

Fauna Chilensis.

Abhandlungen

zur

Kenntniss der Zoologie Chiles

nach den Sammlungen

von

Dr. L. Plate.

Dritter Band.

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The Actiniae of the Plate Collection.

By

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With plates 14–19 and 5 fig. in the text.

Our present knowledge of the Actinian fauna of the coast of Chili is due almost entirely to expeditions which have touched at various points in the course of prolonged voyages and while the sum total of the results so obtained is by no means inconsiderable, the individual results of each expedition have, as a rule, been comparatively slight. The first expedition to yield actinological results was that of the "Coquille", the Actinians obtained having been described by LESSON in 1830. Slightly later, in 1835, J. F. BRANDT described a single species from the neighbourhood of Valparaiso and in 1846 the results of the U. S. Exploring Expedition, described by DANA, added materially to the number of known forms. In 1854 GAY published descriptions of a number of forms from Chiloe and in 1857 MILNE EDWARDS described a single form under the name of *Cystiactis eydouxi*. In all these cases the descriptions lack much of what is necessary for the correct determination of the position of the various forms in our modern system classification, and only in the publications of LESSON and DANA are the descriptions accompanied by figures.

More recent contributions have been made by VERRILL, who described three forms from the Peruvian Coast in 1869, by STUDER,

who in 1878 made known a couple of Patagonian forms collected by the "Gazelle", and by RIDLEY, who reported in 1881 on the coelenterata collected by the "Alert", during a survey of the Straits of Magellan.

The descriptions of these authors are, however, also more or less incomplete, and it is not until 1882 and 1888, when the Actiniaria of the "Challenger" Expedition were described by RICHARD HERTWIG, that attention was given to the anatomical details of South American actinians. In 1893 I published a report on the forms obtained by the "Albatross" during a voyage from New York to San Francisco, and in 1896 KWIEŃNIEWSKI published a revision of the forms previously described by STUDER. Finally in 1899 CARLGREN gave in a preliminary form his observations on the species collected by the "Eugenia" Expedition (1851—53), the German South-pole Expedition (1882—83), the Hamburg Magellan Expedition (1892—93) and the Swedish Expedition to Tierra del Fuego (1895—96).

The PLATE collection compared with most of its predecessors is rich both in individuals and species and contains representatives from various localities along the coast from Iquique on the north to Punta Arenas on the south. It has yielded important results in clearing up with a considerable amount of certainty the identity of some of the forms described by earlier authors, and by perfecting our knowledge of the Chilean fauna by the addition to it of a number of forms it has served to confirm our previous ideas as to the general characters of the actinian fauna of this coast, so excellently expressed by CARLGREN (1899).

Order Actiniaria (DANA) VAN BENEDEN.

The term Actiniaria has been used by different authors with somewhat different limitations. It was introduced by DANA (1846) as a suborder of Actinoidea and included all the Anthozoa (including *Lucernaria*) with the exception of the Alcyonaria. MILNE-EDWARDS (1857) employed the term as an alternative for his Zoantharia malacodermata, a group which excluded all forms possessing a definite corallum and also *Lucernaria*. In this sense it was at first employed by VERRILL (1864), although in a later paper he re-included the Antipatharia in the group.

In 1870 GRAY still further reduced the contents of the group by separating from it the Zoantheae, an arrangement followed later by KLUNZINGER (1877). ANDRES (1883) returned to the use of the

word as employed by MILNE-EDWARDS and in this sense it was also employed by R. HERTWIG in 1882 and 1888 and by various later authors such as HADDON, CARLGRÉN, DUERDEN and myself. In 1898, however, it was employed by VAN BENEDEN with a very extensive modification of its meaning, both the Zoantheae and Ceriantheae being withdrawn from it; in the following year it was used by CARLGRÉN (1899) in the same sense and it is in this sense that I use it here.

It includes, consequently, the orders Edwardsiae Protactiniae and Hexactiniae of my earlier classification (1893), a fusion of these orders being demanded by the recent work demonstrating the existence in certain Edwardsiae of a Hexactinian type of structure. In one respect the group seems likely to require modification in the future to the extent of including in it certain of the Madreporaria, as was suggested by R. HERTWIG. Our knowledge of the corals indicates strongly a necessity for regarding the presence or absence of a corallum as a quite subordinate matter, but since it seems probable from DUERDEN's recent work on *Porites* that the Madreporaria do not constitute a homogeneous group and until we are in possession of definite information as to whether the relations of the hexamerous corals to the Actiniaria are monophyletic or polyphyletic, it seems advisable to retain the two groups separate.

A concise definition of the group as thus limited is rather difficult, owing to the variations presented by different forms from almost every one of the features which may be regarded as typical. It may be stated however, in some such words as these.

Anthozoa, solitary or but rarely approximating to a colonial condition; destitute of a corallum. The mesenteries not less than eight in number constituting four primary couples arranged symmetrically on either side of the sagittal axis; four of these mesenteries situated in pairs at each extremity of the sagittal axis, have, as a rule, their longitudinal muscles on the exocoelic faces and form what are termed the directives mesenteries. Additional mesenteries belonging to one or more sets which appear successively, may be present; the first set consists of two secondary couples which form pairs having their longitudinal muscles on the endocoelic faces with the lateral mesenteries of the primary couples and thus complete a primary cycle of six pairs, the second set consists of a couple or two, four or six pairs with their longitudinal muscles on their endocoelic faces occurring in two or more of the primary exocoels (rarely the

endocoels); the third set consists of one or more cycles of pairs with their longitudinal muscles on their endocoelic faces, developed in all the exocoels present at the time of their development. In consequence of this mode of development of the mesenteries in cycles of pairs the symmetry is usually hexamerous after the development of the primary pairs, but occasionally one or more pairs of the secondary or later cycles may be suppressed, an octamerous, decamerous or rarely an heptamerous symmetry being thus produced. The symmetry may also be disturbed by the formation of more than two pairs of directive mesenteries or by one or both of those usually present developing their longitudinal muscles on their endocoelic faces.

Suborder *Actininae* ANDRES 1883.

Actiniaria with usually simple tentacles arranged in single or alternating cycles corresponding to the mesenteries, any one endocoel or exocoel having but one tentacle communicating with it.

The arrangement of the Actiniaria in suborders must be regarded as provisional, especially so far as the suborder *Stichodactylinae* is concerned, since it seems not at all improbable that this is a composite group, the forms usually assigned to it having possibly a polyphyletic origin.

Family *Edwardsiidae*.

Actininae with a rounded base (physa), and with eight, twelve or fourteen perfect mesenteries; additional imperfect or rudimentary mesenteries may be present in the upper part of the column. Sphincter absent or weak, endodermal or mesogloea, longitudinal muscles circumscribed; parieto-basilar and basilar muscles equally developed or almost so to form a parietal muscle; acontia wanting.

The description by FAUROT¹) of the existence of rudiment have been regarded as typical of the Edwardsiae has necessitated the abolition of that order and has broken down the distinction between it and the family *Halcampidae*. I have chosen the term *Edwardsiidae* to denote the family which must now include these two groups and the genus *Scytophorus* also, since that term seems to have the priority as a family name over *Halcampidae* and because the latter term has been used with a much wider sense than seems to me justifiable. I had

1) ANDRES (1880) was really the first to observe the occurrence of rudimentary mesenteries in an *Edwardsia* (*E. claparedii*), two secondary couples being distinctly represented in his fig. 70.

suggested in an earlier paper a possibility of the extension of the order Protactiniae to include the forms here referred to the family *Edwardsiidae*, but a further consideration of the matter has led me to abandon that idea and in fact to abolish the order Protactiniae altogether.

Without entering into the history of the various classifications which have been proposed for the simpler Actiniaria, it seems necessary to explain my reasons for not adopting the arrangement recently proposed by CARLGRÉN (1899, 1900). He has divided the Actiniaria into two tribes the Protantheae and the Nynantheae, characterized respectively by the presence or absence of longitudinal muscle fibres in the ectoderm of the column wall and stomatodaeum, and each of these tribes he divides again into two subtribes, the Protantheae into the Protactininae and Protostichodactylinae and the Nynantheae into the Actininae and Stichodactylinae, the Actininae finally, being again subdivided into the Athenaria and the Thenaria according as they lack or possess a distinct pedal disc.

The fundamental point in this classification is the presence or absence of an ectodermal longitudinal musculature in the column wall and stomatodaeum and the classification will stand only if this character can be recognized as strictly phylogenetic. I do not imagine that anyone will deny that the ancestors of the Anthozoa probably possessed such a musculature, nor, indeed, that the epithelial cells of all the Coelentera are potentially epithelio-muscular cells, and hence it must be admitted that the occurrence of an ectodermal musculature in the column wall is, in a certain sense, to be regarded as an ancestral character. But even so it does not necessarily follow that it is a character of prime classificatory value; it is only so when it is associated with other characteristics which we believe to be also primitive and, on the other hand, is not associated with peculiarities which must be regarded as highly progressive differentiations. The structural characteristics of any group of animals are in part persistent and in part progressive characteristics. The former are ancestral in their nature and serve to distinguish the group from others; and while some of these characteristics may be lacking in this or that adult member of the group, yet they must be regarded as included in the embryonic potentialities of all and may reappear in forms which really represent a higher degree of specialization than others which lack them. The progressive characteristics, however, are departures along new lines from the an-

cestral conditions and it is these which furnish the basis for the classification of the various forms within the group. For instance, the occurrence of paired bipinnate ctenidia may be regarded as an ancestral character in the Mollusca and they constitute persistent characters in certain members of the group; and yet the grouping together in one order of all those Mollusca which present this peculiarity, ignoring all the progressive modifications which they may show, would constitute an arrangement which would appeal to no one. Rather do we use the progressive characters as a guide for the separation of the group into subgroups at the base of each of which we place those forms in which persistent characters are most perfectly developed.

In the Actiniaria, it seems to me, we have similar conditions. The ectodermal musculature of the column wall represents a persistent characteristic and if not associated with marked progressive characters may well serve as a guide to the more primitive members of the group. But if associated with such peculiarities it is no longer possessed of prime classificatory importance, and to group together all forms which possess it, independently of their progressive modifications, is as incorrect as would be a corresponding classification in the Mollusca. Certain of the Actiniaria which possess the musculature are undoubtedly to be regarded as primitive, or as representing primitive conditions, such for instance as *Gonactinia* and *Protanthea*. But, on the other hand, such forms as *Bolocerooides macmurrichi* and *Bolocera brevicornis*¹⁾ it is associated with the multipli-

1) CARLGREN (1902) has expressed himself as very skeptical regarding the accuracy of my statement that ectodermal longitudinal muscles occur in the column wall of *Bolocera brevicornis* and regards that species as identical with *B. multicornis* VERRILL. I can assure him, however, that there is no room for doubt as to the existence of the musculature. It is true that the epithelium of the column wall was largely macerated away in the specimen I examined and this led me to regard the irregularity of the surface of the mesogloea as the result of the maceration. Where, however, the epithelium is retained in spots the irregularities are clearly muscle-bearing processes of the mesogloea and the presence of an ectodermal musculature is even more distinct than in *Protanthea*.

As to the identity of *brevicornis* with *multicornis*, I may say that when I described the former I had preparations of *multicornis* before me for comparison and the two forms seemed to me to be distinct. If, however, the view of my colleague as to their identity be accepted, an explanation of how one individual of a species may belong to the Nynantheae and another to the Protantheae is in order.

cation of the mesenteries, a remarkable modification of the tentacles at their bases and a tentacular sphincter, and in *Ptychodactis patula* with the reduction of the stomatodaeum and with the multiplication of the mesenteries, all of which characters must, I believe, be regarded as progressive, those associated with the tentacles highly so. Again it will probably be admitted that the stichodactyline arrangement of the tentacles is a progressive character, and it is associated with the presence of a considerable number of mesenteries, also a progressive character. To my mind, the association of forms possessing such characters with others which lack them is comparable, if I may refer again to the Mollusca for an illustration, to an association of *Argonauta* with *Haliotis*.

And not only does the acceptance of CARLGREN's primary division lead to an association of forms presenting widely different grades of progressive differentiation, but it also separates forms of approximately the same grade. Thus to separate by a great and unpassable gulf *Gonactinia* from *Oractis* is unjustifiable. Having regard to the progressive differentiation these forms stand more closely related than do *Gonactinia* and *Bolocerooides* and the same is true for *Gonactinia* and the Edwardsias, even although the latter present progressive modifications in the absence of the pedal disc and the development of strong muscle pennons on the mesenteries, this last character, as APPELLÖF (1893) has suggested, possibly accounting in part at least for the absence of the ectodermal column musculature.

The subdivision of the Actininae into Athenaria and Thenaria also, it seems to me, tends to the confusion of unrelated forms and the separation of others which are nearly related. The subdivision is based upon a persistent character, it is true, and by associating with this the absence or presence of a basilar muscle it seems to have weight. But the relations between the pedal disc and the muscle are so intimate that modifications of the one can hardly be expected without modification of the other. Furthermore when we speak of the absence of the pedal disc we are speaking rather of its modification than its absence in many cases, since its homologue exists in the physa, and in such cases a homologue of the basilar muscle may be seen in the parietal muscle, so well marked in Edwardsias and Halcampids.

CARLGREN's Athenaria corresponds essentially with Gosse's family *Tyranthidae* and associates such forms as *Edwardsia* and *Halcompa* with *Tyranthus parthenopeus* with its twelve pairs of perfect mesenteries,

while, at the same time it ignores the close relationship which apparently exists between the *Halcampas* and *Haloclava* and *Eloactis*, these latter forms being Thenarians.

For these various reasons it seems to me advisable to avoid such a grouping as CARLGRÉN proposes and to divide the simpler Actininae at once into families, recognizing in addition to the *Edwardsiidae*, which will include in addition to the *Edwardsiae* and *Halcampidae* (Auctt.) the genus *Scytophorus*, the *Gonactiniidae*, which will include *Gonactinia*, *Protanthea* and possibly *Oractis*, the *Peachiidae*, including *Peachia*, *Eloactis* and *Haloclava*, and the *Ilyanthidae*, having essentially the limitations recognized by ANDRÉS (1883).

Genus *Halianthus* KWIETN. 1896.

Edwardsiidae with twelve perfect mesenteries, in addition to which there may be other rudimentary ones; sphincter mesogloal.

The proper name for this genus is at present uncertain and will remain so until the anatomical peculiarities of a greater number of forms belonging to GOSSE's genus *Halcampa* shall have been revealed and opportunity be thus afforded for a determination of the synonymy of the various groups into which the genus has been divided in recent years. ANDRÉS (1883) separated the forms possessing more than twelve tentacles from GOSSE's genus, forming of them the genus *Halcampella*, and ten years later CARLGRÉN (1893), discovering a mesogloal sphincter in *H. duodecimcirrata* and *H. arctica*, retained for the forms with this peculiarity the name *Halcampa*, while for those in which the sphincter is endodermal he proposed the name *Halcampomorpha*. KWIETNIEWSKI (1896), however, pointed out that the type species of GOSSE's genus possesses, according to the observations of HADDON and FAUROT, an endodermal sphincter, and HADDON later expressly confirmed that fact. KWIETNIEWSKI, therefore, correctly regards CARLGRÉN's *Halcampomorpha* as a synonym of *Halcampa* GOSSE, and proposed for the forms with a mesogloal sphincter the name *Halianthus*; but, combining with the nature of the sphincter the number of the tentacles as a second criterion for classification, he limits *Halianthus* to forms with not more than twelve tentacles and for the forms with a greater number he founded the genus *Halianthella*. It is not at all improbable that this last genus will prove identical with ANDRÉS' *Halcampella*, and, furthermore, since it seems that the number of the tentacles is hardly a

valid generic character and that there may be, therefore, no necessity for the genus *Halianthella*, it is not impossible that it will be necessary to take ANDRÉS' term as the correct designation for the forms with a mesogloal sphincter. Until, however, *Halcampella endromitata* is examined as to the nature of its sphincter it is advisable to retain KWIETNIEWSKI's *Halianthus*.

1. *Halianthus chilensis* n. sp.

No. 499. Calbuco. 1 specimen.

The single individual (Pl. 14, Fig. 1) of this species which was collected was rather slender, measuring about 1.0 cm in length with a diameter of 0.3 cm at the broadest part of the column. This was covered throughout the greater part of its extent by a thin brownish cuticle to which particles of foreign matter (diatom frustules, etc.) were adherent. The investment was, however, lacking over a small portion of the column immediately proximal to the tentacles, this naked region probably representing a capitulum. The proximal end of the body was rounded and a little to one side of the centre there was a distinct depression, appearing like the opening of a pore, though sections showed that it was really due to a slight invagination (Fig. 2) which may possibly represent a retracted physa.

Not far from the rounded extremity a slight but distinct groove surrounded the column and this might be regarded as the delimitation of a scapus and physa, but the facts that the cuticular covering extended as far down as the opening of the invagination and that the mesogloea of the invagination was much thinner than that of the rest of the column seem to indicate that the first supposition is more correct. If so, then the column shows a distinction into capitulum, scapus and physa, the first and last of these regions being relatively small and the physa capable of retraction. No pores could be discovered in the physal region.

The tentacles were twenty-four in number, arranged in two cycles, and were rather slender and acuminate, though short. The disc was elevated into a distinct cone at the apex of which was the mouth; no gonidial grooves could be distinguished. The disc was thin and translucent and of a paler brown than the column and tentacles.

Structure. The mesogloea of the column wall was on the average but little thicker than the ectoderm, but it varied considerably in thickness in different parts of the same section owing

to its outer surface being raised into irregular ridges. Its inner surface was raised into noticeable, but not high folds, for the circular musculature. The sphincter seems to have been imbedded in the mesogloea, for just below the line of insertion of the outer tentacles there was in the column wall a narrow band of what seemed to be muscle tissue, enclosed within the mesogloea and separated by narrow bands of it from both the ectoderm and the endoderm. Having only a single specimen for study and having devoted its distal extremity to transverse sections, I cannot make any statement as to the pattern of the muscle.

The mesogloea of the tentacles and disc was quite thin and the processes for their ectodermal muscles were short and simple; indeed, they were barely perceptible upon the disc. The stomatodaeum was short, being practically confined to the dome-like elevation of the disc. It was richly folded longitudinally and the two siphonoglyphs which were present were hardly distinguishable, either in form or structure, from the rest of the stomatodaeal surface.

There were twelve pairs of mesenteries, only six of which were perfect; two of these were directives. In a section through the upper part of the scapus, cutting the mesenteries a little below the lower edge of the stomatodaeum (Fig. 3), the six perfect pairs alternate regularly with six very small pairs. Throughout the greater part of their breadth the perfect mesenteries are very thin, but bear at the junction of their muscular and reproductive portions a strong circumscribed muscle pennon, of the usual Edwardsian type and consisting of almost twenty long, more or less branched processes. A slightly developed parietal muscle occurs on both the perfect and imperfect mesenteries, it being the only muscle present on the latter.

On comparing the muscle pennons of the different mesenteries it will be seen that they vary considerably in their development. Thus the pennons of the pairs situated on either side of the directives marked *D* in Fig. 3 are noticeably smaller than those on the majority of the other mesenteries, and, furthermore, the pennon of the individual of each of these pairs which is nearer the directives is much weaker than its fellow. Finally, a distinct difference is noticeable in the size of the pennons of the two directive mesenteries marked *D'*. In a section taken lower down, about the junction of the middle and lower thirds of the scapus, the condition represented in Fig. 4 is seen. The primary pairs are readily distinguishable by their greater breadth, although the secondaries are much broader

than they were in the more distal section. The pennons of the primaries have, however, almost disappeared, except in the cases of two mesenteries belonging to different pairs, situated on the same side of the sagittal plane of the body. It seems certain that this condition is partly due to differences in the contraction of the mesenteries, but not entirely so. HERTWIG (1882) has described a difference in the size of the mesenteries of *H. clavus* which agrees with the probable sequence of their development, and FAUBOT (1895) has shown the same for adult specimens of *H. chrysanthellum* (a form comparable to the present species on account of its possession of twelve pairs of mesenteries). A section of the present species taken at about the middle of the column shows that the same correspondence of size and sequence of development occurs here also. Such a section is shown in Fig. 5 in which one pair of directives, *D'*, has practically lost the pennons, while they are still present, though reduced in size on the other pair; furthermore, one mesentery of each of the lateral pairs has lost its pennon. If we regard the directives *D* as the third couple of mesenteries, these it will be the fourth, fifth and sixth couples which have lost their pennons, a condition corresponding with what occurs in *H. chrysanthellum*.

Finally, it may be added that in sections through the proximal (aboral) third of the column all the mesenteries have lost their pennons except those of the first and second couples (Fig. 5). The difference seen on the two sides of this figure is also noticeable in Fig. 4 and is probably due to the section being cut somewhat obliquely, owing to the curvature of the column (Fig. 1).

I could not discover any mesenterial stomata, and the state of preservation of the specimen was not favourable for an accurate study of the filaments, though it may be stated that they were distinctly trilobed in their upper part and simple below, as in the majority of the Actiniaria. No acontia were present. The specimen was a male, the reproductive organs occurring on all the perfect mesenteries, including the directives.

