Scientific results of explorations by the U. S. Fish Commission Steamer Albatross.

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No. XXIII.—REPORT ON THE ACTINIÆ COLLECTED BY THE UNITED STATES FISH COMMISSION STEAMER ALBATROSS DURING THE WINTER OF 1887–1888.

BY

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[With Plates xix–xxxv.]

The collection which forms the subject of this report was forwarded to me soon after its arival in Washington, and I gladly availed myself of the opportunity thus presented of continuing the investigation of the deep-sea Actinians, which was so admirably inaugurated by Prof. Richard Hertwig. The studies of this distinguished naturalist have resulted in the establishment of a new and more correct basis for the classification of the Actiniæ, by calling to the aid of the somewhat uncertain external peculiarities, the more reliable characteristics revealed by a thorough anatomical study of each species. The revision of the Actinians in accordance with this new system of classification founded by Prof. Hertwig has been carried on by myself for the Actiniæ of the West Indies and by Prof. Haddon for the forms occurring on the coasts of Great Britain. Much has been added to our knowledge of many forms, and many errors have been corrected, and it has been my hope that the present study would clear away still further the mists that obscure the relationships of the various Actinian groups.

The present report deals with the Edwardsiæ, Protactiniæ, Hexactiniæ, and Ceriantheæ obtained by the *Albatross*. I hope in a future report to give the results of my studies of the Zoantheæ.

I gladly acknowledge the many courtesies I have received from my friend, Mr. Richard Rathbun, during the preparation of this report. I am indebted to him for the opportunity of comparing several specimens in the collection with allied and occasionally identical forms obtained by the Fish Commission steamers off the eastern coast of North America.

Part I.

THE CLASSIFICATION OF THE ANTHOZOA, AND ESPECIALLY OF THE ACTINIÆ.

What may be termed an approximately correct idea of the relationships of the various groups of animals now included under the term Anthozoa or Actinozoa can be said to have come in only with the beginning of the present century, and to have had its first exponent in Cuvier. Earlier authors were led astray by the supposed vegetable character of the corals and similar forms, and later, by attaching too great importance to the presence or absence of a hard skeleton, whereby closely related forms were widely separated. Thus Linne in the twelfth edition of his "Systema" referred the genus *Actinia* to the Mollusca, the remaining Actinozoa being referred to two groups, the Lithophytes, which included the Madrepores, and Zoöphytes, which, in addition to the Alcyonaria, contained also sponges, Bryozoa, Sertularia, and Protozoa (*Vorticella*). Pallas (1766) improved this arrangement slightly by fusing the Lithophytes and Zoöphytes to a single group, but the genus *Actinia* he referred, along with the Echinoderms, to his group Centroniæ.

Cuvier by the foundation of the Radiata, a group containing, it is true, very heterogeneous members, did good service in bringing together more closely than previous authors the allied Anthozoa. The third class of the Radiata, the Acalephs, contained the genera *Actinia* and *Zoanthus* with which was associated *Lucernaria*, while in the fourth class, that of the Polypes, were grouped together the rest of the Anthozoa under the term "Polypes corticaux à polypiers." The tribes of this latter group with some of their principal genera are as follows:

Tribe 1 Ceratophytes—*Antipathes*, *Gorgonia*.
2 Lithophytes—*Isis*, *Madrepora*, *Millepora*.
3 Polypes nageurs—*Pennatula*, *Renilla*, to which were added *Orbulites*.
4 Alcyons—*Alcyonium*, *Spongia*.

It will be seen that the character of hardness or softness was given considerable weight in the Cuvierian system, leading to the association in the same tribe of an Alcyonarian, a Hexacorallian, and a Hydrozoon, and similarly to the separation of various Alcyonarian genera, according to their relative consistency. The separation of the Actinians from the Mollusca and their reference to the Acalephs is however a step in advance, though their true relationships were unperceived.

With contemporary and succeeding systematists these two features held firm ground. Lamarck (1818) though referring *Zoanthus* to the Polyps with *Hydra*, *Coryne*, etc., returns to the classification of *Actinia* with the Echinoderms as advocated by Pallas, being followed in this respect by Schweigger (1820), who makes the presence or absence of a hard skeleton the criterion according to which the Zoöphytes are referred to the *Z. monohyla* or *Z. heterohyla*, the former division containing Infusoria, Rotifera, *Zoanthus*, *Tubularia*, and the Alcyonids. The reference of the Actinians to one of the groups of the Polypes dates back to Lamouroux (1821), who still relying on the presence or absence of a skeleton divides the Zoöphytes into (1) Polypiers flexibles, (2) Polypiers pierreux, and (3) Polypiers sarcoides, the last group containing the Actinians together with the Alcyonids and the compound Ascidians.

Notwithstanding the heterogeneity of these groups, Lamouroux's classification paves the way for the more accurate systems that follow. Noticeable especially is that of de Blainville (1834), who associates together in Class III Zoanthaires of his Type Actinozoaires the Actinians, Zoanthans and Madrepores, thus cutting loose from the consistency systems of his predecessors. The remaining Anthozoa, together with the Hydroids, Millepores, and Bryozoa, he refers to the fourth class, Polypiaires.

Before de Blainville, however, Rapp ('29) had published a classification of the Polyps which, though not accepted by his successors, stands out, in the light of our present knowledge, as an evidence of the value of anatomical distinctions as a basis for classification. In his preface Rapp says: "Bei dem Studien der mit einem Gerüste oder Polypenstock versehenen Polypen war dieser Theil, indem man das Thier selbst vernachlässigte, bisher hauptsächlicher Gegenstand der Aufmerksamkeit. * * * Zwar fehlt es über diese Thiere nicht an trefflichen Beobachtungen, welche man hauptsächlich der neuesten Zeit verdankt, aber sie stehen bis jetzt meist noch zu isolirt, als dass sie auf die ganze Gestalt desjenigen Theils der Wissenschaft, welcher mit diesen Geschöpfen sich beschäftigt, einen durchgreifenden Einfluss gehabt hätten." To bring these isolated anatomical facts together, and to add to them was the task Rapp set himself, and as the result of his studies two important facts were brought to light. In the first place he recognized the near relationship of the Madrepores and the Actinians, and secondly he discovered the Actinian nature of the form previously described by him as *Tubularia solitaria*, now known by the generic name of *Cerianthus* proposed by Della Chiaje in 1832.

Rapp assumed as the basis of his classification the mode of formation of the reproductive organs. He found that some polyps produced ova on the outer surface of the body, while in others the "Keimkörner" had their origin in the interior; the former constitute his *Exoarier*, while the latter are referred to the division *Endoarier*. To the former division he assigned the Hydras, Corynes (including *Sertularia* and *Tubularia*) and Millepores(!), while to the latter were referred the Alcyonids, Tubipores, Corals (a group which included *Corallium*, *Gorgonia*, *Isis*, and *Antipathes*(?)*), Pennatulids, Zoanthids, Madrepores, and Actinians. Bearing in mind the fact already stated that Rapp associated the forms now known as *Cerianthus* with the Actinians, it may be seen that his division Endoarier is equivalent to the modern group Anthozoa, while his Exoarier corresponds essentially with the Hydrozoa, though he does not include within it the Hydromedusæ, whose relationships to the Hydroids had not been discovered.

It is interesting to note that in this classification Rapp forestalled the Hertwigs ('79), whose proposed division of the Cœlenterates into

*The mark of interrogation is Rapp's.

Ectocarpæ and Endocarpæ is founded on the identical characteristic which Rapp chose, though the more recent authors define more accurately the place of origin of the reproductive elements in the terms of the germ-layers, structures unknown to Rapp.

Unfortunately, the systematists who immediately succeeded Rapp did not advance the position he had occupied. De Blainville's association of the Actinians with the Madrepores has already been noticed, a happy exception to the complicated confusion into which he falls as to other groups. On the whole, however, his classification must be considered an advance as compared with that of Ehrenberg ('34), who falls back to the old consistence system, though avoiding De Blainville's perpetuation of the earlier misconception of the Bryozoa as allied to the Zoöphytes. To Ehrenberg we owe the substitution of the term Anthozoa for that of Zoöphyta, employed by earlier writers, and this "circulus" he divides into two orders whose limitations may be seen from the following synopsis:

Circulus I.—Anthozoa.
- Ordo I.—Zoöcorallia.
  - Tribus I.—Zoöcorallia polyactinia (Actinians, Zoanthans, and Fungidæ).
  - Tribus II.—Zoöcorallia octactinia (Xenias, Tubiporids, Alcyonids, and Pennatulids).
  - Tribus III.—Zoöcorallia oligactinia (Hydroids).
- Ordo II.—Phytocorallia.
  - Tribus IV.—Phytocorallia polyactinia (Oculinids and Astræids).
  - Tribus V.—Phytocorallia dodecactinia (Madrepores and Millepores).
  - Tribus VI.—Phytocorallia octactinia (Corallium, Isids, and Gorgonids).
  - Tribus VII.—Phytocorallia oligactinia (*Allopora*).

It will be seen from the above that the Zoöcorallia includes all those forms which are destitute of a hard skeleton, or which, like Fungia, possessing a corallum are not fixed, while the Phytocorallia embraces the forms provided with a hard skeleton, being at the same time fixed. Such a classification necessarily separates closely allied forms, as, for instance, the Fungidæ from the other Hexacorallia, and the Pennatulids from the Gorgonids. The group Anthozoa as conceived by Ehrenberg differs from the modern conception of the group in including the Hydroids and Hydrocorallinæ, in which respect Ehrenberg falls far behind Rapp, and in excluding the Antipatharia which are in this system referred to the Bryozoa. In one particular, however, Ehrenberg surpasses his predecessors, with the exception of Rapp, and that is in employing for his secondary groups characters which belong to the living animals. The number of the tentacles is a feature which within certain limits has been found to be associated with the features which mark out the various groups as now recognized.

The association of the various eight-tentacled forms into a single group was one of the important steps which now followed. According to a statement made by Dana ('46a) this was first done by Milne Edwards,* who divided his group of the Polypes parenchymates into three groups:

Sertulariens. Zoanthaires.
Alcyoniens.

Of these the first group corresponds to the Hydroidea, the second to the Actiniaria and Hexacorallia, and the last to the Alcyonaria.

A most important classification appeared in 1846 as the result of the extended study of the Zoöphytes of the Wilkes exploring expedition by Prof. James D. Dana. His groups are as follows:

ZOÖPHYTA.

I. Order. Actinoidea.
  I. Suborder. Actinaria.
    I. Tribe. Astræacea—including the Actinians with which Lucernaria was associated and the Astreid and Fungid corals.
    II. Tribe. Caryophyllacea—including besides the Caryophyllids and Cyathophyllids, the Zoantheæ.
    III. Tribe. Madreporacea—including Madreporids, Favositids, to which are referred the Millepores and Poritids.
    IV. Tribe. Antipathacea.
  II. Suborder. Alcyonaria.
II. Order. Hydroidea.

It will be seen from this that the order Actinoidea is practically equivalent to the group Anthozoa of to-day, and that a clear distinction is made between the Actiniaria and the Alcyonaria. The former group includes all the Hexacorallia and the Actiniaria of later authors, as well as the Antipathacea, and it is interesting to note that Dana insists upon the unimportance of the stony corallum, grouping together, as De Blainville had done before him, the non-skeletogenous Actinians and the skeletogenous Hexacorallia.

One of the principal groups of the Anthozoa, the Alcyonaria, being thus delimited, and a second, the Antipatharia, also marked out, though not considered of equal value, it will be well to go back some distance and note the gradual discovery of various forms recognized now as distinct groups, but included so far as known in the first two tribes of Dana's Actinaria.

The earlier authors recognized a single genus of *Actinia* only, though other names,—*e. g*,. *Urtica*, *Hydra*, and *Priapus*—had been proposed. In 1801 Lamarck separated the genus *Zoanthus* for the form described by Ellis as *Actinia sociata*, and thus paved the way for the distinction which later authors made between this and similar forms and the Actiniæ proper. Cuvier also recognized the genus *Minyas*, referring it, however, to the Holothurians, its true position not being recognized until later by Lesueur ('17). A further division of the genus *Actinia* was inaugurated by Oken in 1815, who established the genera *Metridium* and *Cereus*, and set the example for the more accurate generic

*I take this statement from Dana, not having access to Milne Edwards' work.

classification found in later authors. The large number of forms brought to notice by the scientific voyages of this period increased noticeably the number of Actinian genera, and in the classifications of De Blainville and Ehrenberg we find a considerable number of genera established.

Attention has already been called to the discovery of the Actinian character of *Cerianthus* by Rapp ('29), the subsequent application of the generic name by which it is now known by Della Chiaje. In 1841 Quatrefages ('41), in a paper which is a model of accurate observation and description, established the genus *Edwardsia* on essentially the same basis as that on which it now rests, though more recent observations have added certain particulars which the methods of microscopic investigation of the day have brought to light.

The year 1841 marks therefore the establishment of most of the groups of Actinaria which are now recognized, so far as they possessed generic value, but for some time *Cerianthus* and *Edwardsia* were considered of equal taxonomic value with *Actinia*, *Thalassianthus*, *Discosoma*, and other simply generic terms. The *Zoanthus* group formed to some extent, however, an exception to this rule, probably on account of their colonial habit of life and the power some possessed (*Palythoa*, *Corticifera*) of encrusting themselves with calcareous or siliceous particles, recalling by their consistency skeletogenous forms. Their gemmiparous reproduction induced Dana to group them apart from the rest of the Actinians, and associate them with the Caryophyllid corals.

To give a résumé then of the state of Anthozoan taxonomy at the middle of this century it may be said that the group was definitely delimited, the Bryozoa having been excluded in accordance with the observations of Milne-Edwards. The Alcyonarian forms had been grouped together from their earlier separation into a number of groups each equivalent to the Hexacorallia, Actiniæ, etc. The Antipatharia were referred to the Anthozoa, and even constituted a group of slightly less value than the Alcyonaria. And lastly, the Actiniæ had been divided into a number of genera and associated with the Hexacorallia, the similarity of structure of the animals themselves being considered of greater moment than the possession or absence of a corallum.

A new era in Anthozoan classification was introduced by the publication in 1857 of the first two volumes of Milne-Edwards' *Histoire naturelle des Coralliaires.* In some respects, notably in the severance of the Madrepores from the Actinians, a backward step was taken which has been maintained up to a comparatively recent date, but on the other hand, a decided advance was accomplished in the more accurate delimitation of several groups, and in the recognition of groups of genera among the Actinians.

Milne-Edwards recognized Leuckart's division of the Cuvierian Radiata into the two groups Echinodermata and Coelenterata, and divided the latter into two classes, the Acalephs, including three sub-classes, *i. e.*, the Medusæ, Siphonophores, and Hydroids, and the Coralliaires. The Coralliaires he again subdivided as follows:

Class Coralliaires.
  Sub-class Cnidaria.
    Order Alcyonaria.
    " Zoantharia.
      Sub-order Zoantharia malacodermata or Actinaria.
        Zoantharia sclerobasica or Antipatharia.
        Zoantharia sclerodermata or Madreporaria
  Sub-class Podactinaria (=Lucernaria).

It will be seen from this that Milne-Edwards's class Coralliaires is equivalent to Dana's order Actinoidea, and his sub-class Cnidaria to Dana's Actinaria *minus Lucernaria*, a step toward the separation of this genus from the Anthozoa, and its reference to the modern group of the Scyphozoa. In his division of the Zoantharia, however, Milne-Edwards retrogrades towards the older consistence systems of Lamouroux and Ehrenberg.

So far as the Actinaria are concerned Milne-Edwards did excellent service in delimiting the various genera that had been proposed, in dividing these up in some cases, and establishing new genera, such as *Paractis*, *Phymactis*, *Oulactis*, etc., and in grouping similar genera together, forming families, sub-families, etc. His larger divisions are as follows:

1. Family Actinidæ.
   1. Sub-family Minadæ.
   2. Sub-family Actininæ.
   3. Sub-family Thalassianthinæ.
   4. Sub-family Phyllactinæ.
   5. Sub-family Zoanthinæ.
2. Family Cerianthidæ.

The sub-family Actininæ was again subdivided into sections, thus:

1. Actinines vulgaires—including forms with smooth walls and adherent base.
2. Actinines verruqueuses—including forms with tubercles or verrucæ upon the column.
3. Actinines perforées—corresponding to the family Sagartidae of more recent systems.
4. Actinines pivotantes—including forms which do not possess an adherent base.

In analyzing this classification in the light of our present knowledge of the relationships of the Anthozoan groups we note a recognition of most of the modern taxonomic groups, with, however, very unequal values attached to them. Thus the Alcyonaria constitute a group equivalent to all the others taken together; the Antipatharia, another of equal value with all that still remains; the Cerianthidæ are recognized as a family equal in value to all the other Actinians; while the Zoanthinæ are equivalent only to the Thalassianthinæ, etc. The Edwardsiæ do not have a group value, being recognized simply as a genus of Actinines pivotantes, where they are associated with *Ilyanthus*, *Peachia*, and *Sphenopus*, the last belonging properly to the Zoanthinæ. In choosing the relative consistency of the various forms as a basis for his division of the Zoantharia Milne-Edwards naturally falls into certain of the errors which such a classification entails, and which had been handed down from earlier days, as for instance the grouping of the Millepores with the Madreporaria. In this, however, there is neither loss nor gain, since none of his predecessors, with the conspicuous exception of Rapp, had suggested the reference of these forms to their proper position. The principal error of the classification, as already pointed out, lay in the attaching of too great importance to the presence or absence of a corallum, and in the disregard of the similarity of the soft parts of Madreporaria and Actinaria so definitely stated by Dana.

Milne-Edwards's classification had a marked influence upon later writers, most of whom adopted his larger divisions, the principal modifications introduced by them affecting the arrangement and definition of the lesser groups. An exception to this, however, was the classification of Gosse ('60) who adhered to the arrangement laid down by Dana, but went a little further than that author in dividing certain of the tribes of Actinaria into families, thus:

Suborder Actinaria—
- Tribe I. Astræacea:
  - Family I. Metridiadæ = forms with compound tentacles.
  - II. Sagartiadæ = with simple tentacles, adherent base, and column pierced by cinclides.
  - III. Antheadæ = column smooth and imperforate, margin simple.
  - IV. Actiniadæ = margin beaded.
  - V. Bunodidæ = column warted.
  - VI. Ilyanthidæ = base non-adherent, rounded, simple.
  - VII. Minyadidæ = base non-adherent inclosing an air chamber.
- Tribe II. Caryophylliacea:
  - *a*. Without a corallum.
    - Family I. Capneadæ = simple.
    - II. Zoanthidæ = compound.
  - *β*. With a corallum, certain corals divided into four families.

The coralligenous Astræacea Gosse does not classify, none of the genera being British, nor does he divide the Madreporacea or Antipathacea into families, for the same reason. The Lucernariadæ he excludes from the Actinaria, recognizing their affinities to the Medusæ.

On comparing this classification with that of Milne-Edwards, it will be seen that, independently of the association of non-coralligenous and coralligenous forms, there is a very different grouping of the genera. The family Metridiadæ (a name badly chosen) is equivalent to Milne-Edwards's Thalassianthinæ and Phyllactinæ, the Sagartiadæ are the Actinines perforées, and the Bunodidæ the Actinines verruqueuses, both raised to the rank of families. The Actinines vulgaires are divided into three families, two of which, the Antheadæ and Actiniadæ belong to the Astræacea, while the third, the Capneadæ, is referred, with the Zoanthidæ, to the Caryophylliaceæ, while Milne-Edwards's family Cerianthidæ is abolished, *Cerianthus* and *Arachnactis* being associated with his Actinines pivotantes to form the family Ilyanthidæ. These comparisons refer to the broad features of the groups, there being differences in detail in some. Many new genera were established by Gosse, as for instance, *Bolocera*, *Bunodes* and *Aiptasia*, and this, as well as his disregard for the most part of non-British forms, renders it difficult to make a detailed comparison between the two authors.

By the exclusion of the Lucernariadæ the Anthozoa obtained the limitations which they now possess, except that the Hydrocorallines still continued to be referred to the group. Agassiz indeed upheld their hydroid character, but it was not until Moseley's brilliant observations ('78) were made, that they were definitely assigned to the position long before pointed out for them by Rapp.

As already stated, subsequent authors were more influenced by Milne-Edwards than by Gosse in drawing up their classifications, though the division into smaller groups was not unlike that proposed by the latter. Gosse's smaller divisions were more or less adopted and subordinated to Milne-Edwards's system. It will be altogether unnecessary to refer to all the classifications presenting these features, but still it will be convenient to give one or two examples, choosing those which present most historical value.

One of these may be the classification proposed by Verrill in 1865, which outdoes even that of Milne-Edwards in placing inordinate importance upon the corallum. Verrill divides the Cnidaria or Polypi into 3 orders, *i. e.*, (1) Madreporaria, (2) Actinaria, (3) Alcyonaria, the increase from the number proposed by Milne-Edwards being accomplished by raising the Madreporaria from the subordinate position they occupied in the order Zoantharia and making them of equivalent rank with the Alcyonaria. The division of the Actinaria which Verrill proposed was as follows:

Suborder I. Zoanthacea.
  Families. Zoanthidæ and Bergidæ.
Suborder II. Antipathacea.
  Families. Antipathidæ and Gerardidæ.
Suborder III. Actinacea.
  Families. Actinidæ, Thalassianthidæ, Minyidæ, Ilyanthidæ, Cerianthidæ.

This arrangement is important in giving the Zoanthids a greater importance than had hitherto been assigned to them, and in separating the Cerianthidæ from the Ilyanthidæ, though they do not receive the same position that Milne-Edwards gave them. The family Actinidæ Verrill divided in various subfamilies, differing somewhat from the equivalent groups of Gosse and Milne-Edwards, a subfamily Phellinæ being established for the genus *Phellia*. Milne-Edwards' Phyllactinæ and Thalassianthinæ he unites together in his family Thalassianthidæ, which is subdivided into the subfamilies Phyllactinæ, Thalassianthinæ, Heterodactylinæ and Discostominæ (Verrill, '68), the members of the last named subfamily having the tentacles arranged in radiating rows, more than one tentacle communicating with an intermesenterial space. The establishment of this peculiarity is important, as it is a character which approximates the Actinaria with the Madreporaria.

To the Discostominæ Verrill referred the genera *Discosoma* and *Corynactis*, classed by Milne-Edwards with the Actinines vulgaires, and *Capnea* and *Aureliana*, referred by Gosse to the Caryophylliacea.

The classification of Klunzinger ('77) may now claim our attention as showing a further step toward a correct differentiation of the groups. The classification is to a very large extent similar to that of Verrill, but contains certain important innovations. The Madrepores are, following Milne Edwards, considered a separate group, and the remaining groups are as follows:

- I Or. Alcyonaria.
- II Or. Antipatharia.
- III Or. Zoantharia—including the Zoanthidæ.
- IV Or. Actinaria.
  - 1. Family Actinidæ.
    - 1. Subfamily Actininæ.
    - 2. Subfamily Phellinæ.
    - 3. Subfamily Sagartinæ.
    - 4. Subfamily Bunodinæ.
  - 2. Family Ilyanthidæ.
  - 3. Family Cerianthidæ.
  - 4. Family Discosomidæ.
  - 5. Family Thalassianthidæ.
    - 1. Subfamily Phyllactinæ.
    - 2. Subfamily Thalassianthinæ.

The first noticeable feature of this classification is the separation of the Antipatharia and Zoantharia from the Actinaria, and the elevation of their rank to that of groups equivalent to the Alcyonaria. Furthermore, among the lesser groups there is the separation of the Discosomidæ from the Thalassianthidæ, with which Verrill associated them, the radiate arrangement of the tentacle being the characteristic feature of the family. Klunzinger, however, failed to associate the genus *Corynactis* with *Discosoma*, stating definitely that its tentacles alternate with each other. The other families and subfamilies are essentially the same as those of Verrill, except that no mention is made of the Minyadæ.

We come now to the monograph of the Actiniaria by Andres ('83), which must ever remain a monument to the industry of its author, to whom all actinologists are indebted for placing in their hands such a carefully collated and complete list of the Actinians known up to 1880. Unfortunately for our purpose, Andres does not express his ideas as to the relationships which his Actinaria bear to the Alcyonaria and Antipatharia, but confines his attention solely to the *Zoantharia mala-*

codermata of Milne Edwards. He divides the group into seven families, thus:

Edwardsinæ.	Zoanthinæ.
Actininæ.	Cerianthinæ.
Stichodactylinæ.	Minyadinæ.
Thalassianthinæ.	

The names of the majority of these groups indicate their limitations; the greatest innovations are the separation of the Edwardsias from the Actininæ and the establishment of the Stichodactylinæ. This family possesses for its distinguishing character the feature upon which Klunzinger based his family Discosomidæ, *i. e.*, the radiate arrangement of the tentacles, but at the same time it is made much more comprehensive, the Phyllactinæ of Klunzinger being associated with *Discosoma*, *Capnea*, *Aureliana*, *Phymanthus* and other genera, all of which possess radially arranged tentacles. The Thalassianthinæ is, consequently, poor in genera compared with Klunzinger's Thalassianthidæ, containing only a few forms with large compound tentacles. Four of Andres' groups are certainly well established, namely, the Edwardsinæ, Actininæ, Zoanthinæ and Cerianthinæ. He was influenced, however, too much by the arrangement and structure of the tentacles in making the Stichodactylinæ and Thalassianthinæ equivalent to these four; they should more properly be made subgroups of the Actininæ. The same remark applies, perhaps, to the Minyadinæ, though we are still in ignorance as to the structural peculiarities of its members. The fact that some of the species evidently have their parts arranged on a hexamerous plan favors this view, and the occurrence of others possessing a decamerous arrangement can not be considered as of great weight in favor of keeping them distinct, in view of the same symmetry occurring in the Halcampidæ, for instance, and in other sporadic instances in which there can be no question as to the advisability of associating the forms with their hexamerous relatives in the Actininæ. In fact, it seems probable that the Minyadinæ are not even to be given a value equal to the Stichodactylinæ, but are rather to be referred to the Halcampidæ, a family or subfamily of the Actininæ.

The disappearance of the Ilyanthidæ from the list of families is an important point also. Andres has diminished the importance of trivial characters in accomplishing this, and has emphasized the importance of the numerical relations of the parts as a basis for classification in separating from them the Edwardsias and referring the thus restricted groups to the Actininæ.

Andres enters into a much more minute division of his families into subfamilies, many of which are well founded, but it will not be convenient to criticise them here.

With Andres the second period in the history of the classification of the Anthozoa may be said to close. The period was marked by a gradually growing tendency to divide the group into a number of equivalent subgroups, and, so far as the Actinians are concerned, by the increase in the number of recognized genera and their division into families, subfamilies, etc. The distinguishing characters of the various groups were drawn for the most part from external characters; importance, for instance, being placed upon the presence or absence of a corallum, whether the base is adherent or not, in the shape of the tentacles, etc. Comparatively little was done toward attaining a thorough knowledge of the anatomical relationships of the various parts, or perhaps it would be better to put it in this way, that the anatomical knowledge that had been acquired was not sufficiently extensive to be employed for systematic purposes. The names of Hollard, Quatrefages, Haime, Thorell, Teale, Schneider and Rotteken, Stoliczka, etc., recall important additions to our knowledge of Actinian morphology, but the observations were not sufficiently extended to have suggested the importance that should have been attached to them.

We are now in the third period, so brilliantly introduced by the brothers Hertwig with their monograph on the Actinians ('79). The period in its beginning overlaps, consequently, the second period. The fundamental characteristic of Actinian classification at present is the foundation which it possesses on anatomical and phylogenetic features. The arrangement of the mesenteries and their ontogenetic succession are the criteria which serve to separate the larger groups, and these criteria have been extended, so far as our present knowledge allows of it, to the group Anthozoa as a whole. The first step in this direction, as stated, was made by the Hertwigs ('79), who, as a result of their observations on a number of Actiniaria, arrived at the following conclusion:

Bei der Eintheilung der Anthozoen sind die Septen in erster Reihe zu berücksichtigen, aber weniger die Zahl als vielmehr der Bau, die Anordnung derselben um das Schlundrohr und ihre Entwicklung. Wenn wir von dieser Grundlage ausgehen, werden die Anthozoen voraussichtlich in mehr als 2 Ordnungen zu zerfällen sein. Mit Erfolg aber kann ein neues System erst dann aufgestellt werden, wenn die verschiedenen Familien der Zoantharien, der Fleischpolypen sowohl als der Korallen, auf die Morphologie ihrer Septen, über die wir vielfach noch gar nichts wissen, nach allen Richtungen untersucht sein werden.

The Hertwigs recognize five groups of Anthozoa, based on the characters indicated in the above quotation, viz, the Actinidæ, Edwardsiæ, Zoanthidæ, Cerianthidæ, and Alcyonaria. As regards the Madreporaria, they do not commit themselves definitely, recognizing the paucity of the information with regard to their anatomical peculiarities at their disposal; at the same time, however, they consider it probable that when the required information is acquired the group of the *Zoantharia sclerodemata* will be split up, a large part of the corals being associated with the Actinidæ, others, perhaps, with the Zoanthinæ, and others with Edwardsiæ, while others, again, may show an arrangement and structure of the mesenteries peculiar to themselves.

The idea brought forward in this work was elaborated more fully by Richard Hertwig in his report on the Challenger Actiniaria ('82), in which the structural peculiarities of the various forms are employed, not only to distinguish the principal groups, but also to define in an accurate manner the various families of the Hexactiniæ. In some particulars the idea was carried a little too far, owing to the absence at that time of anatomical studies of a large series of forms, Hertwig being obliged to rely entirely on his own observations in deciding as to the relative importance of a character. Omitting the Alcyonaria and Antipatharia from consideration, Hertwig recognizes six tribes of Actiniaria, which correspond in taxonomic value to Andres's families. These tribes are (1) Hexactiniæ, (2) Paractiniæ, (3) Monauleæ, (4) Edwardsiæ, (5) Zoantheæ, and (6) Ceriantheæ, and all are characterized by the arrangement of the mesenteries. Three ot these orders correspond to families of Andres' classification; other three of Andres' families, viz; Thalassianthinæ, Stichodactylinæ, and Minyadinæ are grouped with his Actininæ to form the tribe Hexactiniæ, while two other tribes, not represented in Andres' system, are instituted for forms presenting an arrangement of the mesenteries not previously recognized. In comparing the systems of Hertwig and Andres, however, it must be remembered that the two works were so nearly contemporaneous that the respective systems were entirely independent one of the other. Andres, it is true, had the advantage of the earlier work of the brothers Hertwig ('79), which no doubt influenced considerably his ideas as to the relationships of certain of the groups, but had no cognizance of Richard Hertwig's later observations.

The introduction into the classification of the Anthozoa of a system based upon anatomical peculiarities, instead of one resting entirely on variable characters, readily subject to modification in accordance with external conditions, was very important. There yet remained to be taken the further step of adding to anatomical characters the information derived from embryological investigation, a step the importance of which the Hertwigs had recognized and contributed to, to a certain extent. Some of the necessary information was contributed later by Boveri ('90) and myself ('91), and as the result of these observations I drew up a classification of the Anthozoa founded upon structural and embryological characteristics. Either of these classes of facts, taken by itself, is liable to lead to errors; it is only by combining both that a true knowledge of the phylogenetic relationships of the various groups can be obtained. For instance, relying entirely on embryological data, the Hexactiniæ could be separated into three distinct groups, one including those forms in which the mesenteries appear according to the succession described by Lacaze-Duthiers; a second, in which the mesentery succession is that described by the Hertwigs ('79); and a third, in which it is that described by Haddon ('87), H. V. Wilson ('88), and myself ('91). I have shown, however ('91 *a*), that the third method is to be regarded as the typical one, and that the orders of succession described by Lacaze-Duthiers and the Hertwigs are secondary modifications of this, called forth by peculiar conditions; and, furthermore, anatomical investigation of forms developing in these various manners shows so much similarity in them all as to do away with any idea of classing them in three distinct groups.

The classification which I proposed differs from that of Hertwig in two particulars. In the first place I disregard his tribe Paractiniæ, which I have shown to be unnatural and untenable, and I group the form upon which his tribe Monauleæ was founded with the *Gonactinia*, long before described by Sars and later studied more thoroughly by Bloehmann and Hilger ('88), and with the *Oractis Diomedeæ*, described in subsequent pages of this report, forming thus a tribe, the Protactiniæ, the members of which I take to represent stages in the phylogeny of the Hexactiniæ. Strictly speaking, perhaps each of these three forms should constitute an order, but is seems to contribute to the convenience of the classification, without introducing any confusion, to group them together. I recognize the following tribes of Anthozoa:

1. Rugosæ.	5. Ceriantheæ.
2. Antipatharia.	6. Zoantheæ.
3. Alcyonaria.	7. Protactiniæ.
4. Edwardsiæ.	8. Hexactiniæ.

The propriety of considering the Rugosæ as forming a tribe equivalent to the Alcyonaria, for instance, is open to question, since we naturally know nothing as to their soft parts and can only form an exceedingly uncertain idea of how they were arranged from the arrangement of the septa in the corallum. The Antipatharia form a natural group, apparently, though it is uncertain what their affinities with the other groups may be. The remaining tribes seem to have their phylogenetic relationships fairly clearly defined.*

* In a recent paper Ed. van Beneden ('91) contests the idea that there is a phylogenetic connection between the Ceriantheæ and the Edwardsiæ and Hexactiniæ. On pages 110-111 of his paper he sums up the differences which the Ceriantheæ show to these forms, and it may not be out of place here to consider the value of these supposed differences. Difference No. 1 does not require consideration, since it stands or falls with the accuracy or erroneousness of No. 2. This is as follows: If the sulcar directives are designated as I and the remaining mesenteries of a twelve-mesenteried Hexactinian are designated according to their succession, counting from the sulcar directives towards the sulcular, as II, III, IV, V, and VI, then the embryonic succession of the mesenteries in the Hexactiniæ is III, V, I, VI, II, IV, while in the Ceriantheæ the succession of the first twelve mesenteries is II, III, I, IV, V, VI. The fallacy of this is evident. It has not been claimed that the first *twelve* mesenteries of Ceriantheæ and Hexactiniæ are homologous, but only that the first *eight* in both groups are homologous with the eight *Edwardsia* mesenteries. Considering the embryonic succession of these mesenteries in both groups, it will be found to be identical, thus: III, I, II, IV. Difference No. 3 refers to the presence of longitudinal (adductor) muscles on the mesenteries of the Edwardsiæ and Hexactiniæ and their absence on those of the Ceriantheæ, and to the presence of ectodermal longitudinal

A detailed criticism of the various families which have been proposed is not necessary, since this will be entered into in the descriptive portion of the report, so far as certain families of the Hexactiniæ are concerned. Andres ('83) added a considerable number of families to those which had previously been recognized, and the majority will, no doubt, stand. Hertwig too has added a number of new families, and at the same time has given an interesting criticism of Andres' classification and a comparison of it with his own. Many of the families Andres recognized are more accurately defined, and attention has been called to the criteria upon which families should be based. One of the most recent classifications, is that of Danielssen ('90), which is essentially that of Hertwig ('82), confused, and without the corrections, which Hertwig ('88) subsequently introduced. In fact, it must be acknowledged that Danielssen's work is a great disappointment, in that the descriptions are given in such a manner as to preclude confidence in their accuracy, while the figures illustrating them are beautiful examples of "how not to do it." The tribe Ægireæ, which Danielssen proposes, certainly requires further study before being accepted, and the same remark applies to his families Sideractidæ, Madoniactidæ, and Andvakidæ.

I shall content myself with stating the families which I believe to be worthy of recognition, making some brief remarks on their limitations, and on certain somewhat doubtful forms.

