Observations on the anatomy of actinia coriacea and on alcyonella stagnorum / by Thomas Pridgin Teale.

TEALE ON ACTINIA
&
ALCYONELLA.

Frances Anne Teale Junr

September 1853

OBSERVATIONS

ON THE

ANATOMY OF ACTINIA CORIACEA,

AND ON

ALCYONELLA STAGNORUM.

BY

THOMAS PRIDGIN TEALE.

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ON THE

ANATOMY OF ACTINIA CORIACEA;

BY THOMAS PRIDGIN TEALE:

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Actinia Coriacea.—Cuvier, Spix, Rapp.
Actinia Senilis?—Linn:
Actinie Ridée?—Lam:

Throughout the writings of Dicquémare, Reaumur, Cuvier, Spix, Rapp, and others, are scattered numerous observations on the structure of Actiniæ; but these anatomical notices are, for the most part, brief and general; and, when more elaborate, they are usually limited to some particular organ, and in many instances are obviously incorrect.

Under these circumstances, it has appeared to me desirable that some species of this extensive and interesting genus should be made the subject of special investigation; and in the hope of contributing, however imperfectly, to this end, I have undertaken the enquiry, and beg leave to submit to the Society the result of my observations.

The species selected for this purpose appears to be identical with the Actinia Coriacea of Cuvier, Spix, and Rapp, and probably with the Actinia Senilis of Linnæus, and the Actinie Ridée of Lamarck.

It is of rather frequent occurrence on the Yorkshire coast, being found in considerable numbers on the lias and oolite rocks of Redcar, Scarborough, and Filey, and more sparingly on the chalk at Flamborough. It is exposed at low tides, and its favourite locality is the bases of rocks, near the sand, in which it is often partially imbedded.

The external envelope is a dense coraceous membrane, closely studded with small tubercular elevations, arranged somewhat irregularly, but with a tendency towards vertical and transverse lines. To these eminences fragments of rocks and shells often adhere. The base, by which it attaches itself with great firmness to rocks, is one inch and a half in diameter, circular, and free from the tubercular eminences; the body is one inch and a half in height, subcylindrical, tubercular, terminating superiorly in a thick rounded margin or lip, which admits of being extensively expanded, or can contract so as completely to conceal the superior surface or roof, and the tentacula. The roof, bounded externally by the lip, supports a double or triple series of from one hundred and fifty to two hundred tentacula, half an inch in length when protruded, about half that size when retracted, conical, and tapering gradually from the base to the summit, which is slightly obtuse and perforated. Internally, to the tentacula, the roof presents a flattened surface, having a central aperture, the mouth, which communicates with a large internal cavity, the stomach.*

The colour of the body is most frequently

* Plate 9, figs. 1 and 2.

deep olive green, occasionally passing into yellow, orange, brown, and red, frequently, but not invariably, marked with irregular streaks and patches of bright red.

The tentacula are generally of the same colour as the body, but of a lighter shade, presenting, in most individuals, a circular band, near the middle, of a rather deeper tint of the same colour, or sometimes of red.

CUTANEOUS SYSTEM.

The external envelope consists of a corium and epidermis.

The corium constitutes the chief organ of support, giving to the animal its peculiar form. A circular horizontal portion forms the base or foot; a cylindrical vertical portion constitutes the sides, and is inflected at the superior border, so as to form a thick rounded lip. The corium is afterwards prolonged over the tentacula, giving investment and form to these organs, and is then extended horizontally to form the roof, near the centre of which it again becomes folded upon itself, forming an internal lip or mouth, at which part it is continuous with the digestive sac.*

The corium at the base and sides is one fiftieth of an inch in thickness, but is considerably thinner at the tentacula. On examining a thin section of corium by the lens, it appears a simple homogeneous translucent structure. Externally the corium, more particularly when deprived of epidermis, pre-

* Plate 10, fig. 1.

sents numerous tubercular eminences, of a conical form, disposed, as has been already stated, somewhat irregularly, but with a tendency to vertical and horizontal lines. These eminences are translucent at their circumference, and present at their summit a perforation which appears as an opaque multangular spot.* They admit of retraction to such a degree as to render the corium perfectly smooth, so that the small opaque spot alone indicates their former situation; they also can be protruded to nearly a line in length, when they bear a close resemblance to rudimentary tentacula. The eminences on one side are often seen in the utmost degree of protrusion, whilst, on the other, they are scarcely perceptible. If, in the protruded state, they be touched with the finger, they are immediately retracted, in the same manner as the tentacula are withdrawn under similar treatment. To these eminences fragments of sand and shell frequently adhere, and the resemblance which they bear to tentacula would lead to the suspicion that it is by a power of suction, similar to that which is exerted by the tentacula, that these foreign substances are retained; the great firmness of the adhesion, however, and its continuance, in some instances, after death,† somewhat militates against this idea, and suggests the possibility that the eminences are follicular glands, whose secretion agglutinates these substances to the integument. The internal surface gives attachment

* Plate 9, fig. 3.

† I have a specimen preserved in spirit, in which the foreign substances adhere to the skin with great tenacity.

to numerous muscles. On making a vertical section of the entire animal, the continuity of the corium with the stomach may be distinctly seen,* in which respect the skin of Actinia is strictly analogous to the cutaneous envelope of the higher classes of animals, in being continuous with the mucous membrane. The apparent contractility of the corium most probably depends upon the muscular fibres which are intimately connected with its internal surface.

The epidermis forms a thin layer of unorganised matter spread over the whole extent of the corium, and may be traced into the stomach. The external surface of the epidermis is dense and membranous; internally, when examined by the lens, it appears as a pulpy substance. Intimately intermixed with it, in irregular patches, and not constituting a distinct or separate layer, is a pigment varying in colour in different parts of the same animal, and in different individuals. This colouring matter is extensively distributed over the base, sides, tentacula, and roof, but I have never observed any trace of it in the stomach.

MUSCULAR SYSTEM.

In Actiniæ the muscular system exists in a high degree of development. The filaments of which it is composed are often distinctly fasciculated, and the fasciculi are grouped into masses or layers often constituting muscles of considerable extent and power. These muscles may be most conveniently described

* Plate 10, fig. 1.

by referring them to the different regions in which they occur.

*Muscles of the vertical Leaflets.**—The space between the cylindrical or lateral portion of skin and the stomach, is intersected into a vast number of vertical compartments, by certain membranous partitions, or leaflets, attached externally to the cylindrical portion of corium, internally extending towards the stomach and giving attachment to the ovaries, superiorly connected with the roof, and inferiorly with the base. These leaflets are generally of a quadrilateral form, the inferior edge being extensively attached to the base, and in many instances prolonged from the circumference to the centre, which forms a common point of union for numerous leaflets, whence their inferior borders seem to radiate. The internal border of most of the leaflets gives attachment to the ovaries and vermiform filaments, with the exception of a small portion of the upper part, which in many instances is attached to the stomach, and fixes it in its situation; a few of the leaflets, destitute of ovaries, are prolonged as far as the stomach, and are attached to this organ throughout the whole extent of their inner border. The breadth of the leaflets varies considerably, some extending scarcely a line from their external attachment, others reaching as far as the stomach, being nearly half an inch in breadth. The height generally corresponds with the height of the animal; a few, however, of the narrowest leaflets extending upwards from the base, terminate obliquely in the sides,

* Plate 10, figs. 3, 4, 5, and 6; and Plate 11, fig. 1.

without being prolonged as high as to the lip or roof.

Each leaflet consists of one or more distinct layers of muscle, and a delicate investing membrane. The muscular filaments are grouped in somewhat coarse fasciculi, particularly those which have a vertical direction, and they are often arranged in distinct layers. The direction of the fibres is extremely various; most of the larger fasciculi passing from the base in either a vertical direction to the roof, tentacula, and lip, or with a slight degree of obliquity into the sides; others pass with greater obliquity upwards and outwards, a few upwards and inwards, traversing the leaflets in a direction from the sides obliquely towards the roof and mouth. In addition to these vertical and oblique fibres, a transverse order of muscular filaments is observed, more delicately fasciculated than the former, extending across the leaflets, in a transverse direction, from the sides towards the bases of the tentacula, mouth, and stomach; the transverse fibres are more obvious at the upper than at the lower portion of the leaflet. Some leaflets present two, three, or more distinct perpendicular muscles, as well as oblique and transverse fibres; a few appear to consist of a single vertical muscle.

*Muscles of the Base.**—Those fibres of the leaflets, which have an attachment to the base, may, to a certain extent, be regarded of muscles of this part; besides these, however, there are special muscles of the base, arranged in a radiating and in

* Plate 10, fig. 8.

a circular direction. These are observed by separating and turning aside two of the leaflets so as to expose the narrow portion of the base which is situated between the attachment of their inferior borders. After carefully removing, with a camel's hair pencil and water, the mucous which obscures this part, two slender muscles, each composed of a single fasciculus of fibres, may be seen with the aid of a lens, extending from the centre to the circumference, close to the insertion of the inferior border of each leaflet. Between these two slender radiating muscles, are seen very delicate fibres, not fasciculated, crossing the intervening space, and constituting a portion of a circular order of muscles of the base.

*Muscles of the Sides.**—In addition to the fibres of the leaflets inserted into the sides, are also special muscles of this part. On turning aside two of the leaflets so as to expose the narrow portion of corium between the insertions of their outer borders, and cleansing it from mucous, distinct transverse bands of fibres may be seen crossing this narrow space and constituting part of a circular order of muscles of the sides.

