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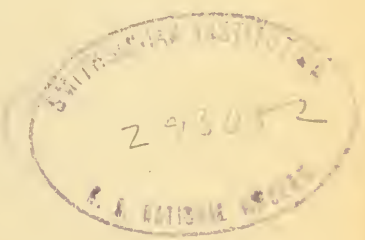
1884.

A.—INQUIRY INTO THE DECREASE OF FOOD-FISHES.
B.—THE PROPAGATION OF FOOD-FISHES IN THE WATERS OF THE UNITED STATES.



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XXXVI.—REPORT ON THE MEDUSÆ COLLECTED BY THE U. S. F. C. STEAMER ALBATROSS, IN THE REGION OF THE GULF STREAM, IN 1883–'84.*

By J. Walter Fewkes.

The wealth of marine life which peoples the surface waters of the Gulf Stream is in part made up of a rich and varied medusan fauna. This fauna has been but little investigated, considering the great number of genera which we have every reason to believe is embraced in it. Although in a general way we may conclude that many of the Northern European medusæ are carried there by the Gulf Stream, and are, therefore, identical with those of our own coasts, many others, particularly those found in warmer waters of Florida and off the Carolinas, do not make their way into these high latitudes. The Acalephs which have been collected from the eastern coasts of the United States are also, in part, inhabitants of the Gulf Stream. The jelly-fishes from New England undoubtedly have associated with these more southern medusæ many others which have been brought south from colder waters through the agency of counter currents setting from the north. The medusæ of the Gulf Stream include, in addition to those mentioned, many others, some of which are new to science; and it is the purpose of the present paper to gather together the scattered observations which have been made on animals of this group found in that part of the Gulf Stream adjacent to our eastern coasts as a contribution to our knowledge of this subject. This paper deals with medusæ known to inhabit the surface waters and those which have been ascribed to the depths of the sea. The majority of the animals which are here mentioned and described were collected by the U. S. Fish Commission steamer Albatross in the years 1883–'84. It would seem to be a most extraordinary exception if, after the floor of the ocean at great depths had been found to be peopled with life, the fathoms on fathoms of water through which the "sounding-lead" passes to reach those depths are destitute of inhabitants. Although means of definitely knowing the character of the free-swimming life were not at hand, it was certainly conjectured long ago that the water at different depths must have its quota of life. At present, if I have rightly read the accounts which have been published of

* This report is limited to medusæ from north of the Straits of Florida. The Albatross has made a large collection of medusæ in the Gulf of Mexico and Caribbean Sea, which it is proposed to describe in a paper on the Hydrozoa of these localities.

the pelagic life claimed to have been taken at different depths, we are hardly able to definitely state the peculiar characteristics or limits of different bathymetrical zones, as far as those animals which do not live on the bottom are concerned.

There is no other group of marine animals better suited than the medusæ to test the question of whether free-swimming marine animals are represented at great depths by peculiar genera or not, and even before direct observations bearing on this point were made it was pretty generally believed that a knowledge of these animals, if such there be, was destined to throw some light on questions of the bathymetrical distribution of pelagic animals. If the recorded depths from which medusæ are found can be trusted, the results of the voyage of the Challenger, bearing on this point, show that the medusan group has a great bathymetrical distribution. From new facts published in the present paper I am not sure that we can suppose certain of the medusæ recorded by the Challenger from great depths do not also live and flourish at or near the surface. It is not in the province of this paper to examine the methods by which it is known that a genus recorded from, for instance, 1,200 fathoms really came from that depth. I leave this question to the collector; but it may be well to remind the reader that the methods of determining the exact depth at which a free-swimming animal entered the dredge, or in case of a *Rhizophysa*, became entangled on the rope, may or may not be the depth of the sounding. There is a call for greater accuracy in a determination of the exact depth from which a deep-sea medusa is taken, and for an improvement of apparatus used in this kind of collecting. In the case of fixed hydroids, or such medusæ as *Cassiopea* and others, which live upon the bottom, the determination of the depth at which they live is an easy task. With genera as *Atolla*, *Rhizophysa*, and others, this determination is more difficult. The depths at which medusæ are reported in the present paper, and the same is probably true of those recorded by Hæckel, Studer, and others, must therefore be viewed in the light of what has been said above. There is no reason to deny the existence of deep-sea medusæ confined to great depths, and on the other hand nothing to show, without doubt, that the same jelly-fishes, with the exception of those mentioned, are not also found at the surface.*

The importance, from a morphological stand-point, of definitely answering the question whether medusæ are confined to certain depths is

* We can hardly hope, in the imperfection of our knowledge of the limits of the habitat of the so-called deep-sea medusæ, for an answer to the many interesting questions concerning them which are suggested by this condition of life. Of the nine Craspedote medusæ which, according to Hæckel, "have either adapted themselves by special modifications of organization to such a mode of life, or which give evidence by their primitive structure of a remote phylogenetic origin," one genus at least is known to come to the surface. *Atolla*, which is certainly one of the most striking of these genera, was taken in one instance (*A. Bairdii*) from the surface waters of the Gulf Stream.

very great. I can at present imagine no place on the globe where the uniformity of conditions under which medusæ are placed can be the same as at great depths of the ocean. I do not mean necessarily on the floor of the ocean, since that may be raised or depressed, and the varieties of conditions which come from such motions may result, but in the depth of the sea, separated from the surface by a wall of water of great depth, and from the ocean-bed by a similar wall of equal amount. Here, if anywhere, may we look for the continuance of ancestral features unmodified by environment. On this account the determination of the bathymetrical limits of free medusæ no less than that of those animals which inhabit the bottom is a most important thing, and from it should be eliminated all possibility of error. I have been struck, in looking over deep-sea medusæ with the predominance of those which are placed in the Acraspeda as compared with hydroid gonophores. This condition may spring from the fact that the former are larger and more easily seen than the latter, or from a lack of hydroid gonophores at great depths. Several observers have already noticed the predominance of the Plumularidæ and allied Sertularian genera at great depths, while hydroids with free medusiform gonophores, as far as our knowledge now goes, do not form a large share of deep-sea life. The Plumularidæ have no free medusiform gonophores, as far as known.

Of the medusæ placed among the Acraspeda which I have studied the majority are allied to the simpler genera represented by the family of Ephyridæ. These are regarded as closely approaching the ancestral form, Ephyra, from which a great group of medusæ has sprung. If it should be found, on a larger acquaintance with these animals, that they conform to the law which they seem to indicate, we may have new facts of greatest importance in the study of the phylogeny of the medusæ. It is self-evident, I think, that if medusæ are confined to certain depths and cannot penetrate below them in younger or adult stages, a development without a fixed Scyphostoma stage must be the only means of development from the egg in these genera. We may find, as in *Cunina*, commensalism or parasitism, or even a free nurse akin to that of the "mother bud" of *Cunina*, as recorded by Metschnikoff and others; but the possibility of the depth below which the animal cannot sink being the same as the depth of the bottom would be doubtful. What are the possibilities of a medusa separated by a zone of 1,000 fathoms of water, through which it is supposed that it cannot penetrate, being able to make its way to places of that depth at which it lives for its Scyphostoma to become attached? If we say that the eggs may be dropped and sink to the floor of the ocean, no matter how deep, can we still hold to the proposition that the medusa is limited to any depth? *A priori* then, if medusæ are confined to a certain depth, we must suppose that they can have an attached Scyphostoma only when brought, as planulæ or otherwise, into those regions of the ocean whose floor comes within their bathymetrical zones.

We can, therefore, predict that here we may look for medusæ with a direct development, or at all events for those with an unattached young. We know too little of the embryology of different genera of medusæ to get together enough facts to throw much light on this question. It is among those genera with which the deep-sea Acraspeda have their closest likenesses that we find a direct development, but late researches have shown that even some of the highest also skip the *Scyphostoma* stage, and have a development more like that which is called direct. The so-called deep-sea medusæ seem to me to indicate that the mode of development known as direct is the primal condition, and that the growth in which an attached form enters the series is a secondary modification; but they certainly do not prove such to be the case, and I doubt whether we can demonstrate it as far as they are concerned until the bathymetrical limits of their habitat is known.

The material used in the preparation of this paper was sent me by my esteemed friend, Prof. A. E. Verrill. It is a pleasure to acknowledge this indebtedness. I am also indebted to Mr. R. Rathbun for several interesting specimens, also collected by the Albatross. Many of these are from the Caribbean Sea and Gulf of Mexico, and will be mentioned when the collections from these regions are worked over. The present report considers the medusæ of the Gulf Stream region from Florida to the latitude of George's Banks.

ACRASPEDA, Gegenbaur, 1856.

Family PERIPHYLLIDÆ, Hæckel, 1877.

PERIPHYLLA, Steenstrup.

The genus *Periphylla* appears to be common in the waters of the Gulf Stream. It was first found in American waters by Smith and Harger over George's Bank,* and a brief notice of it was published in the *Trans. Conn. Acad.*, 1874.† In 1880 the Blake collected the same genus‡ off Cape Hatteras (*Bull. Mus. Comp. Zool.*, vol. viii, No. 7). In the report on the Acalephs collected by the United States Fish Commission in 1880–'81, *P. hyacinthina*, St., is recorded from the several localities mentioned below:

Station.	Locality.
	Off Martha's Vineyard:
936	S. by E. ½ E. 104½ miles, surface.
952	S. ½ E. 87½ miles, surface.
954	S. ½ E. 91 miles, surface.
995	SSW. ½ W. 104½ miles, surface.

The genus *Periphylla* is represented in the collection of 1883–'84 by many specimens, which differ so much in outward appearance, in color

* Its most northern observed limit on our east coast.

† The medusa referred to ? *Carybdea periphylla* is the same as *P. hyacinthina*, St.

‡ The medusa referred to *Dodecabostrycha dubia*, Brandt, is *P. hyacinthina*, St.

and form, that I have placed them in two species. These may later be generically divided when live specimens are studied.

The two marked differences in these specimens are as follows:

Certain of them have a brown color, with central disk and corona on the exumbral side, very rough, apparently covered with coagulated slime (?), and with the central disk conical and of small altitude. The specimens referred to *P. hyacinthina*, St., have the bell walls more transparent, and the purple color is seen through the bell walls.

These differences might at first be ascribed to the state of preservation of the specimens, but this is improbable since from Station 2036 we have in the same bottle two of the brown and one of the well-known purple *P. hyacinthina*. The brown species is very much smaller than the majority of the examples of *P. hyacinthina*.

Periphylla humilis, sp. nov.

Specimens examined.

Catalogue numbers.	Stations.	Locality, N. lat.	W. long.
		° ′ ″	° ′ ″
8089	2030	39 29 45	71 43 00
9185	2036	38 52 40	69 24 40
9365	2038	38 30 30	69 08 25
9315	2039	38 19 26	68 20 20
9320	2044	40 00 30	68 37 20
9280	2050	39 43 50	69 21 20

The bell is low conical, with diameter double its height. The surface of the umbrella brown, rough, opaque. The central disk and corona of uniform color. Diameter of largest specimen, 18^{mm}, when marginal lobes are expanded; diameter of central disk, 2^{mm}. Diameter of the smallest specimen, 8^{mm}.

When seen from above, the exumbrella is found to be divided into two regions, separated from each other by a coronal furrow. The central region, "zona centralis," "discus centralis," occupies the central portion of the umbrella, while the "zona marginalis" bears the four marginal sense-bodies and the twelve marginal tentacles. The discus centralis is of low altitude, conical, sometimes nearly flat, rounded at the apex. In one or two specimens the elevation of the apex is inconspicuous. No apical opening was seen. The margin of the discus centralis is entire, without sulci radiales. In the largest specimen large (abnormal?) gelatinous white or translucent warts occur on its sides and outer surface.

The zona marginalis in alcoholic specimens is carried at the same angle to the vertical axis as the sides of the conical "discus centralis," forming a continuation of the former, and in one or two specimens it is at right angles to the vertical axis. In most of the specimens the color of this region is like that of the discus centralis, although it has sometimes a blue and light green color.

The zona marginalis is crossed by sixteen incisions, which extend

radially from the vicinity of the coronal furrow to the abaxial points of the marginal lobes. The coronal furrow is generally smooth, sometimes with walls greenish in color, shallow. Immediately around the coronal furrow is a rough undivided zone, inner corona, which forms the axial region of the corona of the umbrella. The sixteen radial, coronal incisions extend from this region along the middle of the marginal lobes to the abaxial points of the same, alternating about the rim of the bell with the tentacles and the marginal sense-bodies.

By the arrangement of these incisions the base of each marginal lappet or lobe is supported by two thickened gelatinous bodies, one side (axial) of which is formed by the abaxial side walls of the coronal ditch, while the other fuses with thickened socles which support the tentacles and marginal sense-bodies. By their approximation near the free (abaxial) end of the lobe they impart to that region a pointed form. A thin membrane skirts the margin of each marginal lobe, assuming the form of a fringe. By the arrangement of the radial furrows, which are found alternating with the tentacles and sense-bodies, it will be seen that the coronal part of the umbrella is made up of sixteen gelatinous blocks, sharply marked off from each other by the radial furrows or depressions, and that these blocks are the thickened basal attachments or supports which bear the tentacles and the marginal sense-bodies. Four of these socles carry sense-bodies; twelve bear the tentacles. There are consequently three tentacles between the members of each pair of sense-bodies. The marginal lappets, when the animal is alive, are probably abaxially placed, acutely pointed, although more or less ragged in alcohol, on account of the rupture and distortion of the marginal membrane.

The tentacles are long, stiffly extended, thick at base, which commonly bears on the external surface a characteristic inflation, not unlike the warts mentioned on the exumbrella, reaching along the outer wall for a few millimeters in length. In some specimens this inflation becomes a globular sac of whitish color; in others it has a chestnut-brown color. The color of the tentacles in two specimens is a bright yellow, while that of the peculiar enlargement or inflation of the wall near the base of attachment is brown in these specimens. The constancy of this enlargement of the base of the tentacle in this species, and its almost uniform absence in the transparent species (*hyacinthina*), has led me to regard it as probably a specific character. It may, however, be of abnormal growth. The specimens are too imperfect for me to observe the character of the sense-bodies, but they probably closely resemble the same in *P. hyacinthina*, St. They are four in number, and prominent, covered above by an extended lappet or hood.