H. chilensis presents many similarities to *H. kerguelensis* (STUDER) and the temptation to regard the two as identical is very great. Until, however, opportunity is afforded for the proper study of the sphincter of *chilensis* it seems less conducive to a possible confusion to regard them as distinct.

Family *Actiniidae* GOSSE. 1858.

Actininae with an adherent base. Column wall smooth or provided with verrucae, but never with hollow vesicular outgrowths. Sphincter endodermal, diffuse or rarely aggregated, usually weak. Tentacles simple, cylindrical; margin smooth or provided with simple acrorhagi. Mesenteries in several cycles of which usually more than one is perfect; longitudinal muscles usually diffuse; parieto-basilar and basilar muscles unequally developed. No acontia.

The history of the term *Actiniidae* is somewhat complicated. It was, so far as I am aware, first employed by JOHNSTON (1838) and later by GOSSE (1855) in a sense almost equivalent to DANA's Actinaria, and it was not until 1858 that GOSSE limited it so as to include only the genera *Anthea* and *Actinia*. It is employed here in the sense in which it is understood by HADDON (1898), with the important modification that the genus *Bolocera* and its allies are excluded, and it is practically equivalent to the family *Antheadae* as recognized by CARLGRÉN and myself in 1893, although additional genera have been added to it since that time.

Genus *Gyrostoma* KWIETN. 1897.

Actiniidae without acrorhagi, verrucae or collar; tentacles moderate or short, sphincter weak, usually diffuse.

Since HERTWIG (1882) showed that *Anemonia sulcata* possessed acrorhagi a strict distinction of that genus from *Actinia* has been a matter of some difficulty. I suggested at one time (1893) that it might be advisable to limit the genus *Anemonia* to forms destitute of acrorhagi, even although this would bring the type species within the genus *Actinia*, and HADDON (1898) states it as his opinion that the genus "stands or falls according to whether the puffy capitular rim of *A. sulcata* is to be regarded as destitute of, or possessing acrorhagi". The genus *Anemonia* is, accordingly, in a somewhat precarious condition, and yet it is one of the oldest genera of the group, having been founded by RISSO in 1826.

It seems to me that a distinction may be found between *Anemonia* and *Actinia* in the nature of the tentacles, their length and feeble contractility in the former genus being very characteristic. But if this be taken as the principal distinction and both genera be credited with acrorhagi, then it becomes necessary to place in another genus those forms which have been referred to *Anemonia*

but possess no acrorhagi and have tentacles of moderate length. CARLGRÉN (1900) has recently pointed out another peculiarity which may distinguish the two species; in *Actinia* the acrorhagi are situated upon the outer wall of the fosse below the margin, while in *Anemonia* they arise directly from the margin. This character may well be combined with that derived from the tentacles and demands also the separation of certain forms originally referred to *Anemonia*.

Before receiving CARLGRÉN's paper (1900) I had decided that these excluded forms could be well assigned to KWIETNIEWSKI's genus *Gyrostoma*, and I was pleased to find that CARLGRÉN had arrived at the same conclusion. KWIETNIEWSKI established his genus for a form, *G. hertwigi*, which, he regarded as the type of not only a new genus but even of a new tribe, the Isohexactiniæ, on account of all the primary mesenteries being directives and being associated with a corresponding number of siphonoglyphs. Observations which have been made on irregularities in the number of the directives show that there is no sufficient basis for the tribe which KWIETNIEWSKI proposed and furthermore HADDON (1898) has brought forward good reasons for believing that *G. hertwigi* is really identical with *Anemonia ramsayi*, first described by HADDON & SHACKLETON in 1893, a form which presents considerable variation in the number of siphonoglyphs and directives. *A. ramsayi* is, however, one of those forms which must be separated from the genus *Anemonia*, and consequently KWIETNIEWSKI's generic name may well be accepted for it and allied forms. I include in the genus *Gyrostoma* the forms which CARLGRÉN (1900) has assigned to it, namely *G. ramsayi* (HADDON et SHACKLETON, 1893), *G. kwoiam* (HADDON et SHACKLETON), *G. tristis* CARLGR. 1900, *G. stuhlmanni* CARLGR. 1900, and *G. dubia* CARLGR. 1900, and in addition *G. inaequalis* (McMURRICH, 1893) and possibly the form imperfectly described by FEWKES (1889) as *Anemonia stimsonii*.

2. *Gyrostoma selkirkii* n. sp.

- No. 91 a. Juan Fernandez. 4 specimens.
309. Juan Fernandez. 6 specimens (young).
257. Juan Fernandez. 1 specimen (young).

The individuals catalogued in the collection as 91 a varied considerably in size, the measurements of the largest being: diameter

of the base 1.75 cm, height of the column 1 cm, diameter of the column at the margin 1.1 cm, while the corresponding measurements of the smallest were 0.9 cm, 0.6 cm, and 0.7 cm. The specimens numbered 309 and 257 were still smaller, measuring 0.45–0.3 cm in height with a basal diameter of 0.65–0.35 cm, and they are evidently immature, although no indications of reproductive organs were found in any of the specimens.

Accompanying the specimens No. 309 was a label which read "Junge Actinien der gemeinsten braunrothen Art", and it must be concluded, in the absence of any definite statement, that specimens No. 91a were adult and had, during life, a brownish-red colour. In their present condition there is little evidence of what the color may have been.

The base in all the specimens is more or less expanded (Fig. 6); the column is cylindrical, tapering but slightly above, and, except for wrinkles due to contraction, is quite smooth, having no verrucae or papillae. The margin is distinct and quite smooth and is separated by a relatively deep fosse from the bases of the outer tentacles. The tentacles are, as a rule, only partly concealed and are short stout and obtuse. Theoretically their number should be thirty-six, but apparently the last cycle is incompletely developed, since I was able to count only seventy-five in one specimen and in another only sixty-four. The disc and mouth are concealed from view in all the specimens.

Structure. The mesogloea of the column wall is much thinner than the ectoderm and the processes for the support of the endodermal musculature are but feebly developed. Sections through the upper part of the column (Fig. 7) show that the margin forms a well defined parapet, upon the inner wall of which is situated a distinct though weak diffuse endodermal sphincter. A few scattered nematocysts occur in the ectoderm of the parapet, but they are not aggregated to form acrorhagi and the margin of the parapet is practically quite smooth. In some of the young specimens which are well expanded this parapet cannot be seen, and it is probable that it may be smoothed out even in adult individuals during complete expansion.

In the adults the endoderm of the upper part of the column contains a considerable amount of brownish pigment in the form of granules and a few zooxanthellae are also present; the young specimens show indications of the same kind of pigment, but it is

present in much less quantity, indeed, in the smallest individual examined it could not be perceived. The adults also show a diffuse yellowish pigment in the cells of the ectoderm.

The longitudinal musculature of the tentacles and the radial muscles of the disc are moderately developed and are confined to the ectoderm. The stomatodaeum is long, reaching nearly to the base and it is deeply grooved longitudinally (Fig. 8). In all the specimens examined it possessed two well defined siphonoglyphs, whose endoderm was much higher than that of the general surface of the stomatodaeum, presenting an appearance similar to what I have already described (1901) in *Cribrina elegantissima*.

The mesenteries in the adult specimens are arranged hexamerously in four cycles, a few pairs only of the fifth cycle being developed. There are two pairs of directives and the mesenteries of the first three cycles are perfect, only those of the first cycle, however, being attached throughout the entire length of the stomatodaeum. The longitudinal muscles on the members of the first cycle are only moderately developed, and, in the upper portions of the mesenteries, form a low diffuse pennon tapering gradually at either edge; lower down, however, below the level of the stomatodaeum, they become narrower and higher, tapering gradually toward the outer edge but terminating abruptly internally. A well developed parieto-basilar occurs, extending almost up to the disc; its mesogloal folds for the support of the muscle fibres are decidedly feeble, but the inner edge of the muscle forms a distinct fold on the surface of the mesentery. The mesenteries of the fourth (and fifth) cycle are destitute of a muscle pennon and develop no mesenterial filaments. No reproductive organs were present.

In the young individuals the mesenteries are fewer, there being but three complete cycles and in the smallest specimen examined the mesenteries of the third cycle were rudiments. Occasionally pairs of the fourth cycle were seen. Only the first cycle mesenteries were perfect, those of the second cycle just touching the stomatodaeum at its oral end. In one of the young individuals a fusion of the free edges of a pair of mesenteries was observed, the phenomenon occurring in two pairs of mesenteries belonging to the second cycle (Fig. 8). In both pairs the mesenteries were separate in their upper parts, the fusion beginning about half way down and, in one pair, extending only for a short distance, while in the other it continued to the base.

3. *Gyrostoma incertum* n. sp.

Talcahuano.	1 specimen.
Tumbes near Talcahuano.	6 specimens.
No. 448 a. Puerto Montt.	1 specimen.

The form assumed by this species in contraction differs considerably in different individuals. Some are distinctly barrel-shaped, smaller both at the margin and base than at the middle (Fig. 10), while others are more elongated (Fig. 11) and more cylindrical, although still showing a diminution in diameter toward either extremity.

The base was evidently adherent, though probably but feebly so; the column was almost smooth, except for transverse wrinkles due to contraction. In many specimens the tentacles were completely concealed, while in others they were more or less exposed and were short, conical and acuminate, and more or less distinctly brownish in colour. Their number seemed to be somewhat irregular; four cycles are regularly present and in serial sections through the uppermost part of the column of an individual from Tumbes I found representatives of a fifth cycle over some of the exocoels. Accurate counts were not easy to make, owing to the greater or less contraction of all the specimens, but in one individual eighty were counted, in what was approximately a quadrant of the large individual from Talcahuano there seemed to be representatives of six cycles, while in one of the specimens referred to below, in which about half the tentacles were lacking, I counted fifty-seven remaining.

A peculiarity observed in several of the specimens from Tumbes was the absence of tentacles from a considerable portion of the disc. The individual shown in Fig. 11, if viewed from the opposite side has the appearance represented in Fig. 15, no tentacles being perceptible in almost one-half of the circumference of the disc, the ridged stomatodaeum passing directly over into a very narrow and smooth disc and this into the column wall. A similar condition was observed in two other individuals, but the remainder were normal. The condition seems to be more probably the result of injury than a normal suppression of the tentacles, but it possesses some interest in connection with LESSON'S description of *Actinia picta*.

On account of the differences in shape there is considerable variation in the size of the various specimens. The largest barrel-

shaped form measured 2 cm in height and 1.8 cm in diameter at about the middle of the column, while another individual, from Tumbes, measured 1.4 cm in height with a diameter of 1.5 cm at its broadest part and of 0.8 cm at the base. One of the more elongated individuals measured 2 cm in height with a greatest diameter of 1.1 cm.

None of the specimens showed any distinct coloration of the column, although a brownish pigment occurs in the endoderm. The tentacles were brownish, the color being due to endodermal pigment. The stomatodaeum was longitudinally ridged and the siphonoglyphs were well marked. The margin was indistinct but smooth and separated by a slight fosse from the bases of the outermost tentacles.

Structure. The mesogloea of the column wall is distinctly fibrous in structure and is raised upon its ectodermal surface into numerous ridges which produce the transverse wrinkles mentioned above. Throughout the greater part of the column the ectoderm is nearly as thick as the mesogloea, but toward the margin the latter thickens distinctly. The endodermal circular musculature is but feebly developed and a sphincter can hardly be said to exist, although the muscle processes are a little more pronounced at the upper part of the column than elsewhere.

The musculature of both tentacles and disc is feeble and is not imbedded in the mesogloea. The stomatodaeum is longitudinally ridged and possesses in all the specimens examined two well developed siphonoglyphs.

The mesenteries present several interesting features in their arrangement. In sections passing through the middle of the column there are twenty-four pairs of mesenteries visible, twelve pairs, including the two pairs of directives, being provided with strong longitudinal muscles, while the remaining pairs are small and destitute of muscle pennons and mesenterial filaments. In the upper part of the column the twelve large pairs are perfect, but before the lower edge of the stomatodaeum is reached six of them become separated from it and as they are traced down the column they lose their mesenterial filaments and the muscle pennons diminish in size and eventually disappear (Fig. 12), so that in the lower portion of the column only six pairs of mesenteries with pennons and mesenterial filaments occur. It will be observed that the number of mesenteries does not agree with that of the tentacles, of which there are representatives of five and, in some cases, of six cycles. In sections through the marginal region of the column it was possible to detect

in individuals which had a fifth cycle of tentacles some exceedingly small representatives of a fourth cycle of mesenteries, but they did not form a complete cycle, nor, indeed, were they always distinguishable in those portions of the column where tentacles of the fifth cycle were present. Frequently the fifth cycle tentacles were much crowded against the adjacent fourth cycle ones and appeared to arise from the bases of the latter rather than directly from the disc and in such cases no corresponding mesenteries could be observed.

It would seem that in this species there is presented an instance of a form in which a reduction of the original number of mesenteries had taken place. The reduction has effected an almost complete obliteration of at least one cycle of mesenteries and has even affected the development of the second cycle. Instead of regarding the small number of perfect mesenteries and the relatively low total number of mesenteries as primitive, I would prefer to consider the species as a degenerated form derived from ancestors possessing a greater number of completely developed mesenteries.

The longitudinal muscles, when developed, form strong pennons, the processes ending somewhat abruptly at the inner edge, though tapering gradually externally (Figs. 12 and 13). The parieto-basilar is represented but does not form a fold. The majority of the individuals examined showed no reproductive elements, but in the largest one (Talcahuano) they were present in the mesenteries of the second and first cycles, including the directives. Both oral and parietal stomata were present and there was a weak basilar muscle having the form represented in Fig. 15.

I was inclined for a time to refer this species to the genus *Condylanthus* of CARLGRÉN (1899), but the fact that the rudimentary mesenteries in CARLGRÉN'S *C. magellanicus* were confined more especially to the proximal portion of the column, while in the present form they are in the distal portion, seemed to stand in the way of this and it seemed preferable to place it under *Gyrostoma*.

Genus *Parantheopsis* n. g.

Actiniidae without acrorhagi but with conspicuous verrucae in the distal portion of the column; no collar, but the margin a distinct parapet within which is a well marked fosse; tentacles of moderate length and rather slender, capable of being concealed in contraction; sphincter diffuse.

This genus resembles the genus *Antheopsis* of SIMON as modified by CARLGRÉN, except in the arrangement of the tentacles. It is distinguished from *Actinioides* of HADDON & SHACKLETON, by the absence of true acrorhagi and from *Condylactis* by the possession by the latter of a "collar" in place of a parapet and of longer and stouter tentacles.

I assign to this genus the form which, since my paper of 1893, has generally been termed *Condylactis cruentata*. VERRILL has recently (1899) placed it in the genus *Actinioides*, but, as CARLGRÉN has pointed out, the absence of true acrorhagi excludes it from this as defined by HADDON & SHACKLETON. It has always seemed to me a little out of place in its position under *Condylactis* and I believe its reference to a new genus will prove more satisfactory.

4. *Parantheopsis cruentata* (COUTHOUY).

Actinia cruentata COUTHOUY, 1846; GAY, 1852.

Cereus cruentatus MILNE EDWARDS, 1857.

Bunodes cruentata GOSSE, 1860; VERRILL, 1869; ANDRES, 1883.

Condylactis cruentata McMURRICH, 1893; CARLGRÉN 1897 and 1899.

Bunodactis cruentata VERRILL, 1899.

Actinioides cruentata VERRILL, 1899.

No. 590.	Punta Arenas.	6 specimens.
581.	Punta Arenas.	1 specimen.
604.	Punta Arenas.	5 specimens.
301.	Cabo Espiritu Santo, Tierra del Fuego.	1 specimen.
	Talcahuano.	1 specimen.

These specimens are all identical with those I described from the "Albatross" collection (1893) as *Condylactis cruentata*. They are, however, in somewhat better condition and are accompanied by notes of the coloration which dispel all doubts as to their identity with the forms described by DANA (1846) as *Actinia cruentata* COUTHOUY. This is a matter of importance, since CARLGRÉN (1899) has recently described a *Bunodes* (*B. octoradiatus*) from the Straits of Magellan which, in its external form and coloration closely resembles DANA'S description, indeed, the figure which CARLGRÉN gives of his *Bunodes* might readily be mistaken for a representation of an expanded *A. cruentata*. Of course it is quite possible that DANA may have confused individuals of the two species, but since in the description he states the number of the tentacles to be forty-six while CARL-

GREN finds never more than thirty-two in *B. octoradiatus*, and since the first form anatomically studied to be identified with COUTHOUY'S *A. cruentata* was the Actiniid and not the Bunodid, the name given the latter by CARLGREN must be retained for it and the Actiniid regarded as the form described by COUTHOUY.

The majority of the individuals in the present collection are much more fully expanded than were those which I originally studied and their average height is about 1.5 cm and the diameter of the column about 1.0 cm.

According to the label which accompanied specimens No. 590, the basal portion of the column was rosecolored, while the upper portion and the tentacles were deep carmine with flecks of grey. This account agrees very well with that given by COUTHOUY, but the species is apparently liable to considerable variation in color, since the specimens studied by CARLGREN were in some cases olivaceous with greyish tentacles, in others white with greyish-green tentacles and in others the tentacles were carmine only at the tips.

The base is adherent and the column finely corrugated in its proximal part and distally is provided with longitudinal rows of arge and well marked verrucae to which particles of sand adhere with considerable firmness. Each alternate row is somewhat longer than the adjacent ones, but even the longer ones do not extend beyond the middle of the column. The margin forms a distinct parapet and in the more perfectly expanded individuals can be seen to bear marked papillae opposite the extremities of the longer rows of verrucae and smaller ones opposite the shorter rows. These papillae present a strong superficial resemblance to acrorhagi, but they do not show any special development of nematocysts, agreeing in their histological structure with the column wall.

The tentacles are separated from the margin by a distinct fosse and are short and blunt. They are arranged in about two cycles, each of which, in one individual in which a count was made, contained sixteen tentacles. As already stated, however, DANA states that the tentacles are forty-six in number and CARLGREN found the number to vary from forty to forty-eight. As will be seen later both octamerous and hexamerous individuals occur, a fact which explains these discrepancies. The disc is smooth and the stomatodaeum is longitudinally ridged and possesses two siphonoglyphs.

Structure. The circular musculature of the column wall is but moderately developed and the sphincter is diffuse and very

feeble, indeed, in some individuals it can hardly be said to be developed.

I am able to confirm CARLGREN'S observation that both octamerous and hexamerous individuals occur, since I found both arrangements in the specimens from Punta Arenas; the single individual from Cabo Espiritu Santo was hexamerous. In the hexamerous forms the mesenteries are arranged in three cycles, all of which are perfect, although the members of the third cycle are very much narrower in the lower part of the column than are the others. In the octamerous individuals only sixteen pairs of mesenteries were present, and of these eight pairs were very much smaller than the others. It would seem that the eight primary pairs of the octamerous arrangement are to be regarded as equivalent to the twelve primaries and secondaries of the hexamerous individuals. I have not found any evidence that the octamerous condition is merely transitory, as CARLGREN supposes, and while I am not disposed to deny the occurrence of a transformation of one condition into the other in the face of my colleague's definite statements, I would point out that the occurrence of both arrangements in individuals of the same species is not without precedent.

In the "Albatross" specimen which I examined reproductive elements occurred only in the primary (octamerous) mesenteries, with the exception of the directives. In individuals of the present collection I find them also in the secondaries (tertiaries of the hexamerous arrangement) and have observed them in one individual in one of the pairs of directives, so that CARLGREN is probably correct when he describes all the mesenteries, including the directives, as being fertile.

5. *Parantheopsis ocellata* (LESSON).

Actinia ocellata LESSON, 1828.

Cribrina ocellata EHRENBERG, 1834.

Cribrina (Diplostephanus) ocellata BRANDT, 1835.

Cereus (?) ocellata MILNE-EDWARDS, 1857.

Bunodes ocellata VERRILL, 1869.

Bunodactis ocellata VERRILL, 1899.

Nr. 61.	Cavanca near Iquique.	1 specimen.
154.	Tumbes near Talcahuano.	12 specimens.
219.	Puerto Montt.	5 specimens.
256a.	Calbuco.	3 specimens.

The various individuals which I have ventured to assign to this species present considerable differences in general appearance in the preserved condition but anatomically they do not show sufficient dissimilarity to warrant their separation into several species.

The base is adherent in all and the column is more or less contracted and has assumed the form either of a low dome or of a short cylinder (Fig. 44), the tentacles being completely concealed in some, while in others they are partly exposed. One of the individuals from Tumbes (Fig. 45) was considerably higher than the rest and had its tentacles almost concealed. The column wall is provided with verrucae to which, in some individuals, particles of sand and shell were adhering, but the extent to which the verrucae were developed varied greatly. They are in all cases arranged in longitudinal rows, forty-eight in number, and which may either extend the entire length of the column, as in two specimens from Puerto Montt, or may be limited to the upper half, the lower half having a reticulated appearance not unlike that seen in some specimens of *Antholoba achates*. The verrucae are not borne on pedicles, but resemble those of *Parantheopsis cruentata* for instance.

