Dr. Wm. H. Ford was elected a member.

The following appointments were, with the consent of the Meeting, made by the President:

Prof. Francis S. Holmes, Corresponding Secretary pro tem.
W. H. Wright, Esq., Recording " "

In the absence of Dr. Francis T. Miles, Treasurer, Robert Hume, Esq., was appointed by the President to fill the temporary vacancy thus caused.

The Committee of Curators, to whom was referred the paper of Prof. Lewis R. Gibbes, on *the Accentuation of Names in Natural History*, report, that this paper is likely to be of great usefulness in America, where many engaged in the pursuit of Natural History are unacquainted with the Latin and Greek languages. The Committee, therefore, recommend that it be published in a small and portable form, as a Manual, and so placed within the reach of every student, however limited his means.

APRIL 15th, 1857.

Dr. L. A Frampton, in the chair.

Prof. McCrady introduced the following paper:

Gymnopthalmata of Charleston Harbor. By John McCrady.

No class of the Animal Kingdom, perhaps, presents more or stronger attractions than that of Acalephæ. To the lover of what is beautiful, they exhibit a variety of forms unsurpassed in delicacy, grace, and harmony of color, by even the fairest flowers; to the physiologist they exhibit the functions of life, performed by structures of the most wonderful simplicity; and to the philosopher their development produces problems as marvellous to the fancy as they are essentially important to the processes of generalization. It is then, perhaps, due to the many obscure passages in their history, as well as to the small number of sea-side Naturalists, that

that our own rich shores have been so little interrogated for answers to the interesting questions which their history raises.

On the Medusæ of the United States, North or South, I believe there has been, until the present time, but a single special publication, and that consists of the two beautiful and valuable papers by Prof. Agassiz, entitled "Contributions towards a knowledge of the Acalephæ of the United States." Besides these, I am acquainted with only a very few desultory notices and descriptions, no native American Naturalist appearing to have turned his attention this way with any connected plan of research.

Yet so abundant are our Southern coasts in genera and species, that one might easily spend the greater portion of his life-time in investigating their astonishing variety, and the singular phases of their history. In a single locality, at the mouth of Charleston harbor, I have collected during the past summer (1856) nineteen species of Naked-eyed Medusa, belonging to fourteen genera, and I still feel quite satisfied that more are to be found. Among them was discovered a new and unsuspected instance of "*Homogony*," besides ample opportunity of throwing light on the method of development already known.

An account of the development of O. Turritopsis nutricula has already been given. I now proceed to present a descriptive account of our species, (all of which are new), hoping hereafter to devote a special paper to a more detailed account of the history and structure of each genus. Of these genera the greater number are new to our American Fauna.

It has been customary among naturalists to separate in description the Hydroidea from the Acalephae. The historical connection of the two groups is of itself something so wonderful, as to make it difficult to bring ourselves to an implicit reliance upon it as a general truth, and the somewhat discrepant observations upon which our conclusions are to be founded have, no doubt, contributed to the same result. The fact, however, that the Hydroidea are all larval or low forms of Medusæ, there is no longer any good reason to doubt. There have been so many observations by Sars, Dalyell, Van Beneden, Löven Steenstrup, Dujardin, Siebold, Agassiz, Köl-liker and others, all tending to demonstrate the impossibility of separating these two groups in a natural classification, that scarcely more is needed. However, to my mind, the difficulty felt by some authors in the persistent individual-independence of the polyp-form in Tubularia, Campanularia, &c., is completely explained away by

the development of *Aeginopsis Mediterranea* observed by Müller, Kölliker and Gegenbaur, of *Stenogaster complanatus* by Kölliker, and by the similar embryological history observed by myself in the bell-cavity of *Oceania* (*Turritopsis*) *nutricula*. In each of them the polyp or hydra-form is not persistent, and Medusæ are not produced by gemmation from Hydræ, but the Hydra itself is individually and totally metamorphosed into the Medusa, thus at once demonstrating that the Medusæ cannot be the *young* of the Hydræ, and that there is no essential difference between the so-called alternation of generations and a direct and regular metamorphosis, or homogony. The inevitable conclusion must be that Hydræ are either young or inferior forms of Acalephæ, and consequently that they are not entitled to independent positions as perfect animals, but must be described as Larvæ simply.

With regard to the difference between the Siphonophoræ and Hydroidea, it is greater in appearance than in reality. For the Campanularians, Tubularians and Hydractinians in which the Medusæ do not become free are just as really communities of hydroid and medusiform individuals as Siphonophoræ, differing only in the comparatively unimportant circumstance that they are attached forms, and that in them specialization is not carried so far, so that instead of having from three to five kinds of individuals, we there find only from two to three.

For the foregoing reasons, I include in this Report on the Hydroid Medusæ (Craspedota Gegenb.) of Charleston Harbor, all the Hydroidea and Siphonophoræ, known to me, describing the Hydroids as larval forms in connection with their perfect forms, where these have been ascertained, and giving them provisional names while their Medusæ are still unknown. At the same time I should state that I lay no claim to originality in thus limiting the order. The idea in some form or other has been floating in the minds of those who have particularly studied this subject ever since the appearance of Steenstrup's remarkable treatise on Alternate Generation, and Agassiz, Huxley, Leuckhart, Owen, Kölliker, and Gegenbaur have all expressed it in some form or other. Prof. Agassiz, in his lectures, has given the group those limits which I now assign it.*

*The delay which has unavoidably attended the publication of this paper, enables me to state that Prof. Agassiz, in the first of his elegant volumes on the Natural History of America, gives this order the limits which he had formerly given in his lectures, and applies the name of Hydroidea to it, according to the rule of priority. June, 1858.

The synonomy of the group stands thus:
Cryptocarpæ, Eschscholtz. (1829.)
Hydroidea, Johnston. (1838.)
Gymnopthalmata, Forbes. (1848.)
Craspedota, Gegenbaur. (1856.)

Of these, the first in order of time, that of Eschscholtz, expressing an erroneous view as to the economy of these animals, has been by common consent abandoned. The Gymnopthalmata of Forbes, and the Craspedota of Gegenbaur, besides being based upon characters which do not characterize all the genera in the group, are subsequent in time to the Hydroidea of Johnston. Two years ago Prof. Agassiz informed me of his intention to include the Hydroid Polyps, the Naked-eyed Medusæ, and the Siphonophoræ in a single order under the name Hydroidea. This appears to me the only solution of the question as to nomenclature.

Class ACALEPHÆ.

Order Hydroidea Agassiz.

Syn. *Gymnopthalmata*, Forbes.
Craspedota, Gegenbaur.
Hydroidea, Johnston.

This Order includes the lowest of the Acalephæ, and the animals which compose it are distinguished by the following characters:

The general form of the body varies within a wide range. It is sometimes acorn-shaped or conical, often mushroom-like, or with the form of an umbrella, in many forms lenticular, but most frequently distinctly campanulate. There are many compound forms where the Medusæ, developed by gemmation from their larvæ, remain organically connected with them during life, and thus form floating or fixed plant-like communities. The animals therefore are either fixed or free. When fixed, though possessing sexual organs, their other parts are frequently rudimentary, or even entirely wanting. Or the disk may be well developed while the digestive, sexual and tentacular systems are wanting, or the whole animal may have the form of a tentaculum, or of a leaflet pierced by tubes. Or again, the digestive trunk may be the only part developed.

The Hydroidea are distinguished by a simple digestive cavity, of various forms from that of a depressed chamber, to that of a very much elongated tube. The circulatory system consists of

delicate tubes communicating directly with the stomach, and radiating towards the periphery of the disk, where they usually anastomose with a concentric tube passing around the margin. In the Aeginidæ, this tube is not only absent, but the radiating tubes themselves are represented only by short pointed projections of the digestive cavity, while in many of the fixed Hydroidea, there is neither any true digestive cavity, nor any circulatory canal, both of these systems being represented by a simple blind diverticulum of the larva's nutrient canal.

The nervous system is hardly known. Professor Agassiz has described as such a cellular cord which accompanies the circular tube and enlarges at intervals at the bases of the tentacula to form ganglion-like bodies which are also in connection with the ocelli when present. I have also made out this cord in the genus Eucheilota with distinctness, and I think also that I have done so in Hippocrene and Nemopsis, but was not so successful with Oceania, where however I have thought myself sometimes able to trace a delicate cord passing down beneath the radiate tubes. Pl. 12, fig. 1, 2, *exhibits a portion of this system in Eucheilota where it will be seen that there is a ganglion for each marginal sense-capsule. The sexual glands, whether ovaries or spermaries, are always situated between the walls of the digestive or circulatory organs, and the epithelium of the inferior surface of the body. They vary considerably in position, sometimes embracing the digestive cavity, sometimes the radiating tubes, sometimes being in connection with both of these at once, and in one genus, are connected with the radiate and marginal tubes at their junction. In Cunina and Aegina, &c., where the tubes do not exist, these glands are situate on the periphery of the depressed digestive cavity. In the most rudimentary fixed forms, they surround the blind diverticulum of the larva's nutrient canal, which we have already spoken of as representing both the digestive and circulatory systems. The spermatozoa of some species have been described; they have very much the form of thread-cells with the threads extended, but without the reverted hooks at the base of the lash. The ova appear to be impregnated within the sexual gland and are not discharged until they have reached the form of a round or ovoid embryo. This is sometimes ciliated and capable of independent motion, (Planula,) sometimes it merely falls to the

* See also the structure figured in this volume. Pl. 7, ff. 34, *x*, and 42.

ground where it takes the hydroid form, and at other times it remains within the bell-cavity of the parent until it has attained a digestive cavity and tentacula, when it escapes, and moving for awhile by means of these organs, at last becomes fixed like the ciliated forms. In two known cases the hydra-form never becomes fixed, and similar independence is probably realized by a third.

The embryological history of most of these Medusæ, so far as known, is one of Alternate Generation, or Metamorphosis, where two of the stages are represented by two distinct individuals. There are, however, three stages: first, the Planule, next, the Hydra, and thirdly the Medusa, bearing the sexual organs.

In two instances, that of *Æginopsis Mediterranea*, observed by Müller, Kölliker, and Gegenbaur, and the similar mode of development observed by myself in the bell-cavity of an Oceania, the hydroid and medusoid stages are not divided between two individuals, but the individual Hydra is wholly metamorphosed into the Medusa, thus forming a direct metamorphosis. In both modes there is no intermediate type of form between the hydra and the ultimate medusa stage.

These Medusæ are distinguished from the Discophores proper either by the entire absence of ocelli, or by having them unprotected (*Gymnopthalmata*, Forbes.) They also either entirely want the vail or have it as an unvascular organ which as a perforated septum partially closes the mouth of the bell-like disk. But the most constant difference lies in their embryology for the larva of the Hydroid Medusa passes directly from its polyp form into that of the Hydroid Medusa, while the researches of Steenstrup and Frantzius show that there is a stage in Cyanea and Cephea wherein the form of the Hydroid Medusa is assumed before the animal attains its final form as a Discophore.

With regard to the subdivisions which may be made in this order, it may be remarked, as Prof. Agassiz has already done in his beautiful monograph, that the organs of essential structure constitute so nearly the totality of a Gymnopthalmatous Medusa, that it is difficult to obtain characters founded on those minor structural details which are usually employed to distinguish genera and families. And Prof. Agassiz in that work expresses the idea that the whole of these animals constitute a single natural family. But when we come to include, as he has done, both the Siphonophoræ, the Hydroids proper and the Æginidæ in the one order, it appears to me scarcely possible that the varieties of form

we find upon close study, should be only extremes of a single family group. Yet since we are in reality acquainted only with a comparatively small number of genera among Medusæ, and those of European and American seas only, we certainly are not yet fully prepared to define families by structural limits, a mode of classification which requires the most extensive comparison of generic forms. If, however, we call in the aid of Embryology, in connection with such knowledge of structure as we have, we may obtain views, it appears to me, which even should they not prove absolutely correct in the end, will still be suggestive and lead in time to the desired natural classification.

For taking it for granted as I do, that the Hydroid polyps and the Gymnopthalmata of Forbes constitute a single natural order, and knowing that in a considerable number of instances, as for example, in Clava, Hydractinia and some Tubulariæ, the Medusa never forsakes its polyp-stalk until death,* we see that we cannot omit in classification a careful consideration of the peculiarities of the Hydroids, which are so complex in their gradations that Ehrenberg formed two distinct groups upon the basis of the Linnean genera, Tubularia and Sertularia. These two groups, I believe, have been generally acknowledged by authors since the publication of Ehrenberg's work.† Not having this work, I quote the characters of these two groups from Johnston's British Zoophytes. They are distinguished by their different characteristic methods of producing reproductive buds, (*ovisacs* and *bulbules*, Johnston.) The Tubularina include those Hydroids which produce naked bulbules—that is, those in which the medusa-buds, while attaining sufficient growth to become free, are not protected by a horny theca. The second, the Sertularina, are those which have what are called ovisacs—horny thecæ or cases, bell-shaped usually, and closed at their free open extremities by a polyp-

* This occurs even in genera, where the rule is, that Medusæ are free. For example, I once had the opportunity of observing a fine specimen of *Sarsia mirabilis* (Agassiz,) which is one of the most abundant free species in Boston Harbor, wither on its stalk, never severing its connection with its Coryne, though in every respect, except ocelli, which were absent, it resembled the perfect animal. It unfolded its four long tentacula, exhibited strong rythmical contractions of the disk, and behaved in all respects like a perfect Medusa except that it never became free.

† Corall. der Roth. Meer. (1834.) Lamouroux had previously subdivided these genera, at the same time recognizing their affinity to each other more clearly than Lamarck.

head without tentacula, the medusa-buds being developed on that portion of the stem included between this polyp-head and the bottom of the case. They afterwards become free by passing between the lip of the horny case and the abortive polyp-head. This is at least true for the Campanularians. Among the Sertularians proper, especially such genera as Sertularia, Aglaophenia, and Thuiaria, where the Medusæ appear to be always abortive, more investigation is needed—at least my limited access to European authors has made me acquainted with no researches that entirely clear up the question of the relation of their planules to the fleshy parts of the polyp-stem.* But these groups differ, also, by the more complicated development of the polypidom among the Sertularina, and the position of the medusa buds. In the group just named, there is a considerable tendency to an observance of some of the rules of vegetable growth in the medusa-bearing capsules, as was first noticed by Edward Forbes. Each of these capsules, like the flower-bud in plants, may be considered as in some sense a modified branch of the polypidom, wherein all the lateral polyps undergo their full development into sexual Medusæ. Analogically, also, with the position of the flower-bud in plants, though never at the extremity of a branch, so far as I am aware, the medusa-capsules are generally at or near the *axils*, so to speak, of branches or of individual polyps which may be taken into the consideration as the analogues of the leaves in plants. Among the Tubularina on the other hand, the disposition is freer, and the medusa-buds are found among the tentacula, or beneath them, of the individual polyps, and sometimes scattered over the whole ramified stem of the polypidom.†

The researches which have of late years been made by authors, and which to a small extent I have had the opportunity of repeating, appear to me to add still another distinctive character to confirm this division of the Hydroids into two groups. It is the manner in which the Medusa disk is developed. Among the Corynidæ, Tubularidæ, &c., the Medusa emerges first as a bud, the outer covering of which becomes that of the disk of the free swimming

* In Hydractinia however which belongs, I think, to the Tubularina, the medusa-buds which are naked, are also developed on the stalk of an abortive untentaculated polyp.

† I do not here investigate the question whether both these modes of distribution may not in the end be referred to single common plan. They are at least different modifications, and as such I use them.

adult,—the cavity of the bell is, so to speak, hollowed out from the original substance of the bud—and the proboscidiform digestive cavity, is from the first enclosed by a parenchyma which becomes gradually metamorphosed into a moveable disciform or campanulate organ of motion. The lower aperture of the bell, which, in the adult is usually guarded by the vail, appears to be pierced through this original parenchyma, and the tentacula never originate near the attached base of the gradually growing proboscis, but on the contrary, near what is to be its free extremity. Now, a reference to Van Beneden's figures of the development of Campanularia, which, I think, in one of our species I have been able to confirm, will show a mode of growth which in some respects is entirely the reverse. There the proboscidiform digestive cavity is early conspicuous as a free projecting knob, and is not over-arched by the disk until some time after the Medusa becomes free, in several species. The tentacula, instead of originating near the free extremity of the proboscis, originate near its base—and that organ, instead of being from the beginning covered by the disk, is only gradually over-arched by it. And lastly, the aperture of the bell, instead of being formed by piercing the parenchyma of the bud, is formed by the border of the outgrowing lateral fold or disk which in this case is always free. The result is, that in its early stages, just before its independence, the young Campanularian Medusa bears an extremely close resemblance at first sight to the mere hydroid polyp from which it is bred, which is not the case among the Tubularina. Now, a reference to the description of the mode of growth exhibited by the larva of *Aeginopsis Mediterranea*, and that described by myself in the bell of an Oceania,* it will be seen at once that it is essentially the same as that of Campanularia, and this corresponds to the structural affinities of the Aeginidæ, which every one, I believe, considers more closely allied to the Thaumantiads than to the Sarsiadæ and the like.

But these differences are not confined to the Larval stages alone. The adult Medusæ, so far as known, belonging to these two groups, appear to be distinguished by general form and structural peculiarities in such a manner, that we must consider the Sertularian group inferior. I might notice, however, beforehand, that embryologically they appear to be lower, for while, if anything, their polyps are more complicated, and vegetative character more prom-

* This, I have since satisfied myself, is the parasitic young of a Cunina. See the descriptions of Turritopsis and Cunina below.

inent in them than in the other; there are, at the same time, a larger number of genera among them, which apparently never have free Medusæ. Now, on structural grounds, I think I may distinguish these two general groups of Medusæ, as follows:

First, as to general form. Among the Sarsiadæ and the correlated groups, we find that the general form is nearly always a deep bell; while in the Campanularian Medusæ, and their relatives, the general form of the disk has a constant tendency to being more or less shallow; the few deep-belled species which exist are the extraordinary forms. Both shallow and deep-belled species are found in each group, but in one of them the deep-bell is the prevailing form; in the other, the broad, shallow, cymbal-like or watch-glass shape predominates.

They differ also in the general character of important organs. The digestive cavity in the Sertularian group (if we include the Aeginidæ, for which I shall attempt to show there is reason,) varies through Aequorea and Staurophora, from the form of a depressed polygonal chamber, which may be said to be imbedded in the disk, to that of a flower-shaped organ, pendent from the vertex of the disk concavity. But in this group the prevailing characteristic of the organ is that it is comparatively shallow, and we see this still hold good, even where, as in Liriope and Tima, it is placed at the extremity of a long and habitually exserted peduncle or proboscis. Very different is the case in the Tubularian group. There, the prevailing character of the digestive cavity is that of a more or less long cylinder or tube, never imbedded in the disk, but always pendent from it. There are several forms, as Sarsia, Slabberia, and Dipurena,* with long exsertile peduncle, but here it is formed entirely of the digestive organ usually surrounded by the generative glands, and never is traversed by radiate tubes to the extent seen among Geryonidæ and in Tima.* Next, with regard to the radiate tubes, we find that in the genera allied to the Campanularian Medusæ, there is rather a tendency to a vegetative repetition of them, as in Aequorea, Berenice, &c.; while in the other group they appear to be more nearly limited to a small and definite number. We also observe that in the Campanularian group, there is a strong tendency to the formation of sinuses in the radiate tubes, while the junction of these with the marginal or

*In Turritopsis, however, as I have shown already, there is an arrangement somewhat analogous to that of Tima. Indeed, the Oceanidæ, as a group, are analogous to Thaumantiads.

peripheral tube is a simple anastomosis. In none of the Tubularian genera, on the other hand, is there any sinus in the length of the radiate tubes, but often there is a large sinus at the junction of these tubes with the marginal one. With regard to the position of the sexual glands, it varies, I think, in both groups, from immediate connection with the digestive cavity, to a position somewhere along the length of the radiate tubes.* But among the genera which I think referable to the Tubularian group, there are only two instances of such connection, the most remarkable being that of *Slabberia*, (Forbes;) and another, Nemopsis, (Agass.) in which latter the generative glands are connected at once with the digestive trunk and the radiate tubes. While among the Campanularians our only instance is Staurophora, which is evidently again related to the arrangement which takes place among the Aeginidæ. It is evident, therefore, that according to this arrangement, one of these positions of the sexual organs is in a general manner characteristic of the first of these groups, and the other of the second. Coming now to the vailed rim of the bell, we find it, in my view, quite characteristic in each of the groups. In the whole of the second, or Campanularian group, it is quite complicated, and we have the lash of the tentaculum usually simple, or only complicated by buttons of thread-cells as in the Campanularian polyps. The reverse is the case in the Tubularian group, where the rim of the bell is comparatively simple, so far as the variety of its appendages is concerned, though decidedly specialized in some genera, as Hippocrene, and on the contrary the lash of the tentaculum exhibits a decided tendency to specialization and complexity, as in Nemopsis, Cladonema, Zanclea, Slabberia, Dipurena, Corynitis, &c. When, on the other hand, the tentaculum is at all complicated in the Campanularian series, it is usually the basal portion of it, or what is called its bulb,† which in Eucheilota has even two small lateral tentacula of a different type; and, indeed, in this genus, sometimes these bulbs are

*In the singular genus Aglaura, which is referable to the Sertularian group, the sexual glands have a peculiar position. The chamber which exists to some extent in nearly all of this order, just above the digestive cavity, and towards which the radiate tubes converge, is here lengthened into a delicate pedicle, at the extremity of which is the digestive cavity of Thaumantioid type—and just above this point are the generative organs in the form of diverticula from the delicate pedicle. See Gegenbaur's paper, Zeits. f. Wissen. Zool. B. 8, ht. 2, pl. viii, fig. 13.

†However, in Liriope of this series, the tentacula are somewhat specialized into two sorts.

found with their small lateral tentacula, but with no ordinary lash. (Pl. 12, fig. 2.) Again, in the whole Tubularian group, we have not a single instance, at any age of the animal, of those remarkable sense-capsules, under the form of little pendent, transparent vesicles, containing corpuscles which sometimes appear to be inorganic concretions, while these are characteristic of nearly all the genera of the Sertularian group, including the Aeginidæ. In fact, ocellary pigment spots, which are characteristic of most genera among the Tubularina, are to be found only in Thaumantias,* Tiaropsis, and Staurophora, among the Sertularina, and their absence in the rest is supplied by the presence of sense-capsules. And I suggest the probability, from analogy, of Thaumantias and Tiaropsis, with Eucope, that these ocellated species will be found characterized by such marginal capsules in the early stages of their existence, for those organs are observed in Eucope and Cunina in the earliest stages of their Medusa form, while nothing like them are seen at any stage of existence in such genera belonging to the group of Tubularina, as have been observed.

There are two facts which appear to militate against this separation of Tubularina from Sertularina—the first that *Eudendrium ramosum* described by Van Beneden, appears to be an intermediate form between them. This genus produces free medusæ (which there is very strong reason to believe are Hippocrenidæ) after the ordinary Tubularian manner, but has, according to Van Beneden, some terminal enlargements of the branches very similar in appearance to the medusa-bearing capsules of Sertularians. thus leading to the impression that it may possess both modes of developing Medusæ. But certainly there are no observations to countenance this view, and it is very probable that Van Beneden was right in his conjecture that the enlargements referred to were produced by some parasite within the tube, or it is even quite possible that this may be the form which a creeping branch takes before it has fixed itself and begun giving rise to polyps. See below Hippocrene and Eudendrium.

Next, it may be thought that the mode of growth exhibited by the radiate tubes in the Tubularian method, renders the reality of

*It is evident that Forbes made no constant distinction between well defined ocellary spots and the mere coloration of the tentacular bulbs which often exists without the presence of ocelli. The greater ocellus in Tiaropsis, however, is perhaps a combination of the ocellus and the concretionary capsule.

our distinction questionable. But it appears pretty clear that the outer covering of the bud at the stage when this takes place, is the same that protected it before the tubes appeared, and if it were not the same as the external surface of the future medusa's disk, we should certainly observe at some point in the course of growth a casting or shedding of this original covering. Now nothing of this kind has ever occurred in the course of my own observations, nor been mentioned by any observer with whose writings I am acacquainted. The growth of the tubes, however, appear to be accomplished in the same centrifugal manner in both groups, with this difference, that in the Campanularians they grow out synchronously with the outgrowing disk, while in the Tubularians they are hollowed out in the disk after the digestive trunk is already covered by it.

There are still two groups among Hydroid Medusæ whose relations to these two we ought to determine as far as practicable. They are Siphonophoræ and the Aeginidæ, as well as the typical fresh water Hydra.

All the Siphonophoræ appear to be developed after the manner of the Tubularina, in free grape-like bunches as in Tubularia, (e. g. Physalia, Physophora, &c.) or as in Clava and Coryne (e. g. Porpita and Velella.) Huxley describes (Müller's Archives 1851) the development of Diphyes, and from his description and figures it is evident that the development of the bud proceeds according to the Tubularian method. The observations of Quatrefages on the structure of Physalia (Annales des Sciences Naturelles 4 ieme, Ser. vol. II. p. 128 and Pl. 4, 2) show pretty clearly, I think, that the development of the tubes in the sexual Medusa follows the Tubularian plan and that the disk covers the digestive trunk from the first. Also Kölliker has described in *Agalmopsis punctata* the growth of the swim-bells, and these, according to his description, have the disk closed in the earlier periods of existence, even until the tubes are formed, and the interior of the bell entirely without communication with the surrounding medium which it last gains by formation of an opening, in some manner not observed. This fact is specially to be remarked since here there is no digestive trunk nor sexual organ. The figures given by Kölliker (Schwimmpolypen von Messina) have all so general and striking a resemblance to the various appearances of the Medusa buds at various stages in Tubularia and Coryne, that I think it will at once be recognized. On the other hand the free Medusa of Velella is

known through the researches of Huxley, Vogt, Kölliker and Gegenbaur, under the name Chrysomitra, and has already been referred to the neighborhood of Sarsiadæ, Cladonemidæ and Oceanidæ, by Gegenbaur, (Zeitsch *loc. cit.*) It has, however, some very remarkable peculiarities which I shall notice more particularly when I come to describe our own species of Willsia. Whether the Physophoridæ which seem to be communities of Medusæ rather than of Hydroid Polyps, should constitute a separate subdivision in the group of Tubularina on account of the wonderful degree of specialization among the individuals of a single community, I do not undertake to decide, since, unfortunately, my observations on our own species, in spite of my efforts to the contrary, have hitherto been too limited to enable me to add anything to our knowledge of the group. It should, however, it seems to me, be borne in mind that the social insects whose classes of individuals are also differentiated upon an embryological basis, just as is the case with Siphonophoræ, do not constitute a single group, but are distributed among different orders and different families in the same order. This analogy, though rather a remote one, should, it seems to me, be allowed some weight in guiding the investigation. The Velellidæ, on the other hand, seem to be floating polypidoms, with only one class of Medusæ, i. e., those with reproductive organs. The Physophoridæ are, to a certain extent, comparable to the budding Sarsias and Lizzias, and the Velellidæ to Tubularia, Hydractinia, &c.

The singular group of Aeginidæ comes up next for consideration. I have already mentioned that a series of gradations can be established between the genera Cunina, Aegina, Aegineta and Aeginopsis and Polyxenia, and the genus Eucope, the Medusa form of Campanularia. First, Equorea by its digestive cavity and mouth, the correspondence of other characters appears to be a form nearer to the Aeginidæ than to the Eucopidæ. Next comes Rhopalonema and Stomobrachium, in which the number of tubes is already reduced, and the sexual organs are found in the two forms, the circular and elongated, which are common in the subdivisions of Eucope.

While, therefore, there is a structural gradation between the two groups, we find a discrepance in their embryological history. In Campanularia, as is well known, there is a regular individualized metamorphosis or alternate generation. But among the Aeginidæ, where the embryology is known in at least three instances,

Aeginopsis, (Müller, Kölliker and Gegenbaur,) *Stenogaster** (Kölliker,) and *Cunina*, (See p. 111, note,) it is in every case a homogony or direct metamorphosis, in which every individual hydra is metamorphosed into a perfect medusa of low type. I have shown that gemmation takes place, but the larvæ are never fixed and swim freely, or attach themselves as parasites to the bell cavity of other medusæ, and every bud assumes first the form of the hydra, from which it directly passes to that of the medusa along with the stock-hydra, from which it is bred. There the original hydra and all its buds become medusæ. A strong analogy exists, therefore, between this state of things and the communities of medusæ among Siphonophoræ such as Forskalia, where a considerable number of the parts possess circulatory tubes, and though much modified, appear to be referable to the medusa stage of growth, as well as the sexual buds. Add to this that in both instances the communities are free, that is, in the latter case attach themselves at will. But here the analogy ceases. The Siphonophoræ develop the medusæ after the Tubularian method, the disk inclosing the digestive trunk from the first. The contrary is the case in the Aeginidæ, as I have shown already in this volume. In the larval Cunina (Pl. 6 and 7.) which I have there described, the disk grows out from the base of the hydra as a circular fold and growing downward gradually overarches the gradually contracting siphon of the digestive cavity, so that the disk does not come wholly to include the digestive trunk until after it has attained its activity as a swimming organ. The digestive siphon gradually retires also within the vailed opening of the disk, having been originally without it; the same is the case with Campanularia, and exactly the reverse is the case with the Tubularians, where the digestive trunk is always originally wholly within the vailed rim of the bell and does not come without until the animal is either completely developed or nearly so. A glance at Müller's figures of the development of *Aeginopsis Mediterranea*, (Müller's Archives, 1851, p. 272) will show that there the disk must grow in the same manner. From this correspondence, therefore, in the growth of the swim-bell or disk, united with their structural affinities, I include the Aeginidæ in the Sertularian group.

To those who believe that there is a deep gulph between alter-

*The resemblance of Stenogaster to the Larva I have described in this volume, pp. 77–79 is so great that it will very probably, I think, turn out to be a Cunina or Aegineta. See below Cunina.

nate generation and direct metamorphosis, this must appear as an incongruous association.

But alternate generation is indeed only an individualized form of metamorphosis, wherein the budding power is specialized among the different parts of the embryonic mass, so that some of the individuals produced by it are permanently adapted to a lower *rôle* than others, and thus (Siphonophoræ) some become free sexual Medusæ, while others having neither digestive cavity nor sexual organ, are doomed to remain as mere motor-machines, or swim-bells, still others, as the canal-bearing bracts, are specialized to perform, perhaps, respiratory functions only, while other individuals assume the form of long tentacula, having nothing much developed about them but their thread-cell bunches, and many others remain still as simple digestive trunks provided with mouths. Now, in this there is no alternation of *generations*, for no one of these classes of individuals form a separate generation; there is but a single generation the result of a single generative act, and that generation includes all the classes of individuals, and would not be complete if any one of them were omitted. The only difference, then, between this and the direct metamorphosis of Cunina, is that there gemmation produces no permanent classes of individuals, but each individual entering into that single generation, unless abnormally aborted, is equal in rank to every other. There is therefore no distinction in kind, no essential and fundamental difference between these two forms of metamorphosis united with gemmation; the difference is one of degree only, and manner, in carrying out a single fundamental plan.

But we may bring these two modes of metamorphosis still closer together by the link supplied in the valuable observation of Gegenbaur, that his genus Trachynema, so nearly allied to the Eucopidæ is developed from a ciliated larva like Aeginopsis, which, as he observes, separates the Trachynemidæ from the Eucopidæ. On the other hand, they approach quite nearly to Eucope, in a structural point of view. It is to be remembered, also, that nothing is known as yet of the development of Circe, Aequorea, Geryonia, Liriope, as well as Sminthea and Eurybiopsis, while there is not much probability were it from fixed hydroids it would have escaped observation up to this time, in some one of these genera, and their affinity to Trachynemidæ on the one hand, and Aeginidæ on the other, render it probable that they have a direct form of metamorphosis. Also, the development of Stomobrachium into

Mesonema seems to indicate another complication of the embryological plan by the introduction of fissiparition.

