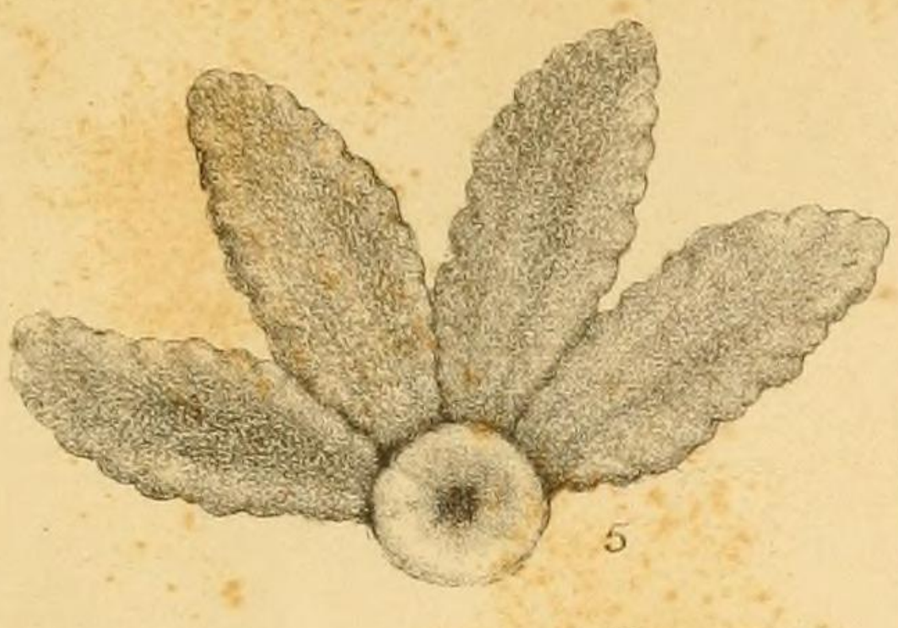
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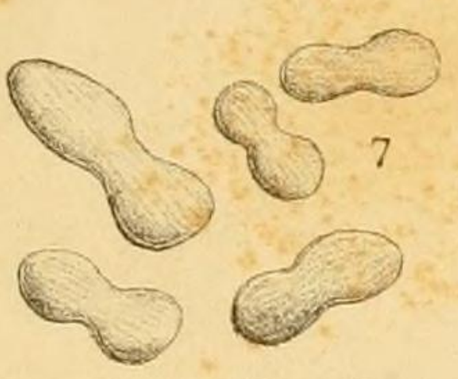
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