At its distal end each alternate row of verrucae is prolonged upon a well marked conical process resembling an acrorhagus in appearance but possessing no special development of nematocysts. These structures are what CARLGREN (1899) has named pseudo-acrorhagi, and they are very noticeable in the more expanded individuals. Since they correspond with the alternate rows of verrucae their number is twenty-four, but half of them are much smaller than the others, with which they alternate.

The tentacles are short, stout and rounded at the tips, and in some cases showed indications of being longitudinally fluted. They were too much crowded to make a certain count, but seemed to be in the neighbourhood of 100, probably 96, in number. The disc and mouth were concealed in all the specimens.

In the majority of the individuals the height and diameter of the column is about the same and somewhere about 1.5 cm. Some specimens are, however, more conical, an individual from Puerto Montt measuring 1.5 cm in height while the diameter of its base was 2.5 cm, and another from Tumbes had a height of 2.5 cm, with a diameter at the base of 1.7 cm. Notes giving the coloration in life accompany the specimens from Cavanha and Puerto Montt. The former is said to have been provided with "Reihen von rothen Warzen"

while the statements as to the latter read as follows: "Mauerblatt grüngrau mit Längsreihen von braunrothen Warzen. Fühler schwarzgrau, manchmal weiss gesprenkelt. Mundscheibe tief rothbraun." In the preserved condition the coloration varies somewhat and is due to the black pigment contained in the endoderm, all traces of the reddish color having disappeared. In the specimens from Puerto Montt this endodermal pigment is abundantly developed and their color is a uniform dingy grey-brown, the centre of each verruca being of a clearer brown and the tentacles almost black. The specimens from Tumbes are either entirely colorless or the upper part of the column is dingy dark slate colored, and the Calbuco specimens are quite colorless, except where the ectoderm has been rubbed away the endodermal pigment then showing through and giving a dark slate color.

Structure. The mesogloea of the column wall is in general thinner than the ectoderm, and bears on its inner surface low processes for the support of the endodermal musculature. In the region of each verruca the column wall shows a slight outpouching throughout the extent of which the muscle processes are wanting. The ectoderm of the verrucae consists of slender cells, closely set and uniform in character, there being no trace of gland cells, such as occur in the rest of the column ectoderm and no pyriform cells. In the individuals in which the verrucae are confined to the upper part of the column the mesogloea of the lower part is raised into strong ridges which give the reticulated appearance already described. The pseudo-acrorhagi present the same structure as the rest of the verrucal portion of the column, except that the mesogloea is somewhat thinner. There is practically no sphincter muscle, the few muscle processes occurring where it should be found being scattered and no larger than those of the general column wall.

The longitudinal muscles of the tentacles and the radial muscles of the disc are feeble and are throughout ectodermal. The mesogloea of the tentacles is very thin.

The stomatodaeum is strongly ridged longitudinally and is provided with two distinct siphonoglyphs. The mesenteries are arranged hexamerously in four cycles, the first three of which are perfect, though losing their connection with the stomatodaeum at different levels, those of the first cycle, which includes two pairs of directives, being attached lower down than the others. The mesenteries of the fourth cycle differ a little in the extent of their d

velopment in different individuals, in some being very narrow and destitute of muscle pennons and mesenterial filaments, while in others they are broader and possess these structures. All the mesenteries may be fertile, with the possible exception of the directives. The longitudinal muscles of the first three cycles are well developed, occupying about one-half the muscle-bearing surface of the mesentery. The processes vary somewhat in height in different individuals, Fig. 46 representing an average condition. The parieto-basilar forms a distinct fold, often more marked than that shown in Fig. 46 and the basilar muscles are well developed (Fig. 47).

The differences in color in this form and LESSON'S *A. ocellata* seem to be explainable by the fact that the coloration is the resultant of a diffuse ectodermal pigment and a granular endodermal one which varies in the amount of its development. It may be noted that there is a probability that LESSON'S *A. papillosa* is identical with his *A. ocellata* but there is too much uncertainty about this as yet to warrant the combination of the two under the term *A. papillosa*.

Family *Paractidae* R. HERTWIG, 1882.

Actininae with an adherent base; sphincter mesogloal; mesenteries arranged in several cycles, of which usually more than one is perfect; longitudinal muscles of the mesenteries usually diffuse, parieto-basilar and basilar unequally developed; no acontia.

Genus *Paractis* MILNE EDWARDS et HAIME, 1882.

Paractidae with thin and smooth column wall; tentacles of moderate length and of uniform thickness throughout; margin not lobed; the individual mesenteries of each pair equally developed.

The genus *Paractis* possesses a somewhat doubtful standing if the first species mentioned under a new genus is to be recognized as its type. The genus was established by MILNE EDWARDS & HAIME in 1852 and the first species mentioned under it was *P. impatiens* (COUTHOUY), a form which I find in the present collection and which proves to be a Sagartiid. The precise definition given to the family *Paractidae* by R. HERTWIG removes, however, any danger of confusion as to the forms which should be assigned to it and it seems probable that had MILNE EDWARDS known of the possession of acontia by *P. impatiens* he would not have included it in the new genus. The

abolition of the genus or the bestowal of a new name upon it would now be very confusing and it seems preferable to simply remove *impatiens* from it and recognize it as limited by HERTWIG.

6. *Paractis nivea* (LESSON) VERRILL.

Actinia nivea LESSON, 1830.

Actinia (Isacmæa) nivea EHRENBERG, 1834.

Actinia (Diplostephanus) nivea BRANDT, 1835.

Actinia (?) nivea MILNE EDWARDS, 1857.

Sagartia nivea VERRILL, 1869 (nec GOSSE, 1860; nec DUERDEN, 1898).

Aplasia nivea ANDRES, 1883.

Paractis nivea VERRILL, 1899.

No. 150. Coquimbo. 1 specimen.

The single individual of this species (Fig. 16) was pronouncedly goblet-shaped and measured 2.5 cm in height. The base was somewhat expanded measuring 0.5 cm in diameter, and, though slightly bulbous, was evidently adherent. Immediately above the base the column was relatively very narrow, measuring only 0.3 cm in diameter, but from that it gradually enlarged until at a distance of about 2 cm from the base it had a diameter of 0.7 cm. At this point it enlarged suddenly to a diameter of 1.3 cm, which size was maintained up to the margin. Throughout the proximal part the wall was minutely rugose and had a firm leathery consistency, but in the distal portion it was smooth, thin and somewhat translucent. The margin was smooth and the tentacles, which covered the greater portion of the disc, were moderately long, slender and rather flaccid. The inner ones measured about 0.6 cm in length.

In color the column was pure white throughout. The tentacles were apparently arranged in irregular groups differing in colour; there were three groups of a purplish-brown color alternating with groups which were almost colorless although occasionally here and there a purplish-brown tentacle occurred in them.

Structure. In the column wall the mesogloea was throughout much thicker than the ectoderm, although its actual thickness differed in the upper and lower portions, the former region being only one-tenth the thickness of the latter (Figs. 18 and 19). It was throughout fibrous in structure and in the upper part was almost reticular in the outermost portions. The circular musculature was but moderately developed and immediately below the margin there was an oval mesogloal sphincter, reticular in structure and lying much more closely to the ectoderm than to the endoderm.

The tentacles and disc were thin-walled and their longitudinal (radial) musculature was moderate and not imbedded in the mesogloea. The brownish tentacles owed their color to pigment granules seated in their endoderm. The stomatodaeum was rather short, extending only about half way through the upper enlarged portion of the column; its mesogloea was rather thin and it possessed two rather shallow siphonoglyphs.

The mesenteries were arranged hexamerously in three cycles, of which only the primary one seemed to be perfect, although the secondaries were almost as broad as the primaries and possessed well developed muscle pennons. The tertiaries were moderately broad, but their longitudinal muscles were feeble and they possessed no mesenterial filaments. In the upper and lower portions of the column the mesenteries differed greatly in appearance; in the former region (Fig. 18) their mesogloea was exceedingly thin, with smooth surfaces and they were much broader than in the lower region (Fig. 19) the mesogloea in this portion of their extent being much thicker and its surfaces raised into numerous processes and lobes for the support of the parieto-basilar and basilar muscles, the former of which did not, however, form a fold upon the surface. The muscle pennons of the primaries and secondaries were strong and ended abruptly only at their inner edges. The reproductive organs were entirely confined to the upper broader parts of the mesenteries and were borne by those of the primary and secondary cycles, with the possible exception of the directives; the tertiaries were sterile.

In form and coloration this specimen so closely resembled the individual of *Actinia nivea* shown to the left in LESSON's figure of that species (1830, tab. 3, fig. 8 B) that there seems no doubt of its identity. LESSON, however, describes the species as capable of assuming various forms; his description runs thus: „Sa partie supérieure peut aussi rentrer avec les tentacules et se cacher dans l'ampleur moyenne de corps. Enfin, l'enveloppe est très-lisse, très-douce au toucher et seulement marquée de quelques rades ou plissures verticales.“ The goblet-like form of the column cannot, therefore, be regarded as absolutely characteristic of the species, but when associated with a coloration resembling so closely that shown in LESSON's figures it certainly becomes of importance.

The majority of the synonyms of LESSON's species are based solely on his description and only in three cases was the name of his species applied to specimens actually examined, namely in the

case of GOSSE (1860) who described a British form as *Sagartia nivea*, in that of VERRILL who described a form from Callao, Peru, at first (1869) as *Sagartia nivea* and later (1899) as a *Paractis*, and in that of DUERDEN who applied the name (1898) to a West Indian form, assigning it to the genus *Sagartia*. In the case of GOSSE's name there was no presumption that the species was identical with LESSON's¹⁾ but both VERRILL and DUERDEN supposed that they were dealing with forms identical with LESSON's. Concerning DUERDEN's form I agree with VERRILL in regarding its identity as erroneous, it must be so if LESSON's form was a *Paractis*. But with regard to VERRILL's form the case is different. The coloration given in VERRILL's earlier paper tallies with that of the present species and his description of the sphincter in his later paper corresponds with what I have found. In the arrangement of the mesenteries there is, however, considerable difference, for VERRILL describes four cycles with rudiments of a fifth and from twelve to twenty-four perfect pairs. Apparently VERRILL's specimens showed considerable variation and it is consequently difficult to compare with them a single individual. Although I could not find that the second cycle reached the stomatodaeum in my specimen, yet the fact that its mesenteries were so nearly of a size with those of the first cycle and so different from those of the third, renders it possible that they may reach the stomatodaeum in its uppermost part, though having been so unfortunate as to accidentally lose my sections through this region I cannot decide the point; in the highest sections I possess some of the first cycle mesenteries, even, have separated from the stomatodaeum. The number of tentacles present is certainly much greater than the total number of mesenteries and this suggests a further possibility that an additional cycle of small mesenteries may have been present in the uppermost part of the column, and if this be so then the divergence between VERRILL's specimens and mine amount to little. I believe that both are identical with LESSON's *Actinia nivea*.

The specimens which LESSON described were collected at Paita, Peru, where they were very abundant, but he also describes another form, *A. bicolor*, as plentiful in the same harbour. Examining his

1) Since GOSSE's *Sagartia nivea* is a true Sagartian and LESSON's species is a *Paractis*, there is no necessity for the abolition of GOSSE's term for his species as proposed by VERRILL (1869) unless the supposition of ANDRES that it is identical with *S. venusta* be correct.

description and figure of *A. bicolor*, one cannot fail to be struck by its great similarity to *A. nivea*, the principal difference being apparently the color of the tentacles which in *bicolor* were emerald green. From what we know of the variability in color in Actinians one may be inclined to doubt the sufficiency of a difference of this kind for the separation of the two forms, but until we possess an anatomical description of *bicolor* it seems well to leave them distinct, since a fusion would necessitate the abolition of the term *nivea*.

7. *Paractis ignota* n. sp.

No. 61a. Iquique. 2 specimens.

The base is adherent and somewhat smaller than the column (Fig. 20), and in both specimens is somewhat irregular in outline. The column is about 1.2 cm in height; it is somewhat irregular in cross section, its walls are thin and much wrinkled by contraction especially in the proximal portions, and there is no indication of acrorhagi, tubercles, or capitular ridges, the margin being but faintly marked. The tentacles number about ninety-six and are moderate in length, conical and somewhat slender; they are exposed in both specimens. There is no trace of color remaining in either tentacles or column.

Structure. The column mesogloea is thin, though somewhat thicker than the ectoderm and has a markedly fibrous structure. The circular muscles are rather feeble and in the upper part of the column there is a thin though broad mesogloea sphincter (Fig. 21). It is elongate triangular in form, reticular in structure and is separated from the endoderm by a narrow layer of mesogloea, while although very close to the ectoderm above, it separates from it below so that its lower part lies almost in the middle of the mesogloea.

The tentacles are thin-walled and their longitudinal muscles are not imbedded in the mesogloea. The stomatodaeum possesses two rather shallow and small siphonoglyphs.

The mesenteries are arranged hexamerously in three cycles, with occasional representatives of a fourth. Those belonging to the first two cycles are apparently perfect and they alone possess well developed muscle pennons (Fig. 22), which occupy about one-half the surface of the muscular portion of the mesenteries, tapering abruptly at their inner edges, but very gradually externally. A weak parieto-basilar can be distinguished but it does not extend as high as the stomatodaeum. The mesenteries of the first and second

cycles are fertile, with the possible exception of the two pairs of directives.

8. *Paractis tenuicollis* n. sp.

No. 256b. Calbuco. 4 specimens.

Two of the individuals of this species were much more elongated than the others and in these the base had a diameter of 1.3 cm, the column about 0.9 cm, while the height of the column was 3.5 cm. The corresponding measurements of one of the shorter individuals (Fig. 23) were, diameter of the base 1.6 cm, diameter of the column about the same, height of the column about 1.2 cm.

The base was adherent and usually somewhat larger than the column. This is almost cylindrical, expanding but slightly toward either end and its walls have throughout the greater part of their extent a considerable amount of consistency. No verrucae were present, but a number of regularly arranged longitudinal ridges could be distinguished, terminating rather abruptly above about 0.5 cm below the margin, the portion of the column above them being quite smooth and its wall markedly thinner than that of the lower part, thus forming what may be termed a capitulum (Fig. 24). The tentacles were numerous, long and flaccid; they were probably about ninety-six in number and the outermost cycle was situated directly upon the margin. In none of the specimens was there any infolding of the column over the tentacles, the mouth and disc being plainly visible in some individuals and readily brought into view in the others by separating the tentacles which were matted over them. The disc was quite smooth and the mouth was provided with two moderately distinct gonidial grooves.

The only traces of color remaining were a slight brownish tinge in the tentacles, deepening toward the tips as if these had been specially colored, and a yellowish pigment in the ectoderm of the stomatodaeum.

Structure. The mesogloea of the column wall is thicker than the ectoderm and its outer surface is raised into numerous ridges and elevations. In the upper or capitular region these elevations are, however, entirely absent and both the mesogloea and the ectoderm are much thinner than they are lower down. The circular musculature is feeble, the processes which support it being low, unbranched and somewhat distant from one another. At the margin and extending downward a short distance on the capitulum is the

sphincter muscle (Fig. 28), completely imbedded in the mesogloea. It is very weak and has a delicately reticular structure, the trabeculae separating the meshes being very delicate. The muscle cells are few in number and exceedingly small, the majority of the meshes, indeed, seeming at first sight to be mere empty spaces. The smallness of the muscle fibres is, however, a characteristic of the circular musculature of the column and there can be no doubt that the reticulum represents the sphincter and is not merely loosely arranged mesogloea. At the upper part of the scapus cavities occur in the mesogloea, some scattered and others aggregated to form a reticulum whose trabeculae are much thicker than those of the capitular sphincter; these seem to constitute a second sphincter.

The tentacles are very thin-walled except toward the tips, where the extra thickness is probably due to a little extra contraction. Their ectoderm is thicker than both the mesogloea and endoderm together; the longitudinal muscles are but feebly developed and are situated in the ectoderm. Brownish pigment granules occur in the endoderm, especially toward the tips, and it is also present in the endoderm of the column and disc. The structure of the disc is essentially similar to that of the tentacles.

The stomatodaeum is irregularly ridged longitudinally and possesses two siphonoglyphs. The mesenteries of the first three cycles have a well developed longitudinal musculature which occupies nearly the entire surface of the muscular portion of the mesenteries and consists of numerous slender and branching processes which diminish in height somewhat gradually toward the outer edge of the muscle, but abruptly at the inner edge (Fig. 26). The basal portions of the mesenteries bear several short, rather stout, unbranched processes, but there is no distinct fold representing a parieto-basilar muscle, nor do tangential sections through the base reveal a distinct basilar. Reproductive cells in very early stages of development were seen in some of the mesenteries of the second and third cycles. The mesenteries of the fourth cycle are small and destitute of both muscle pennons and mesenterial filaments.

In certain respects, such as the possession of a capitulum, this form differs from the typical members of the genus *Paractis*. It is not improbable that it may be necessary to assign it to another genus when the anatomical peculiarities of *Paractinia*, *Paranthus* and *Parantheoides* are more definitely determined.

Genus *Pycnanthus* McMURRICH 1893.

Paractidae with a thick column wall, destitute of tubercles or verrucae, but with capitular ridges; margin tentaculate, not lobed; tentacles slender and not bulbously enlarged at the base.

9. *Pycnanthus lineolatus* (McMURRICH).

Paractis lineolata McMURRICH, 1893.

? *Actinia lineolata* COUTHOUY, 1846.

Juan Fernandez. 30 fathoms. 1 specimen.

The single specimen of this species (Fig. 27) was strongly contracted, the upper portion of the column being completely infolded and the tentacles concealed. The base was adherent and the column had the form of a low dome, its walls being perfectly smooth, except for some irregular circular furrows, due to contraction, and radial ridges upon the summit which were probably the continuations of the capitular ridges.

The height of the column was about 2.5 cm, and its diameter at its widest part 3.2 cm. In color it was probably uniformly chocolate brown, the coloring matter being located in the ectoderm, so that where this had been removed and the underlying mesogloea exposed, white blotches occurred.

Structure. The column ectoderm was very uniform in structure, consisting of cells about 0.26 mm in height whose basal portions were densely packed with pigment granules of a yellowish-brown colour and so fine that they gave the appearance of an almost homogeneous coloration. I could detect no gland cells and no nematocysts in my preparations. The mesogloea was very thick, measuring 3.0—3.5 mm in thickness, and contained numerous minute cavities occupied by cells and lying in an almost homogeneous ground substance. It is interesting to note that in the outermost portions next the ectoderm, the contents of the cavities were colored by the same pigment as occurred in the general ectoderm. In the infolded portion of the column the mesogloea increased in thickness, until at the junction with the disc it was almost twice as thick as it was lower down and its surface was raised into distinct longitudinal ridges, giving it an appearance such as is seen in the capitulum of certain *Phelliinae*. I could not determine the number or arrangement of these capitular ridges without mutilating the single

specimen more than seemed advisable, but they seemed to be solid elevations whose ectoderm was pigmented like that of the rest of the column.

The circular musculature of the column was but moderately developed, but there was a strong mesogloea sphincter (Fig. 28), triangular in section, tapering off rather abruptly at its lower edge and separated from both ectoderm and endoderm by a distinct layer of homogeneous mesogloea. It extended throughout the length of the capitulum and in its upper part presented a reticular appearance, while below it showed distinct indications of layering.

The tentacles were probably forty-eight in number and were of moderate length and simple, possessing no enlargement of the mesogloea at their bases. Their longitudinal muscles and the radial muscles of the disc were well developed and were not imbedded in the mesogloea; the ectoderm of both disc and tentacles was destitute of pigment granules and abundantly supplied with both gland cells and nematocysts. The stomatodaeum was long, reaching nearly to the base; its mesogloea was thick and it possessed two well-marked siphonoglyphs, where lower edges were somewhat prolonged.

The mesenteries were arranged hexamerously in four cycles and only those of the first cycle were perfect. Their longitudinal musculature was only moderately developed (Fig. 29), the supporting processes diminishing gradually in height toward either edge while those of the middle portion were more or less branched, often pinnately. In the region occupied by the parieto-basilar muscles the mesogloea was somewhat thickened in the mesenteries of the first and second cycles, and as the thickening ended abruptly where the longitudinal musculature began the parieto-basilar in some cases formed a slight fold upon the surface of the mesentery. Basilar muscles were present but were feeble in proportion to the size of the specimen. The individual mesenteries of each pair were equally developed and all possessed mesenterial filaments, the ciliated lateral lobes of which were very well developed. No reproductive cells were observed nor could I determine the presence of mesenterial stomata.

The specimen, apart from its much greater size and the uniformity of the coloration of its column, resembles very closely the form I have described (1893) as *Paractis lineolata* and, indeed, there seem no reasons for doubting its identity with that form. The difference in coloration may well be associated with the difference

in size and a re-examination of the "Albatross" specimens demonstrated the existence of capitular ridges which I had previously overlooked. I feel dubious however, as to the identification of the "Albatross" forms with *Actinia lineolata* of COUTHOUY. In neither the small "Albatross" specimens nor in the larger one here described was there the flattening of the column to the extent described and figured by DANA (1846), nor does it seem likely that it could occur on account of the thickness of the mesogloea. And, furthermore, there is no indication of the dark purple-brown coloration of the disc which DANA's figures show. In the meantime, however, it seems just as well to retain for the form here described the specific name first applied to it, leaving open for the present the question of its identity with COUTHOUY's species.