The subumbrella is made up of a central and a peripheral region, of which the former is wholly occupied by the stomach. The sixteen radial grooves or furrows of the exumbral side of the corona are represented on the subumbral side by the same number of radial furrows in the marginal or coronal umbrella region. These furrows are rendered

prominent by the bases of attachment being left in intaglio by the muscular regions which separate them. They follow the same radial course as the exumbral depressions in the marginal lappets above, and seem to indicate the points of fusion of the upper and lower umbral walls. The exumbral furrows mark the lines of attachment of ends of the muscles, which on the subumbral side are connected by a narrow zone formed of sixteen muscular swellings homologous with the coronal muscle of the subumbrella of *Atolla*, where, however, instead of being broken or externally depressed at its attachments, the muscle is continuous, at least in *Verrillii* and *Bairdii*. In *Periphylla* there are sixteen subumbral radial muscles separated by as many radial furrows. A radius, therefore, which passes through a tentacular base or the style of a marginal sense-body bisects one of these muscles, which together form the coronal subumbral zone. On the inner boundary of this zone begins the region of the proboscis or stomach, which occupies the whole central part of the subumbrella. The arrangement of the parts which form the stomach walls could be well studied in two specimens in which the upper surface of the bell was more or less infolded, and the coronal part brought to the level of the apex of the bell, while the stomach walls are stiffly protruded. The stomach or proboscis has the form of a sac which is made up of plates of different sizes united together. From a point cut by the radius passing through the middle member of the three tentacles which alternate with the four sense-bodies, two-thirds the distance between the center and bell margin, a thickened support for the stomach walls is found. This support spreads out into a flat plate, which, becoming broader, unites with a similar support from the next quadrant, and in that way the completed stomach wall is formed. The portion of the stomach wall adjacent to the lips of the mouth has the same color in the alcoholic specimens as the marginal lappets. The lips are destitute of marginal tentacles, although the rows of gastral filaments can be seen on the inner stomach walls, and one or two protrude outside the mouth.

Periphylla hyacinthina, Steenstrup.

Specimens examined.

Catalogue number.	Stations.	Locality.	Depth.
			Fathoms.
9724	936	Off Martha's Vineyard, S. by E. ½ E. 104½ miles.	705
9725	936		
9726	936		
9723	995	SSW. ¼ W. 104¼ miles	358
		N. lat. W. long.	
9312	2037	38° 53′ 00″ 69° 23′ 30″	1,731
9283	2043	39 49 00 68 28 30	1,467
9318	2044	40 00 30 68 37 20	1,067
9720	2044	40 00 30 68 37 20	1,067
9311	2045	40 04 20 68 43 50	373
9297	2047	40 02 30 68 49 40	389
9295	2051	39 41 00 69 20 20	1,106
9184	2075	41 40 30 65 35 00	855
8743	2110	35 12 10 74 57 15	Surface.

Sub-family COLLASPIDÆ, Hæckel, 1879.

ATOLLA, Hæckel, 1879.

(Plates I–V.)

The genus Atolla, one of the most extraordinary forms of deep-sea medusæ, is represented in the collections made by the Albatross by several specimens. It will probably be found when live specimens are studied that we have in the Gulf Stream more than two species, which are possibly represented in this collection. The differences which the several specimens exhibit are very great, but due to the state of preservation rather than to structural modifications. At present they are all placed in two species, to which I have given the names *Bairdii* and *Verrillii*.

The only known examples of this genus which have been described are five specimens collected by H. M. S. Challenger* and placed in the species *Wyvillii* by the founder of the genus.

Hæckel unites *Atolla* with a like genus, *Collaspis*, in a sub-family, the Collaspidæ,† of which these two genera, each with a single species, are the sole members.

The most important difference between these two genera lies in the structural feature, observed by Hæckel, that in *Collaspis* the genitalia are regularly distributed at equal distances from each other on a ring situated between the peripheral border of the line of junction of the proboscis and the inner edge of an inner coronal muscle (*mus. cor. i.*), while in *Atolla* these sexual bodies are arranged in four pairs, the intervals between the pairs being greater than that between the two glands which compose a single pair. In several of the specimens which are found in the collection before me and included in the genus *Atolla*, the whole lower floor of the subumbrella was so ruptured in capture that it is impossible for me to investigate the character of the genitalia and their location in reference to each other. In still others, characters of both genera appear on the same specimen, so that, from what I have seen of the alcoholic representatives and the tendency to distortion which they exhibit, I find great difficulty in separating the two genera. The resemblances between the organs which were present and the same in other specimens, where the ovaries have the arrangement characteristic of *Atolla*, have led me to refer all my specimens to this genus.

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* Report on the Scientific Results of the Voyage of H. M. S. Challenger. Zoology. Vol IV. No. II. Report on the Deep-sea Medusæ dredged by H. M. S. Challenger, by Prof. Ernst Hæckel, M. D., Ph. D.

† *Op. cit.*, p. iii. By an unfortunate typographical error in his diagnosis of the Collaspidæ, Hæckel excludes in this place the genus *Atolla* by assigning to the sub-family "16 to 18 sense-clubs" or marginal sense-bodies. *Atolla* has from (19 *teste* Hæckel) 22–28 sense-clubs as far as yet observed. The reading of the diagnosis in his System der Medusen is 16–32, which was probably intended to be repeated in this instance. In Plate 29 (*op. cit.*), Figs. 1, 2, 3, where the marginal lappets ought to be shown, they are omitted. In Fig. 4 they are represented.

The most marked character which strikes the attention in looking at the disk of *Atolla* from the aboral or exumbral side is a ring-shaped furrow or ditch (*fos. cor.*), situated at about two-thirds the distance from the center of the disk to its periphery. This ditch will be called, in our subsequent descriptions, the coronal ditch or furrow (*fos. cor.*); the central part of the disk, the discus centralis, or central disk (*dis. cent.*), and the peripheral portion the corona. The separation of the corona from the central disk by the coronal furrow has suggested the generic name, *Atolla*.

A second marked feature, which a superficial study of the exumbral side of the umbrella partially shows, is a strong peripheral muscular band (*mus. cor. e.*) which, although belonging to the subumbral side of the disk, is, in most of the specimens, by its contractions, brought into view on the exumbral side, so that it appears as a light brown ring on the margin of the subumbrella, showing through between the intervals of the gelatinous blocks which carry the marginal lappets. This muscle (*mus. cor. e.*) reaches, in *Atolla* and *Collaspis*, a most extraordinary development. The umbrella of *Atolla* in alcohol is translucent and has a bluish color, while the muscle, as may be said also in relation to other muscles in the same medusa, has an opaque, light chestnut-brown color. Between the coronal ditch and the peripheral muscle thus abnormally brought to view on the exumbral side of the disk lie two rows of gelatinous blocks, confluent below the surface, yet superficially marked off, alternating with each other, which form the corona and bear either a single tentacle or a small marginal sense-body with marginal lappets. The short, solid (?) muscular tentacles (*ta*), in many alcoholic specimens rise almost perpendicularly from the exumbral surface of the corona, while the sense-bodies are borne on quadrangular or polygonal gelatinous blocks (*soc. s. b.*), the bases of which are dovetailed into the interstices on the peripheral side of those gelationus blocks (*soc. ta*), which bear the tentacles.

Seen from the subumbral side, the large peripheral coronal muscle (*mus. cor. e.*) is found to have a greater width than when seen from the exumbral. The most characteristic feature, however, of this region is the stomach hanging from the subumbral walls of the middle of the lower umbrella. This organ is a bag-shaped structure fastened on a cross-shaped double line, with a simple mouth (*or*) opening at the free end. The stomach opens by four orifices at the angles of the cross-shaped body into an annular sinus included in the walls of the corona. In the walls of the stomach are four broad, pouch-like plates (*lb. per.*) alternating with as many narrow lobes (*lb. int.*), which are triangular-shaped. The latter fuse with the lower walls of the umbrella and form the re-entering angles of the cross-shaped attachments. On the inner surface the "phacellen" are arranged in lines and are thickly matted together in the stomach cavity, imparting a purple color to the inner walls.

Of the two new species here described, *A. Bairdii* more closely resembles *A. Wyvillii* than does *A. Verrillii*. They are easily distinguished by the narrow and long socles of the sense-bodies in the latter, and the greater prominence of the external coronal muscle as seen from the exumbral side. It must be confessed that all these features may be the result of alcoholic contraction, and it will be no surprise to me if live specimens shall show that we have here only a single species.

Atolla Bairdii, sp. nov.

Specimens examined.

Catalogue numbers.	Stations.	Locality— N. lat.	Locality— W. long.	Depth.
		° ′ ″	° ′ ″	*Fathoms.*
6723	2104	38 48 00	72 40 30	991
8743	2110	35 12 10	74 57 15	Surface.

Exumbrella.—The central disk, discus centralis (*dis. cent.*), is disk-like, with the upper surface slightly rounded. The walls are translucent, so that the appendages to the lower floor can be indistinctly seen through them. Color, slightly blue, with iron-red rust-colored patches, especially on the border of the coronal furrow. Twenty-two slight notches on the periphery of the central disk, each notch corresponding with the tentacular socle. Diameter of central disk, 53^{mm}; altitude, about 10^{mm}.

The coronal furrow (*fos. cor.*), which separates the central disk from the corona, has a reddish color in certain portions. Furrow deep, broad at bottom, slightly overarched by the wall of the central disk.

The corona or peripheral region of the exumbrella is bounded axially by the coronal furrow, and includes all that part of the umbrella on the abaxial side of the coronal furrow. It is composed of four regions, which are as follows, beginning with the most axially placed: 1. Undivided zone, whose inner walls are the abaxial walls of the coronal furrow, and whose outer bounding line is indicated superficially by a slight groove of reddish color (*m. cor.*). This zone may be called the inner corona (*i. cor.*). 2. A zone formed of twenty-two gelatinous blocks, placed side by side, bearing the tentacles, and separated from each other by shallow grooves also of reddish color. This is the zone of the tentacular socles (*soc. ta.*). 3. A zone of twenty-two gelatinous blocks, non-continuous, separated from each other by the tentacles. These blocks bear the marginal sense-bodies (*mg. sb.*), and are the socles of the rhopalia or sense-bodies (*soc. sb.*). 4. A peripheral region of the corona made up of forty-four marginal lappets, or patagia (*mg. lp.*).

1. The internal corona (*i. cor.*) is a narrow ring-shaped zone, undivided, its inner wall forming the peripheral wall of the coronal furrow. Its outer border is marked by the slight furrow (*m. cor.*) which separates it on the peripheral region from the second zone, that of the tentacular

socles (*soc. sb.*). Its division from the latter is only superficial, for interiorly its gelatinous substance is confluent with the zone of tentacular socles. In the type specimen there is considerable width to this zone. In live specimens it is probably not as broad, although the zone of tentacular socles probably does not adjoin the coronal furrow, as Hæckel describes and figures them in *A. Wyvillii.*

2. The zone of tentacular socles (*soc. ta.*) is composed of twenty-two gelatinous blocks, placed side by side, separated from each other laterally and superficially by small, shallow, radial grooves, and marked off from the inner corona (*i. cor.*) by a ring-shaped groove (*m. cor.*). The radial markings which separate the different components of the zone are superficial, and the members internally form together a solid gelatinous zone. Each gelatinous block or socle bears a tentacle. The socle (*soc. ta.*) is convex above, rounded abaxially, slightly cuneiform. Abaxially the periphery is slightly angular, with two lateral faces, and an abaxial face from which hangs the tentacle (*ta.*). The polyhedral shape of these bodies, described by Hæckel in *A. Wyvillii*, does not exist in this species, and may in his species be in part a result of contraction. The tentacles (*ta.*) vary in length, the longest projecting outside the abaxial margin of the patagia. They are stout at the base and taper uniformly to the distal extremity; tentacles flexible. On the lower subumbral side (Pl. II) they are fastened by two muscles with insertions under the coronal muscle. Width of tentacular socle, 10^{mm}; length, 5^{mm}. Tentacles, 15–20^{mm} long; 4^{mm} diameter at base.

3. The socles of the sense-bodies (*soc. sb.*) are twenty-two in number; they lie between the tentacular socles in the intervals on the peripheral margin and alternate with the tentacles. The members of this zone do not join each other. On their subumbral side lies the external coronal muscle (*mus. cor. e.*). The plane of their upper or exumbral surface is lower than that of the tentacular socles. Width, 10^{mm}; length, 10^{mm}. On the medial (abaxial) part of the exumbral surface there is a brown, crescentic-shaped body, with concavity looking outward, in which lies a marginal sense-body (Pl. III, Fig. 2). In this specimen these bodies are poorly preserved. There is nothing, however, to indicate that they are poorly developed, although such may be the case, as Hæckel has found in his species. When the medusa is seen from the exumbral side (Pl. I) only a small part of the external coronal muscle (*mus. cor. e.*) can be seen in the intervals between adjacent socles of the sense-bodies in the typical specimen.

4. The most peripheral zone of the corona is made up of forty-four thin flaps, marginal lappets, or patagia (*mg. lp.*), which as a general thing are poorly preserved. Two of these arise from each socle of the sense-body (*soc. sb.*) on the peripheral edge, and between them lies the sense-body (*mg. sb.*). Each patagium is leaf-like, with rounded rim. Length, 10^{mm}; width, 5^{mm}.

Subumbrella.—We recognize in the subumbrella (Pl. II) a large cen-

tral proboscis, around which is a zone in which are placed the sexual bodies (*oa.*). Outside of this zone is a third zone, the inner coronal muscle (*mus. cor. i.*), on the periphery of which is the external coronal muscle (*mus. cor. e.*). The very periphery is made up of the under surfaces of the socles of the sense-bodies and marginal lappets (*mg. lp.*).

Outside (abaxially) of the musculus coronalis externus (*mus. cor. e.*) the lower surface of the twenty-two socles of the sense-bodies (*soc. sb.*) and the subumbral surface of the marginal lappets show nothing peculiar. The socles of the sense-bodies (*soc. sb.*) have, however, a small, medial, radial groove, more or less reddish in color, which extends from the sense-body to the edge of the coronal muscle radially along its medial line.