This direct metamorphosis among Aeginidæ, is of lower rank than the alternate generation or individualized metamorphosis of the Campanularians and Tubularians. If we bear in mind the condition of the larva in its earlier stages among Campanularians, when producing only planules, we find that it is a free swimming embryo until it is ready to assume its polyp form, when it loses its power of locomotion and becomes fixed for life. This ciligrade movement, then, is the index of a low condition, and among the Aeginidæ we find, that the existence of this ciligrade locomotive condition is prolonged in Aeginopsis, until the Medusa form is assumed and in Stenogaster and Cunina, though probably it exists for a shorter time, yet the young hydroid never becomes fixed but only assumes that condition which we find in the larva of Tubularia, when with developed tentacula and freed from the bell of its medusa, it moves about by means of the tips of these tentacula, and selects a site to spend its remaining existence. Hence, when compared with the remaining Hydroid medusæ, the larval conditions of the Aeginidæ, are of low type, and we should not exclude from this consideration the fact, that they are in two instances parasitic in their character. If we compare this conclusion from embryology with that which we should derive from their low structure, we find that both would equally prove them to be the lowest of the Medusæ. At the same time the gentle gradations which superior knowledge is leading us to conclude, exists between the Aeginidæ on the one hand, and Eucope and Thaumantias on the other, gives weight to the belief that there is no essential difference of type between the direct metamorphosis of the one and the individualized metamorphosis of the other. In both at a particular stage, multiplication by gemmation takes place—but in one the buds are all of the same kind, and all become medusæ—in the other the buds originally similar, are gradually differentiated into different classes of individuals. And this latter mode is evidently only a development by specialization of the one fundamental plan of the embryology of the Hydroid Medusæ.

It seems pretty clear from the observations of Prof. Agassiz, (Boston Soc. Nat. Hist. Proc., vol. 3, p. 354,) that the fresh water Hydra produces free Medusæ. But having never had an opportunity of repeating this observation, I cannot give more than a conjecture as to the relations of this Medusa to the others. Prof. Agassiz's very short account, however, seems to indicate a medusa of nu-

merous chymiferous tubes, a broad digestive cavity (?) and tentacula arising above an undulating margin which hangs below them. Also, a folded mouth. These characters, if I have conceived them rightly, would indicate something approaching the Aeginidæ and Aequorea, but I would not venture to speak more particularly.

To sum up the matter, it appears to me that the Hydroid Medusæ form two natural groups or sub-orders, based on general form, and an *ensemble* of structure characteristic of each, and also on a difference in the method by which the locomotive disk is formed; which difference will probably prove constant. That this corresponds in part to the distinction introduced by Ehrenberg between the different forms of the fixed hydroid larvæ of these Medusæ, by which he divided them into Tubularina and Sertularina. But that these groups are not sufficiently inclusive, since there are many hydroids which are never fixed—and that these should be united with the two foregoing groups, viz: the Siphonophoræ, with the Tubularina; and the Aeginidæ, and their allies with the Sertularina. Should subsequent research prove these two methods of developing the disk which we observe in Tubularia and Cunina to be constant for their groups respectively, to which I have referred them, I propose to name the two sub-orders so distinguished, Endostomata, including the Tubularina and Siphonophoræ and Exostomata, including the Sertularina and Aeginidæ.

We should next consider the Families which may naturally be formed under these groups. The subdivision of the Gymnophthalmata into families by Forbes, has already been criticised by Agassiz and Gegenbaur. His characters are the simple or branched forms of the radiate tubes, their number, and the position of the sexual organs; thus constituting Willsia, a distinct family, on account of its branching tubes. The characters of his other five families, it is difficult to sieze. They are besides Willsiadæ—Oceanidæ, Aequoridæ, Circeadæ, Geryonidæ, and Sarsiadæ. Oceanidæ and Sarsiadæ are natural groups. Circe, which alone constitutes the family of Circeadæ, with the addition of a new genus, Persa, described below, will probably also represent a natural group. Tima, among his Geryonidæ, is referable to the Eucopidæ; and it is at least doubtful whether Stomobrachium should be ranked with the Aequoridæ, while *Polyxenia Alderi* is probably the type of a new genus, whose position will hardly be assignable until further research has made it better known.*

*Is it a Hooded-eyed Medusa?

His names will probably be retained, all of them, except Sarsiadæ, being, however, strictly attributable to Eschscholtz.

Gegenbaur (*loc. cit.* p. 218,) divides these Medusæ, which he calls Craspedota, from the presence of the vail, into seven families. They are Oceanidæ, Thaumantiadæ, Aequoridæ, Eucopidæ, Trachynemidæ, Geryonidæ, and Aeginidæ. These divisions are founded on collective structure, so that the characters employed by Gegenbaur, are drawn from all the principal organs of these animals. The author also makes mention of the larva-type, as a subsidiary character in his diagnoses of the families. His Oceanidæ include the Oceanidæ, Sarsiadæ, and Willsiadæ of Forbes, with other genera, which he thus divides into sub-families:

Oceanidæ, proper, with short digestive trunk, simple tentacula, and simple radiate-tubes.

Sarsiadæ, with simple tentacula, simple radiate-tubes, and very much elongated digestive trunk.

Bougainvillidæ, with short digestive trunk, oral tentacula, and simple marginal tentacula grouped in bunches.

Willsiadæ, with branching radiate tubes and simple tentacula.

Cladonemidæ, with forked radiate tubes and branched tentacula.

These groups appear to me natural, but of unequal value; thus setting aside the fact, that the development of Willsia is not known, (and otherwise its proximity to Cladonema seems quite plausible,) the Bougainvillidæ are distinguished from all the rest by the presence of highly organized oral tentacula, and the grouping into bunches of their marginal tentacula, while so far as known, their larvæ are allies of Eudendrium and Tubularia. On the other hand Oceanidæ and Sarsiadæ agree in having Corynidæ for their larvæ, no oral tentacula, and their marginal tentacula, though frequently complicated in structure, never exhibiting that peculiar grouping characteristic of Bougainvillidæ. Again, Gegenbaur separates the Thaumantiadæ from the Eucopidæ, placing Aeginidæ between them. The genus Æquorea, on account of its large, broad-mouthed digestive cavity imbedded in the disk, is certainly more distantly related to either Thaumantiadæ or Eucopidæ than these are to each other, when we consider that the greatest distinction between them consists in the fact, that Thaumantias has ocelli and not marginal sense capsules, while the reverse is the case with Eucope. But Agassiz' genus Tiaropsis is certainly a Thaumantiad, and yet its larva is Campanularia, which is also true of Eucope. These two groups, therefore, are no further removed from each other

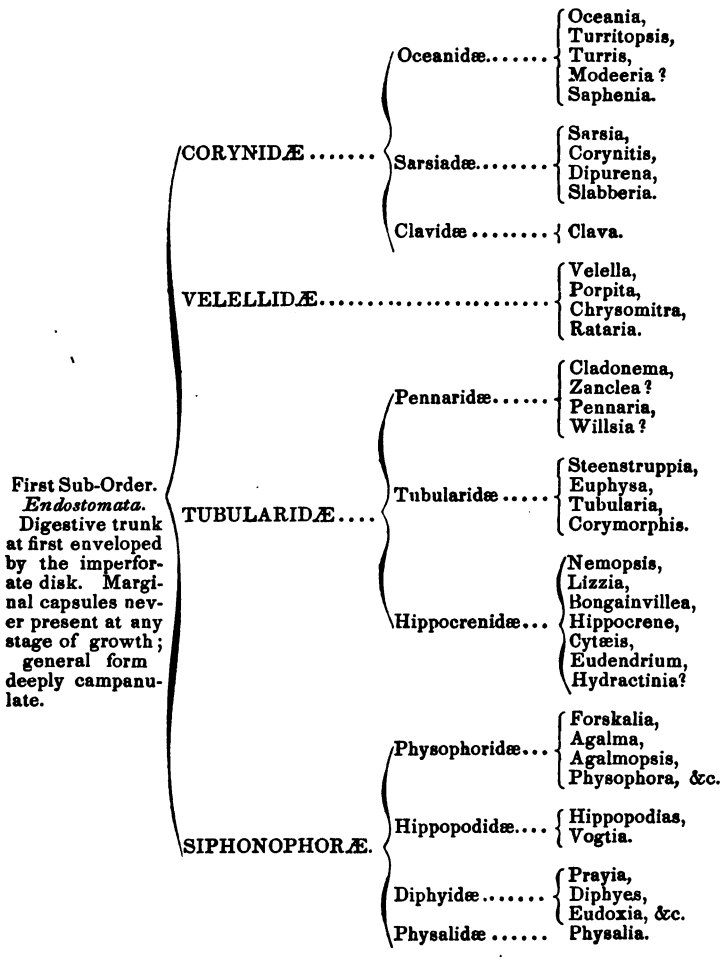
than the Oceanidæ proper, and the Sarsiadæ. The Trachynemidæ and Geryonidæ of Gegenbaur and the Æquoridæ, can never be well located until we become better acquainted with their embryology. But it appears to me the Aequoridæ are certainly very closely related to the last family of Gegenbaur, the Aeginidæ, which no doubt constitute a family apart.

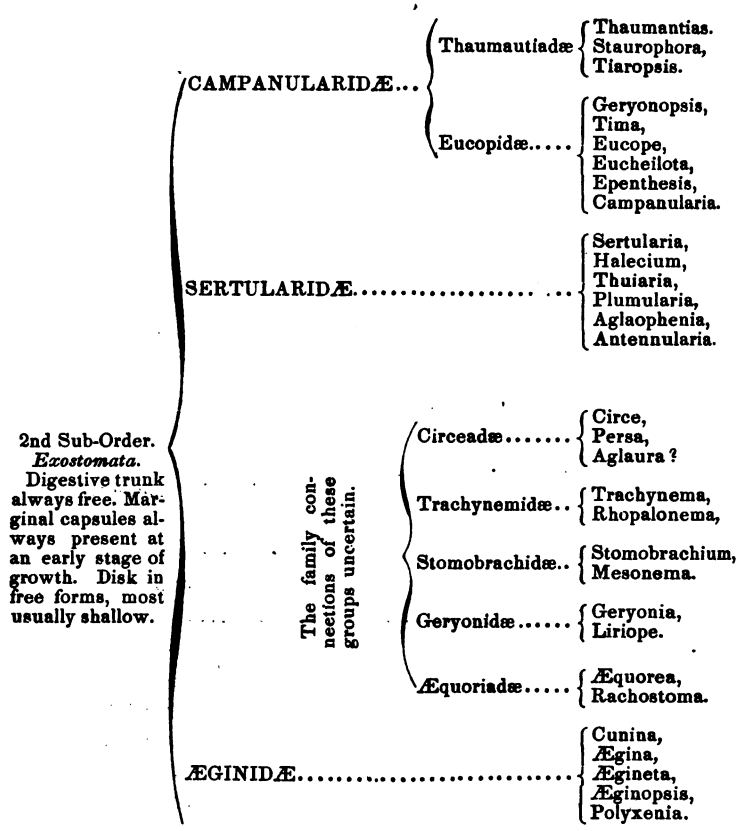
It is evident also from the name which Gegenbaur applies to this order, Craspedota (provided with a veil,) that he does not take into consideration those lower forms of Hydroidea which never attain so high a degree of complexity. All the Sertularians, proper, Clava and Hydractinia are left out by this mode of drawing the bounding line, and consequently do not appear among his families. The Siphonophoræ also with the exception of Chrysomitra find no place among these families.

In attempting to group the Hydroid Medusæ of Charleston harbor into families, I have of course been led to consider many forms which are not found in our waters, and it appears to me that families in this group are founded on certain apparently slight modifications in structure and combination of organs both in the larva and adult—that members of the same family of Medusæ are derived from hydroid larvæ of one type, or not differing from each other more than generically and that frequently on account of the low grade of development of the adult form, it is more easy to determine the family from the characters of the larva than from those of the adult. Thus *Tubularia coronata*, according to Van Beneden, produces medusa buds, which never become free; the same is true of a species in Charleston harbor, while the two other species described by Van Beneden, both produce free medusæ. The Medusæ which never become free, have no tentacula, while those that swim freely have them; yet certainly in spite of their differences of structure and condition, they belong to one family. Again, Sarsia and Callichora (Oceania?), differing as they do in structural details, are all developed from Corynidæ, and it is almost impossible to decide whether such groups should hold the position of families or of sub-families, while from this group of Corynidæ I doubt whether it would be proper to exclude even Clava. In the same way Tiaropsis, an ocellated genus, belongs to the same group as Eucope, which is unocellated, for both are developed from Campanulariæ. The genera Nemopsis, Bougainvillia and Lizzia, on the other hand, seem to constitute a natural family, having fasciculated marginal tentacula and branching

oral cirrhi, while so far as known they are separated from other groups also by their embryology. However, they are relatives of Tubularia proper, as I shall show further on.

Without, therefore, pretending to set the matter at rest, I present the following scheme as a sort of rough draught of the divisions which would probably result from the view I have taken. At the same time stating my belief that limited as are our observations as to the embryology of most genera, it will be impossible to assign any very definite limits to families, or even, in many cases, to decide to what family a given genus should be referred:





This scheme exhibits as nearly as I have hitherto been able to make them out, the actually known, and in cases where there is no actual knowledge, the probable embryological relations of the Hydroidæ. It is probable that such relations will hereafter serve as our principal guides in determining families. It is possible also that the families will be even more numerous than those already established among the Hydroid polyps or larvæ, and that such groups as the Oceanidæ and Hippocrenidæ will hereafter enjoy the rank of families, as well as the marked group of Æginidæ, which it is not unreasonable to expect will have to be sub-divided. Certainly the *generic* limits employed hitherto have been often too comprehensive. Prof. Agassiz's *Hippocrene superciliaris* differs from the *Bougainvillea Brittanica and B. nigritella*, by the position of its ocelli, and this difference is generic. The *Oceania*

flavidula of Peron and *O. pusilla* of Gosse, are, by the position of their ocelli, separated from Oceania, and belong to the genus Turritopsis, about to be characterized. The Eucopes and Timas of Charleston harbor have lateral cirrhi to the bulbs of their tentacula and must be separated from their European representatives; while the number of marginal capsules should also serve as a distinctive character, since within certain limits it is constant for certain groups.

The Hydroidea of Charleston harbor, arrange themselves under the following genera: In the sub-order of Endostomata, we have representatives of the Corynidæ, Velellidæ, Tubularidæ, and Siphonophoræ. Among Corynidæ, the Oceanidæ are represented by the genera Turritopsis and Saphenia; Sarsiadæ by two new genera Corynitis and Dipurena, and by Sarsia; Clavidæ have no representative. The Velellidæ by the genus Porpita. Among Tubularidæ, the Pennaridæ, are represented by Zanclea,* Pennaria and Willsia; Tubularidæ by Tubularia proper; the Hippocrenidæ, by Nemopsis, Hippocrene, Eudendrium, Corynedendrium, and Hydractinia. Among Siphonophoræ, no representative of the group of Physophoridæ, or Hippopodidæ, have been found; Diphyes, Eudoxia, and perhaps Ersæa, represent the Diphyidæ—and the genus Physalia has a representative in a transient visitor of our waters.

In the second sub-order, the Exostomata—Campanularidæ and Sertularidæ, are pretty fully represented. It is doubtful whether Thaumantias has a representative. The Eucopidæ are represented by Eutima, Eucheilota, Epenthesis, Campanularia, and Laomedea; the Sertularidæ, by Dinamena. Plumularia and Aglaophenia; Circeadæ, by a new genus Persa allied to Circe; neither Trachynemidæ nor Stomobrachidæ, have representatives as yet; Geryonidæ, are represented by Liriope; Aequoridæ are without representatives. Lastly, the Aeginidæ are represented by a species which I have referred here to Cunina, but which will, in all probability, fall

*This approximation of Zanclea to the Pennaridæ, I owe to Professor Agassiz, and the delay which, from unavoidable causes, has retarded this publication.—Professor A. informed me this spring that he had observed the development of a genus like Zanclea, from a Pennaria-like Hydroid. I had before, however, suspected some relation between Zanclea and Cladonema, and a relation between the latter genus and Pennaria, on account of the characters of Stauridium.—June, 1858.

into another group when Cunina is finally sub-divided. We now proceed to the description of the species.

SUB-ORDER—ENDOSTOMATA.

Bell always deep, never disciform. Ocelli generally present; marginal capsules never, at any stage of growth. Development always an individualized metamorphosis or alternate generation. Bell-wall enclosing the digestive trunk in the medusa-bell from its first appearance. Or, since the digestive trunk is sometimes wanting, it may be, perhaps, better expressed—that the cavity of the bell is at first a blind sack, formed before the opening of vail, by which it subsequently communicates with the surrounding medium.

1st GROUP CORYNIDÆ. Johnston.

Larva Coryne; consisting of a fusi-form polyp, with scattered tentacula usually clavate at tip. Among these tentacula, or just beneath them, are developed the Medusa-buds. External surface of the Medusa-bell usually beset with scattered thread-cells not arranged in regular lines. Tentacula varying in number. Digestive trunk nearly always elongate.

The group of Corynidæ contains three lesser divisions, which we distinguish as follows, so long as no connecting links between them are known to Science.

I. OCEANIDÆ. Eschscholtz.

General form, spherical, conical, or truncate, tentacula having elongate and mostly fusiform bulbs; their number is various, but usually great; position of the ocellus variable, sometimes it appears to be absent altogether; digestive trunk massive; sexual organs generally circumscribed and arranged in four distinct lobes about the digestive cavity; mouth surrounded by an armature of four leaf-shaped oral tentacula.

TURRITOPSIS, *nov. gen.*

General form deeply campanulate; tentacula numerous, making the entire circle of the bell-margin; no conspicuous vertical muscular bands as in Turris. Ocelli on the inner or lower side of the tentacula. The upper part of the tentaculum, which at its free extremity carries the ocellus, has the appearance of being slightly distinguished from the rest, even when extended, and is

quite a distinct part when contracted. It may be characterized as an elongated ocelliferous bulb; upper portion of the digestive trunk composed of a hyaline mass of large cells surrounding the origin of the radiate tubes. This structure is an extraordinarily developed epithelium.

Larva?

Remark.—The several genera in this group, are very closely allied—Turris differs from Oceania only by its muscular bands—and Saphenia only by its two highly developed tentacula. The present genus Turritopsis, differs by the structure of its digestive trunk and the position of its ocelli. I am now pretty well satisfied that these characters are sufficient to distinguish it generically.

Distribution.—British Seas, Mediterranean, Charleston Harbor.

TURRITOPSIS NUTRICULA.

Syn. O. Turritopsis Nutricula. Proceedings of Elliott Society, Vol. I., p. 55, pl. 4 and 5.

Pl. 8, Fig. 1. (*young.*)

A deep-belled species, flat at top, with its profile descending nearly vertically from the top for about a third the animal's height, and sloping outwardly for the rest of the descent. The digestive trunk is massive, filling a large portion of the bell-cavity. The transparent or upper part in full-grown individuals, is nearly square and about equal (in its expanded state) in height to the height of the digestive cavity. The four sexual lobes are voluminous, rounded below and separated by deep furrows. The four leaflets, placed one for each of these furrows, are large, and have their margins tufted with many pads of thread-cells. They are capable of being extended upward along the corresponding furrows, so as to appear just above the sexual lobes, and thus be seen through the transparent tissues of the animal from above. The whole trunk thus described, generally hangs so low as nearly to reach the opening of the vail. Sometimes a specimen may be found with these oral prehensile organs protruded beyond the vail, and this even seems, in some cases, to be habitual; but it is not the ordinary carriage. The tentacula are about one hundred, sometimes a little over, sometimes under that number. They are slightly clavate at the extremity, and somewhat surpass the height of the disk in length. They are usually carried tightly curled at the extremity.

Although I have not been able to observe the hydroid larva of this species, yet I have been able to observe the medusa at a very

young stage, when possessed of only eight tentacula, and measuring only .08 in. alt. and .06 in. lat. At this stage it has somewhat the form of *Sarsia turricula*, (pl. 8, fig. 6,) but its digestive trunk is of an elongate conical form, reaching nearly down to the vail. It resembles in form the trunk of Corynitis rather than that of Sarsia. The mass of large cells occupies but a limited space, about one-fourth the length of the trunk; is composed of few cells, and is quite narrow, scarcely exceeding in width the digestive portion of the trunk, which is slender, and rather resembling the trunk of a young Sarsia, than that of an adult Turritopsis. The trunk ends in a bluntly pointed muzzle, well stocked with thread-cells, which appears to constitute a single bunch. One peculiarity which should also be noted in this young stage is, that the transparent tissue of the upper portion of the disk, is, at this time, prolonged for a short space downwards, so that the large-celled transparent mass does not, at this time, abutt as it afterwards does against the wall of the bell above, but is united with it by a downwardly directed projection of the disk. This character afterwards disappears, but we still see a trace of it in figure 1, a more advanced specimen. Here the height of the bell is equalled by its width, the cavity is very roomy, and the general form of the animal approaches that of a sphere. The trunk has still its conical form, but the single bunch of thread-cells at the mouth now begins to divide itself into four; while the large-celled mass above has increased, in extent and the number of its cells, and the tentacula have reached the number of twelve. After this, the four labial appendages grow out gradually, the digestive cavity increases in size, the sexual organs begin to be developed, the large-celled mass fills up gradually the space between it and the bell-wall above, while the tentacula constantly increase in number. It may as well be observed here, that the tentacula of the young Turritopsis have a certain stiff appearance, which they afterwards lose almost entirely. This remark is applicable to other genera, as Corynitis, but not to Sarsia proper.

Since writing the article on *Turritopsis nutricula*, and the development of the medusan larva found in its bell (*supra*) I have become fully sensible of the error of supposing that larva to have been the young of Turritopsis, into which error I was misled by the analogy of Tubularia. I cannot doubt that the larva in question is the young of a Cunina, about to be described as an inhabitant of our harbor, and that it passes its embryonic life for the

most part in the bell-cavity of *Turritopsis nutricula*, from whose stomach it appears to derive its nourishment until it is prepared to pursue an independent existence.

The coloration of this species is a rich and rather reddish orange on the sexual lobes, with deep lake in the furrows; the labial appendages frosted, as well as to a slight extent the outer surface of the disk; tentacula have sometimes a purplish tint, with a slight nucleus of lake in the clavate extremity. Found in Charleston Harbor from the early part of June to the early part of October.

SAPHENIA. Eschscholtz, (*Forbes*,)

General form varying from one having a profile emarginate on each side near the summit, to that of a hand-bell, in which the emargination has proceeded so far, as to make the upper part of the disk appear a more or less conical appendage to the lower The sexual glands are placed on the upper part of the digestive trunk, the two-fold character of each gland being quite distinct. To this part of the trunk the stomach proper seems also confined. The neck, which like the neck of a bottle, separates this upper portion from the mouth in all the genera of the group, is in Saphenia very long, and in the following species when contracted appears capable of forming a separate or lower cavity, Pl. 8, fig. 3 *a*. The circulatory canals are broad as usual in the group. Only two of the radiate canals have corresponding tentacula, and these two at their junction with the marginal canal form a sort of flat triangular sinus. The somewhat fusiform bulbs are proportionally large, and the characteristic of the tentacula are length and great contractility. There are no ocelli. Larva—unknown.

Remark. It may be reasonably questioned whether this genus is really that to which Eschscholtz intended to give the name Saphenia. Not having within reach the material for settling the doubt, I have continued to use Saphenia in Forbes' sense.

Distribution, (with the present limits of the genus.) British seas, Mediterranean and Charleston Harbor.

SAPHENIA APICATA, *nov. spec.*

Pl. 8. Ff. 2, 3.

Bell shallow, being almost square in profile; bell-wall thin throughout, and surmounted above with a long conical appendage tapering to a delicate point, which is sometimes turned jauntily on one side as in the figure. Digestive trunk very long, when

extended, reaching very considerably below the bell-margin. It is also capable of contraction, so that the lips appear distinctly *within* the vail. The sexual glands abutt directly upon the upper portion of the bell-wall, and extend very slightly radiately with the radiate tubes. Four ridges corresponding to these glands extend downward along the neck of the flask-shaped trunk, merging themselves at its extremity each into one of the leaf-shaped oral tentacula, on the margins of which latter I have failed to find tufts of thread-cells. The bulbs of the two tentacula are as usual in the group, large and elongate. They seem to be separated from the lash of the tentaculum, by a slight constriction. The lash is very long and tapers gradually to its extremity—being throughout irregularly nodose, but especially towards its extremity. Its outline, also, is difficult of definition. There are traces of six other tentacula; two of these are larger than the rest, and are situate at the extremities of the two remaining radiate tubes. They are all very faint and small, and for a long time escaped my attention altogether.

The color of the ovaries is a pale yellow or straw-color, the tentacular bulbs are of a beautiful claret red; and the lashes of these organs have a whitish, almost frosted appearance by reflected light.

It is a beautiful sight to see this species in motion, swimming, like other shallow-belled species by rapidly repeated pulsations of the disk with swiftness, trailing after it, its long tentacula which alternately approach and recede from each other in graceful curves, now curled together in an inextricable tangle and instantly loosed again as if by magic, when suddenly they contract and put an end to the exhibition. I have taken but few specimens of S. apicata, one as early as June 5th, another as late as September 16th. It is therefore a rare summer species in all probability.

II. SARSIADÆ. Forbes.

These Corynidians are distinguished from Oceanidæ by having usually an elongate digestive trunk, around which the sexual organs are rather equally distributed. The digestive trunk is terminated by a simple mouth, or one with scarcely undulated margin. The number of tentacula appears to be limited to four. The principal distinction lies in the form of the ocellary bulb, which is concentrated, almost spherical, confined to the margin, and usually containing a sinus which connects the radiate and

concentric canals. The ocellus is always placed in the transparent tissue which surrounds the darker mass of this bulb, and is therefore always marginal, not tentacular in its position.

The different genera included under this head differ widely in the form of the tentaculum which in Sarsia proper is long, very contractile, and lash-like, while in Dipurena and Corynitis it is short and clavate. Prof. Forbes' genus, Slabberia, also, is the only genus in the whole group of Endostomata, which appears to have the sexual organs entirely on the radiate tubes. With deference to that lamented and able observer, I must entertain a doubt as to the exactness of this observation for the present. In this group, also, occurs the only instance of which I know, in which the digestive cavity appears to be divided into two distinct stomachs. I refer to a new genus, Dipurena, described below.

CORYNITIS, *nov. gen.*

General form conico-campanulate. Bell-wall of great thickness above. External surface ornamented with scattered groups of small thread-cells, each enclosed in a containing cell. Digestive trunk massive—sexual organs confined to the upper portion. Between the four radiate tubes, the bell cavity rises in four over-arched spaces of unusual height. The four ocellated marginal bulbs of the short tentacula arising from them have the same massive character as the digestive trunk. The tentacula are clavate and bristle with large pads of thread-cells. A sinus occupies the interior of the ocellary bulb, and is connected by canal through the axis of the tentacular shaft with another and larger sinus occupying the interior of the enlarged extremity of the tentaculum. The inter-communicating canal may be completely obliterated by the contraction and closing together of its walls, and though this appears to be done at will in the younger stages of growth, I have not been able satisfactorily to ascertain that it was not a permanent condition in the full-grown adults.

The larva is a coryne with a short thick polyp and few tentacula. The medusa-buds grow in the usual position, just below or among the lower tentacula, and the peculiar character of the tentaculiferous bell-margin is conspicuous at an early age, Pl. 9, ff. 6, 7, 8, *a*. Two of the tentacula are developed a considerable time before the others. They at first appear as hollow enlargements of the margin at opposite poles of one of the diameters of the marginal circle. They increase in size and gradually project

downwards, the cavity within elongating with them, fig. 6, *a*. At first there appears to be but one cavity; a slight constriction appears on the elongating tentaculum just below the margin, and in the next stage known to me, fig 5., there are two sinuses connected by a canal through the tentacular shaft, in the engraving represented by a median line passing from the dark central core of the ocellary bulb to the hollow enlargement *c*, at the extremity of the tentaculum. The young Medusa at this stage is free, with but two tentacula, though with four marginal bulbs. Each tentaculum has one or two patches of thread-cells, besides the enlargement at the end. The bell-wall is still very thin; the digestive trunk large, conical and pointed below; the mouth not yet perforate. In a day or two, from the remaining two bulbs, tentacula begin to sprout, which soon obtain a complete resemblance to the other two, though for some time after they are perceptibly inferior in size, thus giving a sort of bilateral symmetry to the animal. It should be remarked that the cavity or sinus in the terminal bulb of the tentaculum is lined by colored cells similar to those which line the cavity of the ocellary bulb, and in my opinion, also, to those which line the digestive cavity.

This development shows that we should be careful in founding new genera upon a difference in the number of tentacula.

Distribution. Charleston Harbor.

CORYNITIS AGASSIZII, *nov. spec.*

Pl. 9. Ff. 3—8.

When fully grown, this species is nearly of the size of *Turritopsis nutricula*, about .3 in. in height, which was the size of the specimen figured fig. 3; that from which fig. 4 was taken having been in contracted condition and smaller. The general form is mitrate, the outline swelling out as on either side it rises from the tentacular rim, and terminating above in a rather obtuse vertex. The outline is broken by slight protuberances at tolerably regular intervals, which are the bulging clusters of thread-cells, scattered over the whole outer surface. The massive digestive trunk has a little more than its upper third occupied by the digestive cavity and the sexual organs. The remainder is prolonged in the form of a tube terminated at the mouth by several (3? or 4?) indistinct lobes. This tube is capable of extending itself beyond the vail or of almost confounding itself with the upper and more stationary portion by contraction. The large ova, of

which each ovary contains only a few, as they grow, swell the outline of the upper portion of the trunk in large sweeping curves. The whole trunk thus described, appears suspended in the bell-cavity by many radiately converging arches, like one of the massive pendants hanging from a gothic ceiling. The principal of these arches, (those with double lines,) are the result of the arrangement described in the diagnosis of the genus, by which the radiate tubes, springing from the upper surface of the dark-coloured digestive cavity, proceed, for a short time, in almost horizontal direction outwards, then with a bold curve sweep downwards almost vertically to the ocellary bulb. They nowheres, therefore, reach higher than the base of the digestive trunk. The cavity, however, of the disk is prolonged upwards in four over-arched spaces, between the arches of the radiate tubes, and the outline of these is marked out by the double outline of the epithelium clothing the inner surface of the bell, (figure 3, *p*.) Above these at *q*, are two arches of single lines, disclosing a differentiation between the tissues in that part of the wall, the immediate purpose, and the homologies of which, I do not undertake at present to explain. The tentaculiferous margin of the bell is characterized by an unusual development of the transparent tissue which always surrounds the faintly-colored marginal tube and the colored ocellary bulbs. The bulbs, and the tentacula which they bear, are like the digestive trunk massive. The ocellus is borne in the surrounding clear tissue of the bulb near its upper margin. The shaft of the tentaculum tapers from the marginal bulb to its junction with the clavate extremity, and is ornamented with four or five oblong pads of thread-cells, whose longer axis is placed rather obliquely to the transverse axis of the shaft. These shafts possess considerable contractility, though it is very slow in operation, the tentacula never contracting suddenly to any great extent upon irritation. The shafts, however, may be so contracted gradually by continued stimulus, as to bring all the pads of thread-cells together, thus forming a spiral chain of them round the shaft; and finally the shaft be so contracted as almost entirely to disappear. The enlarged extremity of the tentaculum also partakes, to some extent, of this susceptibility, so that its usually ellipsoid bulb, (figure 3, *c*,) is sometimes changed by contraction into an almost spherical ball, (figure 4, *c*.)

The specimen represented, figure 4, had but three sexual lobes, the fourth being abortive. At the same time the mouth presented

a quadrate aperture. This reminds us of the corresponding discrepance between the numerical formulæ of the mouth and sexual organs in Cladonema, observed by Dujardin; but I have not been able to ascertain whether it is constant for all the specimens.

With regard to coloration—the peculiar ornamentation of the external surface, gives the animal a rich and obscurely frosted appearance. With this exception, the disk is colorless. The coloration of the digestive trunk is a combination of a deep red, with a rich orange, the lining membrane of the stomach being of the former color, and the sexual lobes of the latter. The red color characterizes also the opaque portion of each ocellary bulb, and to a rather less degree, the lining of the cavity in the terminal bulb. The transparent tissue surrounding these parts in both cases, is of the orange tint. The shaft of the tentaculum mostly colorless, but having occasionally, near the terminal bulb, a few fleckings of lake color. The pads of thread-cells have a whitish frosted appearance, which is peculiarly rich and agreeable to the eye, and which resembles that on the whole outer surface of the disk. These pads, and the external surface of the terminal bulb, are always bristling with innumerable points, which are the lashes of the thread-cells.

In comparing this figure of the adult (fig. 3) with the figures of the young, (ff. 5, 6, 7, 8,) we cannot but be struck with the fact, that in the young, (fig. 5,) the bell-wall is throughout thin, and that no trace exists of that complicated system of arches described in the adult as serving to suspend the digestive trunk. This constitutes one of the most marked distinctions between the bi-tentaculate and adult stages. Besides the difference of form already noticed, the animal, in its bi-tentaculate stage, has a bright lake nucleus just in the centre of the base of the digestive trunk whence spring the radiate tubes. It is at this stage apparently so awkward in its motions as almost to provoke laughter.