Genus *Actinostola* VERRILL, 1883.

Paractidae usually of large size, with a firm leathery wall, which may be corrugated or folded but is not furnished with verrucae; margin not lobed, tentaculate; tentacles short, and stout, fluted and not enlarged at the base; the individual mesenteries of each pair in certain cycles unequally developed.

10. *Actinostola chilensis* n. sp.

No. 220. Calbuco. 16—20 fathoms. 1 specimen.

The base is somewhat concave and is adherent. The column is practically cylindrical (Fig. 30), diminishing slightly in diameter from the base to immediately below the margin where it undergoes a sudden but slight enlargement. It measured about 3.7 cm in height, but, the limbus being somewhat irregular, measurements taken along different lines varied somewhat, the extremes being 4.7 cm and 3.0 cm. Its diameter just above the limbus was nearly 5 cm, while at the margin it fell to 3.8 cm. The surface has a rugose appearance due to slight longitudinal and transverse furrows, probably produced by contraction; the consistency of the column wall is firm and leathery and there are no verrucae or tubercles.

The tentacles are completely exposed and are arranged in about four cycles, the innermost one consisting of twenty-four tentacles. This would make a total of one hundred and ninety-two provided that all the cycles were fully developed, a condition which, however, does not seem to be fulfilled, since an enumeration of the outer cycle

failed to give ninety-six tentacles. The inner tentacles are markedly larger than the outer ones, the latter being seated upon the margin, but all are of essentially the same shape, short and stout, with rounded tips, in the centre of which there is in the majority of cases a marked depression, suggesting a perforation. The inner tentacles measured 0.6 cm in length and had a diameter of about 0.3 cm. The stomatodaeum is widely expanded and completely hides the portion of the disc unoccupied by the tentacles. Two rather feebly developed siphonoglyphs can be distinguished and the walls of the stomatodaeum are longitudinally ridged. Practically no traces of color remains.

Structure. The mesogloea of the column wall measures a little more than 1 mm in thickness at the middle of the column and has an almost homogeneous or in some places slightly fibrillar ground substance in which numerous cells, sometimes arranged in groups of two or three, are scattered. The circular musculature is rather feeble, the processes for its support being low, stout and, for the most part, unbranched. The mesogloea sphincter (Fig. 31) is developed in the upper part of the wall and is much feebler than that found in other species of *Actinostola*. It is comparatively very thin, though fairly broad, and lies close to the endodermal surface. It is reticular in structure and presents no indication of layering, resembling in this respect the sphincter CARLGREN (1893) has described for *A. spetsbergensis*.

The longitudinal muscles of the tentacles and the radial muscles of the disc are well developed and imbedded in the mesogloea. In the tentacles branching laminae arise from the ectodermal surface of the mesogloea and seem in individual sections to enclose portions of the ectodermal epithelium (Fig. 32), although this appearance is due solely to the manner in which the laminae are cut, the enclosed epithelium of any section becoming continuous at higher and lower levels with the general ectoderm. No muscle cells could be distinguished in these apparent enclosures.

The mesenteries are arranged hexamerously in five cycles, with occasional representatives of a sixth, and the members of the first and second cycles are perfect. There are two pairs of directives attached to the siphonoglyphs, whose lower margins are prolonged downwards as lappets almost to the base. In Fig. 33 is shown a transverse section of a portion of the column in which is seen a minute mesentery belonging to the sixth cycle adjoining a primary

mesentery and paired representatives of the third, fourth and fifth cycles. In the latter it will be seen that one individual of each pair is distinctly narrower than the other, the arrangement conforming to the rule laid down by CARLGREN for the genus.

All the mesenteries are very thin their at their insertion into the column wall, but increase rapidly in thickness as they are traced inwards. The longitudinal muscles are rather weak being borne upon low and simple processes, which, in the larger mesenteries are set upon broad low elevations of the general surface of the mesogloea, the result being that the mesenteries in section present an undulating outline over the surface occupied by the muscles. The parieto-basilar muscle forms a slight fold, as shown in the third cycle mesenteries represented in Fig. 33, and in some mesenteries cavities occurred along the line of fusion of the muscle with the surface of the general mesogloea.

All the imperfect mesenteries, with the exception of the rudimentary members of the sixth cycle, were fertile. The single specimen in the collection was hermaphrodite; the great majority of the fertile mesenteries contained ova, but in a few cases spermatozoa occurred in their stead. Thus in the larger member of the pair belonging to the fifth cycle shown in Fig. 33 to the right, ova occurred, while the smaller member of the same pair contained spermatozoa, and in another pair, this time belonging to the third cycle, the smaller member bore ova and the larger spermatozoa.

I did not succeed in determining the occurrence of marginal stomata, but oral ones were clearly present.

I am inclined to suspect that this form will prove identical with *A. excelsa* which I described (1893) from the "Albatross" collection. The much greater thickness of the mesogloea and the remarkable thinness of the sphincter, not to mention the hermaphroditism, seem, however, to mark it as distinct. So long as the structure of only one individual of a species is known, the amount of its variability in any direction remains unknown and it is not impossible that the differences between the present form and *A. excelsa* may be bridged over by the study of additional individuals. It certainly seems strange that three different species, *A. excelsa*, *A. intermedia* and the present form, agreeing in many respects but differing principally in the thickness of the column wall and in the sphincter, should occur in nearly contiguous areas, when *A. callosa* has such a wide distribution.

As regards the hermaphroditism of *A. chilensis*, it may be pointed out that CARLGRÉN (1899) has observed its occurrence in *A. groenlandica*, a form as yet undescribed. The number of cases of hermaphroditism in actinians is constantly increasing and it is open to question whether it is entitled to taxonomic value.

Genus *Antholoba* R. HERTWIG, 1882.

Actinia (pars) DANA, 1846.

Metridium (pars) MILNE EDWARDS, 1857.

Actinobopsis VERRILL, 1899.

Paractidae with the column wall thin and more or less reticulate upon the surface, but destitute of tubercles or verrucae; tentacles short, very numerous and not enlarged at the base; margin lobed; the individual mesenteries of each pair equally developed.

VERRILL (1899) has proposed the generic name *Actinobopsis* to replace *Antholoba* under the erroneous impression that HERTWIG had used DE BLAINVILLE'S term *Actinoloba* for *A. reticulata*. This not being the case VERRILL'S name is unnecessary.¹⁾

11. *Antholoba achates* (DRAYTON).

Actinia achates DRAYTON, 1846.

Sagartia achates GOSSE, 1855.

Metridium achates MILNE EDWARDS, 1857.

Actinoloba achates GOSSE, 1860.

Actinia reticulata COUTHOUY, 1846.

Sagartia reticulata GOSSE, 1855.

Metridium reticulatum MILNE EDWARDS, 1857.

Actinoloba reticulata GOSSE, 1860.

Antholoba reticulata R. HERTWIG, 1882.

Actinobopsis reticulata VERRILL, 1899.

No. 25.	Iquique 20 metres.	3 specimens.
98.	Cavanca near Iquique 30 metres.	1 specimen.
43.	Coquimbo.	4 specimens.
65.	Coquimbo.	3 specimens.
68.	Coquimbo.	2 specimens.
69.	Coquimbo.	1 specimen.

1) It may also be remarked that the term *Phelliopsis* proposed by VERRILL for Paractids with an adherent cuticle has already been used by FISCHER (1887) for *Phellia nummus* ANDRES.

No. 121.	Tumbes, near Talcahuano.	10 specimens.
128a.	Tumbes, Talcahuano.	6 specimens.
169.	Talcahuano.	3 specimens.
?	Talcahuano.	1 specimen.
286a.	Punta arenas.	1 specimen.

DANA in his report on the Zoophytes of the WILKES exploring expedition described two forms from the coast of South America which had been named *Actinia achates* and *Actinia reticulata* by DRAYTON and COUTHOUY respectively. The latter form has been identified and re-described by R. HERTWIG (1882), myself (1893) and CARLGRÉN (1899), and HERTWIG, discovering that it was a Paractid, established for it the genus *Antholoba*. A study of the specimens contained in the present collection has convinced me that COUTHOUY'S species is really identical with DRAYTON'S, and since the latter is the first of the two described in DANA'S report it should be taken as the type.

The differences between the two forms as shown in the figures in the Report are principally in size, coloration and the apparent absence of a reticulation of the column wall in *A. achates*; the difference in the number of tentacles is probably associated with the difference in size and the difference in habitat, *A. achates* having been obtained in thirty fathoms, becomes of little consequence as individuals of *A. reticulata* have been collected in similar depths, specimens in the "Challenger" collection having been taken in forty-five fathoms. The numerous individuals in the present collection show considerable variation both in coloration and in the distinctness of the reticulation of the column wall and it is impossible to separate anatomically the forms which resemble *achates* in these respects from those that resemble *reticulata*.

In the majority of the specimens the column is low in proportion to the diameter, which increases rapidly from the limbus to the margin. In extreme cases the form is almost saucer-like, but between this condition and almost cylindrical forms there are almost all gradations, and the two specimens from Iquique, which were adherent to lamellibranch shells were somewhat conical in form. The margin is generally somewhat infolded, although the tentacles and disc are as a rule visible, but in the more cylindrical forms the tentacles may be concealed although the infolding never quite reaches completeness. The reticulations of the surface of the column are always

present, though frequently noticeable only on close inspection, their distinctness being dependent partly on their coarseness and partly on the coloration, since they are much more distinct in the darker varieties than in the paler ones, the difference being due to the ridges which compose the reticulations being, in the darker varieties, either darker or paler in color than the depressions which they enclose.

The lobation of the margin is usually well marked in the more expanded individuals, the number of lobes varying from five to six, though occasionally seven were observed. I have nothing to add concerning the tentacles except to remark that judging from the specimens I have seen HERTWIG has possibly exaggerated their number in stating that they are "several thousand". The disc is smooth and flat and the peristome usually considerably elevated above its general surface.

The different individuals varied considerably in size, not only absolutely but also in their relative proportions. One of the more columnar specimens measured 2 cm in height and had a diameter of about 2.3 cm, but the majority were much broader at the margin than at the base, thus,

Height	Diameter at base	Diameter at margin
3 cm	2.4 cm	3.5 cm
4 cm	2 cm	3.8 cm
1 cm	3-4 cm	5 cm

A number of the specimens from Tumbes showed the extreme flattening indicated by the lowest row of figures.

The coloration of the preserved specimens is very varied. Some are practically colorless; other have only a narrow dark greenish gray band around the margin; in others the upper half of the column is of the dark color, sometimes uniformly distributed and sometimes most pronounced in the depressions of the reticulation; and in others again the column is dark greenish throughout though somewhat darker above than below. In other individuals, less numerous in the collection, the general color is brown, varying from a pale chocolate to a dark seal brown, sometimes uniformly distributed and sometimes deeper upon the ridges of the reticulation. In the specimen No. 69 from Coquimbo the coloration was almost identical with that shown for *A. reticulata* in DANA'S tab. 4, fig. 31,

the brown of the column being mingled with a greenish tinge and a very distinct line surrounding the margin as in the majority of the paler specimens.

The tentacles were usually colorless, although in some of the brown specimens they partook of that color. A noticeable marking in many of the specimens was a dark band around the margin of the mouth opening, and in some cases there was also a similar band surrounding the base of the elevated peristome. These two bands are shown in DANA'S figure of *A. achates*, and they occur in individuals of the present collection which in other respects resemble *A. reticulata*.

Structure. I have little to add to the descriptions already published. I may state, however, that I have not found in any of the specimens I have examined as many mesenteries as HERTWIG has described; my finds agree with those of CARLGREN who describes only six complete cycles, though indications of what seems to be an incomplete seventh cycle occur. The specimen described by HERTWIG was a little longer than any of those described by CARLGREN and myself, and this may account for the difference, although possibly HERTWIG may have made a mistake in the order of the interseptal space which he examined for the determination of the arrangement of the mesenteries. I find but three cycles of perfect mesenteries, while CARLGREN describes four, the fourth, however, reaching the stoma-todaeum only in its uppermost part.

I find the mesenteries of the fourth, fifth and sixth cycles to be perfect, but although I have examined a number of specimens I have not yet observed any cases of hermaphroditism such as both HERTWIG and CARLGREN have described. The number of Actinians known to present hermaphroditism is constantly increasing and the question is suggested whether all species do not really exhibit protandric or protogynic hermaphroditism, or whether at different seasons or under different circumstances of nutrition the same individual may not at one time produce male reproductive cells and at another ova, the two kinds of cells being sometimes present simultaneously. This idea was long ago suggested by my observations on *Cerianthus americanus*, in which I found no indications of hermaphroditism, although the species had been described as hermaphrodite by LOUIS AGASSIZ and Mr. ALEX. AGASSIZ informed me by letter that there could be no doubt but that this was the condition in the specimens described by his father.

Family *Boloceridae* McMURRICH, 1893.*Bunodidae* (pars) GOSSE, 1800.*Aniheidae* (pars) KWITNIEWSKI, 1896.*Actiniidae* (pars) HADDON 1898.*Liponemidae* + (?) *Polyopidae* HERTWIG, 1882.? *Sideractidae* DANIELSSEN, 1890.

Actininae with an adherent base. Column wall smooth or with verrucae, but never with hollow vesicular outgrowths. Sphincter endodermal, diffuse or rarely circumscribed. Tentacles constricted at the base and readily detachable, fluted and usually provided with a sphincter muscle. Margin simple, without acrorhagi. Mesenteries arranged in several cycles, of which more than one is perfect; longitudinal muscles usually diffuse; parieto-basilar and basilar unequally developed. No acontia.

The genus *Bolocera* was established by GOSSE in 1860 with the *Actinia tueliae* of JOHNSTON (1832) as its type. GOSSE, however, placed his new genus in the family *Bunodidae*, although JOHNSTON (1838) had transferred his species to the genus *Anthea* and GOSSE (1858) had concurred in the transference. This species has since been frequently described from European waters and in 1873 VERRILL identified with it a form occurring in deep water off the Atlantic coast of North America. We possess, however, no anatomical description of the type with which to compare the American form and it is consequently impossible to say at present whether the two are really identical, although they will probably prove to be so.

In a supplement to his *Actinologica Britannica* GOSSE (1860) referred to the genus another species which he named *B. eques*. Different opinions have prevailed as to the true affinities of this form; VERRILL (1869) suggested that it might be identical with *Urticina crassicornis*, an idea which was subsequently revived by CUNNINGHAM (1889) who identified it with *Tealia tuberculata* (COCKS), and was opposed by G. Y. & A. F. DIXON (1890). I am of the opinion that VERRILL and CUNNINGHAM are in the right in the matter, especially since, as Professor VERRILL has found, *U. crassicornis* occasionally is hexamerous.

In 1879 STUDER described what is really the second species of the genus, *B. kerguelensis*, a form which has since been studied by KWITNIEWSKI (1896), and in the same year VERRILL described

B. multicornis. Other species were later described by CARLGRÉN, KWITNIEWSKI and myself, but until quite recently no one had proposed new generic names for any of the species, notwithstanding that considerable differences were observed in their structure. In 1900, however, CARLGRÉN had an opportunity for studying a species from Zanzibar, which proved to be identical with that from Amboina previously described by KWITNIEWSKI (1898) as *B. mc murrichi*, and, observing that it possessed well developed ectodermal muscles in the column wall, established for it a new genus *Boloceroidea* and transferred it to his tribe Protantheae. I have made re-examination, with CARLGRÉN'S observation in mind, of all the species of *Bolocera* of which I have examples and find that in *B. brevicornis* the ectodermal column muscles are also quite well developed. This form must accordingly be associated with *B. mc murrichi* in the genus *Boloceroidea*, for it seems advisable to retain the genus even although one may not be able to agree with the tribal position to which CARLGRÉN assigns it.

A division of the original genus being thus initiated, the question arises whether it should not be continued still further. I have long thought that some subdivision was necessary, but the relatively small number of specimens examined seemed a reason for waiting until more extensive observations had given a surer basis for classification. The discovery of the form to be described below seems to demand a new genus, since it lacks the tentacular sphincter so characteristic of other species, while in other respects it is a typical Bolocerid. I propose to establish for it the genus *Boloceropsis*.

Another genus might well be established for *B. pollens*, in which I found (1898) a strong circumscribed sphincter instead of the more usual diffuse or aggregated one, but this may well be left for further observations to determine.

Genus *Boloceropsis* n. g.

Boloceridae with rigid tentacles not provided with a sphincter; no longitudinal ectodermal musculature in the column wall.

12. *Boloceropsis platei* n. sp.

No. 22.	Calbuco.	16—20 fathoms.	1 specimen.
232.	Calbuco.	10 fathoms.	4 specimens.

The base is adherent and the column cylindrical and low (Fig. 34), its diameter being greater than its height. It presents several more or less marked horizontal folds or ridges due to contraction, but no longitudinal ridges; whether or not verrucae were present on the upper part could not certainly be determined, though it is probable that there were none. The outermost tentacles were marginal in position and the remaining cycles, of which there are about five (the innermost with twelve tentacles), occupy the greater portion of the disc. Each tentacle has the form characteristic for the *Boloceridae* and is rigid and usually shows indications of a longitudinal fluting. In one specimen in which a count of the tentacles was made, the total number fell somewhat below the theoretical 192, owing to an incomplete development of the outermost cycle. The disc was smooth and the mouth almost circular, the gonidial grooves being but poorly marked; the stomatodaeum, which was considerably evaginated in several individuals, was longitudinally ridged.

The label accompanying the specimens No. 232 stated that in life they were "schön rosa", but all traces of color are wanting in the preserved material. In the largest individuals the height of the column was 1.2 cm and the diameter of the base 3.2 cm, while in smaller specimens the height was 0.7 cm and the diameter 2.3 cm. The innermost tentacles had a length of 1.2 to 1.4 cm, and a diameter at their broadest part of about 0.4 cm.

Structure. The mesogloea of the column wall is rather thin and at irregular intervals has horizontal ridges projecting from its outer surface. The circular musculature is well developed and in the distal portion of the column increases in height to form a diffuse endodermal sphincter (Fig. 35), supported upon numerous branched mesogloea lamellae, the uppermost of which is situated immediately beneath the bases of the outermost tentacles and is somewhat stronger than the rest and gives rise to secondary lamellae from its lower surface.

A longitudinal section through one of the tentacles shows that its mesogloea becomes very thin a short distance beyond where it joins the disc and distally to this region thickens again quite suddenly (Fig. 34). This is a feature common to all *Boloceridae*, but in the present species a marked peculiarity is the absence of a tentacular sphincter. I was much surprised to find no trace of it in the first tentacle I sectioned and to make sure of its absence I

sectioned several tentacles from the same and from other individuals, but in no case could I find any signs of its presence.

Transverse sections of the tentacles showed the existence of longitudinal ridges of mesogloea which give rise to the fluted appearance. The longitudinal musculature of the tentacles and the corresponding radial musculature of the disc are ectodermal and fairly strong, the mesogloea lamellae which support it in the tentacles being higher and more numerous over the ridges than in the intervals between these. In some preparations the mesogloea had a reticular structure suggesting a mesogloea musculature, but no traces of muscle fibres could be found in the meshes of the reticulum, nor was the reticulum of general occurrence throughout in any one tentacle.

Two well developed siphonoglyphs are readily distinguishable in sections through the stomatodaeum, the slight development of their corresponding gonidial grooves being due to their having been flattened out by the evagination which the stomatodaeum had undergone in many of the specimens. The mesenteries were arranged in four cycles, one individual, that in which the tentacles were counted, showing an incomplete development of a fifth and some irregularities in the fourth. Twelve pairs of mesenteries were perfect, six of these, however, separating from the stomatodaeum sooner than the others, which included the two pairs of directives. The longitudinal muscles were moderately developed; at the lower edge of the stomatodaeum they occupy the greater portion of the non-gonophoric part of the mesentery and increase gradually in height from without inwards, ending abruptly at the inner edge. The parieto-basilar are feeble, not forming a fold and the basilar muscles are also weak, resembling those which CARLGREN has figured for *B. longicornis*.

A few words may be added concerning the sphincter of the Bolocerids. There are within the limits of this family sphincters of all gradations from "absent" to "strong endodermal circumscribed", but in the majority of the species they are endodermal and diffuse. Even in these, however, considerable variety has been found; thus in *B. longicornis* CARLGREN, *B. occidua* MC M., *B. brevicornis* MC M. and in my preparations of *B. multicornis* VERRILL the sphincter is typically diffuse, while in *B. kerguelensis* STUDER, *B. pannosa* MC M., *B. multipora* (HERTWIG), *B. tuediae* VERRILL and in CARLGREN'S figures of *B. multicornis* there is at the upper edge of the muscle

a mesogloal lamella much stronger than the rest and giving rise to secondary lamellae and it is sometimes of sufficient strength to suggest a somewhat circumscribed muscle. In my description (1893) of *B. pannosa* this upper lamella was so strong that I described the sphincter as circumscribed, but further study has shown that it is really of the diffuse variety. In studying different sections through the sphincter of *B. platei* I noticed that in some a distinctly stronger process at the upper edge occurred as shown in Fig. 35, but in others it was by no means so distinct, and a comparison of the different sections showed that it was found only when the section passed through the point of insertion of a tentacle. HERTWIG observed the same condition in the sphincter of *B. multipora*, and an examination of *B. tuediae* VERRILL showed that the same rule held good for it, while in *B. pannosa*, although the strong fold could be detected in the intervals between the tentacles it was much stronger opposite their insertions. On the other hand I found that in *B. occidua* a fold with lateral secondary lamellae though no longer than the succeeding folds could be found at the upper edge of the muscle opposite the insertions of the tentacles but not in the intervals.