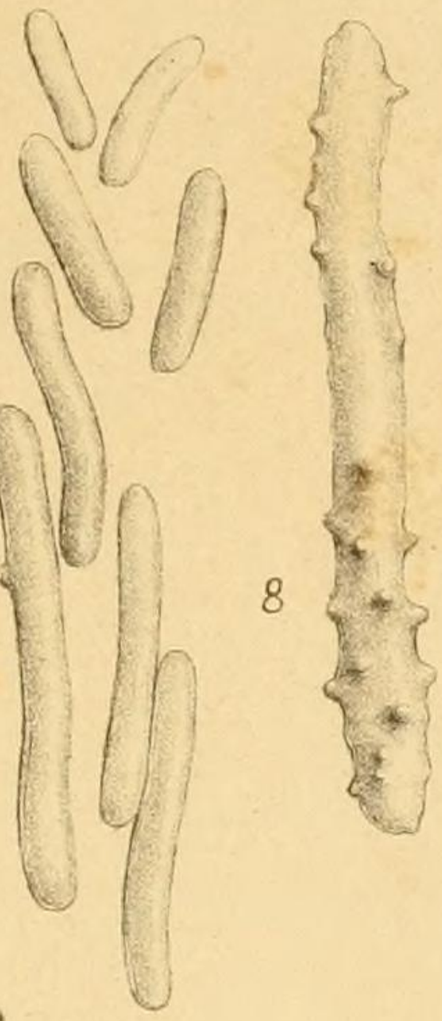
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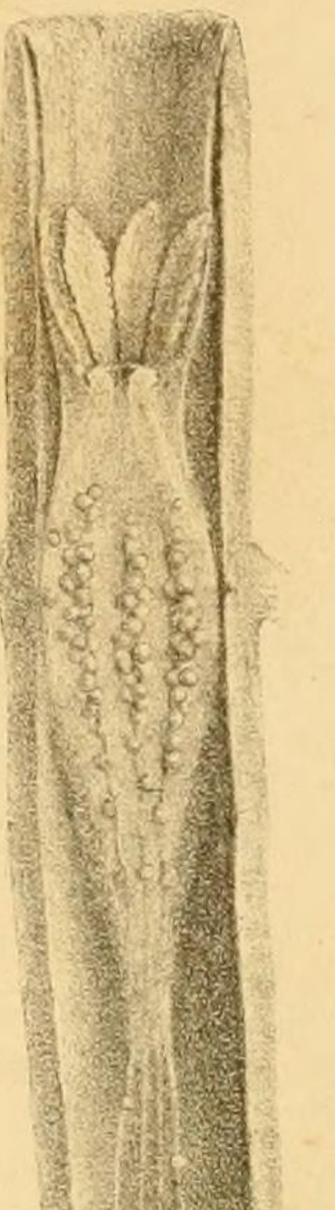
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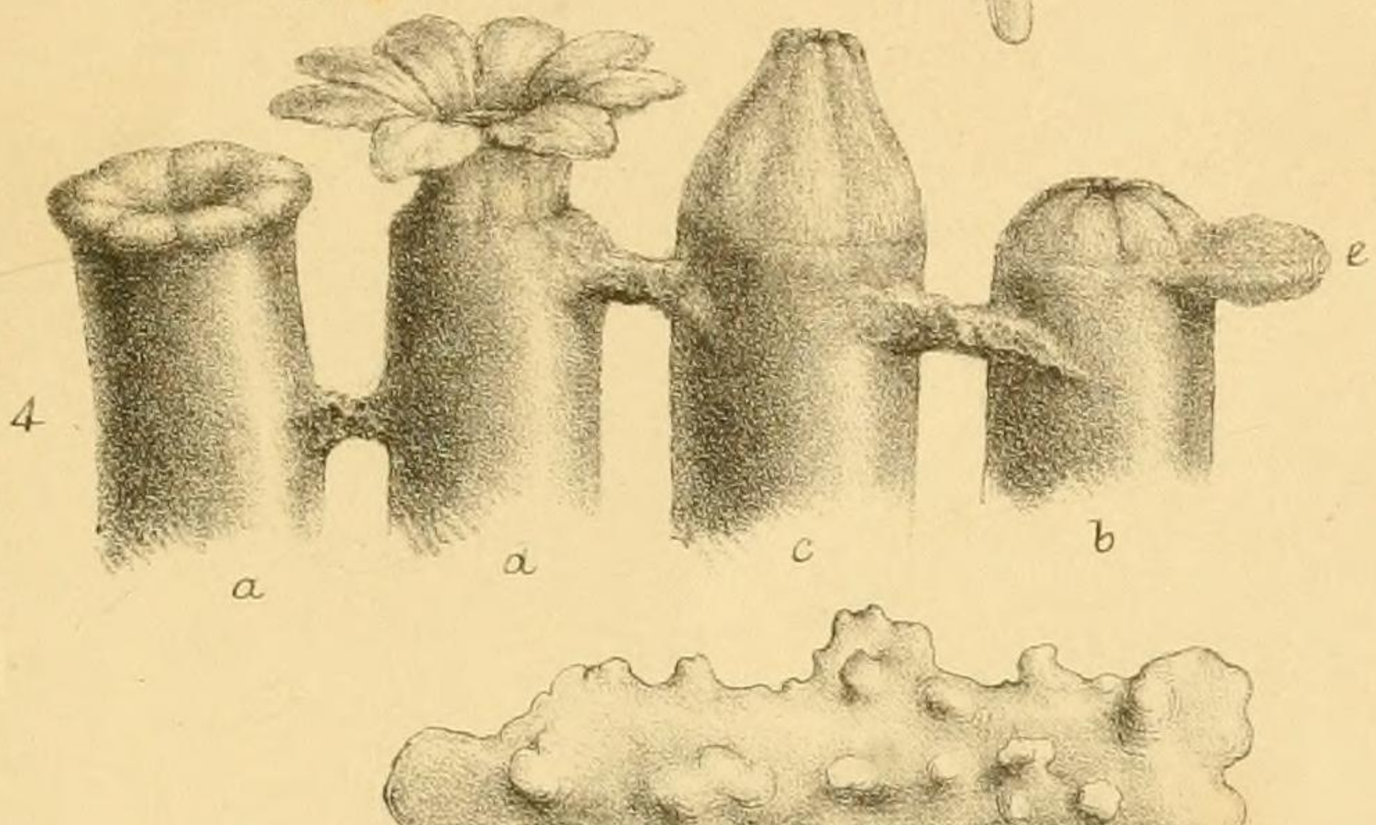
