliquely into a cord-like bundle, which divides and subdivides irregularly into branches, that again unite with each in substance (anastomose) when in contact, and finally form a straggling bushy head. Hydrotheca long, clathrate, tubular, terminating the ends of the branchlets or prolonged from some of the proliferous tubercles which beset the surface of the trunk and larger stems. *Minute structure*: composed of clathrate chitinous fibre throughout, whose meshwork is subrectangular and massive in the stems, where there is no difference between the centre and circumference, with the exception that the fibre is stouter in the former or oldest part; hydrotheca composed of several longitudinal fibres or ridges lattice-worked together transversely into a tubular form, somewhat contracted at the extremity, in the centre of which is an aperture of the meshwork a little larger than the rest. Height of specimens about 14 inches, trunk about 1 inch in diameter; hydrotheca averaging 1-3rd of an inch long by 1-60th of an inch in its broadest part, and the aperture 1-90th of an inch in diameter.

Hab. Marine; erect.

Loc. New Zealand.

Obs. There are several specimens of this beautiful polypidom in the British Museum; one of which (bearing the no. 57. 1. 2. 36) was presented by Dr. Sinclair, and the rest by Sir G. Grey; all from New Zealand. From their worn state they appear to have been long subjected to the friction of the waves and beach before they were picked up for preservation. Hardly any of the hydrothecæ on them are perfect; and it is only by looking carefully over the specimens that one can be found answering the description above given; and then it requires to be viewed with an inch compound power "end on" (as it is termed) to see the aperture at the extremity; the least inclination to one side will bring the surrounding network into focus, and thus defeat the object of the observer. In some the dried remains of the polype are still present, which mark the position of the tubular cavity. Conical ovoid thread-cells may be seen in the clathrate structure of the polypidom, which hang about the fibre in a dried fleshy substance that appears also to be the remains of the cœnosarc; and on some of the larger stems there are little superficial holes, which appear to be the remains of canals through which the cœnosarc was continued into the cavities of the hydrothecæ respectively, now worn off. The specimen differs so markedly from all the rest in its

erect habit, and in the form and position of its hydrothecæ, that it must be considered the type of a new genus, to which I have given the name of *Chitina* and designated the species *ericopsis*, from its being so much like the stems of the common heather here used for making brooms.

These species may be provisionally tabulated thus :—

Family **Hydractiniidæ**.

Incrusting species :—

Hydractinia echinata.
H. levispina.

Branched procumbent species:—

Ceratella fusca, Gray.
Dehitella atrorubens, Gray.
Ceratella procumbens, n. sp.
C. spinosa, n. sp.

Branched erect species :—

Chitina ericopsis, n. g. et sp.

In this way I hope to get rid of them from among the Spongiadæ, and to bring them to the notice of those who have specially devoted their attention to the Hydroid Zoophytes.

EXPLANATION OF PLATE I.