It would seem, then, that there is a special development of the sphincter whenever it lies beneath the insertion of a tentacle and that quite different appearances may be presented according as a section passes through such regions or between them. Probably the strong upper fold figured by KWIETNIEWSKI for *B. kerguelensis* (1896) will be found to be greatly reduced in size in the intervals between the tentacles, the section which he figures being apparently one that passes through a tentacle, to judge from the sudden outward bending of the column wall just above the muscle. Similarly it is probable that the differences between CARLGRÉN'S figures of the sphincter of *B. multicornis* (1902) and what I find in my preparations of that species are due to the different relations of the sections to the tentacles.¹⁾

1) A re-examination of my preparations of *B. pannosa* has convinced me that I was mistaken in stating that the sphincter was lower on the column than usual and that a true marginal sphincter was wanting. The torn condition of the margin in the specimen examined contributed to the mistake and as a matter of fact the sphincter is immediately below the margin, the musculature above it being the circular musculature of the basal portion of one of the tentacles.

Family *Aliciidae* DUERDEN, 1895.

Actininae with an adherent base. Column wall with simple or compound hollow tubercles or with vesicular outgrowths. Sphincter endodermal, diffuse. Margin with or without acrorhagi. Tentacles simple. Mesenteries arranged in several cycles of which usually more than one is perfect; longitudinal muscles diffuse; parieto-basilars and basilars unequally developed. No acontia.

Genus *Phymactis* MILNE EDWARDS, 1857.

Actinia (pars) DANA, 1846.

Phymactis MILNE EDWARDS, 1857.

Cladactis VERRILL, 1869 (non PANCERI).

Eucladactis VERRILL, 1899.

Aliciidae with the margin provided with acrorhagi; column wall entirely covered with closely-set simple or compound hollow tubercles.

The determination by CARLGRÉN (1899) of the true systematic position of this genus and the more perfect description of the type species have reduced VERRILL'S genus *Cladactis* and his later substitute *Eucladactis* to the rank of synonyms, for they seem to possess no peculiarities sufficient to warrant their retention as distinct from *Phymactis*.

13. *Phymactis clematis* (DRAYTON) MILNE EDWARDS.

Actinia clematis DRAYTON, 1846.

Phymactis clematis MILNE EDWARDS, 1857.

Actinia florida DRAYTON, 1846.

Phymactis florida MILNE EDWARDS, 1857.

? *Actinia pluvia* DRAYTON, 1846.

? *Eucladactis grandis* VERRILL, 1899.

No. 18.	Cavancha near Iquique.	6 specimens.
19.	Cavancha near Iquique.	6 specimens.
38.	Iquique.	1 specimen.
39.	Cavancha near Iquique.	1 specimen.
91.	Juan Fernandez.	3 specimens.
116.	Tumbes.	3 specimens.
128.	Tumbes.	1 specimen.
164.	Tumbes.	2 specimens.
?	Tumbes.	1 specimen.

The base is adherent and, in the majority of the specimens, the limbus is somewhat recurved, presumably the result of contraction subsequent to the removal of the specimens from the substratum to which they were attached. The column wall is covered throughout its entire extent with closely set tubercles, for which no definite arrangement in rows can, as a rule, be discerned, though in one specimen from Cavancha (No. 18) such an arrangement could be made out distinctly in the upper part of the column but not lower down. The general indistinctness of the arrangement is due, however, to the large number of rows which occur and also to the fact that the majority of the tubercles are compound, consisting of a hollow stem bearing at its summit two, three, or four hemispherical knobs. Simple tubercles, with but a single knob also occur but they are much less frequent than the compound ones, and since all the tubercles are formed by evaginations of the column wall in the intermesenterial spaces, they must really be arranged in longitudinal rows.

The surfaces of the knobs may either be quite smooth or may be marked with fine lines. In the specimens from Cavancha a peculiar condition was observed, in that the extremities of the pedicles, instead of being rounded and knobbed, were elongated and more or less curved, so that the column had the appearance shown in Fig. 38. The individuals presenting this peculiarity resembled the forms with knobbed tubercles (Fig. 37) in other respects, however, and there seems to be no reason for regarding them as forming a different species.

The upper portion of the column, especially in the more elongated individuals, is strongly inverted, the tentacles and margin being concealed; but in the lower and broader individuals the incurving is not sufficient to conceal the parts mentioned and it may be seen that the margin is provided with acrorhagi which are lobed and of a different color than the column. A distinct fosse occurs between the acrorhagi and the bases of the tentacles. These are arranged in about five cycles and are probably about 192 in number in the smaller individuals and 384 in the largest. A slight difference in their shape, no doubt due to differences in contraction can be noticed in different individuals, in some they are distinctly acuminate, while in others they are obtusely pointed. A dark spot, indicating the presence of a perforation is distinct in the centre of the apex of many tentacles, and in some cases mesenterial filaments protruded

through the perforation. A longitudinal fluting is noticeable in most of the specimens. The tentacles of the innermost cycle take their origin directly from the disc, but those of the second cycle arise from the summit of radial ridges which gradually increase in height as they are traced peripherally, and the outer cycles arise from other ridges, each of which as it is traced peripherally becomes confluent with the adjacent ridge of the tentacle of the next oldest cycle. It is thus possible to separate the tentacles into groups, each of which clusters, as it were, around a ridge bearing a tentacle of the second cycle, the lines separating adjacent groups passing through tentacles of the innermost cycle.

The disc is somewhat concave and is marked by radiating grooves separating areas which are continuous peripherally with the ridges bearing the second cycle tentacles. The peristome is somewhat elevated and the stomatodaeum is longitudinally ridged and provided with two siphonoglyphs.

The measurements differ in different individuals somewhat, in accordance with the form assumed in contraction. The majority of the specimens are considerably broader than high and are somewhat smaller in diameter at the base than they are at the margin. Measurements of three individuals of this form gave for the height 3 cm, 3 cm and 3.7 cm, for the diameter at the base 3 cm, 3.5 cm and 3 cm, for the diameter at the broadest part of the column 5.5 cm, 4.7 cm, and 5 cm. Other individuals are higher in proportion to the diameter and have a more conical form, and measurements of three of these gave for the height 4.5 cm, 3.0 cm, and 4.0 cm, for the diameter of the base 3.7 cm, 3.0 cm, and 3.4 cm, and for the diameter of the margin or rather of the column just below the margin 3.0 cm, 2.2 cm, and 2.5 cm. The tentacles vary in different individuals from 0.4 cm to 0.6 cm in length, according to the degree of contraction.

The great majority of the specimens in their preserved condition are of an olive-green color. The base and stomatodaeum are paler and rather brownish or flesh-colored, and the tentacles and disc are usually somewhat darker than the column. The acrorhagi are, as a rule, paler than the column tubercles, a condition which agrees with what might be expected from DRAYTON's descriptions of their coloration. Two specimens from Cavancha (No. 18), however, had a different color from the majority, being of a uniform pale brown, and the single specimen from Iquique is, so far as its ectoderm is concerned, quite colorless, pigment in the endoderm, however, giving

the regions where the ectoderm has been macerated away a decided dark coloration. This Iquique specimen is stated in the label which accompanies it, to have been of a blue color during life.

Structure. The tubercles of the column are evaginations of the wall in the intermesenterial spaces and each contains a cavity continuous with that of the space in whose wall it occurs. In the intervals between successive evaginations the mesogloea of the column wall is moderately thick and is thrown on its inner surface into well marked branching processes for the support of the circular musculature, but the mesogloea of the evaginations is on the contrary thin and its inner surface is smooth. The endoderm everywhere contains dark pigment granules, which are less plentiful in the lighter colored individuals than in the others, and it seems probable that the great variety observed in the coloration of living specimens may be due to a diffuse pigment located in the ectoderm. No nematocysts were detected in the ectoderm of the tubercles, but that of the acrorhagi was densely crowded with them (Fig. 39).

The sphincter is a well-developed representative of the diffuse endodermal type, having the appearance shown in Fig. 39. In some individuals the lamellae are more branched than in that from which the figure was drawn, but the general form and development were about the same in all the specimens examined.

The tentacles have their mesogloea longitudinally ridged upon the outer surface, the fluted appearance mentioned above being thus produced. Their longitudinal musculature is entirely ectodermal (Fig. 40), as is also the radial musculature of the disc (Fig. 41), the latter, however, being somewhat stronger than the former and supported on fairly high but unbranched mesogloea processes.

The stomatodaeum is provided with numerous longitudinal ridges and possesses two siphonoglyphs. The endoderm of the latter seems to be much thickened, the thickening, however, being due to numerous fine fibrillar processes which arise from the mesogloea and support the endodermal cells, an arrangement which I have already described as occurring in *Cribrina elegantissima* (1901). On the ectodermal surface of the mesogloea of the siphonoglyphs small and somewhat widely spaced simple processes occur for the support of a longitudinal ectodermal musculature, which was either absent or consisted of only a few scattered fibres over the general surface of the stomatodaeum.

The pairs of mesenteries were 192 in number in the largest

specimen and 96 in the smaller ones. In the latter a section taken immediately below the margin showed forty-eight pairs of perfect mesenteries with intervening imperfect ones, but lower down only twenty-four pairs were still connected with the stomatodaeum, and still lower only twelve. In other words there were five cycles of mesenteries of which the first four were perfect; the first three cycles were sterile and the fourth and fifth fertile. I did not examine a specimen with six cycles to determine how many were perfect, but found in one individual that the fourth, fifth and sixth cycles were fertile. Both external and internal stomata were present, the former being small.

The longitudinal muscles at the level of the stomatodaeum form a low band, composed of short and for the most part simple folds (Fig. 42 a). They are situated nearer the inner than the outer part of the mesentery and occupy only a comparatively small part of its surface. Immediately external to the muscles the mesenteries were very thin, but further out they became thicker and bore a distinct parieto-basilar muscle (Fig. 42 b), whose edge formed a fold and in some cases a series of cavities formed by the irregular fusion of the muscle with the surface of the mesentery could be distinguished. The basilar muscles were well developed, having the form shown in Fig. 43; those on the endocoelic faces of the mesenteries were considerably stronger than those on the exocoelic faces.

There seems to be no reason for doubting that this species is identical with that described by DRAYTON as *Actinia clematis* and, furthermore it is almost as certain that DRAYTON'S *A. florida* must be regarded as a synonym. CARLGRÉN (1899), from a study of numerous specimens contained in the Natural History Museum at Hamburg and the Reichs-Museum at Stockholm, has come to the same conclusion. It seems to me exceedingly probable that the synonymy should be extended still further and include the form described by DRAYTON (1846) as *Actinia pluvia*. This species was obtained at Callao, Peru, and in its general form resembles *P. clematis* very closely. In the description given by DANA, however it is distinctly stated that the "upper margin [is] not tuberculate", and on this account the species was referred by MILNE EDWARDS (1857) to his genus *Cereus* and by GOSSE (1860), VERRILL (1869) and ANDRÉS (1883) to the genus *Bunodes*. The locality from which the species was obtained is identical with that from which the original specimens of *P. florida* were collected, and the difference in

coloration of the two forms need not be regarded as a bar to their identity considering the variability in this respect presented by *P. clematis*. It seems to me very probable that the existence of acrorhagi in *A. pluvia* was overlooked on account of its coloration, for in the descriptions of *A. florida* and *A. clematis* they are stated to be either white or yellow or red, and it may be that in individuals in which the prevailing color was orange they would not be readily perceived. DANA's statement as to their absence is, however, so definite that I have included the term with an interrogation in the list of synonyms given above.

There is, furthermore, a probability that VERRILL's *Eucladactis grandis* is also a synonym. The figure which VERRILL gives of the species (1899) has certainly but little resemblance to the specimens of *P. clematis* that I have seen, the tubercles being represented as arranged in definite rows separated by distinct intervals. In the description, however, it is stated that it is "a large species with the entire surface of the column covered with close vertical rows of crowded elongated papillae" (1869), and again "They [the tubercles] are thickly crowded over the entire surface". VERRILL gives as the range of the species Paita, Peru to San Salvador and states (1869) that the species seems to be the most abundant one of the Panamanian zone. I have seen in the Museum of Natural History, Turin specimens of a form from Ecuador which is certainly identical with *P. clematis*¹), a fact which strengthens the supposition that VERRILL's form is also identical.

Family *Sagartiidae* GOSSE, 1858.

Actiniinae with an adherent base; sphincter mesogloea or rarely endodermal; mesenteries arranged in several cycles, longitudinal muscles usually diffuse, parieto-basilar and basilar unequally developed; acontia present.

Sub-family *Sagartiinae* VERRILL, 1868.

Sagartiidae with more than the first cycle of mesenteries perfect; column wall usually thin and perforated by cinclides.

1) I may add that CARLGRÉN had inspected these specimens before my visit to Turin and had identified them as *P. clematis*.

Genus *Sagartia* GOSSE, 1855.

Sagartiinae with the column smooth or provided with verrucae in its upper portion; cinclides more or less scattered; acrorhagi wanting; margin not lobed.

14. *Sagartia chilensis* (LESSON) ANDRES.

Actinia chilensis LESSON, 1828.

Dysactis chilensis MILNE EDWARDS, 1857.

Nemactis (?) *chilensis* VERRILL, 1869.

Sagartia chilensis ANDRES, 1883.

? *Actinia primula* DRAYTON, 1846.

No. 153.	Tumbes near Talcahuano.	10 specimens.
154a.	Tumbes near Talcahuano.	3 specimens.
158.	Bay of Guayacan near Coquimbo.	4 specimens.
254a.	Calbuco. 20 fathoms.	8 specimens.

The label accompanying the specimens No. 153 identified them as *A. chilensis* LESSON, and the identification having been made on living individuals lends strong support to the results obtained from the study of the preserved specimens.

Some individuals have the form of a low dome with the tentacles almost concealed, while in others the column is a low cylinder (Figs. 48, 50), the tentacles and disc being completely exposed and the stomatodaeum somewhat everted. The base is of the adherent type, some of the individuals from Calbuco being attached to hydroid stems around which the base is wrapped, though there is no fusion of the edges. The column when fully expanded is smooth and destitute of verrucae; when contracted it shows distinct longitudinal folds, especially towards the summit of the column. Slight rounded eminences, each of which is a cinclidal tubercle, can be observed over the surface of the column, apparently without regularity (Fig. 49), though somewhat more abundant in the upper part and rare below the middle; acontia protrude through the openings in some individuals.

The margin is smooth, except when the longitudinal folds already mentioned occur on the upper part of the column, and the tentacles are moderate in length, rather slender, elongate-conical in form and markedly entacmaeous. They are arranged in four or five cycles, the innermost consisting of twelve members, so that there is a

theoretical total of 96 tentacles, although the specimens I counted showed either a greater or less number than that, one specimen possessing 158 tentacles while in another I could count only 66.

The largest specimens have a height of 0.9 cm and a diameter at the margin of 1.2–2.0 cm, the diameter at the base being about the same. One of the dome-shaped individuals measured about 0.8 cm in height, while an unusually elongated one measured 1.2 cm, with a diameter of about the same. The innermost tentacles in the expanded individuals measured 0.4–0.5 cm in length, although in one specimen from Calbuco they reached as much as 0.9 cm.

In the preserved condition the specimens from Tumbes are entirely colorless, but the label which accompanied specimens No. 153 gave their coloration in life as follows. "Farbe im Leben ein zartes Meergrün mit dunklern durchsichtigen Längsstreifen. Tentakel rosagelb. Oder Körper weissgelblich mit rosagelben Längsstreifen. Die Fühler können auch weissgelb sein." The specimens from Calbuco on the other hand had a more or less uniform chestnut brown color which I am inclined to attribute to the use of osmic acid in their preservation. A label which I take to refer to these specimens (the vessel in which they were contained also a Zoanthid) gives the life coloration thus: "Mundscheibe gelb, Fühler, Lippen, Seiten des Körpers weiss, die letztern mit zahlreichen durchscheinenden Längslinien." The specimens No. 158 showed upon the column wall twelve or twenty-four faint pink longitudinal lines and the disc was also pink, though the peristome, tentacles and column were colorless.

Structure. The mesogloea of the column wall is thin, being about the same thickness as the ectoderm and has a homogenous or finely fibrous structure. Near the margin it thickens somewhat to enclose the sphincter (Fig. 51) which is fairly strong and elongate triangular, or in the more expanded individuals elongate-clavate in section. In its upper part it is separated from the ectoderm by a very narrow band of mesogloea and by an even thinner band from the endoderm, but below it separates further from the ectoderm. Its cavities are elongated in the upper part but below and on its outer surface they are more rounded and scattered. The circular musculature of the column wall is feeble.

The margin is hardly marked and no fosse exists between it and the bases of the tentacles. There were no acrorhagi. The longitudinal muscles of the tentacles and the radial musculature of

the disc were moderately developed and entirely confined to the ectoderm.

There were twenty-four pairs of perfect mesenteries and twenty-four imperfect ones, and in some individuals an incomplete fifth cycle, composed of very small mesenteries, also occurred. In one specimen, No. 158, the mesenteries were arranged octamerously, there being sixteen perfect and sixteen imperfect pairs. I examined only one individual from this locality, but to judge from the number of the longitudinal pink lines which adorned the column, the others were hexamerous. The longitudinal muscles were rather weak, the pennon being narrow and usually low (Fig. 52), although in the octamerous specimen it was fairly high. There were merely indications of the parieto-basilar and basilar muscles. Acontia were present but they were not especially abundant; there were no reproductive organs in the individuals examined. Inner stomata were present but no marginal ones were observed.

The identification of this form rests largely upon Dr. PLATE'S statement, but there seems to be no good reason for doubting its correctness. In LESSON'S figure of *A. chilensis* the acontia are shown protruding only from the upper part of the column, but in the present forms the cinclidal openings are scattered, though in some cases they are slightly more numerous in the upper than in the lower portions of the column. In general appearance and in coloration the similarities are marked, although it is evident that in the coloration there may be considerable variation.

Several species of Sagartians have been described from the Chilian region by DANA (1846), GAY (1854) and CARLGRÉN (1899) and it is possible that the present species may be identical with some of these. The coloration in some of its varieties suggests *Actinia primula* DRAYTON, but the statements as to the existence of marginal tubercles (acrorhagi?) in that form are so precise as to render its identification with *chilensis* doubtful without further information as to the exact nature of the tubercles. There do not seem to be sufficient reasons for regarding any of the new species described by GAY and CARLGRÉN as identical with *chilensis*, although it must be remembered that the distinction of the various species of *Sagartinae* is at present very uncertain.

15. *Sagartia herpetodes* n. sp.

- No. 168. Tumbes near Talcahuano. 13 specimens.
 218. Puerto Montt. 5 specimens.
 364 a. Tumbes near Talcahuano. 1 specimen.

The base in all the specimens is adherent and the column is low and, in the smaller specimens, practically cylindrical, though in the larger ones it is more or less oval in section (Fig. 53) and in the largest is very much elongated in one of its transverse axes so that it might almost be described as having the form of a thick band (Fig. 54). The column wall in nearly all cases has attached to it particles of sand and shell, and these adhere with considerable force, suggesting the existence of well developed verrucae; no such structures can be observed, however, by the naked eye on the bare portions of the column and even the microscope does not reveal such definite verrucae as might be expected. Acontia protruded freely through the column wall in several individuals, but there were no cinclidal tubercles to be seen, nor did there seem to be any regularity in the arrangement of the openings through which the acontia passed. Transverse and longitudinal furrows occur upon the column wall, but these are evidently due to contraction.

The majority of the individuals are expanded, allowing a complete view of the tentacles and disc; some of the smaller specimens, however, are contracted, one completely so. There is no definite margin, the outermost tentacles being seated at the junction of the disc and column. The tentacles are short, rather slender and acuminate and are arranged in about four sub-equal cycles; there is, however, little definiteness in their number as will be readily understood from the arrangement of the mesenteries.

The disc is smooth and translucent and is perforated by a varying number of mouths. In the smaller specimens there is a central mouth and a varying number of smaller ones situated near or even among the bases of the tentacles. In the more oval individuals there are two larger mouths, whose longer axes are at right angles to the longer axis of the body (Fig. 55) and in the largest elongated specimen there were three large mouths, whose longer axes corresponded with that of the disc. The smaller more peripheral mouths vary in number; in one of the oval individuals there were only three (Fig. 55), but in the individual from which Fig. 53 was drawn there were no less than twelve, situated near

the bases of the inner tentacles, though two lay in close proximity to the large central mouths. The arrangement of the mouths in this individual and their relations to the mesenteries are shown in text figure A (page 270). Each mouth opens into a separate stomatodaeum which is longitudinally ridged; the larger central mouths may possess either one or two siphonoglyphs, but never more than one was found in any of the smaller stomatodaea.