The musculus coronalis externus (*mus. cor. e.*) is a very powerful ring-shaped muscle of light-brown color, not visibly marked into regions, and opaque. Width, 5mm.

Axially to the external coronal muscle there is a musculus coronalis internus (*mus. cor. i.*), a thin, transparent muscle, through which can be seen twenty-two pairs of radial clasps (*cl.*), which bind it to the lower surface of the umbrella, separating chymiferous pouches, which extend radially from a coronal "intestine" yet to be described. Each pair of clasps correspond with a radius which passes through a sense-body.

Between the inner edge of the internal coronal muscle and the line of attachment of the proboscis is a zone 10mm wide, in which lies the kidney-shaped sexual organs (*oa.*). The lower wall of this region is muscular and membranous, formed of longitudinal and radial fibers, which in eight radii become radially concentrated and form the deltoid muscles (*mus. delt.*), which separate the sexual glands from each other. The width of these muscles varies, but I do not find the regularity of this variation as marked in our species of *Atolla*, as Hæckel describes it to be in *A. Wyvillii*. In the two sexual bodies which I have figured (*oa.*), the deltoid muscle which separates them is narrower than that (*mus. delt.*) which separates the pair from an adjacent pair. The lower wall of the zone in which the genitalia lie covers the sexual glands (*oa.*), so that these bodies lie in a circular sinus, which is shown in one of the intervals which has been cut into between two glands. (See interval between upper ovary (*oa.*, Pl. II) and that at left.) Each sexual body is bean-shaped, inflated with ova, with hilum axially placed. Diameters, 12mm and 10mm. Color, chestnut brown. The internal zone of the subumbrella is occupied by a bag-shaped structure with dark blue or purple walls, which form the stomach or proboscis. The walls of this structure are formed of eight sections of two sizes. The four perradial sections (*lb. per.*) are broad and bag-shaped (25mm in breadth), tapering from insertion to the edge of the open mouth (*or.*). The interradial (*lb. int.*) sections, which alternate with these, are narrower (5mm wide), likewise tapering, and fused with the walls of the subumbrella. The bag-shaped structure or proboscis formed by the combination of these sections is

30–50^{mm} long, and is united to the walls of the subumbrella on a double line, forming a figure shaped somewhat like a Greek cross, the re-entering angles corresponding to the smaller or interradial sections (*lb. int.*), which are fused with the walls of the lower floor of the disk, forming the "cathammal plates." As nearly as could be observed, the free lips of the proboscis are smooth. The "phacellen" are in poor condition. Flakes of purple or brown color in the interior of the stomach walls are the only remains of them which are visible.

The stomach cavity opens by four orifices into a circular sinus, which lies in the corona. These openings are situated at the extremities of the cross-shaped union of stomach walls and subumbrella. The coronal sinus, sometimes called the intestine, lies between the musculus coronalis internus and the upper walls of the corona, and sends out radially twenty-two pouches of the peripheral organs. When a portion of the musculus coronalis internus is cut through, as at one of the deltoid muscles, the scalpel penetrates the coronal sinus. It is a ring-shaped recess, upon the upper wall of which—the lower floor of the disk—a ring-shaped groove, corresponding on the under surface of the corona to the coronal furrow on the upper, is seen. The coronal sinus is marked out on the upper wall in such a manner that the axial portion is inclosed above by a portion of the lower surface of the discus centralis, and the abaxial by the lower wall of the internal corona.

The twenty-two pouches which extend radially from the coronal sinus to peripheral organs pass below, or in a natural position of the medusa, above the musculus coronalis internus and the musculus coronalis externus, and are separated laterally by a pair of clasps (*cl.*), which serve to bind these structures to the lower side of the disk. The clasps lie in the radii of the sense-bodies of the umbrella margin, while between the members of a pair there is a narrow tube which extends from the coronal sinus to the vicinity of the sense body. The ultimate termini of this and the other pouches were not traced. Our specimen was not well enough preserved to follow out with satisfaction the minute structure and course of these organs in the elaborate way that Hæckel was able to do in *A. Wyvillii.*

Atolla Verrillii, sp. nov.

(Plates IV and V.)

Eight specimens of an *Atolla*, which differs from the preceding as well as from any known species, were examined. They have long and narrow sense-socles, which are more or less quadrangular, almost cartilaginous in texture. The marking, on the exumbral side of the umbrella, which separate the socles of the sense-bodies from those of the tentacles and the inner corona, as already described, are not seen in any of the specimens of *A. Verrillii.*

Of the eight specimens some are mutilated, perhaps distorted or badly

preserved. The following description was made from all the specimens. No. 2 of the tables is figured in Pl. IV, and No. 4 in Pl. V.

Specimens examined.

No.	Catalogue numbers.	Stations.	Locality— N. lat.	W. long.	Depth.
			° ′ ″	° ′ ″	*Fathoms.*
1	9182	2034	39 27 10	69 56 20	1,346
2	9181	2037	38 53 00	69 23 30	1,731
3	9314	2039	38 19 26	68 20 20	2,369
4	9183	2040	38 35 13	68 16 00	2,226
5	9301	2042	39 33 00	68 26 45	1,555
6	9317	2044	40 00 50	68 37 20	1,067
7	9309	2045	40 04 20	68 43 50	373
8	6250	2094	39 44 30	71 04 00	1,022

These specimens will be known throughout my descriptions by the Arabic numbers (1-8) prefixed to the catalogue number.

The following table represents in tabular form the number of tentacles, sense-bodies, marginal lappets, diameter of the central disk, and width of the corona in each specimen. The diameter of the central disk, measured from the inner walls of the coronal ditch on each side, seems to vary less from the action of the alcohol than the true diameter from margin to margin. In smaller specimens it is extremely difficult to tell from the abnormal position of the subumbral muscle the external limit of the corona. The measurements, therefore, of the latter part (corona) are not relatively so accurate as those of the central disk. From the nature of the case, all measurements are probably too small for living representatives.

No.	Tentacles.	Sense-bodies.	Marginal lappets.	Diameter of central disk.	Breadth of corona.
				mm.	*mm.*
1	22	22	44	45	14
2	28	28	56	45	10
3	22	22	44	18	5
4	22	22	44	40	10
5	24	24	48	14	5
6	23	23	46	21	5
7	22	22	44	21	5
8	24	24	48	25	5

Umbrella flat, discoid, with a diameter six to eight times the vertical thickness at the center. Umbrella is divided into two regions, a central disk (*dis. cent.*) and a peripheral corona. The breadth of the corona is about one-quarter the diameter of the central disk. The diameter of the central disk varies in different specimens from 14 to 45^{mm}; breadth of the corona from 5 to 14^{mm}. Between the central disk and the corona is a coronal furrow (*fos. cor.*). The inner border of the corona, which forms the outer wall of the coronal ditch (furrow), is formed by a thin yet strong muscle. There are from 22 to 28 tentacles, the same number of sense-bodies and twice as many marginal lappets.

Habitat.—This species has been collected, as shown in the above table, between latitudes 38° 19′ 26″ north and 40° 4′ 20″ north; longitudes 68° 16′ 00″ west and 71° 4′ 00″ west. It was taken from 373 to 2,369 fathoms.

Umbrella.—Two different regions of the umbrella, called the aboral or exumbral and the oral or subumbral side, can be distinguished in these specimens of *Atolla*. If the medusa is free-swimming, the former is probably uppermost as it moves in the water, but the stiff, gelatinous, almost cartilaginous character of the disk suggests that it has little power of motion in the central disk.* The umbrella is flat, discoidal, of a slight blueish tinge. The consistency of the bell is at times cartilaginous. The wall of the exumbrella is divided by a circular furrow (*fos. cor.*), which is almost as deep as the thickness of the umbrella. In two specimens well-marked radial lines or slight depressions, sulci radiales (*s. r.*), are found on the peripheral region of the central disk; in the other specimens these markings are not as plainly seen. When present the number of radial markings (*s. r.*) on the exumbral surface of the central disk correspond with the number of tentacles or marginal sense-clubs. These bodies correspond with what Hæckel has described in *Wyvillii* as the "sulci radiales." In *A. Wyvillii*, however, they are broader as compared with their length than in this species. The corona of the umbrella is seen on the exumbral side to be marked off into two zones of gelatinous blocks, the innermost zone (*soc. ta.*) bearing the tentacles; the outermost, the sense-bodies. In some of the specimens the exumbral surface of the corona appears almost smooth, in others the outer surfaces of the gelatinous blocks are rough or channeled. The external faces of the tentacular ring of blocks are more prominent than those of the sense-organs, and are well marked on larger specimens. There are as many of the tentacular blocks as of tentacles. The inner faces of the tentacular blocks are fastened to a flat circular muscle, which forms the outer wall of the coronal ditch. On each side the tentacular block fits closely upon its neighbor and fuses with it, forming a continuous ring. On the exumbral side the block is slightly convex, and on either side, extending from the upper surface to the sides which adjoin, is a small polygonal facet. The division of the tentacular blocks is superficial. The base of the tentacle occupies an abaxial facet, while the two lateral faces leave an interval into which fit the alternating gelatinous bodies of the sense-blocks. The tentacles are in most of the specimens short, stiff, and very cartilaginous. Although Hæckel describes their base as penetrated by a tube in his species, in *Verrillii* I was unable to discover any cavity or cœcal ending of a tube. On the side turned to the central disk there is a strong muscle, which arises from

* The great development of the subumbral coronal muscle indicates that *Atolla* does not resemble *Cassiopea* in living upon the bottom. It is probably a free-swimming medusa. A proboscis, like that of *Atolla*, implies food of large size, and not the small animals upon which *Cassiopea* feeds.

the face of the gelatinous blocks already mentioned, while on the peripheral side are two strong muscles, which coalesce in the smaller part of the tentacle, forming a large part of its wall, but which divide into two muscles on the base of the tentacular socle. Passing around the margin of the corona of the disk, these two muscles are inserted under the high coronal muscle (*mus. cor. e.*), which forms the marginal boundary of the exumbral side of the disk. Both of these muscles, as well as the smaller muscle on the side of the tentacle turned towards the center of the umbrella, have a brown color in the conservative fluid (alcohol), in which the medusæ are preserved.

Perhaps the most characteristic organs of the corona are the sense-clubs and the gelatinous elevations upon which they are carried. Strangely enough, of the five specimens observed by Hæckel, and of the examples which I have studied, only two have a multiple of the number four in the number of these organs. When we reflect how few known instances among medusæ there are which do not have this numerical resemblance and relationship, the exceptions become even more prominent. I believe, however, that this departure from the normal number is without morphological significance. The sense-bodies are long, narrow, borne upon the members of the external zone of gelatinous blocks (*soc. sb.*), and are of the same number as the tentacles. The bases of these organs are cubical or quadrangular pieces of translucent gelatinous character, with flat lateral faces and slightly curved upper face. In alcohol the distal ends are bow-shaped, curved downward. On each side at the free extremity there is a flat leaf-like appendage or patagium (*mg. lp.*), in the angle between which lies the sense-bulb. In most of the specimens the sense-bulb, although poorly preserved, is well developed and prominent, while the hood is inconspicuous or wholly absent. The patagia were neither as broad nor as long as in the closely allied *Wyvillii*, where, according to Hæckel, they are in the specimens which he studied "invariably torn and badly preserved." I was unable to trace the tubes from the chymiferous system of vessels into the sense-bodies, although they probably have the same course and general character as in the species *Wyvillii*.

Subumbrella.—The subumbrella is more complicated in its structure than the exumbrella, and from it hang several important structures. The tentacles, which, in a majority of Acraspedote medusæ, belong to the appendages of the subumbrella and their homologues, the sense-clubs, have been pushed around the margin of the corona to the exumbral side by the great development of a circular muscle (*mus. cor. e.*) already mentioned, as seen in part on the exumbral side, and which forms a large portion of the margin of the subumbrella. Within this large peripheral muscle, which is composed of a number of parallel layers, is a second smaller and concentric thin circular muscle (*mus. cor. i*), the inner edge of which forms the inner rim of the corona. In the species *Wyvillii*, according to Hæckel, "the subumbrella is divided in the

same way as the exumbrella, by a deeply incised coronal furrow, into two separate principal areæ, which are connected only by the thin gelatinous ring at the bottom of the coronal furrow." In most of my specimens of *Verrillii* I was able to discover this furrow on the subumbrella, but in none was it so deeply incised as in *Wyvillii*. The coronal ditch can be seen on the oval side of the umbrella, and can be used as a line of division between a central subumbral disk and a subumbral corona. The latter region is formed by two zones, an external peripheral opaque muscle (*mus. cor. e*), and an inner, thin, translucent, (*mus. cor. i*). In most of its specimens there are no deep radial furrows on the subumbral surface of the corona, and the lower surface of the corona is smooth. Through the translucent inner muscle of the corona on the subumbral side can be seen the triangular bases of attachment of the two muscles to each tentacle already described, alternating with radial gelatinous clasps (*cl.*), by which the circular muscular system or the lower floor of the subumbrella is bound to the lower surface of the umbrella. These pairs of clasps (*cl.*) lie in the same radii as the sense-bodies, and equal them in number in different specimens.

From the subumbral wall of the central disk hang some of the most important organs of the digestive and generative system. The wall itself is fastened to the lower surface of the umbrella by four gelatinous pillars, which are so broad that small orifices only remain between them. The space left between the subumbral wall and the lower surface of the umbrella is the stomach, opening by these four orifices into a coronal sinus. The walls of the subumbrella, or lower floor of the disk, are muscular, in which is a layer of circular fibres, and on the lower surface eight well-developed deltoid muscles passing over or bridging the space between the central disk and corona, thus helping to form the membrane-like body at the fundus of the coronal ditch. These deltoid muscles are 45° apart, separating the outer appendages of the central disk in the following manner:

The most peripheral set of appendages to the wall of the subumbrella is a ring of oblong, bean-shaped bodies (*oa.*), eight in number. These bodies are the ovaries, and they are found on the outer rim of the subumbral portion of the central disk. The four alternate radial deltoid muscles just mentioned separate these eight glands into four pairs, of which, consequently, there is a single pair in each quadrant. An inequality in the distances between adjacent sexual glands is one of the prime differences between the two genera *Atolla* and *Collaspis*.