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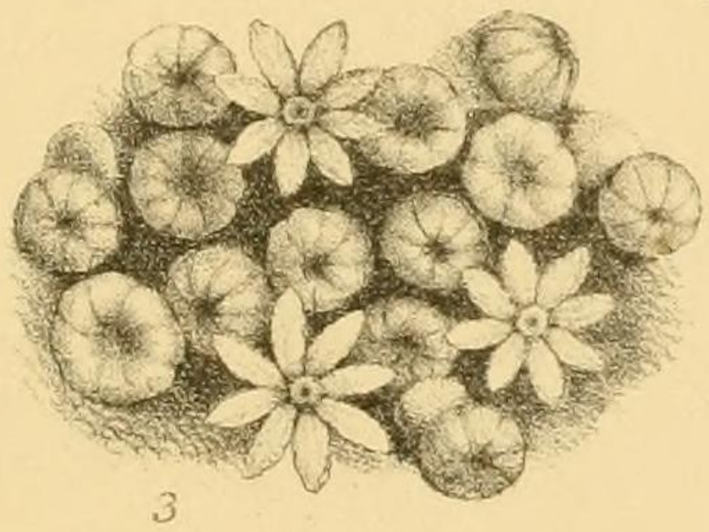
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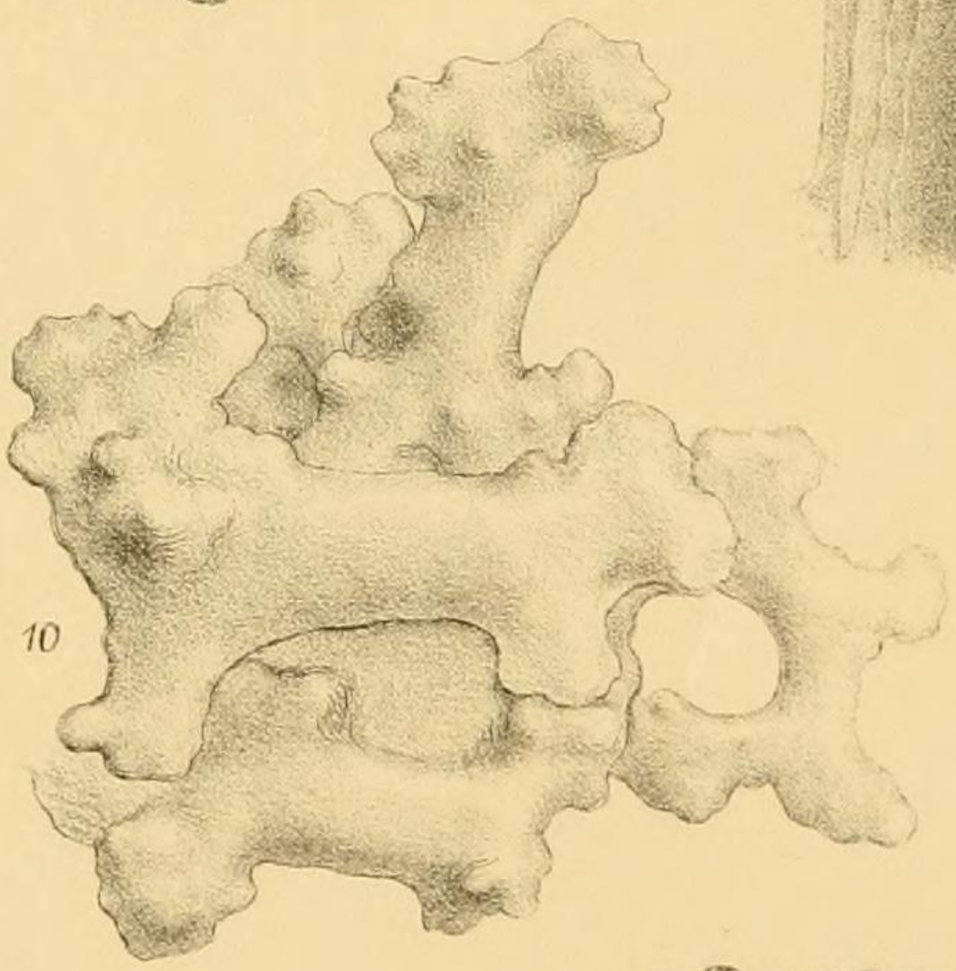