Muscles of the Lip.†—The lip is a complicated structure, externally composed of the common integument, which doubled upon itself forms a rounded edge or border, within which are muscular fibres, prolonged upwards from the vertical leaflets; these fibres taking the course of the skin are, along with it, reflected, and thereby enclose a thick circular muscle, coarsely fasciculated, between the fasciculi

* Plate 10, fig. 7. † Plate 10, fig. 11.

of which are numerous cavities communicating freely below with the interseptal spaces; these cavities communicate above with numerous tubular eminences, arranged along the border of the lip, each of which is perforated at the summit, and resembles a rudimentary tentaculum. The summits of these eminences are generally white, and form a circle of glistening spots.

This structure allows water to pass freely from the interseptal spaces into the cavities within the lip, and thence into the tubular eminences, by which all these parts become forcibly injected and distended during the expansion of the animal. Contraction and closure of the lip is principally produced by the powerful action of the circular muscle, and is facilitated by the escape of the fluid from the apertures in the tubular eminences.

*Muscles of the Tentacula.**—The tentacula are formed of tubular prolongations of integument enclosing longitudinal and circular fibres. They are perforated at the summit, communicate freely at their base with the interseptal spaces, and are lined by a prolongation of the delicate investing membrane of the interseptal spaces. The perpendicular fibres are arranged in distinct and rather widely separated fasciculi, and are easily seen to be prolongations of the vertical fibres of the leaflets; the circular order of fibres are placed internally to the former, are not fasciculated, and form an extremely delicate layer; they are distinctly seen to be a plane of fibres continuous with the transverse fibres of the leaflets.

* Plate 10, figs. 9 and 10.

Near the summit of the tentacula the circular fibres become a little more developed, and constitute a kind of sphincter.

The structure and connections of the tentacula allow them to be readily distended with water from the interseptal spaces, by which they are protruded during the expansion of the animal; the escape of the water from the summits of the tentacula, and from the stomach, aided by the contraction of the longitudinal and circular fibres of the tentacula, produces the retraction of these organs.

Muscles of the Roof and Mouth.—The common integument, after having formed by its duplicature the lip, and by its tubular prolongations the tentacula, is extended in an horizontal direction as the roof, and becomes doubled upon itself, forming an inner lip or mouth, a circular aperture, at which part the external envelope becomes continuous with the stomach. Beneath the portion of integument forming the roof are numerous converging fibres, passing from the circumference towards the centre. These are evidently the transverse fibres of the upper part of the leaflets continued along the roof to the mouth, where some of them turn downwards to constitute a muscular coat of the stomach.

In addition to these converging fibres, a circular layer surrounds the mouth, in which part are numerous cavities communicating with the interseptal spaces, and admitting of distension by water injected from these spaces.

Muscles of the Stomach.—These fibres will be noticed in treating of the digestive apparatus.

The stomach is a membranous cavity formed by an internal prolongation of the common integument.

It is bounded above by the mouth, below it forms an imperfect sac, terminating abruptly, and leaving a circular portion* near the central part of the base deficient, where it communicates freely with the interseptal spaces, and where portions of the vermiform filaments, and sometimes of the ovaries, are seen protruding into the stomach. Spix describes and represents numerous very minute apertures at the inferior part of the stomach as the terminations of the oviducts. These apertures I have not been able to detect.

The stomach is principally composed of the corium, which here constitutes a mucous membrane, lined by epidermis, but destitute of colouring matter. It is strengthened by a series of muscular fibres passing downwards from the mouth to its inferior boundary. These fibres are an evident prolongation of the converging fibres of the roof, which after having traversed the roof and reached the edge of the mouth, suddenly turn downwards to give an investment to the stomach. Lamarck has noticed "flat longitudinal parallel fibres surrounding the alimentary sac."†

The stomach is held in its situation by numerous fibres of a tendinous or perhaps muscular cha-

* Plate 10, fig. 2, *a*.

† Lamarck, Hist: Nat: des Animaux sans vertibres, 3, 65.

racter, which pass from the internal border of the vertical leaflets to the sides of this organ. The attachments are most numerous to the upper portions of the leaflets above the part where the ovaries are attached. To some of the leaflets, which are destitute of ovaries, the stomach is connected nearly throughout their whole extent. These connections with the leaflets produce a plicated appearance of the internal surface of the stomach, throwing this membrane into numerous minute vertical folds. Two of these folds, placed opposite to each other, are much broader and more strongly marked than the rest.* They are produced on each side by the firm adherence of the gastric membrane to a pair of very dense, fleshy, but narrow leaflets, throughout their whole extent, or, in other words, from the top to the bottom of their internal border. These depressions divide the animal into two lateral halves, constituting a bilateral symmetry in Actinia, as has been observed by M. Agassiz in other supposed radiated animals.

The stomach, with its circular aperture at the base, and its two depressed folds, may be most conveniently observed on the spontaneous eversion of the animal. If several specimens be placed for a few hours in a basin of sea-water, some of them will begin to protrude the small folds of the stomach, and this protrusion proceeds until the whole of the stomach is everted; in this state specimens may be preserved by suddenly immersing them in spirit. This spontaneous eversion I have frequently seen

* Plate 10, fig. 2, *b. c.*

in Actinia Coriacea, but never in Actinia Equina (Actinia Purpurea, Cuv:)

In the stomach is poured out a very copious and viscid secretion, which appears to be the principal agent in the digestive process.

Actiniæ are remarkably voracious, and devour large animals, often of higher grades than themselves. In the stomach of an Actinia Equina I found a bivalve one inch in length, by which the animal was distended considerably beyond its natural size, and from an Actinia Coriacea I obtained portions of a crab broken into fragments, which must have been as large as itself. They greedily devour crustacea, shell-animals, and small fishes. Dicquémare observed that they would swallow individuals of their own genus; these, however, were not digested, but were rejected alive in eight, ten, or twelve hours. Although often so voracious, Dicquémare ascertained that they could exist more than a year without any other food than the animalcules existing in sea-water. The ordinary period of digestion appears to occupy forty, fifty, or sixty hours. M. Dicquémare found that when living bivalves were swallowed, their shells were ejected in the time above mentioned.

An interesting enquiry here presents itself. By what means is the nutrient fluid resulting from the digestive process conveyed from the stomach into the different textures of the animal for the purposes of growth and nutrition? In the Echinoderma, animals a little more elevated in the scale of organization than Actiniæ, the nutrient fluid is distributed

by distinct blood vessels, but as yet no isolated system of vessels of this character has been detected in Actiniæ. In the Medusariæ, ramified canals are seen extending from the stomach, by which the digested alimentary matters are conveyed to distant parts of the body, and it is not improbable that the numerous interseptal spaces of Actiniæ, which we may regard as cavities prolonged from the stomach, answer a similar purpose of diffusing the nutrient fluid throughout their body, and of exposing it to an extensive membranous surface for absorption.

REPRODUCTIVE SYSTEM.

The Ovaries.—The ovaries, about two hundred in number, form elongated masses attached along the inner border of most of the leaflets.* Each ovary is composed of several horozontal folds or plaits, which, when unfolded,† show this structure to be about three times the length it assumes when attached to the leaflet. By carefully spreading out these folds, the ovary, with the assistance of a lens, is seen to consist of two very delicate layers of membrane, enveloping a closely compacted layer of ova. After enveloping the ova, the membranous layers are placed in apposition, and form a kind of mesentery,‡ by which the ovary is attached to the internal border of the leaflet. The two layers afterwards separate to pass one on each side of the leaflet, thereby lining the interseptal spaces, from which this membranous investment is prolonged into

* Plate 11, fig. 1, *e*. † Plate 11, fig. 2.
‡ Plate 11, fig. 1, *f*.

the tentacula, as well as into the cavities within the structure of the lip and mouth. At the summits of the tentacula, and of the tubular eminences of the lip, the membrane becomes continuous with the common integument, whilst at the inferior part of the interseptal spaces it is continuous with the digestive sac. The breadth of the ovaries is nearly uniform from the top to the bottom. Some irregularities are occasionally observed in their attachments to the leaflets. Sometimes one leaflet supports two ovaries, and not unfrequently two neighbouring ovaries are continuous with each other at their inferior extremities.

The Ova.—The ova are round, except in an advanced stage of development, when their circular outline becomes a little interrupted by the pressure of neighbouring ova. A well marked central depression may also then be seen indicating the situation of the oral aperture, but without tentacula. The ova, when of large size, project considerably beyond the surface of the ovary, protruding before them their delicate investing membrane. In this state they are readily detached by very slight pressure with the point of a needle.

The ova are nearly of the same size in the same ovary, except a few small ones scattered here and there amongst those which are generally more mature. There is no regular gradation of size in the ova from the top to the bottom of the ovary, as if they successively arrived at maturity in that order as imagined by M. Spix. In the same individual, however, are sometimes seen ovaries whose

ova are generally less developed than those of neighbouring ovaries. At the same season also it is common to find different individuals, even from the same rock, with their ova in very different stages of development; some exhibiting the ova distinctly to the naked eye, whilst others require the lens for their detection. This difference in the development of the ova in different individuals is not limited to any particular season. I have repeatedly observed it throughout the whole of Spring, Summer, and Autumn, from March to November inclusive.

The colour of the ova in this species varies considerably. It is most frequently pale yellow, but is occasionally white, pink, or brown.

*The Vermiform Filaments.**—Connected with each ovary is a remarkable structure, whose nature and offices are involved in considerable obscurity.