I think it convenient to consider the mode of arrangement of the tentacles of classificatory importance, and to recognize two subtribes of the Hexactiniæ to which Andres' name may be applied: Actininæ to those to which the tentacles are arranged in cycles, and Stichodactylinæ to those in which they are arranged radially. To these two I added ('89) a third, the Dendromelinæ, which is hardly of equal value, and which it will be better to reduce to the rank of a family. It includes forms which possess dendritic or globular processes or arms projecting from the column wall below the margin, such as are found, for instance, in *Lebrunea*, *Ophiodiscus*, and *Viatrix**

The Thalassianthinæ I would not, however, adopt as a subtribe, since they differ from the Actininæ only in the compound character of their tentacles, and a passage to them is furnished by the member of Andres' subfamily Heteractidæ. This family is, however, not altogether natural since the genus *Ragactis* must be removed from it and referred to the

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muscles in the latter and their absence in the other two groups. The absence of "adductor" muscles in the Ceriantheæ is a question of observation, since Boveri has described and figured them; and with regard to the presence of ectodermal longitudinal muscles in the Hexactiniæ, van Beneden has apparently overlooked Hertwig's account ('88) of their occurrence in *Corynactis* sp? and *Corallimorphus obtectus*. In the present report I describe their occurrence in *Halcurias pilatus*.

*It seems fairly certain that the actinian recently described by H. V. Wilson ('90) as *Hoplophoria coralligens* (*sic*) is identical with the *Viatrix globulifera* originally described by Duchassaing and Michelotti ('60).

Sagartidæ, as was demonstrated to me by the late Dr. J. I. Northrup, who discovered the Sagartian character of *R. lucida*, an observation I have since been able to confirm.* The genus *Eloactis* also proposed by Andres ('83) for the *Ilyanthus mazeli* of Jourdan ('80) seems to belong rather to the Halcampidæ, *E. Mazeli* being apparently nearly related to *H. producta* of Stimson.

The following is the classification I suggest:

- A. Tentacles arranged in cycles. Actininæ.
  - Column simple.
    - Tentacles cylindrical, smooth.
      - Sphincter absent or weak endodermal
        - Mesenteries not numerous .. Halcampidæ.
        - Mesenteries numerous .... Antheadæ.
      - Sphincter endodermal; tentacles deciduous .... Boloceridæ.
      - Sphincter mesoglœal
        - No acontia .... Paractidæ.
        - Acontia .... Sagartidæ.
      - Sphincter endodermal circumscribed.
        - Acrorhagi wart-like. Bunodidæ.
        - Acrorhagi foliate. Phyllactidæ.
    - Tentacles warty or branched
      - Tentacles simple . Heteractidæ.
      - Tentacles compound . Thalassianthidæ.
    - Tentacles reduced to stomidia ....
      - Polyopidæ.
      - Sicyonidæ.
  - Column provided in its upper part with branched or globular processes .... Dendromelidæ.
  - Free-swimming forms .... Minyadæ.
- B. Tentacles arranged radially. Stichodactylinæ.
  - Tentacles all of one form.
    - Tentacles few, capitate.... Corallimorphidæ.
    - Tentacles numerous, cylindrical .... Discosomidæ.
    - Tentacles nodulated .... Aurelianidæ.
  - Tentacles of two forms.
    - Marginal tentacles cylindrical; disc tentacles wart-like, branched, or foliate .... Rhodactidæ.
    - Marginal tentacles pinnate, disc tentacles wart-like .. Phymanthidæ.
  - Tentacles of various forms, not cylindrical ... Criptodendridæ.

I have chosen the term Halcampidæ in preference to that of Ilyanthidæ because we are at present ignorant of the anatomical characteristics of *Ilyanthus*; it will, however, probably prove to be similar to *Halcampa* in many respects, in which case the older term should be restored. The Siphonactinidæ, I think, should be fused with the Halcampidæ, the presence or absence of a conchula not being of sufficient moment for family distinction.

The Boloceridæ is a new family, for whose existence reasons will be given in Part II. The Antheomorphidæ of Hertwig ('82) I include

* It seems doubtful, however, if the *R. pulchra* of Andres is likewise a Sagartid. I should rather be inclined to consider it a *Phymanthus*, since it presents certain striking resemblances, judging from Andres' description, to *P. crucifer*.

for the present with the Antheadæ. My reasons for placing the Phyllactidæ among the Actininæ have been given in another place ('89a). Hertwig's Polyopidæ and Sicyonidæ I have placed in the Actininæ, not recognizing his tribe, Paractiniæ. These forms require further study. The Liponemidæ are too much open to suspicion to be accepted, as will be seen from what is said in Part II concerning *Bolocera brevicornis*, *Liponema* recalling strongly a *Bolocera*, while *Polysiphonia* recalls *Actinernus*.

Under the Sagartidæ is included the Phellidæ, which may be regarded as a subfamily under Haddon's name of Chondractininæ, and the Amphianthidæ, which are probably all referable to the Sagartidæ and to the subfamily Chondractininæ.

The Minyadæ are inserted with the Actininæ as a family, but little is as yet known of their anatomical peculiarities.

The classification of the Stichodactylinæ hardly calls for comment, except to point out that, of the Aurelianidæ and Criptodendridæ very little is known, nothing indeed as to anatomical characters. I have employed the form of the tentacles, following Andres with modifications, as a basis for the classification; but in those groups members of which have been studied it has been found that more or less definite anatomical features are associated with the various tentacular modifications.

This classification is, it must be understood, intended to be purely tentative and to take cognizance only of families which seem well authenticated. No doubt the changes and additions which will be required to make it at all accurate are numerous—how numerous future observation will determine.

PART II.

DESCRIPTIVE.

Tribe EDWARDSIÆ, Hertwig.

Actinozoa not forming colonies; with eight mesenteries, three of which on each side have their longitudinal muscles upon their sulcar faces, while the other two, situated at the sulcar surface, have these muscles on their sulcular faces. Tentacles simple, usually more numerous than the mesenteries.

Genus EDWARDSIA, Quatrefages.

With the characters of the tribe.

I do not consider it necessary at present to divide the Edwardsias which we know into two genera, as Andres ('83) has done, much less to make the number of the tentacles the feature upon which to base such a division, since this is a character liable, to judge from the descriptions of species which we possess, to numerous gradations. When a thorough anatomical study has been made of a number of different species, it may be found advantageous to make a division; at present it does not seem advisable.

1. Edwardsia intermedia, sp. nov.

Plate XIX, Figs. 1–4.

No. 704. Station 2783. Lat. 51° 02′ 30″ S.; long. 74° 08′ 30″ W. Depth 122 fathoms. 1 specimen.

The single specimen for which I propose the above name was strongly contracted, the entire capitulum being introverted. In this contracted condition (Pl. XIX, Fig. 1.) it measured 1.7^{cm} in height, and its greatest diameter is 0.45^{cm}.

The physa is rounded and translucent, allowing the mesenteries to show through. The scapus is covered by a thin, brown, chitin-like "epidermis," resembling, apparently, that covering *E. Claparedii*, but unlike it, being almost smooth. It is quite translucent and consists of two layers (Pl. XIX, Fig. 4); on the outside is a thin layer of foreign matter (*f*), consisting of very fine sand particles, spicules, etc., and below this a cuticle-like layer (*cu*) covering the ectoderm (*ec*) and sending here and there into that layer prolongations which seemed occasionally to unite with the mesoglœa. The arrangement is very similar indeed to what I have described for *Zoanthus sociatus* ('89), though it is not so certain in this case that the cuticle is really a portion of the mesoglœa. The ectoderm (Pl. XIX, Fig. 4, *ec*) consists of cells, not at all columnar, as is usually the case in the Actinozoa, and shows no trace of either gland cells or nematocysts.

The scapus is marked by eight longitudinal furrows, corresponding to the insertions of the mesenteries, and the intervals between these furrows are occupied by numerous irregularly scattered clear spots, which recall the tubercles described by Andres ('80) and Danielssen ('90). Their structure is, however, somewhat different from what these authors have described. The ectoderm over a small area is slightly thickened and projects through the covering investment, but no nematocysts were to be found in it. The transparent appearance which is so characteristic of the tubercles is due to a comparatively large oval cavity in the mesoglœa, lying below the tubercle and always separated, apparently, by a very delicate layer from the ectoderm, though a small collection of granules and, in some cases, a few cells are to be found in the cavity. (Pl. XIX, Fig. 4).

In transverse sections it is seen that a portion of the scapus is introverted as well as the entire capitulum; sections taken at a little more than 3^{mm} from the upper extremity of the contracted animal show the cuticular investment which is characteristic of the scapus. In this introverted region, however, the layer of foreign material (Pl. XIX, Fig. 2, *f*) is very much thicker than on the outer surface of the body, and, furthermore, in each interval between the insertions of two mesenteries a strong ridge, formed principally of mesogloea, projects, and as the capitulum is approached cavities appear in the ridge, giving it in cross-section a club-shaped outline.

The capitulum is apparently very short and is destitute of any investment. The number of the tentacles I could not ascertain, but they seem to be few, perhaps eight, almost certainly not more than sixteen. They project down into the stomatodæum in the manner described by Quatrefages ('41).

The stomatodæum is short and is slung by the eight mesenteries, whose musculature has the usual arrangement. All the mesenteries are gonophoric and possess mesenterial filaments. Since Andres ('80) has stated that in *E. Claparedii* the respiratory portions of the filament are wanting, I may state that in the species here described they are unmistakeably present, though short. The bases of the mesenteries at their insertion into the column wall are furnished with pinnately arranged muscle processes (Pl. XIX, Fig. 3 *b m*). The longitudinal muscles are strong, resembling in transverse section those of *E. tecta* as figured by Haddon ('89).

It is impossible to identify this form with any of the species that have been described. Within recent years a number of Edwardsias from deep water have been described by Moseley ('77), Marion ('82), R. Hertwig ('88), and Danielssen ('90), but the descriptions are not in all cases sufficiently detailed to permit of a correct idea of the morphological characteristics. The structural features which are of importance for classificatory purposes seem to be the tubercles, the shape of the longitudinal and basal muscles of the mesenteries, the presence or absence of longitudinal ridges on the column, and, what is probably of less importance, the number and arrangement of the tentacles.

E. intermedia agrees, as already stated, with *E. tecta* (Haddon, '89) in the structure of the longitudinal muscles, but differs from it in possessing tubercles and in the shape of the basal muscles of the mesenteries; it approximates *E. fusca* Danielssen ('90) in the number of the tubercles, though they are not arranged with anything like the regularity which they have in Danielssen's figure, and in addition the shape of the longitudinal muscles is altogether different; it resembles *E. carnea* (Haddon, '89) in the possession of longitudinal ridges on the capitulum and upper part of the scapus, but differs from it altogether in the shape of both longitudinal and basal muscles.

In consequence of its possessing certain of the characteristics of each of these three species I have named the form here described *E. intermedia.*

Tribe PROTACTINIÆ.

Anthozoa with twelve primary mesenteries, of which eight at least are perfect, and which are arranged in pairs, the longitudinal mesenteries of each pair being on the faces of the mesenteries which are turned towards the intramesenterial space, except in the case of two pairs, the directives, situated at the extremities of the sagittal axis of the stomatodæum, whose longitudinal muscles are on the faces of the mesenteries which look towards the adjacent intermesenterial space. In addition to these primary mesenteries secondary mesenteries are also present; of these there may be one on each side, situated in the sulculo-lateral intermesenterial space, or a pair on each side in the same intermesenterial space, or two pairs on each side in the sulculo-lateral and lateral intermesenterial spaces. The development of the mesenteries is upon a bilateral plan.

Genus **ORACTIS**, gen. nov.

Protactiniæ with twenty mesenteries, twelve of which are primary, and two pairs on each side, in the sulculo-lateral and lateral intermesenterial chambers respectively, secondary. Only the eight primary mesenteries corresponding to the *Edwardsia* mesenteries, are perfect, gonophoric, and provided with mesenterial filaments.

2. Oractis Diomedeæ, sp. nov.

Plate XIX, Figs. 5–8; Plate XX, Figs. 9–11.

No. 727. Station 2839. Lat. 33° 08′ N.; long. 118° 40′ W. Depth, 414 fathoms. Several specimens.

All the specimens are contracted extensively (Pl. XIX, Figs. 5 and 6), and measure in this condition 5 to 8mm in height and 10 to 13mm in diameter. The base and column are colorless and translucent, allowing the internal organs to show through, but sections show that the disc and tentacles have yellow pigment granules in their ectoderm, and probably in the living condition they had a more or less decided yellow color.

The base is more or less rounded (Pl. XIX, Fig. 5) and passes directly into the column, there being no limbus. The column is marked by twenty longitudinal grooves corresponding to the insertions of the mesenteries. At the summit of the contracted animal ten tubercle-like processes can be seen surrounding the entrance into the cavity containing the contracted tentacles, and in sections these tubercles may be seen (Pl. XX, Fig. 11, *tu*) to be due to thickenings of the mesoglœa. In some of the specimens they appear to be infolded along with the tentacles. The ectoderm of the column wall has entirely disappeared. The mesoglœa is thin, and more or less fibrillar in structure with comparatively few cells. The sphincter muscle is of the diffuse type (Pl. XX, Fig. 11.), its mesoglœal processes being long and numerous, so that a fairly strong muscle is produced.

The tentacles appear to be ten in number. They are rather short, cylindrical, obtuse. In transverse sections it is seen that their longitudinal muscles are confined to the ectoderm, and for the most part are of moderate strength, but towards the base two regions are to be found upon the outer surface of the tentacle where the muscle processes reach an excessive development (Pl. XIX, Fig. 7.) In sections which pass through the point of origin of the tentacles, just where they arise from the disc (Pl. XX, Fig. 10), it can be seen that these two muscle bundles (*m*) are continued upon the disc, forming strong muscles lying immediately over the mesenteries, one bundle of each tentacle coming from the mesoglœa over each of the mesenteries which limit the intramesenterial space to which the tentacle belongs. These muscle bundles are not, however, continued to any extent upon the disc towards the mouth opening, but appear to be confined to the peripheral region where the tentacles arise.

The stomatodæum (Pl. XIX, Fig. 8*t*) is rather short, and has only one siphonoglyphe which is deep, its mesoglœa being much thicker than it is elsewhere on the stomatodeum. The remainder of that structure is marked by six longitudinal ridges, each of which corresponds to the insertion of a mesentery.

As is indicated by the furrows of the exterior of the column there are twenty mesenteries. Eight of them are perfect, gonophoric, and provided with mesenterial filaments, while the remaining twelve are imperfect, sterile, and destitute of filaments. The arrangement of the mesenteries is exceedingly interesting (Pl. XIX, Fig. 8). There are two pairs of directives, having the characteristic arrangement of the longitudinal muscles; that pair (III) which is attached to the siphonoglyphe marks the sulcar surface of the body. On each side of the sulcar directives is an imperfect mesentery (V) with its longitudinal muscle upon its sulcular surface, and succeeding this comes a perfect mesentery (I) forming with the imperfect one a pair. Then follow a pair of imperfect mesenteries (VIII), then a pair formed by a sulcar imperfect (VI) and a sulcular perfect mesentery (II), then a pair of imperfect mesenteries (VII), and finally the sulcular directives.

It must be stated that the figure I have given is to a certain extent diagrammatic, inasmuch as in a section through the stomatodæum the longitudinal muscles of the imperfect mesenteries could not be readily made out, while further up the column, in sections which passed through the column and disc, they were well developed. I have represented therefore the arrangement as regards the perfectness or imperfectness of the mesenteries as seen in a section passing through the stomatodæum, but the musculature as seen in sections passing through the column and disc.

The longitudinal muscles are not strong, and in the perfect mesenteries occupy the greater part of the surface (Pl. XX, Fig. 9). The endoderm of the mesenteries presents a rather peculiar vacuolated appearance, reminding one of the structure which it presents in *Cerianthus*. The mesenterial filaments which are developed only on the eight perfect mesenteries appear to lack the "Flimmerstreifen" but I can not be certain that they are really absent. The contraction of the specimens renders it difficult to understand the exact structure of the filaments. The ova are large and contain a considerable amount of food-yolk.

The significance of the arrangement of the mesenteries of this form I have elsewhere pointed out ('91). The eight perfect mesenteries evidently correspond to the eight *Edwardsia* mesenteries; the imperfect mesenteries which form pairs with adjacent perfect ones (I and II), are evidently the mesenteries which convert the octameral into the dodecameral condition with paired mesenteries. The imperfect pairs VII and VIII are secondary mesenteries and arise in pairs in the two intermesenterial chambers nearest the sulcular directives.

If we omit pair VIII we have the arrangement which occurs in *Gonactinia* (Blochmann and Hilger, '88), and if the sulcular member of pair VII be omitted the condition obtaining in *Scytophorus* (Hertwig, '82) will appear. It seems that these two forms, together with *Oractis*, represent three links in the chain by which the ancestor with twelve mesenteries, all of which arose singly and bilaterally, becomes converted into the Hexactiniæ, in which the muscles arise in pairs and radially. In *Scytophorus* the original method of formation is carried over into the formation of the single secondary mesentery. In *Gonactinia* the paired mode of formation is beginning, in *Oractis* it is thoroughly established, but in both these forms the bilateral mode still holds. Finally, in *Halcampa* the mesenteries arise in pairs and radially.

It will not be necessary to enter into the details of this idea here, since it has been treated of elsewhere in connection with some other facts ('91*a*). It may be well, however, to point out that there is embryological evidence to show that the secondary mesenteries of the Hexactiniæ make their appearance in the sulculo-lateral chambers earlier than in the others, and those of the lateral chambers develop before those of the sulco lateral ones (Dixon, '89), a succession which exactly corresponds with the phylogenetic development seen in the Protactiniæ.

Tribe HEXACTINIÆ.

Actinozoa with six, eight, or ten pairs of perfect mesenteries, which form a principal cycle, and to which may be added a varying number of additional cycles, perfect or imperfect, the mesenteries of which develop in pairs and radially, appearing almost simultaneously in all the intermesenterial spaces. The longitudinal muscles of each pair are on the faces which look towards the intramesenterial spaces, except in the case of two (occasionally one) pairs, the directives, which are attached to the two (occasionally one) siphonoglyphes, and whose longitudinal muscles are on the faces which are turned towards the adjacent intermesenterial spaces.

The above definition differs considerably from that given by Hertwig ('82), who founded the tribe. This results from the fact that I include within it not only hexamerous forms, but also octamerous and decamerous Actinians. In other words, I fuse with the original Hexactiniæ Hertwig's tribe Paractiniæ, which is altogether artificial and unnecessary. My reasons for this opinion have been given at length elsewhere and need not be repeated ('89, '91).

Order ACTININÆ, Andres.

Hexactiniæ in which the tentacles are arranged in cycles, only a single tentacle communicating with each endocœl.

Family HALCAMPIDÆ.

Actininæ with a small number of mesenteries, six, ten, or twelve pairs being all that are present; longitudinal muscle pennons narrow, but strong; no special sphincter muscle; conchula present or absent; base usually rounded and vesicular.

In his monograph, Andres ('83) divided the family Ilyanthidæ, which had been previously limited by the exclusion of the Ceriantheæ and Edwardsiæ, into three distinct families, or, as he termed them, subfamilies. One of these, the Halcampidæ, contained the genus *Halcampa*, the Ilyanthidæ included only the genus *Ilyanthus*, while for those forms which possessed a conchula the family Siphonactinidæ was established.

A more recent author, Haddon ('89), seems to regard this last family with uncertainty. At all events he removes from it and associates with the Halcampidæ the genus *Peachia*, recognizing, however, the the possible necessity for the establishment of a separate family for it.

The uncertainties which interfere with the delimitation of the family Halcampidæ are mainly two. Are forms which possess a conchula to be associated with others which do not have this structure, but whose mesenterial arrangement is similar? And are decamerous to be associated with hexamerous forms? I believe that both these questions should be answered affirmatively. The forms belonging to the family Siphonactinidæ, so far as they are known, agree in certain important features, viz, in the usual absence of an adherent base, the absence of a sphincter, the small number of mesenteries, and the strong though narrow longitudinal muscles, with the members of the genus *Halcampa*, and differ from them only in the possession of a conchula, a structure of probably comparatively little morphological importance. As regards the arrangement of the mesenteries, even if we separate the forms with a conchula from those without it, it will be necessary to associate together hexamerous and decamerous species, unless we wish to multiply families beyond convenience and necessity. *Halcampa endromitata*, etc., are hexamerous, and *H. producta* is decamerous among the Halcampidæ; and among conchula-bearing forms *Peachia hastata* is decamerous, while *Bicidium parasiticum* is hexamerous, possessing twelve pairs of mesenteries.

I think that the purposes of classification will be better served by uniting these and similar forms into a single family, for which the name Halcampidæ, already used in this sense by Haddon ('89), may be employed, and to recognize in this family several genera. The genus *Halcampa* seems to be well characterized by its hexamerism and the distinction into capitulum, scapus, and physa. *H. producta*, of the east coast of North America, and *H. capensis* Verr., *H. brevicornis* (Stimpson), and *H. Stimpsonii* Verrill ('65), decamerous forms, may be referred to another genus, though probably it will be well to separate *H. producta* from the other three and refer it to a separate genus. The form described by Jourdan ('80) as *Ilyanthus Mazeli* seems to be closely related, and *H. producta* may be referred with it to the genus *Eloactis* proposed by Andres ('83).

In addition to these three genera, since Andres' genus *Halcampella* and Danielssen's *Halcampoides* ('90) do not seem necessary, there will be of the conchula bearing forms *Peachia*, which is decamerous, and *Bicidium*, which is hexamerous. The genus *Actinopsis*, which is associated with these two genera by Andres, presents certain external characters which make one hesitate somewhat to retain it in the group. Until an anatomical study of it has been made it will probably be as well to leave it where it is.

Among the *Albatross* material I find two species which may be referred to the family thus emended. One of these is a *Peachia;* the other must, I think, be referred to a new genus related to *Halcampa* or *Eloactis*.

Genus **HALCURIAS**, gen. nov.

Halcampidæ with an adherent base; column cylindrical; tentacles numerous and short; ten pairs of mesenteries, all of which are perfect, though four pairs situated in the sulco-lateral and lateral intermesenterial spaces are less extensively developed than the other six. No conchula.

3. Halcurias pilatus, sp. nov.

Plate XX, Figs. 12-13. Plate XXI, Figs. 14-15.

Nos. 708, 709. Station, 2785. Lat., 48° 09' S.; long., 74° 36' W. Depth, 449 fathoms. Three specimens.

The base is flat and adherent, one of the specimens being seated upon a piece of dead coral. The column (Pl. XX, Fig. 12) is cylindrical, much wrinkled from contraction, but apparently possessing no warts or tubercles. It measures 2.3^{cm} in height, while its diameter at the base is 2^{cm}. Slight indications of longitudinal bands of color can be perceived, but they are exceedingly obscure and could not be discovered on all the specimens.

The margin is smooth and forms a very distinct parapet around the bases of the tentacles. These are numerous, amounting to about seventy in one specimen in which they were counted, and are arranged in about three cycles. They are simple, cylindrical and taper to a point, and cover almost the entire disk. There being no special sphincter muscle, the tentacles are not covered in contraction.

There is no conchula, and only one siphonoglyphe, which is neither very deep nor well defined. The surface of the stomatodæum possesses numerous ridges, which are high (Pl. XXI, Fig. 14, *st.*) and may bifurcate at the extremity or give off secondary ridges. They are more numerous than the mesenteries, and do not seem to stand in any very definite relation to them. The mesenteries are twenty in number. They are arranged in pairs, two of the pairs being directives, and are all perfect. Below, however, it is seen that four of the pairs, as in *Peachia*, are much narrower than the other six, these narrow pairs being situated in the sulco-lateral and lateral intermesenterial spaces. The mesenteries are thin; at the base there are pinnately arranged muscle processes (Pl. XX, Fig. 13, *bm.*), and separated from these by a region in which the mesentery is exceedingly thin are the longitudinal muscles. These are very strong (Pl. XX, Fig. 13), but at the same time narrow, forming a strong protuberance upon the surface of the mesentery. Above, however, they widen out (Pl. XXI, Fig. 14) and the processes are not so high.

All the mesenteries bear reproductive organs.

There are a few points in the histology of this species which are interesting. The mesoglœa is fibrillar, especially towards its inner surface, and contains very numerous cells. It is in the ectoderm however, that the most interesting peculiarities appear. The ectoderm of the column wall is high and contains, as usual, many gland cells. In addition to the usual elements, however, it also contains numerous nematocysts (Pl. XXI, Fig. 15, *n*) lying in its outer portion, sometimes very closely crowded together. Immediately external to and resting upon the mesoglœa, roundish bodies—or, rather, bodies appearing round in cross-section (*mf.*)—which stain somewhat deeply, can be perceived. These seem to be muscle fibres, having a longitudinal direction. They have all the appearance of muscle fibres, but I was not able to render their nature certain by the study of maceration preparations. Futher evidence for their muscular nature is, however, to be found in the presence, exterior to them, of a thin layer of fibrillæ having all the appearance of a nerve layer.

Longitudinal muscles and a nerve layer are, as a rule, absent in the column wall of the Hexactiniæ; but, on the other hand, are well developed in the Ceriantheæ, and it seems probable that the more primitive Actinozoa likewise possessed them. Hitherto they have been found among the Hexactiniæ only in *Corynactis?* sp? and *Corallimorphus obtectus*, in which forms they have been described by Hertwig ('88). The fibres of *Halcurias* resemble those of *Corallimorphus* in being poorly developed, and are apparently fewer in number. In *Corynactis?* on the other hand, they seem to reach a fair degree of development.

A few words are necessary regarding the affinities of this form. It differs from all other genera of the Halcampidæ by its adherent base and by the large number of tentacles which it possesses. *Actinopsis* possesses the same characteristics, although the tentacles are much longer in proportion, but differs in having a conchula. There is reason to doubt, however, whether *Actinopsis* can be referred to this family. Among the members of the family, however, indications of an adherent base are found, as in *Eloactis producta*, and the importance of this character seems to be far outweighed by the small number of the mesenteries and the structure of their muscles. It seems tolerably certain that the Halcampids are the simplest and probably the most primitive of the Hexactiniæ, and the presence of longitudinal muscle fibers in the ectoderm of the column wall of *Halcurias* is a primitive characteristic. I think, on the whole, that it is to be regarded as much more nearly related to the Halcampids than to any other family of Hexactiniæ.

Genus **PEACHIA**, Gosse.

Halcampidæ, with rather short tentacles, few in number; with four pairs of narrow sterile mesenteries, situated in the lateral and sulcolateral intermesenterial spaces, and six pairs of perfect fertile mesenteries; and with a single deep siphonoglyphe. Longitudinal muscles of the mesenteries strong. Conchula present.

Gosse ('55) instituted this genus for the reception of *P. hastata* and *Halcampa chrysanthellum*, later on, however ('58), removing the latter form to the genus to which it is now universally assigned. Andres ('83) employs, instead of Gosse's name, that proposed by Koren and Danielssen ('56), *Siphonactinia*, but the term proposed by Gosse has undoubtedly the priority, as Haddon points out ('84). In his revision of the British Actiniæ, Haddon ('89) gives a definition of the genus somewhat more precise than that given above, including certain peculiarities which seem likely to prove specific rather than generic. If they are retained the form described below and *Siphonactinia Boeckii* would be excluded from the genus, to which they seem naturally referable. Rather than establish a new genus for their reception, I prefer to extend somewhat the limitations of the genus *Peachia*.

4. **Peachia koreni**, sp. nov.

Pl. XXI, Fig. 16.

No. 951. Station, 2764. Lat., 36° 42′ S., long., 56° 23′ W. Depth, 11½ fathoms. One specimen.

The single specimen of this species (Pl. XXI, Fig. 16), which I dedicate to Prof. Koren, to whom, in collaboration with Prof. Danielssen, we owe the Fauna Litoralis Norvegiæ, is evidently closely related to *P.* (*Siphonactinia*) *Boeckii* (Kor. et Dan.). I regret that I can not give as complete a description of it as I should like to do, owing to a disinclination to mutilate the sole example obtained.

The base does not seem to have been adherent, but it is somewhat mutilated, so that it is not possible to be certain of this. No distinction, however, into capitulum, scapus, and physa is possible. The column is considerably wrinkled by contraction and shows no trace of tubercles or warts, and is not covered with foreign substances. Toward its lower part longitudinal grooves, marking the insertions of the mesenteries, are to be seen, but they can not be traced upward toward the margin for any distance. The height of the column is 1.1^{cm} and its diameter 0.8^{cm}.

The margin is simple, and in the contracted specimen covers the bases of the tentacles. These are only eight in number and are short and stout.

The conchula, formed by the prolongation of the lips of the single siphonoglyphe, is as long as the tentacles. On each side of the main portion of the conchula is a lobe rising only to about half the height of the former, and at the sulcular extremity of the mouth is a still smaller unpaired lobe.

By cutting across the column until it was almost divided I was able to ascertain the arrangement and number of the mesenteries without appreciably mutilating the specimen. There is only one siphonoglyphe, which is long and deep, with thick and firm walls, almost cartilaginous in their consistency. The mesenteries are twenty in number, arranged in ten pairs; two of these are directives, and in addition to these there are four other perfect pairs of about equal width, making altogether a principal cycle of six pairs of mesenteries. The remaining four pairs are imperfect and much narrower, and are situated in the sulco-lateral and lateral intermesenterial spaces. The longitudinal muscles are strong.

The arrangement of the mesenteries is the same as that found in *Peachia hastata*, but, as already stated, the general appearance of the animal, the form of its tentacles, and the possession of a well-developed conchula bring it very close to *P.* (*Siphonactinia*) *Bœckii*. Whether the latter has also ten pairs of mesenteries remains to be seen. It has twelve tentacles, which would lead one to suppose that it was hexamerous, but the species here described shows, as does also *Peachia hastata* with twelve tentacles, how little can be ascertained as to the number of the mesenteries from the number of the tentacles. It is possible that the specimen of *P. Koreni* examined was young and had not developed its full quota of tentacles. I can not make any statements with regard to the presence or absence of reproductive elements, not having made microscopical preparations of the mesenteries.

I think, however, that there can be no doubt as to the specific distinctness of this species from that obtained on the Norwegian coast. The form of the conchula is entirely different, a fact in itself sufficient, in the present state of our knowledge of the anatomy of the conchula bearing Halcampidæ, to warrant the establishment of a distinct species.

Family ANTHEADÆ.

The limitations of this family proposed by R. Hertwig ('82) seem satisfactory and will be adopted here.

Genus ACTINIA, Linn.

It seems doubtful whether such definitions as Andres ('83) proposes can be maintained for the genera *Actinia* and *Anemonia*. It may be, perhaps, better to unite all the forms of these genera which possess acrorhagi under the genus *Actinia*, leaving those destitute of such structures and without a distinct collar and fosse in the genus *Anemonia*.

5. Actinia infecunda, nom. nov.

Plate XXI, Fig. 17.

Synonym: *Comactis flagellifera*, Hert. (non Dana).
Nos. 957, 1739, Abrolhos Islands. Two specimens.

The resemblance of these forms to that described by Hertwig as *Comactis flagellifera* is very great, and it seems almost certain that they are identical with it. They are somewhat smaller, measuring 0.25^{cm} in height, with a diameter at the base of 0.5^{cm}, and at the margin of 0.7^{cm}. The sphincter muscle differs from the figure given by Hertwig ('82) only in being a little broader, and the radial muscles of the disk have the Cerianthan appearance which Hertwig mentions. The siphonoglyphes are not well defined though easily made out in sections, and have as usual directive mesenteries connected with them.

All the mesenteries appear to be perfect, though the youngest cycle are clearly marked out in sections below the middle of the stomatodæum by being much narrower than the mesenteries of the other cycles, all of which are about the same width, so that a pair of broad mesenteries alternates regularly with a narrow pair. I found indications of reproductive organs, but the ova were few in number, though fairly large, and appeared to occur in a few of the larger perfect mesenteries. Hertwig did not succeed in finding reproductive elements in the specimen he examined, and considered it therefore to be immature. Since, however, the specimens which I have studied possess ova and yet are smaller than Hertwig's specimen it seems probable that the latter is to be considered mature.

One interesting histological peculiarity I have observed in this form may be mentioned. It is in connection with the structure of the upper part of the mesenterial filaments. The mesoglœa has as a rule only a few scattered cells, but in the processes which support the median and lateral portions of the filament in its upper part the cells become exceedingly numerous, closely packed together in the thickened mesoglœa.

(Pl. XXI, Fig. 17, *mg*). I have not met with such an arrangement in any other forms, and it forms a very striking peculiarity.

As already stated there seems little room for doubt but that this species is the same as that described by Hertwig as *Comactis flagellifera*. The external appearance is the same and the anatomical peculiarities are so similar that I do not believe a separation of them would be justifiable. Nevertheless, I have not followed Hertwig in his identification of the form. It was with some hesitation that he associated his form with Dana's *Actinia flagellifera*, recognizing the great difference between his specimen and the figure given by Dana ('46). He regarded Verrill's account ('66) of the alcoholic specimens as furnishing a reconciliation of the discrepancies, notwithstanding the paucity of the facts which Verrill contributed. Johnson ('61) has, however, studied the sea anemones of the region where Dana's form was collected, namely, Madeira, and convinced himself that it was in reality identical with the common European *Anemonia sulcata*, which view is accepted by Andres. For this reason it seems advisable to separate Hertwig's *Comactis* under a new name.

Genus ANEMONIA, Risso.

6. Anemonia variabilis, sp. nov.

(See Appendix P.)

Plate XXI, Figs. 18, 19.

Nos. 694, 1362. Station, 2768. Lat., 12° 24′ S.; long., 61° 38′ 30″ W. Depth, 13 fathoms. Numerous specimens.

The numerous specimens (Pl. XXI, Fig. 18) were for the most part only partially contracted, and measured in this condition 0.5 to 0.7^{cm} in height and 0.5 to 1^{cm} in diameter at the base. They were seated upon sponges or occasionally upon Tubularian stems, the base of the Actinians in the latter cases surrounding the stem.

The column is somewhat wider at the base than higher up and has therefore a slightly conical shape. The ectoderm for the most part has been macerated away, leaving the slightly translucent mesoglœa exposed, and allowing the insertions of the mesenteries to be seen through the wall as fine longitudinal striæ. The mesoglœa is comparatively thin and almost perfectly homogeneous, containing very few mesoglœal cells. No verrucæ or acrorhagi are present.

The tentacles are short and numerous, usually approaching one hundred, but varying in number in the various specimens. One tentacle communicates with each exo—and each endocœl, and their number depends upon the number of mesenteries present in any one individual. In the majority of cases they are completely exposed, the sphincter muscle of the column being endodermal and diffuse and very weakly developed, as is the case with the general musculature throughout the body. The ectodermal muscles of the tentacles and disk form a simple layer, the mesoglœa not being raised into supporting processes.

The stomatodæum is elongated, but without well-marked siphonoglyphes. Its ectodermal lining is thrown into very pronounced folds, supported by delicate though high longitudinal ridges of mesoglœa (Pl. XXI, Fig. 19).