The dimensions vary according to the amount of elongation the body has undergone in different individuals, although the height of the column is fairly uniform, being about 0.7 cm. In the oval specimens one diameter is in the neighbourhood of 1 cm, while the other may be any where from 1.1 to 1.7 cm. In the largest specimens from Tumbes the column in its narrower diameter measured about 1.3 cm, while its longer axis was 9.0 cm.

In the preserved condition the specimens are colorless, except for a slight yellowish tinge on the ridges of the stomatodaeum in some individuals. A label accompanying the specimens from Puerto Montt states the coloration in the living condition as follows: "Weiss, Fühler mit sehr hell braunem Anfluge. Mundscheibe zuweilen braun, Mundrand weiss."

Structure. The column mesogloea is finely fibrillar in structure and is about as thick as the ectoderm. This is very richly provided with clavate gland-cells, whose contents stain very deeply with haematoxylin, but at frequent intervals areas occur in which the gland-cells are much less numerous and the epithelium resembles that usually seen in verrucae, though lacking the pyriform cells. These verrucal areas are not sharply marked off at their edges from the more glandular epithelium, nor do they show any distinct depression of the centre, such as usually occurs in verrucae.

The circular muscles of the column are moderately developed and there is a distinct mesogloea sphincter. In the smaller specimens this had a clavate form (Fig. 56) and occupied almost the whole thickness of the mesogloea at its distal edge, tapering off gradually below, though separated throughout its entire width from the endoderm by a narrow band of mesogloea. In the larger individuals, however, it had a more linear form (Fig. 57) and was relatively much less developed. The longitudinal muscles of the tentacles and the radial muscles of the disc were moderate and entirely ectodermal in position.

In accordance with the multiplicity of stomatodaea the arrangement of the mesenteries presents considerable irregularity as may be seen from text-figure A, which represents the conditions in the upper part of the column of one of the smaller specimens from Puerto Montt. From this it will be seen that in this individual there were altogether eighty-five pairs of mesenteries, showing a general grouping around the large central stomatodaea, combined with a subordinate grouping around the more peripheral smaller ones. At one portion of the circumference there seems to be a tendency for the perfect mesenteries to alternate with imperfect ones, but in another portion all the mesenteries are perfect, and this

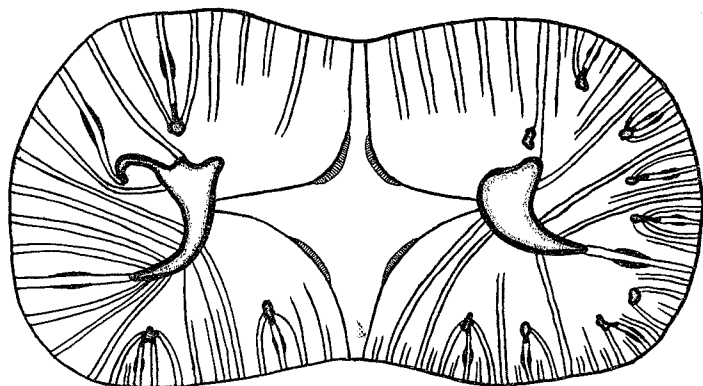


Fig. A.

is true with regard to both the primary and the secondary grouping. In another individual with only a single central stomatodaeum sixty-five pairs of larger mesenteries were counted and in addition thirty-three pairs of smaller ones; the larger pairs seemed to show a tendency to be alternately perfect and imperfect, but frequent disturbances of such an arrangement occurred. Each of the smaller stomatodaea had in connection with it a single pair of directives; the central stomatodaea in the individual represented in text-figure A had in one case one pair and in the other two.

The longitudinal muscle pennons were fairly well developed (Fig. 58), consisting of comparatively few, but high and branching mesogloea processes. In the upper part of the column, the process at the outer edge of the muscle was larger than the others and gave rise to numerous lateral processes, so that the pennon seemed

to consist mainly of this process and to be attached to the mesentery by a very narrow base. The parieto-basilar muscles are not very strong although they form a fold upon the surface of the mesentery. The oral stomata are small but the marginal ones are very large and may occupy almost one-half the width of the larger mesenteries. Acontia were numerous. No reproductive organs were found in the individuals examined.

This species is particularly interesting as showing the occurrence in one of the *Actininae* of a peculiarity hitherto known to exist only in the *Stichodactylinae* (e. g. *Ricordea florida*) and in the Corals. The existence of a multiplicity of stomatodaea denotes an imperfect division and although cases of this have been observed in *Metridium*, yet it cannot be considered a normal occurrence in that genus and does not proceed farther than the formation of a second mouth; it may, indeed, represent only a stage in a complete division. In the present species the imperfect fission is evidently a normal occurrence and is furthermore peculiar in that there are invariably produced a number of small peripheral stomatodaea in addition to two or more central ones. It would seem at first sight that the peripheral mouths had been formed in situ and not by a separation of portions of an original central stomatodaeum, but I am inclined to believe that this is not the case, but rather that the original stomatodaeum was polyglyphic, the majority of the siphonoglyphs and small neighbouring portions of the stomatodaeum having separated at an early stage, carrying with them their own directives and one or two pairs of neighbouring mesenteries. The reasons for this belief are, first, that occasionally small mouths are found in close relation to the larger ones (see text-figure A), having probably separated later than the others, and, second, that if the small stomatodaea had formed independently of the large ones it might be expected that their mesenteries would be limited to the level of the stomatodaea, but, on the contrary, there are just as many mesenteries in the lower part of the column, below the level of the stomatodaea, as there are in the upper part, and, furthermore, they are arranged below with reference to the larger stomatodaea, the smaller subordinate groupings being confined to the upper part of the column entirely. In default then of definite embryological observations to the contrary it may be assumed that the various stomatodaea have resulted by a number of incomplete fissions.

Genus *Choriactis* n. g.

Sagartiinae with a thick leathery column wall, provided in its distal portion with longitudinal ridges which may be broken up into rows of tubercles; no cinclides (?).

16. *Choriactis impatiens* (COUTHOUY).

Actinia impatiens COUTHOUY, 1846.

Paraetis impatiens MILNE EDWARDS et HAIME, 1852.

Sagartia impatiens GOSSE, 1860.

Cylista impatiens ANDRES, 1883.

No. 286. Punta Arenas. 11 fathoms. 2 specimens.

574. Punta Arenas. 10 fathoms. 2 specimens.

The four specimens which belong to this species are of very different sizes. The largest one is completely contracted, the tentacles and disc being almost completely concealed, but the others (Fig. 59) are well expanded. The base is of the adherent type and is distinctly broader than the column. The latter is cylindrical, expanding, however, considerably toward the margin, and its walls are firm and opaque. In the largest individual the lower part of the column is covered with low flat elevations arranged rather irregularly and becoming indistinct near the limbus; in the upper part they are larger and are arranged in twenty-four longitudinal rows separated from one another by deep furrows. These tubercles are simple thickenings of the mesogloea similar to those occurring in many *Phelliinae* and are not verrucae. In one of the smaller individuals the tubercles occur over the greater part of the column and are arranged in rows toward the upper part but they are much smaller and less distinct than in the largest specimen, and in a still smaller individual they are lacking, the only indication of their existence being a number of low longitudinal ridges at the upper part of the column, separated by shallow grooves. Apparently the tubercles increase in size and distinctness as the individuals grow and may be almost wanting in small specimens.

There is no distinct margin, the outermost tentacles being situated along the line of junction of the disc and column. The tentacles are 192 in number and are arranged in four cycles, the innermost of which consists of twenty-four members. They cover nearly the whole of the disc, are moderate in length and rounded

at the tips. They are decidedly entacmaeous, the inner ones being at least four times the length of the outer. In the expanded individuals the mouth is widely open and the stomatodaeum is seen to be strongly ridged, the ridges being twenty-four in number. Two distinct siphonoglyphs occur.

The largest specimen, which was contracted, measured 4.3 cm in height and had a diameter at the summit of 2.5 cm. The largest of the expanded individuals measured 2.3 cm in height, with a diameter at the base of 1.7 cm, at the middle of 1.1 cm and at the margin of 2 cm.

The column in all the specimens is distinctly brown, the color deepening to a chesnut brown on the tubercles of the column, in the tentacles and on the stomatodaeal ridges when these are exposed. This coloration, however, is probably the result of the fixation of the specimens in a chrom-osmic solution and the tentacles and stomatodaeum in contracted specimens are colorless. A label which accompanies specimens No. 574 states that the body and tentacles were rose-colored.

Structure. The mesogloea of the column wall is very much thicker than the ectoderm and has a finely fibrillar structure. The circular musculature is well developed and the strong mesogloea sphincter (Fig. 60) is finely reticular in structure, without any layering, and is of an elongate triangular form, having a width in the largest individual of about 5 mm. In the uppermost part of the wall, above the tubercles, it occupies the entire thickness of the mesogloea and in this portion the meshes are elongated; lower down it is separated from the ectoderm by a layer of ordinary mesogloea which increases in size as it is traced downward, the sphincter lying throughout its entire extent in close proximity to the endoderm. The meshes throughout all the lower portions of the muscle are circular.

The longitudinal muscles of the tentacles and the radial musculature of the disc are rather weak and show no signs of being included in the mesogloea.

The mesenteries are arranged hexamerously in five cycles, of which the first three are perfect, the third, however, separating from the stomatodaeum some distance above its lower edge. There are two pairs of directives. The mesogloea of the mesenteries is rather thick, and toward the column wall is specially so (Fig. 61), a marked fold arising from the inner edge of this basal thickening being the

parieto-basilar muscle. The longitudinal muscles are weak, their processes being low and simple or but slightly branched, and the basilar muscles are hardly developed. The mesenteries of the first and second cycles are sterile, while those of the third and fourth are fertile. There seemed to be no outer stomata, although the inner ones were quite distinct.

There seems little reason for doubting that this form is identical with the *Actinia impatiens* of COUTHOUY. In its external form, the thickness and firmness of the column mesogloea and the occurrence of tubercles, it suggests one of the *Phelliinae*, but the complete absence of a cuticle and the fact that more than the primary cycle of mesenteries are perfect excludes it from that sub-family. I cannot state positively that cinclides are wanting, but a careful examination failed to reveal their presence and the thickness of the column wall is against their occurrence as inconspicuous openings.

17. *Choriactis crassa* n. sp.

No. 627. } Cabo Espiritu Santo / 3 specimens.
628. } East coast of Tierra del Fuego. / 2 specimens.

All the individuals belonging to this species were strongly contracted, having a dome-like form, with the disc and tentacles completely concealed (Fig. 62). The base is flat and of the adherent type, and in some of the specimens has fragments of hydroid stems attached to it. The column walls are almost leathery in their consistence and are quite smooth except at the summit where there are from twenty to twenty-three radiating ridges differing somewhat in height, although no definite arrangement of the larger and smaller ones could be made out. A slight circular fold separates the ridged portion from the remainder of the column. No cinclides could be discovered.

On making a longitudinal section of the column it was evident that a considerable portion of the distal part of the wall was inverted (Fig. 63), forming a capitulum-like portion which was distinctly ridged. The tentacles were rather numerous, moderate in height and conical in form. Some were invaginated into themselves and some projected down into the widely open stomatodaeum almost to the base.

The diameter of the base was about 1.4 cm, and the height of the contracted column 0.5 cm. No trace of color persisted in any

of the specimens but a label accompanying No. 627 stated that in life they were orange, yellow, red and white, while the label with No. 628 described them as pure white.

Structure. The mesogloea of the column wall is slightly thicker than the ectoderm and has a fibrillar structure. The ectoderm is higher than usual, however, the cells composing it being slender, so that the mesogloea is really much thicker than is usual in Sagartiids of the size of the present forms. The circular musculature is moderately developed and there is a strong sphincter (Fig. 64). It is triangular in form and beautifully reticular throughout; in its upper part it occupies practically the entire thickness of the mesogloea, tapering off below very gradually toward the endoderm, from which it is separated throughout by a thin layer of mesogloea.

The longitudinal muscles of the tentacles and the radial muscles of the disc are moderately developed and entirely ectodermal in position. The stomatodaeum is provided with numerous high longitudinal ridges and has two rather shallow siphonoglyphs.

The mesenteries are arranged hexamerously in four cycles, of which the first two are perfect and include two pairs of directives. Representatives of a fifth cycle are present in some of the exocoels, but the cycle is never complete. Muscle pennons of moderate size (Fig. 65) are present on the perfect mesenteries, while those of the third cycle are small and those of the fourth cycle practically wanting. The parieto-basilar may form a slight fold, but there are practically no mesogloea processes for the support of muscle fibres external to the fold. Oral stomata were quite evident but no marginal ones could be distinguished. Acontia were present, but were not numerous; no reproductive organs were developed in the specimen examined.

The same reasons which led to the assignment of *Actinia impatiens* to the *Sagartiinae* hold with regard to the present species, which seems on the whole closely related to *impatiens*, although it is evidently a distinct species.

Subfamily *Metridiinae* CARLGREN 1893.

Sagartiidae with a relatively thin column wall, perforated by cinclides; only the primary cycle of mesenteries perfect.

Genus *Metridium* OKEN, 1816.

Metridiinae with the cinclides scattered; column wall with a collar.

18. ? *Metridium parvulum* n. sp.

No. 123.	Coquimbo.	4—19 fathoms.	9 specimens.
252a.	Calbuco.		1 specimen.
508.	Calbuco.		1 specimen.

The individuals representing this species were all small except the single specimen, No. 252a, from Calbuco, and were apparently young. The specimens from Coquimbo were taken upon a muddy bottom, adhering to shells of *Pecten purpuratus* and No. 252a was seated upon a piece of coralline.

The base in all the specimens is larger than the column (Fig. 66), which, in the majority, is distinctly constricted a short distance above the limbus. Above the constriction the column is cylindrical or tapers slightly to the margin, between which and the bases of the outermost tentacles is a relatively broad interval. At the margin the mesogloea is somewhat thickened, but above the wall is thinner than elsewhere, making it seem probable that in the expanded condition the margin formed a collar situated some distance below the tentacles, as in *Metridium dianthus*. The periphery of the disc showed, however, no indications of the lobation characteristic of that species. The column wall was practically smooth, except for some faint ridges; cinclides were observed in sections, but they could not be recognized with certainty on the surface, although in the specimen from Calbuco an acantium protruded from the column wall half way between the limbus and the margin.

The tentacles are more or less exposed in all the specimens and are somewhat entacmaeous. The inner ones may be described as moderately long and all are thin-walled and blunt at the apex. In one specimen, of which serial sections were made, there were forty-eight tentacles, but in other individuals there were probably fewer, judging from the number of mesenteries present. The disc and mouth were completely concealed by the tentacles in all the specimens.

The height of the column in the small specimens was only 3.0 to 4.0 mm and the diameter at the base 6.0—6.5 mm. The larger specimen from Calbuco measured 7 mm in height and had a basal

diameter of 10 mm. The specimens from Coquimbo are practically colorless, but that from Calbuco was brownish; all the specimens contain more or less brown pigment in the endoderm of the mesenteries and to a less extent in that of the tentacles.

Structure. The mesogloea of the column wall is on the average thinner than the ectoderm, but toward the margin it thickens until it becomes two or three times as thick as that layer and above this it diminishes again to a thin lamella (Fig. 67). It is fibrous in structure and its outer surface is raised into numerous ridges. The circular musculature is well developed and at the margin or collar and extending a slight distance above it is a feeble sphincter. This in the smaller specimens (Fig. 67) forms a linear band lying close to the endoderm, composed of two or three irregular rows of cavities in most of which only scattered muscle fibres can be perceived. In the largest individual it was better developed, occupying the entire thickness of the mesogloea at its upper part, but it is still a weak muscle.

The tentacles are thin-walled, the mesogloea being merely a thin lamella, and the longitudinal muscles are rather weak and confined to the ectoderm. The stomatodaeum is provided with longitudinal ridges and of the individuals examined one possessed two siphonoglyphs and another only one.

Transverse sections were made of two individuals from Coquimbo and of each of the individuals from Calbuco, and all showed differences in the arrangement of the mesenteries. In one of the Coquimbo specimens they were typically hexamerous, and were arranged in three cycles, those of the first cycle only being perfect. There were two pairs of directives and the mesenteries of the first and second cycles were provided with well-developed muscle pennons which were narrow but relatively high (Fig. 68), consisting of about twelve slender and somewhat branched processes. The members of the third cycle lacked both pennons and mesenterial filaments. In the second Coquimbo individual there were only twenty pairs of mesenteries: the first cycle contained six pairs which were all perfect but included but a single pair of directives; the second cycle was represented by only four pairs of imperfect mesenteries, while the third consisted of ten pairs, destitute of muscle pennons and filaments. It is clear that in this individual the decamerism starts with the development of the third cycle of mesenteries and is due to the failure of two pairs of the second cycle. In the Calbuco specimen

No. 508 there were six pairs of perfect mesenteries but only one pair of directives; the second cycle consisted of only five pairs and the third cycle of ten pairs instead of eleven as might have been expected, the missing members being those of the primary exocoel from which the second cycle pair is wanting.

The parieto-basilar and basilar muscles are practically wanting, at least no marked mesogloal processes are developed for their support. No reproductive organs were visible in the specimens examined. Acontia were present but by no means abundantly.

The assignment of this form to the genus *Metridium* is open to question but the existence of a collar seems to indicate an association with that genus. In not a few respects the species resembles *Sagartia lobata* CARLGRÉN (1899) and might be regarded as identical were it not that CARLGRÉN refers his species to the *Sagartiinae* while in all the individuals of the present one that were examined only the primary cycle of mesenteries was perfect.

Genus *Aiptasia* GOSSE 1860.

Metridiinae with markedly entacmaeous tentacles; no collar; cinclides arranged more or less regularly around the middle of the column, sphincter very weak mesogloal or endodermal.

19. ? *Aiptasia* sp.?

No. 364. Tumbes. 1 specimen.

The single individual of this species (Fig. 69) was evidently immature. The base was adherent and smaller in diameter than the column which was cylindrical, though somewhat irregularly folded longitudinally, probably as a result of contraction. No cinclides nor verrucae were observed. The outermost tentacles were much smaller than the inner ones and were seated on the margin; the inner ones were of moderate length, slender and cylindrical.

The column measured 4 mm in height, with a diameter at the base of 2.5 mm. It had a uniform brown color, but it seems probable that was entirely due to preservation.

Structure. The single specimen was cut into transverse sections from which it was seen that the column mesogloea was slightly thinner than the ectoderm and that the circular muscles were but feebly developed. A weak mesogloal sphincter was evidently present immediately below the margin, but the direction

of the sections made any determination of its form impossible. Cinclides were undoubtedly present but no definite information as to their distribution or arrangement could be obtained.

The stomatodæum was longitudinally ridged and possessed two well developed siphonoglyphs. The mesenteries were arranged octamerously in two cycles, only the first of which, containing two pairs of directives, was perfect. Longitudinal muscle pennons occurred on the perfect mesenteries and the parieto-basilar, though weak, formed a distinct fold. Acontia were present, but no traces of reproductive cells could be discovered.

It is by no means certain that this form is referable to the genus *Aiptasia*, and the imperfection of the data which could be obtained from the single specimen seems to render the bestowal of a specific name inadvisable.

Subfamily *Phelliinae* VERRILL, 1868.

Sagartiidae with a thick column wall in which a capitulum and scapus are recognizable; no cinclides nor verrucae; with the mesenteries of the first cycle alone perfect.

Genus *Hormathia* GOSSE.

Hormathia GOSSE, 1860.

Chondractinia LÜTKEN, 1861.

Chitonactis FISCHER, 1874.

Phelliinae with the scapus more or less tuberculate; capitulum smooth; tentacles not enlarged at the base.

20. *Hormathia exlex* n. sp.

No. 240. Calbuco. 2 specimens.

Of the two individuals of this species one was contracted to an almost globular form, the capitulum and upper part of the column being completely infolded. The other one (Fig. 70), on the contrary, was fully expanded and was consequently selected for examination, the description which follows being based upon it, except when otherwise stated.

The base is of the adherent form and of about the same diameter as the column or, as in the contracted form, slightly smaller and with its edges slightly incurved so that it is somewhat concave. The column is practically cylindrical and in its lower four-fifths is

furnished with numerous small tubercles arranged more or less distinctly in closely set longitudinal rows, except for a short distance above the base where they are either lacking or are disposed irregularly. At the junction of the upper and second fifth of the column, however, the majority of the rows suddenly cease, only fourteen extending further, and of these alternate rows, composed of smaller tubercles, do not extend as far up as the other seven. The longer rows correspond with endocoels of the primary mesenteries and the shorter ones to those of the secondary mesenteries. In the contracted specimen the various rows are distinctly separated from their neighbours by narrow grooves and all reach the limbus. The majority stop a short distance below the summit of the contracted column, those which are continued upon it being apparently sixteen in number and are alternately longer and shorter, the upper ends of the longer ones being infolded, so that their full length cannot be seen.