It appears as a delicate vermiform thread, minutely convoluted, and united by a mesentery to the inner border of the ovary. It is of a milk-white colour, about the thickness of a horse-hair, and of extremely soft consistency, yielding readily to slight pressure of a needle. By its numerous convolutions it constitutes a mass of an elongated form, attached superiorly to the inner border of the leaflet above the attachment of the ovary, it then passes over the ovary, united to the whole length of its inner border, and below the ovary it has an attachment to the inferior part of the internal border of the leaflet. Superiorly the filament is extremely minute, and in the multitude

* Plate 11, fig. 1, *g*.

of its convolutions I have been unable to detect its point of commencement, for, in attempting to unravel these convolutions with the needle, their delicate structure has been unavoidably lacerated. The difficulty of detecting its commencement is in many instances still further increased by two neighbouring convoluted masses being frequently continuous at their upper extremities. Inferiorly the filament becomes gradually increased in size and less convoluted, and at length it appears as a simple wavy line, still attached by its mesentery to the inferior part of the leaflet, near which it terminates in the coats of the stomach. The orifices by which the filament, if tubular, may open into the stomach, I have not been able to detect; they are, however, distinctly represented by M. Spix, in his plate of Actinia Coriacea. It is most probable, and indeed there can be but little doubt, that the filament is tubular; but of this I have not yet been able to obtain evidence. Under the microscope it appears simply as a round, solid, translucent chord.

The vermiform filament can only be seen to advantage in the living animal, and it may be readily observed protruding through the lacerations of the integument, which in most instances are produced by detaching the Actinia from the rock. If the filament be immersed in water for half an hour after vitality has ceased, its characteristic appearances become obscured or lost from the rapid endosmose which occurs in this tissue after death, but which it resists during life. In diluted alcohol this obscuration of the tissue takes place, but less rapidly than

in water. I have repeatedly placed portions of the vermiform filament in spirit for the purpose of preservation, but the natural appearances of it only remained for one or perhaps two days, after which it was impossible to recognise the structure, a mere flocculent membranous substance remaining. The only manner in which I have been able to preserve it has been by spreading small portions upon glass as objects for the microscope. When dried on the glass these specimens have retained much of their characteristic appearance, exhibiting distinctly the rounded filament and its mesentery.* A line of granular fatty matter is seen, in some specimens more distinctly than in others, accompanying the filament throughout its whole extent, and enclosed within the layers of the mesentery.

It is this filament which has been frequently noticed as protruding from the mouth and sides of Actinia. M. Dicquémare speaks of "soft limber threads, of the thickness of a horse hair," and Cuvier notices the long filaments proceeding from the ovaries, and protruding at the mouth.

For the purpose of examining this limber thread I placed several specimens of Actinia Coriacea and Actinia Plumosa in sea-water in the month of August. Some of them soon began to protrude long slender hair-like filaments, others ejected a small rounded white mass, which on examination was the same kind of filament, but with its mesentery attached, which caused it to retain the convoluted arrangement, and prevented it assuming the

* Plate 11, figs. 3 and 4.

elongated form. Other masses of larger size were also cast off, and these proved to be portions of ovary, with some of the white convoluted substance attached to them.

These hair-like filaments were observed to possess a distinct serpentine motion. Some of them, about an inch in length, were placed in sea-water upon the shell of a murex, where they slowly coiled themselves into a variety of forms, and possessed a considerable locomotive power, having traversed a great extent of the surface of the shell in a few hours; afterwards their motions gradually ceased, they remained fixed to one part of the shell, their form and outline became somewhat obscured from a surrounding cloudiness in which they were enveloped, and in twenty-four hours a diffused whitish flocculent substance was the only trace of them that remained. The same vermicular movements were observed in those portions to which the mesentery was adhering.

I am of opinion that these substances and filaments are not spontaneously protruded by the animal, but that they are cast off in consequence of having been detached by mechanical violence, as I have never been able to detect them protruding from Actiniæ whilst unmolested in their native haunts. When, however, they are separated from the rocks, (a process requiring considerable force,) and are placed in a basin of sea-water, these filaments, convoluted masses, and portions of ovaries, are protruded in considerable abundance.

The preceding description of the ovaries and

vermiform filaments differs materially from that of the ovaries given by M. Spix, and it would have been with the greatest diffidence that I advanced opinions at variance with those of so respectable an authority, more particularly as the descriptions which he has given, as well as his plates, have for many years been regarded as the standard of reference on the subject, and have been copied by Professors Carus and Goldfuss and other naturalists, had not the strongest conviction of the inaccuracy of M. Spix been forced upon my mind by repeated and careful dissections, the results of which, as far as regards the ovaries, may at any time be verified by reference to the preparations of these parts which I have preserved in spirit.

The following are the observations of M. Spix: "Chaque ovaire est composé de trois ou quatre boyaux cylindriques et cohérens, qui, vers la base, s'allongent dans un tuyau commun, et dont le sommet s'amincit en pointe, à mesure que les œufs deviennent plus petits (chaque ovaire en contient à peu prés un soixantaine.) Les tubes communs de deux ovaires des plus voisins se reunissent, en serpentant, dans un seul, au moment qu'ils sortent de la concavité longitudinale; ce dernier forme ensuite, avec le canal du paire prochaine l'oviducte, qui est consequemment commun aux quatre ovaires, et s'ouvre dans l'estomac. L'insertion s'y fait en zig-zag; car les uns entrent plus haut, et les autres plus bas."*

In the above quotation it is evident that M.

* Annales du Muséum.

Spix has described as both ovary and oviduct what in the preceding pages has been spoken of as the vermiform filament, having either altogether overlooked the true ovary, or confounded it with the vermiform filament; for when he describes the ovary as composed of three or four cylindrical and coherent tubes (boyaux) which after performing a serpentine course, are prolonged inferiorly into a common tube, ultimately terminating in the stomach, it is obvious that the description can refer only to the vermiform filament, and that no part of it can belong to that flattened layer of ova, enveloped in two layers of membrane, which conjointly constitute the true ovary.

Much doubt exists as to the nature of the vermiform filament, and I have designedly selected for it a name which does not imply any opinion as to its function. The convoluted form of this filament, and its connection with the ovary, have probably suggested the idea that it is an oviduct; an opinion, however, which has but little evidence for its support, and not much probability in its favour. It is somewhat difficult to imagine how the fully developed ova, distending their envelope, and ready to burst through their slight membranous barrier, and fall into the interseptal spaces, should reach and obtain entrance into the commencement of this delicate tube; on the contrary it is much more easy to suppose that, when sufficiently matured, they actually burst their membranous envelope and become lodged in the interseptal spaces, where they are exposed to the free access and continued supplies

of sea-water, the grand stimulus to their further development. This supposition receives some confirmation from the fact that in the smaller species of Actinia (Actinia Equina) so abundant on our coasts, it is in the interseptal spaces, and not in the stomach, that the young are lodged; and in that situation, during the months of Spring, Summer, and Autumn, if not of Winter, they may be found of various sizes, from a small red point not larger than a pin's head, to that of fully developed Actiniæ two lines in diameter. When, also, we consider the immense length of all the vermiform filaments, which when taken conjointly, exceed by many hundred times that of the animal, and when we consider the immense number of ova, there being some thousands in each Actinia, it is reasonable to expect if these tubes were really oviducts, that occasionally ova, so numerous, might be detected traversing canals of such extraordinary length. To ascertain this point, I have examined many thousands of the tubes, in Actiniæ, whose ova were fully developed, but have never been able to detect a single ovum in its transit.

In the absence, then, if any direct evidence as to the nature of these tubes, I am inclined to suspect that they are elongated follicular glands, analogous to the salivary, pancreatic, and hepatic follicles of animals a little higher in the scale of organization, supplying secretions subservient to the digestive process.

RESPIRATORY SYSTEM.

The extensive internal membranous surface,

exposed to the free access of sea-water, with the addition of the external envelope, must be regarded as the respiratory apparatus. From the inferior aperture of the stomach, water has ready access to the numerous compartments of the interseptal spaces, and from these to the various cavities of the lip, tentacula, and mouth.*

NERVOUS SYSTEM.

From the highly developed state of the muscular system in Actinia, it might be imagined that the nervous system existed in a corresponding degree of development. Under this impression I have repeatedly searched for the nerves with the greatest

* In May last, at Scarborough, I detected the existence of ciliary currents along the surfaces of the muscular leaflets, without being aware at the time that Dr. Sharpey, as early as 1830, had observed these currents in Actiniæ. He has since pursued the investigation further, and in the recently published numbers of the Cyclopædia of Anatomy and Physiology, has described the various parts of Actiniæ on which the currents occur, as well as their particular directions. Dr. Sharpey has observed them on the surface of the oviducts, (in the present paper described as the vermiform filaments,) and their supporting membrane, and also on the internal surface of the stomach. "In one small but full-grown species," Dr. Sharpey further observes, "I found currents commencing near the centre of the disc, and proceeding outwards in a radiating manner to its circumference, whence they continued along the arms as far as the points. On examining this species, which was semi-transparent, by transmitted light, I distinctly perceived moving particles in the water contained within the tentacula, and behind the protruded stomach. Some of these particles were no doubt ova. The motion of these particles obviously indicated a current in the water along the surfaces containing it, which current, like that on the oviducts, it may be inferred was produced by cilia, for it went on while there was no perceptible contraction taking place in any part of the animal. The particles indicating the currents within the tentacula, were moved in two different directions, namely, from the base to the point, and from the point to the base, and (supposing the arm spread out horizontally) the outward current was along the under part of the tube and the returning one along the upper."—*August* 30, 1836.

care, but as my investigation has been hitherto unattended with success, I will here take the liberty of quoting the observations of M. Spix, "Ayant soulevé par une legere incision, les muscles longitudinaux à leur reunion au milieu de la base, j'aperçus, par une loupe, un entrelacement formé de quelques paires de nodules, disposés autour de centre, et qui communiquent par plusieurs filets cylindriques. De chaque nodule, deux filets se dérigent en avant ; on voit l'un ramper le long du muscle, l'autre le percer, se diviser en deux branches, et enfin se perdre dans la cavité longitudinale que forme les muscles flottans. La situation des nodules et des filets au-dessous de l'estomac, et leur figure ronde ne me laissérent pas les confondre avec les muscles, qui sont larges et aplatis, en forme de rubans, d'autant moins, que je vis les derniers pourrir trés-promptement, tandis que les premiers restèrent intacts."—p. 444.