The mesenteries are irregular in number. In sections of three specimens, for example, there were respectively 28, 33, and 36 pairs. As a rule a perfect and an imperfect pair alternate, but this arrangement is not infrequently interrupted by the succession of two pairs of perfect ones, or of three or two pairs of imperfect ones. There are two pairs of directive mesenteries, and the number of mesenteries intervening between them on each side is usually the same, though there are exceptions to this rule. In the specimen of which a section is figured on Pl. XXI, Fig. 19, it will be seen that only eleven pairs of mesenteries intervene between the two directives (*D*) on one side, while there are as many as twenty-one on the other side. This section represents the condition as seen towards the level of the lower extremity of the stomatodæum. Higher up two pairs of mesenteries are to be found which are not represented at the level figured, and these increase the number of mesenterial pairs of one side of the body to fourteen—*i. e.*, thirteen pairs intervene between the two directives. Even in the uppermost sections, however, there is not equality in the number of the mesenteries of either side. That the irregularity which is found in the succession of perfect and imperfect mesenteries is not an artificial production is shown by the relation of the perfect pairs on either side of the two (*x*) and three (*y*) imperfect pairs of the figure. It is there seen that these perfect pairs are attached to the stomatodæum opposite successive mesoglœal ridges, and this relation of the ridges to the insertion of mesenteries, though not constant, is of sufficient frequence to warrant the assumption that the groups of mesenteries *x*, *y* are truly imperfect.

The mesoglœa of the mesenteries is considerably thicker a short distance from their insertion into the column wall than elsewhere and is raised into only very low muscle processes. Consequently the muscle pennons are almost wanting, the longitudinal muscles forming little more than a simple layer over the surface of the mesoglœa. None of the specimens examined were mature; immature ova were observed, however, in the endoderm of some of the perfect mesenteries and in that of the directives.

The habits of this form suggested identity with that described by Verrill ('83) as *Sagartia spongicola*. Examination of specimens of the latter showed at once that the two forms were very different, *S. spongicola*, for example, possessing strong muscle pennons on the mesenteries attached by a slight pedicle in a manner recalling the conditions described by Hertwig ('82) for *Leiotealia nymphæa*.

7. Anemonia (?) inequalis sp. nov.

Plate XXXIV, Figs. 114–115.

No. 742. Pichilingue Bay, Lower California. Littoral. Two specimens.

The two specimens which represent this species are contracted, though the tentacles are not completely concealed. The base was adherent. In height the largest specimen measures 0.7^{cm}, with a diameter of 1.3^{cm}. The column wall is thin and soft to the touch, and shows 72 longitudinal lines which mark the insertion of the mesenteries. The ectoderm is completely macerated away. The mesoglœa is fairly thick and is homogeneous in appearance, with numerous cells scattered through the matrix. A sphincter is present; it is endodermal and of the "diffuse" variety, forming, however, a not very compact mass and being rather weak. (Pl. XXXIV, Fig. 114.)

The tentacles are short, and apparently thirty-six in number, arranged in a single cycle. Their ectodermal muscles are weak and are not embedded in the mesoglœa.

The stomatodæum is ridged longitudinally and possesses at least one shallow siphonoglyphe. In half the circumference of one specimen examined eighteen pairs of mesenteries were present, from which it may be concluded that there are altogether thirty-six pairs, a number which corresponds with the number of longitudinal lines seen from the outside. Their arrangement is very peculiar. All are perfect above, but below they are evidently divided into three cycles, each consisting of twelve pairs. If the first cycle be considered to represent two primitive cycles, the apparent second cycle will really represent the third cycle, while the apparent third will be the fourth, in which, however, only half the proper number of pairs has developed (Pl. XXXIV, Fig. 115.). The mesoglœa of the mesenteries resembles that of the column wall, being homogeneous and tolerably thick. The longitudinal muscles are not very strong and cannot be said to form a circumscribed pennon. The parieto-basilars form folds upon the surface of the mesenteries, the edge of the fold sometimes, however, uniting with the mesentery and so producing one or more cavities enclosed within the mesoglœa of the mesentery near the insertion into the column wall. No ripe reproductive elements were present, but I succeeded in finding a few very young mother cells, the macerated condition of the internal parts preventing, however, an accurate determination of their distribution. Some certainly occurred on one of the mesenteries of the second actual cycle and I thought I could distinguish others on some mesenteries of the third and fourth cycles, but of this I can not be certain.

I assign this form provisionally to the genus *Anemonia*. It differs materially, however, from the typical forms of the group, as, for instance, in the short and not numerous tentacles. The abnormal arrangement of the mesenteries is not, I believe, of sufficient importance to be generic and in the general structure there are undoubted affinities to the Antheadæ. As to the presence of acrorhagi nothing can be said, on account of the absence of the ectoderm, and the macerated condition of the internal parts proved a decided obstacle to a thorough study of the specimens.

Genus **CONDYLACTIS**, Duch. et Mich.

The genus *Condylactis* was established in 1866 by Duchassaing and Michelotti ('66) for the reception of the common West Indian form *C. passiflora*. I have shown elsewhere ('89) that this form is in all respects an Anthead, and that it agrees closely in general characteristics with the form described by Della Chiaje as *Actinia aurantiaca*, subsequently assigned by Andres ('83) to the genus *Cereactis*, which is referred to a special family. The generic name proposed by Duchassaing and Michelotti has undoubted priority and must replace that proposed by Andres. I see no good reason for separating *Condylactis* from the other Antheads, from which it is distinguished by the absence of acrorhagi and by the presence of a fosse between the margin and the bases of the tentacles, as well as by the usual presence of minute verrucæ upon the column wall.

8. Condylactis cruentata (Dana).

Plate XXI, Figs. 20—21.

Synonyms: *Actinia cruentata*, Dana (1846); *Cereus cruentatus*, Milne-Edwards (1857) *Bunodes cruentata*, Gosse (1860).

No. 736. Sandy Point, Straits of Magellan. Littoral. Four specimens.

All the specimens (Pl. XXI, Fig. 20) are contracted, the tentacles being concealed; in this condition the height and diameter of the column are about the same .05 cm. The preserved specimens show no coloration, but in sections brown granules of pigment are found in the endoderm of the disk and tentacles.

The base is adherent. The column wall is thrown into strong folds, and toward its upper part are rows of verrucæ to which particles of sand are strongly adherent. The verrucæ cease at the well-marked margin, between which and the bases of the external tentacles there is a well-marked fosse, which is made especially evident in contracted specimens by being drawn down by the strong longitudinal muscles of the mesenteries. Circular muscles are developed upon the column wall but are wanting at the margin; internally to this, however, a few small muscle processes are found which represent the sphincter. It is very weak and can have only little effect in producing the concealment of the tentacles; this is mainly brought about by the longitudinal muscles of the mesenteries.

The tentacles are not very numerous; their longitudinal muscles, like the radiating muscles of the disc, are not imbedded in the mesoglœa.

The stomatodæum possesses well-developed siphonoglyphes with smooth walls, the rest of the stomatodæum being longitudinally ridged. There are only sixteen pairs of mesenteries, all of which are perfect, eight losing connection with the stomatodæum, however, sooner than the others. The longitudinal muscles are strongly developed, forming a strong pennon (Pl. XXI, Fig. 21), and the parieto-basilar (*pbm*) forms a strong fold upon the surface of the mesenteries. The reproductive organs are borne by the mesenteries of the first cycle, with the exception of the directives. No acontia are present.

There is necessarily some doubt as to the correctness of this identification. The external structure agrees well with Dana's species, as does also the habitat; as to the coloration nothing can be said. In referring it to the genus *Condylactis*, I have separated it widely from the genera to which it has previously been assigned. The nature of the sphincter and the arrangement of the mesenteries indicate a relationship to the Antheadæ, and of existing genera of this family, by its possession of verrucæ, and of a fosse, and by the absence of acrorhagi, it comes nearest to *Condylactis*. It differs from the described forms of this genus in its size and in the prominence of the verrucæ, but it seems advisable for the present to include it in the genus.

9. **Myonanthus ambiguus**, gen. et sp. nov.

Plate XXI, Fig. 22; Plate XXII, Fig. 23.

No. 731*a*. Station 2839. Lat., 33° 08′ N.; long., 80° 15′ W. Depth, 414 fathoms. Many specimens.

In looking over the collection soon after it reached me I noticed that in the bottle which contained the species described below as *Paractis vinosa*, there were a large number of examples of a form which, while resembling the specimens of *P. vinosa* in general form and size, yet differed decidedly in color. On submitting them to anatomical examination I found that very decided structural differences existed, and that I had to do not only with a distinct species, but even with a member of a distinct family. After much uncertainty as to the family to which it should be assigned, I determined to insert it in this report as an appendix to the Antheadæ. My reasons for so doing will better be understood after a description of the specimens has been given.

They are all more or less contracted, some having the tentacles completely contracted, while in others they remain more or less exposed (Pl. XXI, Fig. 22). The color of the column and tentacles is pale pink or flesh color. In height the less contracted specimens measure about 1^{cm}, their diameter ranging from 1.3 to 1.5^{cm}.

The base is adherent, and in many specimens is more or less covered by a dark brown, somewhat granular cuticle. Its diameter is as a rule somewhat greater than that of the column; in the specimen from which the measurements given above were taken its diameter was about

2^{cm}. Its mesoglœa is rather thin, allowing the straw-yellow color of the reproductive organs to shimmer through.

The column wall is smooth for the most part, except for the slight folds caused by contraction. In the more intensely contracted specimens in the upper part twenty-four longitudinal folds were more or less distinct, terminating abruptly at the margin; twelve of the folds are smaller than, and alternate with, the other twelve. The ectoderm has been to a large extent macerated away from the column wall, but where present it has the same color as the mesoglœa. No trace of verrucæ or tubercles could be discovered. The mesoglœa is much thicker than that of the base and has a fibrous structure. It is not, however, stiff and parchment-like to the touch, but on the other hand rather soft and tough. Just at the margin, where the longitudinal folds of the contracted specimens terminate, is a well-developed endodermal sphincter (Pl. XXII, Fig. 23). It can hardly be classed either as "circumscribed" or "diffuse," since, though well defined, it is not connected to the column wall by a distinct pedicle. It is rather intermediate between these two varieties of sphincter, and resembles closely that form of muscle which I have elsewhere ('89 *a*) described for a species of *Phyllactis*. I would suggest the application of the term "aggregated" for this variety of muscle. Its appearance in cross section may be understood by a reference to Pl. XXII, Fig. 23. It is to be observed that anastomes between the muscle processes are not unfrequent, so that bundles of muscle fibers become enclosed within the mesoglœa. Immediately adjacent to the sphincter the ordinary circular muscles of the column are hardly developed, but lower down they become stronger, without, however, forming a second sphincter.

The sphincter seems to occur just at the margin, and apparently a slight fosse exists between this and the outermost tentacles. No acrorhagi could be detected. The tentacles are numerous and arranged in several cycles, but I could not ascertain their actual number. Their color is the same as that of the column and they are of fair length and rather slender. Their longitudinal musculature is not imbedded in the mesoglœa, resembling in this respect the radial muscles of the disc.

The stomatodæum possesses two siphonoglyphes whose lower ends are prolonged apparently some distance beyond the lower opening of the stomatodæum. In consequence of this the directive mesenteries are attached to the stomatodæum throughout a greater extent of their length than are the other perfect mesenteries. There are, altogether, four cycles of mesenteries, of which only the six pairs forming the primary cycle are perfect. The mesenteries of the fourth cycle are small, and hardly project beyond the endoderm. All the mesenteries except those of the fourth cycle and the directives are gonophoric. The reproductive organs are very evident in dissected specimens, owing to their bright orange color due to the presence of numerous oil globules in the ova and sperm mother cells. The mesenterial filaments are not deeply colored, as in *P. vinosa*. This forms a simple point of distinction between the two associated species. The longitudinal muscles are only moderately developed, and do not form a well-marked pennon. The parieto-basilar seems to be weak. No acontia occur.

From the above description it may be seen that this form is not readily referable to any of the recognized families. On the whole, however, it seems to approach more nearly the Antheadæ than any of the others. The smooth column wall and the distribution of the reproductive elements are points of similarity, but on the other hand the small number of perfect mesenteries and the strong sphincter are decided differences. The sphincter, however, is practically an endodermal one, and the definition given by Hertwig ('82) for the Antheadæ does not exclude the existence of a recognizable sphincter. In fact, in *Actinia infecunda*, which he recognizes as an Anthead, a sphincter is present of such a form that an excessive amount of differentiation would not be called into play to transform it into such a muscle as we find in *Myonanthus*.

I think, accordingly, that it is advisable to refer this form to the family Antheadæ, regarding it as a somewhat aberrant form, which has the power of completely retracting the tentacles, owing to the possession of a well-defined sphincter, a character which has suggested the generic name I have applied to it (μυών = a knot of muscles).

Family BOLOCERIDÆ.

Actininæ with usually stout nonretractile tentacles, strongly constricted immediately above their insertion into the disk, and hence readily deciduous. Sphincter muscle endodermal, diffuse, or in some forms approaching the circumscribed type; the tentacles and disk fully exposed in the contracted condition. With more than six pairs of perfect mesenteries.

Bolocera tuediæ discovered, in 1832, by Johnston, and later referred by him ('47) to the genus *Anthea* may be taken as a typical example of this family. Gosse ('60) established for it the genus *Bolocera*, and separating it from the Antheadæ, with which Johnston and Milne-Edwards ('57) associated it, placed it among the Bunodidæ, in which classification he has been followed by Andres ('83). A study of the form occurring in the deep water off the eastern coast of the United States, and which has been identified by Prof. Verrill with *B. tuediæ*, as well as of other species of *Bolocera* from the *Albatross* collection, has demonstrated that, so far as their anatomical peculiarities are concerned, these forms are very different from the Bunodidæ, but stand in relatively close affiliation to the Antheadæ. The nature of the tentacles, however, and other structural characters, seems to be of sufficient importance to warrant the establishment of a distinct family for them.*

* It seems probable that Danielssen's ('90) *Sideractis* is a *Bolocera*, though the existence of an endodermal sphincter would preclude such an identification. It is to be noticed, however, that Danielssen's figure (Pl. VII, fig. 10) hardly bears out his assertion on this point.

Genus BOLOCERA, Gosse.

With the characters of the family.

10. Bolocera occidua, sp. nov.

Plate XXII, Figs. 24–27.

No. 706. Station 2783. Lat. 51° 02′ 30″ S.; long. 74° 08′ 30″ W. Depth, 122 fathoms. Two specimens.

No. 701. Station 2779. Lat. 53° 06′ S.; long. 70° 10′ 30″ W. Depth, 77½ fathoms. Three specimens.

No. 697. Station 2771. Lat. 51° 34′ S.; long. 68° W. Depth, 50½ fathoms. Two specimens (young).

The base is evidently adherent, and is slightly smaller than the column. It is marked with fine radiating ridges, which are continued over the limbus upon the column.

This is nearly cylindrical, expanding slightly above, and in the contracted condition can not be said to possess verrucæ or warts, though the entire surface is marked out into small quadrangular areas by the crossing of vertical and circular furrows, processes of mesoglœa supporting the ectoderm of the elevated areas (Pl. XXII, Fig. 24). In the largest specimens the height and diameter of the column are about 3cm. Near the margin, in most of the specimens, complicated structures could be seen which, on examination, proved to be mesenterial filaments protruding from openings formed by the falling off of the tentacles.

The margin is tentaculate. The tentacles are large and stout, covering the greater portion of the disk. They are arranged in about four cycles, of which the two inner cycles each possess twelve tentacles, the third cycle twenty-four, and the fourth forty-eight. The tentacles retain their cylindrical shape in the preserved specimens and are plainly furrowed (Pl. XXII, Fig. 26). At their insertion into the disc they suddenly diminish in diameter, so that they are attached by a short and narrow pedicle; they are thickest immediately above the pedicle, where the inner tentacles in the largest specimen measured 0.9cm in diameter, and from that taper gradually towards the extremity, which is somewhat obtuse. The length of the tentacles of the innermost cycle in the largest specimen was 5cm.

In consequence of their manner of insertion into the disc the tentacles are readily broken off, leaving a circular opening upon the disc which indicates their former position. The opening, however, is diminished by a circular fold of mesoglœa, covered by endoderm, which encroaches upon it (Pl. XXII, Fig. 27, *tsp*); the free edge of the fold is thrown into numerous muscle processes, and it seems probable that by the approximation of the edges of the fold the opening may be completely closed.*

*Since this was written Carlgren ('91) has described, in a paper on *B. longicornis*, a similar sphincter fold. He points out, correctly, that the sphincter is thrown off with the tentacle, and it therefore does not serve to close the opening left on the surface of the disk. My description was drawn up from sections through tentacles still adherent, and the conclusion was somewhat hastily reached that the use of the sphincter fold was to occlude the opening.

The circular muscles of the tentacles and disk are ectodermal and comparatively weak.

The lips are prominent, and are marked by delicate and numerous striæ, which are continued down the stomatodæum and apparently correspond approximately to the mesenteries. Two siphonoglyphes are present and are deep, the directive mesenteries being comparatively narrow.

The sphincter muscle (Pl. XXII, Fig. 24, *sph*) is endodermal and diffuse, the endodermal muscle processes of the column being more numerous and somewhat higher just below the margin than elsewhere.

The mesenteries are arranged in three cycles. The first cycle consists of twelve perfect mesenteries, including two directives, the second cycle likewise of twelve mesenteries, which are imperfect, however, and the third cycle of twenty-four mesenteries, which are quite narrow and imperfect. All the mesenteries of the first and second cycles, with the exception of the directives, are gonophoric. The longitudinal muscles of the mesenteries are fairly well developed, the supporting process covering the entire non-gonophoric region of the mesentery and being of almost uniform height throughout. (Pl. XXII, Fig. 25.) There is no special development of the parieto-basilar muscle.

In its general appearance *B. occidua* resembles very closely *B. tuediæ*. I have been able, however, to examine some preserved specimens of the latter obtained from the deeper water off our eastern coast, and can state that there are marked differences in the anatomy of the two species. For instance, *B. tuediæ* has the tentacles arranged in only three cycles, and the parieto-basilar muscles upon the mesenteries show a condition similar to what occurs in *B. pannosa*, to be described below.

It is possible that the form here described may be identical with Studer's ('78) *B. kerguelensis*, which is described as having the tentacles arranged in several cycles. We possess, however, no account of the anatomical peculiarities of this form; and since the general shape of the body differs decidedly from that of *B. occidua*, and there are said to be seven cycles of tentacles in large specimens, I have considered it advisable to separate the two forms. I believe that in a case of doubt it is preferable to consider the newer form a distinct species; the union of forms improperly separated is a much simpler matter than the separation of forms erroneously identified.

A third form, with which *B. occidua* might possibly be identified. is *B. multicornis*, of Verrill ('79). Andres ('83) places this form among the doubtful Bunodidæ, not being able to determine from Verrill's description whether it is truly a *Bolocera* or not. I have been able to examine a specimen of it, however, and can confirm Verrill's assignment of it to that genus. The greater number of its tentacles and their much smaller dimensions show that it is distinct from *B. occidua*.

11. Bolocera pannosa, sp. nov.

Plate XXII, Figs. 28 and 29. Pl. XXIII, Fig. 30.

No. 729. Station 2839. Lat. 33° 08′ N.; long. 118° 40′ W. Depth, 414 fathoms. Eight specimens.

This form, in its preserved condition, presents at the first glance only a remote similarity to other species of *Bolocera*. One misses the robust appearance and the large, stout tentacles, and finds instead a ragged mass. Closer observation reveals, however, many points of similarity to *B. tuediæ*, and it is necessary to consider both as belonging to the same family, and probably also to the same genus.

The base is oval and attached. In average specimens it measured 7^{cm} in length and 2.5^{cm} in breadth. It is thin, especially toward the center, allowing the mesenteries and the dark, wine-colored pigment of the mesenterial filaments to be indistinctly perceived. Toward the periphery radiating and concentric grooves are readily made out, marking off the surface into small quadrangular areas.

The column is low; in none of the specimens does it exceed 0.7^{cm} in height, and it is folded back upon itself, so that the margin and limbus are nearly in contact. Immediately below the region where the bending back occurs is a relatively strong, circumscribed endodermal sphincter, which is, no doubt, the cause of the reversion of the margin. This sphincter (Pl. XXIII, Fig. 30) consists of a main mesoglœal process projecting out almost at a right angle to the column wall and giving rise to numerous secondary processes mainly on its marginal side, other processes arising below it directly from the column wall and grading off into the ordinary circular muscle processes. This sphincter, it will be noticed, is situated low down on the column wall, some distance away from the margin. Muscle processes supporting circular muscles occur above it, but they are not specially aggregated to form a sphincter. The sphincter which is present is to be regarded as a lower sphincter, the marginal sphincter not being developed.

The surface of the column is divided into small quadrangular areas by longitudinal and circular lines corresponding to the radiating and concentric grooves of the base. No warts or verrucæ, however, seem to be present, nor are there any very decided mesoglœal processes supporting the quadrangular areas as in *B. occidua*.

The entire animal is of a pale rosy tint, or in some cases salmon-colored, the mesenterial filaments being of a deep wine purple. Probably in life the colors were more pronounced, resembling the coloration which seems usual to the Boloceridæ.

The margin is tentaculate. The tentacles are numerous and strongly entacmæous, arranged apparently in about seven cycles, 6, 6, 12, 24, 48, 96, 192. The inner tentacles measure about 3.7^{cm} in length, and apparently are not capable of being contracted to any very great extent. In their general structure the tentacles resemble those of *B. tue-*

diæ, being constricted just at their insertion into the disc, being widest just distal to the constriction; consequently they readily fall off, leaving a round opening in the disc. These openings are, however, partially closed by a muscular fold of mesoglœa arising from their margins, and similar to what has been already described for *B. occidua*.* Notwithstanding their close similarity in the structure, the tentacles have a very different appearance from those of the species just mentioned. Instead of being plump, turgid, and robust, they are flaccid, flattened, and rather slender, and give to the preserved specimen a very ragged and torn appearance. It is on this account that I have bestowed upon the species the name *pannosa*.

The musculature of the tentacles is weak, the ectodermal muscles not being imbedded in the mesoglœa (Pl. XXII, Fig. 28), but supported by hardly noticeable mesoglœal elevations. The longitudinal ridges of mesoglœa which give to the tentacles of the Boloceridæ their fluted appearance are readily to be seen in the tentacles of the inner cycles, but they are not so well developed as in other species of Bolocera.

The disc is almost entirely covered by the tentacles, only a relatively small area around the mouth being naked. Its ectodermal muscles are weak, though the endodermal circular system is fairly well developed; less so, however, toward the margin.

The stomatodæum is prominent and possesses two siphonoglyphes. The mesenteries are numerous, there being probably about ninety-six pairs, of which twenty-four are perfect and non-gonophoric (two of them being directives), twenty-four well developed, though not perfect, and forty-eight relatively small. All the imperfect mesenteries are gonophoric. The musculature of the mesenteries is not particularly strong, but presents a very peculiar arrangement. If a transverse section of a mesentery of the first cycle be examined (Pl. XXI, fig. 29) it will be seen that at its attachment to the column wall it is comparatively thin; it soon, however, becomes thicker, and numerous cavities, containing apparently the degenerated remains of cells, are seen in the mesoglœa. The exocœlic face of this portion of the mesentery bears muscle processes which are cut transversely (*pbm*), and therefore give support to longitudinal muscles, or rather to the oblique muscles forming the parieto-basilar muscle. The inner edge of this muscle is to a slight extent free from the mesentery, and it seems as if the cavities had been produced by the fusion at intervals of the mesoglœa of this free edge with that of the mesentery during the growth of the animal. Beyond the region of the parieto-basilar muscle the mesoglœa becomes thinner, and its exocœlic surface is covered by a simple layer of muscle cells whose fibres internal to the parieto-basilar region run longitudinally, then became transverse, and finally near the insertion of the mesentery into the stomatodæum become again longitudinal, being now supported

* See note p. 151.

on short processes of mesoglœa. On the endocœlic face of the mesentery near its insertion into the column wall are muscle processes bearing longitudinal muscles (*lm*), but the greater portion of the surface is covered by a well-marked layer of transverse muscles (*tm*), amongst which, however, some longitudinal fibres may be detected. This transverse layer covers about two-thirds of the surface, but the third adjacent to the stomatodæum is occupied by the moderately developed longitudinal muscle-pennon (*lm*). The arrangement appears at first sight to be the normal relations reversed, so far as the faces of the mesentery are concerned, and to a certain extent this is the case. The greater portion of what normally would be exocœlic transverse musculature has become longitudinal, while the endocœlic longitudinal musculature has to a large extent become transverse. The longitudinal muscle-pennon, and the parieto-basilar muscle still, however, retain their normal relations.

A histological point was well shown in the preparations of this form, on account of the specimens having undergone a certain amount of maceration in the preserving alcohol. Delicate mesoglœal filaments can readily be seen to extend from the muscle processes out between the cells, both of the ectoderm and the endoderm. I have called attention to this fact in the case of *Cerianthus americanus* ('90), and have since observed it in numerous forms, so that it is probably a normal arrangement.

12. **Bolocera brevicornis**, sp. nov. (See Appendix, p. 209.)

Pl. XXIII, Figs. 31–33.

No. 730. Station 2839. Lat. 33° 08′ N., long. 118° 40′ W., 111 fathoms. Two specimens.

This interesting form was dredged in the same locality as *B. pannosa*. It is represented in the collection by two specimens, one of which is apparently full grown, while the other is evidently young. The base is circular in outline and adherent. It measures in the large specimen 2cm.

The column wall is bent downwards, so that the margin is almost level with the base, and the whole expanse of the disk is exposed. The column is marked by numerous longitudinal lines, extending from the limbus to the margin, where they terminate in a well marked circular fold. Apparently the upper portion of the column is furnished with verrucæ, but owing to the somewhat imperfect preservation of the column ectoderm it is impossible to be certain on this point. The mesoglœa of the column is moderately thick, and on its inner surface is richly folded, so that the circular musculature is relatively strong. In the region of the circular fold, which forms the margin, the muscle processes are longer and more closely aggregated than elsewhere, forming a well-marked endodermal sphincter of the diffuse type (Pl. XXIII, Fig. 31). Below the sphincter the wall is thinner than elsewhere, and has the appearance of being pouched, the pouches perhaps corresponding to verrucæ. Below this thin region the muscle processes are somewhat longer than further down, suggesting a second sphincter.

The disc is very broad, measuring 6^{cm} in diameter. Its whole surface, with the exception of a small area immediately surrounding the mouth, is covered with tentacles, or with openings which correspond to them. The tentacles must have been exceedingly numerous when all were present, having been arranged in as many as fourteen or fifteen cycles. They are short, very short, when compared with those of *B. tuediæ*, those of the inner cycles, a few of which persist in the large specimen, measuring only 1.6^{cm} in length. In other respects, however, they have all the characteristics of the Bolocerid tentacles. They are attached to the disc by a narrow neck, the mesoglœa of which is very thin. They are readily deciduous and they are fluted. In character they resemble the tentacles of *B. pannosa* rather than *B. tuediæ*, being somewhat flaccid. Above the neck of the tentacle there is a sphincter-bearing fold of mesoglœa, projecting into the cavity of the tentacle, as in other Bolocerids.

The mouth is slightly prominent and two well developed siphonoglyphes are present. It is difficult to estimate the number of mesenteries present. I judge that there are about forty-eight pairs of perfect mesenteries. Between each pair of perfect mesenteries there are three well defined series of mesenteries of gradually diminishing size and belonging to three different cycles, so that if the estimate of forty-eight is correct for the first cycle, there will be in all three hundred and eight-four pairs of mesenteries, arranged in four regular cycles. This number does not, however, at all compare with the number of tentacles, and if the column wall be closely examined a number of minute ridges may be seen between the pairs of mesenteries, hardly, if at all, rising above the level of the endoderm, and not apparently arranged in regular pairs or separable into definite cycles. These seem to be somewhat irregularly formed abortive (or incipient?) mesenteries, an attempt being apparently made to preserve the relation of mesenteries to tentacles which is usually found.

The specimens examined show no trace of reproductive organs, but from the general appearance of the mesenteries it is presumable that the ova or spermatozoa are borne by the imperfect mesenteries of the second, third, and fourth cycles.

The musculature of the mesenteries is weak and presents no such peculiar appearance as has been described for *B. pannosa*. The muscles on the endocœlic face, however, appear to be transverse in the region near the column wall, but form a low and diffuse longitudinal muscle pennon covering the inner three-quarters of the muscle-bearing region of the mesentery (Pl. XXIII, Fig. 33). The parieto-basilar muscle is present (Pl. XXIII, Fig. 32), as shown by the direction of its fibres, but it produces no such cavities in the mesoglœa of the region of mesentery occupied by it as it does in *B. pannosa*. The musculature of the rest of the exocœlic surface is for the most part oblique, becoming for a short distance transverse, and finally, as in *B. pannosa*, becoming longitudinal. The general arrangement of the musculature therefore agrees closely with that of *B. pannosa*, the main difference being the absence of cavities in the mesoglœa of the parieto-basilar region.

This form is one of considerable interest. When I first saw it in glancing over the collection, I believed I had before me a specimen of Hertwig's *Liponema multiporum* ('88). The presence of the tentacles, however, induced me to believe that I was wrong in this supposition, but the general similarity in appearance suggested the idea that possibly Hertwig's specimens were identical with this, but had lost all their tentacles. When I had finished my study of the anatomy of *B. brevicornis*, I perceived that this idea was not quite correct, but that though the two forms can not be considered identical specifically, yet they are so closely related as to warrant the conclusion that they belonged to the same genus, and that *Liponema multiporum* is a *Bolocera* which has lost all its tentacles.

To anyone who has followed my description carefully and has compared it with that of *Liponema*, I think the similarity between the two forms will be apparent. There is the same general appearance, the same folding back of the voluminous disk, the same "stomidia" almost covering the disk (though in the *Albatross* form these are normally surmounted by tentacles), the same circular fold at the margin, the same longitudinal lines on the column, a similar double endodermal sphincter, the two muscles being separated by pouchings out of the column wall, the same discrepancy between the number of mesenteries and tentacles (or stomidia), and a close similarity in the arrangement of the perfect and imperfect mesenteries.

These similarities are, I think, sufficient to mark the two forms as belonging to the same genus. The different shape of the marginal sphincters and the slight difference in the arrangement of the mesenteries leads to their assignment to distinct species.

It is worthy of note, too, that Hertwig describes a sphincter fold closing the openings on the disk, the "stomidia." This reminds me strongly of the muscular fold in the tentacles described in the preceding species of *Bolocera*. Taking all the facts into consideration, I believe that Hertwig's *Liponema multiporum* should henceforth be known as *Bolocera multipora*.

Family PARACTIDÆ, R. Hert.

Actiniæ usually with numerous perfect mesenteries; circular muscle strong, imbedded in the mesoglœa; acontia wanting.

The family Paractidæ was established by R. Hertwig ('82) on anatomical grounds, the forms belonging to it having been previously associated for the most part with the Antheadæ. In the above definition I have modified somewhat that given by Hertwig, thereby extending the limits of the family so as to include certain forms with short, stout, non-retractile tentacles. I consider the presence of a strong mesoglœal sphincter and the absence of acontia the two most marked characteristics of the family, the number of mesenteries being of less importance, for although the majority of forms to be assigned to the family possess numerous perfect mesenteries there are nevertheless some in which only the mesenteries of the first cycle are perfect. These are, however, so closely related to those with numerous perfect mesenteries that it seems to me injudicious to separate them.

Andres ('83) independently established a family Paractidæ, which probably is identical with that of Hertwig. The definition was, however, founded altogether on external characters, which are undoubtedly of less value in Actinian taxonomy than are anatomical features.

Genus **PARACTIS**, M.-Edw.

Paractidæ with smooth body-surface, without papillæ or marginal spherules; tentacles, slender, not exceptionally numerous, nearly equal in length and strength; margin not lobed. Sphincter widening somewhat abruptly in its upper part, and occupying near the margin nearly the entire thickness of the mesoglœa. This is the definition which Hertwig ('82) gives of the genus, with the exception that he includes in the definition the presence of "numerous longitudinal furrows of the wall," which it appears to me limits the genus too narrowly, and by what is probably a more or less trivial character. He himself points out the possible alliance of his *P. excavata* to the *Actinia peruviana* of Lesson, in which the longitudinal furrows, are wanting, except near the base, the column wall being described as smooth.

In the *Albatross* collection there are two forms which must be assigned to the genus as here limited, although they differ greatly in certain respects. In one, the column wall, though not particularly thick, is leathery, while in the other it is of a much softer consistency; and again in one the radial muscles of the disc and longitudinal muscles of the tentacles are imbedded in the mesoglœa, while in the other they are ectodermal. Whether this latter feature is one sufficient for generic distinction can only be determined by the examination of a large number of Paractidæ. I propose to place both the forms provisionally in the genus *Paractis*, leaving it for future workers to decide as to the advisability of their separation. There is one feature in which they both agree, and that is in the shape of the sphincter muscle, which from being very narrow below gradually widens as it nears the margin, and has consequently a somewhat club-shaped form. Apparently *P. excavata* has a similar sphincter, though Hertwig has given no figure from which its form may be accurately determined.

13 Paractis lineolata (Dana) M.-Edw.

Plate XXIII, Figs. 34–36.

No. 719. Station 2804. Lat. 8° 16′ 30″ N.; long. 79° 37′ 45″ W. Depth, 47 fathoms. Eight specimens.

The species to which I refer the form about to be described was first mentioned by Dana ('46) as *Actinia lineolata*, and was subsequently referred by Milne-Edwards ('57) to his genus *Paractis*. Verrill ('68), however, removed it from that genus and placed it in the genus *Sagartia*, and Andres ('84), assuming it to be a Sagartid, assigned it to *Nemactis*. In its general appearance the "Albatross" specimens seem to agree with Dana's description, and the absence of acontia show that they are to be replaced in the genus *Paractis*, as it is here understood.

The individuals are small (Pl. XXIII, Fig. 34), and, for the most part, contracted to a hemispherical shape, the tentacles being entirely concealed, as a rule, though in some specimens they are not perfectly infolded. The base, which is adherent, measures in the contracted specimens 0.5^{cm}, and the height of the contracted column is about 0.6^{cm}.

The column is pale in color and is marked with irregular chocolate-brown spots arranged distinctly in rows, and giving the effect of longitudinal bands of brown on a pale ground. There is some variation in the width of the bands, but I could not make out a regular alternation of three narrower bands with a wider one, such as Dana describes. The column wall is perfectly smooth; its mesoglœa below is rather than, but near the margin it thickens rather suddenly. In this thickened region the sphincter muscle (Pl. XXIII, Fig. 36) is imbedded. It occupies in its upper part nearly the entire thickness of the mesoglœa, being separated from the endoderm on the one side, and the ectoderm on the other, by only a small band of mesoglœa. In its lower part it tapers off, and lies nearer the endodermal than the ectodermal surface. The mesoglœa throughout the column wall has a fibrous appearance, and the slightly oval muscle cavities appear to be separated by fine fibrous partitions in transverse sections.

The tentacles are short and obtuse; in one specimen in which they could be seen they were numerous, probably numbering ninety-six, while in another there seemed to be only forty-eight. In this respect the form here described differs from Dana's *A. lineolata*, which is described as having only twenty-four tentacles, arranged in two cycles. The longitudinal muscles of the tentacles, and the corresponding radial ones of the disc, are rather weakly developed and are entirely ectodermal in position. The tentacles seem to cover a large portion of the disc, though, owing to the contracted condition of the specimens, this could not be accurately ascertained.

The mesenteries are few in number, and are arranged in four cycles. The six pairs of the first cycle are alone perfect, those of the second and third cycles are gonophoric, while those of the fourth cycle are quite small and are destitute of mesenterial filaments. This was the arrangement in a specimen which had about forty-eight tentacles. It will be seen from this that we have an arrangement of the mesenteries which Hertwig considers typical for the Sagartidæ, but a careful search, both in dissected specimens and in sections, for acontia failed to reveal their presence. The longitudinal muscles of the mesenteries form a distinct, though somewhat narrow, pennon (Pl. XXIII, Fig. 35), but the parieto-basilar appears to be very weak.