The coryne, which bears this Medusa, is rather rare, as is also the Medusa. It is found growing on sponges a little above dead low water mark. It has been found during the summer months, and whether or not it exists during the winter, (as in all probability it does,) has not been ascertained. A young bi-tentaculate, but free Medusa, has been taken as early as the 5th of June. A fully developed specimen has occurred in the end of July, while as late as the 12th of September, buds were still produced from the coryne, ff. 6, 7, and 8, having been drawn at this date. This leads

me to say that I have not seen the actual separation of a bud from the Hydroid, and its assumption of the form of figure 5. My confidence that they are one and the same, is due to the very marked and almost unmistakeable peculiarities of the Medusa, which are plainly exhibited in the buds while attached to their hydra. To my former Master in Science, Professor Agassiz, to whom America owes the only special publication on her Medusæ, I inscribe this remarkable species.

DIPURENA, *nov. gen.*

General form rather conical; digestive trunk elongate, and divided into two cavities, one above and the other below, connected with each other and with the small quadrate chamber at the origin of the radiate tubes, each by a delicate slender tube; sexual glands arranged in two masses, one surrounding the upper and the other the lower digestive cavity, separated by a constriction; tentacula four, clavate, tubular, attached at the disk margin to colored bulbs, each of which bears an ocellus. This genus differs from Slabberia in the position of its sexual glands—and from Sarsia by its clavate tentacula, and the division of its sexual gland into two portions.

Remark..—This genus is certainly a remarkable one, on account of the number of chambers or sinuses in the course of the nutrient circulation. First the digestive cavity itself appears to be divided into an upper and lower cavity, besides which there is a separate chamber at the intersection of the radiate tubes as in Sarsia, then each of the marginal bulbs must be counted in this category as in Sarsia, to which in this genus appear to be added four other chambers in the terminal bulbs of the tentacula, making in all eleven chambers in the course of the digestive and circulatory systems.

Distribution. Charleston Harbor.

DIPURENA STRANGULATA, *nov spec.*

Pl. 8, Ff. 1-2.

General form of the disk ovoid, truncated below, of considerable thickness above the insertion of the digestive trunk, its outline converging above to a rather pointed apex. The four radiating tubes, very faint in outline, being indeed scarcely visible. The chamber into which they open at the base of the digestive trunk is quite distinct, separated from the digestive cavity by a constriction, and with a lake colored nucleus. Digestive trunk incapable of retraction within the bell. The constriction occurs about one

third of its length from the point of insertion. The walls of the tubular digestive cavity are colored lake, and this cavity also, like the sexual gland, appears to be divided into two parts, an upper and lower. The sexual organs (ovaries in the specimen figured) are of an orange tint; and the mouth is small and appears to be a perfectly simple round opening. The marginal bulbs are conical in form, as in *Slabberia halterata*, with a small black ocellus. The shaft of the tentaculum is finely striated transversely, giving it an annulate appearance, the terminal bulb is oblong and ellipsoid in shape, colored by a dark red nucleus. Active circulation of granular fluid is visible in the canal which perforates the shaft, and appears to pass into the terminal bulb, which thence I conclude is also hollow, though the dark and opaque coloring of the walls of this presumed cavity prevented my seeing the circulation within it. The tentacula, though short, are borne in rather graceful waving curves, and not carried stiffly or at right angles, as Forbes relates of those of *Slabberia halterata*.

This is also a rare species. I have hitherto taken but two specimens, one on 12th June, the other two months later, 11th August.

DIPURENA CERVICATA, *nov. spec?*

I have met a specimen of Dipurena which had the slender tubular connection between the upper cavity of the digestive trunk and the intersection of the radiate tubes, so much longer than in the last species, that it equalled in length the height of the bell-cavity, and thus caused the sexual organs and digestive cavities to lie wholly without the bell. This difference was accompanied by a difference of outline in the disk, which was narrower proportionately above, being more like that of *Turritopsis nutricula*, when viewed in profile, the outline sloping inwardly in its descent from the top to the tentacular rim. The tentacular bulbs also appeared to be slightly smaller than in the D. strangulata. There was no difference of coloration. This neck-like elongation of the digestive trunk in this specimen, appeared to be permanent, for in spite of the irritation of being laid flat upon its side in a watch-glass for examination, it was not contracted but remained hanging out.

With regard to the value of coloration upon which considerable stress seems to have been laid by Forbes, I may say a few words in this connection. So far as my observations go, there are two

principal colors in these Medusæ—yellow and red. There are different shades of these—but the digestive cavity is nearly always red or orange colored, or red within and slightly yellow without. The same is true of the tentacular bulbs and of the clavate extremities of the tentacula in such genera as have them. Blue is found among the Siphonophoræ, and is said to tint the transparent disks of some Æquoreœ. But in this latter case as in that where by reflected light a green tint is given to the sexual organs of Tima, the color does not appear to be due to pigment cells. In fact color among these animals is very uniform, belonging not so much to ornamentation as to a connection with the functions of essential organs, and therefore hardly enters ordinarily into specific character as an important element. The peculiar tone and disposition of color might more safely be assumed as a source of generic than of specific character.

SARSIA. Lesson. 1843.

Syn. *Sthenyo* Dujardin, Ann. Sci. Nat. 3ieme. Ser. vol. 4, p. 275. (1845.)

General form more or less deeply campanulate. Digestive trunk, long, cylindrical tubiform, separated by a constriction from the intersection of the radiate tubes, where there is a small quadrate chamber. Sexual organ investing the digestive trunk; four radiate tubes forming four sinus-like enlargements at the four marginal bulbs, each of which bears an ocellus at its upper part, while from its lower springs a contractile, filiform, nodose tentaculum, which is tubular (?).

The larva is coryne (*Syncoryna*, Ehrenberg.) The medusa is developed among the tentacula, or immediately below them. In the course of development the disk is involute, and the tentacula first appear within it, at least in the species of Boston harbor.

Remark.—Forbes makes no mention whether the tentacula of his four Sarsiæ are tubular or not. Dujardin is similarly silent with respect to Sthenyo. *Sarsia mirabilis* of Boston harbor is known to possess tubular tentacula. The condition of Gegenbaur's *Oceania thelostyla* is, in this respect, also unknown, while in the following species I have as yet not been able to observe any canal in the tentaculum. The Sarsiæ of the Northern shores of Europe must be the true Sarsiæ, and since such a difference as that of solid and tubular tentacula would be of generic value, the question merits attention, and can only be settled by an examina-

tion of the English, French and Norwegian species, which from their general resemblance to *S. mirabilis* will probably be found to possess the same type of tentaculum. They also agree in general size, and especially in having usually long tentacula. *O. thelostyla*, and the following S. turricula, on the contrary, are both characterized by short tentacula, which are probably solid. Their digestive trunk also appears to be short. Such a generic distinction is not rendered less probable by the fact that it would be consonant with a difference in climatic distribution.

At the same time, it should be mentioned, that Gegenbaur's *O. thelostyla* is an immature animal, as also were all the specimens I have observed of the following species.

Distribution.—Seas of Norway, Great Britain, France and New England; and also, coast of Sicily(?), and of South Carolina(?).

SARSIA TURRICULA, *nov. spec.*

Pl. 8, Ff. 6-8.

This species has not been observed in its adult condition. It is tall, its length being somewhat greater in proportion to its breadth than that of *S. mirabilis*, Agass., and *Oceania thelostyla*, Gegenb. which I take to be a Sarsia, or a relative of Sarsia, with short tentacula. The latter species is much more closely allied to S. turricula than any other of which I know. They are both tall and cylindrical, and both have short and almost serrate tentacula, from the marked character of the thread-cell-bunches. The present species, however, seems to be separated from that of the Mediterranean by its greater height in proportion to its width. I have not observed the tentacula to be tubular. When younger than in fig. 6 this Sarsia sometimes has a quadrate form, which it afterwards loses, fig. 7. I have not observed its actual liberation from any hydroid, but can scarcely doubt that its larva is a branching Coryne, with eight or nine scattered tentacula, (sometimes however evincing a disposition in about three indistinct whorls,) and a somewhat elongated body, which grows commonly on the break-water of Sullivan's Island. Sarsiæ of this species were found in a jar where this Coryne had been kept a day or two. This Coryne grows in branching tufts upon algæ, or rather together with them, the alga and Coryne forming small pedunculated tufts above low-water mark. I have observed Medusa-buds upon it, which bore a resemblance to this Sarsia.

It is to be remarked that this Sarsia of Charleston harbor is anal-

ogous with that of the Mediterranean, and that these two have so distinct an appearance, on account of their short tentacula, that Gegenbaur considered *S. thelostyla* a new type of Medusa. With regard to the transparent tissue which clothes the bulb beneath, and to which Gegenbaur seems to attach some weight, according to my observations it exists not only in *S. mirabilis* and our own species, but in other large-bulbed genera, as for instance Corynitis where it is well marked.

The largest specimen of this species yet found did not equal a tenth of an inch in height, and though, as formerly remarked, not entirely mature, I have yet found specimens in which the incipient sexual organs, on the sides of the digestive trunk, were easily distinguishable, and I conclude that the greatest size attained by the species can hardly be much more than one tenth of an inch in vertical diameter.

Specimens have been found as early as the beginning of June, and as late as the latter part of September, but never have any been taken during the winter. It may probably with safety be set down as entirely a summer species.

The *Clavidæ* differ from the other Corynidæ by their filiform tentacula, which want the terminal buttons of thread-cells. A similar difference occurs between the oral tentacula of Tubularia and those of Pennaria, yet Tubularia, when very young, agrees with Pennaria in this respect. An analogous difference takes place between Sarsia and Corynitis, and I look upon it as only a slight distinction. The fresh-water genus, Cordylophora, also agrees with Clava in its tentacula, and I can scarcely doubt belongs to this group, of which there is as yet no representative known in our neighborhood. If I be correct in my conjecture, that the fresh-water hydra is an Exostome, both the sub-orders will thus have fresh-water representatives.

2ND GROUP. VELELLIDÆ. Eschscholtz.

The only free Medusa-form yet known in this group is Chrysomitra, which is characterized by a broad and unusually shallow bell for the sub-order. Its digestive trunk is also short and broad; its radiate tubes unusually numerous (16,) not branched, but each originating in the upper portion of the digestive cavity, and

descending to a marginal sinus. The sexual organs are situated as usual among Endostomata, around the digestive trunk. There appears to be no distinctly circumscribed ocellus, and the (originally two?) short tentacula are terminated by a wheel-shaped appendage, which is attached, not by its circumference, but by its centre. The genus presents also the remarkable peculiarity (so far as I know, not observed in any other free Hydroid Medusa, unless it be Cladonema,) of having the inner surface of the disk, between the radiate tubes, conspicuously colored. A reference to the description of the Medusa-buds, in the following species of Porpita, will show that there is some probability that this is a family character, or at least not uncommon in the group. It has another character which is common to a large number of genera in the next group—that of Tubularidæ. It is the existence of rows of thread-cells, extending upward along the outer surface of the disk, from the margin towards the summit; a localization of these organs very different from their scattered state in the Corynidæ. It is something analogous to the localization of the pedicellariæ into belts (*fasciolæ*) among Spatangoids.

The larvæ of Velellidæ are free floating oceanic hydroids. We should consider each of them as a community of animals, which in some respects is analogous to the community formed by a single polyp-head of Tubularia, with its numerous pedunculated Medusæ. There is a central fibrous shield, consisting of numerous concentric air canals, which may be taken as the representative of the horny polypidomata of fixed genera. Around the periphery of this shield the general fleshy mass is produced in a sort of border. Immediately beneath this border radiate on every side, a number of organs which might be compared in position to the lower circle of tentacula in Tubularia or Pennaria. But it is doubtful whether, finally, we shall not be obliged to consider these as each an individual of a peculiar form. The centre of the lower surface of the disk is occupied by a large, broad-based polyp, of the form of an inverted cone; from its base pass towards the periphery, a sort of canals which communicate with the canals of the outer circle of the so-called tentacula, and with the cavities of the individuals next to be described. These are untentaculated polyps, which seem nevertheless to be provided each with a mouth and a digestive cavity. They should be compared to the ramified stem bearing the Medusæ in Tubularia, to which they are analogous in position. Each of these, however,

is individually far more perfect than its analogue, and just as we see it in Hydractinia, the medusa-buds are borne on the side-walls of these untentaculated individuals, where they may be seen sometimes as dark specks, even with the unassisted eye. Imperfect otherwise, these individuals are provided with digestive cavity and mouth, which perform their functions independently of the great central polyp. The hepatic cells which exist in these animals are probably the homologues of the dark-colored cells which line the digestive cavity of many fixed hydroids.

I have placed the Velellidæ between the Corynidæ and the Tubularidæ, not because I consider them as really an intermediate group between these extremes, but because they have connections with genera yet included in these groups, and very little connection indeed with the Siphonophoræ, with which they are usually associated. The latter are more nearly related, I think, to Tubularia and its immediate allies than to Velellidæ, which, indeed, constitute a very distinct family. We should specially compare this group with Hydractinia.*

There have been, hitherto, but two genera in this group. They are founded on the differences of the hydroid entirely, and are due to Lamarck. It is, however, probable that more genera will be formed, so soon as we become acquainted with the medusa-forms of more species of the Hydroid. That of *Velella spirans*, from the Mediterranean, has been described above from the description of Gegenbaur.

The characteristics of Velella are a quadrangular shield, which supports a diagonally-placed pointed crest. Its marginal tentaculiform individuals are without buttons of thread-cells, but have rows of such organs disposed longitudinally upon them.

The characters of Rataria, a genus defined by Eschscholtz, are a contractile, not a fixed crest, a disk or shell disposed longitudinally, not diagonally with regard to the elliptical outline of the fleshy border, and supporting the crest which consequently has also this longitudinal position. Lastly, an absence of the marginal tentaculiform individuals of Velella and Porpita. The species hitherto known of this genus are all small, none of them exceeding three lines in diameter. In view of this, it is not unlikely that, as de Blainville supposed, they should prove to be the young of Velella.

* Prof. Agassiz, in his *Nat. Hist. of U. S.* vol. 1st, speaks of a relation between Hydractinia and the Siphonophoræ. Vol. I, p. 72.

In the same way we should not shut our eyes to the fact that Lesson's genera Ratis and Acies are both very small, and their characters make it not improbable that they represent different stages in the growth of Porpita.

PORPITA. Lamarck.

So few have been the observations on the medusa-buds of Porpita, that we cannot proceed to give a generic diagnosis of them. Kölliker mentions that they are like the un-freed buds of Velella. I can from my own observations confirm this so far as agreement between the figures of the Velella-buds, given by Kölliker, and the buds I have seen upon the following Porpita are concerned. But I have never seen a Velella. The following were the principal characters of the bud at the highest stage of development which has come under my observation. The general form was pyramidal, the vertex corresponding to the attached extremity. The opening of the vail was, as far as could be ascertained, not yet formed. There were no tentacula, but the four points of the margin corresponding to the extremities of the radiate tubes, were prominent and armed each with a few thread-cells. The outline of the cavity to be expected within was not traced out with such clearness as to enable me to assert its existence from actual observation, but the arrangement of the parts within can hardly be consistent with any other supposition. Near the apex of the pyramid at the top of the bell-cavity was a lump of small dark cells semicircular when viewed in profile, but quadrate like the digestive trunks of most Hydroid medusæ when viewed from above, from which proceeded downward four lines, evidently the radiate tubes. These were of a whitish color, like that of ground glass, near the rudimentary digestive cavity, and this color became confounded below with a reddish orange-colored enlargement of the canal, showing that the perfectly developed medusa probably has something like a colored marginal bulb. They were large enough in nearly all the specimens to be brought, all the four quite close together, and I did not observe with certainty the circular tube, even in one or two specimens in which these bulbs were unusually separated. A character like one of Chrysomitra must be noted. In the neighborhood of the lower colored extremities of the radiate tubes were a number of scattered circular golden-colored cells, on the inner surface of the yet unopened bell-cavity which leads me to conclude that in the adult condition the bell-

cavity is colored like that of Chrysomitra. At this stage of growth and with no trace that I could find of sexual organ, these buds became detached from the medusa-bearing polyps and sunk in clouds to the bottom of the vessel in which the larva was contained. This I believe to have been abnormal, for the bell-cavity was yet unopened and the buds consequently motionless. I suppose the premature fall to be due to the rough handling all the specimens I have seen, had received.

The buds at their first appearance were colorless. It will be seen from the foregoing description that the development of the disk in this genus is strictly according to the Endostome or closed manner. The larval community of Porpita is distinguished from that of Velella or Chrysomitra by having its air-shield circular and without a vertical crest. Its marginal tentaculiform individuals also are provided with three rows each of knobs along their sides.

No doubt as we increase our knowledge of the Medusa-forms of these species, Porpita will be sub-divided into new genera. Thus *P. gigantea* probably constitutes a new type with its numerous marginal individuals and their sessile knobs; while the distinction made by Lesson between the species with white and blue shields is probably founded upon structure, and therefore a good generic distinction. It may be due to the blue-disked species having the mantle prolonged upwards over the white shield. In that case, perhaps, *Polybrachionia*, a name given by Landsdown Guilding to a Carribbean species, might be retained for one of the groups. The species following belongs to the white-disked group. If I am right in my conjecture that Lesson's Ratis and Acies are types of two stages in the growth of this larval community, the following would be the method: First, a small free polyp having a conical mouth and digestive cavity, and, like Eudendrium, a single whorl of tentaculiform organs; an air-shield which is small and fleshy, not fibro-cartilaginous, placed on the base of the polyp. At this stage there are no medusa-bearing individuals. This corresponds to the Acies of Lesson. Next, the polyp which was originally as great in diameter as the shield, is now become, by the growth of the shield, relatively less, and within the row of marginal tentaculiform individuals a few medusa-bearing polyps have appeared. This stage would be Lesson's genus Ratis. Now this is the order of growth among the corresponding parts in our next group, the Tubularidæ, and I think such

a coincidence enhances the probability that my suggestion will prove correct.

Distribution.—The genus Porpita is found in the Mediterranean, and appears to be distributed in all the tropical oceans extending north or south of the equator, probably not more than 40° either way; though being a floating genus it is probably frequently driven to higher latitudes by storms.

PORPITA LINNEANA. Lesson.

Syn. *Polybrachionia Linneana.* Landsdown Guilding. Zool. Journ., vol. XI, p. 403.—(*Quoted from Lesson.*)

The form of the imperfect Medusa above mentioned is a four-sided pyramid, whose altitude is about equal to the width of its base, or slightly exceeds it. The uncolored parts are very transparent so as not to be easy of definition. The digestive trunk is of an earthy red, the lower portion of the radiate tubes of a reddish orange color. The digestive trunk was quite short and confined to the upper part of the yet unopened bell-cavity.

The Larval community is almost exactly of the size given by Guilding, that is, the whole disk, including the border, is generally about an inch in diameter. Sometimes, however, a large specimen will have an air-shield nearly an inch in diameter without the border which is in width between a tenth and two-tenths of an inch. When viewed in profile it is seen that this air-shield is not perfectly flat but that the centre is very slightly elevated above the border. The longest marginal tentaculiform organs are in length about equal to the diameter of the disk. They are, however, of three or four sizes, the smallest not emerging from under cover of the border. These tentaculiform organs are not straight but curve upwards at the end. The pedunculated buttons or knobs on the longest are further apart than on the shorter ones. Next beneath and within are the Medusa-bearing individuals. They are generally slender and tapering, the mouth appearing to be simple like that of the digestive polyp of Physalia, not cloven into lips as represented by Kölliker in *Porpita Mediterranea.* Only, when contracted, do they assume a sometimes flask-shaped, sometimes almost globular form. The Medusa-buds are not confined to the bases of these polyps but scattered over their length, sometimes appearing not far from the oral extremity. The coloration of these buds when advanced, is so distributed as to mark

each with five spots, which, appearing as one to the naked eye, contrast strongly with the fleshy white of the polyps and give them a spotted or wharty appearance. The central polyp is, as usual, flask-shaped or funnel-shaped, and presents no distinctive character from those represented for other Porpitæ, or none which, without a direct comparison of the animals, I could seize. Its base is in width about one-fourth part the width of the disk. The mouth capable of such expansion as to equal the base in width, but according to my observation this only occurs when the polyp is contracted lengthwise, so as to lose altogether its polypoid appearance and assume the form of a mere fold around the centre of the disk's lower surface. The silvery white air-shield is marked as in *P. coerulea* Esch., with little tubercles or denticles, but they are according to my observation few in number and scattered, or rather occurring at rare and irregular intervals along the course of the radii. The shining silvery appearance is given to the shield by the presence of the air-bubbles in the multitudinous inter-communicating cells within. It is lost, when, at the death of the community the air disappears and the whole polypidom sinks to the bottom.

The border of the disk is not blue, strictly speaking, but a bluish green; there is little or no pure blue about the polypidom, that I can find. The stem of the tentaculiform individuals is of a pale transparent tint of yellow, and the knobs or buttons along its sides are of a green, rather bluer than that of the body. The medusa-bearing polyps are all of a fleshy white, as is also the central polyp. The color of the medusa-buds which appear to spot the polyps is, to the naked eye, a kind of reddish brown. The medusa-bearing polyps near the tentaculiform individuals are not blue, as stated by Eschscholtz to have been the case in *P. coerulea.* I have taken these animals only twice at an interval of nearly four years. The last time finding only a single specimen. They are not inhabitants, but only transient visitors of Charleston harbor, and appear there only after a prolonged southeast or southerly gale lasting several days, when large numbers of Physaliæ and this Porpita are brought in and thrown on the beach of Sullivan's Island. When obtained, consequently by me they were always more or less injured, principally in the border and the marginal individuals, which latter are so easily detached as to render it difficult or almost impossible to transfer the community to a vessel of water without depriving it of nearly the whole of

them. To injury of this kind, I refer also the premature fall of the medusa-buds already mentioned. This circumstance gave me an opportunity, however, of observing what I believe has not been observed before; viz: that among the marginal tentaculiform individuals, when the longer ones are shed, the small ones immediately grow out, and in three or four days, according to their state of advancement, acquire equality with the longest of the original circle. I have observed this fact on both the occasions when I had these animals under examination.

I should here mention that this community is not merely passive and floating, nor is activity confined to the central polyp, but each of the three classes of individuals has its own peculiar kind and range of motion, and this is pretty actively kept up by each when the community is but little injured. The motion of each class also is independent, as to time, of the motion of any other class, considering the central polyp as the sole representative of its class. These motions, in the case of the two other classes, may be performed either by any individual singly, or (as, according to my observation, is rather oftener the case,) by all the individuals of each class together. The motion of the marginal tentaculiform individuals is a vertical one, the whole bending down vertically together, as mentioned by Guilding; but it is to be observed that, in this motion, there is no longitudinal contraction, but that the individual, remaining outstretched, sways downward with a motion somewhat resembling that with which one of the digestive polyps of Hydractinia, slowly sways itself from side to side. The medusa-bearing polyps, on the other hand, have a worm-like movement of contortion also, which is executed by each individual independently of the rest. But the individuals of this class have also a common motion, which I have at times observed to have a sort of rythmical relation between its successive acts, and I am inclined to think, that in a wholly uninjured community, this motion will be found to be kept up with but little cessation. It consists in an alternate elongation and contraction of the polyps in a vertical direction, which is executed synchronously by all of them, and with a sort of jerk, which distinguishes it from the elongation and contraction of the central polyp.

The months in which this Porpita has been found are June and September. At both times the fall of colored particles occurred, but it was only in June that their condition was examined, and the result was the imperfect medusa-bud described above. They

could not, however, have been much further advanced in the September specimens, since after falling to the bottom of the vessel, they never rose from it.

Whether this is really Guilding's species of the Caribbean sea, or a new one, I cannot say, having never seen either Guilding's figure or description. That description is very meagre, as given by Lesson. I have, for the present, attributed to it Guilding's name, from unwillingness to create a species without an actually known difference of character, and because, as before stated, the species is brought to us by prolonged southerly winds, thus coming from the neighborhood of Guilding's *Polybrachionia linneana*. However I am, despite this reason, inclined to think it a new species.

3rd Group. TUBULARIDÆ. Johnston.

I have included in this group all those Endostomata whose larvæ have the tentacula distributed in one or two regular whorls, including thus Pennaria and Stauridium, besides Eudendrium, while a provisional position is also given here to Hydractinia, on whose probable affinities I shall venture a few remarks further on.

The Medusæ of this group are distinguished by a smooth exterior to the bell, or a peculiar ornamentation, like that described in Chrysomitra, viz: rows of thread-cells, extending upwards from the bell-margin towards the vertex of the bell. This is very different from the scattered condition of the thread-cells among Corynidæ. For, as will be seen in the representation of this structure in Gegenbaur's figures of Chrysomitra and Zanclea, in Van Beneden's figures of the medusa of Tubularia, (*Les Tubulaires*, pl. 5, fig. 20–25,) and in the figures of Willsia and Zanclea of this work, (pl. 9, f. 10, pl. 8, f. 4 *x*.,) the thread cells in this case are not only arranged in rows, but these rows are inclosed within a delicate bounding membrane. In Pennaria proper, these rows of thread-cells appear to be replaced by rows of pigment cells, occupying the same position; while among the Hippocrenidæ, the external surface appears to be smooth and unornamented throughout. Mehrtens, however, described certain villosities near the bell-margin of his species of Hippocrene, and it seems to be in this position that the thread-cell-rows first appear, afterward growing upwards towards the summit, which they seldom actually reach. There are besides various complications of the principal organs, which, though not constant among the Medusæ here brought to-

gether, are still of frequent occurrence and indicate the structural tendencies of the group. Thus the tentacula exhibit a marked tendency to specialization, both in number, grouping, and form. Ocelli are frequently wanting. There are also found in one part of the group, oral tentacula, which, like the marginal tentacula, in another part of the group, are branched. The radiate tubes also are sometimes branched.

The group, with these general characters, contains three minor groups, quite distinct from each other. They are Pennaridæ, Tubularidæ proper, and Hippocrenidæ, and are characterized as follows:

I. PENNARIDÆ. *mihi.**

The general range of form in this group (which must eventually be subdivided) is like that in the group of Sarsiadæ. We must, however, except the genus Willsia, which with Chrysomitra, is remarkable among Endostomata for the shortness of its vertical in comparison to its horizontal diameter. In the other genera, the bell is deep, the transverse diameter short, the digestive trunk more or less elongate, and Sarsioid in form. The mouth is simple, or provided with bunches of thread-cells, like that of the young in Oceanidæ. The radiate tubes are in two instances branched; the tentacula vary, but the present group is the only one in which they are found branched. In all the genera here included, except Cladonema, there are no ocelli, and the exterior of the disk is ornamented with lines of thread-cells, or pigment cells, ascending from the bell-margin.

The Larvæ have two whorls of tentacula, of which the oral whorl are clavate at the tip like those of the very young larva of Tubularia proper. The body, also, of this larva is not expanded into a broad basal enlargement at the insertion of the whorl of lower or filiform tentacula, as in Tubularia when full grown, but the whole body preserves the cylindrical form of the same part in the young stage of Tubularia, at the moment when it becomes fixed. The genus Stauridium has but eight tentacula in all, and might be regarded perhaps as a connecting link between the Tubularidæ and Corynidæ; at any rate, notwithstanding its correspondence in character with Pennaria, when its medusæ are better known, Stauridium will probably form a new group.*

* Prof. Agassiz has mentioned to me his having found in Charleston harbor a Stauridioid genus, but I have not met with it.

The genus Pennaria is the only Endostome having a symmetrically branched polypidom for its fixed larva.

WILLSIA. Forbes.

The characters of this genus are a rather shallow bell for one of the Endostomata; a mouth surrounded with leaf-shaped labial tentacula, or a simply undulated movable margin; rather short digestive trunk, around which are placed the sexual glands; four or six radiate tubes which bifurcate near their origin, the branches thus formed again bifurcating before reaching the marginal tube, at which point is appended a single tentaculum to each branchlet of the radiate tubes; the tentaculum has a sessile bulb. Between every two tentacula passes upward on the outer surface of the disk, a structure resembling a knotted cord, consisting apparently of a delicate, superficial, membraneous tube, which widens at intervals, to contain groups of thread-cells. Forbes has described a complicated ocellus, but I have been unable to find that any such existed on the colored bulb of the tentaculum.

Larva unknown. But the shallow bell and short digestive cavity of Willsia seem to bring it into the neighborhood of Chrysomitra. I have placed it, provisionally however, in this group near Cladonema, on account of its branching circulatory tubes.

Distribution.—British Seas and Charleston harbor.

WILLSIA ORNATA, *nov. spec.*

Pl. 9, Fig. 9–11.

The form of the bell is rather more conical than that of *W. stellata* (Forbes,) bluntly pointed above; the mouth is surrounded with only an undulating frill-like margin, which I never saw assume the appearance of being divided into arms. The digestive trunk short and stout; radiate tubes only four in number; tentacula sixteen, rather short, lashes having a roughened surface. In the frill-like border of the mouth are implanted a series of large, oval, light-refracting bodies, which have the appearance of thread-cells, and in which I have at times thought I had detected the coil of the thread, but could never satisfy myself of it. They are much larger in proportion to the animal than thread-cells usually are in these medusæ. The same may be said of the peculiar rows of cells mentioned in the analysis of the genus, though these are rather smaller than those around the mouth. The arrangement of these bodies is peculiar, and a group of them in

this species cannot but remind us in appearance of the ocellary body of Bolina among Beroid Medusæ. In Chrysomitra, as figured by Gegenbaur, and in this Willsia* they appear to be contained in a tube, which is connected with the marginal canal. When my single specimen of Willsia was dead and contracted, I observed that two of these groups, in some instances, each normally containing only three, four or five corpuscles, had been forced together, without destroying the continuity of the membranous wall by which they were surrounded; a large group had been thus formed, containing nine of these bodies, while the double outline of the membrane by which they were surrounded was still distinguishable. (See pl. 9, fig. 10, *b*.) As thread-cells they are of a peculiar type, and are much larger than the ordinary thread-cells on the tentacula, and probably have a peculiar function.

The single specimen obtained of this species was found July 4th. Its appearance and carriage in the water is very Thaumantioid, on account of its numerous tentacula, short digestive cavity and shallow bell.

ZANCLEA.† Gegenbaur.

General form nearly that of Sarsia. Exterior of the disk ornamented with four rows of thread-cells extending from the insertion of each tentaculum a greater or less distance upwards towards the summit of the bell. The thread-cells in the older animals are arranged one by one along the row, but in the younger there is simply a cluster of them above each tentaculum, as represented, Pl. 8, Fig. 4, *x*. Digestive trunk, more like that of Cladonema than of Sarsia, divided at its oral extremity into four short lappets. Sexual organs confined to the upper portion of the digestive trunk. Radiate tubes four, unbranched. Tentacula four ocelli wanting; marginal bulb very small; shaft of the tentaculum provided for the greater portion of its length with pediculated appendages, the enlarged utricular heads of which contain each a few cells which appear to be thread-cells.

Larva?—Probably as in Corynitis the young medusa has at first only two tentacula.

This genus, I think, is related to Cladonema, as Gegenbaur also believes, yet the tentacula are of a very distinct type. The four short appendages of the mouth, however, and the position of the sexual organs are approximations to that genus.

* Gosse has figured the same structure in *Willsia stellata*.

† See p. 125 *note*.

It will be seen, however, from the following description, that it is possible this species may prove the type of a new genus closely allied to Zanclea, though not identical with it. For in the (unfortunately) young specimens which I obtained, there were but two tentacula, which were moreover of a different appearance from those of Zanclea, and the yet unopened mouth gave no generic character. Should the mature animal preserve the chief of these peculiarities, I propose for it *Gemmaria* as a generic name.

Distribution.—Mediterranean and Charleston Harbor.

ZANCLEA GEMMOSA, *nov. spec.*

Pl. 8, Fig. 4–5.

Of this singular looking species, I have unfortunately taken only a few individuals, all of which were quite young and possessed of but two tentacula. At this stage the breadth of the bell is nearly equal to its height. The digestive trunk reaches half way down the bell-cavity, is bluntly pointed at its yet imperforate oral extremity. The sinus at the intersection of the radiate tubes is very large. A slight swelling of the lateral outline of the trunk probably indicates the future sexual organs. A trace of the connection with the larva is still left. The bell-wall is thin throughout. The sinus at the junction of each radiate and marginal tube is small, but dark colored, and this color, though not deep, is continued down the core of the tentaculum, which may possibly be tubular. Immediately above each anastomosis and on the outer surface is a beautiful cluster of large cells which are certainly thread-cells, whose refractive powers give them a brilliancy such as to remind us irresistibly of clusters of precious stones. These brilliants are set in a membranous case as the similar less showy organs of Willsia. Their disposition in a cluster is probably a character of very young individuals, for I have found a specimen not differing much in size from the rest which had these cells arranged in a row one by one as in Gegenbaur's species. Their position, confined to the neighborhood of the bell-margin, is also due to the immaturity of the specimens. The tentacula are stout in the shaft. The lower surface is irregularly roughened with the prominences of a diaphanous epithelium. The appendages of the upper surface have a distinct, somewhat conical head, containing two or three round cell-like looking corpuscles each. The pedicle by which this head hangs to the tentaculum is extremely difficult of

definition, like the small lateral tentacula of Eucheilota. I believe that I have not seen the true wall of this pedicle at all, and that the dark irregular line figured is only a sort of granular content of the cells, composing the pedicle. On each of the other two points where tentacula might be expected, there was only a dark colored spot, marking the position. From what has been related of Corynitis, however, it will be seen that it would not be safe to conclude that the species preserves this bi-tentaculate form through life. There was a remarkable tendency to fold these tentacula inwards, so as to bring them within the bell. After a careful search, I determined that the ocelli were entirely wanting, as Gegenbaur also has observed in his more mature *Z. costata*.