The whole of the middle region of the subumbral surface of the central disk is occupied by the walls of the proboscis. In the largest specimens this portion is wholly destroyed, and only one or two of the sexual glands remained, while in the smaller I was able to investigate the main peculiarities of this structure.

The general shape of the proboscis of *Atolla* recalls that of the genus *Linerges*, and has more likenesses to that of the Ephyridæ than the cur-

tain-like folds or solid consolidated mouth-parts of a majority of the Acraspeda. The proboscis is a bag-shaped structure confluent with the walls of the subumbrella. It is free at one end and open at the opposite. This structure is fastened to the umbrella walls on a line which forms a cross shaped figure, by which four lateral extensions and four re-entering angles are formed in its external walls. The terminal opening or mouth is smooth and destitute of appendages. The external surface of the walls is quite smooth.

The walls of the proboscis are formed of eight parts, four broad alternating with four narrow. The broad lobes (*lb. per.*) are bag-shaped; the narrow lobes (*lb. int.*) flat, muscular, narrow. The former are perradial; the latter interradial. At their union a stiff structure is formed which serves as a means of common union and of firm attachment to the lower walls of the umbrella.

On three of the specimens observations were made in relation to the cavity of the disk. The mouth opens directly into the proboscis cavity, or stomach, where we find four double lines of gastral filaments. At its base the stomach cavity is slightly constricted, and from the circular recess, thus partially separated from the stomach, four openings radiate. The roof of the circular recess is formed by the under side of the umbrella, and its floor is made up in part by the subumbrella wall. Its diameter is about that of the diameter of the central disk (*dis. cent.*). The four radial openings communicate with a ring-shaped sinus, "intestine," surrounding the central cavity placed in the corona. I was unable to trace the course of certain radial pouches which were observed to arise from the periphery of the coronal sinus.

Subfamily, NAUSITHOIDÆ, Hæckel, 1879.

NAUPHANTOPSIS, gen. nov.

(Plate VI.)

Nauphanta-like medusa, with thirty-two marginal lobes, twenty-four tentacles, and probably eight marginal sense-bodies. With shallow coronal furrow, and sculpturing on the exumbral side of the corona as in *Nauphanta*. Thirty-two radial exumbral coronal furrows and the same number of rounded elevations, instead of sixteen, as in *Nauphanta*.

The genus *Nauphantopsis*, although closely allied to *Nauphanta*, differs from it so much in the arrangement of the tentacles upon the disk margin and the number of marginal lappets, that I do not hesitate to place it in a new genus. Both genera undoubtedly belong to the same family and are morphologically among the most interesting of all so-called deep-sea medusæ. The single specimen of *Nauphantopsis*, collected by the Albatross, has the central disk, discus centralis (*dis. cent.*), torn away, and with it have disappeared also the stomach and ovaries.

Still the walls of the corona are intact and the marginal lobes, with a few tentacles, are in a good condition for study.

The systematic position of this genus is in the family of Nausithoidæ, and it lies between *Nauphanta*, and *Collaspis* of the Collaspidæ. *Nauphantopsis*, more closely even than *Nauphanta*, is related to the well-known genus *Periphylla* in possessing three tentacles between two marginal sense-bodies. It probably (?) has, however, eight sense-bodies on the disk margin instead of four, as in the last mentioned genus. The sculpturing on the corona of the umbrella also resembles that of *Periphylla* in a distant manner. *Nauphantopsis* is allied to the Periphyllidæ on the one side and to the Collaspidæ on the other.

A single specimen of *Nauphantopsis* was taken by the Albatross at the following station:

Catalogue number.	Station.	Locality— N. lat.	W. long.	Depth.
9279	2038	° ′ ″ 38 30 30	° ′ ″ 69 08 25	*Fathoms.* 2,033

In my description of the species I have availed myself of what is known of the allied genus, *Nauphanta*, to which it has many resemblances in a discussion of doubtful points of structure.

Measurements.

Diameter of the umbrella.	Width of corona.	Length of marginal lappet.	Breadth of lappet.	Length of tentacle.
mm. 70	*mm.* 10	*mm.* 10	*mm.* 8	*mm.* 80

In the type specimen of *Nauphantopsis* I was unable to discover with certainty the character or number of the marginal sense-bodies. If these bodies are present they are probably very obscure and simple, as might be expected from the anatomy of those of closely related genera. As in the genus *Nauphanta*, the depth at which these medusæ occur has probably led to a reduction in the complication and size of these bodies. Three tentacles in adjacent marginal indentations were observed, arising in a position similar to that of the tentacle in *Nauphanta*. Considering the number of marginal sense-bodies as eight, as in *Nauphanta*, we find there are eight intervals or octants, each with three tentacles, or twenty-four tentacles in all.

We can hardly suppose that there are only four sense-bodies, since from their probable arrangement on the bell margin we would have twenty-eight intervals (indentations between marginal lappets) to be occupied by twenty-four tentacles, or six in each quadrant and two remaining, nor sixteen sense-bodies, since I have observed in one segment three tentacles side by side. Sixteen sense-bodies would imply only

sixteen tentacles, considering the number of marginal lappets as thrity-two. The indications, therefore, are that there are either eight sense-bodies and twenty-four tentacles, or thirty-two tentacles and no sense-bodies. I do not entertain a belief in the latter condition, but from my observation of three tentacles, following each other, consider the former as a correct interpretation. To that conclusion also the various affinities of medusa with *Nauphanta* also point. If sense-bodies are so difficult to find in a specimen the margin of which is so well preserved, we may well conclude that they are rudimentary or possibly functionless.

The genus *Nauphanta*, to which *Nauphantopsis* is most closely allied, differs primarily from it in the arrangement of the tentacles on the bell margin. Whatever the number of tentacles may be found to be by later research, the following fact is the result of direct observation: Three tentacles are found in three consecutive indentations between the marginal lappets in *Nauphantopsis*, while in *Nauphanta* a tentacle alternates with the marginal sense-body. *Nauphanta* has sixteen longitudinal furrows extending across the corona, while *Nauphantopsis* has thirty-two. There are thirty-two marginal lappets in *Nauphantopsis;* sixteen in *Nauphanta*. Hæckel describes, in addition to the sixteen deep furrows, which traverse the whole corona of *Nauphanta*, sixteen others, shallow, found intermediate between the deeper in the peripheral part of the corona and on the central disk. These smaller furrows, thirty-two in number, likewise exist in *Nauphantopsis*, but appear to be less conspicuous than in *Nauphanta*. The shape, size, and border of the marginal lappets in *Nauphanta* and *Nauphantopsis* are very different. The horizontal diameter of *Nauphantopsis* is five times that of *Nauphanta;* its height certainly from three to four times as great.

On the exumbrella the gelatinous blocks are convex, and at the peripheral part are very prominent, projecting in a considerable elevation of knot-like shape, slightly incised midway in their breadth, although the incisions are very shallow as compared with similar "shallow furrows" in *Nauphanta*. On the subumbral side of the umbrella two rounded continuations of the gelatinous blocks were noticed as forming the base or basal supports of the marginal lappets. No great variations in size of the gelatinous blocks were noticed. No regular variation by which the blocks which lie in the same radii as the tentacles are larger than those which lie in the radii in which sense-organs lie was observed in the single specimen of *Nauphantopsis* which was studied. It is certainly not as prominent, if it does exist, as in Hæckel's figures of *Nauphanta Challengeri*, Hæck.

Nauphantopsis Diomedeæ, sp. nov.

(Plate VI.)

Bell cap-shaped or high disk-shaped, with walls probably somewhat vertical, as in *Linerges*. The exumbrella is divided into a central disk

(*dis. cent.*) and a peripheral corona, by a shallow coronal furrow (*fos. cor.*). The exumbral wall of the former (*dis. cent.*) is horizontal, that of the latter somewhat inclined to a perpendicular. Corona crossed by thirty-two deep radial furrows alternating with the same number of radial rounded elevations (*soc. sb., soc. ta.*). The radial depressions alternate with the marginal lappets; the incisions on the bell margin between the marginal lappets correspond to the radial elevations.

The coronal region of the umbrella, which is the only portion of the disk of this medusa which remains, indicates that this portion is ruptured easily from the central disk along the line of the coronal furrow. The coronal furrow, however, has a shallow depth. From the resemblance of *Nauphantopsis* to *Nauphanta* the diameter of the discus centralis is supposed to be about the width of the corona. The corona when seen from the exumbral side (Fig. 2) is found to be composed of two zones, an inner of gelatinous elevations alternating with radial furrows, and an outer of leaf-like flappers or marginal lappets (Fig. 1, *mg. lp.*).

In the inner region (axial) the radial furrows extend wholly across the exumbral surface of the corona alternating with the marginal lappets, a furrow ending at the axial end of the medial line of each lappet. The rounded radial elevations (*soc. sb., soc. ta.*), which lie between the radial furrows, are sausage-like structures in half relief on the exumbral surface of the corona. If the division of these elevations into socles of the tentacles and those of the marginal sense-bodies be made, it will be found that there are three contiguous tentacular socles (*soc. ta.*) which alternate with a single socle of the marginal sense-body.

The marginal lappets (*mg. lp.*) are thirty-two in number and are rectangular with rounded free angles. Their walls are very thin except at the base, where they join the zone of the axial region of the corona, after which they increase in thickness. The axial region of the corona is formed of a confluence of the zones of the tentacles and that of the sense-bodies, which are, as we have seen in *Atolla*, sometimes more distinct or differentiated from each other.

The tentacles which remain are long and flexible, arising from the incision between the marginal lappets. In one instance three adjacent tentacles were found, from which fact I was led to conclude that there are twenty-four tentacles in all since there are thirty-two marginal lappets, and I suppose there are eight marginal sense-bodies. This reasoning is, however, based on the supposition, which accords with the facts in other genera as far as known, that the different sectors of the disk of *Nauphantopsis* resemble each other. A live specimen may show it to be false. When the corona is seen from the subumbral side we see still additional evidences that the walls of the corona are at least as perpendicular as in *Periphylla*. Through the walls of the corona, looked at from the subumbral side, the longitudinal radial depressions, which are so pronounced on the walls of the exumbrella, are easily seen. The surface of the walls of the subumbrella is, however, without protuber-

ances corresponding to the sausage-like bodies of the exumbrella. From the base of attachment of each tentacle to the abaxial end of the radial prominences there extends a short conical spur or rib which recalls similar structures in certain Narcomedusæ.

The lower floor of the umbrella (subumbrella) is made up of a powerful zone, formed by a sheet of muscular fibers scantily developed near the abaxial periphery, but larger and more pronounced near the axial border. The ovaries, stomach, and all those organs which occupy the central portion of the subumbrella are wanting in the specimen before me. They probably closely resemble the same structures in the genus *Nauphanta*.

Family EPHYRIDÆ, Hæckel, 1877.

Ephyroides, gen. nov.

(Plate VII.)

There are several small medusæ, members of the family of Ephyridæ, which cannot be identified as belonging to any described genus. In these medusæ it was very difficult to investigate the structure of the subumbrella, although in two specimens at least the umbrella on the exumbral side could be easily studied. One specimen in particular (Station 2042) shows such a characteristic exumbral surface of the disk that there was no hesitation in referring it to an unknown and undescribed genus. The distinguishing character of *Ephyroides* is the presence of from sixteen to thirty-two, or more, rounded, radial ribs on the peripheral zone of the exumbral surface of the disk, alternating with the same number of prominent marginal lappets. These elevations recall similar structures in the Periphyllidæ and Collaspidæ, but while in these families we have the elevations very broad and the radial depressions appearing as narrow trenches separating the elevations, here the elevations are narrow, forming slight ridges, while the spaces between them are broad, flat, equal to the width of the marginal lappets of the umbrella. The radial elevations on the exumbral surface of the bell recall the coronal sculpturing of the Collaspidæ and Periphyllidæ, and it may be supposed that *Ephyroides* is an ancestral genus connecting the genus *Ephyra* with such genera as *Nauphanta*, *Atolla*, and *Periphylla*.

Specimens of *Ephyroides* were collected by the Albatross at the following localities:

Catalogue numbers.	Stations.	Locality. N. lat.	Locality. W. long.	Depth.
		° ′ ″	° ′ ″	*Fathoms.*
9300	2042	39 33 00	68 26 45	1,555
9319	2044	40 00 30	68 37 20	1,067
9298	2047	40 02 30	68 49 40	389
9294	2051	39 41 00	69 20 20	1,106

EPHYROIDES ROTAFORMIS, sp. nov.

(Plate VII.)

The different specimens of *Ephyroides* were regarded as members of a single species, *E. rotaformis*. Three specimens in the collection were collected from Station 2044, and one from each of the others. None were in the best of condition for a study of specific characters, and the character of the subumbrella was impossible to be made out with any great accuracy. With one exception (Station 2042), the whole medusa was covered with a brownish, coagulated slime, not unlike that found on the surface of many specimens of *Periphylla* (*P. humilis*), which rendered it extremely difficult to study the minute anatomy. The generic characters are, however, well marked on the exumbral surface of the umbrella of all specimens.

The umbrella is flat, discoid, and when seen from the exumbral side appears divided into three zones: (1) Discus centralis (*dis. cent.*); (2) Zona coronalis (*cor.*); (3) Zona marginalis (*mg. lp.*). The diameter in alcohol is about 15^{mm}.

The zona centralis (*dis. cent.*), which corresponds to the central disk of *Atolla et alia*, is circular, about 5^{mm} in diameter. Its surface is smooth and destitute of superficial appendages. No coronal fissure was observed separating the discus centralis from the zona coronalis.