14. Paractis vinosa, sp. nov.

Plate XXIII, Figs. 37–40; Plate XXIV, Fig. 41.

No. 731. Station 2839. Lat. 33° 08′ N.; long. 118° 40′ W. Depth, 414 fathoms. Many specimens.

The majority of the specimens were contracted, many, however, showing the tentacles protruding (Pl. XXIII, Fig. 37), while in others they were not at all infolded. In the latter the height of the column was 1.4 to 1.6^{cm} and its diameter 1.2 to 1.6^{cm}.

The base is adherent and thin, allowing the insertion of the mesenteries and the dark color of the mesenterial filaments to be seen through it. In some specimens it is covered by a somewhat granular membrane, which is very friable and easily removed in fragments, and seems to be equivalent to the firm basal membrane occurring, for instance, in *Adamsia palliata*.

The column is of a leathery consistence, quite thin near the base, where it is marked with vertical furrows corresponding to the mesenteries, and fading out rapidly above. In color the column wall is white, owing to the absence of ectoderm, the few fragments of this which persist being of a pale brown color. The mesoglœa has a finely granular appearance in sections and is thickest near the margin. The sphincter muscle (Pl. XXIV, Fig. 41) occupies the greater part of this thickened region and is strong. Below it tapers off slowly, extending a long distance down the column wall, lying immediately below the endoderm and passing gradually into the ordinary endodermal circular muscles which are well developed and borne on strong processes. (Pl. XXIII, Fig. 40.)

The margin is smooth, although in some more contracted specimens it may be thrown into a few folds. The tentacles are arranged in about four cycles, and their number appears to be sixty-four They are white and translucent, but probably this is due to the ectoderm having been macerated away from their exposed surfaces, since in some of the strongly contracted specimens the ectoderm of the tentacles contains granules of reddish pigment. The disc is of a deep wine color, as is also the stomatodæum, the pigment granules being so abundant in the ectodermal cells as to completely obscure their structure. The ectodermal muscles of the tentacles and disk are imbedded in the mesoglœa, occurring in the tentacles at about the middle of that layer. (Pl. XXIII, Fig. 38.)

The stomatodæum is thrown into strong folds, borne on rather stout longitudinal elevations of the mesoglœa. The siphonoglyphes are deep with smooth walls, and the ectodermal cells lining them have the pigment confined to their outer ends and not scattered through their entire thickness as happens elsewhere and on the stomatodæum.

The mesenteries are thirty-two in number, sixteen being perfect and sixteen imperfect. The longitudinal muscles are fairly well developed (Pl. XXIII, Fig. 39), covering the greater portion of the surface of the perfect mesenteries; the parieto basilar is not, however, particularly strong. Only the imperfect mesenteries are gonophoric, and the reproductive organs are very conspicuous on account of their bright orange color due to the presence of large oil globules in the ova and spermatozoa mother cells. The mesenterial filaments are, like the disc, of a deep wine color, the general endoderm being colorless.

In its coloration, so far as this can be determined, this form comes close to *Paractis rubus* obtained by the Wilkes Exploring Expedition at Valparaiso. The very different habitat of the *Albatross* form, which is an inhabitant of deep water and the uncertainty of an indentification of an alcoholic specimen with a form described as seen living and without any characteristic anatomical features, has induced me to consider for the present the *Albatross* form as distinct.

Genus **ANTHOLOBA**, Hertwig.

Paractidæ with a large number of short tentacles covering the greater portion of the disc; margin of the disc lobed as in *Metridium.* Sphincter strong, prolonged a long distance down the wall.

Hertwig ('82) established this genus for a form previously referred to the genus *Metridium*, and which bears strong resemblance to the forms properly belonging to that group, at least in so far as the margin and the tentacles are concerned. On the other hand, Hertwig has shown that in this case the external similarity is accompanied by such differences in internal organization that the establishment of a new genus and the reference of this to the family Paractidæ is necessary.

15. **Antholoba reticulata**, (Dana) Hert.

Synonyms.—*Actinia reticulata.*—Dana U. S. Expl. Exped., 1846.
Metridium reticulatum.—Milne-Edwards, 1857. Verrill, 1868.
Actinoloba reticulata.—Gosse, 1860. *Antholoba reticulata.*—R. Hertwig, 1882.

Nos. 737, 738. Station: Port Otway, Patagonia. Littoral. Two specimens.
No. 739. Station: Lota, Chile. Littoral. One specimen.
No. 740. Station: Charles Island, Galapagos Archipelago. Littoral. One specimen.

I have very little to add to the description Hertwig has given of this form. I do not find, however, that the margin of the disc is "swollen like a pad," but on the contrary the uppermost portion of the column wall is in some specimens thinner than it is farther down. The presence of a pad may be due to contraction.

The sphincter muscle, as Hertwig pointed out, extends from the upper to the lower end of the wall. Its shape may be of generic importance, since it does not present the sudden widening near the margin which is to be seen in the forms I have referred to the genus *Paractis*, but tapers off very gradually indeed as it passes down the column.

The specimens I examined did not possess reproductive organs, so that I can not decide the question Hertwig has raised regarding the hermaphroditism of this form.

Genus **Actinernus**, Verrill.

Paractidæ with thick column wall; margin lobed; tentacles short, situated near the margin, the mesoglœa thickened toward their bases, so as to give them a more or less bulbous appearance. Sphincter muscle rather weak (sometimes absent?).

The genus *Actinernus* was established by Verrill ('79) for a deep-sea form obtained off the more northern portion of the east coast of the United States. Verrill's definition and description speak of the margin below the tentacles being "divided into acute lobes or teeth continuous with the body wall," the tentacles being adnate to these teeth. This is the appearance which *Actinernus nobilis* presents, but I have preferred to speak of the teeth as thickenings of the mesoglœa of the bases of the tentacles, since this more nearly describes what obtains in *A. plebeius*, and probably also in *A. saginatus*. The sphincter muscle is quite weak in *A. plebeius*, as will be seen from the following description, and apparently is wanting in *A. nobilis*, being indistinguishable with a powerful lens. This character offers a marked difference, independent of the nature of the tentacles between this genus and *Antholoba*.

The similarity which the figure of *Polysiphonia tuberosa* given by Hertwig ('82) shows to an *Actinernus* is very striking and suggests its possible reference to the latter genus. The lobed margin, the basally swollen tentacles, the disc marked with radiating grooves, the chalice-like shape of the column, are all similarities which attract attention. The sphincter muscle, too, though differing in shape from that of *A. plebeius*, to be described below, is nevertheless mesodermal and by no means powerful. The principal characteristic upon which Hertwig relies in the establishment of the genus is found in the rather large openings at the tips of the tentacles. Such openings are known to be of frequent occurrence, and their enlargement within certain limits, unaccompanied by a marked abbreviation or other alteration of the tentacles, can not be considered sufficiently distinctive for the formation of a new genus. It seems to me that a reference of *Polysiphonia tuberosa* to Verrill's genus *Actinernus* will place it with forms to which it is far more closely related than it is to *Polystomidium*. (See Appendix, p. 209.)

16. Actinernus plebeius, sp. nov.

Plate XXIV, Figs. 42–45.

No. 711. Station 2791. Lat. 38° 08′ S.; long. 75° 53′ W. Depth, 677 fathoms. One specimen.

The body is calyciform and measures about 5^{cm} in height, with a diameter of about 7^{cm} at the disc. The base on the other hand measures only 2.5^{cm} in diameter. It was probably adherent, though from its great distortion in the single specimen it is difficult to be certain what its character may have been.

The column wall is rather soft in consistency, though relatively thick, and its surface being somewhat torn into threads has a rather ragged appearance. The ectoderm is almost entirely macerated away, but the few fragments that remain show that it was of a chocolate brown color. The sphincter is embedded in the mesoglœa, not far from its endodermal surface. It extends some distance down the column wall, but is very narrow. In sections (Pl. XXIV, Fig. 43) it is seen to consist of a series of cavities placed one above the other, for the most part in a single row, each cavity being separated from its neighbor by a distinct partition of mesoglœa. Each cavity is occupied by a mesoglœal network of fine fibre, in the circular or oval interstices of which the muscle cells are arranged.

The margin is tentaculate and wavy or lobed in outline. The tentacles are about ninety-six in number and are arranged in two or three cycles at the margin. They are of a purplish-brown color and are short and slender, each being provided at the outer surface of its base with a marked mesoglœal thickening (Pl. XXIV, Fig. 42), which extends a short distance upwards towards the tip upon the outer surface of the tentacle. The longitudinal muscles are weak and are not embedded in the mesoglœa.

The disc is concave and of a wine-purple color and is marked with radiating ridges, due to the roofs of the inter- and intra-mesenterial spaces being pouched out. The radiating muscles are ectodermal and not at all embedded in the mesoglœa.

The mouth forms an elevation at the center of the disc. It is provided with two well-marked siphonoglyphes. The stomatodæum is longitudinally ridged, the walls of the deep siphonoglyphes being on the other hand smooth. The ectoderm of the stomatodæum is of a deep wine-purple color.

The mesenteries are arranged in four cycles, though indications of a fifth and sixth cycle were present, neither of them being, however, perfect. In a sextant of the wall examined only one pair of mesenteries of the sixth cycle was present, and five pairs, instead of eight, of the fifth cycle. Only the six pairs of mesenteries of the first cycle are perfect, and only the mesenteries of the third and fourth cycles are gonophoric. The musculature, both longitudinal and parieto-basilar, is very weak. What corresponds to the muscle pennon is very low, the mesoglœa being raised into short, blunt processes which carry the muscle cells and give to the surface of the mesentery on which they occur a crenate appearance in transverse sections (Pl. XXIV, Fig. 44). The endoderm of the mesenteries and that of the body wall is of a purplish-brown color, paler than the stomatodæum, while the mesenterial filaments, in whole or in part, have the same deep wine color which has been described for stomatodæum and disc. The mesoglœa of the reproductive region of the gonophoric mesenteries is much thickened, as is shown in Pl. XXIV, Fig. 45.

Genus **ACTINOSTOLA**, Verrill.

Paractidæ usually of large size, with firm, leathery wall, which may be somewhat corrugated or folded, but is not furnished with verrucæ. The margin is not lobed and is tentaculate; the tentacles are short and stout, fluted and with their longitudinal musculature embedded in the mesoglœa. Sphincter well developed, extending a considerable distance down the column wall and not expanding abruptly above.

The genus Actinostola was established by Verrill ('83) for a species which he had previously ('82) described as *Urticina callosa*. In his description of the genus he states that the column is "covered with large, irregular tubercles not having the power of adhering to foreign substances," and in the description of the species ('83) he says: "The surface of the column is usually more or less covered with low, irregular, often flattish verrucæ, which become more and more prominent and sometimes form longitudinal series or crests on the upper part, but fade out to mere wrinkles toward the base." In specimens of *A. callosa*, which I have, through the kindness of Mr. Rathbun, been able to examine, I could find nothing that could be properly termed verrucæ, or even tubercles, though the surface of the column wall was more or less corrugated, resembling in some specimens beaten silver, and bore irregular ridges of mesoglœa near the margin. The *Albatross* specimens present the same appearance, though in one case the corrugations are sufficiently strong to give an almost warty appearance to the column.

Verrill considers the genus *Actinostola* to be allied to *Bolocera*, *Urticina*, and especially to *Actinauge*. What the genus *Urticina* may embrace remains to be seen, but the other two genera mentioned have certainly only very remote affinities with *Actinostola*, *Bolocera* being related to the Antheadæ, and *Actinauge* one of the Sagartid genera.

17. Actinostola callosa, Verrill.

Plate XXIV, Fig. 46; Plate XXV, Figs. 47–52.

Synonym:—*Urticina callosa*, Verrill. 1882.

Nos. 714–715. Station 2792. Lat. 0° 37′ S.; long. 81° 00′ W. Depth, 401 fathoms. Four specimens.

No. 721. Station 2807. Lat. 0° 24′ S.; long. 87° 06′ W. Depth, 812 fathoms. Two specimens.

No. 723. Station 2818. Lat. 0° 29′ S.; long. 89° 54′ 30″ W. Depth, 392 fathoms. One specimen.

The *Albatross* specimens denoted above I can not distinguish from Verrill's *A. callosa*, with authentic specimens of which I have carefully compared them. They measure about 8cm in height, with a diameter of 5.5cm. Most of the specimens (Pl. XXV, Fig. 47) are only partially contracted, allowing the tentacles to partially protrude, but in some they are entirely concealed from view.

The base is flat, marked with fine radiating lines, and has the limbus folded back over its edges in all the specimens. The column is nearly cylindrical, and slightly smaller above than below. Its wall has a firm, parchment-like consistency, and is variously corrugated, in part owing to contraction. In the more fully expanded specimens the surface has somewhat the appearance which beaten silver or other soft metal presents, while in others the corrugations may be sufficiently pronounced as almost to justify the designation of irregular tubercles. There are, however, no indications of verrucæ. Below the margin the mesoglœa is rougher than elsewhere, and is raised into irregular ridges. The column wall has a snowy white appearance, the ectoderm in all the specimens having almost disappeared; the fragments of it which remain in some specimens seem to indicate that it was of a pale, brownish-purple color. The sphincter (Pl. XXV, Fig. 51) is well developed and extends a considerable distance down the column wall. In its upper part it does not occupy the entire width of the column wall, but lies throughout its course nearer the endodermal surface than the ectodermal, its cavities passing, in fact, directly into the ordinary circular musculature of the endoderm. It does not expand suddenly above, but its upper part, though larger than the middle region, tapers off very gradually as it is traced downwards. In its upper part the closely packed muscle cavities show a tendency to be arranged in longitudinal bands (Pl. XXV, Fig. 52) separated from one another by streaks of nearly homogeneous mesoglœa, and recalling the arrangement which Hertwig ('82) has described for his *Dysactis crassicornis*.

There is no well-defined margin, the tentacles being inserted upon it. They are rather numerous, situated close to the margin, and are short and stout, with well-marked pores at their extremities. They have a more or less decided pink or salmon color, and are rather indistinctly longitudinally fluted. Their longitudinal musculature is imbedded in the rather thick mesoglœa (Pl. XXV, Fig. 48), as is also the radial musculature of the disc. This portion of the body is smooth and concave and has the same pinkish color which occurs in the tentacles. The mouth is wide, and the stomatodæum is about half the length of the body. It is longitudinally ridged, and has two well-marked, deep siphonoglyphes with smooth walls, which are continued down below the lower edge of the stomatodæum, almost to the base.

Twenty-four pairs of mesenteries reach the stomatodæum, but twelve of them are united to the stomatodæum to a less extent than the other twelve. In addition to these there is another cycle of twenty-four imperfect pairs, which may be counted as the fourth cycle, while the fifth cycle of forty-eight pairs, also imperfect, presents the anomalous condition of one mesentery of each pair being much more highly developed than its fellow (Pl. XXV, Fig. 46). One of each pair is quite small, without reproductive organs and mesenterial filaments, and hardly projects above the column endoderm, while its fellow is fairly broad, and carries reproductive organs and a mesenterial filament. A similar disparity, though less marked, is to be found in the pairs of the fourth cycle, but I could not distinguish it in the third cycle. The relation of the small to the large mesentery of each of the unequal pairs seems to be constant, and is shown in the diagrammatic figure (Pl. XXIV, Fig. 46). It will then be seen that in the fifth cycle (V) the small mesenteries are those nearest the mesenteries of the fourth cycle (IV), while in the fourth cycle the strongest mesenteries are those nearest the pairs of the first and second cycle. A few irregularly disposed mesenteries of the sixth cycle could also be seen. The mesenteries of the fourth and fifth cyles are gonophoric.

As regards the musculature of the mesenteries, it is not very strongly developed. At the base of each mesentery (Pl. XXV, Fig. 50) there is a strong development of muscle processes on both sides, producing a basal muscle (*bm*) similar to what occurs in the Edwardsiæ, and to a less extent in many Hexactinians. In the mesoglœa of the basal region of the mesenteries of the first three cycles some cavities are to be observed similar to, but less highly developed, than those already described for *Bolocera occidua*, and like those developed in connection with the parieto-basilar muscle (*pbm*), which forms a slight projection on one side of the base of the mesenteries. The longitudinal muscles cover all the muscular portion of the mesenteries in an almost uniform layer, only toward the inner edge of the muscular region becoming longer and forming a rather weak muscle pennon (Pl. XXV, Fig. 49). The muscle processes, especially in the pennon, show a tendency to be arranged in groups on more or less distinct blunt processes of mesoglœa.

Amongst the *Challenger* material *Dysactis crassicornis* presents certain features of marked similarity to *Actinostola callosa*. The general arrangement of the muscle cavities of the sphincter muscle seems to be identical in the two forms, and the peculiar arrangement of the mesenteries of the younger cycles shows interesting similarities. There are, however, certain differences in the arrangement, which have made me hesitate to identify the two forms, though I am inclined to believe that *Dysactis crassicornis* is to be properly referred to the genus *Actinostola*, and that it is even probable that it may be identical with *A. callosa*. There can be little question that its reference to Milne-Edwards' genus *Dysactis* is incorrect, since we know that two at least of the forms referred by its author to it, *D. annulata* (Lesueur) and *D. biserialis* (= *Aiptasia couchii* Gosse), are Sagartids, while *D. chilensis* is also referred to that family by Verrill and Andres. If, therefore, the forms referred to Milne-Edwards' genus are Sagartids it can scarcely be proper to associate with them Paractids. In cases like this where the definition is imperfect we have to interpret the genus from the forms which have been assigned to it and not *vice versâ*, and a more perfect definition of the genus *Dysactis* will include a mention of the occurrence of acontia and cinclides. (See Appendix p. 209.)

18. Actinostola excelsa, sp. nov.

Plate XXVI, Figs 53–56.

No. 696. Station 2770. Lat. 48° 37′ S.; long. 65° 46′ W. Depth, 58 fathoms. One specimen.

No. 698. Station 2771. Lat. 51° 34′ S.; long. 68° 00′ W. Depth, 50½ fathoms. Two specimens.

This very striking form (Pl. XXVI, Fig. 53) measures about 6 cm in height and from 5.5 to 6 cm in diameter. The base is evidently adherent and the limbus is not folded over it, as was the case in *A. callosa*.

The column is cylindrical, narrowing slightly towards the margin, and is apparently capable of little contraction. Its walls are firm, and for the most part smooth, though in contracted specimens irregular longitudinal ridges are to be seen below the margin; these, however, seem to be due to the state of contraction. The ectoderm of the column has a pale brown or buff color; where it has been macerated away the subjacent mesoglœa is seen to be cream white. The sphincter muscle (Pl. XXVI, Fig. 54) is fairly strong, but nevertheless is unable to overcome the resistance offered by the firmness of the column mesoglœa, so that in none of the specimens are the tentacles concealed from view. In shape the sphincter differs markedly from that of *A. callosa*. It forms a delicate network, occupying almost the entire thickness of the mesoglœa in its upper half, and its inner surface passes into the general circular musculature of the column wall. There is no tendency for the muscle cavities to arrange themselves in longitudinal rows as in *A. callosa*, but rather in horizontal lines perpendicular to the surface of the column. The column wall is less thick in its uppermost part than a little lower down, and consequently the thickest portion of the sphincter is below its uppermost edge, in fact almost half-way down. In its lower part it is thin, lying close to the endodermal surface of the mesoglœa, and is prolonged downwards some distance in this condition, gradually becoming lost in the muscle processes of the circular musculature of the column wall.

There is no definite margin, the tentacles occurring at the junction of the disc and column wall. They are rather numerous, numbering perhaps one hundred and ninety-two, and are short and stout, with pores at their extremities. They are longitudinally fluted, and also transversly grooved, so that the surface seems much corrugated. The mesoglœa of the tentacles is almost entirely occupied by the longitudinal muscles

(Pl. XXVI, Fig. 56); in the elevations which give rise to the flutings, however, it has a very delicate structure resembling greatly typical areolar tissue with its connective tissue corpuscles.

The mouth is large; the stomatodæum is irregularly ridged longitudinally, and the siphonoglyphes are deep and prolonged below the lower level of the stomatodæum.

The mesenteries are arranged in ninety-six pairs, of which only those of the first two cycles, twelve in all, are perfect. These, together with the mesenteries of the third cycle are sterile, the reproductive organs occurring only on the mesenteries of the fourth and fifth cycles. The longitudinal musculature (Pl. XXVI, Fig. 55) is fairly strong but does not form any distinct pennon upon the surface of the mesentery. The muscle processes show a tendency, especially in the basal portion of the mesentery, to be grouped upon low elevations of the general mesoglœa. The parieto-basilar muscle (*pbm*) is well developed and forms a decided projection upon the basal portion of the mesenteries, which portion, where the parieto-basilar occurs, contains a number of cavities, evidently developed, as in *B. occidua*, in connection with the growth of the muscles.

19. Actinostola pergamentacea, sp. nov.

Plate XXVI, Figs. 57 and 58; Plate XXVII, Figs. 59–63.

No. 695. Station 2769. Lat. 45° 22′ S.; long. 64° 20′ W. Depth 51½ fathoms. Five specimens.

These specimens (Pl. XXVI, Fig. 57), which seem to belong to the genus *Actinostola*, are very much macerated, the tentacles having dissolved into shreds, so that it is impossible to ascertain their shape or structure. The specimens measure 3^{cm} in height and 2^{cm} in diameter.

The base is evidently adherent and larger in diameter than the column. This is almost cylindrical, enlarging somewhat at the margin and limbus. Its walls are smooth, firm, and parchment-like, being brittle rather than tough, and readily broken. It is pure white in color, the ectoderm, however, being entirely absent. The sphincter Pl. XXVII, Fig. 59) resembles in general appearance that of *A. excelsa*, but is by no means as strong. None of the specimens show the slightest trace of the margin being infolded over the tentacles, and this is not remarkable, considering the stiffness of the column mesoglœa.

The tentacles seem to have been numerous, perhaps one hundred and ninety-two, though this is merely an estimate, since they are too badly macerated to allow of a count. Their longitudinal musculature is imbedded in the mesoglœa in a number of small cavities (Pl. XXVII, Fig. 60). The disc is roughened by radiating rows of small tubercle-like elevations, and the radial musculature resembles that of the tentacles, though in one specimen the cavities were elongated and separated by narrow trabeculæ of mesoglœa, presenting the appearance shown in Pl. XXVI, Fig. 58.

The mouth is prominent. The siphonoglyphes are deep and longer than the stomatodaeum. All the mesenteries, with the exception of the youngest cycle, are perfect; there are apparently five cycles, the mesenteries of the third and fourth cycles being gonophoric. The muscle processes of the longitudinal muscles are developed over the entire muscle-bearing surface of the mesentery, increasing slightly towards the inner edge of this surface to form a weak pennon. In the upper part of the mesenteries, above the region where the parieto-basilar occurs the parietal part of the mesentery is somewhat thickened, and the muscle processes in this thickened region are somewhat more numerous and more slender than elsewhere (Pl. XXVII, Figs. 62–63). Over the general surface of the mesenteries the processes are comparatively stout (Pl. XXVII, Fig. 61). The parieto-basilar muscle presents essentially the same characteristics as in *A. callosa*, the mesoglœa in the region occupied by it having small cavities enclosed in it. As in *A. callosa* also a basal muscle is present (Pl. XXVII, Fig. 62), but it has relatively but a slight development.

Genus PYCNANTHUS, gen. nov.

Paractidæ of moderate size, with thick, though rather soft, column wall; no tubercles or verrucæ, though the upper portion of the column is marked by more or less distinct longitudinal ridges running to the bases of the tentacles. Margin tentaculate, not lobed; tentacles short, but slender, not swollen at the base. Sphincter muscle rather weak, lying close to the endoderm.

I have established this genus for the reception of a form which does not seem to be assignable to any of the genera of Paractidæ as they are here understood. The weak sphincter and slender tentacles exclude it from the genus *Actinostola;* the absence of a marked dilatation of the sphincter and the occurrence of ridges upon the upper part of the column, running to the bases of the tentacles, show it to be distinct from the genus *Paractis.* The ridges are hollow, with rather delicate walls, and resemble those found in certain Sagartids which possess a capitulum. The absence of acontia, however, precludes the association of the form about to be described with the Sagartidæ.

20. Pycnanthus maliformis, sp. nov.

Pl. XXVII, Figs. 61–67; Pl. XXVIII, Fig. 68.

No. 728. Station 2839. Lat. 38° 08′ N.; long. 118° 40′ W. Depth, 414 fathoms. Fourteen specimens.

The largest specimens (Pl. XXVII, Fig. 64), measure 2.5cm in height, and 3.3cm in diameter. All are contracted, the tentacles and upper portion of the column being infolded. The alcohol in which they are preserved is stained a very distinct yellow, and when specimens are placed in fresh alcohol this quickly assumes the same coloration. The pigment seems to saturate the alcohol quickly, fresh alcohol continuing to extract more of it even after several changings.

The base is thin, allowing the mesenteries to be seen through, when the more or less membranous brown coating which covers it is removed. The margin of the base in all the specimens is concealed by the limbus being reflected over it.

The column is white, the ectoderm having been entirely removed, and is irregularly corrugated; no tubercles or verrucæ are present, however. The mesoglœa is very thick, measuring in one specimen at a point a short distance above the limbus as much as 3.5^{mm} in thickness. It is not, however, harsh or resistant to the touch, but on the contrary is rather soft, and in structure is almost homogeneous or hyaline, with small cells scattered through it. Towards its upper part are a number of ridges, which are hollow and thin-walled, and pass to the bases of the tentacles of the outer row. The sphincter muscle extends a considerable distance down the column wall (Pl. XXVII, Fig. 65), but is throughout thin. It lies throughout its entire extent close to the endodermal surface of the mesoglœa, passing into the circular musculature of the column wall. Above it is very slightly thickened, but not at all as in *Paractis*. The muscle cavities for the most part show little tendency towards any regular arrangement (Pl. XXVII, Fig. 66), though towards the lower edge of the muscle they are somewhat elongated, and arranged in lines nearly perpendicular to the surface of the mesoglœa.

The margin is tentaculate. The tentacles are arranged in four cycles, 12, 12, 24, 48. The ridges upon the upper surface of the column run to the bases of the outer tentacles, and from the bases of the inner ones ridges extend outward, but only for a short distance, losing themselves before they reach the outermost cycle of tentacles. The mesoglœa of the bases of the tentacles is only very slightly thickened, and the longitudinal muscles of the tentacles are imbedded in the mesoglœa. In the disc the radial muscles are mesoglœal and are arranged in a very characteristic manner (Pl. XXVIII, Fig. 68), recalling what Hertwig has figured for *Dysactis crassicornis*. Opposite the insertions of the mesenteries into the disc the radial musculature is interrupted so that it is divided into radial bands, each separated from its neighbors by a depression on the surface of the disk. Each radial band appears to be a single flattened cavity, traversed by perpendicular, somewhat branching, fine trabeculæ of mesoglœa, which divide the large cavity into a great number of smaller ones, in which lie the muscle cells.

The stomatodæum is longitudinally ridged and is continued downwards almost to the base. The siphonoglyphes are deep, and near their lower extremities two transverse folds, lying one above the other, project across the cavity of each, closing it below.

The mesenteries are arranged in ninety-six pairs, the youngest cycle of forty-eight pairs being indistinguishable to the naked eye. The twelve pairs of the first two cycles are perfect, the twelve tertiaries also reaching the stomatodæum, but being united to it to a less extent than are the primaries and secondaries. The reproductive organs are borne upon the mesenteries of the third and fourth cycles. The longitudinal muscles of the mesenteries do not form a distinct pennon, (Pl. XXVII, Fig. 67). In the perfect mesenteries the processes which support the muscle cells arise in bunches from stout elevations of the mesoglœa. The parieto-basilar muscles extend only a very short distance up from the base, and in sections through the middle of the column are not to be distinguished. No acontia appear to be present. The endoderm is considerably macerated, so that the form of these structures, if they existed, could not be made out; I base my statement as to their absence in the absence of nematocysts in the tissues lying in the body cavity, the macerated remains of the mesenterial filaments.

Genus **CYMBACTIS**, gen. nov.

Paractidæ of moderate size, crateriform in shape, with the mesoglœa of the column wall rather thick but soft; surface of column rugose in contracted forms, but without verrucæ or warts; no capitulum with longitudinal ridges. Sphincter muscle relatively weak, lying close to the endoderm; margin not lobed, tentaculate; tentacles numerous, situated close to the margin, short, slender, not bulbous at the base.

The form for which I establish this genus approaches somewhat in appearance an *Actinernus*, having the short tentacles concentrated near the margin as in that genus, a large portion of the disc being left uncovered. The absence, however, of any bulbous enlargements or thickening of the mesoglœa at the bases of the tentacles induces me to place the form in a separate genus, which, from the cup-shaped form of the specimens to be referred to it, I name Cymbactis (*κύμβη*—a drinking cup).

21. **Cymbactis faeculenta**, sp. nov.

Plate XXVIII, Figs. 69–71.

No. 732. Station 2839. Lat. 33° 08′ N.; long. 118° 40′ W. Depth, 414 fathoms. Six specimens.

All the specimens seem to be immature, as I did not succeed in finding reproductive cells in those I examined. The largest specimen measured 2 cm in height, with a diameter at the margin of 2.5 cm, and at the base of 1.3 cm.

The base is adherent. The column which gradually enlarges from the base to the margin, producing a more or less cup or vase shaped form, (Pl. XXVIII, Fig. 69), is rather thick-walled, but soft to the touch, the mesoglœa not being of fibrous structure but hyaline. The ectoderm has macerated away from all the specimens, but when a trace of it is left it may be seen to be of a chocolate brown color. In consequence of the absence of ectoderm the column is white, though in some of the smaller specimens, in which the mesoglœa is thinner, the color was a dark slate blue, due to the dark pigment of the endoderm showing through. The column wall is very rugose, probably due to contraction, and shows no signs of possession of verrucæ or permanent warts. The sphincter (Pl. XXVIII, Fig. 70) is weak, compared to what it is in most Paractids, and is for the most part confined to a thin layer immediately external to the endoderm. Toward its upper part a few scattered and isolated cavities are to be seen deeply imbedded in the mesoglœa, apparently undergoing degeneration.

In the contracted specimens the tentacles are concealed partially by an infolding of the margin, but this infolding is not carried far enough to conceal the disc and the wide mouth. The tentacles are situated close to the margin in about five cycles, and are apparently about ninety-six in number. They are short, acuminate, and slender. Their ectoderm and that of the disc seems to be of the same color as that of the column. The radial musculature of the disc and the longitudinal muscles of the tentacles are imbedded in the mesoglœa. The mouth is wide and leads into a stomatodæum which reaches nearly to the base. The siphonoglyphes are well developed.

The stomatodæal ectoderm and the endoderm throughout is of a dark wine color; the pigment occurs in the form of granules scattered through the cells, and is insoluble in alcohol, turpentine, and xylol. The mesenteries appear to number twenty-four pairs, half of which are perfect. Their mesoglœa is thick, and there is no special muscle pennon, the longitudinal muscles being comparatively weak (Pl. XXVIII, Fig. 71). No reproductive organs could be made out.

Family SAGARTIDÆ.

Actininæ with sphincter muscle imbedded in the mesoglœa, usually with only a few perfect mesenteries; furnished with acontia.

According to the above definition the Sagartidæ will form a group parallel to the Paractidæ, and distinguished from them by the presence of acontia. Whether this is a character of sufficient importance for a family diagnosis and indicates phyletic affinity of all the forms which present it future observation must determine. It seems at present convenient to associate all Actininæ with acontia in a single family, though it may be necessary to recognize in the family various subfamilies, as several authors have already done. Haddon ('89) has discussed the limitations of the family as they have been placed by various authors, and accordingly it will be unnecessary to repeat such a discussion here. The same author has established a new subfamily Chondractininæ, which may, for the present, be adopted, though it seems not improbable that it is practically identical with the subfamily, Phellinæ, which was separated from the Sagartidæ by Verrill ('67), and recognized by Andres ('83) and Hertwig ('88). I have in a previous paper (1889) proposed the separation of the Sagartidæ into the subfamilies Sagartinæ and Phellinæ, but since Haddon's subfamily is somewhat more extensive than and probably may include the genus *Phellia*, it seems advisable to adopt it.

Subfamily SAGARTINÆ.

Sagartidæ with the ectoderm naked, the acontia being emitted from the mouth and through the column wall, in which definite openings (cinclides) are present (always?) for their emission.

Genus SAGARTIA.

Sagartinæ with smooth column destitute of verrucæ and with no special arrangement of the cinclides; margin tentaculate; tentacles concealed in contraction, the sphincter being fairly strong.

In alcoholic specimens it is not always possible to be certain as to the arrangement of cinclides, and some of the forms which I assign to this genus may possibly be more properly referable to some other Sagartian genus. The absence of verrucæ, the tentaculate margin, and the concealment of the tentacles in contraction are points which assist in determining the assignment of a form to this genus.

22. Sagartia lactea, sp. nov.

Plate XXVIII, Figs. 72–75; Plate XXIX, Fig. 76.

Nos. 710–956 Station 2785. Lat. 48° 09′ S.; long. 74° 36′ W. Depth, 449 fathoms. Numerous specimens.

The specimens were adherent to a dead coral, and were for the most part strongly contracted, forming a low rounded cone with a widely expanded base (Pl. XXVIII, Fig. 72). In these the tentacles were completely concealed, but in a few forms the contraction was not so great, and the tentacles were partly visible. Such specimens measured from 1.1 to 1.3^{cm} in height, with a diameter at the upper part of the column of about 1.1^{cm} and at the base of about 1.5 or 2^{cm}.

The base is provided with a brown membranous covering, evidently a secretion of its ectoderm cells. The ectoderm in all the specimens has been entirely macerated away from the mesoglœa of the column wall, which has a milky white color. It is tolerably firm and parchment like, though not very thick, and is for the most part smooth, though in some specimens more or less wrinkled by contraction. In the upper part of the column delicate longitudinal ridges can be seen, which become stronger as they approach the margin and recall the capitular ridges of *Actinauge;* they are not, however, visible in the less contracted specimens, and seem to be produced by the contraction of the sphincter, and to be due to a certain extent to the pergamentaceous consistency of the mesoglœa. The sphincter muscle (Pl. XXVIII, Fig. 73) is fairly strong and in its upper part occupies nearly the whole thickness of the mesoglœa, being separated from the ectoderm and endoderm by thin layers of mesoglœa. It is composed of very numerous more or less circular (in section) cavities lined with muscle cells, and so closely arranged as to be separated only by very narrow bands of fibrous mesoglœa (Pl. XXIX, Fig. 76). In consequence of their arrangement this portion of the column wall, under low magnification seems to have a reticular structure. The sphincter extends a considerable distance down the column, becoming thinner and having the cavities more separated in its lower part, until finally they are scattered singly or in pairs in the lowermost portions.

The tentacles are slender and acuminate, and their number I estimate at slightly below one hundred, though I was unable to make a definite count. They have a cream-white color. Their longitudinal musculature is ectodermal, and the mesoglœal supporting processes are fairly strong. Large numbers of nematocysts occur in their ectoderm.

The disc has strong radiating ridges corresponding to the endocœls of the first and second cycles of mesenteries, and has its radiating musculature ectodermal, like the longitudinal muscles of the tentacles. In the ectoderm of the disk are numerous oval or spherical bodies, of a granular structure, which stain deeply with borax carmine. I could not detect a nucleus in any of them. Their abundance and general appearance seem to preclude the idea that they are foreign bodies, and the only explanation as to their significance which suggests itself is that they are glandular bodies. The preservation of the ectoderm was not sufficiently perfect, however, to allow of any certainty on this point.