The few specimens of this species from which the above description was made, were taken during the summer and fall, in the months of June, August and October.

PENNARIA. Goldfuss. (1820?.)

Syn. *Globiceps*.—Ayres. Proceedings Boston Soc. Nat. Hist., vol. 4, (1852,) p. 193.
Eucoryne.—Leidy. Marine Invertebrata of N. Jersey, p. 4, pl. X, ff. 1–5, (1855.)

The general form of the Medusa is that of a deep bell, with short transverse axis giving an elongated cylindroid figure. External surface ornamented with rows of pigment cells ascending from the marginal bulbs. Digestive trunk elongate, surrounded by the sexual organs. Radiate tubes four, simple. Marginal bulbs large, almost colorless. Ocelli wanting, as in Zanclea. Tentacula, so far as yet known, mere rudimentary tubercles, four in number. Larva, a hydroid having a cylindrical body with two whorls of tentacula, of which those of the double oral whorl are clavate, those of the lower whorl, filiform as in Stauridium, but instead of being limited to four as in that genus, they are numerous in each whorl. The horny polypidom forms a regularly and beautifully branched plume, along the branchlets of which at pretty regular intervals and uniserially, are arranged the individual polyps, each attached to the branchlet by a distinctly annulate pedicle. The Medusa is developed as in Tubularia, between the upper and lower whorls of tentacula, and becomes free. Judging from the condition of the following species, which condition is probably the same for the *Sertularia pennaria* of Cavolini, several planules are developed in the cavity of the Medusa-bell during its growth, and are discharged at the time of the Medusa's liberation from its larva.

Distribution.—Mediterranean Sea, Long Island Sound, Charleston Harbor.

PENNARIA TIARELLA, (*mihi.*)

Syn. *Globiceps tiarella.* Ayres. *loc. cit.*
Eucoryne elegans. Leidy. *loc. cit.*

The form of the bell cylindrical and elongate tapers to a rather blunt apex above. The very elongate digestive trunk reaches rather lower than the vail, and protrudes through its aperture at every contraction of the disk; the cavity of the bell is very narrow, so that in repose its wall is scarcely separated from contact with the surface of the digestive trunk. On the external surface of the disk are marked the four longitudinal lines of red blotches, which lie over the radiate tubes and follow their course, are rather irregular though deep colored, and give a remarkable appearance to the Medusa. Tentacula mere rudimentary knobs, four in number, beneath the four marginal bulbs. The coloration of the digestive trunk is a deep opaque red, and the pigment of the vertical lines on the disk is of the same color.

The polypidom has already been described by Ayres and Leidy. I can find no difference, either in habit or appearance, between the species of Long Island Sound and the coast of New Jersey, as described and as figured by Leidy, and the species found at low water mark in Charleston harbor. The Medusæ are developed between the upper and lower sets of tentacula, and while attached to the stem, contain planules which give them their milky-white opacity mentioned by Leidy. They detach themselves, so far as my observations yet extend, *before* casting their planules, though this may not be an invariable rule. The first efforts of contraction appear to be directed to this result, and the planules when cast are untentaculated round embryos. I have observed the Medusa very apathetic after this, exhibiting contractions of the vail only, and these but three or four in succession, then a pause. This portion of its history was observed on the 14th of August. At a later date, September 16th, I found three specimens of the Medusa free and actively swimming about in my jar. Though these were probably more advanced than that of the former date, the tentacula had not increased in length, nor had ocelli made their appearance. The Medusa, before its liberation from the hydra, being greatly dis-

tended with large embryos, has an almost ovoid form, which is exchanged for the cylindrical one described, after their expulsion.

I found the hydroid of this Medusa as late as November 24th as well as during the summer months, but have not hitherto succeeded in procuring specimens of it during the winter. It may be, however, that only those polypidomata growing near the surface are killed by the cold, and consequently it may exist during winter at some distance below the surface.

Remark.—The identity of *Eucoryne elegans* (Leidy) with *Globiceps tiarella* (Ayres) is acknowledged, and was in fact pointed out to me by Prof. Leidy himself. The generic identity of Globiceps with the *Sertularia pennaria* of Cavolini may be seen at a glance by comparing this description and Leidy's figure and description (*loc. cit.*) with those of *S. pennaria* by Cavolini. (Polyp. Marin. p. 134, pl. 5, ff. 1–6.)

II. TUBULARIDÆ.* Johnston.

General form spherical, conical or cylindrical. Tentacula sometimes four, sometimes one only, sometimes altogether wanting. Ocellus wanting. Digestive trunk cylindrical or flask-shaped, and probably in general it will be found elongate. Sexual organs apparently equally distributed around the walls of the digestive trunk. Mouth simple. But the character which, if constant, constitutes the greatest peculiarity of the group, is a series of longitudinal crests which in Euphysa, Steenstruppia, and certain attached species of Tubularia, ornament the bell-margin, springing from the line of junction of the bell-wall and vail and rising upward along the exterior of the disk for a short distance. These crests are distinct from the tentacula, existing frequently without them, and the tentacula when present are attached to their lower extremities. They are also distinct from the marginal bulbs, since they are out-standing processes of the exterior of the bell. They seem to be simple epidermal protuberances containing irregularly arranged thread-cells.

The larvæ of these Medusæ differ from Pennaridæ, by having both whorls of tentacula simple and inclavate. The lower basal

* It will be seen by reference to the scheme, p. 123 of this paper, that I include among Tubularidæ proper, Forbes' two genera Steenstruppia and Euphysa. To this I was led by a fact communicated to me some years ago by Prof. Agassiz, that he had observed the liberation of a species of Steenstruppia from a Tubularia of the coast of Massachusetts.

portion of the polyp's body also is dilated into a kind of disk, the circumference of which bears the lower whorl of tentacula. These latter, like the corresponding ones in Pennaria, are capable of only very limited contraction. The horny polypidom though sometimes branched is never branched so as to produce a regular pattern as in the case of Pennaria.

This group includes among its larvæ the largest of known hydroid polyps. The stems of *Tubularia indivisa* (*?*) sometimes attain a height of more than a foot. (See Dalyell's *Rare and Remarkable Animals of Scotland*, vol. 1, p. 3.) The only approach to them in size is made by the communities of the genus Physalia, (which, however, I look upon as communities of medusæ not of hydræ,) whose air-bladder, which must be looked upon as the base of a community, is sometimes nearly a foot in length, with the extended tentaculiform individuals measuring nearly three feet in length.

TUBULARIA. Linnæus.

The genus Tubularia contains those fixed hydroids whose pipe-like horny stem is surmounted by a polyp broad below and tapering above, and encircled by two whorls of simple tentacula, between the upper and lower of which the medusa-buds spring from the smooth untentaculated space. The polyp-stem is continued below in a creeping intertwining root.

The digestive cavity of the polyp does not extend into the expanded base, except during the young and locomotive stage of the larva. The tentacula in both whorls are generally numerous, and not clavate at their extremities. The medusa-buds are sometimes each separately attached by a short pedicle to the sides of the polyp; sometimes hang in several grape-like clusters of great beauty among the tentacula of the lower whorl.

There are at least two groups in this genus which may be distinguished by their Medusa-forms. In some, as in *T. calamaris*, and *T. Dumortierii*, whose development has been traced by Van Beneden, the Medusa has four tentacula and becomes free. In *T. indivisa* on the contrary, as observed by Dalyell; *T. coronata*, by Van Beneden; in a species of the Mediterranean observed by Kölliker, and the analogous species about to be described from Charleston Harbor, the Medusæ want tentacula, do not become free, but hanging in clusters, nurse within their bell-cavities, round embryos which there become tentaculated and at last escaping thrust themselves out by means of their tentacula, and afterwards

by the same means crawl about with considerable activity, until they have selected a position upon which to fix themselves for the rest of their existence.

1st Group. TUBULARIA proper.

Medusæ without tentacula but provided with from four to eight crests disposed in a radiate manner around the opening of the bell-cavity. Digestive trunk quite large and surrounded by the sexual organ. Radiate tubes four. On the outside of the disk pass upward eight rib-like stripes which appear to contain round cells, (thread-cells?) towards the top of the disk. The medusæ remain fixed to the hydra from which they hang in clusters. The females develop their embryos in the interior of the bell-cavity which they do not leave until provided with tentacula. After discharging its young in this manner the Medusa shrinks and gradually dwindles away.

2nd Group.

Medusa like the last in general structure—but provided with four tentacula—becomes free and never nurses its embryos.

TUBULARIA CRISTATA, *nov. spec.*

The pedunculated Medusa of this species is, when the disk is expanded, of a rather deeply campanulate form. The digestive trunk is very long and very frequently is thrust through beyond the opening of the vail. It is shaped like a Florence flask, being very broad near its junction with the bell, from which its outline is distinguished by a constriction. The margin of the bell has in this condition a lobulated appearance, and there are eight such lobules, and eight external rows of thread-cells(?) which run up the outer surface of the disk like meridian lines. When, however, the disk is distended with embryos in course of development it has a more or less spherical form, the opening of the vail being contracted as if by a sphinctor, and at this time, a number of crests, from four to eight, more or less elevated according to their state of expansion, are observed, disposed radiately around the closed opening and longitudinally with regard to the axes of the body. There are no tentacula, and the crests just described appear to me homologous not with tentacula but with the similar and similarly placed crests figured by Forbes in his Steenstruppia and Euphysa. What I believe to be the sexual organ, in which I think I have seen ova with germinative vesicle and dot, is at this stage broadest and most developed at the upper part of the digestive trunk

near its junction with the bell, and gradually thins away as it passes over the slenderer portion of the organ. I have observed contractions of these Medusæ, independent of the hydra, but they are slow and slight, and the Medusæ never become free.

They are united several together in an irregularly alternate manner upon a stem, which grows out from the side of the polyp-form. The number of bunches thus encircling the untentaculate zone of the polyp is variable, but they are numerous.

The polyp is slender, the expansion which bears the lower circle of tentacula does not much exceed in diameter the width of the portion above it. The lower circle of tentacula (which appears to be uniserial) is composed of twenty or more uncontractile tentacula, the upper, which is at least bi-serial, contains eighteen or more. The tentacula of the lower whorl are whitish, slender, and exceeding the polyp itself in length; those of the upper are more reddish, short, and rather clumsy in appearance. The stem on which this polyp-head is mounted is generally about two inches in height, sometimes however exceeding this and reaching nearly three inches.

At the time of leaving the bell of the parent the young are provided with from three to eight or a few more long tentacula, four or five times the length of their own bodies. These belong to the lower circle, and are usually carried turned backwards acting as locomotory organs. The oral tentacula are also apparent, three or four in number around the mouth, and according to my observations, clavate at this stage, at their extremities, like the oral tentacula of Pennaria. After moving about a short time, the basal end of the body elongates and the young hydra attaches itself, after which it attains its maturity by increasing the length of the stem, multiplying tentacula and developing medusa-buds.

Found the year round at low-water mark and a little above it, attached to the rocks of a jettee exposed to the ocean on Sullivan's Island. I have also taken it, growing luxuriantly, from the bottom of a schooner which had been lying about six months in the harbor. The budding of the Medusæ begins at an early stage of the larva's growth, so at nearly all times of the year either the elegant grape-like bunches of medusæ or the budding knobs which represent them are to be found. I have observed the Medusæ fully grown and casting their larvæ as early as March 10th, and as late as September 13th, during all which time thousands of larvæ are continually shed, and in consequence thousands of new

colonies established, their multiplication becoming so great durring a favorable season that the rocks literally appear clothed with the yellow stems and rose-colored blossom-like bodies of these flower-animals. There is, however, in their coloration, as is usual in these Medusæ a combination of yellow and a shade of red, which are not distributed in the same proportion in different clusters of individuals, so that a series of varieties are produced between an almost uniform yellow where the red is reduced to a minimum, and a most beautiful rosy tint which is characteristic generally of the finest and most vigorous clusters.

III. HIPPOCRENIDÆ.

General form of the Medusæ always more or less spherical; bell-wall very thick, especially above the digestive trunk, in free animals. Tentacula, grouped in bunches or tufts round the bell-margin; a single marginal bulb thus corresponding to a plurality of tentacula. Ocelli present in free animals, and borne sometimes on the bulb, sometimes on the tentaculum. Digestive trunk short, with the sexual organs disposed about it in four distinct lobes, which, in one genus, afterwards acquire an unusual connection with the radiate tubes; mouth with a simple or undulate border, and armed with four or more cirrhi, generally more or less branched.

The larvæ of these Medusæ present, at first sight, more dissimilarity to each other than those of the other groups of the same value. They are Tubularia-like hydræ, with sometimes two, sometimes only one whorl of tentacula; the larvæ are either fixed or free; the medusa-buds are developed either as in Tubularia, between the two whorls of tentacula, or upon different parts of the stem. Sometimes this stem is apparently altogether wanting; sometimes it is a branched, tree-like structure, nearly six inches in height. The free or fixed condition of the larvæ is a difference of no greater than generic consequence. The other difference, that in the number of tentacular whorls, is probably to be explained by the history of Stimpson's genus, Acaulis, which, at first, has two whorls, but afterwards loses the lower, which circumstance then gives the medusa-buds, growing originally, as in Tubularia, between the two whorls, the appearance of being developed upon a stem. It may be, however, that the same indifference as to whether the medusæ be developed on the stem or among the tentacula, which we see in Corynidæ, may be the true explanation here also. Stimpson's suggestion as to the homology

of tentacula between Tubularidæ and Corynidæ is also well worthy of consideration. In that case the tentacula of Corynidæ would correspond to the upper or oral whorl of Tubularidæ, which are the latest in development, and the single whorl of Eudendrium proper would probably correspond to the lower whorl of Tubularia, thus representing a condition of the Tubularian hydra still earlier than that represented by Pennaria. But there are other Eudendrium-like larvæ, (Hippocrene,) in which the single whorl of tentacula seem, from their contractility, to be allied to the oral tentacula of Tubularia, not to the uncontractile tentacula of the lower whorl.

The *Eudendrium ramosum* of Van Beneden is peculiar, in having a funnel-shaped expansion of the horny polypidom to receive each polyp. This reminds us of the fixed Exostomata.

Remark.—If Cytaeis be a good genus, the compound tentacular bulb will not be a family character. But all the species hitherto referred to this genus, are extremely small, and since I know that Hippocrene sometimes passes through a stage in which it has all the character of Cytaeis, I, for the present, regard the compound bulb as a family character. (See Pl. 10, fig. 10.)

The *Oceania Blumenbachii* of Rathke (*Mem. Imp. Acad. St. Petersburg*, vol. 2nd, 1835, p. 321 and plate,) seems to be one of the Hippocrenidæ, possessing not only eight compound tentacular bulbs, like Lizzia, but eight radiate tubes also, while its oral cirrhi are but little developed.

NEMOPSIS. Agass. (1849.)

General form rather higher than that of Hippocrene. Oral tentacula large and very much branched. Sexual glands not only attached to the parietes of the digestive trunk, but also to the radiate tubes, hanging from them free in the concavity of the bell, and following their course towards the circular tube. Tentacular tufts four, as in Hippocrene, but the middle pair of tentacula are clavate, and borne aloft like the eyes of a crab. Each of the tentacula, the clavate as well as the others, has, at its origin, a small black ocellus, those of the clavate being on the inner and somewhat on the lower side, while those on the filiform tentacula are on the upper side of the base.

Professor Agassiz, who established this genus, in his "*Contributions to the Natural History of the Acalephæ of North America*," Part I, page 289, remarks that it closely resembles Hippo-

crene, but "differs from it in having a more movable and bottle-shaped digestive cavity, which may be more or less protruded from the main cavity of the body, and is not so persistent in its form as that of Hippocrene. The tentacles are arranged, as in Hippocrene, in four bunches, with eye-specks at their base; but there are two of these eye-specks, supported upon two distinct stalks, rising above the others and above the tentacles, similar in appearance to the protruding eyes of a snail."

I have had frequent opportunity of examining this genus, and have particularly sought for an ocellus at the enlarged extremities of these tentacula, but I am satisfied that these bulbs in our species at least, contain no pigmentary matter, their deeper hue being owing to their greater thickness and their consequent approach to opacity. A true ocellus, however, is found at the base of each of these organs precisely, as in the filiform tentacula. See fig. 10, pl. 1*a*.

The larva of Nemopsis, (Pl. 10, fig. 7,) as observed by myself, is a free hydroid, with a base broader than that portion of the body which contains the digestive cavity. The stem is represented by a solid knob in the middle of this expanded base. There are two circles of tentacula, one about the expanded base, the other around the mouth. That around the base is composed of two rows, the tentacula of which alternate with one another. The medusa-buds are developed directly from the sides of the polyps, between the two circles of tentacula, as in Tubularia. They are not disposed in grape-like branches.

The tentacula of the Medusæ are developed *externally*, and may be distinguished, apparently, before the cavity of the bell is open. The sexual organs are at first confined to the walls of the digestive cavity, and do not grow downwards until comparatively late in the animal's life. The clavate tentacula are also absent until the animal has attained considerable size.

Distribution.—Coast of the United States, Long Island Sound, and Charleston Harbor.

NEMOPSIS GIBBESII, *nov. spec.*

Pl. 10, Ff. 1–7.

This species differs considerably from Prof. Agassiz's figure, *loc. cit.* The general form of the fully grown animal when at rest, is almost spherical, the tentaculiferous margin being then somewhat contracted, but when in motion it appears truncated

below. The disk above the digestive trunk is very thick, the sexual ribbons extend about two-thirds of the distance from the digestive trunk to the marginal bulbs. In the males this gland is rounded below, rather opaque, and has the appearance of containing a somewhat twisted cord; in the female the ovary is pointed below, does not reach quite so low down as in the male, is more transparent, and never presents the twisted appearance, so far as my observations extend. The ova are plainly visible, and frequently so crowded as to lose their circular outline. The digestive cavity is fusiform, between the bases of the sexual glands, tapering in a sort of œsophagus towards the mouth, which is of waved outline, giving the impression of rudimentary lips. At a considerable distance above the mouth, between the sexual lobes, are inserted the oral tentacula, which are long and very much branched, (fig. 1,) and of precisely the same structure as those of Hippocrene. I have never seen the trunk approach extension beyond the vail, as Prof. Agassiz seems to indicate, occurs in *N. Bachei.* The four radiate tubes appear buried in the sexual glands for a considerable part of their course, and near the margin lose themselves in the opaque, compound, tentaculiferous bulbs. These have the structure figured by Forbes in *H. Brittanica.* The ocelli of the club-shaped tentacula are carried on their lower surface, turned somewhat inwards, that is, towards each other; the ocelli of the other tentacula on their upper surfaces, (fig. 1*a*.) In full grown individuals the number of tentacula to each bulb is $8+1+1+8=18$. They are very contractile, with the exception of the clavate pair, which possess the power of elongation and contraction in a very limited degree only. The filiform tentacula may be elongated, as in fig. 1, or reduced to mere knobs, as in fig. 3, while the clavate can only shorten themselves a little, or elongate themselves so far as to pass round the bulb, and just appear on the inside of the bell cavity.

The appearance of this Medusa is at once singular and beautiful. The conspicuous crescentic outline of the pale, orange-colored sexual ribbons, the vivacious movements of the mouth and its appendages, the graceful, waving outline of the flapping disk, with the clavate tentacula carried erect, as if always on the watch, the others floating in various curves or tightly curled at their extremities, make it an unusually remarkable object, even in this remarkable group.

It is with no small pleasure that I have here availed myself of

an opportunity of connecting with this species the name of my friend, Prof. Lewis R. Gibbes, who pointed out to me the first specimens I examined, lying on the beach of Sullivan's Island.

The young buds on the hydra are at first mere buttons. (Pl. 10, fig. 7.) They grow and become heart-shaped in outline, as the four large, marginal bulbs are formed, with their very distinct sinuses. The external transparent tissue of each bulb becomes first bifid, as far as I can ascertain, then quadrifid or trifid, (ff. 6 and 5.) At this time the digestive trunk almost entirely fills the cavity of the yet closed bell. The bud elongates; the tentacular bulbs make the bell broader at its lower than at its upper (attached) end. The little points of each quadrifid bulb next elongate; slight contractions are visible in the bell, which probably at this time becomes open. The next observation, a few hours later, finds the Medusa free, and having three or four straight, stiff tentacula, with rings of thread-cells, (fig. 4.) At this stage the digestive trunk is still nearly of the height of the bell; when contracted, however, it forms only a hemispherical mass in the upper portion of the bell-cavity. No oral cirrhi; no distinguishable sexual organs. At this stage the N. Gibbesii may be distinguished from *Hippocrene Carolinensis*, by the large size of its marginal bulbs and digestive trunk, and the fact that it has three or four tentacula to each bulb.

In the next stage which has come under my observation, the base of the digestive trunk is very broad; its height less in proportion to that of the bell. There are four long-shafted, oral cirrhi, bifid at their extremity; the number of tentacula has increased. Shortly after, ocelli have appeared. The young medusa is still distinguishable from the young of *Hippocrene Carolinensis* by the long shafts of its oral cirrhi.

Some intermediate stages I have not been able to observe. The next form is that wherein the sexual glands are like those in Hippocrene, but have a broad base upon the four radiate tubes, being not constricted above, as in the genus just mentioned. See fig. 3, pl. 10. At the same time the clavate tentacula are quite conspicuous, and on each side of that pair there are four or five filiform tentacula to each bulb; 4+1+1+4. Next, the sexual organs are discovered, already half-way down the radiate tubes. See fig. 2. The animal increases in size, the tentacula in number, the oral cirrhi become very much branched, and their delicate dendritic form gives them an extreme beauty. Lastly, the sexual glands reach fully two-thirds of the distance from the base of the stom-

ach to the marginal bulbs. Nemopsis thus passes through a form like that of Hippocrene, and must therefore be ranked above it.

I give the above details partly to show how important it is in describing Medusæ, to ascertain as far as possible all their changes during growth. Ff. 1 and 3, might very well be mistaken for distinct species.

The hydra of this species is extremely like Acaulis described by William Stimpson, in his *Marine Fauna of Grand Manan.* I have only observed the development in one specimen. It was floating at large, and taken with the dip-net. It lived five days, developing medusæ, but never fixed itself; only gradually dwindling away as the medusæ were developed. The tentacula were all, at last, retracted, especially those around the broad base. In its first activity it was incessantly moving about by means of its tentacula, mouth downwards.

I surmise that Acaulis belongs to this group of Medusæ. Together with this larva of Nemopsis, it should be compared with the young stage of Tubularia when first freed from the bell of the medusa.

Nemopsis Gibbesii is a winter species. I have found large specimens as early as the 10th December. It may be taken also as late as the 10th of June. It is frequent during May. I have found it in the latter part of April, and the larva and young just described were taken on the last day of January. I have never found a naked-eyed medusa in Charleston harbor during the early part of January.

HIPPOCRENE. Agass. (1849.) Mertens and Brandt (*pars.*) (1835.)

General form spherical. Sexual organs in four lobes round the digestive trunk, to which they are confined. Oral tentacula smaller and less ramified than in Nemopsis. Radiate tubes four. Compound marginal bulbs four also, bearing a variable number of similar, simple, solid, and extremely contractile tentacula, which bear their ocelli on the inner or under side, in this respect it differs from Bougainvillia, whose ocelli seem to be on the upper side of the tentaculum. Larva is a small Eudendrium-like hydroid polyp with a branching stem, whose twigs are each terminated by a conical mouth, surrounded by a single whorl of few tentacula. The body of the polyp is of the same width as the stem, and is not distinguished from it by a constriction, the stem itself appa-

rently being a branching polyp-body, whose many mouths are each surrounded by a circle of tentacula. The medusa buds are developed indifferently at any point along the branching stem, and since the polyp has the faculty of contracting its tentacula like Hydractinia, the medusa buds growing near the extremity of a stem, sometimes appear to be unconnected with any hydra-like polyp. The tentacula of the medusa are developed in the involute manner, like those of Sarsia, and unlike the tentacula of Nemopsis, which, as described, are developed in the evolute or external manner, like those of Corynitis. When very young the medusa's bell is, as usual, thin, increasing to the great thickness of the same organ in the adult, as the animal grows older. The digestive cavity is small and the oral cirrhi are at first simple, and as they grow first bifurcate and afterwards repeat this until the specific character of the cirrhi is acquired. The number of tentacula to each bulb at the time of the medusa's liberation is probably two or three in most cases, but I have found a specimen (Pl. 10. fig. 10) fully representing the genus Cytaeis, having besides the simple oral cirrhi only a single tentaculum to each bulb.

Distribution.—Harbors of Boston and Charleston.

HIPPOCRENE CAROLINENSIS, *nov. spec.*

Pl. 10. ff. 8–10.

In general form this species approaches more nearly the *H. superciliaris* Agass. than either of the species described by Forbes. It varies slightly from a nearly globular form to one a little more elongated and oval. The largest specimens are usually the more globular. The marginal bulbs give origin to but six or eight tentacula each, at the base of each of which, on the under side, is a very small black ocellus. The tentacula are of medium length and usually carried tightly curled at the ends, one pair of each tuft borne quite stiffly upwards on the outside of the disk, and another pair turned within the cavity of the bell. The digestive trunk is quite elongate for Hippocrenidæ, though it appears to possess much contractility only in that part below the sexual glands. The trunks of the males have usually appeared rather longer than those of females. The oral tentacula are quite short and with very few branches, bifurcating only twice or thrice, and are never conspicuous. In some specimens the radiate tubes present an arched outline in passing the top of the bell-cavity,

as seen in *H. superciliaris*, but not generally, their usual course being one of direct descent from their connection with the digestive trunk to the marginal tube. In females heavy with ova, the sexual lobes bulge downward at their lower extremities, so as somewhat to overhang the mouth coming down between the origins of the oral tentacula.

Disk of great transparency. Ovaries pale yellow. Digestive cavity has each of its two extremities marked with a red spot. Tentacular bulbs yellowish white, with a red spot within. There is a variety in which the whole digestive cavity is of a brickdust-red, and where this color is more conspicuous in the tentacular bulbs.

The larva of this species has about twelve contractile tentacula. The polypidom grows about an inch or slightly more in height. I have found it but once on a piece of wood which had evidently been submerged for some time and probably considerably below low water. I have not observed the actual liberation of the medusa, but have obtained a number of young H. carolinensis by keeping this hydra when in bud suspended according to Dalyell's plan, in a jar of water.

This species is one of the most common in our waters during the summer. I first took it June 2d, and continued to find it in greater or less abundance until November 4th, the last day on which a specimen was found. It appeared to be most abundant in June, somewhat less so in August, and again appearing more frequently in September, after which its numbers gradually diminish along with that of the other summer medusæ. I have taken it in warm fair weather, at times when thunder storms were rising, between heavy showers of rain, and after rain, in the afternoon as well as the morning. There are scarcely any times of day or any ordinary kinds of weather in which this medusa may not be taken, yet sometimes under the most auspicious circumstances, fair sky, warm sun, smooth water, not a specimen is to be found, while perhaps other species are abundant. This is more or less the case with every species. This genus is not spoken of from the Mediterranean. The latitude of Charleston harbor seems, therefore, to be its most tropical habitat, so far as our present knowledge extends. We might suppose that its presence here was due to our low mean annual temperature, but it is found only during our tropical summer.

EUDENDRIUM. Ehrenberg.

Medusæ but little known. According to Dalyell's account, they seem to be mere cysts, serving to protect the planules during their growth, and are developed on the twigs which bear the polyps, but usually near the bases of the latter.

The polypidom is branching and horny, attaining considerable size. The polyps are distinguished from those of the larvæ of Hippocrene by a slightly expanded base, bearing the circle of tentacula, and by having the oral prominence, a very contractile organ, sometimes separated by a slight constriction from the expanded base. The twigs which bear the polyps are more or less annulate.

Distribution.—Coasts of Great Britain and South Carolina.

EUDENDRIUM RAMOSUM.

If this species be not identical with the *E. ramosum* of Europe, I do not know by what characters to distinguish it since I have never been able to observe its medusa-buds.

The rose-colored polyps are quite small, and have about eight tentacula on a base, which is not much expanded, but I do not describe from the fully developed polyp. The mouth in the young polyps, at least, is more or less prominent and proboscidiform, sometimes assuming a spherical shape, being then distinguished by a constriction from the tentacular base. The branchlet on which each polyp is borne is annulate near the base of the polyp.

The polypidom is composed of slender branching dark-colored tubes, about six inches, sometimes perhaps even more in length, on which the polyp-branchlets are not disposed with much regularity.

It is evident that the *E. ramosum* of Van Beneden and the *E. ramosum* of Dalyell, are very different species from that of Johnston, with which, for the present, I consider this identical.

I observed, on one occasion, a singular deformity in a polyp of this species. The body of the animal was much enlarged below the bases of the somewhat stunted tentacula. There was no proboscidiform prominence to the mouth. The turgescence was so evidently occasioned by something within, that after it had remained a day or two in a jar of salt-water, I slit the polyp open beneath the microscope and found that it contained a reddish granular thread, coiled in such a manner as to remind one of the

coiled threads of the greater thread-cell nodes of some of the Siphonoporæ figured by Kölliker. (See *Schwimmpolypen von Messina*, pl. 5, ff. 2–3.) I did not observe any organic connection, however between this thread and the polyp—nor did it exhibit any motions, nor appear to be ciliated. I do not venture to offer an explanation, having never observed anything of the kind before or since.

The branching polypidom of this Eudendrium, torn from its moorings, is frequently thrown up by the waves on the beach of Sullivan's Island, especially during the winter months. It is usually denuded of its polyps, but I have had them reproduced from the stem, in a jar of salt-water—as Dalyell relates of Tubularia as well as Eudendrium, and as I have also observed in that genus. I have never been so fortunate as to obtain a specimen with medusa-buds.

This species grows below low-water mark, and is always rare, but especially so in summer.

I have, on one occasion, found a single denuded but comparatively robust polypidom, whose general appearance was so much that of *E. rameum*, as to make it probable, that either this or a nearly allied species is an inhabitant of our harbor. I have also once found twining among algæ a small creeping polypidom, whose polyp's expanded base, and few and apparently contractile tentacula, make it probable that a species like Van Beneden's *E. ramosa* (*Corydendrium* Dana.) is also found here.

HYDRACTINIA. Van Beneden.

This genus preserves the form of a community. The Medusa does not become free, and attains but a very low stage of development. There is no distinction, that I can find, between the disk and the wall of the sexual organ; the males and females appear to reside in distinct communities. The sexual contents of the female ovary divides sometimes into several embryos.

The polyps, according to Van Beneden are from the first provided with but a single whorl of tentacula. These in the adult are cylindrical, (not clavate, nor pointed,) and very contractile. The polypidom is horny and covered with spines. It is neither dendritic nor climbing, but incrusting, and protecting only the base of each polyp. The medusa-buds are developed on clavate stems which are polyps, modified in form for the fulfillment of this function.

The two forms described by Van Beneden, from the coast of

Ostend, I suggest, are males and females of one species. I have found the same differences of habit and in the medusa-buds, between those of Charleston Harbor.

Remark.—The true position of Hydractinia is a question of some difficulty. Its affinities are complex, and probably indicate that it should constitute a minor group of itself. Its tentaculated polyps are like those of the larvæ of Hippocrene, from which it again differs in its horizontally expanding polypidom. On the other hand, its medusa-bearing polyps are untentaculated like those of the Velellidæ. For this reason I am disposed to think that it will constitute, when better known, an under-group in the neighborhood of Velellidæ.

Distribution.—England, Denmark, Holland, France, Long Island Sound, Charleston Harbor.

HYDRACTINIA ECHINATA. Johnston.

It is impossible to distinguish, with any certainty, this species from the European. There appears to me to be a greater delicacy and slenderness in the general form of the polyps. The tentacula appear to be more numerous, and I think also the spines, especially in the female polypidom, more marked and longer. But this comparison is made only from drawings.