The zona coronalis, (*cor.*) is, like the zona centralis, about 5^{mm} wide, and bears upon its surface a number of radial elevations (*soc.*), which have suggested the name *rotaformis*, "wheel-formed," a resemblance which is striking, shown in a specimen from Station 2042. These elevations vary in number in the different specimens, but are always found in the radius which cuts the marginal fissures separating the marginal lappets. They are simple, rounded, sausage-formed elevations, smooth superficially, ending a short distance from the deepest point of the marginal incision on the peripheral side, and abutting the line of junction of the discus centralis and zona coronalis, on the centripetal extremity. Their length varies slightly in different radii and in different specimens. The resemblance which they impart to this region of the umbrella and that of *Nauphanta* is striking. In all the specimens studied the zona coronalis is extended horizontally, by which the elevations become radial. Homology, when this genius is compared with the most closely related genera, would lead us to believe that these bodies are more vertical, although in *Ephyra* the homologous region is horizontal.

The most peripheral of the three zones is the zone of the marginal lappets, or the zona marginalis. The marginal lappets (*mg. lp.*), as in all Ephyridæ, are prominent and large. Their walls are thin, cutlines rounded, twice as long as broad. The marginal lappets are sometimes folded back on the exumbrella, when they lie in the spaces which separate the radial elevations. The marginal lappets (Fig. 2) are long, thin, supported at their base by a pair of gelatinous socles (*mg. soc.*) continuations with the walls of the bell. The tentacles in several cases

were observed hanging from the incision which separates the marginal lappets. It was not observed—on account of the poor preservation of this region of the bell—how many tentacles and how many sense-bodies there are in *Ephyroides*. I think from what I could observe that there are eight tentacles and eight sense-bodies on a specimen with 32 radial socles. This is, however, conjectural, and was not observed, as the figures show. The structure of the subumbral region of the disk is in all cases too distorted to admit of a scientific examination.

Family LINERGIDÆ, Hæckel, 1877.

Linerges Mercurius, Hæckel.

There is no doubt that when the Gulf Stream is more carefully explored *Linerges* will be found in great abundance. I have taken it by thousands in the Straits of Florida, and the Albatross collected many specimens from the Gulf of Mexico and the Caribbean Sea. It also occurs in the Sargasso Sea, at Bermuda, and off Florida.

The different species of *Linerges* recorded by Hæckel seem to me based on doubtful specific characters. Of the bottle full of specimens of *Linerges* from the Gulf of Mexico some have characters of *L. Mercurius*, others of *L. Pegasus*, while there is a complete series of individuals which forms a graded series from one into the other. If the two species are good ones both may be expected in the southern part of the Gulf Stream.

Family AURELIADÆ, L. Agassiz, 1862.

Aurelia flavidula, Per. et Les.

Catalogue numbers.	Stations.	Locality— N. lat.	W. long.	Depth.
		° ′ ″	° ′ ″	
9289	2231	38 29 00	73 09 00	Surface.
8302	2253	40 34 30	69 50 45	Do.

These two specimens closely resemble *A. flavidula*, but have very long oral arms, and in the position and size of the "ovarian openings" seem to stand intermediate between *A. marginalis*, Ag., and *A. flavidula*. One of the specimens is an interesting one in having only three oral arms and three ovarian openings.

Family CYANEIDÆ, L. Agassiz, 1862.

Cyanea, sp.?

The bell of a mutilated *Cyanea* is found in the collection. It resembles *C. Arctica*.

Catalogue number.	Station.	Locality—	Depth.
5124	(?)	Locality unknown. Gulf Stream. ?	Surface.

Sub-family STOMOLOPHIDÆ, Hæckel, 1880.

STOMOLOPHUS MELEAGRIS, Ag.

Catalogue number.	Stations.	Locality. N. lat.	Locality. W. long.	Depth.
		° ′ ″	° ′ ″	
6249	2085–88	{ 40 05 00 { 39 59 15	70 34 45 70 36 30	70 143

Family PELAGIDÆ, Gegenbaur, 1856.

PELAGIA CYANELLA, Per. et Les.

Specimens examined.

Catalogue numbers.	Stations.	Locality.	
		N. lat. ° ′ ″	W. long. ° ′ ″
9751	950	Off Marthas' Vineyard, S. 79½ M.	
9716	952	Off Martha's Vineyard, S. ¼, E. 87½ M.	
9718	953	Off Martha's Vineyard, S. ½, E. 91½ M.	
4138	1038	39 58 00	70 06 00
8083	2223	37 48 30	69 43 30
8084	2223	37 48 40	69 43 30
9722	.....	41 25 00	65 10 00

TRACHYMEDUSÆ (Hæckel emend.) Claus.

Sub-family TAMOYIDÆ, Hæckel, 1877.

TAMOYA, Fritz Müller.

I have seen several specimens of *Tamoya* from the Gulf Stream.

In the collection made by the Albatross there are two specimens referred to this genus taken off Cape Hatteras.

Catalogue number.	Station.	Locality— N. lat.	Locality— W. long.
		° ′ ″	° ′ ″
8473	2289	35 22 50	75 25 00

Family AGLAURIDÆ, L. Agassiz, 1862.

TRACHYNEMA DIGITALE, A. Ag.

Specimens examined.

Station.	Locality.
1026	Off Martha's Vineyard, S. SW. ¼, W. 94½ M.

AGLAURA VITREA, Fewkes.

Aglaura is common along the Florida Keys, and occurs in the latitude of the Bermudas.

NARCOMEDUSÆ, Hæckel, 1877.

HALICREASIDÆ, fam. nov.

HALICREAS, Fewkes, 1882.

(Plate VIII.)

There are several specimens of this most extraordinary genus, some of which are well preserved, from which I am able to add something to what little is at present known of its anatomy. In 1882 (*Bull. Mus. Comp. Zool.*, vol. ix, No. 8), from two specimens collected by the U. S. Fish Commission, I established a new genus and species, to which was then given the name of *Halicreas minimum*. This medusa reoccurs in the collections of 1883, and from them the fragmentary observations then made can now be confirmed and several others added to our limited knowledge of its exceptional anatomy.

Halicreas is recognized by the possession of eight rounded protuberances (*mg. p.*), in many alcoholic specimens bearing rounded tubercles of brownish color, placed on the margins of the disk. From these, tubercles extend radially on the subumbra side towards the center of the disk, like spokes from the rim of a wheel, a corresponding number of radial ribs, which are in some specimens well marked, in others less evident. When seen on the subumbral side in one specimen these spokes (Figs. 1, 2, g.) seem to be glandular. No tentacles in alcoholic specimens, and no proboscis. Eight sausage-shaped or tentacular-formed bodies were observed in one specimen hanging down from the under-side of the umbrella, each arising from a point between the radial ribs not far from the center of the disk. A line passing through the center of the disk and the center of the point of attachment of these structures cuts the margin of the umbrella midway between two bundles of tubercles.

The affinities of *Halicreas* with known genera are probably the nearest to the strange family of Pectyllidæ, Hæckel, and of these it has a distant likeness to the genus *Pectanthis* in some particulars. In *Pectanthis*, however, we have on the bell margin sixteen clusters of small tentacles with sucker extremities, while in *Halicreas* there are only eight marginal tubercles. Moreover, the surface of these tubercles is sometimes covered with small conical teeth, which may in a distant way correspond to the sucker-bearing tentacles of *Pectanthis*. These tubercles in *Halicreas* never bear tentacles nor suckers. There are eight ovaries in *Halicreas*, and the genus has a very thick velum, which is highly muscular and contractile. This velum at times almost completely closes the entrance into the bell cavity.

These and other features ally *Halicreas* in a distant way to the Pectyllidæ, but I know of no family in which the genus can find a legitimate place. In a specimen of *Halicreas*, which is destitute of the tubercles on the eight marginal projections, we find the prominence slightly everhanging the bell-margin, recalling in general structure the marginal lappets of the Ephyridæ. I think this fact, taken in connection with the existence of the number eight, may be found to be a significant one in relation to the affinities of this medusa. In the specimen where there is the closest likeness between the marginal tubercles and the socles of sense-bodies of an Acraspedote medusa, there is a nearer resemblance to the original types of *Halicreas* described in 1882 than in the case of the other specimens. The papillæ on the prominences are, however, not as well marked as in the type and in the last-mentioned examples. This fact is a confusing one, and but for the regularity of the tubercles would lead me to ascribe them to the state of preservation of the specimen. It seems, however, impossible that the "papillæ" are the result of alcoholic contraction, and all these specimens are therefore placed in my old species, *H. minimum*.

Halicreas minimum, Fewkes.

(Plate VIII.)

The genus and species is represented by several specimens in the collection made by the Albatross. One of these closely resembles the type; the others are doubtfully placed in the same species. In the specimen like the type (Station 2236) the tubercles have inconspicuous papillæ; the remainder have papillæ even more prominent than in the type. In the latter the margin of the bell becomes very much hardened and contracted in alcohol, so that the resemblance to the live medusæ must be very distant.

Specimens examined.

Catalogue numbers.	Stations.	Locality— N. lat.	W. long.	Depth.
		° ′ ″	° ′ ″	*Fathoms.*
9284	2034	39 27 10	69 56 20	1,346
9316	2039	38 19 26	68 20 20	2,369
9308	2041	39 22 50	68 25 00	1,608
9297	2042	39 33 00	68 26 45	1,555
----------	2202	39 38 00	71 39 45	515
9334	2216	39 47 00	70 30 30	963
8091	2236	39 11 00	72 08 30	636

In addition to this material I have found in the collections of the Blake, made in 1880, a specimen of *Halicreas*, which, if it belongs to the above species, shows many differences from the type. It was found in lat. 39° 25′ 30″ N., long. 70° 58′ 40″ W; depth, 1,394 fathoms.

The bell of several of these specimens is smaller than that of the *H.*

minimum described in 1882, flat, discoidal, about 6mm in diameter; the exumbral surface (Fig. 1) smooth, walls gelatinous, slight convex, white or light-straw colored in alcohol. The marginal prominences (*mg. p.*) have a marked difference from those of the type. In one specimen (Station 2034) the bell as seen from the exumbral surface shows the tips only of the eight marginal prominences. In another (Station 2041) the tubercles are very prominent on the prominences. This also holds true in a majority of the specimens. In one of two specimens from Station 2216 the transparent part of the bell is inflated so that it is almost spherical. This condition is thought to be the result of the contraction of the bell margin.

The region of the bell upon which the tubercles of the margin of the umbrella are best seen is the subumbral (Figs. 2, 3). The tuberculated elevations (*mg. p.*) are invariably eight in number, and are colored light-brown, almost amber-colored in some cases. Individual papillæ are simple, conical elevations, of which there are three or more (generally a regular arrangement) side by side on the bell margin. There is commonly one of these tubercles which is more axially placed than the others on the upper surface of the umbrella. The great degree of hardness attained by these tubercles, as well as the whole umbrella margin, is a noticeable characteristic in several specimens. The marginal prominences are destitute of tentacular appendages, and in the best preserved specimens there was nothing to indicate that they are homologous to similar appendages in some Pectyllidæ. Their homology and function is unknown to me. In all cases the structure of the stomach and the velarium (*vel.*) could not be made out on account of the contracted condition of the specimens. The whole structure of the medusa, as far as known, shows that *Halicreas* belongs somewhere among the Narcomedusæ of Hæckel, as I have already stated in my original description of the genus. It has certain affinities with the family of Pectyllidæ, but differs very greatly from the genera which have been described by Hæckel.

Family SOLMARIDÆ, Hæckel, 1877.

Solmaris incisa, sp. nov.

(Plate IX.)

A medusa closely allied to *Solmaris* is represented in the collection by several specimens. These are at present placed in a new species of *Solmaris*. Some of these specimens are simply fragments, containing, however, the greater part of the umbrella margin; some are in a good state of preservation. I was at first led to suppose, from the resemblance of the margin of the umbrella to the marginal lobes or lappets of certain members of the family of Ephyridæ, that these specimens are close relatives of that family. A study of the other organs, especially a careful

examination of the velarium, shows me the error of such a view as far as the systematic determination of the species goes. It was seen that in almost all cases the velum is broken up into parts resembling marginal lappets, breaking along the lines of the peroniæ, thus giving us structures which closely resemble the marginal lobes of the Acraspeda. Several of the peroniæ are still unbroken in certain specimens, enabling me to observe the anatomy of this region of the disk margin. Although the majority of the specimens have the velarium broken into marginal lappets, the union of these marginal lappets in several instances was thought to prove that the lappets are nominally united in all specimens.

The umbrella is discoid in shape, slightly convex above, flexible in alcohol. The velarium (*vel.*) hangs from the lower outer rim of the disk, and is crossed by a number of vertical ribs (fig. 2, *per.*) connecting with the free edges of the velarium and the tentacular bases. These bodies (peroniæ) are always the lines along which a break occurs when the velarium is divided into the bodies which resemble and are supposed to be homologous with the marginal lappets (*mg. lp.*).

The exumbrella has from 24 to 32 shallow radial depressions (*fos. rad.*) or furrows, found near the periphery. These furrows are separated from each other by the same number of radial, generally more or less polygonal, elevations (*col. sub.*), which lie in the same radii as the tentacles and peroniæ. There are consequently the same number of tentacles as of peroniæ.

Specimens examined.

Catalogue numbers.	Stations.	Locality— N. lat.	W. long.	Depth.
		° ′ ″	° ′ ″	*Fathoms.*
6251	2094	39 44 30	71 4 00	1,022
6723	2104	38 48 00	72 40 30	991
.....	2110	35 12 10	74 57 15	Surface.

The umbrella is flat, discoid, rounded-convex at edges. The vertical thickness of the bell walls at the center of the disk is much less than in the zone of the radial subumbral elevations. Horizontal diameter 50–100^{mm}. On the subumbral side of the disk there is a zone of radial furrows (*fos. rad.*), which begins a short distance from the union of the velarium (*vel.*) with the periphery of the umbrella and extends centripetally 10–15^{mm} from the same. These incisions are shallow trenches in the subumbral side of the umbrella between elevations (*col. sub.*) which lie in that zone. The number of these elevations is equal to that of the tentacles.

Within the disk in a single specimen there is a cavity (*ga.*) formed by a splitting of the gelatinous walls, the rim of which is seen through the wall of the subumbrella, and extends nearly to the internal margin of the zone of radial elevations. This cavity is probably entered by a cen-

tral mouth. Its lower walls are not muscular. The cavity is a simple one, and was not observed to send out radial pouches from its periphery.