The stomatodæum is rather small in diameter, and possesses about ten longitudinal ridges; in some specimens there was only a single siphonoglyphe, but whether this is a characteristic arrangement I can not say. Judging from the observations of G. F. and A. Y. Dixon on various species of *Sagartia* ('88) and my own ('91) on *Metridium marginatum*, it is more probable that there is a variation in the number of siphonoglyphes, some specimens possessing only one and others two. As in the case of *Metridium* and *Sagartia venusta*, there is only one pair of directives in those specimens of *S. lactea* which possess a single siphonoglyphe.

The mesenteries are arranged upon the decamerous plan, there being in all ten pairs of perfect mesenteries, all of which, with the exception of the directives, are gonophoric. I was in hopes that it might be possible, from the distribution of the reproductive organs upon the mesenteries, to ascertain which of the mesenteries of the second cycle it was which had failed to develop, the normal hexamerous arrangement being thus converted into a decamerous one; but in this I was disappointed. Counting the ten perfect pairs of mesenteries as representing two cycles, one of which, the second, is not quite complete, there is present a third cycle of ten pairs, all gonophoric, a fourth one of twenty pairs destitute of reproductive organs, and indications in some exocœls of a fifth pair, which is, however, incomplete. The mesenteries are thin, and their musculature not very markedly developed (Pl. XXVIII, Fig. 74). The acontia are fairly numerous and show a large development of gland cells (Pl. XXVIII, Fig. 75). The convex surface of an acontium is occupied mainly by nematocysts, between which a few scattered coarsely granular gland cells occur, while immediately below the nematocysts these cells are very abundant, as they likewise are at the sides and towards the concave surface. For the most part they stain deeply with borax carmine, though many—probably those in which the glandular products are more completely elaborated—refuse to take the stain and show a yellow color. In one specimen I found the acontia protruding from the mouth, but could not find any emitted through the column wall, although in sections through the wall fine canals can be readily observed which have no appearance of being artefacts, and probably are cinclidal. I could discover no definite arrangement of these canals.

There are three interesting features about this Sagartid: (1) Its decamerism. There are ten pairs of perfect mesenteries, and the imperfect mesenteries are arranged symmetrically to these ten, those of the next subordinate cycle developing in the exocœls between adjacent pairs of perfect mesenteries. I have already suggested ('91) that this condition probably arises by the suppression of a pair of mesenteries of the typical second cycle, so that this cycle consists of four pairs only instead of six. Whether or not it is the same pair that is suppressed in each case in which decamerism occurs can not be stated at present. In the decamerous Halcampids it has been seen that it is the mesenteries on either side of the sulcular directives that have disappeared, but it is not impossible that in sporadic cases of decamerism, such as we have in *S. lactea*, that it is the mesenteries on either side of the sulcar directives that have disappeared, or even the lateral mesenteries of the second cycle. However that may be, it is certain, I think, that we must regard the ten perfect mesenteries of a decamerous form as equivalent to the first and second cycles of a hexamerous form. It follows from this (2) that we have in *S. lactea* another instance of a Sagartid in which more than the six primary mesenteries are perfect. Hertwig ('82) assumed as a character of his family Sagartidæ the presence of only six perfect mesenteries, which were also sterile, but von Heider ('77) had already shown that there were numerous perfect mesenteries in *Cereus pedunculatus*, and F. Dixon ('88) has since shown that in those Sagartias which Gosse considered typical species of the genus there are more than six pairs of perfect mesenteries. It is certainly a fact that the majority of Sagartids whose anatomy we know possess only six pairs of perfect mesenteries, but too many exceptions exist for this peculiarity to be included in the definition of the genus. But not only does *S. lactea* have the mesenteries of the second cycle perfect, but (3) the mesenteries of the first cycle, with the exception of the directives, are not sterile. Here again we have a feature which places this form outside the pale of Hertwig's genus *Sagartia*, but it shares this distinction together with *Aiptasia* sp? and *Aiptasia pallida*, whose peculiarities in this respect I have already pointed out ('89*a*).

I have considered the form described in the following pages to be the representative of a new species. I do so, however, with considerable hestiation. Several Sagartids have been described from the west coast of America, by Lesson ('30), Dana ('46), Gay ('54), Verrill ('68), and Ridley ('81), but unfortunately the descriptions furnish no sufficient basis for the identification of alcoholic material. The form which Verrill ('68), with some reservations, refers to Lesson's *Actinia nivea* seems to be rather closely related and may be identical, though I should be inclined to doubt, without good evidence, the identity of a shallow water form with one living at a depth of 450 fathoms. It is doubtful, too, whether Verrill's form is really *Sagartia* (*Act.*) *nivea*, since Lesson expressly states that in this form "l'enveloppe est très-lisse, très-douce au toucher et seulment marquée de quelques ondes ou plissurés verticales," while Verrill's form has the "integument thin but firm," more nearly resembling *S. lactea* in this respect. It is on account of this uncertainty of definition that I have preferred to consider the *Albatross* form a new species.

23. Sagartia Sancti Matthæi, sp. nov.

Plate XXIX, Figs. 77 and 78.

No. 954*a*. Station, 2761. Lat. 36° 42′ S.; long. 56° 23′ W. Depth, 11½ fathoms. Three specimens.

The three specimens differ somewhat in external appearance. One is quite small, while the other two were larger, measuring about 0.5^{cm} in height and 0.6^{cm} in diameter. One of the specimens was colored, the column being chocolate-brown in color, the tentacles much darker, but of about the same color. The other two specimens showed no traces of this coloration and may possibly be different species. The anatomical details given below were derived from the study of one of the colorless specimens.

The base is adherent and not much larger than the column (Pl. XXIX, Fig. 77). This is somewhat wrinkled by contraction, but bears no warts or verrucæ. Its wall is rather thin, soft, not parchment-like. In one of the specimens an acontium protruded through the wall, but no cinclides were elsewhere visible. The sphincter (Pl. XXIX, Fig. 78) is narrow, but well developed. In its upper part it occupies the greater part of the thickness of the column wall and tapers off gradually below. In section the muscle-cavities in the upper part are elongated perpendicularly to the surface of the column, becoming gradually more circular towards the lower edge of the muscle.

The tentacles are exposed to a greater or less extent in all the specimens; they are short, and pointed at the apex. They are strongly entacmæous and their number is probably less than one hundred. Their longitudinal musculature is ectodermal and is fairly developed.

The mesenteries, as in the preceding species, are arranged upon a decamerous plan. There are ten pairs of perfect mesenteries constituting the first and second cycles; the third cycle is imperfect, but well developed, while the fourth cycle is considerably smaller. Here and there pairs of mesenteries of the fifth cycle can be seen, but this cycle is not complete. No reproductive organs were present. The longitudinal musculature is fairly well developed on the larger mesenteries, the mesogloeal processes increasing gradually in size towards the inner margin of the muscle and there abruptly diminishing.

24 Sagartia paradoxa, sp. nov.

Plate XXIX, Figs. 79-81; Plate XXX, Fig. 84.

No. 692. Station, 2766. Lat., 36° 47′ S.; long., 56° 23′ W. Depth, 10½ fathoms. Several specimens.

In this form (Pl. XXIX, Fig. 79) the base is adherent. The column is longitudinally ridged with fine elevations, and does not bear any tubercles or verrucæ, nor were any cinclides observable, acontia being emitted from the mouth, however, in several specimens. Nearly all the specimens have the tentacles and disc perfectly unretracted, and the stomatodæum is more or less evaginated in many. The specimens have an average height of about 0.8$^{cm.}$, and a diameter of about 0.9$^{cm.}$ The sphincter muscle (Pl. XXIX, Fig. 80) is very well developed, notwithstanding the nonretraction of the tentacles. It occupies the entire thickness of the mesoglœa, and is thickest about the middle, tapering off above and below. The muscle cavities are very numerous, and are separated only by very thin trabeculæ of mesoglœa, so that the column wall in the region of the sphincter has an openly reticulate appearance in longitudinal section.

The tentacles occupy the margin and are very numerous, short and acuminate, and decidedly entacmæous. Their longitudinal musculature and the radial musculature of the disk is ectodermal, the muscle processes being fairly well developed. The disc is smooth. The stomatodæum is longitudinally ridged, and has two siphonoglyphes, one of which, however, seems to be much deeper and more distinct than the other.

The mesenteries present a rather peculiar arrangement in the two specimens of which an anatomical study was made (Pl. XXX, Fig. 84). They are arranged on an octamerous plan. If we consider for convenience in description eight pairs as constituting the first cycle, then the first three cycles (I, II, III) are all perfect, the mesenteries of the third cycle losing their connection however with the stomatodæum about half-way down. A fourth cycle of imperfect mesenteries is present, but it is not complete. There are two pairs of directives (*D*), one of which, connected with the deeper siphonoglyphe, is much stronger than the other. The regularity of development of the mesenteries is somewhat interrupted on either side of these smaller directives. Disregarding the rudimentary mesenteries of the fourth cycle, a pair of mesenteries (*x*) which are perfect succeed on each side these directives, and next there comes a pair (*y*) belonging to the second cycle, which consists of one perfect and one imperfect mesentery, the latter being nearest the directives. This arrangement occurred on both sides of the directives, and in both the specimens examined, and accordingly is probably normal.

Acontia are present, as above stated. All the mesenteries except those of the fourth cycle and the directives are gonophoric. The longitudinal musculature is well developed (Pl. XXIX, Fig. 8), a marked pennon being present, the various muscle processes of which arise independently from the mesoglœa.

25. Sagartia crispata (Bradley) Verrill.

No. 718. Station, 2799. Lat., 8° 44′ N.; long., 79° 09′ W. Depth, 29½ fathoms. One specimen.

The *S. crispata* described by Verrill ('68) was dredged in from 4 to 6 fathoms in Panama Bay, and occurred upon the shell of a large Murex (*Phyllonotus*). The specimen which I identify with it with some hesitation, was found in slightly deeper water in the same locality, and also occurred upon the shell of a good sized Prosobranch, apparently one of the Muricidæ. It is very much flattened in contraction, the margin and tentacles being completely concealed. The base measures about 2.7^{cm} in diameter, and firmly clasps the surface of the shell, which was inhabited by the living mollusk and not by a Pagurid. The column is wrinkled and somewhat roughened by minute elevations produced by contraction, but does not seem to possess any verrucæ. Acontia are emitted through the column wall a short distance above the limbus, but no series of cinclidal tubercles could be made out. The column is marked by numerous, irregularly wavy, longitudinal lines of a chocolate brown color, which are very distinct upon the white ground.

Not wishing to destroy the single specimen I can give no particulars regarding the internal structure.

From the fact that the acontia are emitted a short distance above the limbus it is possible that this form is an *Adamsia*. Its identification with *S. crispata* is necessarily uncertain, owing to there being no opportunities for a thorough comparison of the two forms. The differences between the coloration in this form and Verrill's description of *S. crispata* may be due to preservation.

Genus ADAMSIA Forbes.

Sagartinæ with adherent base, the ectoderm of which secretes a membrane; column without warts or verrucæ, but provided with one or two horizontal series of cinclidal tubercles a short distance above the limbus; margin tentaculate.

26 Adamsia (?) involvens, sp. nov.

Plate XXIX, Figs. 82 and 83; Plate XXX, Fig. 85.

No. 716. Station, 2793. Lat. 1° 03′ N.; long. 80° 15′ W. Depth, 741 fathoms. Twelve specimens.

Every specimen is fully contracted and completely incloses a Gasteropod shell, being wrapped around it in such a manner as to conform itself more or less to the shape of the shell (Pl. XXIX, Figs. 82 and 83). On this account it is difficult to give any accurate measurement of the height of the Actinian, but this may be averaged for the contracted specimens at about 1.5 to 2cm., and the diameter at from 1.25 to 1.5cm. The column is of a pale flesh color, but becoming thinner toward the limbus it has a darker shade, and is here longitudinally streaked with white lines, indicating the lines of insertion of the mesenteries on the column wall. In this thinner region, too, the internal organs shine through. The tentacles are of a salmon color, this tint depending, to a certain extent, and probably entirely, on the bright reddish orange pigment which occurs everywhere in the endoderm. The coloration which these preserved specimens present is entirely independent of any colors which may have been present in the ectoderm, since this layer has entirely disappeared from the surface of the column.

The base incloses the gasteropod shell, and, as it were, forms the opening of the habitation of the mollusk. Its ectoderm secretes a very well-marked chitinous layer, not only over the region in contact with the shell, but also over that which is free from it.

The column wall is smooth throughout and has a parchment-like consistency, the mesoglœa being very fibrous in structure, though rather thin. No cinclidal tubercles could be perceived. The sphincter muscle (Pl. XXX, Fig. 85) is well developed, though not very broad. Toward its upper margin the muscle cavities are in section more or less circular in outline and distinctly separated from one another, but lower down they are more elongated and are separated by narrower partitions, circular scattered cavities lying upon the outer surface. It is separated throughout from the endoderm by a thin layer of mesoglœa. The circular muscles of the endoderm are only slightly developed, the cells being arranged in an almost smooth layer and not supported on well-developed processes of mesoglœa.

The margin is tentaculate, and the tentacles are arranged apparently in three cycles, though their exact arrangement it is difficult to ascertain on account of the contraction of the specimens. They seem to be ninety-six in number, and to be arranged in two cycles of twenty-four each, and one of forty-eight. Their longitudinal musculature is well developed and is entirely ectodermal, supported on strong mesogleal processes. The mesoglea of the tentacles does not partake of the fibrous structure of that of the column wall, but is hyaline.

Two siphonoglyphes are present, apparently, and two pairs of directives. There are forty-eight mesenteries, only the six primary pairs being perfect. The secondary and tertiary pairs bear the reproductive elements, those of the fourth cycle being quite small and destitute of mesenterial filaments. The longitudinal muscle processes are fairly well developed, but do not form a very distinct muscle pennon. Acontia are present; in some of the specimens they were emitted from the mouth, but in none did I find them protruding from the column wall.

On account of any failure to discover cinclides it is of course doubtful if this form is correctly referred to the genus *Adamsia*. The shape of the sphincter is decidedly different from that of *Adamsia parasitica*, and *A. polypus* as described by Hertwig, but does not, however, differ so materially from that of *Adamsia Sol* of our eastern coast. My principal reasons for considering *A. involvens* a possible *Adamsia* is its habitat on gasteropod shells and the secretion of a strong chitinous membrane by the ectoderm of the base, features which are, however, of comparatively small value.

Subfamily CHONDRACTININÆ, Haddon.

Sagartidæ with thick column wall, usually with the upper portion (capitulum) different in character from the lower (scapus) and capable of being entirely invected; the scapus provided with an external cuticle and usually nodulated or warty; the sphincter strong and imbedded in the mesoglea; only the six primary pairs of mesenteries perfect and at the same time nongonophoric; acontia emitted by the mouth only, there being no cinclides.

Genus ACTINAUGE, Verrill.

Chondractininæ in which the capitulum is provided with longitudinal ridges; scapus strongly tuberculate or nodulate, the tubercles near the junction of the scapus and capitulum being usually stronger than those lower down; each tentacle with a bulbous thickening on the outer surface at the base.

This genus was established by Verrill ('83) to receive a form which he believed to be identical with the *Actinia nodosa* of Fabricius. The definition given above contains the essential points of Verrill's definition, with the addition of a mention of the presence of a bulbous enlargement at the base of the tentacles, a feature to which Haddon ('89) has called attention, and made an important factor in the limitation of the genus. In the definition given by Haddon the capitular ridges are limited to twelve, while Verrill expressly states that they are as numerous as the tentacles. From an examination of specimens of the type species I can state positively that there are forty-eight capitular ridges in it, one ridge corresponding to each of the twenty-four more or less distinct rows of tubercles, while a smaller ridge intervenes between each pair of these larger ones. Haddon likewise limits the bulbous enlargements to the bases of the three inner circles of tentacles, but in the type species there is no such limitation in their distribution, all the tentacles possessing the enlargements. The numerical limitations of the ridges and bulbous enlargements must be regarded as of specific but not of generic value.

27. Actinauge Verrillii, nov. nom.

Plate XXX, Figs. 86–89; Plate XXXI, Figs. 90–92; Plate XXXV, Fig. 121.

Synonyms: *Urticina nodosa*, Verrill (1873); *Actinauge nodosa*, Verrill (1883); *Actinauge* (sp.)?, Haddon (1889).

No. 712. Station 2791. Lat. 38° 08′ S.; long. 75° 53′ W. Depth, 677 fathoms. Seven specimens.

No. 731. Station 2839. Lat. 33° 08′ N.; long. 118° 40′ W. Depth, 411 fathoms. One specimen.

Nos. 733, 735. Station 2839. Lat. 33° 08′ N.; long. 118° 40′ W. Depth, 411 fathoms. Six specimens, young.

No. 724. Station 2818. Lat. 0° 29′ S.; long. 89° 51′ 30″ W. Depth, 392 fathoms. One specimen (much torn).

I have been able, by direct comparison, to identify the specimens marked No. 712 with specimens of *A. Verrillii* from the eastern coast of North America and shall give a detailed account of the structure of these specimens. The specimen No. 731 presents some differences from the typical *A. Verrillii*, and it is possible that it may belong to another species, but I did not investigate the structure of the single specimen, and will content myself with giving a description of its external peculiarities. Nos. 733 and 735 were obtained in the same dredging as No. 731, and are probably young forms of the same species, and call for a brief description. Finally, No. 724 is referred to this species with some hesitation; it is very much distorted and torn, so that it is impossible to examine it satisfactorily. It is possibly the *tuberculosa* variety which Verrill has described as a distinct species, but nothing can be said concerning it.

All the specimens of No. 712 are thoroughly contracted, the tentacles and capitulum being concealed (Pl. XXX, Fig. 89). The column is cylindrical, and covered with well-marked, large tubercles, thickenings of the mesoglœa, which are especially high in the upper part of the column, where they are somewhat square in outline, and arranged more or less definitely in horizontal and longitudinal rows, there being about twenty-four of the latter. Lower down upon the column the tubercles become much flatter, and toward the base they are represented by slight transversely elongated, narrow elevations, the longitudinal arrangement being nearly lost. The limbus is smooth, the elevations fading out a short distance above it.

The base is much smaller than the column and is deeply concave, a quantity of mud, which evidently served to anchor the animal, being inclosed in the concavity.

The upper part of the column or capitulum does not possess any tubercles, these being limited to the scapus. The uppermost tubercles are usually more pronounced than those lower down, and form a more or less distinct coronal series (Pl. XXX, Fig. 89 *cor*), consisting of twenty-four tubercles. From each coronal tubercle a ridge (*c. r.*), extends across the capitulum toward the bases of the tentacles, and between each pair of these coronal ridges a smaller ridge intervenes, so that the capitulum bears in all forty-eight ridges. They are decidedly prominent, with thin walls, the cavities which they contain communicating with the endocœls. Before reaching the level of the bases of the outermost tentacles each ridge somewhat suddenly increases in height, and more suddenly diminishes, giving rise to a pouch-like structure. The ridges terminate at the bases of the tentacles of the four inner cycles, the tentacles of the outer cycle being situated upon the sides of the intermediate smaller ridges, in the manner indicated in the scheme given on Pl. XXXV, Fig. 121.

When the cuticle is preserved the column has a dark brown color, but the tubercles are white for the most part, owing to the cuticle having been rubbed off. The capitulum in the alcoholic specimens is colorless; the disc and tentacles, however, are orange or salmon colored, while the stomatodæum is brown.

The mesoglœa of the column wall is thick and delicately fibrous in structure, with a few cells scattered through it. The ectoderm, where present, is covered by the thick cuticle, to which particles of foreign matter adhere. The tubercles are solid elevations of the mesoglœa. The sphincter muscle (Pl. XXX, Fig. 86) is fairly strong, but varies somewhat, both in its thickness and width, in different specimens, the differences not being due to age, as in some cases I have found the muscle much weaker in a large specimen than in smaller ones. It occupies the entire capitular region, and extends a varying distance below the coronal tubercles. Throughout its entire width it is widely separate from the endodermal surface of the column and lies in the scapus very close to the ectoderm. In transverse section (Pl. XXX, Fig. 88) it is seen to consist of more or less circular cavities, traversed by irregular partitions of mesoglœa, though in some cases the cavities are more numerous and smaller, and almost destitute of partitions. Toward the lower edge of the muscle the cavities are in one or two series, but they become more numerous above, but there is no well marked, sudden thickening of the muscle in its upper part. A curious arrangement is found in the upper part, in some forms at least; the muscle fibres and the cavities instead of being cut across by a transverse section through the muscle, give the appearance of being cut parallel to their course (Pl. XXX, Fig. 87) and the section has the appearance of a horizontal or transverse section through the upper part of the column wall. Furthermore, the cavities, branching and anastomosing with each other, pass toward the ectodermal surface of the mesoglœa, and apparently in some cases come into contact with the ectoderm. This arrangement, as I have said, is not so distinct in some specimens as in others, but is more or less marked in all my preparations.

The tentacles are ninety-six in number and are arranged in five cycles. They are rather short, but slender and pointed. At the outer surface of the base of each there is a bulbous swelling (Pl. XXX, Fig. 89), formed principally of thickened mesoglœa (Pl. XXXI, Fig. 91). The ectodermal musculature, both of the tentacles and of the disc, is rather weak, the mesoglœal process for its support being only slightly developed.

The stomatodæum is long, extending, in the contracted specimens, almost to the base. It has two siphonoglyphes, which are well developed though not particularly deep.

There are twenty-four pairs of mesenteries arranged in four cycles. Only the six mesenterial pairs of the first cycle are perfect. The mesenteries of the second cycle, though imperfect, resemble those of the first cycle in being nongonophoric, the reproductive organs being borne altogether by the mesenteries of the third (Pl. XXXI, Fig. 90) and fourth cycles. In the region of the mesentery occupied by the reproductive elements in female individuals the mesoglœa is greatly enlarged (Pl. XXXI, Fig. 90), the ova (*ov*) being imbedded in the enlargement. This does not occur in the mesenteries of male individuals from the Atlantic coast of North America; all the *Albatross* specimens I examined for this point proved to be females. The longitudinal muscles of the mesenteries are not particularly well developed (Pl. XXXI, Fig. 92), and there is no circumscribed pennon. The low mesoglœal processes tend somewhat to be arranged in bunches of a few arising from a common basis. At the bases of the mesenteries, *i. e.*, at their attachment to the column, there is a well-marked pinnate parietal muscle. The acontia are not abundant.

No. 734, as stated above, differs in some respects from No. 712. Its base is not deeply concave as it is in No. 712, nor does it seem to have inclosed mud or sand for an anchor, but appears to have been adherent. The tubercles of the column are somewhat more distinct and rounded than in No. 712, and are all covered by cuticle. The sphincter has essentially the same structure as No. 712, but I did not dissect the specimen sufficiently to determine if the likeness extended to all the parts. I think, however, that there is little reason for disbelieving in the specific identity of the specimen with No. 712.

The specimens Nos. 733 and 735, obtained in the same dredging as No. 734, are both small, and white or pale brown in color, the cuticle being only very slightly developed. The base is only slightly concave and seems to have been adherent. The upper part of the column is marked by twenty-four longitudinal ridges, which show more or less distinct traces of transverse grooves, dividing each ridge more or less perfectly into a series of tubercles. I see no reason for supposing that these are other than young individuals of the same species as No. 734.

In changing the name of this species I have followed the suggestion made by Prof. Haddon ('89), and have named it after the distinguished naturalist who first described it. Verrill identified it with the *Actinia nodosa* of Fabricius, but the more recent observations of Haddon ('89) and Danielssen ('90) show that the two forms are quite distinct, and the former has assigned Fabricius' form to the genus *Chondractinia* proposed for it by Lütken ('60). This being the case, it seems advisable, for the avoidance of the confusion which might ensue from two so closely related forms possessing the same specific name, to change the name of Verrill's species.

28. Actinauge fastigata, nom. nov.

Plate XXXI, Figs. 93–97.

Synonym.—*Actinauge nodosa*, var. *coronata*, Verrill (1883).

No. 713. Station 2791. Lat. 38° 08′ S.; long. 75° 53′ W. Depth, 677 fathoms. Seven specimens.

It is customary, when a form originally described as a variety is advanced to the dignity of a species, to employ the varietal designation as the specific name. I have thought it well in the present case to depart from this precedent, since the specific term *coronata* has already been applied to a form belonging to the genus *Chitonactis*, which is nearly related to *Actinauge*.

The specimens of *Actinauge fastigata*, obtained by the *Albatross* from the same locality as most of the specimens of *A. Verrillii*, are in all respects similar to those described by Verrill ('83) from deep water off the St. George's Banks.

The specimens measure from 3.5 to 4.4^{cm} in height, with a diameter at the upper part of the column of from 2 to 2.5^{cm}.

The base is somewhat smaller than the column and, apparently, is adherent; one of the specimens clasps the tube of a *Hyalinœcia*. In none of the specimens is it deeply concave, inclosing mud or sand, as is the case with *A. Verrillii*. The limbus is smooth, and in nearly all the specimens is destitute of cuticle and is rather thin, allowing the insertions of the mesenteries to show through.

The column is cylindrical (Pl. XXXI, Fig. 93), gradually increasing in diameter towards the upper part, the capitulum being, however, completely infolded in all the specimens. The lower part of the column is covered with low and small warts, arranged, more or less distinctly, in rows, and giving the column almost a granular appearance in some specimens. They become smaller as they approach the limbus, and fade out a short distance above it. A dark brown cuticle covers this portion of the column. Just below the capitulum, and forming therefore the summit of the contracted column, are two circles of very prominent tubercles, tipped with blunt chitinous points. There are twenty-four such tubercles, arranged in two horizontal rows of twelve each, so that there may be said to be twelve longitudinal rows of these large tubercles, each row consisting of two tubercles. Between each pair of longitudinal rows there is usually to be seen a row of small tubercles, so that there are in all twenty-four longitudinal rows of tubercles, twelve of them being very large and prominent, and twelve small and almost hidden by the larger ones. The capitulum is essentially the same as that of *A. Verrillii*, possessing forty-eight longitudinal ridges which run to the bases of the tentacles. It is destitute of cuticle and tubercles. The sphincter (Pl. XXXI, Fig. 94) resembles that of *A. Verrillii* closely. It is tolerably wide, but not thick, being only slightly thicker in its upper part than it is lower down. In section it appears as a number of more or less circular cavities, traversed by delicate partitions, which support the muscle cells. In the lower part (Pl. XXXI, Fig. 95) there is only one such cavity to the thickness of the muscle, but above (Pl. XXXI, Fig. 96) there may be three or four, or even more, since the cavities tend to become smaller in the upper part. Throughout its whole width the muscle is separated by a broad band of mesoglœa from the endodermal surface of the column, lying nearly midway between the two surfaces.

The tentacles are ninety-six in number, as calculated from the number counted in a sextant. They are decidedly entacmæous, and are arranged apparently in four cycles, it being difficult to distinguish those of the first two cycles by their position. Each tentacle possesses at its base a bulbous enlargement similar to that described for *A. Verrillii*. The longitudinal muscles of the tentacles are weak. The tentacles, disc, and stomatodæum seem to have been of a salmon or flesh color.

The stomatodæum is provided with two rather shallow siphonoglyphes.

The mesenteries are arranged in three cycles, there being only twenty-four pairs in the specimen examined. Probably, however, a fourth cycle is present in larger specimens, since the number of tentacles would lead one to expect forty-eight pairs of mesenteries. The mesenteries of the first cycle are perfect and nongonophoric, those of the other two cycles being imperfect and at the same time gonophoric. The longitudinal musculature is well developed (Pl. XXXI, Fig. 97), there being a strong muscle pennon situated near the outer edge of the mesentery and having a somewhat abrupt inner edge, beyond which, however, are a number of much lower muscle processes gradually diminishing in size and finally disappearing a little internal to the mid-longitudinal line of the mesentery.

As stated above, Verrill originally described this form as a variety of *A. Verrillii*, stating that intermediate states between it and the normal form are not rare. The *Albatross* specimens do not show any such intermediate gradations, though both the presumed variety and the type species were obtained from the same locality. Leaving out of consideration the possibility of an approximation of the arrangement of the tubercles in the two forms, there are yet other characters which, it seems to me, are of sufficient importance to necessitate the separation of the two forms as distinct species. These may be briefly summed up as follows: (1) The proportion of the diameter to the height of the column in *A. fastigata* is considerably less than in *A. Verrillii*, the latter having consequently a much more robust form than the former; (2) the base in *A. fastigata* is adherent, while in *A. Verrillii* it is deeply concave and incloses a mass of mud or sand which serves as an anchor; (3) the relations of the nongonophoric and gonophoric mesenteries differs in the two forms; (4) the longitudinal musculature of *A. Verrillii* is weak, whereas in *A. fastigata* it is strong and forms a well-developed pennon.

Genus **CHITONANTHUS**, gen. nov.

Chondractininæ in which the capitulum is provided with longitudinal ridges; the scapus, especially in its upper portion, with strong pointed tubercles not arranged in any definite order, or else with a single circle of coronal tubercles; the cuticle strongly developed upon the tubercles; tentacles without any bulbous enlargement at the base.

I suggest this genus for two forms already described by Hertwig ('82, '88) as *Phellia pectinata* and *Phellia spinifera*. There can be no doubt that it is advisable to remove them from the genus *Phellia*, the typical members of which have a smooth capitulum. If the definitions which Haddon ('89) has proposed for the various genera of Chondractinidæ be accepted, Hertwig's *Phellia spinifera* finds no place among them. It comes close to *Chitonactis*, but differs in possessing ridges upon the capitulum. It is to be noticed that Haddon has assigned the form described by Hertwig ('82) as *Phellia pectinata* to the genus *Hormathia* of Gosse. If this be correct, *Phellia spinifera* must be referred to the same genus whose definition will require to be amended so as to include forms possessing tubercles scattered irregularly over the scapus. However, if the figure given by Gosse ('60) of his *Hormathia margaritæ* be correct, its capitulum is smooth and it would perhaps be as well, especially when we consider how little is definitely known regarding the type species of the genus, to reserve *Hormathia* for those forms in which the capitulum is smooth and which possess only a coronal row of tubercles, associating the *Phellia pectinata* of Hertwig and the *Hormathia andersoni* of Haddon ('88), which possess only coronal tubercles but have a ridged capitulum with Hertwig's *Phellia spinifera* in the new genus *Chitonanthus*. It is of course a question as to whether the presence or absence of capitular ridges is worthy the importance which this arrangement gives it; but it must be recognized that the classification of the *Chondractininæ* is at present more a question of convenience in identification than of phylogenetic relationship, and that what may be trivial characters have been raised to the elevation of generic distinctions. Thus, to judge from Haddon's definitions of the genera, the principal feature which distinguishes *Chondractinia* from *Chitonactis* is that the tubercles in the latter are pointed, while they are mostly low and nodule-like in the former. (See appendix p. 209.)

29. Chitonanthus pectinatus (Hertwig).

Plate XXXII, Figs. 98–102.

Synonym: *Phellia pectinata* Hertwig (1882); *Phellia spinifera* Hertwig (1888).

No. 703. Station 2780. Lat. 53° 01′ S.; long. 73° 42′ 30″ W. Depth, 369 fathoms. Three specimens.

The three specimens which represent this species have a very different appearance from one another. One (Pl. XXXII, Fig. 98), which may be considered the most typical, is seated upon a detached valve of a Lamellibranch shell by a broad, flat disk. Its column was much contracted and thrown, to a certain extent, into folds. It measured 2.1^{cm} in height and 1.9^{cm} in diameter, and was covered with irregularly scattered tubercles which were low and flat near the base, but sharp and prominent above, where they become more numerous. The upper tubercles owe their sharpness to a strong development of cuticle over them, and it is possible that in the lower ones this cuticular point has been lost. Though scattered irregularly over the column for the most part, yet they show a tendency to arrange themselves above in twelve longitudinal rows.

The second specimen, the one which I chose for detailed study, is larger than the first, measuring 3.5^{cm} in height and 3^{cm} in breadth. Its base is broad and flat, like that of the first specimen, but had been detached from its support, only particles of a shelly nature being attached to it. The column is almost smooth and white in color, the brown cuticle, which covered the first specimen, having disappeared, except in the immediate neighborhood of the limbus. The general smoothness of the column is, however, relieved by a few nodule-like elevations (Pl. XXXII, Fig. 99), and some rarer, more prominent nodules tipped with brown cuticle. Toward the summit, however, one finds twelve strong ridges, each more or less broken into rows of tubercles and terminating above in a strong tubercle tipped with a prominent thickening of cuticle.

The third specimen measured 2^{cm} in height and 2.5^{cm} in breadth, and was seated upon the valve of a Lamellibranch shell. Like the second specimen it was white in color, only a few isolated patches of cuticle persisting. It differs from both the others, however, in being utterly devoid of tubercles, the only indication of any such structures being the occurrence of about twelve ridges at the upper part of the column, which end abruptly at the junction of the capitulum and scapus, but are not tipped with a cuticular thickening.

The external appearance of these three forms is so dissimilar that one might suppose them to be distinct species. Their occurrence in the same locality, the similarity of their support, in each case a Lamellibranch shell, and the gradations which they show led me to believe that they were identical. I made a detailed study of only one, the second, and consequently can not speak as to the identity throughout of the internal structure, but so far as this could be examined by slitting the specimens longitudinally there was perfect similarity and I have little doubt but that all three ought to be assigned to the same species.

The infolded capitulum in all the specimens possesses twelve longitudinal ridges and, as in Hertwig's *Phellia pectinata*, the ridges towards their upper termination are divided by a longitudinal furrow which may be extensive enough to give the appearance of twenty-four ridges. In the first and second (Pl. XXXII, Fig. 99) specimens a few tipped tubercles are found on the infolded portion of the column, resting in the lower portion of the ridges, and each is more or less distinctly cleft into two parts. The strong sphincter (Pl. XXXII, Fig. 100) has the general appearance figured by Hertwig for *P. pectinata*. In its lower part it is thin and composed of cavities which are circular in section, but in its upper part (Pl. XXXII, Fig. 101) it thickens somewhat and the cavities are elongated in a direction perpendicular to the surface of the mesoglœa, some scattered round cavities occurring upon the outer surface of the muscle. I did not find in the mesoglœa of the column wall any of the concrements which Hertwig describes in *P. pectinata*. These seem to have been absent in his *P. spinifera* and are probably accidental foreign inclusions.

The tentacles (Pl. XXXII, Fig. 99,*t*) are rather short and slender and do not appear to have a bulbous enlargement at the base. They are arranged in about three cycles and appear to number forty-eight. The first two cycles correspond to the ridges of the capitulum, regarding each of these as really representing two, while the third cycle tentacles alternate with the ridges. The longitudinal muscles of the tentacles are fairly well developed and are not imbedded in mesoglœa. In color the tentacles seem to have resembled the disc, which was of a purplish brown color. Its radiating muscles present the peculiarity already described by Hertwig in *P. spinifera*.

The stomatodæum is long, reaching to below the middle of the internal cavity (Pl. XXXII, Fig. 99, *st.*), and is of the same purplish brown color which marked the tentacles and disc. The broad but shallow siphonoglyphes are, however, not pigmented, and consequently are very noticeable when the animal is opened longitudinally.

There are four cycles of mesenteries, of which the primary cycle is alone perfect, and at the same time sterile; the fourth cycle mesenteries are small and are not gonophoric, the reproductive elements developing only in the mesenteries of the second and third cycles. The longitudinal musculature is well developed (Pl. XXXII, Fig. 102), but can hardly be termed "very strong." The pennon is not wide, the muscle processes arising in bunches from one to three stout elevations of the mesoglœa; it is much more marked in the upper portions of the mesenteries than it is lower down, where it becomes lower and at the same time broader. I did not observe any extensive folding of the transverse muscles, nor could I find in sections any parieto basilar muscle. Acontia are present, lying in bunches in the lower portion of the internal cavity.