Whilst I am compelled to acknowledge my want of success in detecting the nervous system of Actinia, it affords me some consolation to find the distinguished M. de Blainville in a similar dilemma. In allusion to the description of M. Spix, he remarks,* " J'avoue que, quelques soins que j'aie mit à le chercher où il l'indique sur des individus d'une grande taille, tout frais et même vivans, il m'a été absolument impossible de rien rencontrer de semblable à ce qu'il a decrit et même figuré." M. Blainville further remarks that he has observed in the substance of the inner lip, or mouth, a grey pulpy chord, which he has thought might probably be

* Manuel d' Actinologie et de Zoophytologie, p. 80.

nervous. I have frequently seen a similar filament in this situation, which from its extreme softness, and from its being connected with rigidly contracted muscles, immediately disappeared or became lacerated when an attempt was made to separate the muscular leaflets, or to trace it with the dissecting needle. This, however, is a much more probable situation for the nervous system than that assigned to it by M. Spix.

ON

ALCYONELLA STAGNORUM;

BY THOMAS PRIDGIN TEALE:

READ NOVEMBER 13th, 1835.

Alcyonella Stagnorum.—Lamarck, ii. 100.
Alcyonium Fluviatile.—Bruguiére, Encycl: Meth:
Alcyonelle Fluviatile. { Raspail, Mem: de la Société d'Histoire Naturelle, 1828.

On the tenth of August, in the present year, Mr. George Matthewman presented me with a large zoophytic mass taken from a pond in his father's garden, at Little Woodhouse, near Leeds, which on examination was found to consist of a horny basis, arranged in tubes, for the most part of a pentagonal form, opening on the surface by pentagonal apertures, and containing a gelatinous substance. When placed in water, it soon exhibited a multitude of polypes projecting from the tubes, each polype consisting of a beautiful expansion of about fifty tentacula, arranged in a complete circle, indented on one side so as to produce the appearance of a double row of tentacula arranged in a horse-shoe form.

Not being aware of any polype whose characters agreed with those just described, I referred for

information to the works of Natural History within my reach, and the only Zoophyte, to which I could suppose that it approximated, was Alcyonella, of which Lamarck* states that the polypiferous mass is composed of subpentagonal tubes, and that the polypes consist of fifteen to twenty straight tentacula arranged around the mouth in a circle incomplete on one side. He further states that he only knows of one species of the genus, and that it had been described and figured by Bruguiére in the Encyclopédie Methodique. On reference to the plate alluded to I found the tentacula represented as being terminated by a rounded head or button.

As it is stated by Lamarck that he had had the opportunity of examining the living animal from the pond of Plessis-Piquet, near Paris, I could not have the least doubt of the accuracy of his description, and consequently arrived at the conclusion that the animal now under consideration was not the Alcyonella, for although it corresponded with the latter in the description of the horny basis, yet the small number of tentacula, the rounded head at their extremities, and the incomplete circle which they formed, constituted characters so strikingly different from the subject of the present enquiry, that I felt convinced that it must belong to a genus not yet described, and that in undertaking the investigation

* "Polypier fixé, encrontant; a masse convexe and irreguliére; constitué par une seule sorte de substance; et composé de l'aggregation de tubes verticaux, subpentagonés; ouverts a leur sommet. Polypes a corps allongée, cylindrique, offrants a leur extremeté superieure quinze a vingt tentacules droits, disposée autour de la bouche en un cercle incomplet d'un coté.—Lam: ii. 100, 1836.

of its structure and habits, I should be engaged in a pursuit not unacceptable to the Society, and might probably be enabled to make some small contribution to natural history.

After my investigations had terminated, I received from Paris the volume of the Memoires de la Société d'Histoire Naturelle for 1828, containing the essay of M. Raspail on Alcyonella, and was not a little surprised to find that the descriptions of Bruguiére and Lamarck were quite incorrect, and that the Alcyonella, instead of having from fifteen to twenty straight tentacula terminated by a rounded head, had really not less than forty-four tentacula perfectly linear; and that the tentacula, instead of forming an incomplete circle, were arranged in a complete unbroken series depressed on one side.

It is scarcely necessary for me to say that my own observations had, in many of the most essential points, been anticipated, and that in several instances the investigations of M. Raspail had been pursued to an extent which my own inexperience in such enquiries, and my imperfect means of observation had not allowed me to reach.

After the elaborate essay of M. Raspail, it might appear a work of supererogation in me to proceed with the subject; but as the essay alluded to, although published in 1828, has not, as far as I am aware, been noticed by the British press, and as the Alcyonella has not been recorded as a British animal, I feel justified in proceeding, and shall give the description of it in the manner I had arranged previously to seeing this memoir, and shall conclude

with a brief sketch of the bold and ingenious generalizations adopted by M. Raspail, in reference to Alcyonella and several neighbouring genera.

HABITAT.

The pond from which the specimen was obtained, was originally one of those excavations in a bed of clay popularly known in this district as a "brick-pond," but now constitutes a pleasing ornament of an enclosure of moderate extent, tastefully laid out as gardens. The pond is abundantly stocked with carp and gold-fish, which here attain a considerable size. It is about twenty-five yards in length, and half as much in breadth. The depth towards the northern extremity is five or six feet, but towards the South the water becomes gradually shallower, so that the mud and weeds at the bottom can be seen to a considerable distance. The water, which is never stagnant, is derived from drains from the more elevated fields in the vicinity, and also from a spring in the basin of the pond. It contains evident traces of iron, and a spring in the adjoining field is so strongly impregnated with iron as to give a ferruginous tinge to the substances over which it passes, and on this account has long been known as the "Cankerwell." The northern extremity of the pond is sheltered by a fence of willows whose drooping branches are deeply pendent in the water, and frequently form a basis for the deposit and growth of Alcyonellæ.

On visiting the pond on the 11th of August, I found the Alcyonellæ in great abundance. At the

shallower part of the pond they occurred as irregularly rounded masses, and were with difficulty distinguishable from the mud and weeds by which they were surrounded. On viewing these masses externally they appeared as isolated and independent structures, without conveying the idea of their being incrustations deposited upon other substances, but on making a section of them, each exhibited a nucleus of some foreign material, generally a small twig, which it had originally incrusted, and from which during its progressive growth it had radiated as from a centre. Other Alcyonellæ were observed of large size, encircling or incrusting substances at the bottom of the pond. Dead twigs fixed in the mud, and projecting upwards into the water, presented circular masses of large size. An old glass garden-shade, which had been some time in the water, was loaded with lobulated incrustations. A large piece of earthenware was similarly incrusted, and fragments of sand-stone, on their lateral and superior surfaces, were the seat of Alcyonellæ. The slender twigs of willow which were pendent in the water were in some instances weighed down by the load of Alcyonellæ surrounding them; some twigs presented but a thin layer of the animal, and some leaves were seen with but a few tubuli ramifying on their surface.

At this visit, all the specimens which were easily accessible were removed, but in a few days the Alcyonellæ were again found as large and as numerous as before. During the months of August and September they were frequently removed, and

in a very short time their places were supplied with fresh Alcyonellæ. In the middle of October they were remarkably abundant, but on the 9th of November scarcely any were to be found; at which date the old garden-glass was the only source whence they could be obtained, and the greater number of these were dead black, and putrid, and a few exhibited very faint evidences of vitality.

The appearance of Alcyonellæ in this situation during last Summer is remarkable, as it is not probable that they could have existed there in previous seasons; for during many summers the fish and the various aquatic animals have been a constant source of amusement and observation to the owners, and if the large masses of Alcyonellæ had existed, it is scarcely to be supposed that they would have escaped observation. For the same reason it is probable that they had not existed in the present year in any considerable quantity at a date much earlier than that above mentioned. Their equally sudden disappearance may also be anticipated, for Bruguiére, although during one season he had many opportunities of examining Alcyonellæ from the pond of Bagnolet, was never afterwards able to pursue his observations, as they were never again to be found at Bagnolet.*

* During the whole of the Spring and Summer of 1836 repeated searches were made for the Alcyonellæ in Mr. Matthewman's pond, but without success, until the 1st of August, when a few small specimens were found attached to the living pendent twigs of willow and to the old garden-glass. On visiting the pond again at the beginning of September, I could not obtain any specimens whatever, except a few of small size from the garden-glass. The pond at Haigh-Park was visited on the 27th of July, when a few Alcyonellæ, forming thin incrustations upon dead twigs were found, and on the 3rd of September, after a very industrious search, only about

It was my intention during the Summer to have ascertained whether Alcyonellæ existed in other ponds in this neighbourhood, but the only one which I had the opportunity of examining was at the race-course in Haigh-Park, near Leeds, where, after two diligent searches, I procured five specimens of small size. These were found accompanying spongilla friablis, and encrusting dead twigs.

THE POLYPIFEROUS MASSES.