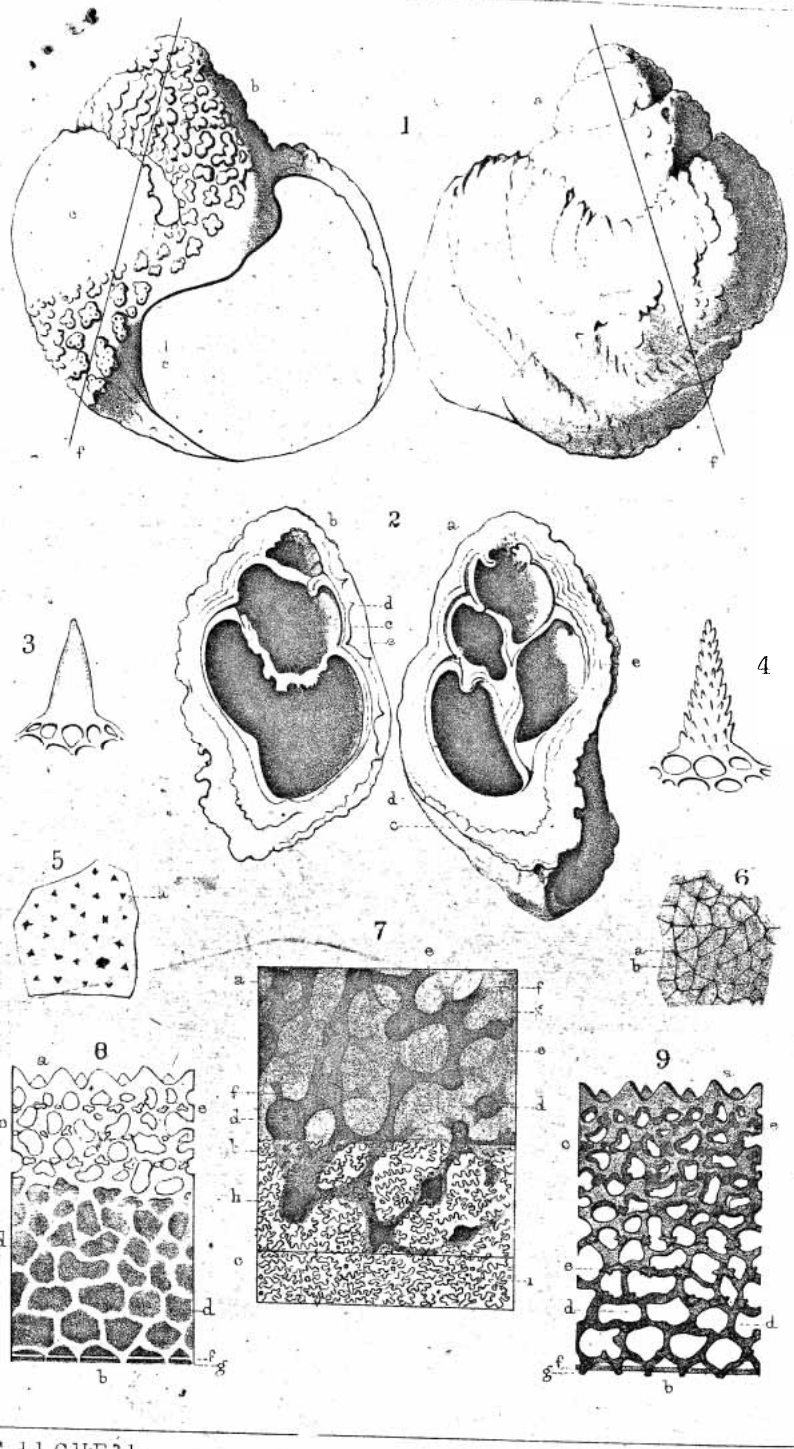
Fig. 1. Upper and lower surfaces respectively of a turbinated (?) shell *wholly* transformed into clathrate chitinous fibre structure by *Hydractinia levispina* (n. sp.): *a*, upperside; *b*, lower side; *c*, smooth area on the latter, produced by friction during the time the shell was tenanted by a *Pagurus*; *d*, tubercular excrescences of the chitinous structure involving one or more spines, which the dark points (*e*) are intended to represent; *f f*, line of section. Natural size.

Fig. 2. Section of the same through the line *f f*, fig. 1, showing that the columella and every particle of the original shell-substance has been replaced by the chitinous structure: *a*, right side; *b*, left side; *c c*, layer surmounted by spines (*d d*) projecting *outwards*; *e e*, surface-layer of the cavity. Natural size.

Fig. 3. *Hydractinia levispina*, n. sp., spine of, with portion of subjacent clathrate structure at its base, showing that it is merely a conical form of the latter; magnified. Real length of spine about 1-30th inch, diameter of base of spine 1-60th inch. To contrast with the serrated form of the following figure.

Fig. 4. *Hydractinia echinata*, spine of, about the same size as the foregoing. To contrast with fig. 3.

Fig. 5. The same, incrusting *Buccinum undatum*, which contains the remains of a *Pagurus*. Magnified portion of lower surface of a fragment of the crust, raised by contraction and fracture from the inner surface of the outer lip close to the canal, showing that it is composed of calcareous matter, through which points of the superincumbent chitinous structure (*a a*) project. Horizontal view.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