I identify this form with Hertwig's *Phellia spinifera*, with which it agrees closely. I have, however, accepted the possibility which Hertwig suggests, that his *P. spinifera* may be a variety of his *P. pectinata*, described in his first report ('82). The dissimilarity in the arrangement of the tubercles in the two forms is to a certain extent, as he remarks, bridged over by the specimen obtained from station 320, and the second and third *Albatross* specimens help to bring the two forms into closer connection. If the difference in the nature of the disc musculature in the two forms holds throughout, it may be necessary to consider them distinct, but since in all other particulars they shade into each other so closely, I think it better to consider them for the present identical.

Genus **STEPHANACTIS**, Hertwig.

Chondractininæ in which the body is elongated in the transverse axis, the base inclosing a cylindrical body, such as an Alcyonarian stem; column with thick wall, but not covered by a well marked cuticle; capitulum smooth, separated from the smooth scapus by a well marked circular swelling.

In his report on the Actiniaria, obtained by the *Challenger*, Hertwig ('82) established a family Amphianthidæ for two genera *Amphianthus* and *Stephanactis*, both of which were characterized by the body being transversely elongated, the base clasping and inclosing the stem of a Gorgonia. From his observations on *Stephanactis tuberculata* he found that in the arrangement of the mesenteries, and in the presence of a sphincter muscle imbedded in the mesoglœa, there was a great similarity to a Sagartid, but he failed to discover acontia, although cinclidal openings pierced the column wall. Previously to Hertwig's discovery of these forms, von Koch ('78) had described an Actinian, adherent to and embracing by its base the stem of *Isis elongata*, and in this he fancied he had found a clue to the ancestry of the Antipatharia. This form, which von Koch named *Gephyra dohrnii*, Haddon ('89) has investigated, and finds that "it belongs to the series of typical Sagartians." Danielssen ('90) again has described a form *Korenia margaritacea*, probably more correctly assignable to Hertwig's genus *Amphianthus*, concerning which he states that "the gastral filaments are richly beset with nematocysts," a remark which suggests the presence of acontia. He, however, finds that there are twenty-four perfect mesenteries, though acknowledging a possibility of error in this determination. Mention must be made also of Verrill's *Actinauge nexilis* ('83), a superficial examination of which leads one to the conclusion that it is a Chondractinian, though I have not been able as yet to detect the occurrence of acontia, the single specimen in my possession not being satisfactorily preserved, and consequently not suitable for accurate observation. A study of sections, which, unfortunately, I have not yet been able to make, may reveal these structures. Concerning this form I believe, too, that it is identical with *Stephanactis abyssicola* first described by Moseley ('77). It is undoubtedly a *Stephanactis*, and the superficial resemblance to Moseley's form is so close that, relying on the external characters, which are all in reality that we have to base a judgment upon, one would have little hesitation in pronouncing in favor of the specific identity of the two forms. Finally, *Chitonactis marioni* Haddon ('89) resembles *Stephanactis* in the elongation of the transverse(?) axis, and the clasping nature of the base, and is, *fide* Haddon, a Sagartian belonging to the subfamily Chondractininæ.

In view of this evidence, which it must be acknowledged is by no means conclusive, I think it is advisable to abolish the family Amphianthidæ and include *Stephanactis* and *Amphianthus* under the subfamily Chondractininæ. Furthermore, it seems not improbable that it may be necessary to disregard the clasping habit, and the consequent elongation of the body to the transverse axis as generic characters, since, as in the case of *Chitonactis marioni* these features may be assumed by species belonging to genera not characterized by them.

Independently, however, of these features depending on the habitat, the genus *Stephanactis* is sufficiently well marked out from other Chondractinidæ to warrant its retention.

30. Stephanactis hyalonematis, sp. nov.

Plate XXXII, Fig. 103.

No. 720. Station 2807. Lat. 0° 24′ S; long. 89° 06′ W. Depth, 812 fathoms. One specimen.

The single specimen I was unwilling to mutilate any more than was absolutely necessary, and consequently am unable to give an accurate description of its structure; nor can I even determine from it whether or not acontia are present.

The base clasped firmly a small bunch of Hyalonema fibres, the margins of the base coming into close contact, but still being separable by the use of a little force. The animal (Pl. XXXII, Fig. 103) is much elongated in the direction of the axis of the bunch of fibres to which it is attached, and is low. The column wall is remarkable on account of its brittleness. It is hard and brittle, like parchment, and is much wrinkled by contraction. In sections through a small piece of the wall no ectoderm or cuticle could be observed, but the mesoglea was found to have been altered into a chitin like substance, not taking the stain (borax-carmine) except on the outer and inner surfaces to a slight extent. A distinct thickened ring surrounds the upper part of the column separating the scapus from the capitulum. The latter has a slightly irregular surface, but is not tuberculate, and differs from the scapus in lacking the chitin like induration of the mesoglea. I could discover no trace of cinclides. A strong sphincter imbedded in the mesoglea is present, but I can give no account of its shape in transverse sections. The tentacles are completely concealed, and my preparations do not throw any light upon the number or arrangement of the mesenteries.

Family BUNODIDÆ.

Actininæ with numerous perfect mesenteries, and with a strong, circumscribed endodermal sphincter. Column wall frequently provided with tubercles, verrucæ, etc.; margin frequently with complicated acrorhagi. No acontia.

Genus LEIOTEALIA, Hertwig.

Hertwig ('83) established this genus for a form which differed from all forms which had previously been assigned to the family Bunodidæ by lacking the tubercles or verrucæ which had been considered characteristic of the family. The internal arrangements of the *Challenger* specimen showed it, however, to be closley related to the verrucose forms, with which Hertwig very properly associated it, substituting for previous definitions of the family, which he named Tealidæ, a more accurate one founded upon an anatomical basis.

To the genus *Leiotealia* are to be referred Bunodidæ without verrucæ or acrorhagi, and perhaps to this may be added the pinnate arrangement of the muscle processes constituting the sphincter.

31. Leiotealia badia, sp. nov.

Plate XXXII, Fig. 104; Plate XXXIII, Fig. 106.

No. 702. Station 2779. Lat. 53° 06′ S.; long. 70° 40′ 30″ W. Depth, 77½ fathoms. One specimen.

The base is firmly adherent to a large annelid tube. The column is contracted to a somewhat conical shape, and measures 2cm in height with a diameter midway between the base and margin of 2.3cm. It is wrinkled transversely by contraction, and also is roughened by numerous small elevations, which, however, do not represent tubercles or verrucae. The specimen is one of the few of the collection which have retained to a certain extent their coloration, the ectoderm of the column wall being of a dark brick-red color. A noticeable feature is the readiness with which the thick ectoderm separates from the mesoglœa in large pieces; an explanation of this is found in the peculiar structure of the lower layer of the ectoderm. The outer layer of the ectoderm contains a few small nematocysts and a large number of gland cells, some of which stain very deeply with carmine, while others hardly stain at all. Below these there is a granular layer which stains rather deeply, and next to the mesoglœa, occupying the region, where, in the tentacles, for instance, the nerve layer is found, is a broad, slightly stained, fibrillar layer, in which are numerous delicate spindle-shaped cells. It seems probable that this layer is more or less nervous in its nature, but whether it is to be regarded as entirely nervous can not be determined. It is in this layer that the rupture takes place, when portions of the ectoderm detach themselves, the structure of the layer being delicate and maceration of it easily brought about.

The region of the column immediately above (or internal to) the margin is much depressed, appearing to represent a distinct fosse, and at the bottom of the depression there is present a strong circumscribed endodermal sphincter (Pl. XXXII, Fig. 104). In section it resembles closely that which I have described ('89) for *Discosoma anemone*, consisting of a central axis from which processes arise, producing a more or less pinnate appearance.

There being only a single specimen of the form, I cut out only a small portion of it for the examination of the sphincter, a piece of the excised portion being cut transversely for a study of the musculature of the mesenteries. I can not accordingly give any facts as to the tentacles, disc, or stomatodæum, or even regarding the arrangement of the mesenteries. A few tentacles were cut in making sections of the sphincter, and it was evident from these that their longitudinal muscles were very weak.

The small portion which was sectioned for the purpose of ascertaining the nature of the musculature of the mesenteries contained representatives of three cycles of mesenteries. Two of these bore reproductive organs, while the third was sterile. Approximately the excised portion represented one-twelfth of the circumference, and it may be computed that there are at least twelve sterile (and perfect?) pairs of mesenteries and twenty-four pairs that are gonophoric (and imperfect). The mass of the mesenterial filaments is very great, but no acontia could be recognized. The musculature of the mesenteries is fairly strong, gradually increasing in thickness from near the parietal edge to about the middle of the mesentery, where it abruptly diminishes (Pl. XXIII, Fig. 106); the parieto-basilars (*pbm*) form distinct folds upon the surfaces of the mesenteries, and numerous cavities are inclosed between the mesoglea of the fold and that of the mesentery proper, as in *Actinostola callosa*.

Owing to the lack of more complete data with regard to this form, I at first hesitated to classify it. It seems, however, to belong to Hertwig's genus *Leiotealia*, though without some knowledge as to the arrangement of the tentacles, the correctness of this reference must remain uncertain; the probability seems to lie in favor of a cyclical arrangement of the tentacles. The form recalls somewhat that described by Verrill ('67) for Kagosima Bay, Japan, as *Urticina coccinea*, but the "few, slightly prominent, inconspicuous verrucæ" could not be detected.

Family PHYLLACTIDÆ.

Hexactiniæ with simple conical tentacles at some distance from the apparent margin; between them and the margin are low tentacular or foliose structures (fronds). Sphincter endodermal, more or less circumscribed, lying in the interval between the tentacles and the frondose or tentacular structures. From two to several cycles of mesenteries perfect.

I have elsewhere ('89*a*) discussed the question as to whether this family should be referred to the suborder Stichodactylinæ, as Andres ('83) has done, or placed in the suborder Actininæ, and have decided in favor of the latter position. Upon this view the fronds are to be regarded as differentiated acrorhagi.

Genus **OULACTIS**, M.-Edw.

Phyllactidæ in which the column is provided with longitudinal rows of verrucæ in its upper part; the fronds are foliose. Sphincter muscle more or less circumscribed.

32. **Oulactis californica**, sp. nov.

Plate XXXII, Fig. 105; Plate XXXIII, Figs. 107–108.

No. 741. Pichilingue Bay, Gulf of California. Two specimens.

The base is adherent and rather thin, allowing the insertions of the mesenteries to be seen through it. The column (Pl. XXXII, Fig. 105) is cylindrical, and in the alcoholic specimens shows no trace of color. The two specimens measure, respectively, 3^{cm} and 3.5^{cm} in height, with a diameter near the upper part of the column of 2^{cm} and near the base of 1.5^{cm}. Toward the upper part of the column are verrucæ arranged in forty eight longitudinal rows, each row being composed of from eight to ten verrucæ. The upper portion bearing the fronds is not concealed. The fronds occupy the margin and extend inwards to the bases of the tentacles, which surround the mouth; they are foliose, apparently becoming thickly so toward their external extremity, and appear to be forty-eight in number, corresponding to the rows of verrucæ, but owing to their close approximation in the preserved specimens their exact number could not be accurately determined. On the endodermal surface of the region which intervenes between the fronds and the tentacles is the sphincter, whose form may be better understood from the figure (Pl. XXXIII, Fig. 108) than from a verbal description. It will be seen that it approaches the circumscribed type, but still has a considerable attachment to the column wall. It may, however, be fairly termed circumscribed.

The tentacles are simple and few in number. They appear to be arranged in two cycles, there being six in each cycle, but it is difficult to make them out satisfactorily in the preserved specimens.

The stomatodæum is provided with longitudinal ridges supported on elevations of the mesoglœa. The siphonoglyphes are deep, with smooth walls, and with the mesoglœa much thickened. There are twenty-four pairs of mesenteries, twelve of them being perfect. The longitudinal muscles form a broad, well-defined muscle pennon (Pl. XXXIII, Fig. 107), and a well-developed parieto-basilar muscle is present. No reproductive elements could be discovered.

This form may have some relationship to the form described by Verrill ('68) as *Lophactis ornata*, as in that form the fronds are more foliose near their outer ends than toward the bases of the tentacles. They seem, however, to be more numerous, though, as stated above, it was difficult to decide upon the exact number, owing to their confusion with one another in the contracted preserved specimen; perhaps twenty-four would be more correct, each showing indications of a division into two toward the outer extremity and so giving the appearance of forty-eight. It seems probable that it is unnecessary to separate Verrill's genus *Lophactis* from *Oulactis*, though very decided differences exist between the present form and his *L. ornata*, with which one might be inclined to identify it.

Genus **CRADACTIS**, gen. nov.

Phyllactidæ with the fronds represented by bunches of simple or slightly branched, short, tentacle-like structures. Sphincter aggregated or circumscribed. Column with verrucæ.

Among the actiniæ which I described from the Bermuda Islands ('89*a*) was one which I referred to the genus *Oulactis* as *O. fasciculata*. I propose here to unite this form, which differs markedly from *Oulactis* in the structures of its fronds, with a form in the *Albatross* collection, in the above new genus. An objection to this may be found in the very different nature of the sphincters in the two species, that of the one being almost diffuse, while the other is typically circumscribed. The structure of the fronds has been a generic character hitherto for the Phyllactidæ, and it is convenient for the present to retain it as such. When the anatomy of a larger number of species is known, it can be determined whether a classification upon this basis can be retained.

33. Cradactis digitata, sp. nov.

Plate XXXIII, Figs. 109–112.

No. 692*a*. Station 2766. Lat. 36° 47′ S.; long. 56° 23′ W. Depth, 10½ fathoms. Three specimens, two of which, however, are small.

The three specimens of this species were contained in the same bottle which held the forms described above as *Sagartia paradoxa*.

The base of the single adult specimen was injured, so that it is impossible to say whether or not it was adherent originally. The column is cylindrical, and measures in the adult specimen 2cm in height and 1.5cm in diameter. The base is somewhat smaller than the column. Numerous, somewhat scattered, verrucæ occur on the column wall, being much more distinct near the apparent margin than lower down. The fronds consist of bunches of short, blunt, tentacle-like processes (Pl. XXXIII, Fig. 110), each of which divides, near its extremity, into two short arms. The endoderm of the fronds is colored with brown pigment. The sphincter (Pl. XXXIII, Fig. 111) is very strong and is circumscribed, resembling closely that form of sphincter which is characteristic of the Bunodidæ.

The tentacles are short and stout, and each has apparently a pore at the tip (Pl. XXXIII, Fig. 109*l*). They seem to be arranged in about two cycles, and are not numerous, probably not exceeding forty-eight. Their endoderm contains brownish pigment similar to that of the fronds.

The stomatodæum in all the specimens is considerably evaginated. It possesses two well developed and deep siphonoglyphes, whose mesoglœa is decidedly thickened and smooth, that of the rest of the stomatodæum being raised into longitudinal ridges.

There are twenty-four pairs of mesenteries, twelve of which are perfect. The longitudinal muscles (Pl. XXXIII, Fig. 112) are well developed, forming a broad pennon, similar to that of *Oulactis californica;* the parieto-basilar muscle is also well developed, forming a fold upon the surface of the mesenteries. No reproductive organs were observed.

Order STICHODACTYLINÆ.

Hexactiniæ, in which the tentacles are arranged radially, more than one communicating with some or all of the endocœls.

Family CORALLIMORPHIDÆ.

Stichodactylinæ, with a marginal corona of tentacles, and intermediate tentacles similar to those of the margin arranged in radial series, each series consisting of from one to many tentacles. Musculature throughout weak; no specially developed sphincter.

This family was established by Hertwig ('82) for the reception of the two forms described by Moseley ('77) under the generic term

Corallimorphus. In the "Supplement" Hertwig ('88) added to this genus, as another member of the family, the genus *Corynactis.* Previous to this, however, Andres ('83) had defined the family Corynactidæ, splitting up Gosse's family Capneadæ, which he had previously accepted ('80*a*), though recognizing that it was not altogether natural, and agreed with Hertwig in incorporating in his new family the genera *Corynactis* and *Corallimorphus,* adding also the genus *Capnea.* The name proposed by Andres is preferable to that of Hertwig, both on account of the greater antiquity of the genus, which serves as its sponsor, as well as on account of Hertwig's name carrying with it a significance which might give rise to misunderstanding. Hertwig's name has, however, the priority in publication, and it is therefore proper to retain it.

Genus **CORALLIMORPHUS**, Moseley.

Corallimorphidæ, with capitate tentacles, there being only one intermediate tentacle in each radial series; some of the marginal tentacles have no intermediate tentacles corresponding to them.

34. **Corallimorphus profundus** Moseley (1877)

No. 731*b*. Station 2839. Lat. 33° 01′ N.; long. 118° 40′ W. Depth, 414 fathoms. Two specimens.

These two specimens I found in a bottle which contained also specimens of *Myonanthus ambiguus* and *Paractis vinosa.* Both were in a very poor state of preservation, so that I can add nothing to the anatomical description given by Hertwig ('82). One of the specimens was attached to a fragment of a gasteropod shell. The column measured 1^{cm} in height and the disk had a diameter of 2.5^{cm}. There were no indications of any tendency to infold the margin, and sections demonstrated the absence of any sphincter.

The marginal tentacles were forty-eight in number, twelve being decidedly larger than the other thirty-six, and there were twelve intermediate tentacles corresponding to the larger marginal ones. The capitate nature of the tentacles could be made out only with difficulty, but they certainly possessed that character. There appeared to be a slight thickening of the disc mesoglœa at the base of each of the intermediate tentacles.

Family DISCOSOMIDÆ.

Stichodactylinæ with tentacles of only one form, short and tentacular, and covering the greater portion of the surface of the disc. Sphincter muscle strong and circumscribed, not embedded in the mesoglœa.

Genus DISCOSOMA.

Discosomidæ in which the column is not covered with tubercles, though verrucæ may be present in the upper part. Tentacles short and fingerlike.

35. Discosoma fuegiensis (Dana) M.-Edw.

Plate XXXIV, Figs. 113 and 114.

Synonyms: *Actinia fuegiensis*, Dana (1846); *Discosoma fuegiensis*, Milne-Edwards (1857); *Sagastia fuegiensis*, Gosse (1860); *Cereus fuegiensis*, Verrill (1868).

No. 693. Station 2767. Lat. 40° 03′ S.; long. 58° 56′ W. Depth, 52 fathoms. Four specimens.

There is a certain amount of doubtfulness in this identification, since it is not possible to be certain as to whether the form described by Dana ('46) is really a *Discosoma*. Milne-Edwards ('57) considered it to be such, and Andres ('83) places it among the doubtful species of the same genus. So far as the description goes the *Albatross* specimens agree fairly well, and come from a station not especially remote from the locality in which Dana's form was found and from comparatively shallow water.

The four specimens differ considerably in size. The largest measures 2.5^{cm} in height, and 4.5^{cm} in diameter, while the smallest is 1^{cm} in height, with a diameter of 2.5^{cm} at the base. Three of the specimens are only partially contracted, the prominent lips of the mouth, and the outer cycles of tentacles being visible, while one of the smaller forms is completely contracted, the tentacles and mouth being entirely concealed, and the body having the form of a cone, sloping gradually upward from the flat base.

The base is adherent and has attached to it fragments of a brown cuticle. The mesoglœa is thin and in some specimens has been ruptured, allowing the mesenterial filaments to protude.

The ectoderm of the column has been macerated away for the most part, the few fragments that persist towards the limbus having a dingy white color in the preserved specimens, and presenting a reticulate appearance. The exposed mesoglœa has a cream-white color, and is smooth. In some of the specimens it has been considerably macerated, especially towards the upper part of the column, where the mesenteries are exposed. Owing to the absence of ectoderm, it is impossible to determine whether or not verrucæ may have been present in the upper part of the column. The sphincter muscle (Pl. XXXIV, Fig. 113) is strong and is of the circumscribed endodermal variety, resembling greatly that occurring in certain Bunodidæ.

The margin appears to have been lobed. The tentacles are numerous and short, and are arranged in radial series. Their ectoderm is very richly supplied with nematocysts. Their longitudinal musculature and the corresponding musculature of the disc is well developed, and is not imbedded in the mesoglœa.

The mouth is very prominent, and shows indistinct traces of a dark, slate-gray pigment. The mesoglœa of its lips is thickened, the thickening gradually thinning out, both towards the disc and towards the stomatodæum. This is marked with longitudinal ridges, supported by mesoglœal elevations, and possesses deep siphonoglyphes.

There are ninety-six pairs of mesenteries. Twelve of them, representing the first two cycles, are perfect, the rest imperfect, the fifth cycle of forty-eight pairs being very small, hardly projecting above the endoderm. Reproductive organs are borne upon the forty-eight mesenteries composing the third and fourth cycles. · No acontia are present. The longitudinal muscles of the mesenteries (Pl. XXXIV, Fig. 114) have a moderate degree of development, forming a rather diffuse pennon. The parieto-basilar is, however, strong, forming a well-marked pouch upon the surface of the more developed mesenteries.

Very decided differences exist between this form and *D. anemone* previously studied by me ('89), but nevertheless a general similarity is well marked, showing itself in the shape and structure of the tentacles, the character of the sphincter muscle, and the deep siphonoglyphe. The musculature of the mesenteries has, however, a very different arrangement, and the relationship of the perfect and imperfect mesenteries is quite different. These points, however may be justly regarded as specific.

Tribe CERIANTHEÆ. Hert.

Anthozoa, with a large number of unpaired mesenteries, and with a single siphonoglyphe; the eight Edwardsian mesenteries are situated, four on each side, at the sulcar surface, and new mesenteries are added at the sulcular surface, being interposed, one on each side of the sagittal plane, between those immediately preceding them in time of formation. The base is not adherent and is usually provided with a pore opening into the body-cavity. Column walls, with strong ectodermal musculature.

Family CERIANTHIDÆ.

With the characters of the tribe.

Genus CERIANTHUS, Della Chiaje.

Whether the form described below be correctly referable to the genus *Cerianthus* is questionable, inasmuch as it seems to differ in several particulars from any of the forms hitherto referred to the genus. Andres ('83) divided the forms assignable to the family Cerianthidæ into three genera (not including *Arachnactis*), but the characters upon which these genera were based hardly seem at present of sufficient importance to be considered generic. It seems to me preferable, at present, to assign the specimen described below to Della Chiaje's genera rather than to establish a new genus on insufficiently understood characters.

36. Cerianthus vas, sp. nov.

Pl. XXXIV, Figs. 117–119; Pl. XXXV, Fig. 120.

No. 726. Station 2838. Lat. 28° 12′ N.; long. 115° 09′ W. Depth, 44 fathoms. One specimen.

The single Cerianthid which I found in the collection gave so much promise of interesting results that I determined to sacrifice it to an anatomical investigation. Unfortunately, however, it did not prove to be well preserved, and many points on which I had hoped to obtain definite information remained obscure, partly owing to the preservation and partly to the difficulties in the way of obtaining all the necessary data from a single specimen. A portion of the upper part I cut in longitudinal sections in the endeavor to obtain, if possible, definite information as to the absence of tentacles, and was thus prevented from making a thorough study of the arrangement of the mesenteries.

The specimen (Pl. XXXIV, Fig. 117) measured 2.0^{cm}. in length and about 0.9^{cm}. in diameter, and had a decided vase-like appearance. The margin was slightly reflected, and there was a distinct neck like constriction a little below it. The column was cylindrical, tapering gradually below, where there was a large, widely open pore communicating with the interior cavity. The ectoderm had a pale brown color, and its musculature was richly developed in the manner characteristic of the Cerianthidæ.

No tube accompanied the specimen, nor have I any information as to whether there was one when it was found.

A remarkable peculiarity which attracted my attention at once was the apparent absence of tentacles. Neither at the margin nor upon the disc could any of these structures be found. It is possible that they may have fallen away, an idea to which the fact that any sections through the margin did not show continuity of the column wall and disc, except in one or two cases, gives support. It seems hardly possible, however, that if they had been present they could have disappeared so completely as they seem to have done, and I am rather inclined to believe that they were absent or reduced to mere rudiments.

The stomatodæum was narrow, extending only a short distance into the interior cavity. The portion which I used for longitudinal sections probably contained the siphonoglyphe. Upon the other side of the stomatodæum no siphonoglyphe occurred.

In a section through the middle of the column (Pl. XXXV, Fig. 120) twenty-two mesenteries could be counted. They showed a tendency to be arranged so that broad and narrow mesenteries should alternate with one another, but this arrangement was frequently marred by a broad mesentery occurring in the place of a narrow one, and vice versa. It is evident, however, that two grades of mesenteries are represented in the section, one consisting of about twelve mesenteries quite wide and bearing reproductive organs as a rule, and one whose mesenteries were much narrower and were also destitute of reproductive organs. Whether, as I am inclined to believe is the case, a third grade is present, extending only a short distance below the stomatodæum, is uncertain. I was not able to prepare a satisfactory series of sections which would demonstrate this point, but sections made through a small portion of the column wall at a level with the stomatodæum seem to show a greater number of mesenteries than occur in a portion of the same size lower down.

The character of the mesenteries attached to the sulcar directive I did not discover. Opposite the sulcular end of the stomatodæum I found a single mesentery (Pl. XXXIV, Fig. 118, *mes*) which rapidly diminished in size as it passed backward, and even at the level of the lower edge of the stomatodæum was reduced to the merest rudiment. This I take to be a newly formed mesentery, its fellow of the opposite side not having appeared.

A decided abnormality was seen in sections taken about the middle of the column (Pl. XXXV, Fig. 120), which involved two mesenteries situated at or near the sulcar surface(*). These had united to form a band from which two lamellæ extended into the body cavity. A little higher these lamellæ were likewise united so that a cavity was inclosed by the united mesenteries.

I was not able to distinguish any acontia in the region where they usually occur in Cerianthids, though mesenterial filaments occurred on all the mesenteries. They were very imperfectly preserved, however, and did not allow of an accurate study.

The reproductive organs are borne by the widest mesenteries, which extend the greatest distance down the column. Both ova and spermatozoa seem to be borne by each mesentery. (Plate XXXV, Fig. 119, *ov* and *te*.) Ova are certainly present and occurring with them, inclosed in the mesoglœa, bodies which I take to be spermatozoa. They (*te*) vary much in size, occasionally being many times larger than the ova, and consist of a deeply staining wall crowded with small nuclei, a cavity occurring in the center of the larger ones and containing numerous nuclei, attached to which I could in some cases discover delicate appendages. They do not resemble the spermatozoa bundles of the Hexactiniæ, but bear a close resemblance to the testes of *C. membranaceus*, figured by the Hertwigs. *Cerianthus vas* is accordingly most probably one of the hermaphrodite Cerianthids.

The endoderm covering the mesenteries presents the same characters as that found in the same regions in *C. americanus*, which I have described elsewhere ('90).

UNIDENTIFIED FORMS.

No. 725. Station 2825. Lat. 24° 22′ 15″ N.; long. 110° 19′ 15″ W. Depth, 7 fathoms. One specimen.

No. 955. Station 2765. Lat. 36° 43′ S; long. 56° 23′ W. Depth, 11½ fathoms. One specimen.

Part III.

GEOGRAPHICAL AND BATHYMETRICAL DISTRIBUTION OF THE ACTINIARIA.

To anyone who has studied the habits of Actinians the dependence of the various species upon their surroundings is very evident. Some are to be found only on rocky shores, others prefer sandy bottoms, while others again make their homes only in muddy flats. Some bury themselves in the sand or mud so that only the disk and tentacles protrude, others are to be found only on gasteropod shells inhabited by Hermit Crabs, while others again firmly clasp stems of Gorgonians. In other words, nearly every species has a more or less definite habitat.

Furthermore, as a rule the various species have a more or less definite distribution, so that it is possible to mark out more or less definite geographical regions characterized by their Actinian fauna. Thus the eastern coast of the United States presents three fairly well defined regions so far as the Actinian fauna is concerned. North of Cape Cod we have what may be termed the Boreal region, characterized by the occurrence, among other forms, of *Tealia crassicornis*, *Metridium marginatum*, and *Cerianthus borealis* Verr. Secondly, there is what Verrill has called the Virginian region, which includes the Virginian and Carolinian coasts, and probably Georgia to the south, and Delaware and part of New Jersey to the north, characterized by the presence of *Phymactis cavernata*, *Adamsia sol*, and *Cerianthus americanus* among others; and lastly, there is the Florida region, characterized by forms identical with those of the West Indies. Northern New Jersey and Long Island Sound constitute an intermediate region possessing forms such as *Metridium marginatum*, reaching their most perfect development in the Boreal region, and others, such as *Eloactis* (*Halcampa*) *producta* and *Paractis rapiformis*, which belong properly to the Virginian region.

When the distribution of genera is considered, however, this definiteness, as might be expected, becomes more or less indistinct, though even with some of these distinct areas of delimitation can be established. With the larger groups the same holds true, and even when the orders are considered a certain amount of limitation of their distribution can be determined. The Actininæ, it is true, have a world-wide distribution, but, as I have pointed out ('89), the Stichodactylinæ, though of wide distribution, have their headquarters in the Pacific and West Indian regions, and it may be said in the regions of coral formation.

Our knowledge, however, of the Actinian fauna of a great deal of the Pacific and Indian Oceans and of the South Atlantic is as yet very slight, and it is hardly time to enter into an exhaustive discussion of the geographical distribution of the larger groups, families, and orders of the Actinaria. So far as the *Albatross* collection is concerned, there is only one point that deserves special mention in this connection, and that is the very wide distribution which it reveals for certain deep-sea species.

Actinauge verrillii and *Actinauge fastigata* have been obtained by the U. S. Fish Commission at various localities off the eastern coast of the United States. The former is recorded from various stations from off the coast of Nova Scotia in the north to off Cape Hatteras in the south, from depths ranging from 30 to 506 fathoms. *A. fastigata* has been recorded from off Martha's Vineyard from a depth of 300 to 980 fathoms. In the *Albatross* collection these forms were obtained from the following stations:

A. verrillii: Stations 2791, 2818, and 2839.

A. fastigata: Station 2791.

Station 2791 was off the coast of Chile; station 2818 off the coast of Ecuador, in the neighborhood of the Galapagos Islands; and station 2839 off the coast of California.

Another form, *Actinostola callosa*, has likewise been obtained at various stations on the eastern coast, ranging from the Grand Banks of Newfoundland on the north to Cape Fear, N. C., on the south, at depths varying from 50 to 640 fathoms. This form likewise occurs upon the west coast of America, having been obtained by the *Albatross* at stations 2792, 2807, and 2818, all of which are off the coast of Ecuador, and vary in depth from 392 to 812 fathoms.

Since we have seen that species of Actiniæ are to a great extent dependent upon external conditions, this wide distribution of these deep-sea species is interesting. It seems improbable that they are wanting in the deep water of the southwestern Atlantic; or, in other words, that they occur sporadically upon the east and west coasts of America. Future observations will probably reveal their occurrence off the east coast of South America, a portion of the ocean whose Actinian fauna is still to be studied, and it seems probable that they occur over the sea bottom of the western trough of the Atlantic throughout its entire extent, and doubling Cape Horn extend up the west coast in deep water as far north at least as California. Since we know that the temperature at considerable depths is fairly constant and low, it may be supposed that over this wide area these forms find conditions sufficiently similar, and have thus been enabled to extend their distribution.

I give here in tabular form the localities and depths at which the various species of the *Albatross* collection were obtained:

No.	Name of species.	Station.	Latitude.	Longitude.	Depth.
			° ′ ″	° ′ ″	*Fathoms*
	Tribe Edwardsiæ:				
1	*Edwardsia intermedia*	2783	51 02 30 S.	71 08 30 W.	122
	Tribe Protactiniæ:				
2	*Oractis Diomedeæ*	2839	33 08 00 N.	118 40 00 W.	414
	Tribe Hexactiniæ.				
	Order Actininæ.				
	Family Halcampidæ:				
3	*Halcurias pilatus*	2785	48 09 00 S.	71 36 00 W.	449
4	*Peachia Koreni*	2764	36 42 00 S.	56 23 00 W.	11½
	Family Antheadæ:				
5	Actinia infecunda		Abrolhos Islands.		
6	*Anemonia variabilis*	2768	42 24 00 S.	61 38 30 W.	43
7	*Anemonia (?) inequalis*		Pichilingue Bay.		
8	Condylactis cruentata		Straits of Magellan.		
9	*Myonanthus ambiguus*	2839	33 08 00 N.	118 40 00 W.	414
	Family Boloceridæ:				
10	*Bolocera occidua*	2783	51 02 30 S.	71 08 30 W.	122
	Bolocera occidua	2779	53 06 00 S.	70 49 30 W.	77½
	Bolocera occidua	2771	51 34 00 S.	68 00 00 W.	50½
11	*Bolocera pannosa*	2839	33 08 00	118 40 00 W.	414
12	*Bolocera brevicornis*	2839	33 08 00	118 40 00 W.	414
	Family Paractidæ:				
13	Paractis lineolata	2804	8 16 30 N.	79 39 45 W.	47
14	*Paractis vinosa*	2839	33 08 00 N.	118 40 00 W.	414
15	Antholoba reticulata		Port Otway, Patagonia.		
	Antholoba reticulata		Lota, Chile.		
	Antholoba reticulata		Galapagos Islands.		
16	*Actinernus plebejus*	2791	38 08 00 S.	75 53 00 W.	677
17	Actinostola callosa	2792	0 37 00 S.	81 00 00 W.	101
	Actinostola callosa	2807	0 24 00 S.	87 06 00 W.	812
	Actinostola callosa	2818	0 29 00 S.	89 51 30 W.	392
18	*Actinostola excelsa*	2770	48 37 00 S.	65 46 00 W.	58
	Actinostola excelsa	2771	51 34 00 S.	68 00 00 W.	50½
19	*Actinostola pergamentacea*	2769	45 22 00 S.	64 20 00 W.	51½
20	*Pycnanthus maliformis*	2839	33 08 00 N.	118 40 00 W.	414
21	*Cymbactis faeculenta*	2839	33 08 00 N.	118 40 00 W.	414
	Family Sagartidæ:				
22	*Sagartia lactea*	2785	48 09 00 S.	71 36 00 W.	449
23	*Sagartia Sancti Mathæi*	2764	36 42 00 S.	56 23 00 W.	11½
24	*Sagartia paradoxa*	2766	36 47 00 S.	56 23 00 W.	10½
25	Sagartia crispata	2799	8 44 00 N.	79 09 00 W.	29½
26	*Adamsia (?) involvens*	2793	1 03 00 N.	80 15 00 W.	741
27	Actinauge Verrillii	2791	38 08 00 S.	75 53 00 W.	677
	Actinauge Verrillii	2839	33 08 00 N.	118 40 00 W.	414
	Actinauge Verrillii	2818	0 29 00 S.	89 51 30 W.	392
28	Actinauge fastigata	2791	38 08 00 S.	75 53 00 W.	677
29	Chitonanthus pectinatus	2780	53 01 00 S.	73 42 30 W.	369
30	*Stephanactis hyalonematis*	2807	0 24 00 S.	89 06 00 W.	812
	Family Bunodidæ:				
31	*Leiotealia badia*	2779	53 06 00 S.	70 49 30 W.	77½
	Family Phyllactidæ:				
32	*Oulactis californica*		Pichilingue Bay.		
33	*Cradactis digitata*	2766	36 47 00 S.	56 23 00 W.	10½
	Order Stichodactylinæ:				
	Family Corallimorphidæ:				
34	Corallimorphus profundus	2839	33 08 00 N.	118 40 00 W.	414
	Family Discosomidæ:				
35	Discosoma fuegiensis	2767	40 03 00 S.	58 56 00 W.	52
	Tribe Ceriantheæ:				
36	*Cerianthus vas*	2838	28 12 00 N.	115 09 00 W.	44

NOTE.—The species in *italics* are described for the first time in this report.