The polypiferous masses are round, sub-lobulated and botryoidal; incrusting stones, leaves, twigs, earthenware, and garden utensils, which had been accidentally deposited in the pond; the size varying from a thin incrustation to masses of several inches in circumference. One specimen, weighed seventeen ounces, and measured fourteen inches and a half in circumference. The surface presents numerous subpentagonal apertures, closed by a translucent polypiferous papilla, which on immersion in alcohol becomes opaque. The apertures on the surface, corresponding with the size of the tubes, are generally about one-fortieth of an inch in diameter; a few of smaller size indicate the commencement of new ramifications. A vertical section exhibits numerous tubes, radiating from a central nucleus, and in their course giving off lateral branches, which,

half a dozen small specimens could be obtained. Hence it appears that the present season is far less favourable for their production than last year; and from the close observation that has been kept at Mr. Matthewman's pond, it is obvious that their development did not take place until the Summer was far advanced, whereas Raspail speaks of the Spring as the time when the development of these polypes from their ova occurred in the neighbourhood of Paris.—*Sept.* 5, 1836.

being placed in apposition with the original tubes, increase the size of the mass as the tubes proceed from the centre. The colour, when the polypes are retracted, is a dirty sea-green, closely resembling that of the mud and weeds; during the full expansion of the polypes the surface of the mass has a paler aspect, and exhibits a velvety, or whitish downy appearance from the thousands of minute tentacula with which it is covered. The odour is peculiar, somewhat resembling that of stagnant water. The masses form a nidus for immense numbers of the larvæ of phryganeæ.

On combustion, the substance of the basis emits a smell like that from horn when burnt. The black ash which remains does not contain any particles which scratch glass. On treating the unburnt substance of the basis with acids, no effervescence takes place. From these rude attempts at analysis it may be inferred that the basis is composed of a horny matter, and that it does not contain spicula of silica or of carbonate of lime.

THE PAPILLA AND POLYPE.

Each tube is the seat of a distinct polype, which appears as a translucent conical papilla* when the tentacula are not expanded. The papilla admits of being completely withdrawn into the horny tube; more frequently, however, it is seen projecting a little from the surface, and is sometimes protruded to such a degree that its length is three times its breadth. The base of the papilla is attached to the

* Plate 12, fig. 1.

upper part of the horny tube, which is thereby perfectly closed. The apex presents a funnel-shaped aperture with striated sides, communicating with an internal cavity or canal, generally containing opaque matter. Some of the papillæ appear small or immature.

When a living specimen is placed in water under the microscope, the aperture at the apex of the papilla is soon observed gradually to widen; the papilla loses its conical form and assumes the appearance of a cylindrical collar,* from the interior of which is seen slowly protruding a beautiful expansion of tentacula, about fifty in number, arranged in an unbroken circle, which is, however, depressed into a deep concavity on one of its sides, so as to produce, as has been already noticed, the appearance of a double row of tentacnla in a horse-shoe form. About one thousand six hundred polypes are situated on a square inch of surface of the mass, consequently the number of polypes in the large specimen before alluded to, and placed in the Society's Museum, may be computed at one hundred and six thousand, and the tentacula at five millions three hundred and twenty thousand.

The tentacula, arising from the two sides of two slightly divergent fleshy arms, are linear and often slightly recurved at their free extremity. This recurved state of the extremity appears to have given rise to the error of Bruguiére respecting the button-like termination of the tentacula; an error which might easily be committed if the examination be

* Plate 12, fig. 2.

made with only moderate magnifying powers. If examined by a common pocket lens of one and a half inch, or even of three quarters of an inch focus, the tentacula appear to be terminated by a rounded knob. This, however, is merely an optical illusion from the recurved state of the extremities of the tentacula, and their linear form throughout becomes immediately obvious on examining them with higher powers. For this purpose, it is easy to detach an entire living polype, and to examine it, when expanded in a watch-glass, with a lens of one-tenth of an inch focus, and single tentacula may be separated and examined with a still higher magnifying power (one-thirtieth of an inch) when the appearance of vibratile cilia on their surfaces becomes distinct.

When an expanded polype is examined with a high magnifying power, a multitude of flocculent particles and animalcules are seen in rapid motion in its immediate neighbourhood. If these moving particles be attentively observed it is obvious that they are propelled by currents which have a definite course. These currents proceed along the outer edge of each tentaculum, wind round its apex, and descend along its internal surface to the mouth, whence some of the particles are again propelled from the centre of the crater. It is by these currents that food is conveyed to the mouth, and not by any prehensile motion in the tentacula themselves, for during the periods when the currents are most vigorous the tentacula are generally perfectly motionless. When an entire polype is extracted

from the horny tube and placed in a watch-glass under the microscope, so great is the force of the currents excited along the surface of its tentacula, that the entire polype is moved by them freely through the water, performing repeated gyrations, and exciting an appearance of incessant turmoil in the particles in the neighbourhood. If a single tentaculum be detached, it also is seen to move freely in the water by the currents excited along its own surfaces.

The animal has the power of instantaneously retracting the entire polype. This is observed on examining an extensive surface of expanded polypes, when one here and there will be occasionally seen to be retracted with the rapidity of lightning as if from alarm. Sometimes a more slow and gradual retraction of the polype takes place, which after a time is succeeded by a slow and gradual expansion. Occasionally a single tentaculum is seen violently to recoil itself into a complete circle; at other times one of these filaments will become violently bent inwards, and perform various contortions as if to get rid of an animalcule too large for deglutition, which has been hurried along the vortex into the crater of the tentacula.

DIGESTIVE APPARATUS.

The mouth* is a circular aperture situated at the bottom of the crater formed by the tentacula. It communicates below with an œsophagus, which soon becomes somewhat expanded, and constitutes

* Plate 12, fig. 2.

the stomach, the inferior portion of which is concealed within the horny tube. A second canal from time to time becomes obvious from the transit of opaque oval masses of excrement which are seen slowly ascending, and at length escaping from an aperture at its superior extremity. This orifice is placed externally to the crater, beneath the tentacula, and corresponds with the concavity formed by the divergence of the two fleshy arms which support the tentacula. The communication of these two canals is seen on separating some of the entire polypes from the horny tubes, and examining them in a watch-glass under the microscope, when the inferior part of the stomach is seen to turn suddenly upwards, and to be continuous with the intestine. The lower portion of the stomach is of a bright brown colour, longitudinally striated. The colour appears to depend upon the alimentary materials which it contains, and the vertical striæ are probably produced by folds in the organ. On lacerating the stomach the brown matter escapes in the form of innumerable minute granules. A sort of vermicular motion is sometimes observed in the stomach.

THE OVARIES AND OVA.

If a vertical section be made of one of the polypiferous masses, it is easy, with a fine instrument to detach the entire contents of some of the tubes. The substances thus detached consist of two parts: first, the polype and its papillary sheath,*

* Plate 12, fig. 3, *a* and *b*.

enclosing the alimentary canal, which occupies the upper part of the horny tubes: secondly, an elongated membranous tube, connected with the papilla above, and extending below throughout the horny tube.

This tube is the ovary,* and contains a series of compressed oval bodies, apparently floating or suspended in a fluid, by which the tube is distended. The ova appear in different states of maturity. Those which are perfectly matured are of a dark reddish brown colour. Others of the same size have their external envelope opaque and white; others are somewhat smaller and translucent, whilst some are very minute and perfectly transparent. The mature and immature ova appear scattered indiscriminately throughout the tube. The ova are stated by Raspail to occur in a double series, I have, however, almost invariably found them in a single row. M. Raspail also says he has been able to see the small filament which connects the ova to their containing membranous tube.

The mature ova have a dense horny envelope, which, on being burst, gives exit to a multitude of minute transparent granules.

The ova appear to float in a fluid in the ovary, and by pressure on different parts of the tube they may be made to pass backwards and forwards. On pushing the ova upwards in the tube, by means of a needle, they are arrested at the upper extremity of it, which is perfectly closed and does not allow of their escape into the polype, until an artificial rent or aperture is produced.

* Plate 12, fig. 3, *c*.

The mode by which the ova are disengaged is by a process of decomposition, and consists of two stages.

In the first, the papilla which during life closes the tubes dies and becomes softened, ragged, and flocculent, and in this state no longer forms a barrier to the exit of the ova. In November, many of the specimens were seen in this condition. On examining the surface of the polypiferous masses, they were seen covered with ragged shreds of membrane instead of the well-defined conical papillæ or expanded polypes.

In the second stage, air is disengaged from decomposition of the contents of the horny tube or ovary. If a recently dead specimen, in which the papillæ are reduced to the state above described, be examined with the lens, a succession of air-bubbles are seen frequently escaping from the horny tubes. By the successive formation and ascent of these bubbles the ova, which at this period are loose and floating in the tubes, are gradually elevated and conveyed to the exterior. In November, many of the specimens were seen with air-bubbles and ova successively escaping, and the external surface was covered by ova thus conveyed to the exterior. Those specimens which were black and putrid, and appeared to have been dead some time, exhibited the horny tubes nearly devoid of ova. After a time, the horny basis itself becomes softened, and appears to undergo decomposition. During the following Spring, according to the evidence of Vaucher and Raspail, the horny envelope of each ovum separates into two

lateral halves adhering on one side as by a hinge. From these valves a small gelatinous tubercle projects, which soon expands into a distinct polype, and gradually becomes elongated into a tubular form. From the sides of this tubular polype small gelatinous buds soon appear, and these again become developed into distinct polypes; the tubular parietes gradually become consolidated and form the horny basis of the mature Alcyonella.

In this instance are exemplified the two modes of reproduction common to some Zoophytes. First, the oviparous, which in Alcyonella according to Raspail takes place only in Spring.* Secondly, the gemmiparous, which proceeds throughout the entire period of growth.

LITERARY HISTORY OF ALCYONELLA.

I will conclude these remarks by a brief sketch of the literary history of Alcyonella and of the

* In November, 1835, I placed several portions of dead Alcyonella in a large jar of water to be reserved for experiment in the ensuing season; and, on the tenth of August in the present year, on finding that the Alcyonellæ had begun to appear in the pond at Little Woodhouse, I took a portion of one of the softened putrid masses, with ova adherent to its surface, and placed it in a glass of clear water, in a window exposed to the sun. On the eighth day, amongst the ova which had floated to the surface of the water, a few were observed to have separated into two halves as represented by M. Raspail, and from each of these a distinct well-formed polype protruded. The tentacula were perhaps a little shorter than in the more perfectly developed Alcyonellæ. In a few days these polypes died. The experiment was repeated on the 23rd of August. On the 30th several ova exhibited a separation into two valves, between which a translucent papilla was situated, and on the following day three or four perfect polypes were visible. On the 5th of September, the day on which this note is written, there are ten or twelve polypes observable in the midst of about two hundred ova, floating on the surface of the water. No development of buds can yet be detected.—*Sept. 5*, 1836.

generalizations adopted by Raspail in reference to this and several neighbouring genera.