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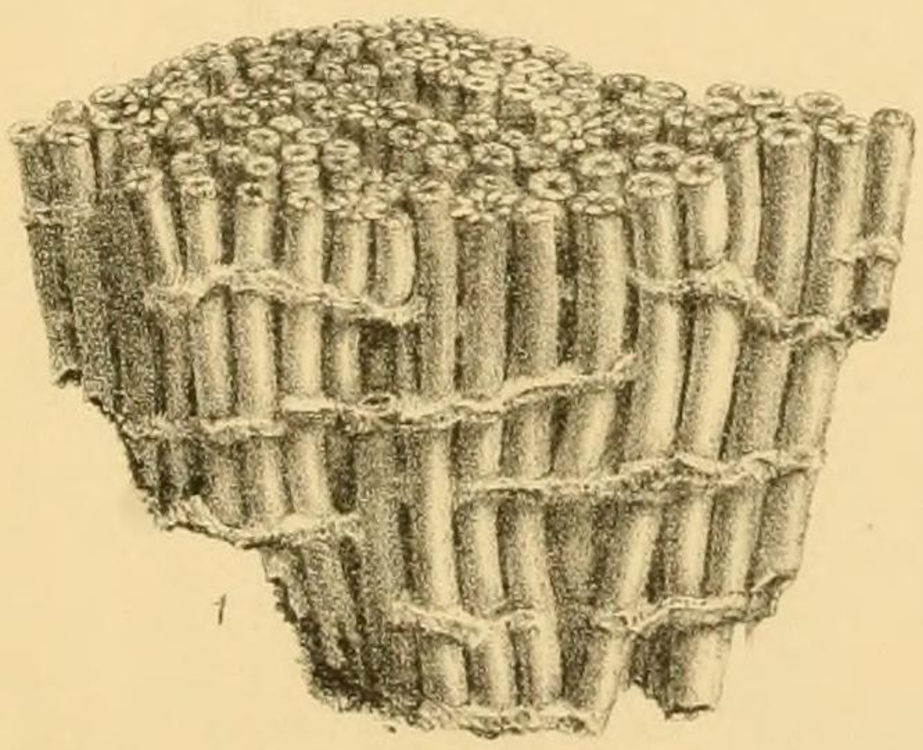
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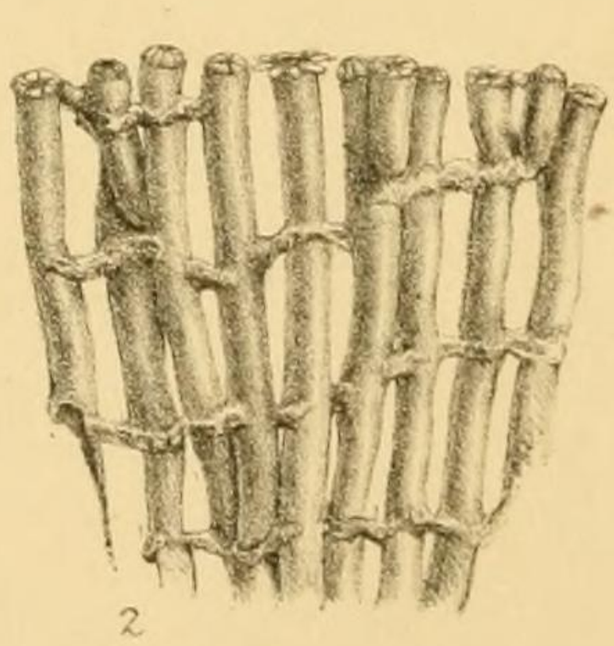
2