Hertwig ('82), as the result of his investigation of the *Challenger* Actiniaria, drew attention to two features presented by some deep-sea forms which marked them out from those living in shallower water, namely the retrogression of the tentacles to stomidia and the unusual arrangement of the mesenteries. The *Albatross* collection seems to lessen somewhat the importance of the first of these peculiarities by suggesting the propriety of doing away with the genera *Polysiphonia* and *Liponema*, but the second characteristic receives some support in the discovery of *Oractis*, although the *Paractiniæ* have been removed from their high place. Two out of three of the genera forming the Tribe Protactiniæ are deep-sea forms, including under this head all those which live at depths approaching 500 fathoms.

It is doubtful, however, if any such limitation can be set to distinguish deep-sea for shallow-water forms. What we mean by deep-sea forms are forms which live under conditions as a rule only to be found in the deeper water, one of the most important of which is perhaps great and constant cold. This is a condition which may be obtained at various depths according to latitude, and it is quite possible, in fact it does happen, that forms which in more southern latitudes are found at 300 to 500 fathoms, may, in higher latitudes, occur at a depth of 30 to 50 fathoms. If, however, a limit is to be given I should suggest one much less than that proposed by Prof. Hertwig, perhaps as little as 100 fathoms. It would be better probably to allow the limit to vary, considering the zone at which the conditions are practically constant throughout the year to be the limit of true deep sea forms.

There is definite evidence of a wide bathymetrical distribution of deep-sea forms. For instance, *Corallimorphus profundus* was obtained by the *Challenger* from 1,375 to 2,025 fathoms, while the *Albatross* specimens were obtained from a depth of only 414 fathoms. So, too, we have seen that *Actinostola callosa* ranges from 50 to 812 fathoms, *Actinauge fastigata* from 300 to 980, and *A. Verrillii* from 30 to 677. Conversely also shallow water forms may extend down to depths sufficient to overlap the regions inhabited by what may be considered deep-water forms. For instance, *Antholoba reticulata* is typically a littoral form, yet the *Challenger* obtained it from a depth of 55 fathoms, a depth greater than the highest limit from which either *Actinostola callosa* or *Actinauge Verrillii* has been dredged.

Making allowance for such cases, however, it is not difficult to divide the Actiniaria into such forms as are typically deep-sea dwellers and those which inhabit shallower waters. Reviewing the various families as to their peculiarities in this respect, it will be found that certain groups may be assigned to one or other category, while others have representatives in both. Among these latter are the Edwardsiæ, Protactiniæ, Sagartidæ, Paractidæ and Corallimorphidæ; among the Sagartidæ the Sagartinæ are principally shallow-water forms, though some such as *Sagartia lactea* and *Adamsia* (?) *involvens* occur in deep water, while the Chondractininæ are essentially deep-water forms, though *Phellia* has several species dwelling in the littoral zone. The Paractidæ, too, though containing littoral forms are apparently more abundantly represented in deep water, and it is interesting to notice that in these as well as in the Chondractininæ, the deep-water forms are characterized by the thickness and firmness of the mesoglœa of the column walls. The Boloceridæ so far as known are deep-water forms, as are also the genera *Polystomidium*, *Polyopis*, and *Sicyonis;* and, on the other hand, the Antheadæ, Bunodidæ, Phyllactidæ, Heteractidæ, Thalassianthidæ, and in fact all the forms with abnormally-shaped tentacles, excluding those in which these structures are reduced to stomidia, are essentially inhabitants of shallow water. Perhaps an explanation of the development of fronds as in the Phyllactidæ and of branching and nodulose tentacles in shallow-water forms may be found in the greater or less mimicry of the plant forms, with which littoral actinians are associated, which is thus produced, and which would serve as a protection from carnivorous enemies.

As with the geographical distribution, however, much yet remains to be done before any proper generalizations as to the significance of and the causes which govern the bathymetrical distribution of the Actiniaria can be made, and the remarks here presented are simply a sketchy outline of some of the ideas that have suggested themselves during the investigation of the *Albatross* collection.

MAY, 1892.

APPENDIX.

Since the preceding report was completed I have had the opportunity of examining the collections of Actinians in the museum at Berlin, and also the *Challenger* collection in the Natural History Department of the British Museum, and must express my sincere thanks at this earliest opportunity to Prof. von Martens and Prof. Jeffrey Bell for the courtesy with which they acceded to my request to examine these very valuable collections and for their great kindness in affording me every facility for studying them. I also desire to state my obligations to my friend Prof. A. C. Haddon for many valuable suggestions and much interesting information with regard to the European *Chondractiniinæ*, as well as for the opportunity of examining the valuable collection of forms belonging to that group which he possesses.

As the result of my studies of these collections I have been able to confirm the correctness of certain suggestions made in the report, and also have obtained new light upon the identification of certain forms, and have thought it advisable to incorporate in this Report in the form of an appendix some of the more important of my results.

Anemonia variabilis (p. 147).—In the Berlin Museum are preserved the forms described by Studer ('78), which were collected by the *Gazelle* expedition, and among them is a form which seems to be identical with that described above as *Anemonia variabilis*. This is *Corynactis carnea*, Studer. In size and habitat it agrees very closely with the *Albatross* specimens, and the capitate character which Studer describes for the tentacles is not at all well pronounced. It was upon this character that Studer relied in assigning it to the genus *Corynactis*, but the tentacles are plainly arranged in cycles, a fact which may be deduced from his statement that the tentacles are "zahlreich in zwei Reihen." The similarity is so striking that, taking it into consideration with the fact that both have the same habit, and come from essentially the same locality and depth, I have no hesitation in pronouncing for its identity with the *Albatross* specimens, whose name should consequently be changed to *Anemonia carnea* (Studer).

Bolocera brevicornis (p. 158).—In the Report I have expressed my opinion that Hertwig's *Liponema multiporum* is a *Bolocera* from which all the tentacles have fallen away. After an examination of the *Challenger* specimens I feel more than ever convinced that such is the case. It is, however, as I suspected, specifically distinct from *B. brevicornis*.

Genus *Actinernus* (p. 165).—There can be no doubt but that Hertwig's *Polysiphonia tuberosa* properly belongs to the genus *Actinernus*, though its specific distinctness from all forms of that genus hitherto described is exceedingly probable.

It is interesting to note in connection with the extension of the geographical range of the genus from the western basin of the Atlantic to the Pacific that Haddon* has recently noted its occurrence in the eastern portion of the Atlantic, in 750 fathoms off the southwest coast of Ireland.

Actinostola callosa (p. 167).—Hertwig's *Dysactis crassicornis* is undoubtedly identical with this form. The description given by Verrill of *Urticina callosa* was published in '82, and Hertwig's report of the *Challenger* Actiniaria appeared in the same year, as did also a preliminary report.† It consequently is a question as to which name has the priority. There can be no question as to validity of Verrill's generic term, and it seems probable that his original description, which appeared in the March–April number of Silliman's American Journal of Science, slightly antedates Hertwig's preliminary report. Leaving this aside, however, it seems preferable to adopt Verrill's name in its entirety, since the term *crassicornis* has a prior association with a member of the genus *Tealia*.

Genus *Chitonanthus* (p. 189).—In establishing this genus I have laid stress upon two features: the presence of capitular ridges and the absence of bulbous enlargements at the bases of the tentacles. The unsatisfactory nature of the classification of the Chondractininæ alluded to above is principally due to the importance bestowed upon the nature and arrangement of the tubercles. The specimens of *Chitonanthus pectinatus* in the *Albatross* show of how little importance this feature may be in some cases, and it seems advisable to seek for some more constant characters. It is possible that these are to be found in the nature of the capitulum and of the bases of the tentacles. The genus *Actinauge* seems well marked off, but this is not the case with *Chondractinia*, *Chitonactis*, and *Hormathia*, genera established principally on the nature of the tubercles, or on their arrangement. It is not improbable that it will prove necessary to fuse these genera into one, removing from it, however, Hertwig's *Chitonanthus* (*Phellia*) *pectinatus* and Haddon's

* A. C. Haddon.—Report on the Actiniæ dredged off the southwest coast of Ireland in May, 1888. Proc. Roy. Irish Acad., 3d ser., Vol. I, 1890.

† Sitzungsber. Jenaisch. Gesellsch, 1882.

Hormathia Andersoni, both of which have been referred by the latter author to the genus *Hormathia*.

The Chondractininæ, if this suggestion prove worthy of acceptance, would then consist of the genus *Hormathia* characterized by the presence of tubercles and a smooth capitulum, and by the absence of bulbous enlargements at the bases of the tentacles; the genus *Actinauge* possessing tubercles, a ridged capitulum, and bulbous enlargements to the tentacles; *Chitonanthus* with tubercles, and capitular ridges, but without tentacular bulbs; and *Stephanactis*, if it prove to be a "good" genus, without tubercles, capitular ridges, or tentacular bulbs, but with a clasping base. To these it may be necessary to add *Phellia* without tubercles, capitular ridges, or tentacular bulbs and without a clasping base.

NOVEMBER 8, 1892.

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EXPLANATION OF PLATES.

ac	acontia.	*m*	muscles.
bm	basal muscle.	*mes*	mesentery.
cap	capitulum.	*mf*	muscle fibres.
col	column wall.	*mg*	mesoglœa.
cor	coronal tubercle.	*nem*	nematocysts.
cr	capitular ridges.	*ov*	ova.
cu	cuticle.	*pbm*	parieto-basilar muscle.
D	directive mesenteries.	*sph*	sphincter muscle.
d	disc.	*st*	stomatodæum.
ec	ectoderm.	*t*	tentacle.
en	endoderm.	*te*	testis.
f	foreign incrustations on the column wall.	*tm*	transverse muscles.
		tsp	sphincter of tentacle.
lm	longitudinal muscles.	*tu*	tubercle.

PLATE XIX.

Fig. 1. *Edwardsia intermedia.* Nat. size.

2. Transverse section through introverted scapus of *E. intermedia.* Zeiss A 2.

3. Transverse section through mesentery of *E. intermedia.* Zeiss A 2.

4. Transverse section of column wall of *E. intermedia*, passing through a tubercle. Zeiss D 2.

5. *Oractis diomedeæ*, viewed from the side. Nat. size.

6. *Oractis diomedeæ*, viewed from above. Nat. size.

7. Transverse section of tentacle of *O. diomedeæ* near its base. Zeiss A 2.

8. Transverse section of column of *O. diomedeæ.* The roman numerals indicate the probable embryological succession of the mesenteries. (An error has been made in the reproduction of this figure. The mesentery numbered V should be I, and the imperfect mesentery intervening between this and III should be V.)

PLATE XX.

Fig. 9. Transverse section of a perfect mesentery of *O. diomedeæ.* Zeiss a 2.

10. Transverse section cutting column wall, disc and base of the tentacles of *O. diomedeæ.* Zeiss A 2.

11. Longitudinal section through margin and upper part of the column wall of *O. diomedeæ.* Zeiss a 2.

12. *Halcurias pilatus.* Nat. size.

13. Transverse section through mesentery of *H. pilatus.* Zeiss A 2.

PLATE XXI.

Fig. 14. Transverse section through the upper part of the column of *H. pilatus.* a 2.

15. Transverse section through ectoderm of the column wall of *H. pilatus.* Zeiss D 2.

16. *Peachia Koreni.* Nat. size.

17. Transverse section through a mesenterial filament of *Actinia infecunda.* Zeiss D 2.

18. *Anemonia variabilis.* Nat. size.

19. Transverse section through the column of *A. variabilis.* *x* and *y* denote areas where the regular sequence of perfect and imperfect mesenteries is interfered with. x about 10.

20. *Condylactis cruentata.* Nat. size.

21. Transverse section of primary mesentery of *Condylactis cruentata.* Zeiss a 2.

22. *Myonanthus ambiguus.* Nat. size.

PLATE XXII.

Fig. 23. Transverse section of sphincter muscle of *M. ambiguus.*

24. Transverse section of sphincter muscle of *Bolocera occidua.* Zeiss a 2.

25. Portion of transverse section of primary mesentery of *B. occidua.* Zeiss A 2.

26. Portion of transverse section of a tentacle of *B. occidua.* Zeiss a 2.

27. Basal portion of longitudinal section through a tentacle of *B. occidua.* Zeiss A 2 unscrewed.

28. Portion of transverse section of a tentacle of *B. pannosa.* Zeiss A 2.

29. Transverse section through a perfect mesentery of *B. pannosa.* Zeiss A 2.

PLATE XXIII.

Fig. 30. Transverse section of the sphincter muscle of *B. pannosa.* Zeiss A 2.

31. Transverse section of the sphincter muscle of *B. brevicornis.* Zeiss a 2.

32. Outer portion of transverse section of mesentery of *B. brevicornis.* Zeiss A 2.

Fig. 33. Inner portion of transverse section of mesentery of *B. brevicornis.* Zeiss A 2.
34. *Paractis lineolata.* Nat. size.
35. Transverse section of imperfect mesentery of *Paractis lineolata.* Zeiss a 2.
36. Transverse section of sphincter muscle of *P. lineolata.* Zeiss a 2.
37. *Paractis rinosa.* Nat. size.
38. Transverse section of tentacle of *P. rinosa.* Zeiss A. 2.
39. Portion of transverse section of mesentery of *P. rinosa.* Zeiss A 2.
40. Portion of transverse section of sphincter muscle of *P. rinosa.* Zeiss D 2

PLATE XXIV.

Fig. 41. Transverse section of sphincter of *P. rinosa.* Zeiss a 2.
42. Transverse section (somewhat oblique) of base of a tentacle of *Actinernus plebeius.* Zeiss A 2.
43. Portion of transverse section of sphincter muscle of *A. plebeius.* Zeiss A 2.
44. Portion of transverse section of primary mesentery of *A. plebeius.* Zeiss A 2.
45. Transverse section of mesentery of *A. plebeius.* Zeiss a 2.
46. Section, partly diagrammatic, showing the arrangement of the mesenteries of *Actinostola callosa.*

PLATE XXV.

Fig. 47. *Actinostola callosa.* Nat. size.
48. Transverse section of a tentacle of *A. callosa.* Zeiss A 2.
49 and 50. Transverse section of a perfect mesentery of *A. callosa.* Zeiss A 2.
51. Transverse section of sphincter muscle of *A. callosa.* x 2.
52. Portion of transverse section of sphincter muscle of *A. callosa.* Zeiss A 2.

PLATE XXVI.

Fig. 53. *Actinostola excelsa.* Nat. size.
54. Transverse section of sphincter muscle of *A. excelsa.* Zeiss a 2.
55. Transverse section of perfect mesentery of *A. excelsa.* Zeiss a 2.
56. Transverse section of portion of a tentacle of *A. excelsa.* Zeiss a 2.
57. *Actinostola pergamentacea.* Nat. size.
58. Tangential section of portion of the disk of a specimen of *Actinostola pergamentacea.* Zeiss A 2.

PLATE XXVII.

Fig. 59. Transverse section of sphincter muscle of *A. pergamentacea.* Zeiss a 2.
60. Portion of transverse section of a tentacle of *A. pergamentacea.* Zeiss A 2.
61. Portion of transverse section of mesentery of *A. pergamentacea.* Zeiss D 2.
62. Outer portion of transverse section of mesentery of *A. pergamentacea* above the level of the parieto-basilar muscle. Zeiss a 2.
63. Middle portion of same section as that from which Fig. 4 was drawn.
64. *Pycnanthus maliformis.* Nat. size.
65. Transverse section of sphincter muscle of *P. maliformis.* x 4.
66. Portion of transverse section of sphincter muscle of *P. maliformis* from the region indicated in Fig. 65. Zeiss D 2.
67. Transverse section through a perfect mesentery of *P. maliformis.* Zeiss a 2.

PLATE XXVIII.

Fig. 68. Tangential section through disk of a specimen of *P. maliformis.* Zeiss A 2.
69. *Cymbactis faculenta.* Nat. size.
70. Transverse section of sphincter muscle of *C. faculenta.* Zeiss a 2.
71. Transverse section of mesentery of first cycle of *C. faculenta.* Zeiss a 2.
72. *Sagartia lactea.* Nat. size.

Fig. 73. Transverse section of sphincter muscle of *S. lactea*. x about 2.
74. Transverse section of of primary mesentery of *S. lactea*. Zeiss a 2.
75. Transverse section of acontium of *S. lactea*. Zeiss D 2.

PLATE XXIX.

Fig. 76. Portion of transverse section of sphincter muscle of *S. lactea*. Zeiss A 2.
77. *Sagartia Sancti Mathæi*. Nat. size.
78. Transverse section of sphincter of *S. Sancti Mathæi*. Zeiss A 2.
79. *Sagartia paradoxa*. Nat. size.
80. Transverse section of sphincter muscle of *S. paradoxa*. Zeiss A 2.
81. Transverse section of a directive mesentery of *S. paradoxa*.
82 and 83. *Adamsia? involvens*. Nat. size.

PLATE XXX.

Fig. 84. Semidiagrammatic section through the column of *S. paradoxa*, showing the arrangement of the mesenteries. The roman numerals indicate the cycles of mesenteries, *x* and *y* the abnormal pairs.
85. Transverse section of sphincter muscle of *A. involvens*.
86. Transverse section of sphincter muscle of *Actinauge Verrillii*. Zeiss A 2.
87. Transverse section through the upper third of the sphincter muscle of *A. Verrillii*. Zeiss A 2.
88. Transverse section through the lower third of the sphincter muscle of *A. Verrillii*. Zeiss A 2.
89. Portion of upper part of column of *A. Verrillii*, the specimen having been divided longitudinally. Nat. size.

PLATE XXXI.

Fig. 90. Transverse section of mesentery of the second cycle of *A. Verrillii*. Zeiss A 2.
91. Transverse section through the base of a tentacle of *A. Verrillii*. Zein A 2.
92. Outer portion of transverse section of a mesentery of the first cycle of *A. Verrillii*. Zeiss A 2.
93. *Actinauge fastigata*. Nat. size.
94. Transverse section of the sphincter muscle of *A. fastigata*.
95. Transverse section of the lower part of the sphincter muscle of *A. fastigata*. Zeiss A 2.
96. Transverse section of the upper part of the sphincter muscle of *A. fastigata*. Zeiss A 2.
97. Transverse section of a mesentery of the first cycle of *A. fastigata*. Zeiss A 2.

PLATE XXXII.

Fig. 98. *Chitonanthus pectinatus*. Nat. size.
99. View of surface of a dissected specimen of *C. pectinatus* which had been divided longitudinally. Nat. size.
100. Transverse section of the sphincter muscle of *C. pectinatus*. x 4.
101. Transverse section of portion of the sphincter muscle of *C. pectinatus*. Zeiss a 2.
102. Transverse section of a mesentery of the first cycle of *C. pectinatus*. Zeiss a 2.
103. *Stephanactis hyalonematis*. Nat. size.
104. Transverse section of sphincter muscle of *Leiotealia badia*. Zeiss A 2.
105. *Oulactis californica*. Nat. size.

PLATE XXXIII.

Fig. 106. Transverse section of primary mesentery of *L. badia.* Zeiss A 2.
107. Transverse section of a mesentery of the first cycle of *O. californica.*
108. Transverse section of sphincter muscle of *O. californica.* Zeiss A 2.
109. Portion of margin of *Cradactis digitata*, showing the tentacles and the fronds. x 2.
110. View of frond of *C. digitata.* Enlarged.
111. Transverse section of sphincter muscle of *C. digitata.* Zeiss A 2.
112. Transverse section of directive mesentery of *C. digitata.* Zeiss a 2.

PLATE XXXIV.

Fig. 113. Transverse section of sphincter muscle of *Discosoma fuegiensis.* Zeiss a 2.
114. Transverse section of the mesentery of the second cycle of *Discosoma fuegiensis.* Zeiss a 2.
115. Transverse section of sphincter muscle of *Anemonia? inequalis.* Zeiss a 2.
116. Transverse section of a portion of the column of *A. inequalis.* Zeiss a 2.
117. *Cerianthus vas.* Nat. size.
118. Dorsal portion of transverse section of the upper part of the column of *C. vas.* Zeiss a 2.
119. Transverse section through gonophoric region of a mesentery of *C. vas.* Zeiss D 2.

PLATE XXXV.

Fig. 120. Transverse section through the middle of the column of *C. vas.* * points to the fusion of two mesenteries.
121. Diagram showing the relation of the tentacles to the capitular ridges in *Actinauge Verrillii.*

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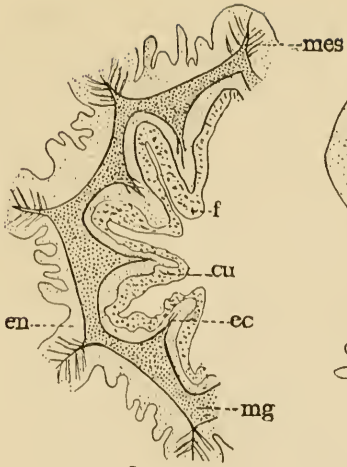

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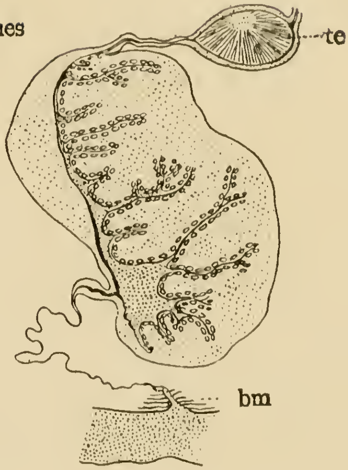

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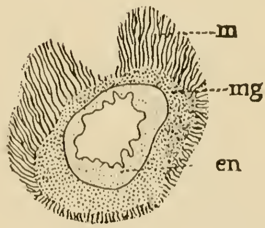

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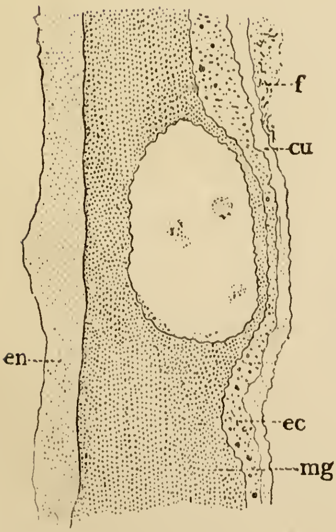

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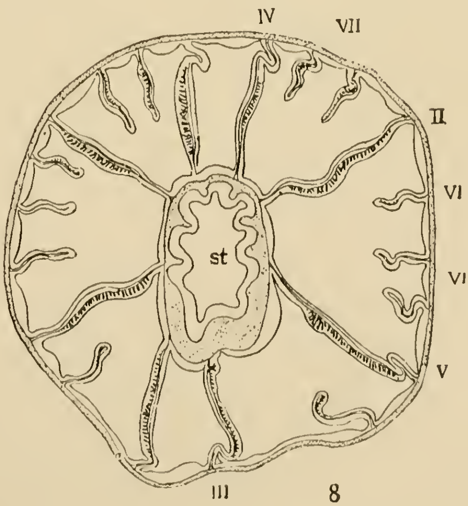

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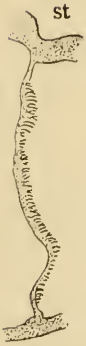
1-4. *Edwardsia intermedia.* 5-8. *Oractis Diomedeæ.*



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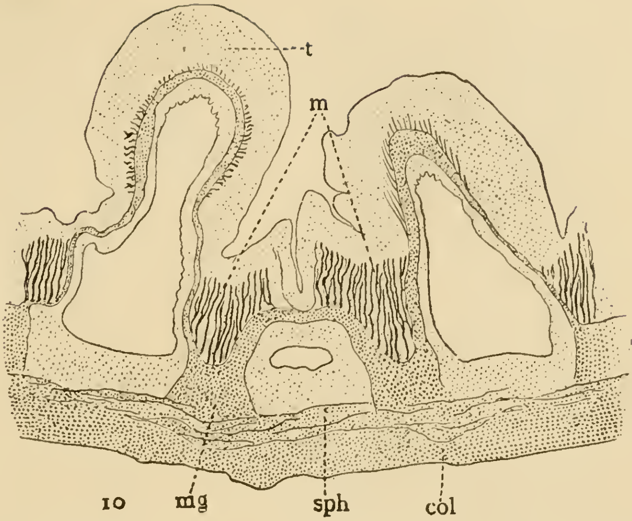

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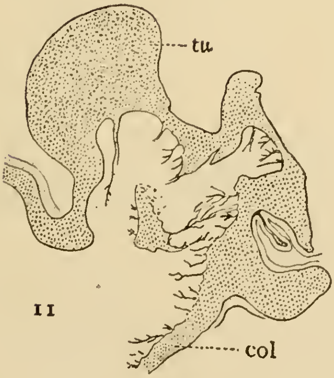

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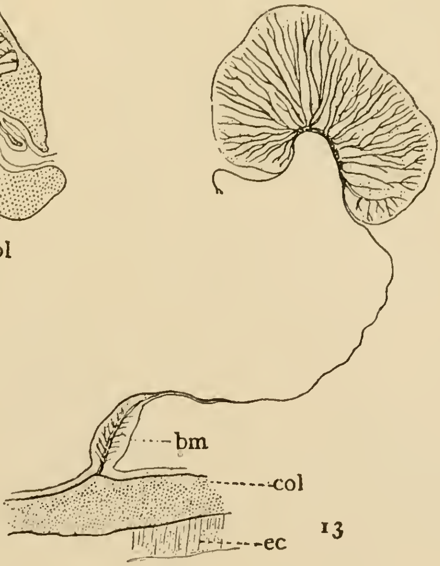

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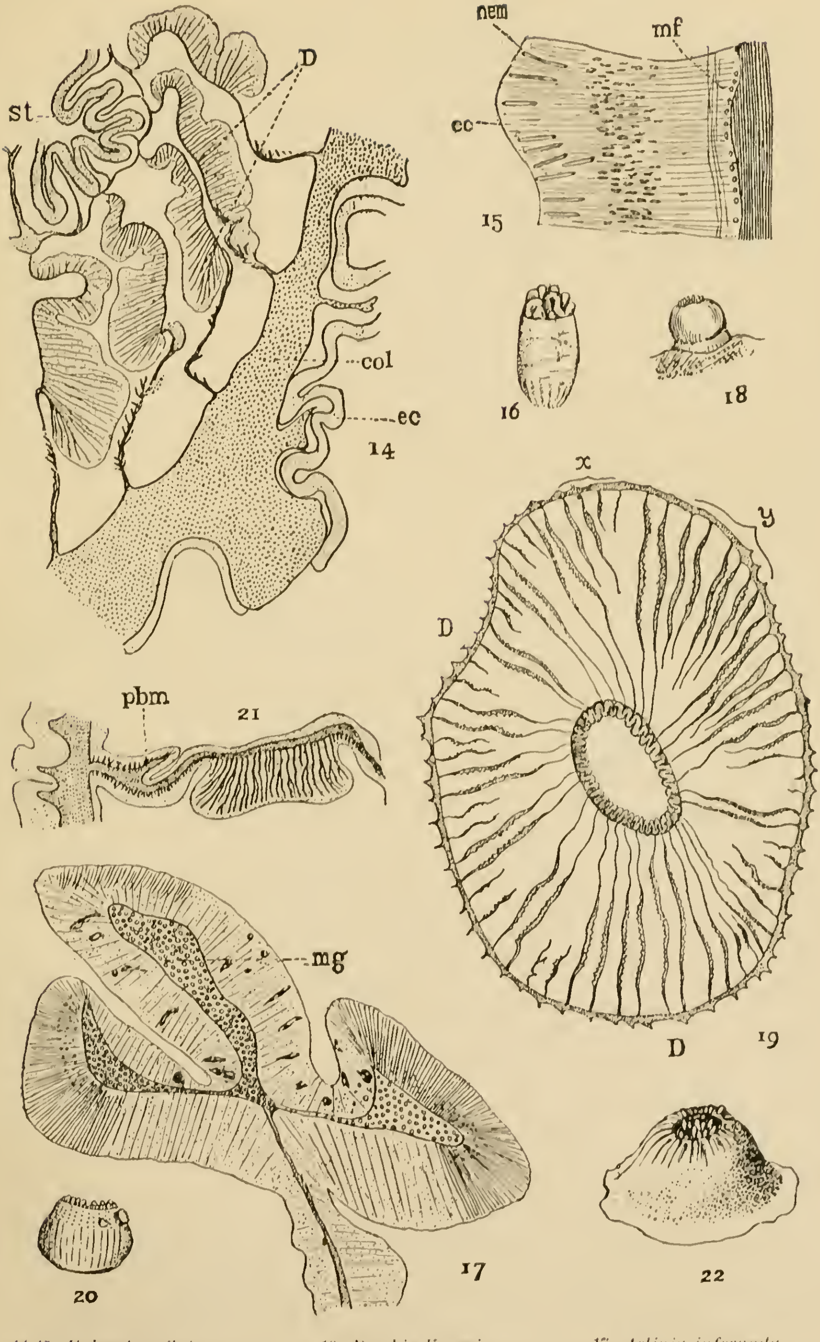
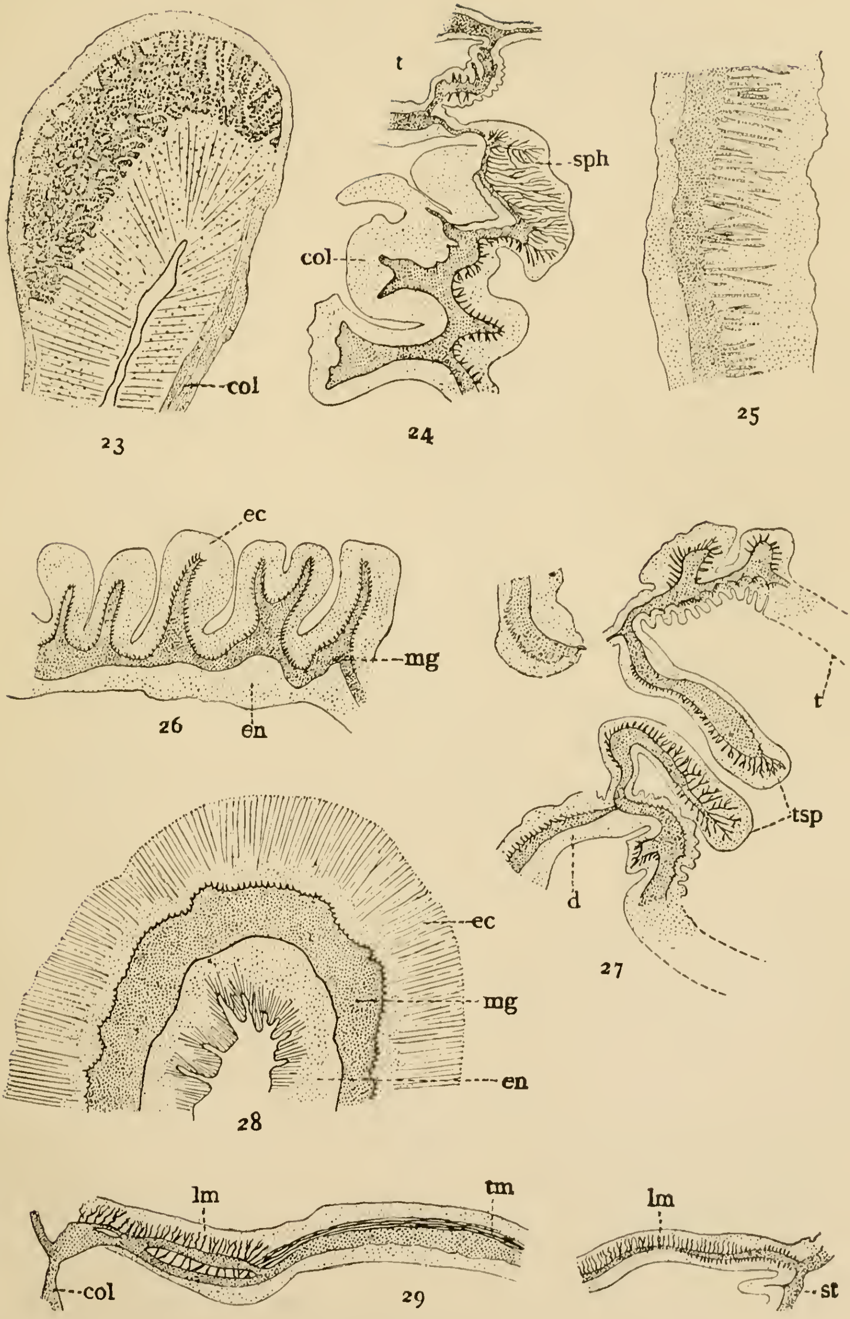
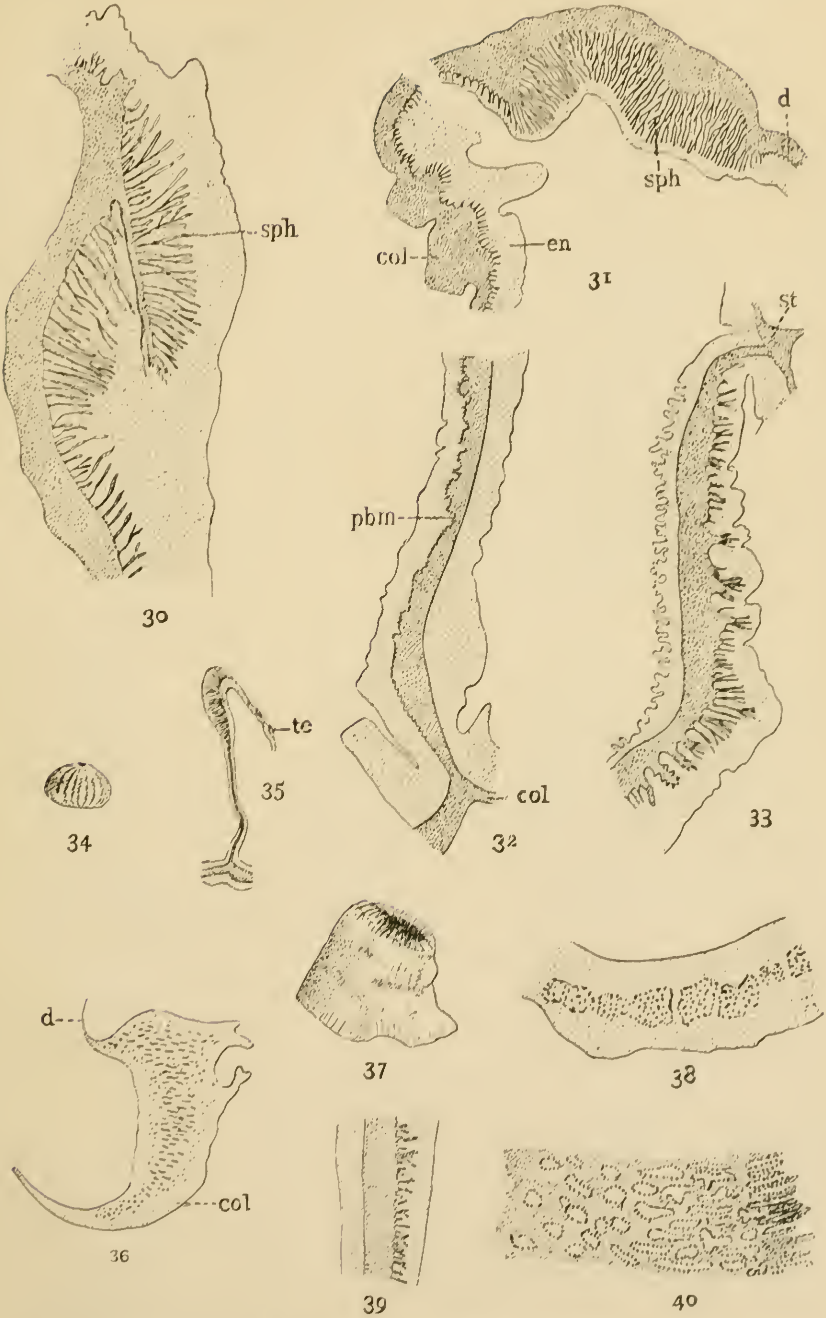
9–11. *Oractis Diomedeæ.* 12–13. *Halcurias pilatus.*