At first sight it seemed as if the scapus ended where the majority of the rows of tubercles ceased and that the primary and secondary rows were continued upon the capitulum. A faint ridge, however, occurs just distal to the extremities of the primary rows and above this is a narrow area which seems to be the true capitulum since it alone is destitute of a cuticle. In the lower four-fifths of the scapus the cuticle is very distinct and contains foreign particles imbedded in it. In the region where the primary and secondary rows alone occur it is very thin and lacks imbedded material so that it cannot readily be distinguished on surface view except over the tubercles where it is well marked. This thin cuticle extends distally as far as the ridge mentioned as occurring above the extremities of the primary rows of tubercles, but beyond this is wanting. The capitulum is quite smooth; it is to be noted that in extreme contraction the upper part of the scapus as well as the capitulum is inverted.

The tentacles are rather short and obtuse and possess no bulbous enlargements at the base. They are arranged in about four cycles. The disc is smooth and the stomatodaeum is longitudinally ridged and possesses two siphonoglyphs.

The column of the expanded individual measures 2.7 cm in height and about 1.2 cm in diameter; the contracted one has a height of 2.0 cm, a diameter at about the middle of the column of 2.5 cm and at the base of 1.2 cm.

The color of the column in both specimens is dark chesnut brown, the tubercles being somewhat darker than the general surface. In the upper part of the expanded individual the color is much paler although the tubercles are as dark as they are below, and the capitulum and tentacles are also paler while the stomatodaeum again is dark. The color of the lower part of the scapus and of the tubercles is largely due to the cuticle, while elsewhere it is due to pigment granules in the ectoderm.

Structure. The mesogloea of the column wall is thicker than the ectoderm and is of an almost homogeneous or very finely fibrillar structure. The tubercles are solid elevations of the mesogloea, over the summit of which the cuticle becomes greatly thickened, forming on the larger tubercles a distinct conical boss. The circular muscles are but moderately developed, their supporting processes being slender and unbranched. A broad though thin mesogloea sphincter is present; its upper edge is situated in the upper part of the capitulum while the lower one is almost at the middle of the scapus, its actual width being about 11.5 mm. In its upper part it occupies the entire thickness of the mesogloea, but in the scapus it is thinner and is separated from the ectoderm by a distinct band of mesogloea. It is reticular in structure, without any indications of layering.

The mesogloea of the tentacles is very thin and the longitudinal muscles weak and entirely ectodermal. In the disc the mesogloea is somewhat thicker than in the tentacles and the radial muscles are also stronger and though still ectodermal show some anastomosing of the branching processes. The ectoderm of the tentacles shows an unusually large number of nematocysts.

The mesenteries are arranged in three cycles and are on an heptamerous plan. There are seven pairs of primary mesenteries, seven secondaries and fourteen tertiaries. Of the primary mesenteries two pairs are directives, three pairs of perfect mesenteries intervening between the two directives on one side and only two on the other. Only the primary mesenteries are perfect and supplied with well developed muscle pennons, although both the other cycles possess mesenterial filaments. The longitudinal muscles of the primaries are fairly well developed (Fig. 71), occupying somewhat less than one-third of the muscular portion of the mesentery, which, between the pennon and the well developed parieto-basilar, is very thin. Acontia were present but no reproductive organs were seen.

In the contracted individual there were also three cycles of mesenteries, but the primary perfect cycle consisted of eight pairs and of these each alternate pair was a pair of directives. The eight primary pairs were sterile, but the eight secondaries and sixteen tertiaries, all of which were imperfect, contained reproductive organs.

This is, so far as I am aware, the first species belonging to the sub-family *Phelliinae* in which a departure from the hexamerous arrangement has been observed, and the specific name which I have chosen for it is intended to denote its departure from the general law. Its occurrence renders impossible the use of the words "only six pairs of perfect mesenteries" in the definition of the group; instead we must write "only the primary cycle of mesenteries perfect".

Genus *Chitonanthus* Mc MURRICH, 1893.

Phelliinae with the scapus more or less tuberculate; capitulum ridged; tentacles without bulbous enlargements at the base.

2. *Chitonanthus castaneus* n. sp.

No. 105. Juan Fernandez. 20—40 fathoms. 12 specimens.

The majority of the specimens are strongly contracted, only a few having the tips of the tentacles visible. They have the form of a dome or low cone, arising from a broad flat base which was evidently adherent. The column in some individuals is furnished with numerous tubercles arranged in longitudinal rows extending from near the limbus to the upper margin of the scapus (Fig. 72); the rows are forty-eight in number, the alternate ones having somewhat larger tubercles than the others. There is, however, a good deal of variation in the development of the tubercles; in some individuals they were quite distinct and conical in form, each being tipped by a small chitinous boss; in others they were low and rounded and lacked any especial development of the cuticle; in others they were confined to the upper portion of the scapus, while in others again the only indications of their existence was a single circular row of twenty-four somewhat elongated elevations surrounding the summit of the contracted column. As a rule the tubercles were more distinct in the smaller individuals than in the larger.

The capitulum was ridged, apparently with twenty-four stronger ridges corresponding in position with the stronger rows of tubercles,

smaller ridges alternating with these larger ones. The tentacles were short and pointed and were somewhere in the neighbourhood of 100, probably 96, in number. No bulbous enlargements of their bases were present. The disc and mouth were completely concealed in all the specimens.

The larger individuals measured 0.8 to 1.0 cm in height with a basal diameter varying from 1.6 to 2.0 cm. The accompanying label states that they were of a redbrown color in life and the same coloration is retained by the preserved specimens. The smaller individuals were paler than the larger ones, the smallest, indeed, being almost colorless. In the larger ones the color is a dark seal-brown throughout the entire extent of the scapus and the tentacles have the same color. The capitulum was colorless and in some specimens in which the cuticle has been rubbed off from the tubercles the exposed surface is white, indicating that the color of the scapus is due to a large extent to the cuticle which covers it, although a brown pigment also occurs in the ectoderm, giving the tentacles their color.

Structure. The mesogloea of the column wall is thicker than the ectoderm and is almost homogeneous in texture. Bays of ectoderm extend down into it at irregular intervals, giving in sections the appearance of cavities in the mesogloea lined with brown pigmented cells. The tubercles are solid elevations of the mesogloea. The circular muscles are feeble, there being but few scattered slender processes of mesogloea for their support and in the upper part of the column even these are practically wanting. The sphincter (Fig. 73) is well developed and triangular in section. It is confined to the capitular region and is reticular in structure, the meshes being elongated transversely in the upper part, while below they are more rounded and more separated from one another; there is no layering.

The longitudinal muscles of the tentacles and the radial muscles of the disc are moderately developed and entirely ectodermal in position. The stomatodaeum is longitudinally ridged and is provided with two rather shallow siphonoglyphs.

The mesenteries are arranged hexamerously in four cycles, those of the fourth cycle being very small and destitute of mesenterial filaments. The musculature of the mesenteries is rather weak, the pennon forming but a slight elevation on the surface (Fig. 74), the parieto-basilaris not forming any fold, while the basilaris were in-

conspicuous. Only the mesenteries of the first cycle, which included two pairs of directives, were perfect, no reproductive organs were observed in the individuals examined.

This species seems to be quite distinct from *C. pectinatus* (HERT.), differing in size, in the development of the tubercles, in the form of the sphincter and of the muscle pennon, and since this is the only form with which it seems possibly identical it may well be regarded as a distinct species.

Family *Cribrinidae* MC MURRICH, 1901.

Bunodidae AUCTION.

Tealidae HERTWIG, 1882.

Bunodactis VERRILL, 1899.

Actiniae with an adherent base; the column usually more or less verrucose and frequently with acrorhagi at the margin, these, however, never being ramose or frondose; sphincter endodermal, circumscribed; usually more than the first cycle of mesenteries perfect; no acontia.

Genus *Cribrina* EHRENBERG, 1834.

Bunodes GOSSE, 1855.

Bunodactis VERRILL, 1899.

Cribrinidae without true acrorhagi; usually with numerous perfect mesenteries; sphincter strong; ectodermal musculature of the disc and tentacles not imbedded in the mesogloea; column wall destitute of an epidermal covering and provided with verrucae arranged more or less distinctly in longitudinal rows; tentacles simple.

22. *Cribrina conica* n. sp.

No. 87. Juan Fernandez. 8 specimens.

The form of the majority of the individuals of this species is shown in Fig. 75. From a broad flat base the column diminishes gradually toward the margin, so that it has the form of a truncated cone. Its surface is marked by numerous circular furrows and in the larger individuals, when viewed through a lens, has a finely reticulate appearance. No verrucae can, however, be distinguished on superficial inspection in these specimens, although microscopical preparations show that they are present, but in some of the smaller

specimens they were distinctly visible extending in longitudinal rows from the margin almost to the limbus. Notwithstanding their presence no foreign bodies were adherent to the surface.

In most of the individuals the margin was separated from the bases of the tentacles by a distinct fosse, but in some this condition was not so evident, although in such cases there could be distinguished immediately below the bases of the tentacles an area differing from the rest of the column in lacking the reticular appearance and in being ridged longitudinally; this area evidently represents the fosse. No acrorhagi occurred.

The tentacles were more or less exposed in all the specimens, with one exception, in which the column had contracted to a low dome and the tentacles were completely concealed. Usually the tentacles were only partially visible, that is to say, only the outer cycles could be seen, the inner cycles being inverted and concealed, but in two individuals all the cycles were visible and the tentacles were seen to be thin-walled, smooth, flaccid structures equalling the column in length; their number was somewhat less than one hundred. The disc and mouth were concealed in all the specimens.

In the larger individuals the height of the column was about 1.3 cm, the diameter of the base 2 cm and the diameter at the margin 0.9 cm. In the single completely contracted specimen the height was only 0.7 cm and the base measured 2 cm in one diameter and 0.5 cm in the other. The tentacles, when most perfectly expanded measured about 1 cm in length. The label accompanying the specimens describes them briefly as "small green Actinians". In the preserved condition they possess a uniform pale olive green color.

Structure. The mesogloea of the column wall averages about the same thickness as the ectoderm, but it is raised on its outer surface into numerous irregularly arranged ridges, which give rise to the reticulate appearance of the column. The ectoderm contains numerous gland cells, but at frequent intervals areas occur, sometimes on the edges of the mesogloea ridges and sometimes between the ridges, in which the gland cells are wanting, the ectoderm consisting of the long slender cells usually found in verrucae and of "pyriform" cells situated close to the mesogloea surface. There is no doubt that these areas are verrucae. The circular muscles of the column wall were moderately developed and a strong endodermal sphincter (Fig. 76) occurred on the inner wall of the fosse. It consists in its

proximal part of several well developed branching and slightly anastomosing mesogloea processes, each of which arises independently from the column mesogloea, but the distal two-thirds of the muscle is composed of long processes which arise from a common, well-developed pedicle, upon which they are arranged palmately, those on the distal surface of the pedicle anastomosing to a considerable extent. In section the muscle has what may be termed a semi-oval form. The endoderm of the column wall, disc and tentacles contains a considerable amount of brown pigment in the form of granules.

The longitudinal muscles of the tentacles and the radial muscles of the disc are moderately developed and are ectodermal in position. The stomatodaeum is longitudinally ridged and, in two of the three individuals of which detailed examination was made, it possessed but a single deep siphonoglyph.

The mesenteries in all three individuals examined showed departures from a purely hexamerous arrangement. In one individual there were two pairs of directives, between which there were on one side of the body twelve pairs of perfect mesenteries and on the other side twelve pairs also plus an additional single perfect mesentery situated next one of the directives. In a second individual, slightly larger than the first, there were twenty-nine pairs of perfect mesenteries, including the single pair of directives, and in addition there were a few scattered pairs of imperfect mesenteries which lacked muscle pennons. In the third and largest individual there were in what was approximately one-half of the circumference twenty-seven pairs of perfect mesenteries, together with a few scattered imperfect pairs, one of these latter, however, possessing a distinct though weak muscle pennon. There was but a single pair of directives. In sections passing below the level of the stomatodaeum some of the perfect mesenteries appeared broader than the others and it was possible to recognize in this way three series; in the half of the circumference sectioned there were six pairs that were broader than the rest, eight pairs of an intermediate width, the space on either side of the directives containing two pairs of this cycle, and thirteen narrower pairs, one of these pairs being lacking in one of the spaces next the directives.

The longitudinal muscles of the perfect mesenteries form moderately developed pennons, broad but not high. The parieto-basilar form a well marked fold which extends upward almost to the disc and the basilar muscles are well developed, having the form shown

in Fig. 77. Both external and internal stomata are present and the mesenteries of the two broader series, with the exception probably of the directives, are fertile.

23. *Cribrina hermaphroditica* CARLGRÉN, 1899.

- No. 116. Antofogasta. 13 specimens.
402. Tumbes. 5 specimens.
448. Puerto Montt. 13 specimens.

The specimens from Tumbes and Puerto Montt were all expanded, those from the latter locality having the stomatodaeum extensively evaginated (Fig. 78); the individuals from Antofogasta, on the contrary, were all contracted to a low dome-like form, with the tentacles only slightly exposed (Fig. 79). The base was adherent and but little larger than the column. This in its distal half or third is provided with longitudinal rows of verrucae, to which particles of sand and shell were adherent. The number of the principal rows was as a rule twenty-four, although a certain amount of variation occurred, one individual from Puerto Montt possessing only twenty-one; alternating with these principal rows were short rows of smaller verrucae. At the extremity of each principal row was a more or less conical pseudo-acrorhagus, situated upon the margin, between which and the bases of the outermost tentacles was a distinct fosse. The tentacles were short, stout and rounded at the tips; they seemed to vary slightly in number in different individuals, as forty-five were counted in one, forty-six in another and in another forty-eight.

The specimens from Antofogasta were all small, some measuring only 1 mm in height and the largest 5 mm, the base of the latter individuals measuring 7 mm in diameter. Of the specimens from the other localities one measured 1 cm in height, but the majority were only about half that size and had a diameter of about 0.9 cm. No traces of color remained in any of the specimens.

Structure. The column mesogloea is as a rule thinner than the ectoderm, but is raised on its outer surface into numerous low ridges. The verrucae did not possess any pyriform cells. The general circular musculature is fairly well developed, but the sphincter, though of the circumscribed form, is rather small and varies somewhat in its development in different individuals. Usually it has the form shown in Fig. 80 and appears at first sight to be of the

palmate variety, although it is in reality unilateral and in some individuals may be reduced to a comparatively small number of mesogloea processes, arising for the most part directly from the column wall. The longitudinal muscles of the tentacles and the radiating muscles of the disc are moderately developed and ectodermal in position. Zooxanthellae occur in considerable numbers throughout the endoderm and are especially abundant in the tentacles.

The stomatodaeum is longitudinally ridged and possesses two well developed siphonoglyphs. The mesenteries are arranged in three cycles, with a partial development of a fourth in some individuals. As a rule they are arranged hexamerously, but in one individual only twenty-one pairs occurred, eight pairs intervening between the two directive pairs on one side and eleven on the other. In some individuals two cycles of mesenteries were perfect, but in others only one cycle reached the stomatodaeum. In all both the first and second cycles were provided with well developed muscle pennons and mesenterial filaments, while the third cycle lacked them. The mesogloea of the mesenterial filaments contained numerous Zooxanthellae. The longitudinal muscles have the form shown in Fig. 81 and the parieto-basilars form a well-marked fold.

As a rule the mesenteries of the first cycle, including the directives, were all fertile and here and there reproductive cells were observed in individual members of the second cycle; the third cycle was sterile in all cases. In one of the specimens examined each fertile mesentery contained both ova and spermatozoa, and in two others, one from Antofogasta and one from Puerto Montt embryos in various stages of development were found in the body cavity. In the individual from Puerto Montt a few scattered ova occurred in some of the fertile mesenteries, but spermatozoa were much more abundant, and in the Antofogasta specimen only spermatozoa were present. It would seem in this last instance either that embryos had made their way from the exterior into the body cavity of a male individual, or else that the specimen was a protogynous hermaphrodite. For many reasons the latter supposition is preferable.

I have identified these specimens with CARLGREN'S *Bunodes hermaphroditicus* (1899) from Talcahuano on account of their marked similarity in every particular except the number of perfect and fertile mesenteries. CARLGREN finds three cycles of these, instead of the one or two described above. This difference may be due to the fact that CARLGREN'S specimens were apparently about twice as

large as those I examined, and the variation which I found seems to indicate that the number of perfect and fertile mesenteries may increase with age.

24. *Cribrina elongata* n. sp.

No. 25 a. Iquique. 20 metres. 1 specimen.

The single individual of this species (Fig. 82) was contracted so that the tentacles were completely concealed and was of a cylindrical form terminating distally in a dome. The base was flat but there was not that sharp distinction between base and column usually found in adherent individuals, a condition which was possibly related to the fact that the bottom on which the specimen was dredged was sandy. The column was marked with fine longitudinal ridges and in its distal two-thirds was provided with well marked verrucae, most abundant on the terminal dome and more scattered and less prominent proximally. No foreign bodies were adherent to the verrucae.

The column measured 1.5 cm in height and 0.5 cm in diameter. Its distal domed portion had a distinct dark grey coloration, as had also the verrucae on the uppermost portions of the column, but otherwise there were no traces of color remaining.

Structure. The ectoderm of the base resembled that of the column, except that it was almost destitute of gland cells, which were, on the contrary, very abundant on the column, whose ectoderm was thicker than the mesogloea. The verrucae did not possess pyriform cells. The endoderm in the distal part of the column, and to a certain extent in the tentacles contained quantities of a dark brown granular pigment, to the presence of which the coloration of the column and the verrucae was due. The circular musculature was rather weak but there was a fairly strong sessile circumscribed sphincter which had the form shown in Fig. 83. No signs of acrorhagi were observed; the verrucae extended distally to the margin. The ectodermal muscles of the tentacles and disc were moderately developed and were not imbedded in the mesogloea.

The stomatodaeum was ridged and possessed two siphonoglyphs which were not situated opposite one another, and in accordance with this lack of symmetry the mesenteries were arranged irregularly. There were in all thirty-five pairs, which seemed to belong to three different cycles. The first two cycles were perfect and were provided

with strong, though narrow pennons (Fig. 84) and with mesenterial filaments. In ten pairs the attachment to the stomatodaeum extended somewhat further down than the others, and their muscle pennons were a little stronger. These pairs I take to represent the primary cycle, and they included two pairs of directives, which, like the siphonoglyphs, were placed unsymmetrically, six pairs of perfect mesenteries intervening between them on one side and thirteen on the other. There were thus twenty-one pairs of perfect mesenteries, eleven of which seemed to represent a second cycle. The third cycle consisted of fourteen pairs of small imperfect mesenteries, destitute, as a rule, of filaments and muscle pennons, although a few showed indications of a pennon. It is needless to say that this cycle was incomplete; where present its members alternated with those of the older cycles.

The perfect mesenteries possessed a parieto-basilar muscle which formed a distinct fold and extended distally as far as the upper third of the column. The basilar muscles were well developed, consisting of a lamella arising from each side of the base of each perfect mesentery and giving rise on one surface to secondary lamellae, so that each may be said to be half-pinnate. Reproductive cells were observed on some of the mesenteries of the first cycle, but they were not sufficiently developed to determine their complete distribution.

It should be stated that all the mesenteries are narrow compared with those of other Cribrinids; in sections through the column below the level of the stomatodaeum they form a narrow fringe around the inner surface of the wall, leaving a large central cavity, while above they keep the walls of the stomatodaeum widely apart.

Suborder *Stichodactylinae* ANDRES, 1883.

Actiniaria with simple, capitate or compound tentacles, arranged in radiating rows, more than one tentacle communicating with some or all of the endocoels or exocoels.

Family *Corynactidae* L. AGASSIZ, 1859.

Stichodactylinae with a marginal alternating cycle of capitate tentacles and with one or more accessory disc tentacles corresponding with a greater or less number of the marginal ones and of a similar form.

Genus *Corynactis* ALLMAN, 1846.

Corynactidae with simply capitate tentacles and with more than one accessory tentacle corresponding to certain of the marginal tentacles.

It seems doubtful if the occurrence of but a single accessory tentacle over any one endocoel is a character of sufficient importance to distinguish *Corallimorphus* from this genus, and this seems to be the principal difference between the two.

25. *Corynactis carnea* STUDER.

Corynactis carnea STUDER, 1879.

Anemonia variabilis McMURRICH, 1893.

Anemonia carnea McMURRICH, 1893.

No. 252. Calbuco. Several specimens.

256. Calbuco. Several specimens.

539. Calbuco. 12 specimens.

The types of this species have recently been carefully studied by KWIETNIEWSKI (1896) and a comparison of the present forms with his description show that they are identical. In 1893 I published a description of specimens which were obtained by the U. S. Fish Commission Steamer "Albatross" and were undoubtedly identical with STUDER'S species, but, failing to observe the capitate nature of the tentacles and their correct arrangement, I referred the specimens to the genus *Anemonia*, at first as a distinct species *A. variabilis* and later, after recognizing its identity with STUDER'S species, as *A. carnea*. KWIETNIEWSKI has shown that STUDER'S species, as *A. carnea*. KWIETNIEWSKI has shown that STUDER'S species, as referring his forms to the genus *Corynactis* and a further examination of the "Albatross" specimens has demonstrated that they too are true *Corynactis*, so that the names which I originally gave them must be regarded as synonyms.