I think there can be no doubt that this species is the same as that observed by Leidy at Point Judith in New Jersey. Has Hydractinia been observed in Massachusetts?

According to my observations, embryos are never found in the form which encrusts the shells (especially of Natica) inhabited by Pagurus. They have a form of medusa, also, in whose sexual organ no ova are seen, but which contain a much more prominent diverticulum of the polyp's canal, than does the egg-bearing, embryo-bearing medusa of the other form, which encrusts rocks. The latter form exists in countless thousands of individuals, covering yards of surface of rock, while the former are confined to the outer surface of shells scarcely more than an inch or an inch and a half in diameter, and are comparatively rarely met with. If these are, as I suppose them, male and female communities of the same species, it will explain the reason why, while the multitudinous females are stationary, the males, few in number, attach themselves to the shells of Paguri, whose nomadic habits thus insure a wider distribution of the seminal product.

4TH GROUP. SIPHONOPHORÆ.* Eschscholtz.

I have already separated from Siphonophoræ the Velellidæ as quite a distinct group, having a closer relation to the larval communities than the former, which it appears to me, from a careful consideration of the facts within my knowledge, receive their most natural explanation by a comparison with the budding Sarsiæ and Lizziæ. So far as I am acquainted with the literature of this subject, there is nothing really known of the *embryology* of these Medusæ. We are only acquainted with their medusa-stages, and the polypoid stage, in none of them, is known. To begin with what seems to me the simplest case that of Eudoxia and Ersaea, we have a modified medusa-disk as the base of the community, corresponding to the bell of the budding Lizzia, its digestive trunk (*tubulus suctorius* Esch.) corresponding to the same organ in Lizzia, and from the walls of this, proceeding as in Lizzia, Medusæ, which here, however, instead of being all sexual, are of three classes, one of which is confined to reproduction; another, has no other organ than a swim-bell, pierced by circulatory tubes, and restricted probably entirely to locomotive and respiratory functions; thirdly, there are growing from the walls of the digestive trunk, tentaculiform organs. Now, if my supposition be correct, these latter cannot be the homologues of the tentacula of the ordinary free Hydroid medusæ, but must be medusa-buds gradually modified into the form of tentacula, and if true here, the same is true for the tentacula of all Siphonophoræ. According to my observation, the ascending canal of the basal medusa's disk, in Eudoxia, contains air, (pl. 8, fig. 9, *a*,) and this is the homologue of the air-bladder in all the other Siphonophoræ, not excluding Physalia. The digestive trunk also of Eudoxia, appears to me the true homologue of the main stem in such genera as Physophora, and Agalmopsis, supporting the swim-bells and the so-called polyps, bracts, and tentacula, as well as the sexual individuals, all which I consider special modifications of medusa-buds, such as exist on the trunk of certain Lizzias and Sarsias. In Physalia, this tubular modification of the trunk appears to be reduced to a rudiment. In Prayia, which is certainly not distantly allied to Eudoxia, the basal medusa-disk and its cavity, as well as

* In his "Lectures on Comparative Embryology," Boston, 1849, Professor Agassiz already considers the Siphonophoræ communities of individuals.

its air-tube, are two-fold, while the tubuliform homologue of the digestive trunk is single, inducing an appearance which leads us to infer something like a partial fission of the single basal disk of Eudoxia. In the same genus the simple digestive trunk of Eudoxia assumes the elongate tubular form, contains at intervals, groups, each of which have all the principal elements of an Eudoxia, with the exception of the sexual individuals, which have not yet been observed. In many Diphyidæ, the same character of the digestive trunk is preserved, but in Abyla, the bracts disappear. In Diphyes and its immediate allies, there appear to be two bell-cavities to the basal medusa-disk, and, except in Prayia, a single air-tube, as if the fission-like modification of Prayia were only in part here preserved. The basal disk, therefore, is among the Diphyidæ highly developed, and assumes a variety of extraordinary forms, as in Cuboides. Among the Physophoridæ, on the contrary, it is entirely lost, being reduced to the mere parenchyma of the air-vesicle, which serves as the float of the community. Here, however, the swim-bells, which generally constitute the uppermost buds on the tubuliform stem, receive an extraordinary development in numbers, occupying a very great portion, sometimes almost the whole of the tubular trunk; a very different condition from the single swim-bell of Eudoxia. They also suffer extraordinary modifications of form in such genera as Hippopodias and Apolemia. All the other principal elements, however, of the gemmiferous trunk appear to remain in most genera of this group, such as the lateral digestive trunks or polyps, the bracts, the tentaculiform, and the sexual individuals. I have hitherto spoken (for the purpose of not at once making exceptions in the enunciation of a broad proposition) of the bracts as well as the "polyps" and "tentacula," as distinct individuals; but it is to be remarked, that the bract holds so constant a relation to the "polyp," that it were well worth to examine whether it does not represent, for each one of these digestive trunks, the disk; to which we are also led by a consideration of Prayia, where the helmet-shaped bract holds a similar relation to the digestive trunk as is held by the basal disk in Eudoxia to the analogous part. However this may be, in the next group, that of Physalidæ, not only the swim-bells, but the bracts also, entirely disappear, the air-bladder or float assumes an enormous development, and as we have said before, the tubuliform homologue of the original digestive trunk in Eudoxia, appears to be reduced to a most modified condition, all that we

can recognize, so far as my acquaintance with that genus goes, as its homologue, being the multifid semi-cartilaginous process, which bears the grand train of digestive, tentaculiform, and sexual individuals.

The characters of the group, as it at present stands, therefore, may be imperfectly summed up as follows:

Larva unknown. Individuals living united together in communities, the base of which is a budding Medusa. They are specialized into classes, performing different functions, and which seem to be mainly these:—1st, the original or supporting Medusa; 2d, the locomotive individuals or swim-bells; 3d, the digestive individuals; 4th, the tentaculiform individuals; and if we do not unite the bracts with the digestive individuals, we have 5th, respiratory individuals, or bracts. The most general characteristics of the medusa-bell, when present, are a great thickness and cartilaginous firmness, and a tendency to the formation of processes from the upper external surface of the disk, (see pl. 8, fig. 10, *c.*) for the more perfect adaptation of the bell to its position in the community: an almost universal absence of color, even in the bell margin—an absence of tentacula, and, in their stead, the occasional presence of sharp triangular processes from the tentacular margin—an absence of ocelli. This absence of color in the medusa-bell, when the latter is present, is sometimes compensated by the intense coloration of the digestive trunks and tentaculiform individuals. The latter, also, which are sometimes branched, exhibit an extraordinary development of the thread-cells.

Of the group of Physophoridæ, I know no representatives in our harbor. There are representatives of Diphyidæ and Physalidæ, but the rareness with which they occur makes my knowledge of them very limited.

I. DIPHYIDÆ.

Basal disk highly developed; often provided with two bell-cavities; one of which gives exit to the budding modified digestive trunk with its appendages, including the single large swim-bell usually present in the genus; the other acts as a swim-bell. Digestive trunk bearing a variable number of appendages of four sorts, swim-bells, bracts, secondary digestive trunks, and tentaculiform individuals.

EUDOXIA. Eschscholtz.

Basal medusa with single bell-cavity; usually helmet-shaped. Digestive trunk single; that is, bearing no secondary digestive trunks, but having a swim-bell besides tentaculiform and sexual individuals growing from its walls; the basal medusa disk serving as a bract to this assemblage of individuals. The sexual individual in each community appears to be solitary. The bell-rim in the locomotive and sexual individuals is armed with four sharp-pointed processes from which run up along the outer surface of the disk, more or less distinct keels or raised lines towards the attached extremity.

Larva?

Distribution. Pacific Ocean; Mediterranean and Adriatic Seas; South Atlantic and Charleston Harbor (?)

EUDOXIA ALATA, *nov. spec.*

Pl. 8, Ff. 9–10.

The basal medusa of the community is small—the sexual medusa large, and the swim-bell or locomotive medusa of medium size. The four longitudinal keels of each of the two latter are small, and placed, so far as I could ascertain, not equally distant from each other, but two on each side nearer together than to the other two. Their terminal processes are pointed and small, the points turning outwards.

The base is helmet-shaped, somewhat conical; concavity shallow, open on one side, where the rim of the depression is continued upward as two converging ridges towards the apex of the cone. The tubular cavity (air-vessel) in the substance of this base was of about two-thirds of its thickness in length. I did not observe the digestive trunk.

The sexual medusa is broad in proportion to its length, its diameter being almost equal to its longitudinal axis. The longitudinal keels appear to be arranged by two's as in the swim-bell. One side of the medusa bulges out decidedly more than the other. The two keels on the less bulging side are much enlarged near the top of the bell, so as to form two conspicuous expansions, whence I have derived the specific name. The sexual organ (in both cases ovaries) was a fusiform appendage from the top of the bell-cavity like the digestive trunk of the Tubularian Medusa,

but I did not find in it any thing to represent the digestive cavity as distinct from the sexual gland. The whole seemed to be a single cavity in which were well marked ova with germinative vesicle and dot, and I saw a granule moving within it at one time as if slowly impelled by cilia.

The foregoing imperfect description, was taken from the disconnected medusæ of two individual communities of this species found in a jar, the day after their collection. The parts being all separate and dead it is impossible to give any precise information as to the mode in which they are grouped together when alive. Also, the digestive trunk (*tubulus suctorius*) of the stock-medusa was gone. These two were the only specimens I have encountered. They were taken on the same day in the end of January.

DIPHYES. Cuvier.

The basal portion of the communities in this genus, is a transparent mass containing two swim-bells of which one is usually greater than the other. Between these in the substance of the double-belled base is a small canal or cylindrical cavity, from the lower part of which originates a long hollow stem, finding exit by a small cavity between the openings of the two bells. This stem which is very contractile, bears the digestive trunks, bracts, sexual medusæ and hollow tentaculiform individuals, so grouped that one of the bracts or leaf-shaped individuals overlies and covers an individual of each other kind. The sexes are found upon separate individuals according to Kölliker, who believes also that the female medusa becomes free.

Diphyes and Abyla appear to be intermediate links between Eudoxia and allied genera (which approach nearest to the budding Corynidian and Tubularian Medusæ,) and the other Physophoridæ. It would seem probable from the figure of *D. Boryi* that the inferior or hinder swim-bell is homologous with the single locomotive medusa in Eudoxia.

Distribution. Atlantic Ocean, South Lat., North Pacific, South Sea, Mediterranean and Atlantic, North of the Equator.

I have observed a species of this genus in our harbor, near in outline to Eschscholtz's *D. angustata,* but quite distinct from Kölliker's *D. Sieboldii,* from which it differed in having the inferior bell shorter, and less projecting downwards. I have seen two specimens, both small about two-tenths of an inch in height. The stem was never so extended as to allow an examination of

the individuals appended to it. I therefore defer the description of this species, which may perhaps properly be called D. pusilla, to a future time.

These two specimens were taken in summer.

DIPHYES PUSILLA, *nov. spec.*

This small species in form is intermediate between Eschscholtz's *D. angustata* and Kölliker's *D. Sieboldii*. The greater swim-bell is relatively greater in height than in *D. angustata* while the smaller bell projects much less downwards than in *D. Sieboldii*.

II. PHYSOPHORIDÆ.

In this group the basal medusa, has its disk reduced to a small air vesicle, its digestive trunk usually long in proportion and bearing numerous appendages, of which the uppermost are the swim-bells which here reach their highest numerical development. Similarly numerous are the bracts which overlie the digestive trunks, and which in this group are still less like the bells of ordinary medusæ, than they are among Diphyidæ, while in the next group they are entirely wanting. The sexual medusæ are usually arranged in clusters as in Physalia, and appear to be more nearly allied in form to free ordinary Endostomata, than the sexual medusæ either of Diphyidæ or Physalidæ.

I have never seen any species referable to this group; Charleston Harbor, so far as my observations yet extend, does not afford one. Even one or two injured transparent bells not here described, though evidently detached from some Siphonophorous community, appeared to me rather referable to Diphyidæ than Physophoridæ, so far as I am acquainted with the group from the writings and illustrations of others.

III. PHYSALIDÆ.

The communities of medusæ in this group, have the basal medusa reduced to a mere cyst containing an air-vessel surrounded by a cavity whose walls (perhaps corresponding to the upper portion of the cavity of the digestive trunk in Eudoxia,) are either prolonged in a single tubular stem (*Rhizophysa*) or metamorphosed by gemmation into a branched cartilaginous structure on the under side of an enormously developed air-vessel (*Physalia* and *Angela* ?). Its sub-divisions in this later case are tubular, and their canals communicate with the cavity between the outer and

inner membranes of the air-vessel. These sub-divisions in Physalia and the tubular stem in Rhizophysa are in this view the homologues of the free digestive trunk in Eudoxia, and in both cases bear the specialized medusa-buds which in these communities perform the most essential functions of life.

The Physalidæ possess neither swim-bells nor bracts, and are by this negative character separated from Physophidæ. The sexual medusæ in Physalia, and apparently also in Rhyzophysa, are developed in grape-like bunches as in many Tubularidæ.

It is quite possible that Eschscholtz' genus, Discolabe, ought to be included in this group.

PHYSALIA.

The genus Physalia is distinguished by an air-vessel having a bilateral symmetry,* and surmounted by a crest divided internally by membranous partitions. The development of the budding diverticula from the digestive trunk, is so great, that the latter loses its character of an elongated tube. In certain species (*P. utriculus* Esch.) there are diverticula of uncertain nature on the upper surface of the medusa-bearing extremity of the air-bladder or basal-medusa, which are wanting in Physalia. These may constitute a distinct genus. The distinctions of the three principal groups of Lesson are perhaps due to difference in relative age.

So much for the air-bladder which represents the basal disk and upper portion of the digestive cavity in Eudoxia. The lower or free portion of the latter is cartilaginous and divaricates more and more as it grows older. From these divarications spring digestive trunks, each with a tentaculiform individual near its base, as in other genera. There are two (perhaps in some species even more) sizes of these digestive trunks and tentacula. The greater are the fewer in number. Besides these four classes there are near the extremity of the branches bundles of digestive trunks with no oral opening, containing peculiar brown cells which Quatrefages considers hepatic. The terminal divarications of the main branches support grape-like clusters of sexual medusæ. The outermost of the latter have the form of peduncu-

* That extremity of the air-vessel in which is found the aperture of communication with the external air has been called the anterior, but it is evident that such terms must be entirely arbitrary. If either extremity can receive such a designation, it would in my view be the opposite, since it would be that which is homologous with the anterior extremity of Holothuridæ.

lated medusa-bells, traversed by four radiate tubes containing within what is probably the cavity of the digestive trunk surrounded by the sexual organ. This medusa has no tentacula nor ocelli, and the digestive trunk with its enveloping sexual organ fills the whole cavity of the bell. The wall of the latter is of firmer consistence than is usual among free species of Endostomata. The sexual buds situate along the sides of the branches are mere ovoidal cysts containing a sexual organ, and in the species about to be described, these are so large in comparison with the terminal bell-shaped individuals as naturally to lead to the suspicion that they are not younger stages of the latter, but male medusæ, which do not need so great a development of the bell, since they are not intended to nurse embryos.

PHYSALIA AURIGERA, *nov. spec.*

The basal vesicular medusa measured in the largest specimen, I have examined about six inches longitudinally. Its height was about three inches. Its gemmiparous extremity is very much more inflated and rounded than the opposite pore-bearing pole. The posterior knob which sometimes appears to be divided off by a slight constriction as a distinct portion of the bladder, is rather over an inch in length. The pore is not situate at the extremity of the bladder, but at a very considerable distance behind it, and instead of being on the median line, denoted by the direction of the crest, is on one side of it, which according to those who consider this extremity anterior, would be the left side of the median line. The crest originates about a horizontal inch behind the inferior or budding extremity of the bladder, and extends backward to within nearly the same distance from the opposite or superior extremity. The descending internal partitions are alternately long and short, and vary in number according to the size of the specimen, the largest number counted being sixteen and the smallest nine. These partitions are longest and the intervening spaces greatest about the middle of the crest, becoming smaller as we approach its extremities. If we consider the crest as marking the mesial line, we must consider the racemose cartilaginous representative of the digestive trunk, which has an elongated, almost linear form, as placed obliquely,* the angle which it makes

* This of course must be considered as entirely a special description; for the crest, horizontal as it is in Physalia, is probably in a general way homologous with

with the line of the crest being very decided, and considerable. When viewed from below, it reaches quite to that extremity of the bladder which I have called inferior, and stretches backward to within five inches of the opposite extremity, and is slightly less than three inches in length. I have never been able to ascertain with exactitude the number of the main stems which proceed from this as a base. They are short, and disposed in pairs, of which I have counted in one instance twelve, making twenty four in all. One remarkable character observed in eight out of thirteen injured specimens taken at one time, was a peculiar digestive trunk, shorter and comparatively stouter than the other greater trunks situate at the inferior extremity of the bladder, and differentiated from the rest, not only by its form, but in its color, which is that of the reddish blue air-bladder, not the green of the other digestive trunks. In the specimens where this was wanting, since they had all been subjected to injury, I suppose that it had been torn away, before they fell into my hands. This trunk is so peculiar in its position as to have the appearance of a small separate compartment of the air-bladder, which appearance was enhanced by my not being able to ascertain positively that it possessed an oral aperture. There were three sizes of digestive trunks in addition to the blind sacs in the form of trunks which Quatrefages considers hepatic. The largest are those connected with the greater tentaculiform individuals, and are about six or eight, perhaps sometimes more in number according to the size of the specimen. They have the form of very much elongated flasks, with rounded bottoms and long necks. The general form of the digestive trunks near the inferior extremity of the bladder is like that of those described, with the exception that they are shorter and comparatively a little stouter in appearance and were not connected with greater tentaculiform individuals as in the case of the great trunks, which moreover are confined to the middle and hinder parts of the elongate area representing the digestive trunk of the basal medusa. In the smallest size of mouth-bearing trunks and in the brown-spotted blind-sacs considered hepatic, I found no distinctive char-

---

one of the vertical lines of the disk in the other Siphonophoræ, perhaps the two ascending crests of the basal medusa in such genera as Eudoxia and Abyla. On the other hand we must probably refer the expansion of the branching trunk to a horizontal plane.

acter. The tentaculiform individuals are probably of three sizes, as described by Quatrefages; but, the transparent ones of the smallest size described by Quatrefages, were either entirely absent from the specimens I have examined, or so injured as to make it impossible to obtain any reliable result from their examination. Those which I have called above the greater tentaculiform individuals are of two sizes and bear each on one side a row of elongate transversely arranged pads of netting cells, which being highly colored give a colored appearance to the organism. They are of cylindrical form, and of two sizes differing in diameter. Contrary to what it would seem natural to expect, the pads of thread-cells are relatively more numerous and crowded on the greater than on the smaller individuals, and the former, at least, if not the latter, are so extensile, as to be capable of acquiring a length of three feet and probably considerably more in large specimens; in addition to this I have reason to believe that, all these tentaculiform individuals in my specimens had been considerably curtailed in their normal length by the rough usage to which they had been subjected. It is possible, therefore, that a perfect specimen floating freely in the water may have these individuals sometimes outstretched to the length of five or six feet.

The sexual medusæ are, as has been said, arranged in grape-like clusters of a full rounded form. They seem to be always at the extremities of the branches of the digestive trunk of the basal medusa, but in the specimens examined when uninjured, they appeared usually to be carried close under the bladder, though in one instance, a cluster hung nearly an inch lower than usual, making it inferable that the stems which bear appendages are contractile. The sexual individuals in one and the same cluster are of three forms and sizes. The smallest which are nearest the main stem, are of a round form, and appear to be composed of an outer homogeneous transparent uncolored envelope, corresponding to the bell-wall of a perfect medusa, and within is a round colored sexual organ, in course of development. The second size are the most numerous and occupy the greater portion of the ramifying stems of the cluster. Their longitudinal diameter is decidedly greater than that even of the third size, to which belongs the most highly developed medusæ in the community. They are thus of a much elongated ellipsoid form, and contain within what is probably a prolongation of the nutritive canal of the stems, representing in them the digestive trunk of a free medusa. The

medusæ of the third size, are few in number and situate only at the extremities of the ultimate twigs of the cluster. These are decidedly shorter than those of the second size, but their breadth is proportionately greater, and their general appearance decidedly different. They are of companulate form, the bell-wall being very thick and transparent. Their attachment to the twigs is not by means of a slender pedicle as in most fixed hydroids but by a very broad transparent neck equalling at its origin the width of the medusa-bell and gradually lessening in diameter until it merges into the twig. In fact, the general form of this medusa reminds one of the form of Forbes' genus, Steenstruppia, with the exception that the conical part above is much greater in proportion to the depth of the bell. Below in the neighborhood of the bell-margin, the bell-wall has the same appearance of being suddenly sloped off towards the origin of the vail as in the above-mentioned genus and Euphysa. I did not make out the vail. The digestive trunk appears to be so enlarged by the developing sexual organ as entirely to fill the bell-cavity. The whole bell and its cavity excluding the conical part which connects it with the twig of the main stem, presents an almost quadrate form, the longitudinal diameter being but slightly greater than the transverse. I can scarcely say that I have made out any difference of character between these latter sexual medusæ and those of *P. Olfersii* figured by Quatrefages. I am inclined to think, however, that in our own species the longitudinal diameter is greater in proportion to the transverse than in the Rochelle specimens. We must now speak of the coloration of this community, which in intensity, beauty, and variety, is certainly equal to that of any other object in nature. The general color of the basal bladder-like medusa is a blue, rather light but sufficiently deep to make the bladder very conspicuous when thrown on the yellow sand of a beach. This blue is not pure but mixed with a certain proportion of rosy pink, which is so small in the middle portion of the bladder as to be only seen in certain lights, when it gives a slightly purplish tint to the blue. Towards the extremities of the bladder this pink increases in quantity and intensity, and both of the very extremities are characterized by it. The pore, however, is of a blue color somewhat deeper than that of the bladder-walls. The ground color of the crest is also blue, but along its upper edge it is characterized by a pink like that of the extremities. Beneath, this pink passes into vermillion which is prolonged downward in

lines of varying length passing and fading away into the blue of the air-bladder. These lines correspond to the partition walls of the crest. On its outermost edge above, the crest is margined by a bright golden yellow or orange line, which adds greatly to the vividness as well as delicacy of the whole effect. The elongate racemose area which correspond to the digestive trunk is of a whitish and yellowish semi-transparency. The greater digestive trunks are of a rich, greenish tint, those towards the inferior extremity being bluer than the others. Of the great tentaculiform individuals, the greater have their pads of thread-cells of a green color, while the same parts in the less are of a lilac-like shade of purple. In the clusters of sexual medusæ, the individuals have their sexual organs colored a beautiful rose-pink within, shading off into delicate orange where it comes in contact with the hyaline bell-wall, and this combination gives to the clusters an indescribable softness and beauty. The coloration of the parts as given above is that of large and fully developed specimens. In small ones the crest is much less vividly colored, and the golden line so far as my observations extend, always wanting, while on the other hand the blue of the air-bladder in small specimens is much deeper and more intense than in the large. In general the pink colours are faint in small specimens and the blue more pronounced.

So slight is my knowledge of this Physalia, that I should have refrained from any attempt at description, were it not important in my opinion to present, as soon as possible, a general view of this much neglected class in its relation to the fauna of at least a portion of the Southern States of the Union. That Physalia aurifera is a new species, I can hardly doubt, since it differs from such species as have been described from the same latitudes or the same isothermal zones of the Atlantic. Yet the circumstances under which all my specimens have been taken render it probable that no one of them was perfect, and therefore the observations recorded, must most of them be used with caution. The golden line upon the crest, from which I have derived the trivial name, I do not find noticed in such descriptions of other species as are within my reach.

Physalia, like Porpita, is not an inhabitant of Charleston Harbor, nor is it brought from the ocean thither, so far as my observations extend, except by prolonged southerly winds.

SUB-ORDER—EXOSTOMATA.

Bell generally shallow, seldom deep. Ocelli rarely present; marginal capsules, always present, in the earlier stages of growth, and generally throughout life. Development sometimes by alternate generation sometimes by a direct metamorphosis, during which multiplication by gemmation or fission may take place. In either case the cavity of the disk or bell appears to be never a closed sack, but always open, being gradually formed by the growth outward and downward of a fold from the base of the proboscidiform projection which becomes the digestive trunk. The latter is thus uncovered and free during growth. In the numerous cases of alternate generation, the young medusa-buds appear to be almost universally protected as are the gemmiparous polyps by a horny case, which is an expansion of the hard rind of the polyp stems. In the case of direct metamorphosis, the free larvæ, sometimes seek protection in the bell-cavities of other medusæ, imitating as parasites the normal condition of the young Tubularia and like Endostomata. They appear also to derive their nourishment entirely from the medusæ upon which they fix themselves.

Remark.—The absence of ocelli is almost universal among these medusæ, such organs being found only in Thaumantias (Gegenb.) and a few allied genera. On the other hand, the remarkable marginal sense-capsules, (which, were either overlooked or confounded with ocelli, and incipient tentacula, by Forbes,) are unmistakably present in every genus well enough known to make its position in the group certain, with the single exception of Thaumantias, in which if representatives of these organs exist, they have not yet been pointed out. Ocelli and marginal capsules ("*the greater ocelli*" Agass,) exist together in the genus Tiaropsis as defined by its celebrated author. These capsules are certainly, in a general sense, as appendages of the disk-margin homologous with the tentacula, but they constitute a second and very distinct class of appendages. A tentaculum never becomes a capsule nor a capsule a tentaculum, but so far as my observations extend they are distinguished from each other in form, even in their earliest stages of growth. Besides this, the capsules are developed in a different position, *i. e.*, in a circle within or below the circle of tentacula, and these two circles do not coalesce until comparatively late in life, and even then their mode of distribution, especially in the higher genera, preserves an evident

trace of their original independence; for while the capsules are *symmetrically* distributed when compared with each other in position, they are nearly always *asymmetrically* placed with regard to the tentacula in their neighborhood, each capsule being nearer to one of the two tentacula between which it occurs than to the other: and when, as in some instances, the capsule is actually connected with the base of a tentaculum, it is placed on one side of it. Nor is this want of symmetrical position, visible in the relation of the capsules to the tentacula only but it is frequently equally so, in their relative position to the radiate tubes, whose symmetrical relation is the same as that of the tentacula. In short, it appears, that we shall be obliged, as our knowledge increases, to look upon the membranous ring, which Forbes elegantly styled a *vail* (velum) as not merely a prolongation and folding in of the bell-wall but a very distinct structure, having its own peculiar appendages, distributed according to its own peculiar symmetrical law. In that case, from embryological data, we should regard the capsules as appendages of the vail, while the tentacula belong to the bell-wall, and though the bell-margin is formed by the union of these two structures, and their several appendages are brought thus closely together yet even in this union, the disagreement of their symmetrical laws is preserved, introducing thus one of those beautiful instances of the expression of special thought, by a departure from mathematical symmetry, which are so frequently exhibited in the works of the great Master-Artist, and to an imitation of which human art so rarely attains.

There are, however, a few genera in which the position of the capsules appears to be more nearly symmetrical with that of the tentacula than usual. But so far as my acquaintance with the subject goes, this occurs only where both kinds of appendages are numerously represented in adult and fully grown specimens, so that the original want of agreement in symmetry has been gradually disguised by the filling up of the unequal spaces through the multiplication of organs of both kinds. These remarkable organs may be described as each consisting of a transparent membranous oval or spherical cyst, projecting from the bell-margin, and connected with a ganglion-like enlargement of the marginal cord, (See pl. 12, fig. 2, *k*.). Within, each contains a variable number of round or polyedral corpuscles which have been considered otoliths, and certainly appear in some instances to contain inorganic deposit. Their function is still unknown.

In view of their idiosyncracy, their appearance at an early period of existence, and their almost universal presence among Exostomata, their entire absence even in the earliest stages of growth among Endostomata, introduces a marked distinction between the two sub-orders.

1st. group. CAMPANULARIDÆ.

The Medusæ belonging to this group are usually cymbaloid or disk-like in form; more rarely they are campanulate; sometimes umbrella shaped. The disk is of very various thickness and solidity, and its external surface apparently always perfectly smooth, and homogeneous. The digestive cavity is always a short cylindrical organ usually cleft into four petaloid labial tentacula around the mouth. It is sometimes sessile, sometimes pedunculate. The radiate tubes vary in number but usually they are limited to four. In their course are the sexual glands, which sometimes occupy but a very limited area, at points varying according to the genus; sometimes stretch from the base of the digestive trunk to the marginal tube; sometimes are connected at once with the wall of the digestive cavity, and with the radiate tubes. The tentacula are always (?) more than four, sometimes extremely numerous. They are usually provided with a prominent bulb at their point of attachment. Besides the tentacula there are nearly always present small prominences, bearing thread-cells, which I think are distinct from the rudiments of tentacula in course of development. All of these, besides the marginal capsules (present in the greater number of genera, comprising the group) are each connected with a ganglion-like enlargement of the colored marginal cords, (Pl. 12. fig. 1–2, *a*, *b*, *c*,) which I regard as the principal portion of the nervous system. There is a third class of tentacula, very small transpaent structures, belonging to a limited number of genera, which have no immediate connection with the marginal cord, but appear to be appendages of the outer cellular layer of the disk. These are variously arranged being sometimes nearly connected with the bases of the other tentacula, sometimes isolated. The marginal capsules are usually round or oval in form, (in the latter case attached by their longer side) and containing a variable number of corpuscles, which do not contain inorganic deposit. (?) They vary also in number, but the typical number appears to be eight and these are placed two between every two radiate tubes, so that one of the latter, always falls midway between two mar-

ginal capsules, which latter also are all at equal distances from each other. Coloration is confined to the digestive cavity, the sexual organs, and the tentacular bulbs. In a limited number of genera, ocelli are present according to observers of the most undoubted authority. They occur near the marginal cord on the bulbs of tentacula, and according to Professor Agassiz, on the upper part of the representatives of the marginal capsules in his genus Tiaropsis.

The larvæ are Campanularidæ, branching or creeping horny polypidomata of great delicacy; each polyp being housed in a rather deep, more or less conical or hemispherical horny cup. This cup, unlike the same part in the next group is mounted on an usually annulate foot-stalk or branchlet. Near the axils of these branchlets is the general position of the medusa-bearing polyps, whose cups are usually much deeper than those of the digestive polyps. The digestive polyps are distinguished from those of the next group by having the mouth at the extremity of a proboscidi-form process from the area within the circle of tentacula. The prolific individuals are said to be at first tentaculated polyps like the digestive ones, but they afterwards, dwindling, lose their tentacula, retaining only the mass of the body in which a trace (sometimes very distinct) of the digestive cavity may be seen, and which remains as a stopper over the mouth of the cup. On the slender outstretched pedicle of the polyp and in the cavity of the cup, the medusæ are developed, according to the Exostome method: frequently however remaining mere pedunculated cysts which nurse planules. As the medusa buds increase in size the polyp-head usually diminishes and at last dwindles so as to leave only a slight trace of its existence. Between it and the lid of the cup the liberated medusa, escape one by one, forcing themselves through by violent exertions. From their manner of growth their appearance before liberation is, except in deep-belled species, much more like that of the digestive polyps than is the case among Endostomata.

There are at least two under-groups in this division which are distinguished by the presence or absence of ocelli. The genus Obelia, (ex. *Thaumautias plana* Sars.) may perhaps constitute a third under-group on account of its depressed form, its stiff short numerous tentacula, and their connection with its marginal capsules.

I. THAUMANTIADÆ.

This group is distinguished from that which follows by the possession of ocelli. The bulbs of the tentacula are smaller than among Eucopidæ. The sexual organs occupy a great portion of the extent of the radiate tubes, and the marginal capsules are either absent or exist under a modified form. The other characters of the group appear to be, in the main, such as will be given for Eucopidæ. From the case of Tiaropsis, which Prof. Agassiz states is bred from a Campanularia of Boston Harbor, I have placed all these ocellated genera as one of the minor groups of Campanularidæ.

Charleston Harbor has, as yet, furnished no instance of an ocellated Exostome. Indeed, in all the opportunities I have had of examining forms belonging to the Sub-order, I have never come across a single instance of a circumscribed pigmentary spot in the outer surface of the tentacular bulb, such as constitutes the ocellus among Endostomata. The tentacular bulbs are on the other hand often highly colored, but this coloration is always easily distinguishable by being situated beneath the transparent parenchyma in the interior of the tentacular bulb, by occupying much more room than is ever appropriated to the true ocellus, and by having its outline gradually shaded off and not clear cut as comparatively it is in the ocellus. It appears to me that Forbes never consistently regarded this distinction.