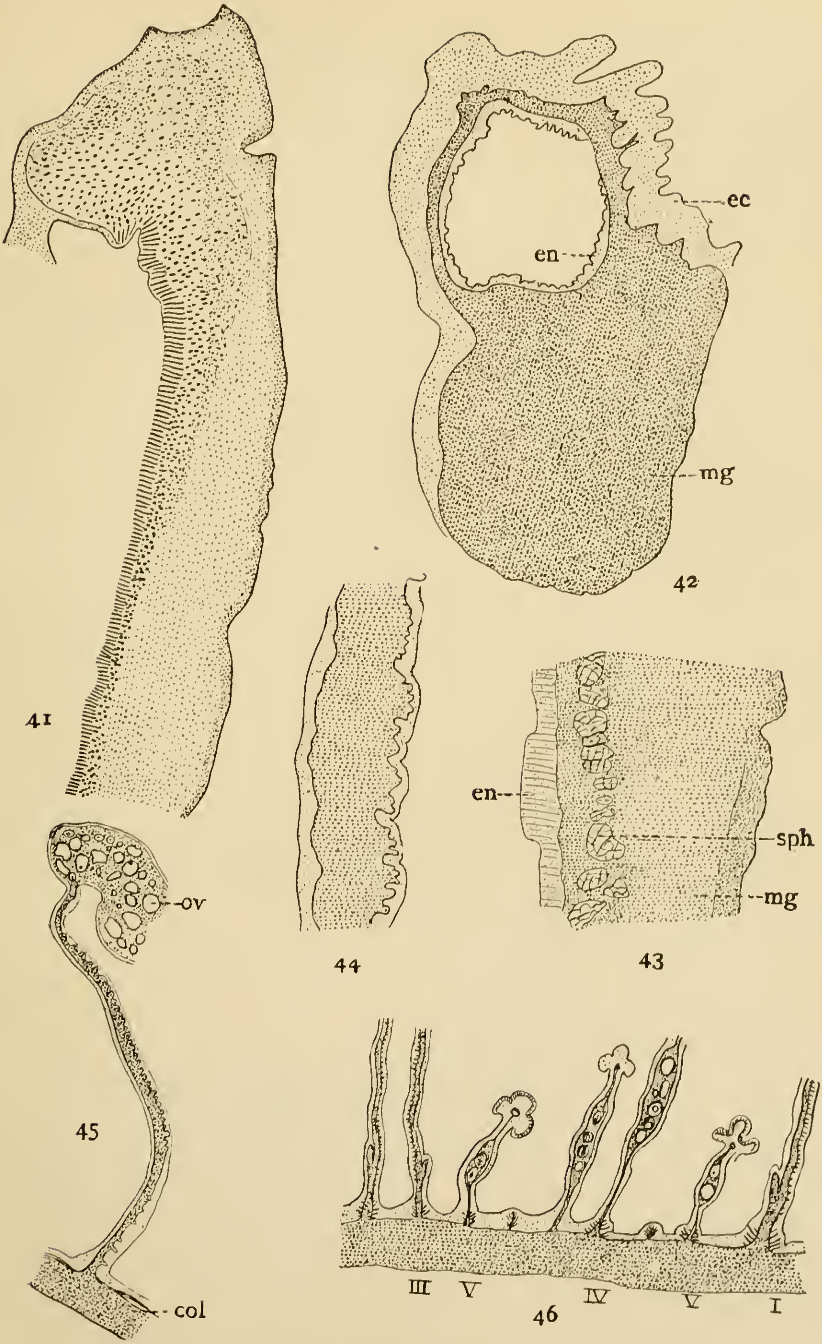
14-15. *Halcurias pilatus.* 16. *Peachia Koreni.* 17. *Actinia infecunda.*
18-19. *Anemonia variabilis.* 20-21. *Condylactis cruentata.* 22. *Myonanthus ambiguus.*



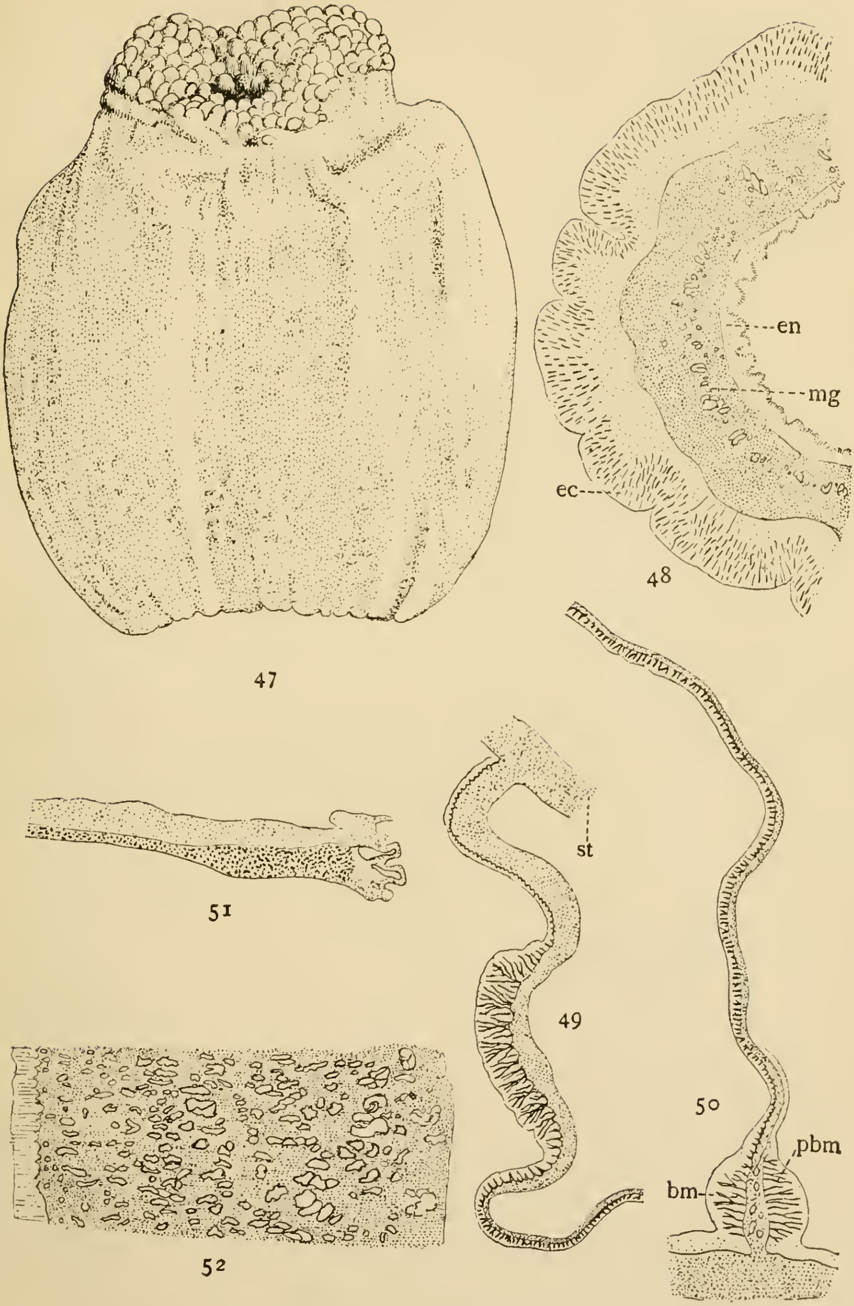
23. *Myonanthus ambiguus.* 24-27. *Bolocera occidua.* 28-29. *B. pannosa.*



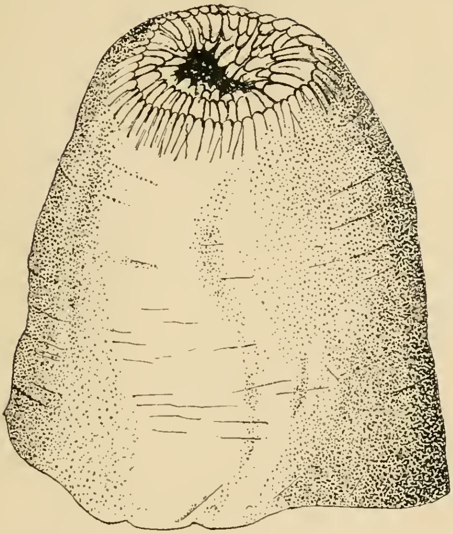
30. *Bolocera pannosa.* 31-33. *B. brevicornis.* 34-36. *Paractis lineolata.* 37-40. *P. rinosa.*



41. *Paractis vinosa.* 42–45. *Actinernus plebeius.* 46. *Actinostola callosa.*



47–52. *Actinostola callosa.*



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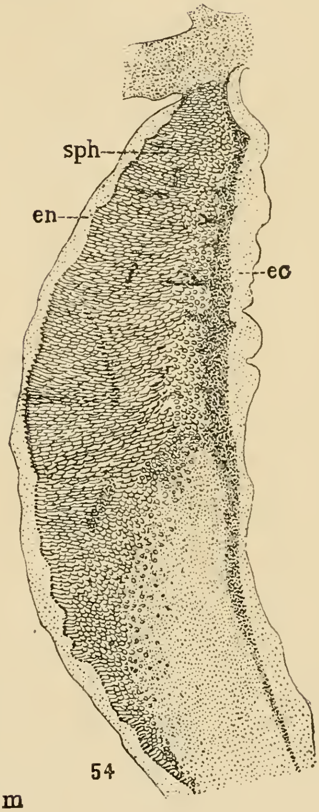

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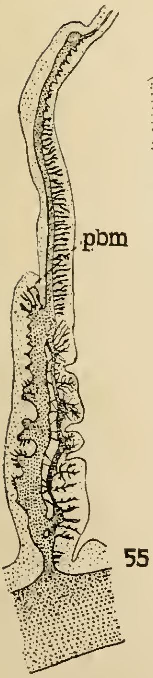

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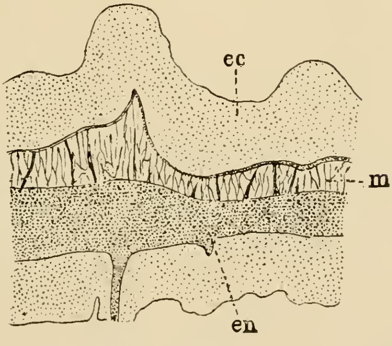

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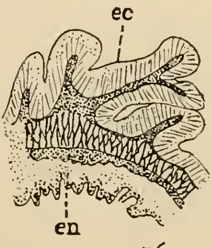

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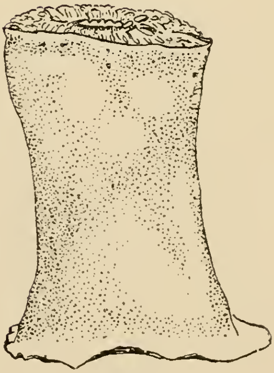

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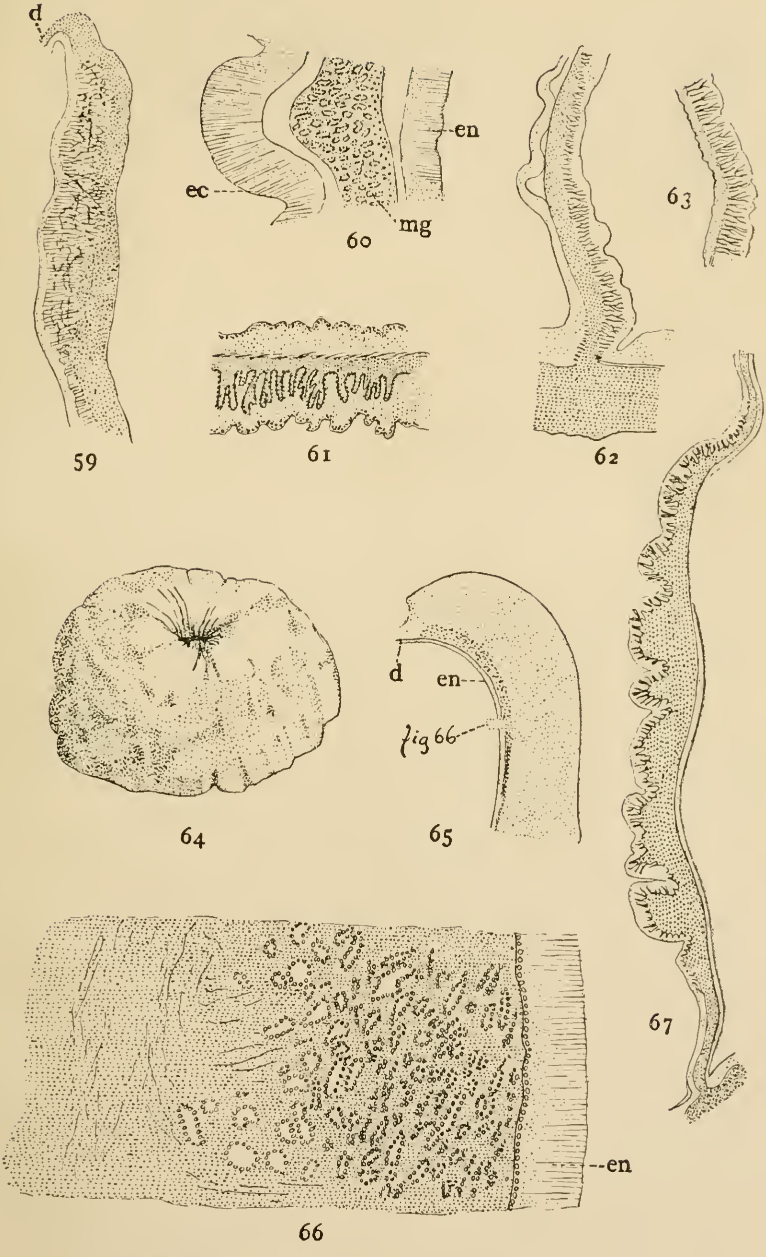
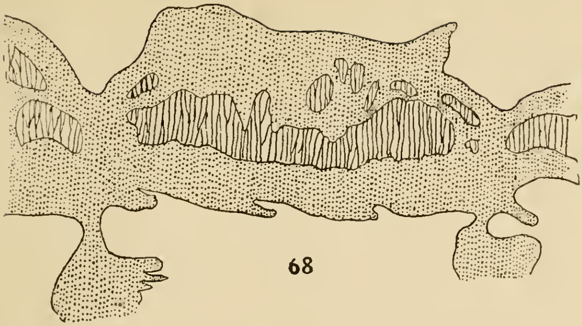
53-56. *Actinostola excelsa*. 57-58. *A. pergamentacea*.



59-63. *Actinostola pergamentacea.* 64-67. *Pycnanthus maliformis.*



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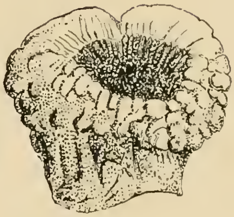

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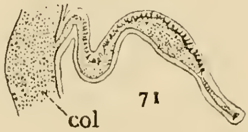

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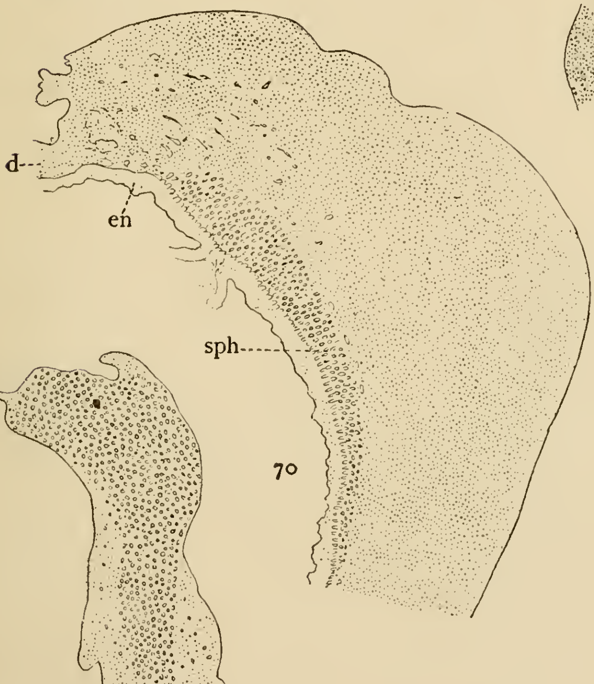

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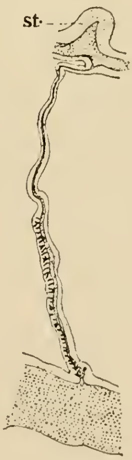

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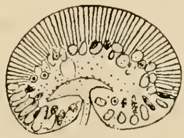

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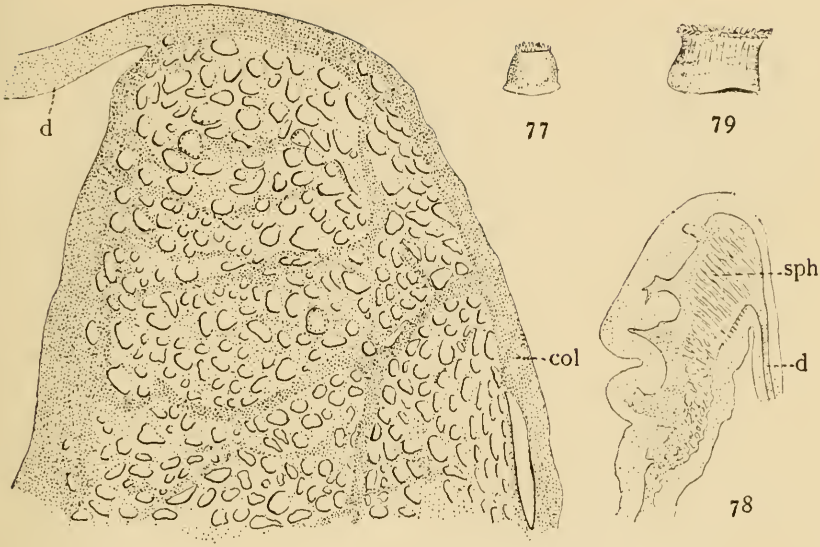
68. *Pycnanthus maliformis.* 69–71. *Cymbactis fœculenta.* 72–75. *Sagartia lactea.*



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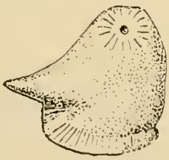

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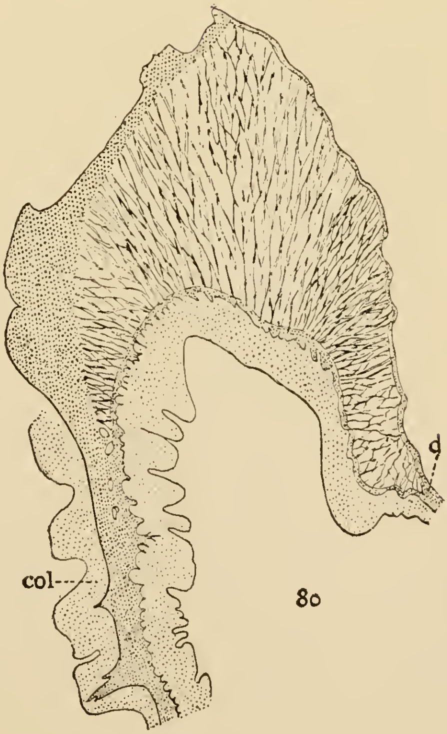

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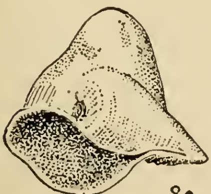

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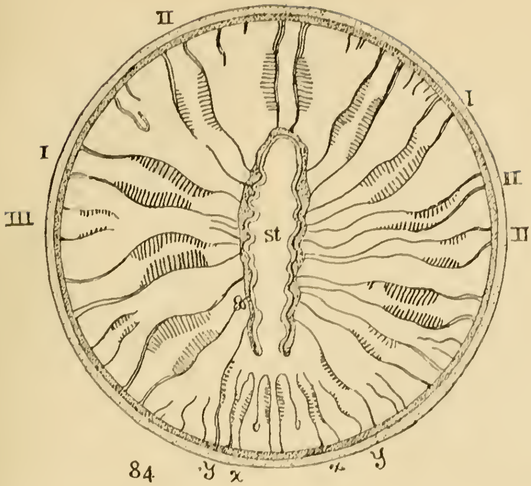
76. *Sagartia lactea.* 77-78. *S. Sancti Mathæi.*
79-81. *S. paradoxa.* 82-83. *Adamsia (?) involvens.*



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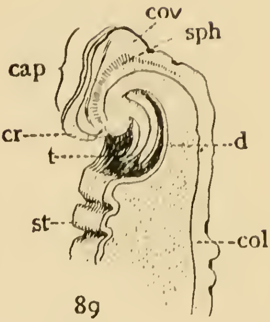

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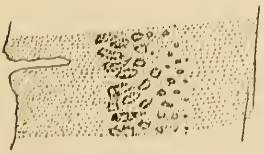

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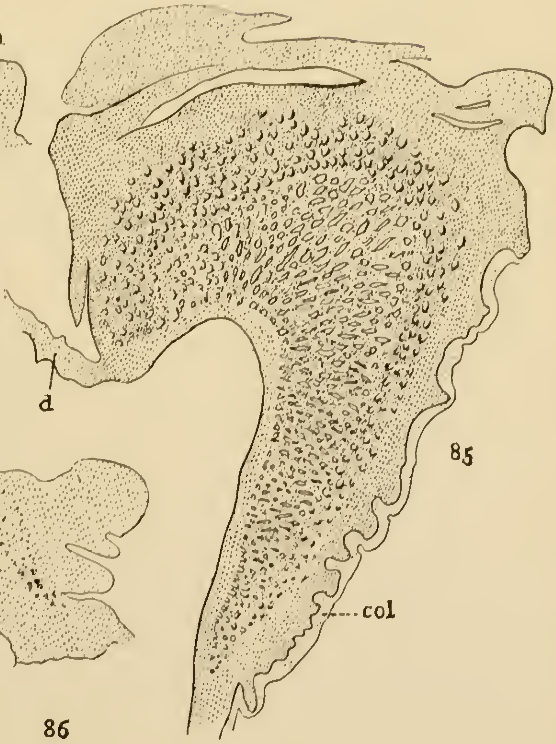

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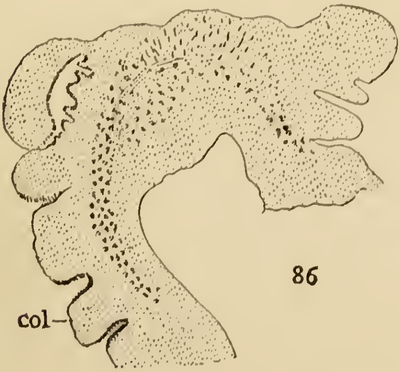

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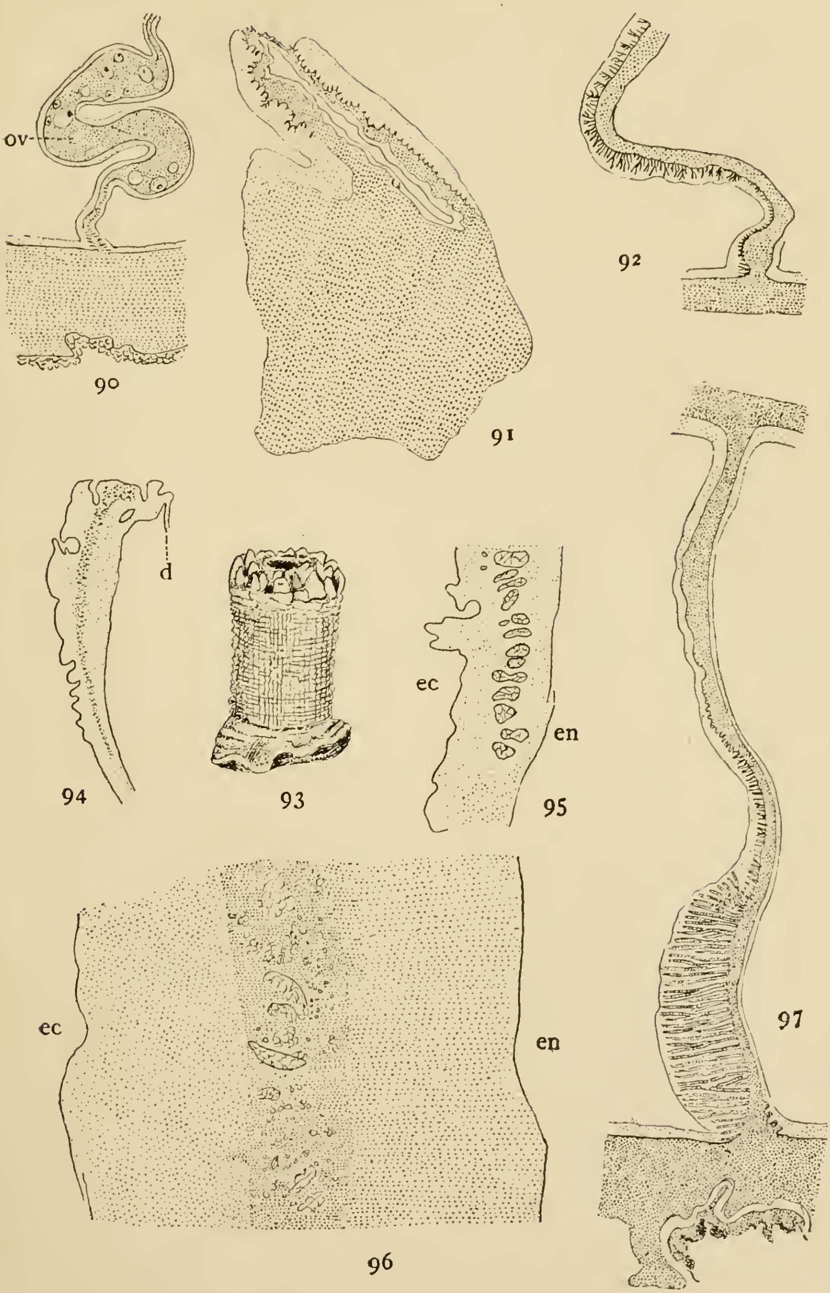
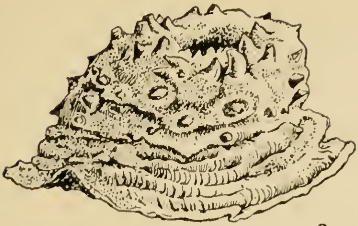
84. *Sagartia paradoxa.* 85. *Adamsia (?) involvens.* 86-89. *Actinauge Verrillii.*



90–92. *Actinauge Verrillii*. 93–97. *A. fastigata*.



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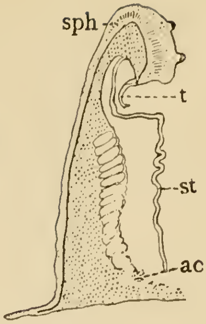

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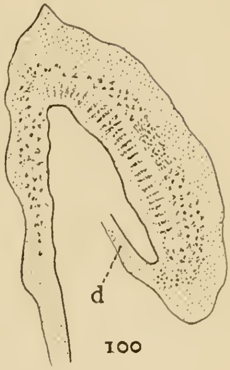

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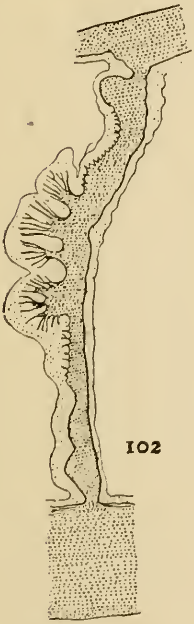

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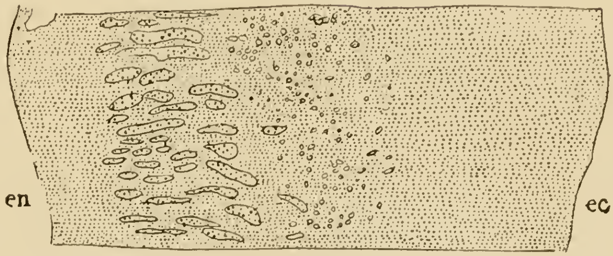

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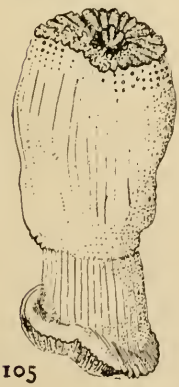

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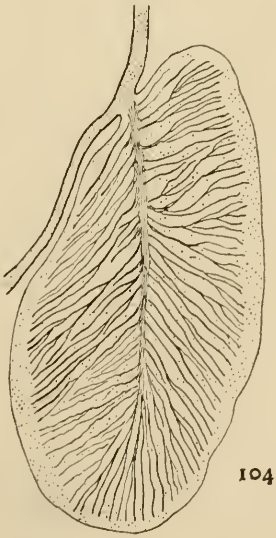

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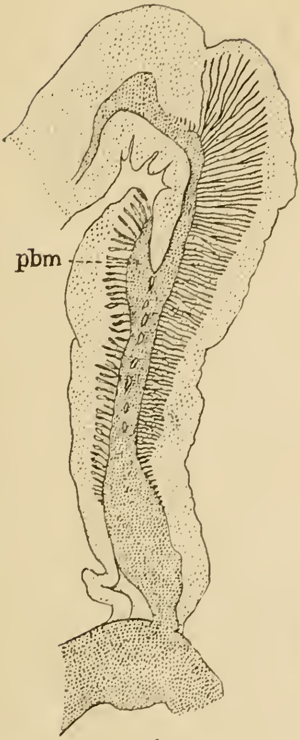
98–102. *Chitonanthus pectinatus.* 103. *Stephanactis hyalonematis.*
104. *Leioteatia badia.* 105. *Oulactis californica.*



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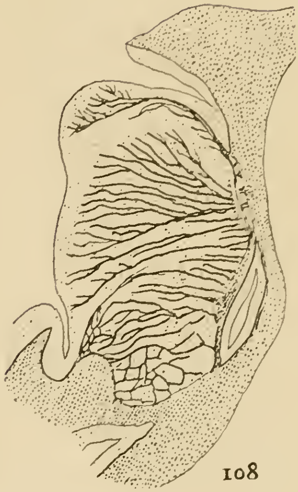
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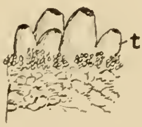

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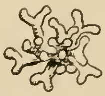
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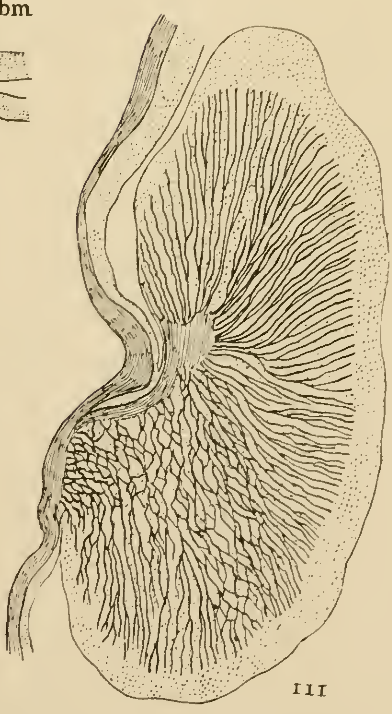
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106. *Leiotealia badia.* 107–108. *Oulactis californica.* 109–112. *Cradactis digitata.*

113

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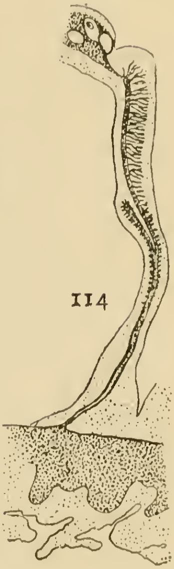
117



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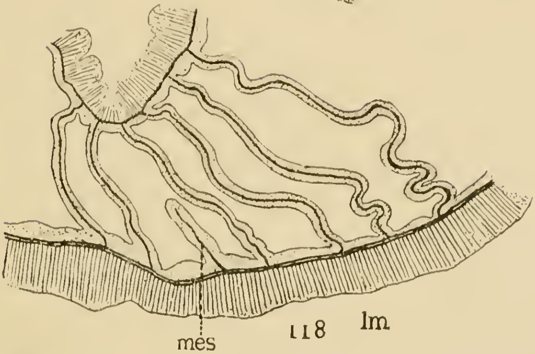

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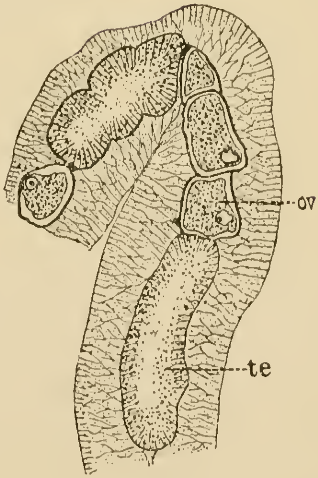

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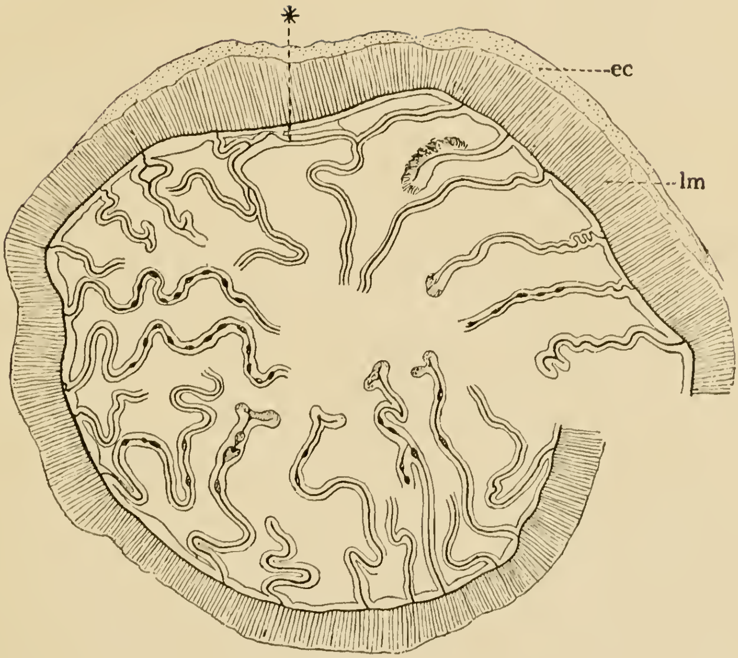
113-114. *Discosoma fuegiensis.* 115-116. *Anemonia* (?) *inequalis.* 117-119. *Cerianthus vas.*



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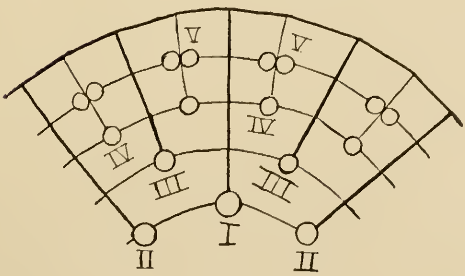

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120. *Cerianthus vas.* 121. *Actinauge Verrillii.*