W. West imp.

G. H. Ford lith.

Tubipora musica.

lished on the 6th of January 1852, Prof. Costa enters upon lengthened details in connexion with his genus, of which the *Orthis anomioides*, Scacchi, is stated to be the type; he also, in pl. 3 bis, gives illustrations of its internal details. In the 'Annals & Mag. of Nat. Hist.' for May 1852, will be found my description and figures of the *Morrisia anomioides*; and it is singular that none of the many conchologists and palæontologists who have adopted my genus should have been acquainted with Costa's work, or been aware of his genus and priority.

XLVII.—*Notes on the Animal of the Organ-pipe Coral* (Tubipora musica). By Ed. Perceval Wright, M.D., F.L.S., Professor of Botany and Zoology, Trinity College, Dublin.

[Plate XXIII.]

Here and there, all along many of the fine sandy bays of Mahé and Praslin, will be found, cast up by the tide, masses of various sizes of the bright-red skeleton of the well-known organ-pipe coral; and in some places the finely broken-up fragments are so mixed up with the sand as to impart to it a slight red colour. Finding the skeletons so common, I expected with a little search to discover the living coral *in situ*, and with this object in view I searched many a mile of coral-reef, but without success. Hearing from some of the fishermen that, on a bank famous for such fine fish as *Mesoprion erythrinus*, *Gerres argyreus*, &c., quantities of red coral were often brought up on their hooks, I proceeded to the spot, and found large quantities of the skeletons of *Tubipora musica*, but no trace of the polyps. In October of 1867 I was residing on the eastern side of Praslin; and, taking advantage of the "grandes marées" of that month, I investigated very closely the extensive coral-reefs on the western side of the beautiful little island called Curieuse. My plan was to commence work about two hours before low water. Sending a small pirogue to row beside the outer edge of the reef, which here encircles the land, I used to walk along this edge, attended by Edward, the black captain of my black crew. His duty was to carry glass jars, into which to put my captures, and to help me in my encounters with eels and cuttlefish; while by the aid of the pirogue I could cross over the deep gullies which very frequently occurred in the coral-reef, without the necessity of having to go to the shore so as to get round them. I need scarcely say that even when wading to my waist in the tepid waters, and half a mile from the shore,

I could see, when the sea was tranquil, the surface of the reef as distinctly as if it were only covered by an inch or two of water. I had walked over this and other coral-reefs so very often, that I had not on this occasion much hope of discovering anything new. The surface on which I walked was a perfect carpet of a pretty bluish-green *Xenia*, interspersed here and there with patches of a bright scarlet and of a green alga. Sometimes, when a small heap of dead coral was met with and turned over, a large cuttlefish would endeavour, and sometimes successfully, to get over the edge of the reef, and then away. Large specimens of that fine Holothuroid *Müllerla nobilis*, and at intervals a *Culcita*, would be seen and collected. The edges of the gullies actually bristled with the long spines of *Diadema Savignyi*. The pain caused by incautiously touching the spines of the species of this genus is very great—so great that I have had my arm and hand quite benumbed by it for some hours. At one spot, near the very edge of deep water, my foot sank in some soft yet brittle stuff, and, from the sensation, I knew I had crushed some coral-structure that I had not before met with. On examination, this proved to be a bunch of the *Tubipora*, which was growing parasitically on a large rock of Madrepore; and now that I found the habitat of this species, I had no difficulty in finding any quantity of it. Some masses were two feet in diameter; but it more usually occurred in irregular lumps of about twelve inches in circumference and from two to four inches in height. Very frequently it was covered over with tufts of a small green confervoid alga, or of some sessile halichondroid sponge; and under such circumstances the red colour of the polypidom was, of course, not conspicuous. The crowns of tentacles, like so many stars, were of a greenish colour. Some few pieces were found elevated on a stalk, as if the budding of the original individual polyp had advanced for some time in an upward and then in an outward direction. The polyps were very sensitive, and quickly contracted themselves; nor were they, like the polyps of *Xenia*, at all quick to show themselves after they had been once alarmed.