II. EUCOPIDÆ.

The form of the disk varies from that of a circular plane, through the hemispherical to the campanulate form, while in one or two instances it is precisely that of an umbrella. Its general characteristic, however, is that of shallowness. The digestive trunk is cylindrical and short, with four or more (?) petaloid labial tentacula. The number of radiate tubes is probably always limited to four, except in cases of deformity by excess. In their course occur the sexual glands, usually four in number, and sometimes surrounding each a sinus of the radiate tube to which it belongs. The presence of marginal capsules distinguishes the group from that of Thaumantiadæ. Their typical number is eight, but in some genera the number is double or triple the typical number. The typical number of tentacula appears also to be eight, but they vary from four to over a hundred. Their bases have usually the form of pendent bulbs, and the lashes have considerable contractility. There are no ocelli.

Remark.—This group is a large one, and contains so great a variety of forms that it must eventually, it seems to me, be subdivided. *Thaumantias plana* Sars, *T. lucida* Forbes, *Eucope radiata* Gegenb., and *Obelia commissuralis* described below, are quite distinct from the remaining forms.

* *Lateral cirrhi to the bulbs of the tentacula.*

EUCHEILOTA, *nov. gen.*

The general form is hemispherical or bowl-like, the cavity of the bell rather deep, so that the disk is only of medium thickness, The digestive trunk is cylindrical and four-lipped as in Eucope, with a small quadrate base upon the junction of the four radiate tubes. The sexual organs are elongate, fusiform or oval, and often contain a large sinus of the radiate tube. They are situate about midway between the digestive trunk and the marginal canal. The bell margin is highly complicated. The marginal capsules are eight in number, two between every two radiate tubes. They are rather large and contain a plurality of corpuscles, probably always more than four. Corresponding to each is an easily discerned ganglion-like enlargement of the marginal cord. The tentacula are sixteen in number. They have large bulbs and slender lashes, bearing rings of thread-cells, and one is found at the extremity of each radiate tube, three more being found between every two tubes. On each side, in the angle formed by the junction of the bulb and margin, is found one of the small lateral tentacula. These are delicate, transparent, and composed of a shaft formed of a pile of cylindrical cells surrounded by a membranous sheath of great tenuity. The extremity has somewhat the appearance of a thread twisted in such a manner as to prevent its track being traced. I have not been able to make out to my satisfaction the nature of this part, but it is probable that the more easily discernible, somewhat disconnected masses of which it seems to be composed, are the contents of thread-cells; the matrix in which these latter are imbedded being of extreme transparency, and surrounded by a membrane so delicate as to be difficult of definition. I think these lateral tentacula are homologous with the small, transparent tentacula described and figured by Gegenbaur in Thaumantias. (See Gegenb. loc. cit. p. 239 pl. 8 fig. 3) Between every two of the sixteen great tentacula thus described, there are a few marginal tubercles, or knobs, bearing at their free extremities a few thread-cells. Each

of them appears to be connected with a slight enlargement of the marginal cord. They differ from the bulbs of the great tentacula by their smaller size, their comparative want of color, and their want of the small lateral tentacula described above. The latter are found on the bulbs of the great tentacula in course of development before the lash has appeared.

This genus has a general resemblance to *Eucope thaumantioides*, Gegenb., but differs by the presence of the lateral cirrhi to the bulbs of the tentacula.

The larva is not known. The only observations I have made which may have any connection with the development, are the following:—Among a great number of specimens taken at various times during a summer, and nearly all of the same size, we find three different forms of the sexual organ similar to those upon which Gegenbaur separated as distinct species, his *Eucope thaumantioides* and *E. affinis*. In one of these I find the sexual organ a small fusiform gland, situated somewhat nearer to the digestive cavity than to the margin. Two of the glands in fig. 2, Pl. 11, are somewhat in this condition. The second is that represented fig. 3, on the same plate. It is oval in form and contains a distinct oval sinus of the radiate tubes. The third form has the sexual organ much elongated and containing a large oblong sinus of the tube. Such was the condition of the organ in fig. 1. Now, so far as my observations yet extend, I have not been able to discover any other constant differences between these forms than those of the sexual organs, and I incline, for the present at least, to look upon the latter not as Gegenbaur has done, as indicating distinct species, but merely as different stages in the growth of the sexual organs in maturing specimens. The case of *Nemopsis Gibbesii* gives us a remarkable instance of the various appearances which the sexual organ may assume, and leaving the point to further research, I shall give a name in this paper to but a single species.

EUCHEILOTA VENTRICULARIS, *nov. spec.*

Pl. 11, Ff. 1-3; and Pl. 12, Ff. 1-2.

The form is nearly that of a segment of a sphere less than the hemisphere. This is the case while the animal is in full activity and swimming in search of food, but when irritated or drooping, there is a sensible shortening of the diameter of the tentacular circle, imparting a more hemispherical outline. In some speci-

mens, perhaps normally, and (I believe) in any specimen in certain conditions of declining activity, there exists a greater or less constriction below the summit of the disk, giving the appearance of a considerable emargination of the usual convex outline on each side (Pl. 11, fig. 2.) The disk is rather thick just above the digestive cavity, diminishing rapidly as it approaches the bell margin, which though seemingly an inconsiderable character, nevertheless imparts a certain peculiarity not long unobserved when comparing active specimens of the species with other Eucopidæ not similarly characterized. I have not observed any *specific* character in the form of the digestive cavity and oral appendages. The sexual organs are less pyriform and more cylindrical than those of *Eucope thaumantioides*, and in fully developed specimens are so long that when the disk is somewhat contracted they frequently appear to occupy nearly the whole distance from the digestive trunk to the margin, but on the whole approaching nearer the latter than the former. The bulbs of the tentacula (which vary from sixteen to twenty in number,) are large and somewhat conical; the lashes are contractile, but not to such a degree as to disappear, only gathering themselves up into small knots on the free extremity of the bulbs. I have never been able to set any limit approaching exactness to their power of elongation, but a specimen of the size represented in fig. 1, will sometimes drag a length of tentaculum after it not much less than six inches. The marginal capsules never exceed eight in number, except in cases of deformity. They usually contain each five or six corpuscles arranged in an arc of a circle.

The digestive trunk is of a general yellowish tint with a red nucleus. The sexual organs are uniformly yellow, and the tentacular bulbs have each a red nucleus to the bulb, while the lash has the whitish, almost frosted appearance, imparted by the presence of great numbers of thread-cells. The marginal cord also is of a light yellow color, whenever it enlarges to form a ganglion-like body for the tentacula, but this coloration is scarcely observable for those enlargements corresponding to the small marginal tubercles.

The graceful motions of this Medusa consist of a rapid succession of strokes,* by which the animal is impelled with considera-

* As a general rule, we may say (according to my observation,) that the rapidity of succession of the rythmical strokes of the disk is in inverse ratio to the depth of the bell. Thus taking a deep-belled and a shallow-belled species, each in full activity and of nearly the same size, the latter will require a greater number of

ble rapidity for a short distance; then comes a period of apparent rest, in which it generally sinks, but still possesses sufficient control over its motions to throw its train of tentacula into various curves, while they float in the wake of the disk, in such a manner as to spread them over a greater surface than could be the case when stretched in a straight line behind it. The motions by which the animal thus steers its course in sinking must be very slight, for I have not been able to observe them. However, it is perhaps effected by employing the mechanical friction of the tentacula against the water, as a means of partly arresting the gradual fall of one side of the disk, while the other side is allowed to fall almost with the full force of gravity by a continual lengthening of the tentacula issuing from it with such rapidity that their friction is not felt until they have reached the limit of extension.

I have not yet been so fortunate as to meet with the larva of this Medusa.

This is a spring, summer and fall species. I have found it from the middle of May, from time to time, until the beginning of November. With the exception of *Hippocrene Carolinensis*, we have no more common species.

EUTIMA, *nov. gen.*

Characters the same as those of Eucheilota, with the exception that the gelatinous disk is developed from the centre of the cavity of the bell into the form of a more or less long conical appendage, at the extremity of which is the digestive cavity, of the same character as the corresponding part in Eucope. The four radiate chymiferous tubes, originating at the base of the digestive cavity, ascend the external surface of the conical appendage and arching, connect themselves in the disk-margin with the circular tube as usual. Sexual organs linear in form in the course of the radiate tubes. Disk-margin with more or less numerous tentacula, whose basal bulbs like those of Eucope, are provided each with two lateral accessory tentacula, and two concretionary capsules between every two radiate tubes as in that genus.

The embryology of this genus is not yet known. Judging from its close resemblance in all essential points to Eucope, it is hardly probable that its larva will be other than a Campanularia.

---

strokes to carry it the same distance, than is required by the former. This of course, is what might be expected *a priori*, since the mechanical impulse given by a single stroke of the deep bell must be greater than that of a single stroke of the shallow bell.

Remark.—The specimens which I include under this genus were in the notes, taken during my observations, ranked as belonging to two distinct genera and three species. A considerable proportion of them had the sexual organs disposed in two masses on each radiate tube, one being on the proboscidiform appendage or peduncle, and the other in the disk, as in Thaumantias and Tima proper. Thus each possessed eight sexual glands, two to each of the four tubes. In fact, in one of the species this seemed to be the rule, but I have since ascertained that there are specimens in both the following forms, some of which have sexual organs in one of these positions only, others in the other position only. From which I have concluded that there are but two species, and that the sexual organs in this genus may be double, and that when single they are placed either on the proboscidian or disk-portion of the radiate tubes, and that all these varieties may occur in one and the same species.

EUTIMA MIRA, *nov. spec.*

Pl. 11, Fig. 8–9.

Proboscidiform appendage very long, (equalling in length four or five times the height of the shallow disk,) tapering and slender, the digestive cavity also rather deep, and of greater diameter than the peduncle at its junction. Oral leaflets deep cleft. Tentacula four only, and these tubular to the very end. The marginal cord between these tentacula exhibit a great many nodes, which are the only representatives of the rudiments of other tentacula. The disk is quite narrow transversely, and though shallow when compared with the deep-belled Eucope, is deep for the genus, in some specimens especially, presenting almost a quadrate outline, but the usual form is more like that of the figure, the outline being emarginate in its descent from the summit of the disk to its margin.

EUTIMA VARIABILIS, *nov. spec.*

This is the broadest species found in our waters. It differs very considerably from *E. mira*, being more like *Tima flavilabris*, Esch. in general form. The peduncle is not more than one or one and a half times as long as the disk is high. The disk is shallow and broad, the digestive cavity partaking of the same peculiarities, the oral leaflets shorter than in the preceding species, the peduncle tapering more rapidly. Tentacula twelve in number; four somewhat longer than the rest, placed one at the extremity of each radiate tube. Between every two tentacula are three

nodes of the marginal cord, making thirty-six in all without tentacula, forty-eight if the tentacular nodes be included. The sexual organs either double on each tube and placed one on the proboscidian, the other on the disk portion of the tube, or single and then located in the disk.

* * *Tentacular bulbs without lateral cirrhi—lashes long and flexible.*

EPENTHESIS, *nov. gen.*

General form much like that of Eucheilota, but the disk is probably rather thinner above, and a vertical section of it would give a more truly crescentic outline than in that genus. There is no notable difference in the form of the digestive trunk, except that in my specimen it possessed five labial appendages instead of four, the typical number in Eucheilota. The radiate tubes are four in number, and the sexual organs are four rather round thick glands, bulging and hanging downwards in the cavity of the bell from its inner surface, and situate each on a radiate tube about one-fourth its length from the marginal canal. The tentacula in the present species appear to be the same in number as in Eucheilota, sixteen, and this is perhaps the typical number. *They want the small lateral tentacula*, but otherwise resemble those of Eucheilota. The marginal capsules are small, and contain one or two corpuscles each. The ordinary numerical formula appears to be, one between every two tentacula, but sometimes by a sort of deformity, there are found two between two tentacula.

Larva unknown.

Remark.—This genus differs from *Eucope thaumantioides* in the form and position of its sexual organs and in the number of its marginal capsules Probably several of the species described by Forbes are referable to it, but I am unwilling to risk a conjecture based upon his figures merely.

Distribution.—Charleston Harbor, British Seas?

EPENTHESIS FOLLEATA, *nov. spec.*

The general form of the disk was that of a spherical segment somewhat greater than a hemisphere. Its cavity is deep and the bell-wall diminishes very gradually from the summit towards the tentacular margin. The possession of five labial tentacula imparted a peculiar aspect to the digestive trunk. The sexual glands

are nearly hemispherical, their rounded surfaces projecting in the cavity of the disk. They are situate about one-fourth the length of a radiate tube from the bell-margin. The tentacula, sixteen in number, have very long and slender lashes, with bulbs of moderate size. The marginal capsules usually contain a single corpuscle each, and are quite small and not very conspicuously placed.

I have spoken of the cavity of the bell as deep in this species, but this is not the result of a campanulate form, such as is seen in *Campanularia noliformis*, but of the thinness of the bell-wall. In a slightly contracted condition my single specimen presented a rather unusually flaccid appearance, due to the thinness and hemispherical form of the disk, but, in full activity, its distended disk and long graceful tentacula made it a very beautiful object.

The only specimen found was taken on the 22d of May,

PHORTIS, *nov. gen.*

The general outline of the disk is probably hemispherical, but unlike the preceding genera the bell cavity is exceedingly shallow, and consequently the solid part of the disk of excessive thickness, giving a heavy-laden and clumsy appearance to the animal at first sight. The digestive trunk is not cylindrical, but narrows into a sort of neck above before reaching the radiate tubes, along whose course it sends out processes of sufficient length to give, when viewed from above, the appearance of a four-rayed star. The four radiate tubes are not regular in their curvature downwards, but first ascend slightly above the base of the digestive trunk. Nearly at the point where they begin to descend, begin the sexual organs, four elongate but not exactly cylindrical organs, which descend towards but do not reach the marginal canal. Their structure is peculiar. Within the sexual gland and on the sides of the radiate canal, are placed small reddish glandular bodies, in pairs, one on each side of the tube. There are in each sexual organ from three to four pairs of these glands. The margin is provided with from twelve to fourteen tentacula resembling those of Epenthesis, and wanting the small lateral tentacula of Eucheilota and Eutima. In the interior of each bulb however there is a pair of small reddish glands like those described in the sexual organ. Between every two tentacula there are one or two knobs provided with thread-cells and from three to four small marginal capsules, each bearing one or two corpuscles.

Larva unknown.

Distribution.—Charleston Harbor.

PHORTIS GIBBOSA, *nov. spec.*

The thickness of the disk above the digestive trunk does not fall far short of its width across the tentacular circle, except when the animal is much expanded. The curvature of the outline from the summit to the margin is not the arc of a circle, but rather paraboloid. The projection downwards of the disk-substance which gives attachment to the digestive trunk is so large as to occupy a very considerable portion of the cavity, converting it, indeed, into a sort of circular fossa, (as in Tima,) whose outer wall is much more steep than the inner. However this prominence does not reach the level of the vail, but gives attachment within the vail to a rather large digestive trunk, which hangs *without* the vail, and this carriage appears to be habitual. The sexual organs, quite elongate in large specimens, occupy nearly all that portion of the radiate tubes which traverses the steep side of the circular fossa representing the bell-cavity. They thus lie near the marginal tube but do not reach it. Though not pyriform, they grow rather larger as they approach the margin. The tentaculum is provided with a rather globular bulb and a slender and very extensile lash. The number of these organs varied among my few specimens from twelve to fourteen, probably sixteen is the highest number ever attained, and this only in cases of deformity by excess. Between the tentacula are found a variable number of tubercles bearing thread-cells and marginal capsules, which I have noticed in the diagnosis of the genus, though by no means certain that the *number* of these should not rather be included among specific characters.

Uninjured specimens of this species are by no means so clumsy in their motions as might be supposed from their heavy appearance. Though the disk-cavity is so very shallow, and though, from the excessive thickness of the disk-wall in its upper part, only a limited portion of it appears to be concerned in giving an impetus to the water, yet this is done with sufficient force and frequency to impart celerity and an air of liveliness, which makes an interesting contrast with the heavy form of the species.

My specimens of this species have all been taken in August. It is the largest Naked-eyed Medusa in our waters with the exception of the two species of Eutima.

CAMPANULARIA. *Miki.*

Syn. *Clytia*, (*pars*) Lamaroux. (1812?)
Campanularia, (*pars*) Lamarck. (1813?)
Eucope, (*pars*) Gegenbaur. (1856.)

The bell is very deep for an Exostome. The digestive trunk rather long, and remains long unprovided with labial appendages. The radiate tube and sexual organs are each four in number, the latter appear to be of the same type as those of Obelia and Epenthesis. The tentacula are more or less long and flexible, wanting the stiff appearance visible in Obelia; they also want the re-entrant radix and have the type of bulb seen in Epenthesis. The tentacula are either four or eight in number, perhaps sometimes more but never numerous. The marginal capsules are eight in number and contain each only one (?) corpuscle.

The larvæ are those Campanularidæ which have usually creeping stems, and deep cups for the digestive polyps. The rim of these cups also is more or less deeply toothed, and the large vesicles of the prolific polyps are annulate, either near the base or throughout their whole extent. The deep character of the Medusa-bell is exhibited at a very early stage of the bud, while it is yet within the capsule, and it is never carried reverted as in Obelia.

To this genus are probably referable all the Medusæ from Campanularidæ like *C. volubilis*. Perhaps also such species as *Thaumantias quadrata* and *T. æronautica* of Forbes, and the *Eucope campanulata* of Gegenbaur.

Distribution.—British Seas, Coast of Holland, Mediterranean, Charleston Harbor.

CAMPANULARIA NOLIFORMIS, *nov. spec.*

Pl. 11, Fig. 4.

I have seen no specimen of this species which had attained maturity, consequently the sexual organs have not been observed. The young specimens possessing four tentacula, which have been from time to time bred in my jars, exhibited a form of less altitude than is represented by Gegenbaur in his *E. campanulata*, the height of the bell in the present species being nearly equal to its width. The diameter of the tentacular circle is not so much less than that of the bell as to give the ovate appearance seen in Gegenbaur's figure of the Mediterranean species. At this stage the marginal capsules contain only a single corpuscle each, and between every two of the four tentacula is a prominent bulb representing the four additional tentacula of *Eucope campanulata.*

The larva is found creeping upon various algæ and even upon denuded Gorgonia stems. The twigs bearing the polyps rise directly from the recumbent stem and attain considerable length. The cell has a pretty regularly conical form, the dentations of its margin are deep, and between the teeth thus formed stretches a delicate membrane of such tenuity as frequently to escape vision. The oral proboscidiform projection of the polyp is quite long, the number of tentacula from twenty to twenty-two. They appear to be arranged in a double row. The prolific capsule is not exactly sessile upon the creeping stem, but connected with it by a very short annulate neck. It is capacious and of an elegant urn-shape, annulate at base and very broad at its mouth, which is filled by a large untentaculate polyp-body. The digestive cavity of this polyp still remains as a large sinus while its medusa-buds are already far advanced. The campanulate form of the latter is visible, while they yet lie motionless buds within the capsule.

This species I have not, as yet, found during the winter, and only in July and September during the summer. It appears to grow below low water mark.

LAOMEDEA. Lamouroux.

As yet nothing is sufficiently known as to the adult condition of the Medusæ of this genus, to point out any distinction between them and the genus Eucope proper. The larva differs in the following particulars:

The whole polypidom appears rather more massive, not so delicate as in Campanularia. At the origin of each petiole supporting a polyp is an enlargement of the stem-canal. The aperture of the medusa-bearing cell is small, the cell being constricted above.

These differences seem tolerably constant through a number of species, and may possibly correspond to differences yet to be observed in the adult medusa.

Distribution.—British and Belgian Seas, New England, South Carolina.

LAOMEDEA DIVARICATA, *nov. spec.*

Of this species I have only once seen a single specimen. The branches of the polypidom parted from the stem at a large angle, the cup were quite shallow and broad at the top. The membrane which passes inward from the lip of the cup towards the

base of the polyp was more distinct than I have ever seen it in any but the medusa-bearing cells of *Campanularia noliformis*. Tentacula numerous; the proboscidiform mouth was very large and prominent. The annulations of the petiole few, large and spherical. The medusa cells did not present any marked peculiarity, their proportions were similar to those of *L. geniculata* in Jonst. Brit. Zooph. pl. 25 fig. 32. They were found only near the rootsof the polypidom.

Unfortunately the Medusæ were only half developed, and I did not succeed in observing their full development, hence it is not impossible that I may be yet able to unite this larval form with one of the foregoing species.

This Laomedea was found on Sea-weed near low water about the middle of September.

* * * *Tentacular bulbs without lateral cirrhi, but with re-entrant radix—lashes short and rather stiff.*

OBELIA. Peron. (1809.)

Syn. *Clytia*, (*pars*) Lamouroux. (1812?)
Campanularia, (*pars*) Lamarck. (1813?)
Eucope, (*pars*) Gegenbaur. (1865.)

The general form of the locomotive organ is not, as usual, campanulate but truly discoid, or rather it has the form of a plate turned up at the edges all round. The digestive trunk has somewhat the form of that described in Phortis, being faintly constricted before joining the disk. The labial appendages, four in number, present however a distinction, which may prove constant in the fact that they have their edges not frilled. The radiate tubes are four, the chamber at their intersection small. The sexual organs are placed nearly midway their length, but the tendency is to have them nearer the margin than to the digestive trunk. They are round or oval, not provided with a distinct sinus, and like those of Epenthesis bulge downwards, so as to appear hanging in the shallow cavity of the disk. The tentacula vary in number but are always numerous, frequently over a hundred. They are short and have a certain stiff appearance not observable in the other genera here described. The pendent bulb is small and simple, and there is a re-entrant radix to each tentaculum, passing back into the disk, within the marginal cord. The marginal capsules are eight in number, usually containing a single corpuscle each. In some of the species, among which is the following, they

are each connected with the bulb of a tentaculum, being placed beneath and somewhat on one side of it. Should this position be not constant for adult specimens of all the species, it may be necessary hereafter again to sub-divide the genus.

The larvæ are those Campanularidæ which have a rather shallow cup with an entire rim, and the horny vesicle of the budding polyps not transversely divided into annulations. When the medusæ first escape from their nurseries, the disk is small and more or less reverted, the mouth not infrequently simple, the tentacula few in number, twelve or sixteen, and the eight marginal capsules considerably distant from their bases. Also the sexual organs are either entirely indistinguishable, or barely traceable near the base of the prominent digestive trunk. The Medusæ referable to this genus appear never to attain a large size.

Distribution.—Seas of Norway, Holland and Great Britain, the Mediterranean and Charleston Harbor.

OBELIA COMMISSURALIS, *nov. spec.*

Pl. 11, Ff. 5–7.

The general form is not so flat as that of *Thaumantias plana* Sars, but when viewed in profile the outline is seen to project slightly at the summit of the disk, producing the form of a cone with very low altitude and very broad base. From the periphery of this base projects downward the lower part of the wall of the disk, like the upturned peripheral edge of a watch glass. The digestive trunk descends nearly to the level of the vail. The nearly round sexual organs are situate quite near the marginal tube. The transverse diameter of these organs exhibits a tendency to diminish towards the marginal tubes. Fig. 6 gives a striking instance of this. The largest number of tentacula counted in any specimen has been thirty-two, but I feel satisfied that the number in specimens attaining full maturity in their native element will be found to be much greater, especially since, even in this instance, new tentacula were springing up between the old ones. The tentacula are short and of stiff carriage, being borne nearly straight for about two-thirds their length from the bulb, and curved or hooked for the remainder.

The larva of this Medusa is a small, delicate, and in fall and winter much branched Campanularia, growing between tide-marks on Bowman's Jettee, Sullivan's Island. In spite of its abundance fully grown Medusæ are seldom taken with the dip-net.

Medusa-bearing capsules have been observed from April to October, and probably the production of medusæ only ceases in the dead of winter, between December and February.

2ND GROUP SERTULARIDÆ.

The Larvæ have their polyps protected by a cell-like expansion of the horny covering of the polypidom as among Campanularidæ, but their cells are sessile upon the main stem or its branches. The polyps themselves want the proboscidiform mouth which characterizes the last group. There are no known instances in which the Medusæ become free. They are developed in large capsules as in Campanularidæ, but remain mere cysts enveloping the sexual products.

In this group there is a particular tendency manifest to a grouping of the individual polyps in such a manner as to subordinate their individuality to the idea of the group. Thus we frequently find that the individual polyp-cells in a given section of the stem are unlike each other, and that the tenant of one only of them attains the fully developed polyp-form, while the remainder undeveloped are grouped round it in various patterns according to the genus. This grouping also is frequently visible in the prolific vesicles, producing what may be called compound vesicles. Instances of these peculiarities, such as Aglaophenia and Plumularia, will be noticed further on.

We should not overlook in this connection the possibility that the presence or absence of this compound character may be the means of distinguishing two minor groups among Sertularidæ. Sertularia, Thuiaria and Dinamena, as apparently also some plume-like species hitherto included in Plumularia, have no lesser polyps, while Antennularia, Plumularia, (which probably contains the types of several genera,) and Aglaophenia, (*vide infra*) all have lesser as well as great polyps, and their genera may be distinguished by the manner in which these are grouped together. Of these two groups Plumularidæ would, on the whole, from the generally funnel-shape of the polyp-cells, make a nearer approach to Campanularidæ than would Sertularidæ proper, whose cells are usually more tubular or even of less diameter at the aperture than below it. I have, however, refrained from insisting upon thus subdividing the group on account of my ignorance of the European species, the descriptions and figures of which by European authors, appear to leave much to be desired.

* *Cells of several orders forming groups—great cells of the digestive polyps funnel-shaped or campanulate.*

PLUMULARIA. Lamarck.

Syn. *Aglaophenia.* Lamouroux.

The polypidom branches regulary, so as to assume a plume-like form, but its tufts appear to be usually of less size than is attained in the following genus Aglaophenia. The greater polyp-cells are disposed universally upon the branchlets. The greater cells are not contracted at the mouth, but preserve a funnel-shape broadest at the mouth. There are always present (in species which I think referable to this genus,) two or three, sometimes four secondary cells with each of the cells destined to contain a greater polyp. These together form a characteristic group. So various are these groups among the species included usually under this genus, that I suggest they will furnish the means of subdividing it still further than my actual knowledge has permitted me to do at this time.

The prolific vesicles of Plumaria proper, according to authors, appear to be developed in the axils of the branchlets of the plume, or near the bases of the greater polyps. They are simple like those of Sertularia, which distinguishes them from those of the next genus.

PLUMULARIA QUADRIDENS, *nov. spec.*

The following description is taken from a detached plume found floating in the water. Its height was about a quarter of an inch. The branchlets were alternate. The main stem has a polyp and its cell at the base of each branchlet, and there are from three to four polyps on the branchlet, the last being terminal. Around each polyp-cell and closely connected with it are three secondary cells, one behind and two (one on each side,) in front, that is on the side towards which the recumbent primary cell inclines. Each of these consists of a rather stout pedicle whose base originates near the base of the greater polyp-cell, and whose top is surmounted by a small shallow hemispherical cup, in which is a round fleshy mass, representing, as I suppose, a polyp. Between every two such groups on the stem is a fourth small cell, even less developed than those around the greater polyp, being indeed scarcely more than a tooth-like process of the stem. What the function of these secondary polyps may be, is an interesting

question for investigation. I saw one of those connected with the primary polyp-cell apparently discharging what seemed to be refuse matter.

The greater polyps have each the form of a hemisphere, attached by its plane surface to the pedicle which connnects it with the bottom of the cup. Around the periphery of the hemispherical body is a circle of from twelve to sixteen tentacula serrate with thread-cells, which being more crowded at the extremity formed a sort of terminal pad. The mouth appeared to be a simple opening on the summit of the curved surface, surrounded by a slight fold of the external membrane, in which were implanted at regular intervals from each other a dozen round corpuscles, which probably are thread-cells.

The polyps did not appear to be capable of stretching far beyond the opening of the cell. They simply expanded their tentacula over its rim, as is done by the polyps of Campanularidæ.

This specimen was taken on the last day of July, and at that season there were no prolific vesicles upon it.

The arrangement of the secondary cells around the primary ones, in this species, is more like that which obtains in Aglaophenia than any which I have seen figured. Indeed I know of no species of Plumularia in which the two lateral secondary polyps, which are never very obvious, have been described as existing at all. Even in Aglaophenia they seem to have been sometimes overlooked, and I can scarcely doubt that they will be observed in some of the European species, if carefully sought after.

AGLAOPHENIA. *Mihi.*

Syn. *Plumularia*, (*pars*) Lamarck.
Aglaophenia, (*pars*) Lamouroux.

Polypidom, consisting of an unbranched or sparingly branched main stem, with short, lateral pinnæ, which bear the polyp-cells. It is either erect or creeping. The erect form has a tortuous and loosely interlacing root-like prolongation, with which it entwines itself around other objects.

Each group of cells occupies a separate joint of the stem. The great cells are compound, each cell being composed of an anterior and posterior portion, of which the latter bears a projecting tubular process, or secondary cell, and the former the usually dentated opening of the great cell. Just beneath this circle issue from the stem, one on each side of the cell, two tubular processes, or second-

ary cells, like that which characterises the posterior portion of the cell. These two processes embrace the anterior portion of the great cell. The end of the main stem does not terminate in a point, but seems somewhat expanded, as if forming there a calicle for a terminal polyp. The appearance of a series of openings or pores in the main stem, like that described in *P. myriophyllum*, was observed in the species to be described, but the pores appear fewer and larger.

The polyp, according to Johnston, has ten tentacula, and a proboscidi~~-from~~ mouth.

The reproductive capsules are, like the cells, also compound. They occupy each the greater portion of one of the pinnæ, and are terminal. They appear to be the result of a metamorphosis of the polyps by which the cells are fused together, the polyps remaining distinct.

I take the *P. cristata* as the nucleus of this group. The *P. plumatella* is probably also referable to it, but we know nothing of its reproductive capsules. *P. myriophyllum* is equally uncertain The species found by Dr. Pickering, of the Wilkes' expedition, upon Gulf-weed, and figured in Dana's Zoophytes, p. 23, fig. 7 is undoubtedly a member of the same group, and a well marked and distinct species. I have some good specimens of it in alchohol, which I owe to Dr. Edmund Ravenel, to whom I have had to offer thanks on a previous occasion for similar favors. These specimens are attached to Gulf-weed, (*Sargassum pacciferum*) and were taken in the Atlantic by a homeward bound vessel. I think it in all probability identical with the *Plumularia pelasgica* of Lamarck, *Sertularia pelasgica* Bosc, *Dynamena pelasgica*, de Blainville.

It is characterised by cells quite long in proportion to their breadth—the posterior process is far behind; the anterior lateral processes, are rather weak and slender. The main stem is recumbent and creeping, giving off at intervals plume-like branches, so much like those of the ordinary true Plumularia, that it would readily be mistaken at first sight. On my specimens I have found no reproductive capsules. This important portion of the community, however, is represented in Dana's wood cut, *l. c.* It is turned *downwards*, thus depending from the stem; is this its natural position?

This species is not improbably an occasional visitant of our waters, but I have never encountered it on the Gulf-weed thrown on our beaches.

Distribution.—Southern coast of England and Ireland, Irish channel, Sargasso Sea, and Charleston Harbor.

AGLAOPHENIA CRISTATA. *Mihi.*

Syn. *Plumularia cristata*, Lamarck.

Main stems from five to seven inches in height, giving of, on their upper half, two or three pairs of opposite branches, and growing together in a bushy cluster usually upon the top of a worn and denuded stem of *Gorgonia virgulata*, about which their twining roots form a very intricate net-work The polyp-bearing pinnæ are found both on the stem itself and on its lateral branches. They are numerous, the points of the stems being very short, and a pinna, or branchlet being given off on each side of every joint. One side of the main stem, however, is always roughened by murications, which are the two processes mentioned on every joint of the stem, and which on the lateral pinnæ embrace the lower part of the cell-opening. The cells have each about eight or ten (?) prominences around the margin. In form they differ very decidedly from *A. pelasgica*, being much shorter in proportion to their length. The posterior process also is more nearly central in position, and the two lateral processes are stronger. In addition to this the transverse diameter of the cell in *A. pelasgica* is so much greater in proportion to that of the stem than in the present species, that the cell overhangs the stem when looked at in this position, decidedly more than in present species. The species has, therefore, a thick stem and small cell. The cell also appears to be somewhat more crescentic in profile, (concave above and convex below,) than in *A. cristata*, as figured by Johnston, though they approach that species very closely. If the figures of Johnston, (Brit. Zooph., pl. 23 fig. 2, and pl. 94 fig. 16,) be exact, the posterior process also is more conical and pointed, its opening being lateral and anterior, not terminal. With regard to the polyps and fleshy parts of the stem, I have not seen them but in their dead and contracted condition. But it may be seen, even then, that a distinct prolongation of the fleshy core of the stem is carried up from the posterior portion of the polyp's base into the conical process of the cell, which represents the posterior secondary cell, and that each of the anterior lateral processes, or secondary cells, has also such a prolongation.