The velarium (*vel*) is a collar-shaped structure hanging from the margin of the umbrella, from which position its walls are probaly vertically placed. It is a thin-walled flexible body, crossed by vertical bands (*per.*) (peroniæ), which in one or two instances bind together adjacent marginal lappets. Its free lower edge is poorly preserved in all specimens studied; but in one specimen a structure, which may be true velum, was imperfectly seen. No sense bodies were observed, although they probably exist, and may be looked for on the free margin of the velarium in living specamens. Tentacles are very long, placed at the line of union of the velum and the outer rim of the umbrella. They are inserted at the proximal end of the peroniæ, and as a consequence, in those specimens in which the marginal lappets are formed by the breaking up of the velarium, the point of insertion of the tentacle is at the base of the cleft formed by the rupture. The tentacles are firmly connected with the free margin of the velarium by means of the peroniæ, and are joined to the walls of the umbrella by a conical root (*pero.*) which penetrates the substance of the umbrella. Each basal root or means of union of the tentacle and the disk lies in the same radius as the elevation (*col. sub.*) on the subumbral side of the disk which separates two radial furrows (*fos. rad.*). The radial elevations are therefore similar in position to the tentacular socles of *Atolla*.

The sexual glands were not observed. These bodies, so necessary to distinguish the two genera *Solmaris* and *Solmoneta* Hæck. from each other, are in all cases wanting.

The function of the radial elevations or their corresponding depressions on the under surface of the umbrella is not known. Similar elevations have been described in *Atolla*, *Collaspis*, *Nauphantopsis*, and other genera on the exumbrella, but are not known to exist or are very rare in other medusæ, especially of the Hydroida. An approach in structure to them which can be mentioned among true hydroid gonophores are the radial rows of small tubercles which I have figured on the subumbral surface of the bell of *Polycanna* (*Zygodactyla*) *Grœnlandica*. These structures can hardly be said to be homologous in the two cases. A radical difference between the Trachymedusæ and Narcomedusæ and the Acraspeda has been thought to be the absence of a velum in the latter, and its development in the former. I think in *Solmaris* we have a genus indicating that the homologue of the velum is to be looked for among the Acraspeda in the marginal lappets.

It has been stated by Hæckel that in the genus *Solmaris* the tentacle and peronia are in reality continuous, so that the true insertion of the tentacle is at the extremity of the peronia on the free border of the wall of the velarium. It is true that the peronia is an appendix of the tentacular base, but that the proximal extremity of the tentacle lies at the margin of the umbrella, near its union with the vertical wall of the

velum—the peronia being a projection extending from the tentacular base to the margin of the velarium—is not so evident.* The position and general appearance of the peroniæ in *Solmaris* recall the same structure in *Cunina discoides*, Few. If we regard the tentacles as in reality ending at the margin of the umbrella, and not at the free margin of the velarium in *Solmaris*, it seems probable that the walls of the velarium are homologous with the marginal lappets of the Acraspeda. That the velarium is, in fact, formed by a consolidation of marginal lappets on their edges along the lines of the peroniæ cannot be demonstrated, but it is certainly indicated by the anatomy of *Solmaris*.

An interesting habit of the genus *Linerges*, a medusa which has other hydroid affinities, may be mentioned in considering the homology last spoken of. *Linerges* when at rest carries its marginal lappet folded inward at right angles to the almost vertical walls of the bell. They seem in a measure to perform a like function as the velum of the hydroid gonophore in partially closing the opening into the bell cavity. Suppose in *Linerges* the edges of the marginal lappets thus folded should be united. We should then have a structure homologous to the return of a free hydroid gonophore.

In some other genera, also, as in the younger forms known as Ephyræ, and in certain adults of the family of Ephyridæ, where almost the whole movement of propulsion is produced by the vibration and repeated strokes on the water of the margina lappets, we have a like infolding of these bodies. The probability that an *Ephyra*-like medusa is the ancestral form of the Acraspeda, and the fact that in it motion is accomplished mainly by the movements of the marginal lappets, leads one to expect that in some Trachymedusæ we may look for a like function in an homologous organ. Although in *Solmaris*, both the umbrella and the velarium probably work together in the propulsion of the medusa in many allied genera, *Cunina* and others, the bell walls are sometimes rigid and the velarium and velum are the sole means of propulsion.

HYDROIDA.

The Craspedote medusæ are represented in the collections by a very small number of genera and species.† This scarcity is not wholly due to their small size. Naturally enough, as we have seen, the gonophores of "free hydroids," Trachymedusæ, would be well represented, but the

* Have we not a similar condition in *Turris episcopalis*, where a spur from the tentacle extends along the side of the bell?

†There is little doubt that many of the hydroid medusæ recorded from Charleston, S. C., Beaufort, N. C., Newport, R. I., and elsewhere on our eastern coast, are brought there by the Gulf Stream. Many others from the same localities belong to a strictly littoral fauna. The difficulty of distinguishing the former from the latter has led me, at present, to eliminate both, and to include only those recorded from the Gulf Stream region. When a more complete account of the Gulf Stream medusæ is prepared it will probably embrace a large number of genera of Acalephs, common in the bays and harbors of the eastern coast of the United States.

facies of the deep-sea fauna, as far as known, leads us to suspect that there are few fixed hydroids on the floor of the Gulf Stream which have free medusiform gonophores. We must suppose also that a large number of the deep-sea hydroids, allied as they are to Plumularidæ, have no medusiform gonophores which come to the surface. The number of these medusæ in the Albatross collection examined is very small as compared with the Acraspeda and Trachymedusæ. They are also mostly of large size, which may indicate a cause of their great minority in numbers.

Family TIARIDÆ Haeckel (1877).

TURRIS EPISCOPALIS (Forbes).

Catalogue number.	Station.	Locality— N. lat.	W. long.
		° ′ ″	° ′ ″
8737	2243	40 10 15	70 26 00

Family CANNOTIDÆ Hæckel (1877).

STAUROPHORA LACINIATA Ag.

Catalogue number.	Station.	Locality— N. lat.	W. long.
		° ′ ″	° ′ ″
9288	2039	38 19 26	68 20 20

Family incertæ sedis.*

CALYCOPSIS TYPA, Fewkes.

Catalogue number.	Stations.	Locality— N. lat. W. long.
	870	
	924	Off Martha's Vineyard S. ½ W. 83½ M.
	945	Off Martha's Vineyard S. by W. ¾ W. 84½ M.
	952	Off Martha's Vineyard S. ¼ E. 87½ M.
9727	936–8??	Off Martha's Vineyard S. by E. ½ E. 100–106½ M.

**Calycopsis* is in certain respects allied to the Æquoridæ of Eschscholtz, from which, however, it has many differences. My impression is that it may form a subfamily of the Tiaridæ; but of that I am in considerable doubt.

Family ÆQUORIDÆ Eschscholtz, 1829.

Polycanna Hæckel, 1879.

In studying the characters of the Æquoridæ found at Newport a peculiar structure in *Polycanna* (*Zygodactyla*) *Grœnlandica* (?) (Ag.) has presented itself, which, as far as I am aware, has not been observed by others. This character easily distinguished this species, and may even be found to be of generic worth.* On the subumbral side of the umbrella we find between the radical tubes small rounded prominences arranged in rows, a single row between each pair of tubes, which correspond in number with the number of ovarian frills on the chymiferous tubes. The number of these projections varies with the size of the specimen. At Newport we have two species of *Polycanna* (*Zygodactyla* Ag.), one of which has these projections, while a second is destitute of the same.

Among the Æquoridæ collected by the Albatross there are two species of *Mesonema*,† *M. cyaneum* Hæckel, and *M. Bairdii*, sp. nov. There is one species of *Polycanna*, *P. Americana*, sp. nov.

In the two species of *Mesonema* here considered the number of tentacles is less than the number of chymiferous tubes. They are very close to each other structurally, and may be eventually placed in the same species.

Polycanna Americana has ovaries like those of *Polycanna* (*Zygodactyla*) *crassa* (A. Ag.).

Polycanna americana, sp. nov.

There are three specimens closely related to *P. Germanica*, Hæck., and *P. Italica*, Hæck., one of the subgenus, *Crematostoma*, to which is given the name *P. Americana*.‡

Specimen examined.

Catalogue numbers.	Stations.	Locality— N. lat. W. long.	Depth.
		° ′ ″ ° ′ ″	
9187 9302	2039	33 19 26 68 20 20 Unknown.	Surface.

The bell is slightly rounded in vertical profile, discoid, with thin gelatinous walls. Diameter of the disk 45mm. Tentacles very long,

*As these structures are not mentioned in the description of *Polycanna* (*Zygodactyla*) *Grœnlandica* by Agassiz, I am unable to say whether this is the same species as his or not. As the tentacles are in a single row in this animal, it cannot, according to Hæckel, be placed in the *Zygodactyla* of Brandt.

† I have here used the term in the restricted sense adopted by Hæckel.

‡ In the preliminary list the generic name *Zygodactyla* is used for this medusa. In Brandt's *Zygodactyla* the tentacles are "biseriata." In *Polycanna* the tentacles are "uniseriata." *P. Grœnlandica* has the tentacles in a single series.

much longer than diameter of bell, equal in number to the chymiferous tubes. Bases swollen into a tentacular bulb. The upper wall of the stomach is almost flat or slightly convex. The ovaries are very numerous, swollen, and hang down as in *Polycanna* (*Zygodactyla*) *crassa*, Hæckel. No knobs between tubes on under side of the umbrella.

Stomach walls rather broad, oval filaments sparse, short and small. This species is easily distinguished from all our Æquoridæ except *P.* (*Zygodactyla*) *crassa* by the numerous swollen ovaries thickly crowded together. Unlike *crassa* it has a single tentacle at the extremity of each tube. The specimens of *P. Americana* which were studied were much smaller and yet had more numerous genitalia than *P. crassa*.

MESONEMA Eschscholtz, 1829.

MESONEMA CYANEUM Hæckel.

There are several other specimens of the family of Æquoridæ, some of which are simple fragments of a central disk or bell-margin, and which belong to a species of *Mesonema*, similar to that to which the name *Zygodactyla cyanea* was given by L. Agassiz.

Unfortunately none of the specimens have the locality indicated, but the bottles in which they are contained are numbered 9303, 9304, 9305, and 9306. These are evidently all the same species, to which may also be referred two other fragments from the following stations:

Catalogue numbers.	Stations.	Locality— N. lat.	W. long.	Depth.
		° ′ ″	° ′ ″	*Fathoms.*
9313	2037	38 53 00	69 23 30	1,731
9186	2038	38 30 30	69 08 25	2,033
9303	----------	----------	----------	----------
9304	----------	----------	----------	----------
9305	----------	----------	----------	----------
9306	----------	----------	----------	----------

The specimens of *M. cyaneum* are of small size as compared with other *Mesonemæ*, varying from 15–45^{mm} in diameter. The species is easily distinguished from others found in the Gulf Stream by the very great vertical thickness of the central region of the bell and its convex subumbral central protuberance, the relatively great diameter of the stomach, and the small size of the oval tentacles.

The bell is composed of two regions, a central disk which has the shape of a plano-convex, in one instance double-convex lens, and a coronal part, a zone in which lie the radial chymiferous tubes and which carries on its margin the tentacles and other organs. In most of the larger specimens the coronal portion is more or less broken or distorted; in the smaller it is entire. The central disk is flat, slightly convex above, rounded convex below. In none of the specimens is the coronal groove of great depth, although some of them have the separation of

central region and peripheral part well marked, while in all in which the marginal zone is present the division between the central disk and the peripheral zone is not difficult to trace. The convex protuberance on the subumbral side of the disk is homologous with a slighter protuberance in several other Æquoridæ and morphologically the same structure exists in the genus *Orchistoma* and other genera. In *Aurelia flavidula*, as I have elsewhere pointed out, we have a similar although more angular pyramidal projection from the lower side of the umbrella above the mouth opening. It seems not improbable that this projection in *Polycanna*, *Aurelia* and elsewhere is homologous with the gelatinous peduncle of such genera as *Liriope*, *Carmarina*, *Geryonia* and others.

The width of the coronal zone is about equal to the radius of the central disk. The coronal walls are thin, crossed by numerous radial chymiferous tubes very closely set together. Margin of the corona very thin. Tentacles not numerous, but long, flexible, with enlarged bases. Otocysts probably exist, but the poor state of preservation of the specimens does not admit of their examination.

The sexual glands in a few specimens are still preserved. They are small, resembling frilled sacs, each extending the entire length of the radial tubes. There are no rows of tubercles between the chymiferous tubes on the subumbral surface of the umbrella.

Stomach walls are fastened to the periphery of the central disk at the line of separation of the same from the coronal zone. They consist of a thin, wide, more or less folded membrane, with muscles fastened on one edge to the lower floor of the umbrella, while on the other edges are borne many small tentacular oral bodies arranged in a single row, separated from each other by a considerable space on the lips. These bodies are smaller than the same structures, the oral tentacles, in other Æquoridæ known from American waters. The embryonic nature of these bodies arouses the suspicion that this species may be the young of *M. Bairdii*, a description of which follows.

The thickness of the central disk in the specimen, No. 9304, is so great and out of all proportion to that of the corona, while the coronal furrow is in others so well marked, that it may be found that this species may connect the Craspedote and Acraspedote medusæ. We are certainly reminded in the partial differentiation of the central disk and the peripheral corona of the similar relationship in *Atolla*, *Nauphantopsis*, and some others. The differences between these genera and the *Polycannæ*, however, are so great that their resemblances cannot be regarded as of morphological value, for what is known of the development of the European species of *Mesonema* and others indicate their unquestioned hydroid affinities. It, is, however, still an interesting thing to see in this largest of hydroid gonophores an anatomical separation between the central disk and a peripheral corona closely parallel to what we find in undoubted Acraspeda.

Mesonema Bairdii, sp. nov.

Specimens examined.

Catalogue numbers.	Stations.	Locality— N. lat.	W. long.	Depth.
		° ′ ″	° ′ ″	
8018	2204	39 30 30	71 44 30	Surface.
9325	2207	39 35 33	71 31 45	Do.