My residence at Mahé after the discovery of the living animals of this coral was too short to admit of my investigating their development; but a very casual examination showed that the tubes were made up of spicules coalesced together, which were found free and distinct on the upper margin of the tube, and that the tentacles were also thickly covered over with minute pale-coloured spicules.

As the differences between the species of the genus *Tubipora* are not appreciable without an examination of the polyps,

perhaps there may always be some doubt as to which species is entitled to be called *musica*; but as the Linnean species came from the Indian Ocean, I think I may fairly assume that the Seychelles species is the *Tubipora musica*, Linn., the *Halcyonium rubrum indicum* of Rumphius; and if so, I cannot find that the polyps have hitherto been dissected. In Prof. Kölliker's short notes on "Polymorphism in various Genera of Alcyonaria"*, he mentions having examined a species of *Tubipora* from the Viti archipelago, which had been preserved in spirits. The species is not mentioned, but is probably one of the two species described by Dana as from the Fiji or Viti Islands, both of which differ specifically, as I take it, from the Indian-Ocean species.

The polyp consists of eight pinnate tentacles, each tentacle with from fifteen to seventeen pinnæ on either side; these tentacles are thickly studded with spicules of an oval shape, flat, somewhat longer than broad; they closely resemble the lenticular spicules of Kölliker: they are met with all over the tentacle, down the centre of which there is one compact row, forming as it were a midrib; they are often slightly compressed in the centre, so as to form a figure of eight. In the centre of the tentacles is the mouth, with a slightly raised circular lip. When the polyp is alarmed, the tentacles are first closed together, and then the polyp sinks down quite into the tube; as it becomes more completely retracted, it draws in after it the uppermost portion of the tube itself, inverting this and folding it in, until the open mouth of the tube is thereby completely filled. It is, of course, only the yet spicular, and not the solid portion of the tube that is thus inverted; and the folds thus formed equal in number the tentacles. I have more than once traced these spicular portions up to the very base of the tentacles, where the fusiform spicules end and the characteristic tentacle- and body-spicules commence, these spicules thus forming a series of triangular spaces, the bases of which join on with the hardened edge of the tube, and the apices are situated at the base of each tentacle. The spicules secreted by this portion of the ectodermic layer are of several sorts:—First, the warty fusiform spicule, so commonly met with in the Alcyonidæ; these spicules will be found in all stages of growth and of coalescence: thus at the upper portion of the edge of the tube, where it is non-retractile, the calcareous tissue will be found to consist of a series of them, partially joined together and making a kind of coarse open network (fig. 10), which, on being macerated in caustic potash, does

* Verhandl. d. phys.-med. Gesellschaft in Würzburg, Dec. 28, 1867, and Zoological Record for 1867, p. 661.

not fall to pieces; but the retractile portion, on being subjected to the same treatment, breaks up into a mass of minute individual spicules (fig. 8). The red colouring-matter would appear not to reside in these latter spicules; for those that I have examined are colourless, presenting in this a marked contrast to the spicules of *Melithæa coccinea*, which retain their red or yellowish-red colour after being exposed to the action of the caustic alkali. A second form of spicule is met with in the retractile portions of the tube; it closely resembles that form of spicule described by Kölliker as occurring in *Eunicea fusca* (Taf. 18. fig. 19), which I think might be called "shuttlecock." While all the forms of spicules met with seem to occupy certain definite portions of the ectodermic layer, yet there is an evident gradation between them, from the smooth fusiform spicule to the most irregularly warty forms, which leads naturally to the inference that all these forms are but different stages of growth, by the aggregation of new calcareous material, until the solid tubular structure so long known to us is at last reached.