The reproductive capsules have a very pod-like appearance, but appear rather more pointed behind than those of *A. cristata*, figured by Johnston, and increasing gradually in width towards the end of

the branchlet which they terminate. I have seen only one or two of them, all of which were dry and empty.

This species is, probably, distinct from the European, but I have no specimens of that species with which to compare it, and the entire absence in Johnston's drawings of the two tubular processes at the anterior end of each joint, and which I have found in all the three species here described, show that these drawings cannot be relied on for so minute a comparison.

The main stems are of a yellowish, horny brown, the branchlets lighter in color, and the tips of the branches have a vivid, somewhat golden yellow color. The whole becomes very dark, almost black, by exposure and desiccation, with the exception of the polyp-cells, which retain great transparency. The coloration, at the tips of the branches, appears to be due to the fleshy pulp and the polyps themselves, not to the polypidom.

Found from time to time, winter and summer, thrown up on the beach on Sullivan's Island. A beautiful tuft of this species is in the Museum of the College of Charleston, taken by Prof. Holmes at one of the wharves of the city.

AGLAOPHENIA TRICUSPIS. *nov. spec.*

This species grows in solitary plumes, much taller than those of *A. pelasgica* and shorter than those *A. cristata.* The plumes also are of broader expanse than in the latter species and the individual polyp-cells are quite different. The three cusps which are placed, as in the species mentioned, are proportionately long and slender, or, which is the same thing, the polyp cell between them is quite shallow, and its rim, instead of appearing distinct from the single cusp behind it, appears to be united with it as with the others. I have also been unable to distinguish any denticulations on the rim, and these are quite conspicuous in the other two species.

The prolific vesicles of this species are as yet unknown. This species was found growing just below dead low water mark, on the submerged rocks of one of the upper jetties of Sullivan's Island. It was taken in midsummer.

** *Polyp-cells of one kind, only more or less tubular or flask-shaped, being generally contracted at the mouth.*

DYNAMENA, *de Blainville.*

The polypidom consists, usually, of a creeping stem which gives off short branches, on which the polyps are opposite and in pairs;

one pair corresponding to each joint of the stem. The cells are triangular, or more or less flask-shaped; the aperture being quite narrow. The polyps which are capable of being retracted entirely within the cells, when protruded stretch far beyond it, discovering an elongate body.

The prolific capsules appear to be developed on the sides of the stem, between the polyp-cells, and to be usually of a form resembling, generally, that seen among Campanularidae; but in the following species I have observed from the same part of the stem the growth of very elongate, narrow, almost tubular vesicles, not much larger at the mouth than at the base, and twisted in partial spiral, like a horn. Whether, as Dalyell thinks is the case in Antennularia, there are more than one kind of vesicle to be found in the same species of this genus, my observations do not enable me yet to decide.

Distribution.—Seas of Europe, Charleston Harbor and East Indies.

DYNAMENA CORNICINA *nov. spec.*

This very delicate species consists of an unbranched stem, rarely, if ever, equalling half an inch in height. Each joint of the stem, with its two opposite polyp cells, instead of presenting a triangular outline, has the appearance of lateral emargination, from the fact that the aperture of the cells is slightly elongate and tubular and is continued not in the direction of the main axis of the stem, but is bent outward from it. The polyp, when extended, equals, in transverse diameter, the diameter of the cell-mouth, and its whole length somewhat surpasses twice that of the cell. At its free extremity is a circle of about sixteen, rather short and stout, but quite flexible tentacula, surrounding an oral area which, though usually of the rounded hemispherical form, which is generally characteristic of Sertularidæ, is capable of being occasionally protruded in a somewhat proboscidi form manner. Yet there is no distinct organ of this kind separated from the body by a well-marked constriction, as among Campanularidæ.

This species is found growing on denuded Gorgonia stems. The curved horn-shaped cells have been observed in the beginning of March, and in the end of June. They open in a direction at right angles to that of the ordinary sessile cells, and on the two occasions on which they were observed, they bore polyps *with tentacula*, in one instance, eight to twelve in number. That these

afterwards became medusa-bearing capsules, I saw nothing to warrant me in believing, since there were no signs of incipient buds on the stems, within the tubular cells. However, this negative observation is no proof to the contrary.

III. CIRCEADÆ. Forbes.

Form in general deeply campanulate, digestive trunk more or less elongate, with unusually deep and tubuli form digestive cavity, for the Sub-order. Mouth provided with labial tentacula. Radiate tubes probably of variable number. Sexual glands varying also from two to six. Tentacula numerous, short and very contractile. Marginal capsules present, but on account of their small size and great transparency, their number and symmetric arrangement is not yet ascertained.

Development unknown. Is it from a free larva?

Remarks.—Forbes is as silent with regard to the marginal capsules in Circe as in other genera, yet their presence in the following allied genus, would make their entire absence in Circe an extraordinary peculiarity, and therefore improbable. The Circeadæ appear to me not distantly related to the following group, that of Geryonidæ.

PERSA, *nov. gen.*

General form like Circe, but broader in proportion to its height. Digestive cavity, colorless, elongate, nearly sessile upon the top of the bell-cavity, instead of being at the end of a proboscidi form appendage. Mouth with four labial appendages. Radiate tubes, eight? Sexual organs, *two*, massive, oblong, cylindrical glands, in which I did not discover any sinus of the radiate tube. These glands hang free in the cavity of the bell. Tentacula numerous, very short or absent. Concretionary capsules probably eight in number, four large and four small, alternating with each other; small, sessile and containing a single corpuscle each. There appears to me to be the same amount of difference between this genus and Circe, that exists between Eucheilota and Eutima. In the three specimens taken, I made great efforts to determine the exact number of radiate tubes and of the marginal capsules, (which latter are of that peculiar type seen in the free capsules of Liriope,) but I was unsuccessful. Of radiate tubes I saw only two with any approach to certainty, and these were those which bore the two sexual glands.

Distribution.—Charleston Harbor.

PERSA INCOLORATA, *nov. spec.*

Pl. 12, Fig. 3.

The form is deeply campanulate, or thimble-shaped, rounded above; widening very gradually downwards. Bell-wall, thin, except just above the digestive trunk, where it thickens to form a low pedestal for the digestive trunk. Digestive trunk, cylindrical, transparent, parted at the mouth into four labial tentacula, rather long for the group, each furnished with a little knot of thread-cells, on its inner margin, not far from its free extremity. These labia, when folded back, have an appearance like that represented by Gegenbaur in *Trachynema ciliatum*. This is the only mature medusa I have seen with a wholly colorless digestive cavity. The radiate tubes are extremely delicate; I could not trace them into the digestive cavity. The sexual glands were placed a little below the mid-height of the bell. They were large and rounded at their poles. The ova observed in one specimen were large, like those figured in Saphenia. The sexual organs were the only distinctly colored portion of the animal; they were of a pale yellow color. The margin of the bell was set all round with thickly crowded (thread-cell bearing?) nodes, which took the place of tentacula. I never saw these exhibit any disposition to stretch out their lashes, if they possessed them. The marginal vesicles were all small, and of two kinds; a larger sort had each a single round light-refracting corpuscle. Between every two of this kind was another smaller, and containing a less transparent corpuscle, of a somewhat granular appearance. If the capsules in Circe are as small as these, and as closely couched among the tentacular knobs upon the margin, they may very well have been overlooked by Forbes. There is a slight break in the chain of tentacular nodes at each point, where there is placed one of these sense capsules. The vail is voluminous and was always turned within the cavity of the bell, during my observation, and the numerous folds into which it was thrown, obscured the view of the other side of the bell-margin.

I have seen but three specimens of this Medusa of different sizes, but no one had more than two sexual glands, nor even a trace of more, as is the case with Eucope, when similarly deficient. These specimens had the exterior of the disk so beset with minute Diatomaceæ and Desmidiaceæ at the time of observation, that they were thrown into a state of contraction by them, and the bell acquired a certain obscurity which rendered it impossible to

trace the tubes with certainty. When contracted, and this may be a generic character, there is scarcely any longitudinal shortening of the body, but the contraction produces deep longitudinal furrows which proceed from the bell-margin up to the thickened basis of the digestive trunk. The largest of these specimens was not quite the tenth of an inch in height.

I did not ascertain any facts with regard to its embryological history.

The three specimens of this species were taken in the last week of January, on the same day. Another taken 22d of May, did not throw any further light upon the obscure characters of the species.

IV. GERYONIDÆ.

The form is, generally, more or less that of an umbrella, with a long peduncle which, according to Gegenbaur, contains in Geryonia, proper, a large cavity, interposed between the digestive cavity, proper, (which as in Tima and Eutima is terminal,) and the origin of the radiate tubes. This is probably homologous with the cavity of the slender pedicle, which in Aglaura supports the large digestive organ. In Liriope, I have not observed any such cavity. The mouth is provided with labial tentacula. The number of radiate tubes vary, but it seems to be always a multiple of two, rather than of four. The marginal canal, according to the author just cited, gives off in Geryonia proper a number of blind diverticula, which penetrate the disk centripetally, and are of various lengths. The sexual organs are large, oval, circular, or cordate sinuses in the course of the radiate tubes. They are flat and do not bulge out into the cavity of the disk, as is more or less the case with the foregoing genera. Their number probably is uniform with that of the radiate tubes. The tentacula exceed the radiate tubes in their number, which, however, appears to be still a multiple of two, rather than of four. They are usually of two sorts. The number of marginal capsules is the same as that of the tentacula, with whose bases they are connected. This connection in Liriope is, as in Obelia, *asymmetrical;* and probably closer inspection would show it to be so in all cases. In Liriope occurs a singular instance of a double marginal capsule, which is also connected in an unusual manner with the outer surface of the disk.

The development of the Medusæ of this group, which are by no means uncommon, has never yet been observed. This suggests the probability that it is a direct metamorphosis from a free larva.

LIRIOPE. Lesson. (1843.) Gegenbaur. (1856.)

Lesson is entitled to no more than the name of this genus, having, in reality, failed to distinguish it from true Geryonia. It is Gegenbaur's Liriope which I here adopt, and which corresponds to the Geryonia of Forbes. General form resembling that of *Eutima mira;* the peduncle of similar conical form, terminating in a digestive flower-shaped organ, with four (or six?) oral leaflets. The sexual organs occupying four or six (?) heart-shaped or circular sinuses of the radiate tubes and located in the disk. Tentacula eight, and of two sorts, four long and four short, the short being provided with a series of thread-cell bunches. Concretionary capsules of two sorts, a small round vesicle containing a concretionary corpuscle at each of the shorter and complex tentacula, and at each of the longer and simple tentacula a double capsule, consisting of two cysts, one above the other, and connected by an intermediate (tubular?) thread, apparently a continuation of the membrane of the cysts.

The embryology of this genus is as yet unknown. The same may be said of Geryonia. Both of them, however, are by no means very distantly related to Aequorea, and this latter has very evident relationship with the Aeginidæ, from the form of its digestive cavity and mouth, the number of its radiate tubes and concretionary capsules. These capsules in Liriope also are unusual in number and complication, when compared with the Eucopidæ, and it further resembles the Aequoreæ and Aeginidæ in the remarkable transparency of its uncolored parts. The very large sinuses of the generative organs certainly also remind us of the large lateral pouches devoted to the same functions in Cunina. Still the position of these organs, as well as the form and position of the digestive cup at the end of a proboscidian prolongation, certainly bring us back to the Eucopidæ, more especially the genus Tima. The true position of the two genera, then, lies between the Eucopidæ and the Aeginidæ, and their embryology will settle the question which of these groups they most nearly approach.

Distribution.—Mediterranean, British Seas, Indian Ocean, (?) Brazil, (?) Carolinian Coast.

LIRIOPE SCUTIGERA, *nov. spec.*

A very transparent and rather small species. Its most distinguishing character is the great size and circular form of the generative organs. They are four in number, and are so large that

they very nearly touch each other laterally, and stretch very nearly from top to bottom of the disk-cavity, thus occupying almost the whole inner surface of the bell. When viewed from above, their unyielding structure gives the disk a quadrate outline, and viewed in profile they appear as large circular shields, especially when at the death of the animal they assume a marked white coloration. The proboscidian elongation of the disk is rather slender below, increasing in diameter rapidly above the digestive cavity; the oral leaflets not so long as in *Eutima mira*, and the four extensile tentacula, I do not recollect ever to have seen stretched more than twice, occasionally, perhaps, thrice the length of the trunk, including the height of the disk. The upper surface of the umbrella is usually very spherical and smooth, sometimes, however, the outline viewed in profile becomes somewhat emarginate in its descent from the vertex to the tentacular rim.

This species is evidently gregarious, great numbers being found together in nearly every instance when I have found it at all. It is bold and rapid in its movements and very rapacious. I have seen one of this species so extremely diaphanous as to make the impression of nothing but a set of outlines—sieze upon a small fish fully thrice as large as itself, and securing itself by spreading out its lips upon it, making them act as suckers, and then entangling about the poor animal its four long tentacula, hang on in this manner despite the violent struggles of the fish, which alarmed swam violently about the jar, until at last apparently from sheer exhaustion, it was evident he was dying. At last changing color, the fish turned over on his side and expired.

I have found specimens of this species from time to time during five months of summer, beginning with the first week in June and ending with the last of October. It may be considered one of the most common of our species.

V. AEGINIDÆ.

In the present state of our knowledge this is the most aberrant and distinctly characterized group of Hydroidea. It is at the same time the lowest in type, both as to structure and development. The general form for the most part is flat and discoid, sometimes thickening into a more hemispherical shape. The mouth is usually simple, the digestive cavity broad, flat, and imbedded in the disk. Radiate tubes rudimentary or altogether wanting. No marginal canal. Sexual organs so far as known,

in the periphery of the digestive cavity, where there are usually broad diverticula of that cavity for their reception. The muscular portion of the bell is represented by a narrow circle of lobes around the digestive cavity, to which on their lower margins is attached the vail which is very distinctly developed. There are no ocelli, but concretionary capsules exist in profusion and in very variable number. The tentacula are in comparison to those of most Hydroidea, stiff and wanting in contractility.

The development is known in *Aeginopsis mediterranea*, and the species of Cunina described below. We should probably also include here the development of *Stenogaster complanatus*, (Kölliker.) The polyp is directly metamorphosed into the Medusa, though multiplication by budding goes on during the metamorphosis in Cunina. In the cases of Cunina and Stenogaster, the larva lives as a parasite in the cavity of another Medusa's bell.

The type of this family is synthetic. It belongs to the Hydroidea, but it has analogies which ought not to be overlooked with the Discophoræ, in the broad imbedded digestive cavity, the position of the sexual organs, and the frequently pendent and slashed vail. Indeed, it is impossible sometimes to avoid being struck with the resemblance between a Cunina and some forms of Ephyra.

CUNINA *Esch.*

Disk more or less broad and low. Tentacula placed each at the end of one of the diverticula from the stomach. Every other character in this genus as at present circumscribed is inconstant. The diverticula, tentacula and concretionary capsules, vary in number among the species. The form of the diverticulum varies from that of a broad tube (*C. vitrea* Gegenb.) to a subquadrate form, which is more usual. Gegenbaur mentions that the broad vail is perforated by several canals which originate in the diverticula of the stomach and end blindly near the margin of the vail. This would constitute a still nearer approach to the Hooded-eyed Medusæ. I saw nothing of this kind in the species about to be described. Larva, a free hydra, like the free stage of the Tubularia; embryo moving about by its tentacula. The stem end of the body flat—the oral prolonged into a siphon-like appendage, terminated by the mouth. Development a homogony. The larva is parasitic.

CUNINA OCTONARIA, *nov. spec.*

Pl. 12, Fig. 4–5. Also, Pl. 4, 5, 6 and 7, Proceedings Elliott Society, vol. 1st.

This species has somewhat the form of *Cunina lativentris* Gegenb. It is rather pointed above. The muscular lobes are eight in number. Tentacula and diverticula of the digestive cavity, the same in number as the muscular lobes. Tentacula alternately long and short. The concretionary capsules are three on each lobe, that at its apex being largest. Each contains from two to three corpuscles. Above each of these is a small, fleshy tubercle, like that described and figured in the Larva found in the bell of Turritopsis. The animal is little less than a third of an inch in diameter.

The digestive cavity is more than half the diameter of the disk, and surrounded by a sinuous wall of a yellow color, forming diverticula, which evince a tendency to increase in breadth as they recede from the cavity. They preserve, however, a nearly quadrate form, their breadth being nearly equal to their length. The mouth may be expanded until it equals the stomach in width or contracted into the four lobed form exhibited in the drawing, pl. 7, fig. 32 *c*. The spaces between the diverticula are quite open. Across these, from one diverticulum to the next, stretches a band of slightly darker color than the surrounding tissue, fig. 4, pl. 12. Compare this with the chain of cells figured pl. 7, fig. 34, *x*. of this volume. The eight muscular lobes are, more or less, gibbous in appearance and are separated from one another by ascending portions of the vail which reach the bases of the tentacula. On their outer margins they bear, each, three concretionary capsules; the middle one of which is the largest and always contains two corpuscles. The other two, smaller, are lateral and contain, each, two or three small corpuscles. Over each one of these organs is a small fleshy tubercle, like that figured, over the single capsule in the young medusa, pl. 7, fig. 34, *p*. That, over the middle capsule, is again the largest. The eight tentacula though differing but slightly in size, are still very distinctly different from each other in this respect. The four greater ones are in length about half the width of the disk—the four less are a little shorter. The difference, however, is rather more distinct in their conical pointed insertions, which project each, into a corresponding diverticulum of the digestive cavity. This structure in the long tentaculum reaches nearly as far inward as do the walls which sep-

arate the diverticula, while that of the less tentaculum is decidedly shorter, fig. 4. The tentacula are rather stiff, commonly carried slightly bent downward. They have the marked transversely striate structure, which is so conspicuous in Ægenidæ.

I cannot doubt, from the identity of general form, of the number of lobes and alternating tentacula, that this species is the same as that found parasitic in the bell of Turritopsis, and which from the analogy of Tubularia I was at first induced to look upon as the young of *T. nutricula*. The principal difference between the oldest form figured in pl. 7, and that here described pl. 12, fig. 4–5, is that in this more mature form the diverticula are quadrate and deeper, and the muscular lobes, instead of a single capsule and tubercle, each, are provided with three capsules and three tubercles each. This, I think, merely a difference in stage of growth. If this be true, Cunina octonaria is probably first a free swimming planule which seeks the bell of *Turritopsis nutricula*, developes two tentacula, and a tubular mouth, which it uses to draw food from the stomach of its foster-parent. It developes there four, and at last eight tentacula, beneath which grows a medusa-disk with concretionary corpuscles, then assumes the form of a proboscidian medusa, becomes free, and at last by the shrinking of the oral tube, becomes a flat Aeginoid medusa.

The specimen figured is the only one I have taken at this state of maturity. Its motion in swimming, though not very swift, is very lively, being effected by many rapidly repeated strokes, and has more resemblance to that of an Ephyra than of any Hybroid medusa with which I am acquainted. It was taken in the beginning of August. The larvæ were observed in the bell of Turritopsis from the early part of July to the middle of September.

Concluding Remarks.—At the close of these descriptions and in review of the characters assigned to the various groups of genera, the single remark should be made, that it is probable the greater and more inclusive groups, viz: Corynidæ, Velellidæ, Tubularidæ and Siphonophoræ, among Endostomata, with Campanularidæ, Sertularidæ, among Exostomata, will, as our knowledge increases, appear to be founded on less palpable distinctions than at present seem to divide them from each other. These distinctions are drawn principally from characters of the larvæ, and in certain instances we may already see that these groups of embryonic forms exhibit a tendency to pass into each other by insensible degrees.

For instance, Stauridium is a link of close connection between Tubularidæ and Corynidæ, and researches into the embryology of Velellidæ and Siphonophoræ, coupled with the discovery of new forms may lay open to our view closer connections with the two former groups than are yet apparent. In fact the free floating larva of Nemopsis, with its medusa-buds, may already furnish a suggestion as to what may possibly be the unknown embryonic condition of the Siphonophoræ. And this is not rendered less probable by the fact that Lizzia which belongs to the same group, (Hippocrenidæ) as Nemopsis, exhibits an instance of the same tendency to gemmation in the medusa-stage, which is characteristic of all the genera included at present among Siphonophoræ. Whether the dividing line now drawn between the larval forms of Campanularidæ and Sertularidæ, will always remain as distinct as it seems at present, must be determined by future researches, but my own observations lead me to suspect that it will not. With regard to such minor groups as Circeadæ, Trachynemidæ, Stomobrachidæ, Geryonidæ and Æquoridæ, the embryology of only one of them, Trachynemidæ, is even yet guessed at, and that exhibits some analogy with the embryology of the Æginidæ, a very different group. The very fact that researches hitherto among fixed Hydroids have not yet discovered the larvæ of these groups, renders it probable that, like those of Trachynemidæ and Æginidæ, they are free swimming Hydroids. Yet the forms of these minor groups, (though the discovery of new genera may possibly diminish their number, by uniting two or more of them,) are in the main quite distinct and probably sufficiently so to distinguish them as families, even should their embryology be found to exhibit a character common to them and the Æginidæ.

I therefore reiterate the remarks made at the opening of these descriptions, that the families of Hydroid Medusæ will probably be found more numerous than those which have hitherto been founded among the fixed hydroids, the Siphonophoræ, and the free, oceanic Exostomata. In other words, that the greater groups which, in this monograph I have endeavored to distinguish as faithfully as possible, in accordance with such information as I have, will be found untenable in a natural classification, and that the minor groups, considerably modified, perhaps, from the form in which I have at present given them, will be, nevertheless, found to be the true family groups of Hydroidea.

Geographical Relations.

In considering this subject, two sets of relations present themselves between different Faunas, and these may be termed, 1st, continental relations; 2d, isothermal, or climatic relations. The first are those typical relations which, existing between all the genera composing the Fauna of a continent, impart to that Fauna an idiosyncrasy distinguishing it from the Faunæ of other continents. The second are those analogical relations found generally between the specific forms, more rarely between the groups of higher value, which belong to the same isothermal zones, but to different continents. Lastly, there are certain relations which are established by comparatively accidental circumstances, such as the course of oceanic currents, &c. All of these relations appear to find exemplification in the Fauna of Charleston Harbor, so far as regards the Hydroid Medusæ.

There are but two harbors in America whose Medusæ have yet been made known, namely, those of Boston and Charleston. In the former, from its northern latitude, we should naturally expect to find a less variety of genera and species than in the latter. Yet it is probable that Prof. Agassiz' forthcoming work will give us a knowledge of a greater number of forms than were described in his admirable memoir before quoted, devoted as it was more especially to an investigation of the structure of certain species, than to a combined view of all the genera comprised in the Fauna of Boston Harbor. Nevertheless, we see that the genus Hippocrene, as distinguished from the European Bougainvillea, is common to both Boston and Charleston Harbor. The Fauna of Grand Manan, as made known by Stimpson in his valuable paper, published in the Smithsonian Contributions to Knowledge, does not differ from that of Boston, except in the presence of the genus Acaulis, which has not yet been noticed from any other locality. The Fauna, of Long Island Sound, also, is partly known through the joint contributions of Ayres, Agassiz, and Leidy, and if it is not premature to form conjectures from only partial knowledge, we may consider it different from the Fauna of the eastern shore of New England.* In it we find the genus Nemopsis, which has also a representative in Charleston Harbor, but has not yet been

* The genus Clava, however, not yet observed in Charleston, is found on both shores of New England.

observed in Europe or elsewhere. In Charleston, the following genera are peculiar: Corynitis, Depŭrena, Eutima, Eucheilota, and Persa. The genera, so far known only in America, therefore may be summed up as follows:

American.		*European.*
Acaulis,		
Hippocrene,		Bougamvillea,
Nemopsis,		Lizzia,
Corynitis,		
Dipurena,	With which may be compared	Slabberia,
Staurophora,		
Eutima,		Tima or Geryonopsis,
Eucheilota,		Eucope,
Persa,		Circe.

Without noticing further the characteristic genera of Europe, these will serve to distinguish the continental types of the two Faunas.

Between the subdivisions of these continental types we find climatic analogies, shown by the correspondence of certain generic, or, at least, sub-generictypes, between the Faunas of those parts belonging to the same isothermal zones. Tubularia and Sarsia are the only genera found in both the Northern and Southern Faunas of both the continents, unless further research should show that this is the case with Obelia and Campanularia. But the Sarsia of Boston Harbor is more analagous with those of Northern Europe, while that of Charleston Harbor is strikingly like that of the Mediterranean. The genus Tiaropsis is found on the Northern seas of both continents, but is absent from the southern. We find a similar analogy between the Tubularidæ of the two continents, for there is so strong a resemblance between the Tubularia described by Kölliker from Messina, and the *T. cristata* of this paper, as to render it difficult to separate them from mere written descriptions.

We may, perhaps, take the isothermal of 50° Farh. as an approximate boundary line between the northern and southern Faunas of each of the two continents. This would divide the British Fauna between the two zones, and there is actually a mingling of the characters of the two Faunas in the Fauna of Great Britain. But it is remarkable that of the four Sarsiæ described by Forbes, the three which have more or less long digestive trunks, and are, therefore, members of the same sub-genus as the *S. mirabilis* of Boston Harbor, were like the last species found north of the isothermal of 50°; while *S. prolifera*, the only species agreeing with Gegenbaur's *O. thelostyla* and *S. turricula*, of this harbor, by the presence of a short digestive trunk is found just south of this isothermal

at Penzance Bay. On our American side of the Atlantic this difference also exists, the only genus found on both sides of Cape Cod being Clava,* so far as at present known. While from Long Island Sound southward we find the genera Nemopsis, Pennaria and Hydractinia, the two latter appearing to be represented by one species from Point Judith on the coast of New Jersey to Charleston Harbor. The mean annual temperature of Charleston Harbor is about 66°, nearly the same as that of Sicily. Accordingly, leaving out the genera peculiar to each place, we find the following, so far as is at present known, common to the Harbors of Messina and Charleston: Turritopsis, Tubularia, Zanclea, Sarsia (short trunked), Porpita, Diphyes, among Endostomata. Among Exostomata, besides Eucope proper and Eucheilota, which are representative genera, we have Campanularia (proper,) Obelia, Liriope and Cunina, common to the two. To these may be added Saphenia, Pennaria, Eudoxia and Physalia, common to the Mediterranean and to Charleston Harbor. Some of the species which represent these genera between the two regions are very similar to each other. This is the case between *Pennaria tiarella* and *P. Cavolini*, *Sarsia turricula* and *Oceania thelostyla*, *Tubularia*———and *Tubularia cristata*, *Campanularia noliformis*, and *Eucope campanuliformis*. There appears to be, therefore, a natural analogy between the Faunas of the Mediterranean and of our South Atlantic coast. And taking the zone whose approximate boundaries are the isothermals of 50° and 66°, we find that in America it includes the coast from Long Island Sound to Charleston, while in Europe it stretches from the southern coasts of Ireland and England, including its northward prolongation, up the Irish channel, to the coast of Africa, the mean annual temperature of Alexandria in Egypt being nearly that of Charleston. In Europe the following genera appear to be common to the northern and sourthern parts of this zone: Oceania, Turritopsis, Cladonema, Sarsia, Lizzia, Diphyes, (?) Agalmopsis, Eucope, Thaumantias, Liriope, Aequorea, (?) Obelia, Campanularia, Physalia; Velella and Porpita, probably have their northernmost limit rather southward of the isothermal of 50°.

In comparison, then, the Faunæ of these zones, in the two continents, saving their continental peculiarities, may be con-

* As to Laomedea and even Campanularia, as ordinarily circumscribed, we cannot speak with an approach to certainty; there is every probability that in each of these, not yet sufficiently investigated groups, two or more genera will be ultimately distinguished, so soon as their medusæ become sufficiently known.

sidered as analogues the one of the other; and whilst the analogies of Charleston Harbor appear to be greatest with the Fauna of the Mediterranean, it has, nevertheless, strong relations with the Fauna of the English and Irish channels, which merit attention. On the other hand, Pennaria, which, so far as I am acquainted with the subject, is on the European side, known only from the Mediterranean, is in America found as far north as the isothermal 50°, and as far south as the isothermal of 66°, thus establishing a sort of relation between the Mediterranean and the northern part of this zone in America. Again, between the southern waters of Great Britain and Charleston Harbor, there are not only strong analogies, but it is doubtful whether some of the species are not identical. The genus Willsia has but two known representatives, and these are natives, one of the south coast of England and the other of Charleston Harbor. The three representatives of the genus Turritopsis are found, one in the Mediterranean, (*T. flavidula*) one on the coast of Devon, (*T. pusilla*) and one in Charleston Harbor, (*T. nutricula.*) Of Saphenia, two species are found in the Mediterranean, two in the British channel, and one in Charleston Harbor. The last, *T. apicata*, is so like the *T. Titania*, from the coast of Devon, that it may be doubted whether subsequent research will not prove them identical, and at least they are representative species. It is likewise doubtful whether the *Eudendrium ramosum* of the English and Scottish coast does not extend to Charleston Harbor. I have not been able to distinguish between the *Aglaophenia cristata* of the coast of Great Britain and that of Charleston Harbor. The genus Epenthesis has probably representatives on both coasts and, Liriope is like Turritopsis, represented in the Mediterranean as well as in the British seas, and in Charleston Harbor. The conclusion naturally arises from this comparison that the Fauna of Charleston Harbor, so far as the Hydroid Medusæ are concerned, has more analogies with that of the southern waters of Great Britain, whose latitude is nearly that of Labrador, than with the Fauna of Boston Harbor, whose latitude is nearly that of Rome, and which, moreover, belongs to the same continent. This analogy can, it appears to me, find its only explanation in the Gulf Stream, which passes by our doors to encircle the coasts of Great Britain.

In conclusion, the Fauna of Charleston Harbor appears to me to present the three following geographical relations:

First. In its continental type it is identical with those of Grand Manan, Boston, and Long Island Sound.

Second. Its natural climatic analogies are with the Fauna of the Mediterranean.

Third. It has strong analogy, if not partial identity, with the Fauna of the southern coast of Great Britain, which must be attributed to the Gulf Stream.

EXPLANATION OF PLATES, 8, 9, 10, 11, 12.

PLATE 8.

Fig. 1.—*Turritopsis nutricula*—(young.)

l, the four incipient labial tentacula, three of which are seen in this profile view.

t, the mass of large transparent cells, above the digestive cavity.

NOTE.—Ocelli are present at this stage, but have not been distinctly given in the engraving.

Fig. 2, 3.—*Saphenia apicata.*

Fig. 3—contracted digestive trunk—*a*, cavity formed by the contraction of the elongate transparent portion of the digestive trunk.

o, ovaries surrounding the true digestive cavity.

Fig. 4 *to* 5.—*Zanclea gemmosa.*—(young.)

Fig. 4.—*p*, clavate appendages of the tentacula.

x, one of the characteristic groups of thread-cells, seen in profile.

Fig. 5.—Magnified view of one of the clavate appendages, *p*, fig. 4.

a, corpuscles contained in the enlarged extremity.

Fig. 6 *to* 8.—*Sarsia turricula.*—(young.)

Fig. 6.—Oldest stage observed.

Fig. 8.—Younger stage, in a somewhat contracted condition. The slight prominences, which enrich the surface, are not represented in fig. 6.

Fig. 7.—Tentaculum of fig. 7 enlarged, showing the arrangement of the tufts of thread-cells.

Fig. 9 *to* 10.—*Eudoxia alata.*

Fig. 9.—Basal medusa.

a, air chamber.

Fig. 10.—Sexual medusa.

c, the elevated crests from which the specific name has been derived.

o, ovary and ova.

PLATE 9.

Fig. 1 *to* 2.—*Dipurena strangulata.*

Fig. 1.—*l*, lower cavity of the digestive trunk.

u, upper cavity of the same.

Fig. 2.—Tentaculum magnified.

c, cavity of the terminal bulb.

Fig. 3 *to* 8.—*Corynitis Agassizii.*

Fig. 3.—Adult—*c*, terminal bulb of the tentaculum.
k, pad of thread-cells.

Fig. 4.—View of another quadri-tentaculate specimen from above; *c*, as in fig. 3

Fig. 5.—Bi-tentaculate, free stage.
* natural size; letters as in fig. 3.

Fig. 6.—Bi-tentaculate bud before separation from the larva, much magnified.
a, single large cavity of the tentaculum.
c, radiate tube.
d, digestive trunk.

Fig. 7 *to* 8.—Two positions of a still younger bud, in which the two large tentacula are just beginning to sprout; *a*, *c* and *d*, as in fig. 6.
b, sinus of the radiate and circular tubes, at one of the points whence the two additional tentacula are to spring.