M. Bosc found in the pond of Bagnolet, near Paris, several irregularly shaped masses covered with pentagonal pores, and sent them to M. Bruguiére for representation in the Encyclopédie Methodique, with the compilation of which the latter was then engaged. He found that each cellule was the habitation of a polype, which he represented as consisting of fifteen to twenty filiform tentacula, each terminated by a rounded head. He placed the animal amongst the Alcyonia, and denominated it Alcyonium fluviatile.

Lamarck, having examined living specimens from Plessis-Piquet, approved of and preserved the characters assigned to it by Bruguiére, but constituted for it a new genus under the name of Alcyonella, which he placed at a great distance from Alcyonium, but very near to Plumatella.

Lamoreux in his turn examined living Alcyonellæ from the neighbourhood of Caen, and considered the plates of Bruguiére so faithful that he thought he could not render a better service to science than to copy his plates without alteration.

Raspail next devoted himself to the examination of Alcyonella throughout the greater part of the year 1827, and, instead of recognising the polype as represented by Bruguiére, discovered a polype closely resembling the polype á pannache of Trembley, and by a long process of investigation arrived at the conclusion that Alcyonella was only a more aged form of Trembley's polype, which in different stages

of its development successively passed through various forms which have erroneously, in his opinion, been elevated to the rank of distinct genera or species.

In order to divest the animal of the confusion of what M. Raspail regards its synonyms, he endeavours to trace it from the egg through its different stages of development.

In the first instance, he confirms the observation of Vaucher, that in Spring each granule opens at the sides and separates into two valves, from which becomes protruded a little polype, a Tubularia enveloped in its sheath, and prolonged in a straight line along the stone.

Soon this polype begins to develope a lateral bud, at the extremity of which tentacula gradually appear, and the bud at length assumes the character of the parent polype. When these two polypes are of uniform size, there is produced a figure precisely identical with the *Leucophra Heteroclita* of Müller, an animal which Müller found in the same vessel with some Tubulariæ. The description given of *Diffulgia* by Lamarck, shows that it is undoubtedly identical with the Leucophra Heteroclita of Müller, and consequently, according to Raspail, is but a form of Alcyonella.

Soon another tubercle announces the formation of a third polype, and we then perceive the *Trichoda Floccus* of Müller, which he found in the same water with the former, after violently agitating the Tubulariæ.

The animal, according to M. Raspail, continues

to propagate by buds under two different circumstances as to locality; namely, either on the inferior surface of a stone, or on the lateral or superior surface, by which its form is materially influenced.

If the polype becomes developed in a downward direction, as if influenced by gravitation, its buds appear at greater distances from one another, and form ramifications. The tubes formed by the external membrane become firm and solid by age, they cease to increase, and at length serve only as a retreat for the polypes at the summits of the branches. In this case is produced the *Polype à Pannache* of Trembley, and the *Plumatella* of Lamarck.

In the second case, the polype ramifying by its own weight on the superior surface of the stone, produces the *Tubulaire Rampante* of Müller, and the *Tubulaire Lucifuge* of Vaucher. When, however, the new polype, gravitating perpendicularly upon the superior surface of the stone, finds an impediment to its spreading along the surface, either from the number of its own buds, or from other circumstances, its new buds separate less from each other, and as their number increases, they press laterally against each other, their tubes assume a pentagonal form, and we have the commencement of Alcyonella, a state precisely represented by the *bell-shaped polype* of Baker.

At length the tubes become more horny, and of a browner colour; they become more and more extended, forming an incrustation of considerable thickness, having a surface which exhibits numerous

pentagonal apertures, which are the orifices of the tubes in which the polypes are retired. We now have the *Alcyonella Stagnorum* of Lamarck; the *Alcyonelle fluviatile* of Raspail.

MR. TEALE'S PAPER ON ACTINIA.

Plate IX.

Figs. 1 and 2. Actinia Coriacea. Natural size.

Fig. 3. Portion of the external envelope magnified, showing the tubercular eminences and their central aperture.

Plate X.

Fig. 1. Actinia Coriacea. Continuity of the skin and stomach represented.

Fig. 2. The stomach spontaneously everted.

a. A circular space where the stomach is deficient inferiorly, at which part it communicates with the interseptal spaces.

b. c. Two deep folds in the stomach, which divide the animal into two lateral halves.

Figs. 3, 4, 5, 6. The muscles of the vertical leaflets.

Fig. 7. The circular muscles of the sides, seen on turning aside two of the leaflets, and exposing the portion of skin situated between their insertions.

a. The fibres constituting the circular order of muscles.

Fig. 8. The muscles of the base, seen on turning downwards two of the leaflets, and exposing the portion of skin situated between their lines of insertion.

a. The fibres which form part of a circular series of muscles of the base.

b. The radiating fibres of the base.

Figs. 9 and 10. Tentacula magnified, exhibiting their longitudinal and circular fibres.

Fig. 11. A portion of the outer lip magnified, having its two folds of skin dissected from each other, to expose the circular or sphincter muscle which they enclose.

Plate XI.

Fig. 1. Actinia Coriacea. The ovary and vermiform filament represented on an enlarged scale.

a. The lip.
b. The mouth.
c. The stomach.
d. The muscular leaflet.
e. The ovary, or gemmiferous organ.
f. The mesentery connecting the ovary to the leaflet.
g. The vermiform filament gradually increasing in size as it passes downwards.
h. The mesentery connecting the vermiform filament to the ovary.
i. Termination of the vermiform filament in the stomach.

Fig. 2. A portion of ovary magnified and partially unfolded. The ova, or rather gemmules, in an advanced stage of maturity, most of them exhibiting a central depression, which indicates the situation of the oral aperture.

Figs. 3 and 4. Portions of the vermiform filament, with its mesentery magnified.

MR. TEALE'S PAPER ON ALCYONELLA.

Plate XII.

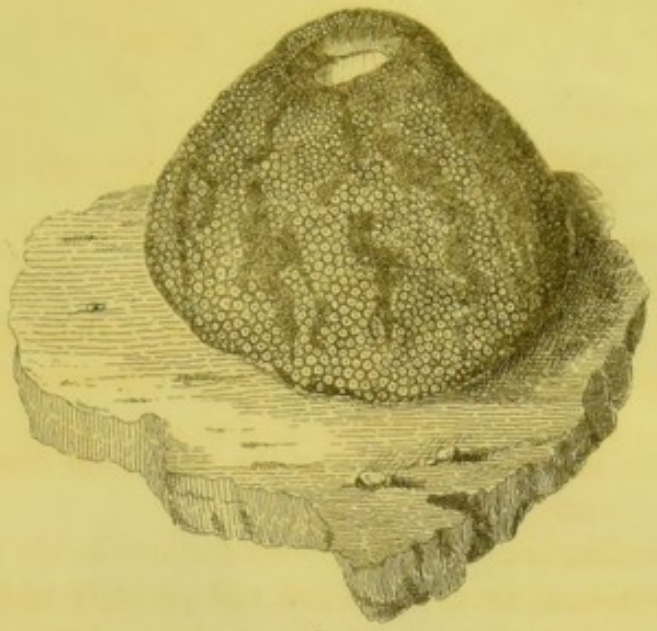
Fig. 1. Alcyonella Stagnorum. The polypiferous papilla exhibited.

Fig. 2. The polype expanded and protruding from the papilla.
a. The mouth.
b. The stomach.
c. The intestine.

Fig. 3. A polype of Alcyonella, with the digestive sac and ovary attached.
a. The polype.
b. The alimentary canal.
c. The ovary, attached to the neck of the papilla, and closed at its upper extremity. The ova are seen in different stages of maturity.

Plate 9

1



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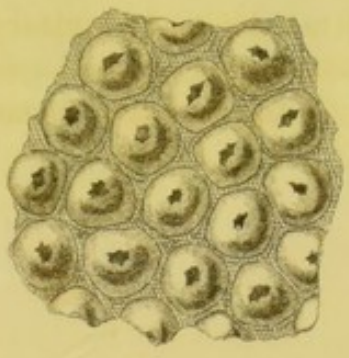

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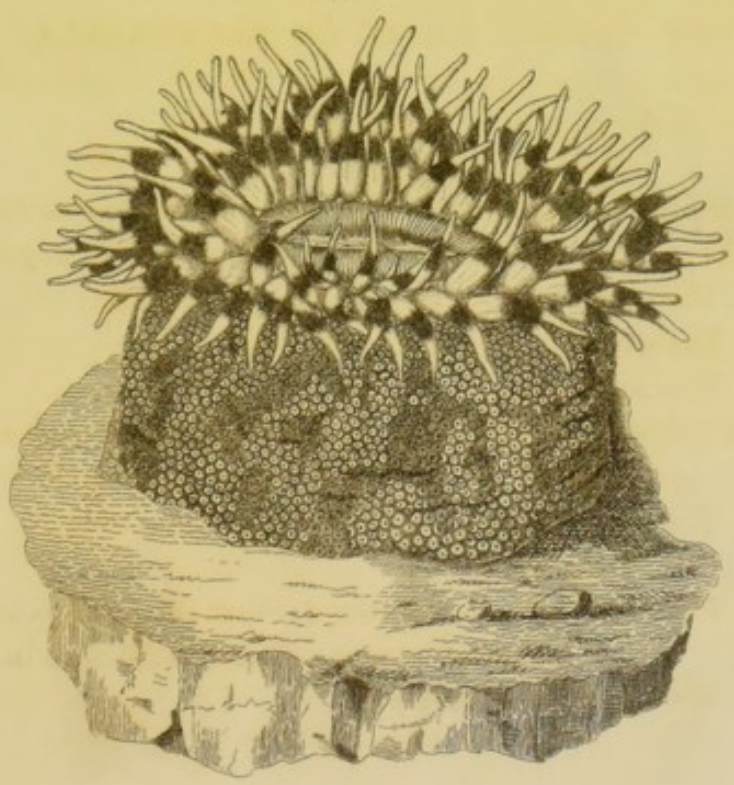