The mouth, which is circular, is distinctly marked, and leads into the stomachal cavity, which is small; the stomachal cavity is separated by a thin and delicate membrane from the general body-cavity. I have not been able to determine with exactness the number of openings between these two portions. The ovaries are in the general cavity, and are invested by a delicate membrane, which is continued in the form of eight mesenteric slender bands to the body of the tube, as is seen in fig. 6.

In his 'Icones Histologicæ,' Prof. Kölliker, when treating of the hardened connective tissue met with in the Alcyonaria, divides the denser structures into:—

I. Hard structures which are in substance made up of small isolated bodies of a fixed shape (such as the calcareous spicules of Alcyonidæ).

II. Hard structures forming a more or less compact structure. Of these there exist:—

1. Hard calcareous bodies, either isolated or coalesced together, and in combination with a horny or chalky internodal substance, or occurring alone as coalesced calcareous substance. (Axis of Melithæaceæ, Sclerogorgiaceæ, and Corallinæ.)
2. Lamellated structures, which may be formed as secretions, and which, when calcified, leave, after the removal of the salts, an organic remainder preserving the same outline. Here belong:—

a. The horny axis of Gorgonidæ and Antipathidæ, and the horny internodes of *Isis*.

b. The more or less calcified lamellose axis of Gorgonidæ (*Primnoa*, *Plicaurella*, *Isis*, &c.) and Pennatulidæ.

3. Crystalline structure, which seems to increase through a deposit of chalk from a preexisting structure, as, after the removal of all the salts, there is still left a small, almost inappreciable organic residue. Here are placed:—

a. The greater number of those polyps with merely superficial skeletons (*Tubipora*); and

b. Structures like the chalky skeletons of the Madrepores.

The structure, however, of the skeleton of *Tubipora*, as will be seen from the above, is certainly not crystalline; and the manner in which it is deposited differs in no essential particular from that described in section II. 1. Fusiform spicules are secreted by the ectodermic layer; these spicules around the base of the tentacles are of a white colour, and in many cases are simply fusiform, not warty; but those at a little distance from the base of the tentacles not only assume a light-red colour, but become crowded over with warty excrescences, and there is then to be found a gradual growing together and consolidation of those around the edge of the tube—that is, where this is formed. In the case of a young bud, there is at first no tube, the spicules having not yet become coalesced; they are here simply placed side by side.

I regret very much that I had no opportunity of watching the development of the egg of *Tubipora*, or even of seeing the formation by budding of the attached zooid forms. From an examination, however, of a large series of specimens, it is, I think, pretty evident that the external tabulæ are formed in the first instance as flattened offshoots from the upper edges of the tubes. Thus in many instances flat plates will be found to project from the upper and still soft portion of the tube; this plate will consist of a fold of ectoderm, into which some of the endodermic layer is tucked: spicules are freely secreted in the outer layer of this fold, which is of a bright-red colour; and in one or two instances a small swelling was seen to arise from the free end of this lateral fold-like prolongation of the tube. I have little doubt that these swellings were the starting-points of fresh polyps. It must not be forgotten that while in some masses of *Tubipora* the skeleton-tubes were all close together, and the polyps all on the same level, in many others the masses vere very much less compact and the polyps were growing in an irregular manner.

The polyp certainly can and does constantly add to the

height of its tube; or, in other words, the spicules are being constantly consolidated into the tube, and the tube thus increases in height. In some cases I have been able to trace the mesenteric bands, which attach the lower portion of the body of the polyp to the walls of the skeleton-tube, as far as the second external septum in depth; and it is very evident that as the outer walls of the tube become consolidated, not only does the tube become elongated, but the polyp elevates itself at the same time in the tube.