Fig. 9 *to* 11.—*Willsia ornata.*

Fig. 9.—Magnified view.
* natural size.

Fig. 10.—Chain of thread-cells which rises from the margin along the outer surface.
a, terminal group of a chain.
b, group which has resulted from the union of two or more smaller groups by contraction.

Fig. 11.—Small portion of the border of the labial circle magnified.
a, one of the larger thread-cells.

PLATE 10.

Fig. 1 *to* 7.—*Nemopsis Gibbesii.*

Fig. 1.—Adult magnified, with (*s*) fully developed sexual organs. Magnified Drawn from nature, by H. Bosse.
c, one of the pair of clavate tentacula.

Fig. 2.—Somewhat younger specimen with (*s*) less developed sexual organ. Drawn from nature, by H. Bosse.

Fig. a.—1, enlarged view of the compound tentacular bulb, showing the ocelli at the bases of the clavate tentacula.

Fig. 3.—Still younger specimen with (*s*) sexual organs confined to the neighborhood of the digestive trunk. Drawn by H. Bosse from nature.

Fig. 4.—Young medusa just after separation from the larva. *s*, mass representing the digestive trunk, and future sexual organs.

Fig. 5.—Bud just before separation. *a* one of the four compound tentacular bulbs with tentacula.

Fig. 6.—Still younger bud; *a* as in fig. 5. No tentacula have yet appeared.

Fig. 7.—Free floating larva with buds *b*, *b*.
s, slight depression in the rudimentary stem, giving it the appearance of a sucker.
u, tentacula of the upper circle.
l, tentacula of the lower circle.
m, the mouth.

Fig. 8 *to* 10.—*Hippocrene Carolinensis.*

Fig. 8.—Adult much enlarged.

a, knobs representing contracted tentacula.

Fig. 9.—Young free medusa, with but from one to three tentacula, to each bulb.

Fig. 10.—Very young Cytæis-like free stage, with but four tentacula, and *a*, three unbranched oral cirrhi.

PLATE 11.

Fig. 1 *to* 3.—*Eucheilota ventricularis.*

Fig. 1.—Full grown specimen, natural size; representing the carriage of the tentacula, while the animal is sinking in the water.

Fig. 2.—Specimen enlarged several diameters. The sexual organs are in an abnormal condition, being represented by a plexus on one side, and by two very slight fusiform swellings in those tubes which are on the right and left side of the digestive cavity.

Fig. 3.—A magnified view of an oval, sexual gland, with its large sinus of the same form.

Fig. 4.—*Campanularia noliformis*, from beneath; showing the tentacular circle, and the arrangement of the eight sense-capsules, *a*, with regard to the radiate tubes.

Fig. 5 *to* 7.—*Obelia commissuralis.*

Fig. 5.—Young medusa viewed from above, and enlarged several diameters.

Fig. 6.—Ovary of an adult medusa. The usually circular outline is modified by the tension of the large ova, of some of which the germinative vesicles only are seen.

Fig. 7.—Small arc of the tentacular circle, exhibiting three tentacula, with their reëntrant radices. With the middle one is connected a sense-capsule, *a*, containing a single corpuscle.

Fig. 8 *to* 9.—*Eutima mira.*

Fig. 8.—Nearly of the natural size.

Fig. 9.—Portion of the marginal cord—showing the form of one of the sense-capsules, *a*, containing four corpuscles.

PLATE 12.

Fig. 1 *to* 2.—*Eucheilota ventricularis.*

Fig. 1.—Portion of the tentacular circle, much magnified.

a, great ganglion of the tentaculum.

b, smaller ganglion of the greater tubercles bearing thread-cells.

c, lesser ganglion for the small tubercles. The dark line connecting these ganglia, *a*, *b*, and *c*, is the nervous cord, which accompanies the marginal canal, *e*, through its whole circuit.

e, *e*, marginal and radiate tubes.

d, tentacular bulb.

f, *f*, the two small lateral tentacula, one of which is stretched out, and the other twisted together.

f' the enlarged and roughened termination of the smaller tentaculum.

Fig. 2.—Another portion of the tentacular circle, exhibiting *d*, a tentacular bulb, without a lash, in course of development. *a* and *f* as in fig. 1; *k*, sense-capsule of the same type as in Eutima, containing five corpuscles; *h*, its ganglion; *m*, marginal cord.

Fig. 3.—*Persa incolorata.*—The sexual organ at the right of the digestive trunk was abnormal in form. Only three of the labial tentacula are represented.
Fig. 4 *to* 5.—*Cunina octonaria*—full grown; much magnified.
Fig. 4.—Viewed from above. On the outer edge of each muscular lobe, are seen the three sense-capsules *a*. Within and above them, are the three corresponding fleshy tubercles, *b*.
Fig. 5.—Viewed in profile.

MAY 1st, 1857.

President Lewis R. Gibbes in the chair.

Prof. Gibbes exhibited a specimen of *Epidendron conopseum*, from the neighborhood of Georgetown, So. Ca., the most northern locality in which it has been found. It was there noticed by Dr. A. M. Forster. Prof. Gibbes also exhibited a specimen of *Ophisaurus ventralis*, and a copy of the Musci Exsiccati of Sullivant and Lesquereux recently issued, and just received by him.

Contributions to the Library.

M. L. A. Huguet Latour presented Reports of the Superintendent of Education for Lower Canada, 1850–1855.

An Act to provide for the better organization of Agricultural Societies in Lower Canada.

Dr. Isaac Lea, Philadelphia, presented

Rectification of Mr. T. A. Conrad's Synopsis of the family Naiades of North America.

On the new Red Sandstone formation of Pennsylvania.

Description of a new sub-genus of Naiades.

Description of a new species of Triquetra.

Description of new fresh water shells from California.

Description of twenty-five new species of Exotic Uniones.

Lieut. Maury presented Astronomical Observations United States Naval Observatory, Washington, D. C.

Academy of Natural Sciences, Philadelphia. Proceedings September, 1856, to January, 1857.

Essex Institute, Salem, Mass. Proceedings, vol. i. 1848, 1856.

Boston Society of Natural History. Proceedings, February, 1857, pp. 81 to 96.

American Philosophical Society, vol. vi. No. 56, 1856.

Correspondents Elected.

Prof. KARL THEODORE VON SIEBOLD, Munich.
Prof. ALBRECHT KÖLLIKER, Würtzburg.
Dr. FRANZ LEYDIG, Würtzburg.
Dr. HEINRICH MELLER, Würtzburg.
Maj. T. C. DOWNIE, St. Simon's Island, Ga.
J. P. POSTELL, Esq., St. Simon's Island, Ga.
Dr. GEO. SMITH, Philadelphia.
Hon. T. L. CLINGMAN, Asheville, S. C.
Dr. EDWARD HALLOWELL, Philadelphia.

Members Elected.

CHARLES D. CARR, Esq.
HENRY W. CARR, Esq.
ROBERT CHAPMAN, Jr. Esq.

MAY 15th, 1857.

President L. R. Gibbes in the chair.

Prof. McCrady said that the common opinion among naturalists with regard to the history of specific form, appeared to be, that they remained absolutely unchanged, from the time of their first creation, through all the ages of their existence. Mr. McCrady believed that no researches which could satisfactorily test the truth of this opinion had ever been made known to the world. He, himself, believed that in one sense a species always remained the same in form, viz.: that it never could, by any kind of transformation, become another species distinct from that which it had first been created. But he raised the question whether it was consistent with the analogy of nature to suppose that each specific form did

not exhibit, in the course of its history, a cycle of changes belonging to itself, and included in its original conception. The idea of the class was, in the course of its history, modified according to the laws of the development of special from synthetic types. So was that of the order, and even that of the family. The individual of any species was not the same in form at all periods of its existence, but exhibited form-changes, which, as in the case of fission, even sometimes encroached upon the notion of individuality as we entertain it. Why, then, should the ideas of the genus and the species be the sole stationary ideas? Why should they alone be excepted from the law of development? If each of these groups had a beginning and an end, why should it not have a history? a progressive morphology? Mr. McCrady thought that the question considered *a priori* resolved itself to this: whether there was anything at rest in nature? Whether, among all the ideas of the Great Morphologist, expressed in the organic world, there was one which was stationary, like a crystal, and not rather living, growing, teeming, like the germ of a plant or animal?

Member Elected.

JAMES JOHNSON, Esq.

JUNE 1st, 1857.

President L. R. Gibbes in the chair.

Prof. McCrady remarked that he had recently had the opportunity of making some incomplete observations on the embryology of a species of Bolina found in Charleston Harbor. From these observations it appeared that Bolina had not at first the singularly graceful bi-lobular form which afterwards distinguished it, but that it first exhibits the form of a Cydippe with very short ambulacra, which were confined to the upper third of the body, around the sense-capsule, which was very large. The remaining two thirds of the body were, as yet, unfurnished with circulatory tubes, and the circulatory system seemed to be represented mainly by two large quadrangular sinuses—one on each side of the apex of the digestive cavity. On a level with these sinuses, and connected

with them, were the rudimentary tentacular chambers as in Cydippe.

The President stated to the Society some of the results of his investigations now in progress into the optical properties of the Turpentines from the the various species of Pine found at the South.

JUNE 15th, 1857.

President L. R. Gibbes in the chair.

The President continued his remarks on the progress of his researches upon the Turpentines of our native Pines. These remarks, at his request, are not reported, his intention being to present them in the form of a written communication at a later day.

JULY 1st, 1857.

President L. R. Gibbes in the chair.

The President exhibited to the Society a specimen of *Xylostroma gigantea*, growing in a cleft of the wood of *Pinus australis* Michaux.

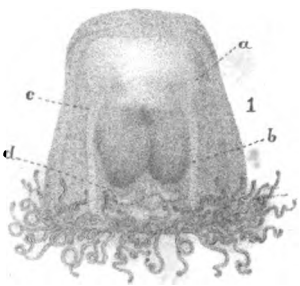
The first part of a paper entitled "*Flora of the Low Country of South Carolina*" was read by its author, W. Wragg Smith, Esq.*

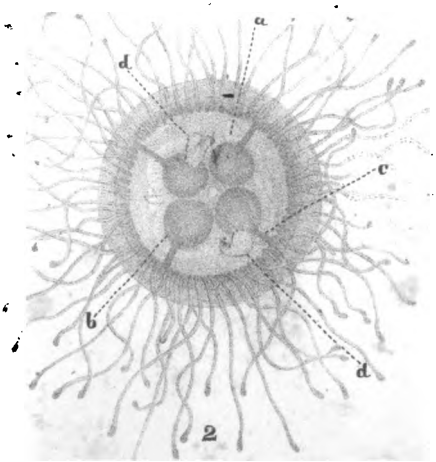
A paper on the "*Ozonicity of the Atmosphere*," by Dr. William H. Ford. The publication of this paper is postponed for the present, at the request of the author, in order that it may be presented at a later date, under another form.

William Jervey, Esq. elected an honorary member.

---

* The whole of this paper will be published by the Society, more connectedly, at a later date.

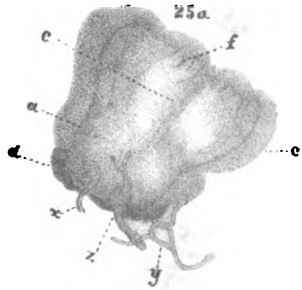




13 14 4 B A 15 a 5 7 8 12 3 9 23a 6 10

J.M'C Del. M.BURNE LITH. CHARLESTON S.C.

Oceania (Turritopsis) nutricula.



29

11

1

14

16

18

c

a

d

o

o

e

o

m

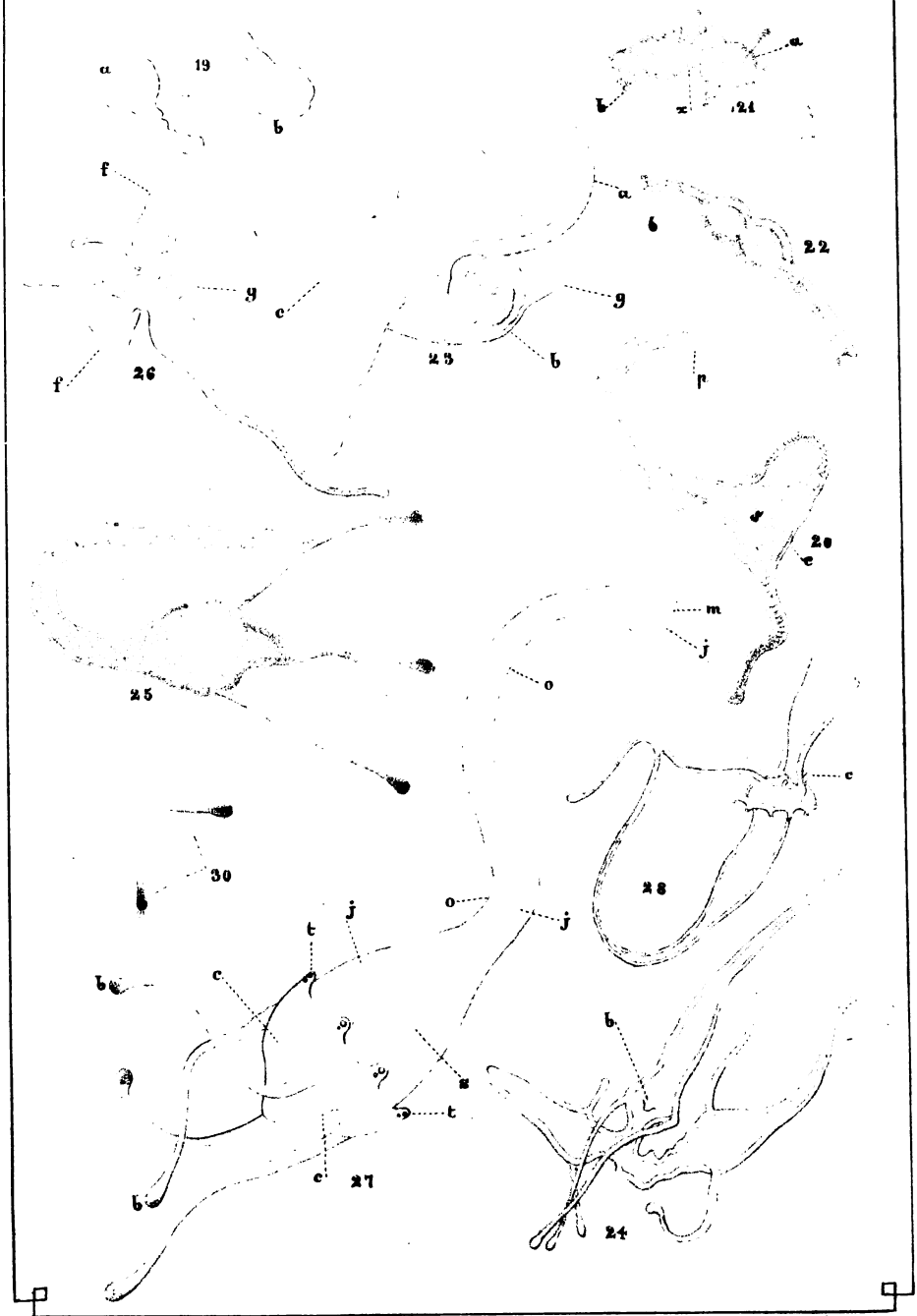
e

28 b

J.M'C Del.

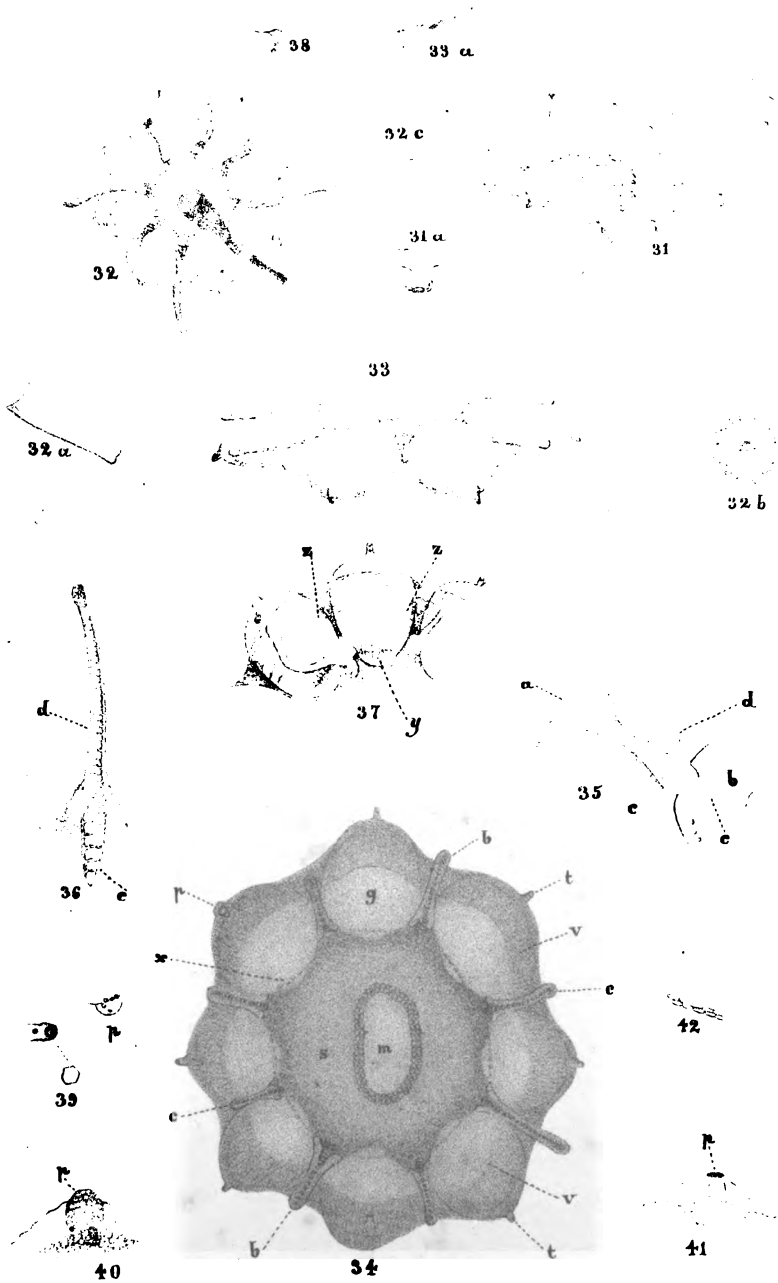
Oceania (Turritopsis) nutricula.

H.BONNE LITH.



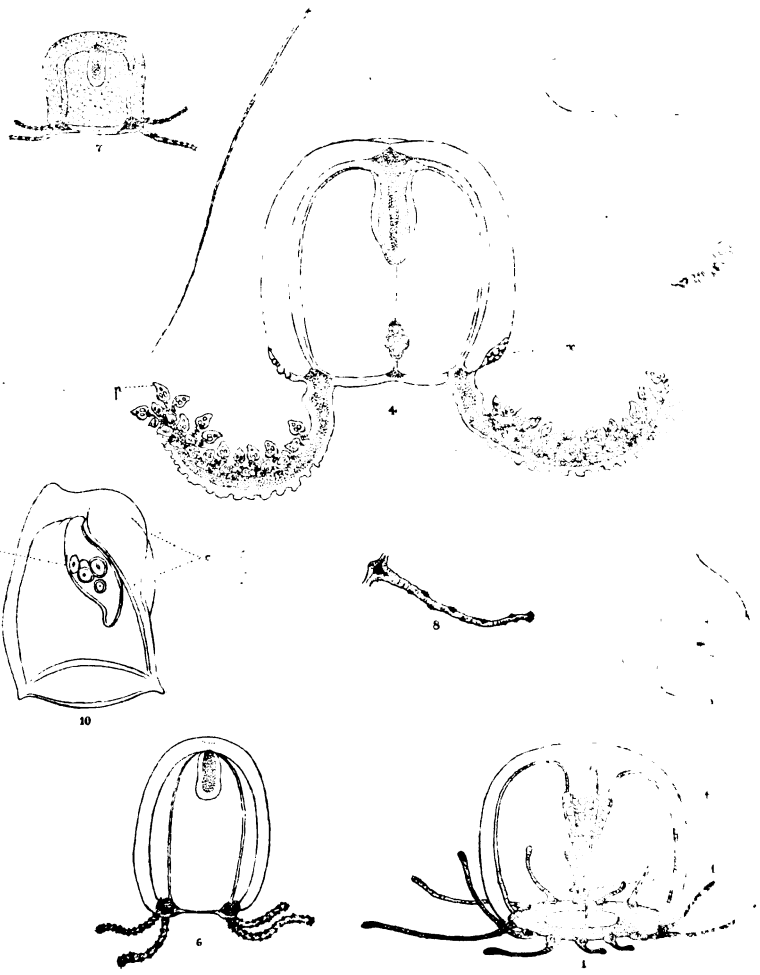
J.M^c Del. H.BOSSE LITH.

Oceania (Turritopsis) nutricula.



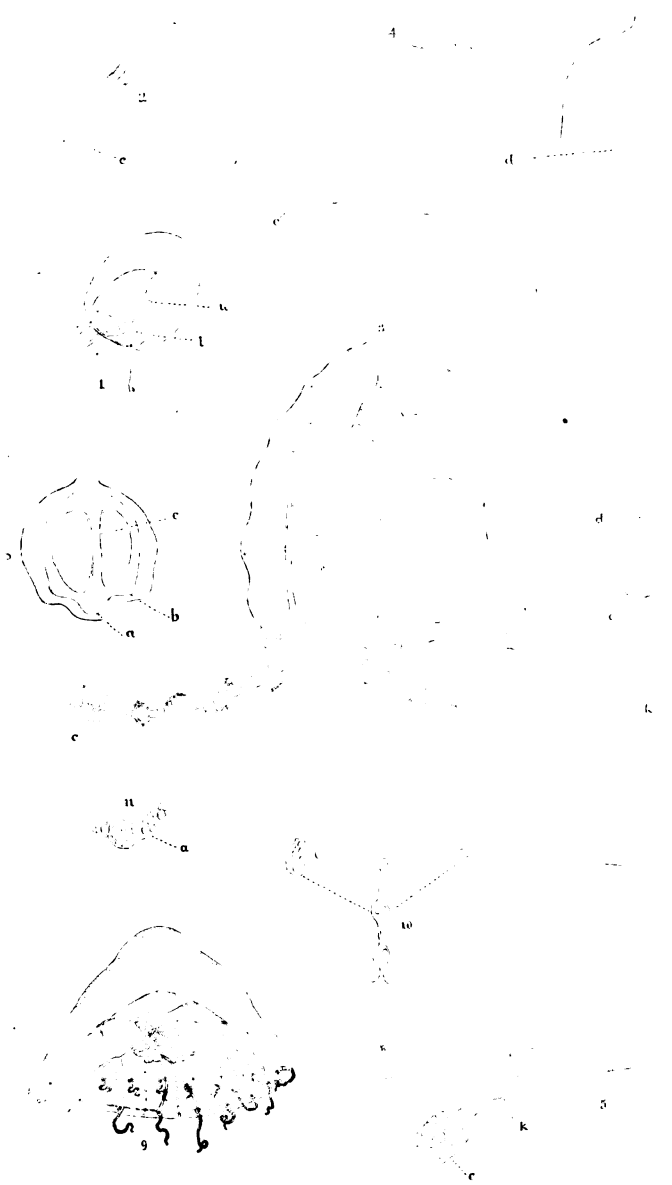
J.M^c C Del. H.BOSSE LITH.

Oceania (Turritopsis) nutricula.

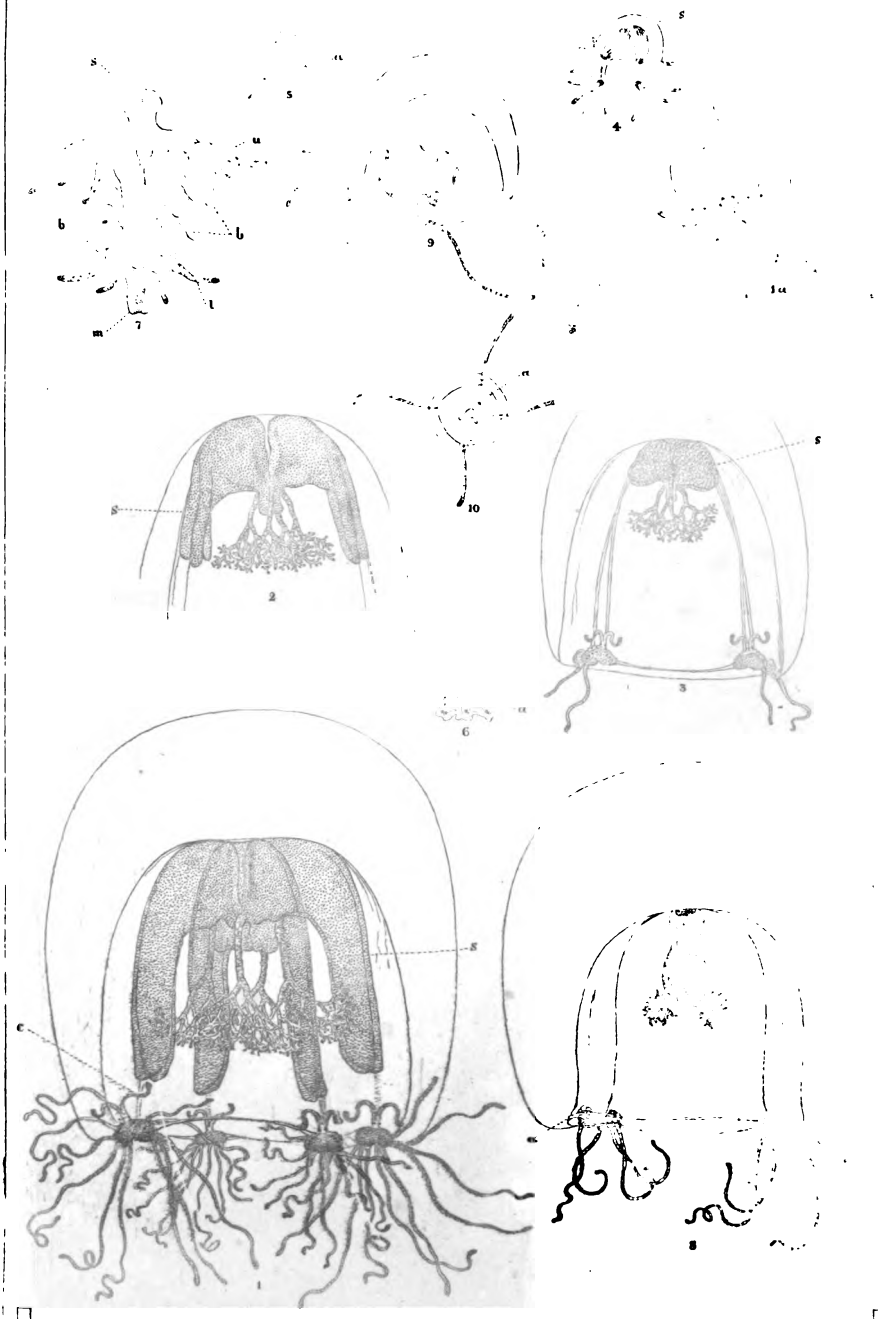


J. McCRADY Del.

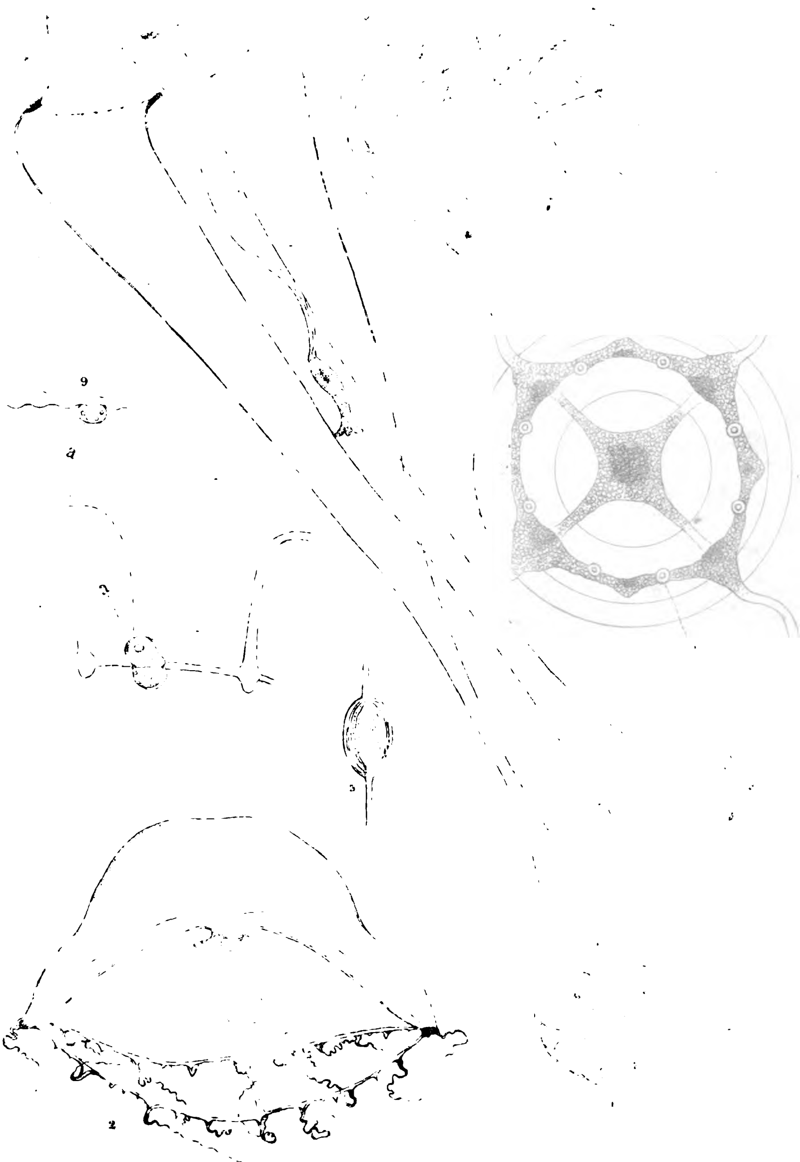
1.0. Turritopsis nutricula 2-3 Saphenia apicata 4-5 Zanclea nemmosa
6-8. Sarsia turricula 9-10 Eudoxia alata.



1-2 Dipurena strangulata 3-8 Corynitis Agassizii
9-11 Willemoesia ornata.

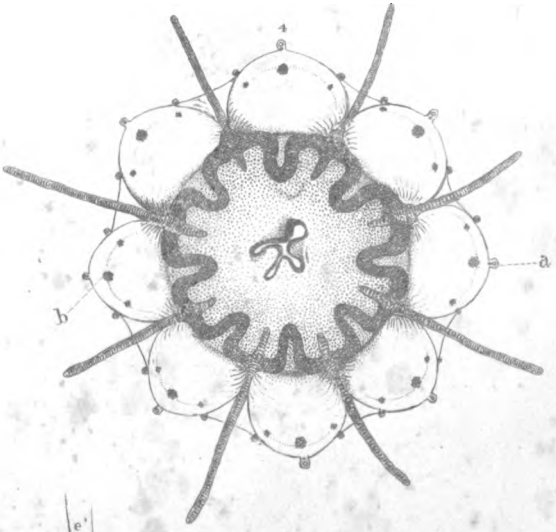


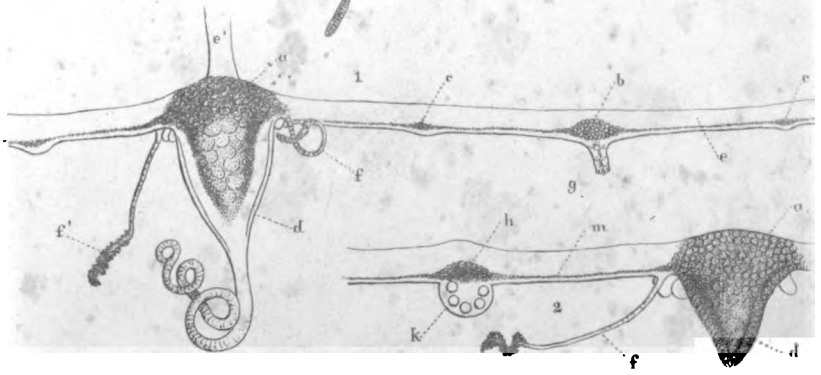
1–7 Nemopsis Gibbesii 8–10 Hippocrene Carolinensis



J.McC. delt. H.Bosse, s.

1, 2 Eucheilota ventricularis. 4 Campanularia [illegible]iformis. 5 to 7 [illegible] 8 & 9 Eutima [illegible]





1-2 Endveilota (bell-rim) 3, Persa incolorata 4-5, Cunina octonaria.