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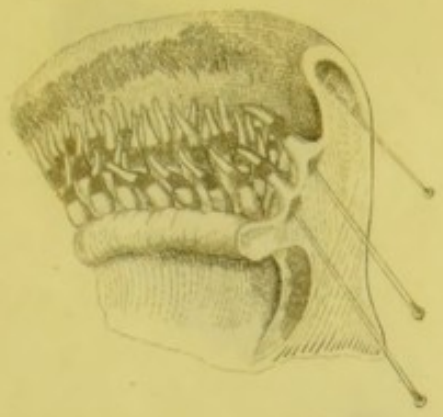
Plate 10

1



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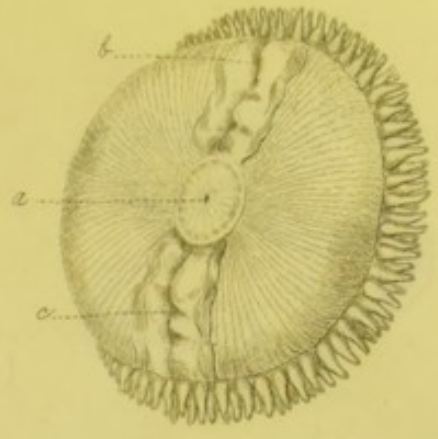

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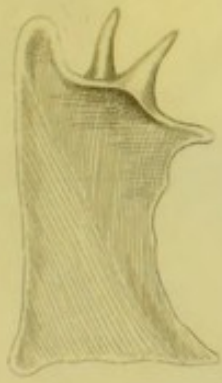

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6

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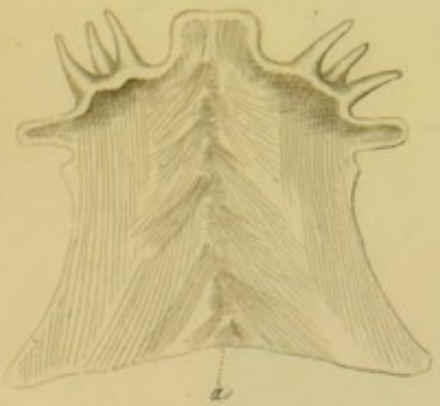
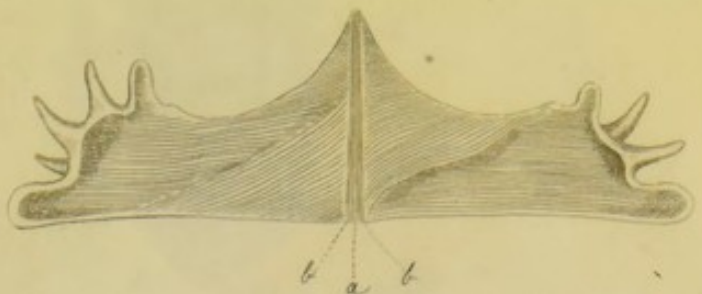


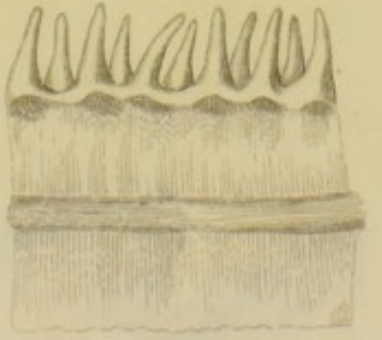
8



9

10

11



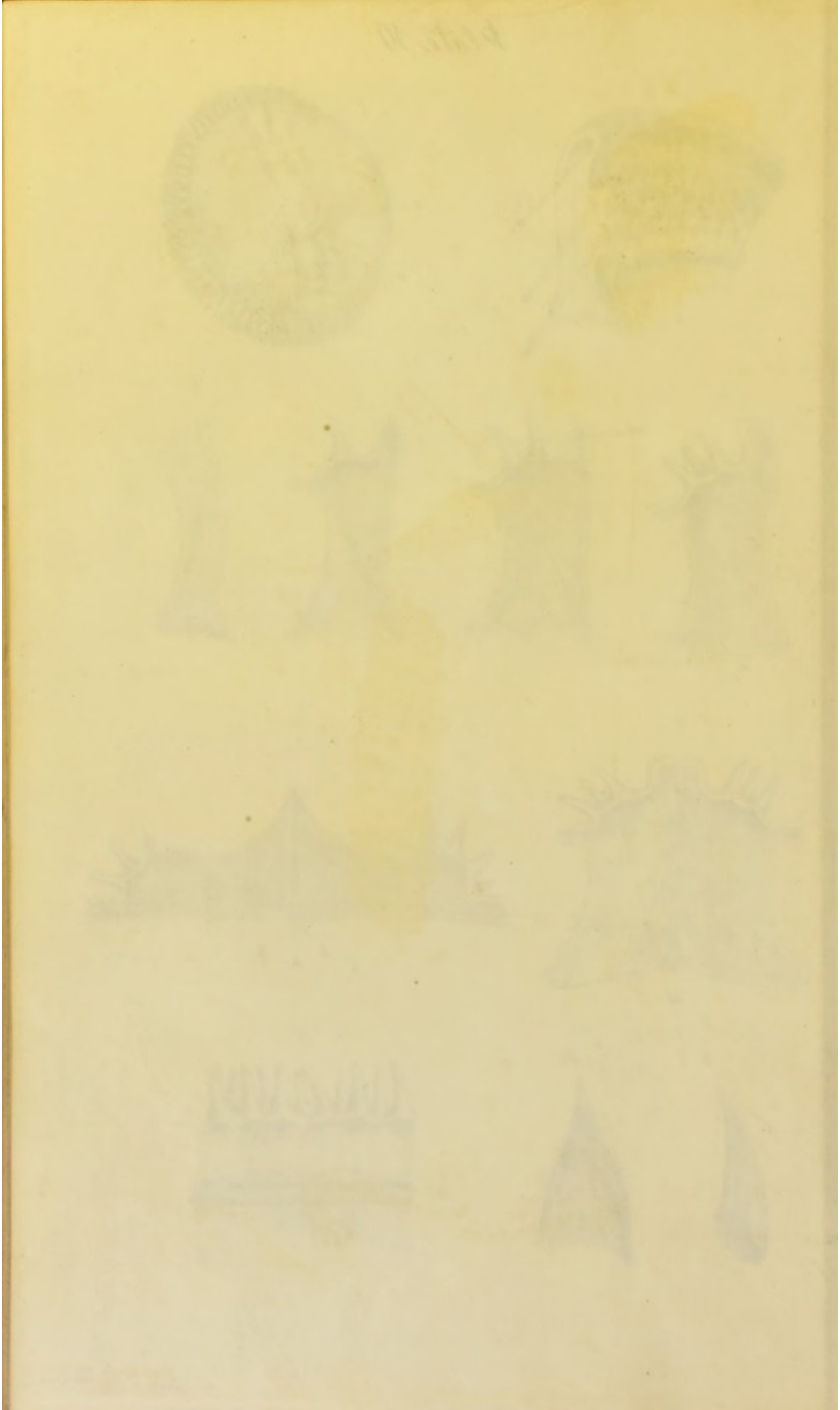
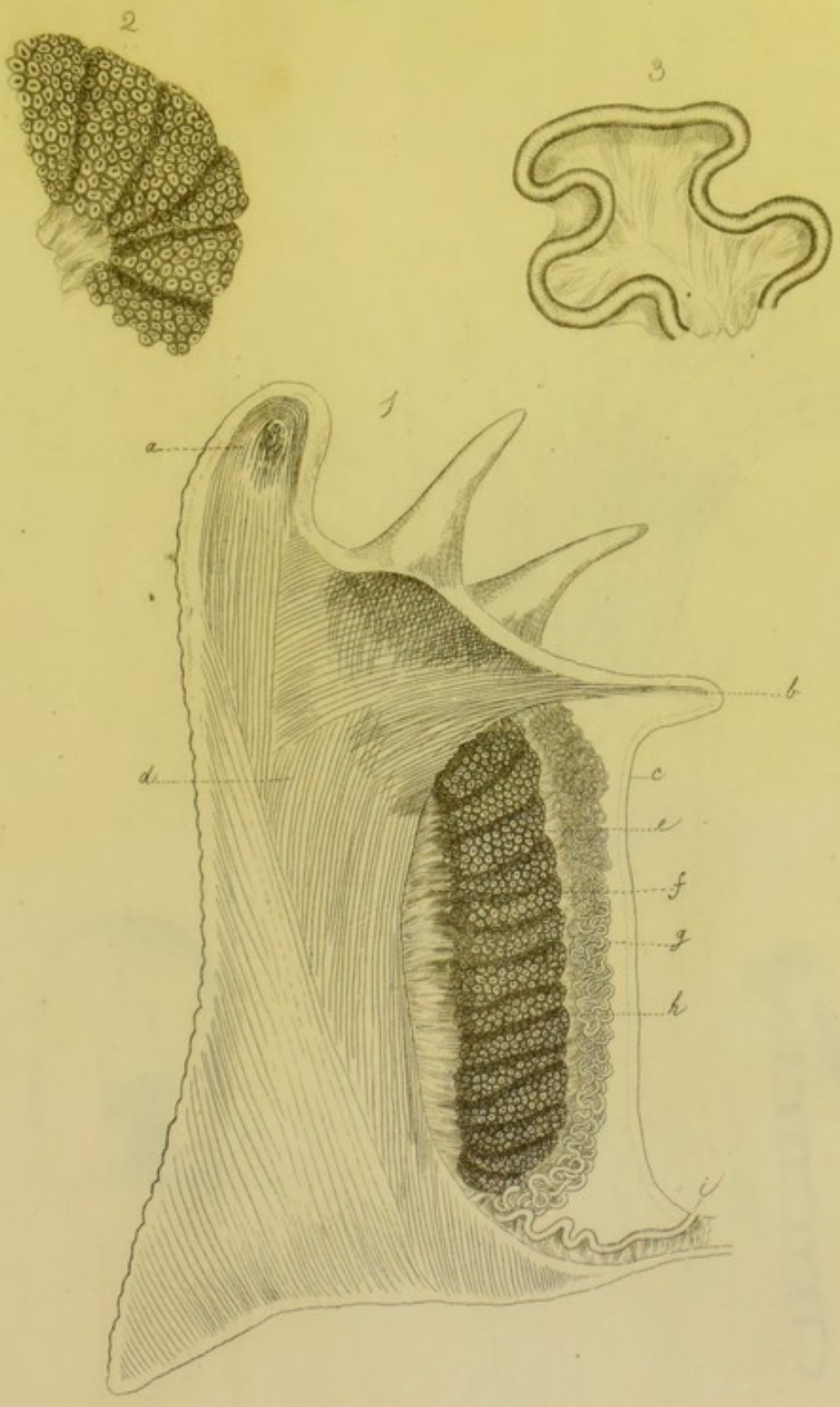