Disk flat, discoidal, with smooth exumbral surface. No indication in alcoholic specimens of a coronal furrow. Diameter of disk 80–100mm. In one specimen there are twenty-nine tentacles. The tentacles lie on the bell margin, regularly placed at the peripheral terminus of a chymiferous tube. As a rule, between the tubes which end at the bases of a tentacle in this way there are three chymiferous tubes. Tentacular bulb slightly inflated, or globular. Tentacles short, dark-brown color. Between the tentacular bases on the bell margin, rounded bodies, probably marginal sense-bodies, are seen. Excretionary openings not visible. The velum is thin, narrow. The bell margin pigmented of the same color as the tentacles and tentacular bases. Seen from subumbral side, *M. Bairdii* has in one specimen one hundred and sixteen ovaries, extending the whole distance along the same number of chymiferous tubes. Ovaries slightly convoluted from the peripheral subumbral margin to the walls of the stomach about a half of the whole radius of the medusa. They are separated from each other by a smooth portion of the subumbrella, which is destitute of the papillæ described in *Polycanna* (*Zygodactyla*) *Grœnlandica*. In the walls of this region of the subumbrella occur small white (muscular) threads.

The walls of the stomach hang down from the subumbral side of the disk, and are fimbriated at their free end or margin by the characteristic labial tentacles, which are closely crowded together. The number of labial tentacles equal that of the chymiferous tubes. Extensions from the openings of these tubes into the stomach are continued in the form of mesenteric structures, which end in the labial tentacles. These mesenteries are probably folds in the stomach walls. Intermediate between these extensions on the stomach walls are strongly developed muscular fibers joining each pair.

The labial tentacles are so short that they can be with the greatest difficulty brought together to close the aperture of the mouth. The apertures of the chymiferous tubes into the stomach have the form of slit-like openings, which lie between the mesenteric folds on the inner side of the stomach walls. When seen from the subumbral side the slit-like channels resemble continuations of the radial tubes.

I dedicate this species, *M. Bairdii*, out of great respect, to Prof. S. F. Baird, of Washington.

SIPHONOPHORA Eschscholtz, 1829.

CALYCOPHORÆ (CALYCOPHORIDÆ Leuckart, 1854).

The Gulf Stream is undoubtedly the home of a number of Calycophores which have never been described. The following are known from this locality: *Diphyes* is represented by two species, as far as known. One of these is *D. formosa*, Few., while the other species is very close to the Mediterranean, *D. acuminata*, Leuck. A *Galeolaria* very similar to *G. aurantiaca* was taken by me at Tortugas, Florida, and there is every probability that this genus is likewise found in our latitudes. It has been recorded from Greenland by Leuckart. I have seen a single *Abyla* from the Gulf Stream which closely recalls the species *pentagona* from Nice. A *Muggiæa* (Chun) is common at Key West, Fla. *Praya** is found at Tortugas, and possibly off Cape Hatteras, North Carolina.

Of monogastric Calycophores, I regard the genus *Diplophysa* taken by me at Newport, as a Gulf-Stream medusa. In the same category also falls *Eudoxia Lessonii*† Hux. *Gleba hippopus*, Forsk., has been found in several localities in the Gulf Stream. A large specimen of *Gleba*, which has certain differences from the Mediterranean species, was captured in 1883 by the Albatross.

GLEBA HIPPOPUS, Forskal.

Specimens examined.

Catalogue number.	Station.	Locality— N. lat.	W. long.
	925	Off Martha's Vineyard.	S. ½ W. 86 miles.
7983	2202	39° 38′ 00″	71° 39′ 45″

The second of these specimens is larger than those which I have found in the Mediterranean, but I can detect no specific differences between them.

* When I first mentioned this genus from Florida in a popular account of the Calycophores (*Amer. Nat.*, Aug., 1883), I did not describe it as a new species, but found, to my astonishment, when the article was printed, that the *Praya*, which I have no doubt is a new species, bears the name *Praya blainv* in my list.

†The *Diphyes pusilla*, McCr., and *Eudoxia alata*, McCr., recorded by McCrady from Charleston Harbor, South Carolina, are probably Gulf-Stream Calycophores. I am not able to tell from McCrady's description whether his *E. alata* is the same as *E. Lessonii*, Huxley, or not. His *Diphyes pusilla* cannot be recognized, for he gives no specific description. He suggests the name, and says (Gymophthalmata of Charleston Harbor, p. 72), "I therefore defer the description of this species, which may perhaps properly be called *D. pusilla* to a future time." I am not aware that he ever described it more in detail, and probably the name ought to disappear from our faunal lists.

? Cuboides, sp.

A medusa referred to Cuboides was collected by Prof. S. I. Smith, on George's Bank, in 1872, Bache Coll. This is the most northern limit of this genus in the Gulf Stream region. The Albatross collected an unidentified ? *Cuboides* and a ? *Sphenoides* from the following locality:

Catalogue number.	Station.	Locality— N. lat.	W. long.	Depth.
		° ′ ″	° ′ ″	*Fathoms.*
9329	2039	38 19 26	68 20 26	2,369

Muggiæa kochii? Chun.

The genus *Muggiæa* as limited by Dr. Chun occurs in the Gulf Stream, although not collected by the Albatross, or at least not represented in the collection sent me. I have seen specimens of this genus in the neighborhood of Key West, Fla., and still others collected by a friend off Nantucket. It also occurs at Beaufort, N. C. It closely resembles the *M. Kochii* of Trieste.

PHYSOPHORÆ (PHYSOPHORIDÆ, Auct.)

There are several genera of Physophoræ,* exclusive of the Rhizophysidæ and *Physalia*, found in the Gulf Stream. They are as follows:

Stephanomia, M. E. (Forskalia, Koll), Atlantica, Fewkes.

Tortugas, Florida, Bermudas.

Agalma Okenii,† Esch.

Tortugas, Florida, Bermudas.

The *Agalma papillosum*, Few., is possibly the young of this species.

(Agalma elegans, Few.)

The bottle in which a specimen of this species is found is labeled "Gulf Stream." (*Bull. Mus. Comp. Zool.*, vol. ix, No. 8.) It is doubtful whether *elegans*, which is a boreal species, ever gets far south in the Gulf Stream.

A. elegans, Few., is probably one of the "forms" described by Sars as *Agalmopsis elegans*. The question of its generic name resolves itself into whether *A. Okenii*, Esch., is specifically different or generically the same as *A. elegans*, Few. As an expression of individual opinion the writer regards them as generically identical. The main differences are

* Fragments of a member of the family of Agalmidæ are found from Stations 2175, 2210, and 2235. The genus could not be recognized.

† *Crystallodes rigidum*, Hæck, *Crystallomia*, Dana, and *Agalma breve*, Hux., are regarded as synonyms of *A. Okenii*, Esch.

as follows: *A. Okenii* has a rigid, untwisted axis (polyp-stem), thick covering scales, the distal (unattached edges) formed of faces, which form the sides of the animal below the nectocalices; horn-shaped continuations of the cavity of nectocalyx into the prolongations which embrace the stem. *A. elegans* has flexible stem (twisted), side of the animal below the nectocalices formed by the upper faces of the thin covering scales. No horn-shaped diverticula from cavity of the nectocalyx. If there is formed a new generic name it should not be made for *A. Okenii*, but for *A. elegans* or *Agalmopsis elegans*, Sars (one form). I cannot accept, therefore, Hæckel's new name, *Crystallodes*. If a new name is sought for (*Agalma*, Leuck, mihi) *Agalmopsis*, Sars (one form), it cannot be *Agalmopsis*, since the "first form" of Sars is not *Agalma* in the sense used by Eschscholtz, but a different medusa. *Stephanomia*, Hux., is the first form of *Agalmopsis*, Sars. The question is reduced to this consideration: Is *Agalma Okenii* and *A. elegans* ("one form," Sars, mihi) generically distinct? If they are, a new generic name must be given to *A. elegans*. If *Agalmopsis* is adopted for it, the "first form," Sars, is eliminated and is without name. Huxley says that his *Stephanomia* is generically the same as Sars's first form. I have thought the best way out of the complication is to let *Agalmopsis* stand for Sars's "first form," *Agalma* for another (*Agalma*, mihi), *Stephanomia*, M. E., for the medusa described by Kölliker as *Forskalia*. If the characters of *A. elegans* and *A. Okenii* are generic, a new name, *Agalmoides*, may be proposed for *Agalma Sarsii*, *Agalma elegans*, Few., and *Agalmopsis elegans* ("one form"), Sars. In the present paper these are all regarded as generically identical. *Nanomia cara*, A. Ag., is regarded as the same as the "first form" of Sars and may be called *Agalmopsis carum*.

AGALMOPSIS FRAGILE,* Fewkes.

Key West, Florida.

ATHORYBIA FORMOSA, Fewkes.

Tortugas, Florida.

HALIPHYTA MAGNIFICA, Fewkes.

Catalogue number.	Station.	Locality— N. lat.	W. long.	Depth.
	953	Off Martha's Vineyard, S. ½ E.	91½ miles.	Surface.

APOLEMIA, sp. (provisional).

Off Block Island. U. S. F. Com., 1880.

* By an error written GRACILE on p. 266, Bull. Mus. Comp. Zool., vol. ix, No. 7.

PNEUMATOPHORÆ (PNEUMATOPHORIDÆ, Chun).

Family PHYSALIADÆ, Brandt, 1835.

The Physaliadæ are represented in the Gulf Stream as elsewhere by the single genus, *Physalia*. The species is very common and is probably *P. Arethusa*, Til. The species is widely distributed in all parts of the Gulf Stream.

Family RHIZOPHYSIDÆ, Auct.

There are two genera of this family, *Rhizophysa** and *Pterophysa* gen. nov. The former genus has four species, *R. filiformis*,† Lam., *R. Eysenhardtii*, Geg., *R. gracilis*, Few., and *R. uvaria*, sp. nov. *Pterophysa* has a single species, *P. grandis*, sp. nov. There is also a fragment of a new ? *Rhizophysa* with a gigantic float.

Many fragments of genera of Rhizophysidæ, which could not be determined, were sent to me for identification as found on the dredge rope used by the Albatross. Among these are possible relatives of Studer's, *R. conifera*, but they were too fragmentary for identification. The indications are that the family of Rhizophysidæ will be found to be represented in pelagic faunas by a great number of new genera and species, although alcoholic material thus far preserved is in a most unsatisfactory condition for good diagnoses of the undoubtedly new species which have been collected. It is only on living specimens that many of the minor specific differences, characteristic of the different members of the genus, can be observed. These characters are commonly lost or destroyed in the preservation of the animal in alcohol. The polypites of my new genus, *Pterophysa*, have such an extraordinary structure that even from a specimen shrunken and distorted by the alcohol, I think myself justified in regarding it a new genus and describing it as such. A species of *Rhizophysa*, very different from any yet described, is also well enough marked to merit a new name, *R. uvaria*.

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* Specimens of a species of *Rhizophysa* were collected by the Blake at Station 147, St. Kitts, depth 250 fathoms. I have examined these specimens and find them to consist of a large number of fragments, mostly gigantic polypites, with one extremity colored a dark purple, while the greater part of the same organ is white or pink flesh colored. The species of *Rhizophysa*, to which these fragments belong, is unknown to me.

† Studer (*Zeit. f. wiss. Zool.*, Bd. xxxi) says, "Erstere (*R. filiformis*) in Mittelmeer häufig beobachtet, scheint eine weite Verbreitung zu haben, wenn die von Huxley citirte Art mit *R. filiformis* identisch ist, sie stammt aus dem Nordatlantischen Ocean." The species recorded by Huxley is not *filiformis* but *Eysenhardtii*, and he observed it in the *Indian Ocean*. *R. filiformis*, as Studer says, occurs in the Atlantic, as I have found it at Key West, Fla., and at the Bermudas.

Rhizophysa uvaria, sp. nov.

A single specimen of a new and characteristic *Rhizophysa* was taken on the surface at Station 2038.

Catalogue number.	Station.	Locality— N. lat.	W. long.
		° ′ ″	° ′ ″
9287	2038	38 30 30	69 08 25

The float pear-shaped, pointed at apex, with zone of dark pigment. Length, 5mm; diameter, 3mm. Apical opening present. Air sac with bodies in cavity hanging from under side within the float as in *R. filiformis*. Stem short, probably broken, the proximal portion alone remaining.

At the junction of the stem and float we find, as in *Pterophysa*, a cluster of half-developed polypites, at the base of which is a botryoidal cluster of gonophores (?). Below the first cluster of polypites there is a smooth portion of the stem, and then another cluster of polypites arising from a somewhat thickened base. In the second cluster of polypites the basal organs near the point from which these organs arise resembles closely the gonophores figured by Studer* in *R. inermis*. Below the second cluster of polypites we have a portion of the stem still remaining, but with the distal end broken off, showing the same smooth character as the section of the axis between the first and second cluster. In *R. inermis*, Studer, we have the same condition, although in this species a single polypite arises from the vicinity of the gonophores, while the continuation of the stem bears polypites without gonophores. There is, moreover, in *R. inermis* nothing corresponding to the proximal cluster of undeveloped polypites and gonophores as I have described them in *R. uvaria*.

The individual polypites of *R. uvaria* resemble those of *inermis* in the structure of the distal extremity, in which is placed the mouth opening where a small button-shaped end is slightly constricted from the polypite. There are no tentacles in the single specimen studied. No ptera or wing-like appendages on polypites.

The characteristic structure of this *Rhizophysa*, by which it is distinguished from all others, is the grouping of the polypites and gonophores into bundles at intervals along the axis and the want of tentacles. We have here something similar to the arrangement of these structures in the well-known *Apolemia uvaria*, except that in *R. uvaria* nectocalices, bracts, and similar structures are not developed. The sexual bodies are here grouped at the bases of the polypites, as in the species *R. gracilis*, Few., from the Florida Keys.