The various individuals in the present collection vary somewhat in the amount of contraction which they have undergone, although in none of them are the tentacles completely concealed, and the general form of the body varies a little also in accordance with the amount of the contraction. Thus in some individuals the column is almost cylindrical, but more usually it is expanded in the upper part and when fully expanded the disc is much wider than the column. The base is of the adherent type, the specimens No. 252

being attached to a barnacle shell and to the stems of a large hydroid.

The column wall shows distinct longitudinal ridges due to elevations of the outer surface of the mesogloea. These, in the individuals examined, while not arranged with perfect regularity, are not so irregular as might be imagined from the statement of KWIECZKOWSKI; for the most part they do correspond to the intervals between the insertions of the mesenteries, the figure which I gave in a former paper (1893, tab. 21, fig. 19) representing the arrangement which I find in the present specimens.

The disc in the expanded individuals is smooth and concave, the peristome usually forming a distinct elevation in its centre. The mouth is oval or in some cases almost circular in outline and the lips are ridged; no distinct gonidial grooves occur.

The tentacles are arranged in two sets, a peripheral or marginal set arranged in two cycles and a disc set arranged in radiating rows upon the disc, the various tentacles of each row communicating with the same endocoel. In two fully expanded individuals it was possible to determine the exact arrangement of the tentacles, which was as follows. The peripheral tentacles were arranged in two cycles, the members of the outer circle being as a rule smaller and directed outwards, while those of the inner cycle were larger and usually directed almost vertically upwards. Of the inner cycle I counted in two cases thirty-one and in another case twenty three(?) tentacles, but I was not able to satisfy myself as to their relations to the mesenterial chambers and must accept KWIECZKOWSKI'S statement that they correspond to exocoels.

The disc tentacles are situated on the radii from which the outer cycle of marginal tentacles arises and on these alone, and two sets may be recognized alternating regularly with one another. In one set each radial row consists of three tentacles and in the other of only two, so that, taking into account the marginal tentacles there will be in a sector of the disc, first, a radius containing a row of four tentacles, then one with only a single tentacle, then one with three and then another with one, and this succession is repeated all round the disc, although occasional irregularities may result from the failure of some of the tentacles of

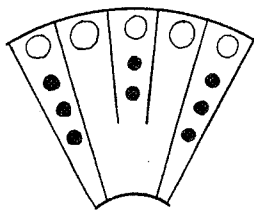


Fig. B.

a radius to develop. The annexed diagram (Fig. B) shows the arrangement on a portion of the disc where no irregularities occurred.

DUERDEN has shown that in several *Discosomidae* the arrangement of the disc tentacles bears a very definite relation to that of the marginal tentacles and I share his hopefulness that something may be accomplished toward clearing up the relationships of the various Stichodactylinae species by a closer study of the arrangement of the tentacles. Unfortunately the literature contains little that can be used in this connection for the *Corynactidae*, the figures and descriptions of *C. viridis* even not yielding data from which an accurate determination of the relations of the tentacles may be made. Indeed the only forms for which the data are sufficient are the two species of *Corallimorphus* and the species of *Corynactis* described by HERTWIG (1882), *C. myrcia* described by DUERDEN (1900) and *C. globulifera* recently redescribed by CARLGREN (1900).

In *Corynactis* sp.? HERTWIG, if I understand the description aright, there are two cycles of marginal tentacles, a larger tentacle as a rule alternating with a smaller one. The latter have no corresponding disc tentacles and are endocoelic in position, but the former have disc tentacles on their radii, arranged so as to mark out three sets. Thus, starting from a directive radius there are first two disc tentacles, then on the next radius one situated more peripherally than the outermost one of the first radius, then one on the next situated on a line with the outermost tentacle of the first radius, then again one corresponding with that of the second radius and finally a radius corresponding with the first one. The arrangement may be expressed by the following formula, in which the disc tentacles are indicated by numerals, the exocoelic marginal tentacles by m and the endocoelic by M.

$$\underline{M}2 - \underline{m} - \underline{M}1 - \underline{m} - \underline{M}1 - \underline{m} - \underline{M}1 - \underline{m} - \underline{M}2$$

In *Corynactis myrcia* the figure given by DUERDEN seems to indicate that there are no exocoelic marginal tentacles and the disc tentacles are arranged in two alternating sets (Fig. C), the formula being

$$\underline{M}3 - \underline{O} - \underline{M}1 - \underline{O} - \underline{M}3$$

In *C. globulifera* CARLGREN found a considerable amount of irregularity, but the fundamental formula may probably be set down as

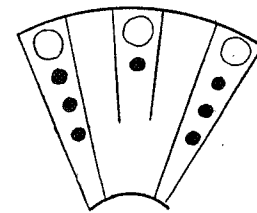


Fig. C.

$M3 - m - M2 - m - M3$

an arrangement which agrees with that occurring in *C. carnea*, in which departures from the fundamental formula are by no means infrequent.

In *Corallimorphus rigidus* (Fig. D) the formula is

$M1 - m - M1 - m - M1$,

the marginal cycles consisting of tentacles of three different sizes, the smallest of which have no corresponding disc tentacles, while the largest have their corresponding disc tentacles much nearer the centre than are those corresponding to the marginal tentacles of

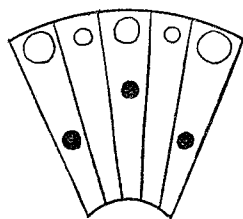


Fig. D.

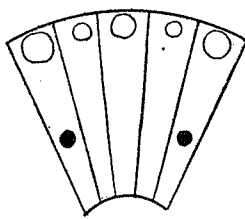


Fig. E.

intermediate size. Finally, in *C. profundus* (Fig. E), while there are again three distinct sizes of tentacles in the marginal cycles, disc tentacles occur only opposite the largest ones, the formula being

$M1 - m - M - m - M1$.

It would seem then, that although irregularities may and do frequently occur at portions of the circumference a definite fundamental plan may be recognized in the arrangement of the tentacles in each of these six species and it is only in *C. globulifera* and *C. carnea* that the plan is identical.

In size the various specimens of *C. carnea* varied considerably, many, however, being much larger than those measured by STUDER. Thus some measured 1.0—1.2 cm in height and had a diameter at the base of 0.4—0.6 cm and at the margin of 0.8—1.0 cm. The coloration of the specimens No. 539 is stated to have been "rust-brown, with blackish tinge around the mouth; disc frequently dark brown; tentacles rust-brown with pale tips".

Structure. Concerning the anatomical structure I have little to add to KWIETNIEWSKI'S account. In the arrangement of the

mesenteries I found occasional departures from the normal, one specimen, for instance, possessing thirteen perfect pairs and only eleven imperfect pairs of the third cycle, one of the pairs of this cycle having apparently broadened sufficiently to reach the stomatodaeum.

I could not detect the slightest trace of an ectodermal musculature or nerve layer in the column wall, whose epithelium was in an admirable state of preservation.

DUERDEN (1900) has found that the mesenterial filaments of *C. myrcia* lack the ciliated streaks and regards this peculiarity as being of sufficient importance and constancy to be worthy of a place in the definition of the genus. CARLGREN also (1900) notes the absence of the streaks in *C. globulifera*. In the present species I find in sections which pass through the upper portions of the filament distinct indications of the trefoil appearance which is associated with the presence of the streaks. The histological preservation of the internal epithelia was not, however, sufficiently perfect to allow of a positive identification of the lateral processes with ciliated streaks but they were supported by mesogloal processes and the nuclei of their epithelium were more densely crowded than in the median process, two peculiarities which correspond with the conditions in typical ciliated streaks. In a specimen of *C. viridis*, which I owe to the kindness of my friend and colleague Professor A. C. HADDON I have observed a similar structure in the uppermost portions of the filaments, and although the cells of the lateral processes are hardly as slender and closely set as in typical ciliated streaks, yet there seems to be no doubt as to their homology with these structures.

Order Zoantharia CARLGREN, 1899

Zoantheae AUCLT.

Zoanthinaria VAN BENEDEN, 1898.

Anthozoa sometimes solitary, but more usually forming colonies; the polyps destitute of a corallum, but frequently encrusted with calcareous or siliceous particles. The mesenteries arranged in pairs, of which two sets may be recognized; the first set consists of six pairs, two of which, situated at the extremities of the sagittal axis and having their longitudinal muscles on the exocoelic faces, con-

stitute the directives. One pair of the directives (the sulcar pair) corresponds to the single siphonoglyph, and is perfect, while the other pair (sulcular) is imperfect. The remaining four pairs of the first set have their longitudinal muscles on the endocoelic faces and are situated on either side of the imperfect directives, the pair nearest these on each side (sulculo-lateral) consisting of a perfect and unperfect mesentery in that order, while the next pair (sulco-lateral) on either side has either a similar arrangement or else consists of two perfect mesenteries. The second set of mesenteries also have their longitudinal muscles on the endocoelic faces and are interposed between the sulco-lateral pairs of the first set and the sulcar directives; each consists of an imperfect and perfect mesentery, the latter of which is always that nearest the sulcar directives; they develop bilaterally and successively in the exocoels on either side of the sulcar directives.

Family *Zoanthidae* DANA, 1846.

With the characters of the order.

Sub-family *Macrocneminae* HADDON et SHACKLETON, 1891.

Zoanthidae with both members of the sulco-lateral principal pairs perfect.

Genus *Epizoanthus* GRAY, 1867.

Macrocneminae with the polyps arising independently from an expanded or band-like coenenchyme; the column wall encrusted with foreign particles; sphincter mesogloea; no ring sinus.

26. *Epizoanthus patagonichus* CARLGRÉN, 1899.

No. 254. Calbuco. 20 fathoms. Several colonies.

Some of the colonies are seated upon hydroid stems and others on stones and shells. In those upon hydroids the coenenchyme is but slightly developed, some of the polyps being quite separate from the others, but in the rest the coenenchyme forms an encrusting layer covering the substratum and gives rise to a variable number of polyps. These have the form of a short cylinder (Fig. 85) or of a dome, the larger ones measuring from 5—6 mm in height, with a

diameter of 4.5—5.0 mm. In one colony, seated upon a stone, all the individuals were considerably smaller, but all gradations of size occurred and the figures given above seem to represent the dimensions of the average mature polyps.

The colonies are of a sandy grey color, due to the incrusting material, and as this lessens in amount at the summit of the column, this has a somewhat paler shade. An accompanying label states that the tentacles in life were rust-red.

Structure. The column wall and coenenchyme were heavily incrustated with particles of sand, rendering the preparation of satisfactory sections a matter of some difficulty. Almost the entire thickness of the mesogloea is involved by the incrustation throughout the greater portion of the column, but toward the summit the particles are less numerous and more limited to the outer layers of the wall. A distinct cuticle was present and the ectoderm was much thinner than the mesogloea. The latter contained rather numerous cell islands, but there were no indications of canals and a ring sinus was wanting. The sphincter was imbedded in the mesogloea and in its uppermost third consists of an open network, while proximally it is composed of a single row of more or less spherical cavities, which gradually approach the endodermal surface of the mesogloea (Fig. 86).

The tentacles and disc were quite free from incrusting particles and the ectoderm of the tentacles was very thick compared with the mesogloea. The stomatodaeum possessed a deep siphonoglyph, whose ectoderm was composed of closely packed slender cells, there being none of the gland cells which were present on the general surface of the stomatodaeum. The mesogloea of the siphonoglyph is much thicker than that of the stomatodaeum proper and the latter has a smooth ectodermal surface, not being raised into longitudinal ridges.

The mesenteries are arranged on the macrotype and are about thirty-two in number, i. e. they are arranged in sixteen pairs. Their mesogloea is thin and the longitudinal musculature but feebly developed. The mesenterial filaments, on the other hand, both in their ciliated and glandular portions are very extensively developed. The perfect mesenteries bore abundant sexual cells, which in the two individuals examined, taken from the same colony, were spermatozoa.

The similarities which this form presents to CARLGRÉN'S *E. patagonichus* indicate its identity, notwithstanding the much greater size of the individuals of the single colony which CARLGRÉN examined. Length, however, seems to have comparatively little importance as a specific characteristic in the Zoantharia.

Genus *Parazoanthus* HADDON et SHACKLETON, 1891.

Macrocneminae with the polyps arising independently from an expanded coenenchyme; column wall incrustated with foreign particles; sphincter endodermal, diffuse; a more or less distinct ring sinus occurs.

27. *Parazoanthus elongatus* n. sp.

No. 242. Calbuco. Several colonies.

The coenenchyme is rather sparse and incrusts or completely encloses the stems of hydroids. The polyps arise from the coenenchyme either singly (Fig. 87, A) or in groups (Fig. 87, B) and are elongated and club-shaped; like the coenenchyme they are incrustated with particles of fine sand.

The fully grown polyps measure in the contracted condition about 1.7 cm in height, the height of those measured varying between 1.5 and 2.0 cm. The diameter of the column at the summit was from 0.3 to 0.4 cm and at the line of union with the coenenchyme from 0.20 to 0.25 cm. The colour of the preserved individuals was sandy, but an accompanying label states that in life they were "grau-gelb, Mundscheibe und Fühler weiss".

Structure. The ectoderm is provided with a cuticle and is almost as thick as the mesogloea. The incrustation is very moderate and involves only the outer half of the mesogloea which contains cell-islands and scattered lacunae; the ring sinus is very imperfectly developed, consisting of some larger transversely elongated lacunae, lying close to the endodermal surface of the mesogloea (Fig. 88) and separated from one another by considerable intervals. The sphincter (Fig. 89) is very weak, consisting of rather low, almost unbranched and scattered mesogloea processes.

The ectoderm of the tentacles and disc is very much thicker than the mesogloea, which appears as a mere line in sections and is homogeneous in texture. The ectodermal muscle processes are hardly developed.

The mesenteries are arranged on the macrotypic, in one individual in sixteen and in another in fourteen and a half pairs, an odd mesentery in the latter case occurring on one side of the sulcar directives and not on the other. In the lower part of the column the mesenteries project but slightly into the central cavity and their mesogloea is throughout exceedingly thin and homogeneous in structure. Their longitudinal musculature is very feeble. No reproductive organs were observed.

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Explanation of Plates.

<i>ac</i> acrorhagus	<i>m</i> margin
<i>col</i> column	<i>Me</i> mesentery
<i>D</i> and <i>D'</i> directive mesenteries	<i>ph</i> physa
<i>d</i> disc	<i>rs</i> ring sinus
<i>i</i> foreign inclusions	<i>sp</i> sphincter
<i>L</i> lips	<i>st</i> stomatodaeum
<i>M</i> Mouth	<i>t</i> tentacle.

Plate 14.

- Fig. 1. *Halianthus chilensis* n. sp. 3:2.
- Fig. 2. Longitudinal section through the proximal part of the column of *H. chilensis*, showing the introverted physa.
- Fig. 3—5. Transverse sections through the column of *H. chilensis*
- Fig. 6. *Gyrostoma selkirkii* n. sp. 1:1.
- Fig. 7. Transverse section through the margin of *G. selkirkii*.
- Fig. 8. Transverse section through the column of *G. selkirkii*.
- Fig. 9. Transverse section of a mesentery of the first cycle of *G. selkirkii*, below the level of the stomatodaeum.
- Fig. 10—11. *Gyrostoma incertum* n. sp. 1:1.
- Fig. 12. Transverse section through a portion of the column wall with mesenteries below the level of the stomatodaeum; *G. incertum*.

Plate 15.

- Fig. 13. Transverse section of a mesentery of the first cycle of *G. incertum*; the section is taken below the level of the stomatodaeum.
- Fig. 14. Section of the basilar muscles of *G. incertum*.

Fig. 15. View of the distal portion of the individual represented in Fig. 11 A, from the opposite side, showing the absence of tentacles.

Fig. 16. *Paractis nivea* (LESSON). 1:1.

Fig. 17. Transverse section of the sphincter of *P. nivea*.

Fig. 18. Transverse section of a mesentery of the first cycle of *P. nivea*, the section being taken in the upper expanded portion of the column.

Fig. 19. Transverse section of a first cycle mesentery of *P. nivea*, taken in the lower part of the column.

Fig. 20. *Paractis ignota* n. sp. 1:1.

Fig. 21. Transverse section of the sphincter of *P. ignota*.

Fig. 22. Transverse section of a first cycle mesentery of *P. ignota*, taken below the level of the stomatodaeum.

Fig. 23. *Paractis tenuicollis* n. sp. 1:1.

Fig. 24. View of distal portion of the column of *P. tenuicollis*.

Fig. 25. Transverse section of the sphincter of *P. tenuicollis*.

Fig. 26. Transverse section through a first cycle mesentery of *P. tenuicollis*, taken below the level of the stomatodaeum.

Fig. 27. *Pycnanthus lineolatus* (MC MURRICH). 1:1.

Fig. 28. Transverse section through the sphincter of *P. lineolatus*.

Fig. 29. Transverse section of a portion of the column of *P. lineolatus* with mesenteries of the first, third and fourth cycles; the section is taken below the level of the stomatodaeum.

Fig. 30. *Actinostola chilensis* n. sp. 1:1.

Fig. 31. Tangential section of the disc of *A. chilensis*.

Plate 16.

Fig. 32. Transverse section through the sphincter of *A. chilensis*.

Fig. 33. Transverse section through a portion of the column wall of *A. chilensis*, showing mesenteries of the 1., 3., 4. and 5. cycles.

Fig. 34. *Boloceropsis platei* n. sp. 1:1.

Fig. 35. Section through the margin and the base of a tentacle of *B. platei*.

Fig. 36. *Phymactis clematis* (DRAYTON) CARLGRÉN. 1:1.

Fig. 37 and 38. Surface views of a portion of the column of two individuals of *P. clematis* showing the form of the tubercles.

Fig. 39. Transverse section through the margin of *P. clematis* showing the sphincter and an acrorhagus.

Fig. 40. Transverse section through a portion of a tentacle of *P. clematis*.

Fig. 41. Tangential section of a portion of the disc of *P. clematis*.

Fig. 42. Transverse sections of a second cycle mesentery of *P. clematis* showing (a) the longitudinal and (b) the parieto-basilar muscle.

Fig. 43. Transverse section through the basilar muscle of *P. clematis*.

Fig. 44. *Antheopsis ocellata* (LESSON). 2:1.

Fig. 45. *Antheopsis ocellata* (LESSON), another individual. 1:1.

Fig. 46. Transverse section of a second cycle mesentery of *oCELLATA*.

Plate 17.

Fig. 47. Transverse section of the basilar muscles of *A. ocellata*.

Fig. 48—50. *Sagartia chilensis* (LESSON). 1:1.

Fig. 51. Transverse section of the sphincter of *S. chilensis*.

Fig. 52. Transverse section of a first-cycle mesentery of *S. chilensis*.

Fig. 53—55. *Sagartia herpetodes* n. sp. 1:1.

Fig. 56—57. Transverse sections of the sphincter of two individuals of *S. herpetodes*.

Fig. 58. Transverse section of a directive mesentery attached one of the secondary stomatodaea of *S. herpetodes*.

Fig. 59. *Choriactis impatiens* (COUTHOUY). 1:1.

Fig. 60. Transverse section of the upper part of the sphincter of *C. impatiens*.

Fig. 61. Transverse section of a first cycle mesentery of *C. impatiens*.

Fig. 62. *Choriactis crassa* n. sp. 1:1.

Fig. 63. Individual of *C. crassa* divided longitudinally.

Fig. 64. Transverse section of the sphincter of *C. crassa*.

Plate 18.

Fig. 65. Transverse section of a first cycle mesentery of *C. crassa*.

Fig. 66. ? *Metridium parvulum* n. sp. 3:1.

Fig. 67. Transverse section of the sphincter of ? *M. parvulum*.

Fig. 68. Transverse section of a first cycle mesentery of ? *M. parvulum*.

Fig. 69. *Aiptasia* sp? 1:1.

Fig. 70. *Hormathia exlex* n. sp. 1:1.

Fig. 71. Transverse section of a first cycle mesentery of *H. exlex*.

Fig. 72. *Chitonanthus castaneus* n. sp. 1:1.

Fig. 73. Transverse section of the sphincter of *C. castaneus*.

Fig. 74. Transverse section of a first cycle mesentery of *C. castaneus* taken near the lower edge of the stomatodaeum.

Fig. 75. *Cribrina conica* n. sp. 1:1.

Fig. 76. Transverse section of the sphincter of *C. conica*.

Fig. 77. Transverse section of the basilar muscles of *C. conica*.

Fig. 78 u. 79. *Cribrina hermaphroditica* (CARLGREEN). 1:1.

Fig. 80. Transverse section of the margin and sphincter of *C. hermaphroditica*.

Plate 19.

Fig. 81. Transverse section of a first cycle mesentery of *C. hermaphroditica*, taken below the level of the stomatodaeum.

Fig. 82. *Cribrina elongata* n. sp. 1:1.

Fig. 83. Transverse section of the sphincter of *C. elongata*.

Fig. 84. Transverse section of a first cycle mesentery of *C. elongata*.

Fig. 85. Colony of *Epizoanthus patagonichus* CARLGREEN. 1:1.

Fig. 86. Transverse section through the sphincter of *E. patagonichus*.

Fig. 87. Single polyp and colony of *Parazoanthus elongatus* n. sp. 1:1.

Fig. 88. Transverse section through a portion of the column wall of *P. elongatus* showing portions of the ring sinus.

Fig. 89. Transverse section through the margin of *P. elongatus*.