I am inclined, with Milne-Edwards, to regard the genus *Tubipora* as belonging to the first family of the order Alcyonaria, viz. Alcyonidæ, but would place it as a separate section of the subfamily Alcyoninæ. Thus we should have—

Order ALCYONARIA.

Family 1. **Alcyonidæ.**

Subfamily 1. *Cornularinæ.*

„ 2. *Alcyoninæ*; and, dividing this into *three* sections, as follows:—

Alcyoninæ.

(I.) Naked or soft, as *Alcyonium.*
(II.) Armed with large spicules, as *Nephthya.*
(III.) Tubed; tubes formed of coalesced spicules, as in *Tubipora.*

Some may perhaps consider it advisable to give more weight to the great difference in the calcareous secretions, and place the genus in a subfamily to rank as a third subfamily of the Alcyonidæ, called Tubiporinæ, which would be characterized by having lenticular spicules developed in the tentacles, the fusiform spicules of the outer body-layer forming dense hard tubes united to each other by calcareous septa.

EXPLANATION OF PLATE XXIII.

Fig. 1. Mass of *Tubipora musica*, nat. size.
Fig. 2. The same, to show the buds.
Fig. 3. Polyps, seen from above, three expanded; from the side of the retracted polyp which is seen in the lower part of the figure, between the two expanded polyps, will be found the lateral fold-like prolongation of the tube referred to in the text.
Fig. 4. Polyps in different stages of expansion and retraction: at *e* the lateral fold-like prolongation is seen.
Fig. 5. Mouth, with circular lip and four tentacles studded with spicules.
Fig. 6. A section through tube and polyp, the latter fully retracted.
Fig. 7. Lenticular spicules from the tentacles.

Fig. 8. Fusiform spicules, plain and warty, from ectodermic layer between base of tentacles and edge of hard tube.
Fig. 9. Warty fusiform spicules.
Fig. 10. The same, gradually becoming coalesced and forming a rough irregular network at one spot; in another becoming solidified.

N.B. All the figures on this Plate have been drawn by Mr. Ford from specimens preserved in spirits. It need not be said that they are accurate representations of the structures thus preserved; yet they would undoubtedly have been much more life-like had they been drawn by Mr. Ford from living specimens. Figure 3, however, is not only an accurate but also to my mind a life-like drawing.

XLVIII.—*On the comparative Carpical Structure of the* Ehretiaceæ *and* Cordiaceæ. By John Miers, F.R.S., F.L.S., &c.

Thus far the carpical structure of the *Ehretiaceæ* has been explained, especially under the typical form of *Ehretia*; and it will tend to a better comprehension of the subject if I offer a few observations upon *Cordia*, because a very distinguished botanist has proposed to amalgamate *Ehretiaceæ* with *Cordiaceæ*. M. Baillon, in an instructive analysis of the ovary of *Cordia* (Adans. iii. 1, pl. 1), points to the analogy existing in the early development of the ovaries of *Cordia* and *Heliotropium*, and, without sufficient consideration of the subject, he pronounces these two genera to be inseparable; and, as the latter has been referred by some to *Ehretiaceæ*, he would unite the *Cordieæ*, *Ehretieæ*, *Heliotropieæ*, and *Borragineæ* into one family (*Cordiaceæ*). He thus divides it into two groups:—

1. *Borragineæ* proper.
2. *Cordiaceæ*, subdivided into
   - A. *Cordieæ*, having an embryo with plicated cotyledons.
   - B. *Heliotropieæ*, with simple cotyledons, without albumen.
   - C. *Tournefortieæ*, with simple cotyledons, with albumen.

But he does not state in which of these he would place the *Ehretiaceæ*.

These were the inferences he drew from his examination of the ovary of *Cordia ferruginea*; and he figured in the drawing above quoted the different stages observed from the period of the earliest development. He depicts the formation of two rudimentary carpels, which, by the inflexion of their margins, form a low dome with a unilocular cavity, in the bottom of which, intermediate between the four cardinal points, he perceived the evolution of four ovules, fixed in the base upon as many placentary ridges, while between them four septiform enlargements emanated from the wall of the cell at those cardinal points, leaving as many shallow fossets in the base