Plate 11



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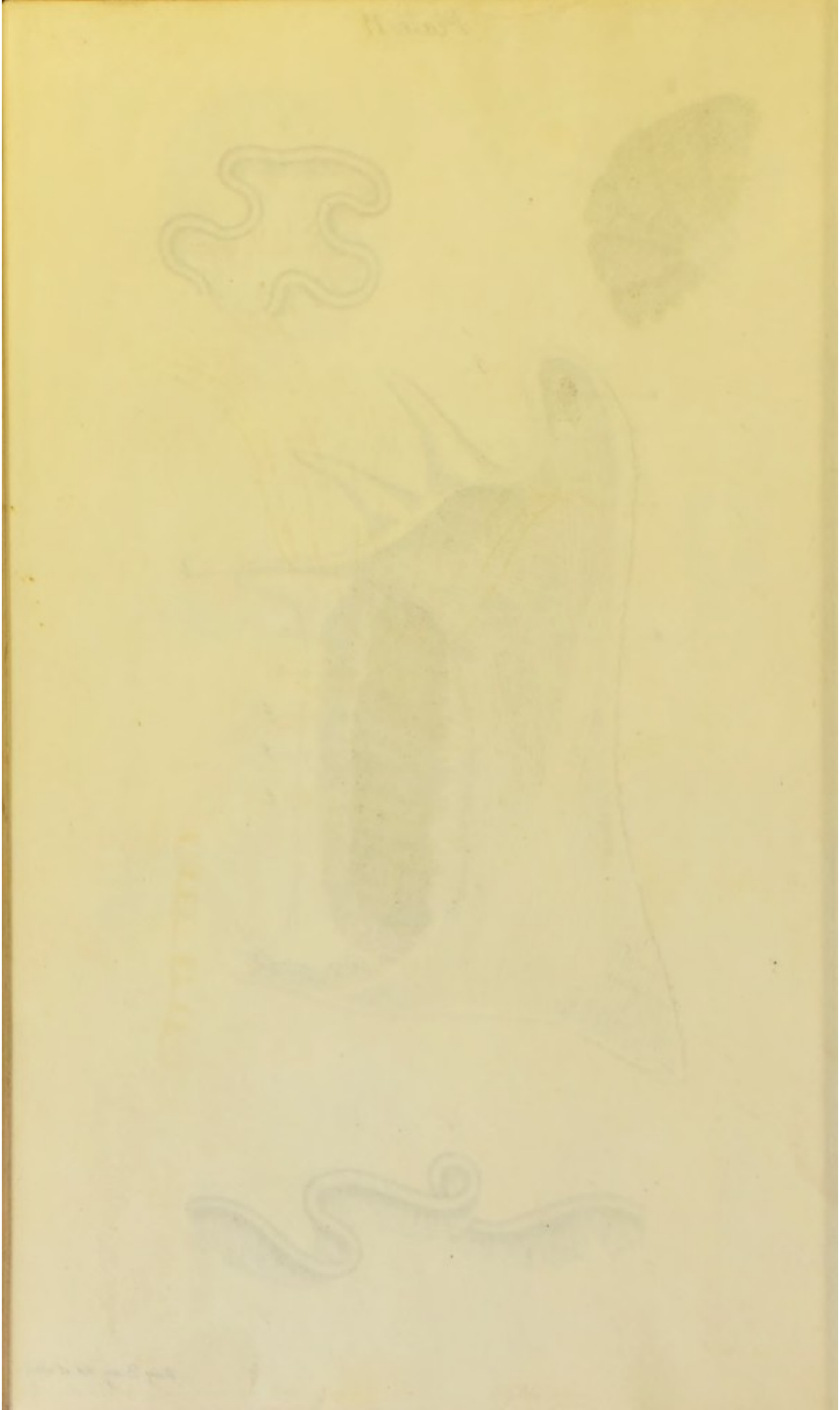
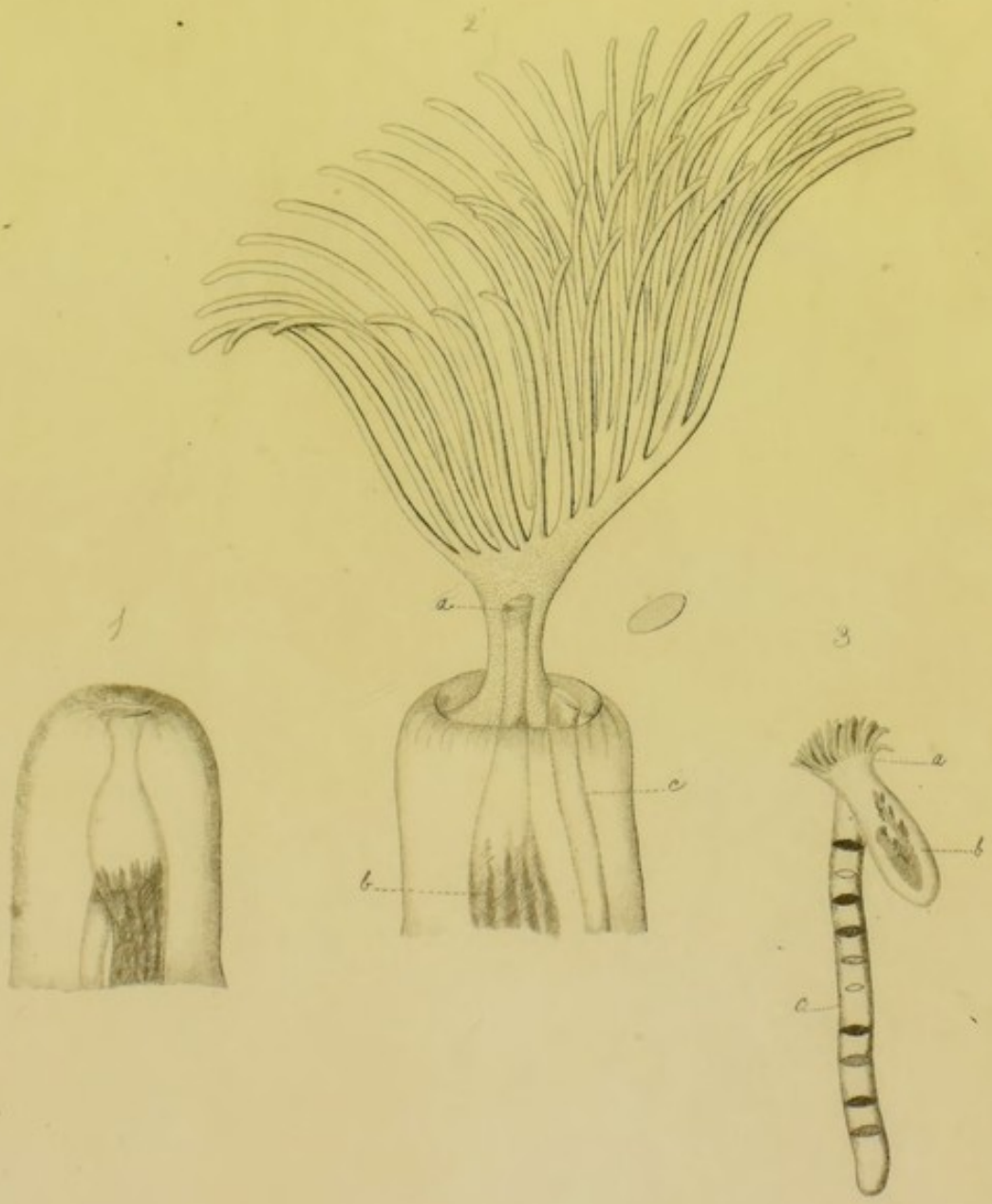


Plate 12



J. P. Teale del.

Henry Denny sculp.