There are several features in *R. uvaria* recalling *R. inermis* and marked

* *Zeit. f. wiss. Zool.*, Bd. xxxi, Taf. I, Fig. 3.

differences. The very great disparity in size of the two strikes one at first glance. Studer says that the stem of *inermis* is 18^{cm} in length, and the diameter of the float is 1^{cm}. These measurements for the length of the stem may not be different from the dimensions of a complete axis of *uvaria*, but the diameter of the stem and float is much larger in *inermis* than in *uvaria*.

RHIZOPHYSA, sp.

(Gigantic float.)

In a fragment of the float and stem of an unknown *Rhizophysa*, the diameter of the float is 1^{mm} and its length 3^{mm}. This is, I think, the largest float of a Physophore, next to that of *Physalia*, *Angela*, and *Angelopsis*, which has yet been recorded. It is unfortunate that the essential organs, polypites and tentacles, of this gigantic *Rhizophysa* are wanting, and I am unable to tell to what species it belongs. It has at the base of the float, at its junction with the stem, a small cluster of half-developed bodies which resemble polypites.

Catalogue number.	Station.	Locality— N. lat. W. long.	Depth.
8085	2224	° ′ ″ ° ′ ″ 36 16 30 68 21 00	*Fathoms.* 2,574

PTEROPHYSA, gen. nov.

(Plate X.)

Two specimens of Rhizophysidæ, taken from the "dredge rope" at Station 2227, are referred to a new genus, *Pterophysa*.

Catalogue number.	Station.	Locality— N. lat. W. long.	Depth.
8086	2227	° ′ ″ ° ′ ″ 36 55 23 71 55 00	*Fathoms.* 2,109

This genus, with a general likeness to *Rhizophysa*, is characterized by the existence on the polypites of two longitudinal wings,* which extend

* Studer (*op. cit.*) first described these wings (pt.) in his species of *Rhizophysa*, called *conifera*. He says of them: "Im hinteren Magenabschnitt (Fig. 17) fangen zwei muskulöse solide Leisten, eine dorsale und eine ventrale, sich zu bilden an, die sich nun auf den Basaltheil des Polypen, als flügelförmige Haftbänder fortsetzen und an den Stamm sich anheften (Fig. 18). Diese Bänder bestehen aus einem soliden Gallertkern, einer Fortsetzung des Mesoderms, der am Rande zahlreiche Ausläufer in das Ectoderm sendet, woran sich die Längsmuskelfasern, wie am Stamm festsetzen."

I cannot find any function suggested for these bands, and I am also in doubt as to the purpose of the dendritic bodies on their free margin in *conifera*. There are homologous structures in the cross-sections of a *Bathyphysa* "polyp," as shown in Plate II, Figs. 32, 33 of Studer's paper.

from one end to the other of this structure. These bands are regarded of generic worth. The depth at which this genus, as well as other supposed deep-sea Rhizophysidæ taken from "dredge ropes," has been recorded, does not necessarily conform to that assigned to the station. The fact that they are found clinging to the rope may mean that they come from any depth less than the sounding. The great relative size of the float of most known species of Rhizophysidæ, as compared with that of other Physophoræ, would seem to imply that *Rhizophysa*, like its relative *Physalia*, is a surface genus. In *R. Eysenhardtii*, Geg., a species which I have taken at the Bermudas on the surface of the water, the relative size of the float is very great. The same is true of the supposed deep-sea species described by Studer.

The habit of clinging to a foreign body, as a rope of the dredge when it is drawn through the water, is exemplified in *R. Eysenhardtii*, where the tentacles must almost be torn from their hold before they loose themselves from their connection with a foreign body. In the last-mentioned species this power is lodged in the tentacles and their branches, but in the new genus *Pterophysa* it is possible that additional structures on the polypites, specially adapted for that function, have been added to increase this prehensile power. These structures are the lateral wings (ptera)*
which characterize the polypites of this genus.

The stem and the various appendages of *Pterophysa* are found to be so closely twisted together that it is hopeless to endeavor to uncoil it. Consequently the general outlines of the body are difficult to make out. Many of the polypites, although broken from their attachments, are in good condition.

Pterophysa grandis, sp. nov.

(Plate X, Figs. 1, 2, and 3.)

The float is oval, oblong, 10^{mm} in longer, 5^{mm} in shorter, diameter. At its apex is an indication of the pigmental zone, and a well marked opening, closed by a sphincter muscle, is seen in one specimen. The form of the float and its relation to the axis indicates that, like the species *R. Eysenhardtii*, *Pterophysa*, carries the longer axis of the float vertical

* In a cross-section of a *Rhizophysa* (*R. conifera*) polypites figured by Th. Studer *op. cit.* Pl. II, Fig. 17, two structures are figured, which are probably the same as the wings of *Pterophysa*. They are not represented in Pl. I, Fig. 4, where the polypite of *R. conifera* is figured. I do not at present understand how a cross-section of the polypite of *conifera* (Pl. I, Fig. 4) can give the strange structure shown in Pl. II, Fig. 18. In the latter figure, which is a "Querschnitt durch den Basaltheil eines Polypen von *R. conifera*," we have structures which resemble ptera, but are much wider than in *Pterophysa*, and bear fringed structures on their edges. Although these structures are four or five times the diameter of the "polyp", in Pl. I, Fig. 4 ("Polyp von *Rhizophysa conifera* mit contrahirtem Magentheil") they are unrepresented. *R. conifera* probably belongs in my genus, *Pterophysa*, on account of the possession of these bands.

instead of horizontal in floating. Its size implies that the animal comes to the surface of the water. At the base of the float, where it narrows into the stem, there arises a cluster of undeveloped flask-like bodies, resembling polypites closely crowded together. In this cluster are young polypites (?) of all ages, but none were observed to have tentacles. The polypites are flask-shaped, oblong bodies, the largest bearing (?) two wings or muscular expansions, one on each side (?) characteristic of the genus. In the smaller specimen of *Pterophysa*, in which the float and axis are present, a little cluster of half-developed polypites below the float is much better preserved than in the larger. In this specimen the axis is very much twisted, and it is impossible to estimate its length with any degree of accuracy, although, judging from the size of the contracted stem of *Rhizophysa filiformis* in alchohol in comparison with the same when alive, the axis of *Pterophysa* must be several feet in length.

In the larger specimens of *Pterophysa*, on the other hand, although the stem is hopelessly twisted, many of the polypites are still attached, and several clusters of sexual organs can be seen. It is in this specimen that the characters of the polypite peculiar to the genus are best seen. Many of the polypites, however, are broken from their attachment to the stem, and the arrangement of these bodies on the axis is very difficult to determine. While the stem of *Pterophysa* becomes tough and opaque in alcohol, the more delicate polypites are more transparent, and easily break off from their attachments. In the bottle in which the *Pterophysa* is preserved there are large numbers of these bodies which have fallen from the stem. They (*pyt.*) invariably have a curved, in profile crescent shape, whether attached to the stem or broken from it. If we examine an individual polypite, we find that the walls on one side are thicker than on the other, and at the same time more muscular, while from each side* there arises (one on each side) a loose muscular flap or wing (*pt.*) to which is given the name pteron. The distance between the two ptera on the concave side of the polypite does not measure more than the third of the whole circumference of the polypite, while the elevation of the ptera above the surface of the polypite, or its width, is less than one-half the distance. The ptera extend from proximal (*a*) to distal extremity of the polypite, and appear almost wholly made up of strong muscular fibers. The polypites are invariably so coiled that the ptera face the concave surface of the organ from which they arise, or extend in loose folds one on each side of the muscular portion of this structure. The coiled polypites in alcohol have a remote likeness to the larvæ of Coleoptera coiled up for defense. They are coiled, both when they are free, or, as often happens, when they tightly embrace the stem, so that

* The relative position of the wings as compared to the axis could not be observed. The bodies with which I have compared them in *R. conifera*, according to Studer, are dorsal and ventral.

the edges of the two ptera, fitting closely upon the axis of the animal, recall the edges of the foot of a Gasteropod mollusk.*

It is difficult to determine definitely the function of the ptera and the peculiar structure of the polypites of *Pterophysa* unless we study the animal alive. The direction of the coiling by which a muscular surface is brought on the concavity of the polypite, and the appearance of the ptera, suggest that the polypite in *Pterophysa* is specialized into a grasping organ, and that these are sucker-like structures by which it lays hold of a foreign body.

The power of grasping by means of the polypites and tasters is a function not unknown, in a limited degree, among other Siphonophora. Both *R. filiformis* and *R. Eysenhardtii* wind their polypites about a pencil thrust near them, while *Physophora hydrostatica*, Forsk. will, in the same way, grasp a foreign body with its tasters, as one can easily see by worrying them or by placing a pencil in their immediate vicinity. There are, however, in neither of these genera no ptera on the polypites and tasters, as in the genus *Pterophysa*. We can, therefore, conclude that *Pterophysa* has the same or a similar power of grasping in its polypites, and that the modification in the structure of the side of the feeding-stomachs with the two lateral wings point to that function. Winding themselves about a foreign body, it probably fastens itself by means of the sucker-like side of the polypite. In this way we are tempted to suppose that it may even drag itself along from place to place on the floating body to which it has attached itself. By the same specialized region of the polypite it may grasp its food, and it is a suggestive fact in this connection that I was unable to detect any tentacles in either of the specimens of *Pterophysa* which was studied.

ANGELIDÆ, fam. nov.

ANGELOPSIS, gen. nov.

(Plate X, Figs. 4, 5.)

The genus *Angela*, discovered by Rang and figured and described by Lesson, has never been retaken, and nothing has been added to our general knowledge of the genus since the first mention. The statement of Professor Huxley expresses the present condition of our knowledge of *Angela*, as it did twenty-five years ago when the now classic "Oceanic Hydrozoa" was written. He says, "All the author of this genus really knows of it is, he says, derived from a drawing 'Communiqué par M. Rang sans nom et sans renseignements.' Under such circumstances it is hardly worth while quoting his definition." While speculation in regard to *Angela* as defined by Lesson, from the imperfection of our knowledge (it must be acknowledged that Lesson's figure has some value), must neces-

* I was reminded in studying the form and relationship of the ptera to the polypites in *Pterophysa* of similar structures in the modified leaf extremity of *Nepenthes* and other "pitcher plants." The resemblance is a distant one, and pertains only to the lateral appendages to the pitcher-like leaf.

sarily be an unprofitable one, the fact remains that the genus *Physalia* in its systematic position is widely isolated from other Physophores, and it is surprising that the gap between its nearest ally, *Rhizophysa*, and itself is unoccupied.

I believe that the additions to our knowledge in the last years have shown that *Physalia* and *Rhizophysa* are more closely related than the former genus and the Velellidæ and Porpitidæ (*Velella*, *Rataria*, and *Porpita*). I think this is shown by the relative size and position of the float, the anatomy of the sexual organs, and the character of the appendages to the tentacles. It seems to me that the resemblances are so close that they ought to be placed together in a scheme of classification. Additions to our knowledge of the species of *Rhizophysa* confirm me in that belief. Still the gap between the two genera is a great one, and we must earnestly expect from the study of genera which connect them, if such exist, a greater or less modification in our ideas of Siphonophore morphology. *Angela* is a genus whose anatomy would throw much light on this subject, but I had, up to the present, supposed that *Angela* was a mutilated *Physophora*, the float representing the bag-like enlargement of the distal end of the stem from which hang the circle of tasters, sexual bells, and polypites, and that the remnant of the necto-stem was seen in the button-shaped apical prominence figured by Lesson. This interpretation of Lesson's figure leaves much to be desired and signally fails to interpret many structures which he figures. It may provisionally be supposed that *Angela* is a good genus and that later studies will again bring it to light.

Still the gap between *Rhizophysa* and *Physalia* may be filled by the discovery of new genera, and these may or may not be allied to *Angela* as well. Among the medusæ collected by the Albatross is a pair of specimens which are considered the closest allies yet found of *Angela*, and which at the same time have relations with *Physalia* more intimate than any other known genus except the problematical medusa of Rang and Lesson. On account of its supposed affinities it is placed in a new genus of doubtful relationship to which is given the name *Angelopsis*. *Angelopsis* recalls the family of Pectyllidæ and may be found to be a transition form from the latter to the Pneumatophoræ.

Angelopsis globosa, sp. nov.

(Plate X, Figs. 4, 5.)

Two specimens which are placed in this species are from the following locality:

Catalogue number.	Station.	Locality— N. lat. W. long.	Depth.
		° ′ ″ ° ′ ″	*Fathoms.*
6565	2105	37 50 00 73 03 50	1,395*

* If my interpretation of organs in this genus is correct it is probably a "surface jelly-fish."

This medusa has a spherical region above which is considered a float, on the under side of which is clustered a number of small bodies resembling tentacles. The former region (*pycy.*) resembles the bell-like body in a medusa; the latter, a clump of tentacles closely massed together, with the form which we might suppose they would have if the entrance to the bell cavity were closed by the velum and tentacles developed over its lower floor. The so-called float is spherical, without apical opening or protuberance, smooth on the outer surface, and without radial elevations. Diameter from 7 to 10^{mm}. The wall of the float is thin, and in the interior is a second thin-walled sac or float, which is supposed to correspond to the pneumatocyst (*pycy.*) of *Rhizophysa.* The inner sac has no opening into the outer, and does not communicate with organs below. It is destitute of appendages. Its cavity (*cav. p.*) occupies the whole interior of the float.

The lower floor of the float is formed of the thickened outer walls which bear the so-called tentacles. The thickened region is found to have a cavity within (*cav. b.*) and to be separated by a muscular floor from another cavity (*cav. l.*) just below the inner air-sac. On the outer walls of this thickened layer (*mm.*), at the point where it joins the thin walls of the outer layer of the float, there are found spherical bag-like structures (*gm.*) of unknown function. These bodies recall in appearance the larger float, from which they hang, and suggest the possibility that they are buds from the outer walls. Whether they are new individuals, peculiar zoöids, or chance swellings I cannot determine. They are found in both specimens, and so closely resemble the larger float that the supposition that they are *new individuals budding from the thickened region* of the bell seems highly probable. The cavity of one of them was found filled with bodies resembling those found on the lower floor.

The whole external surface of the thick walls of the lower hemisphere of the medusa is covered with small clusters of bodies which resemble the gonophores in *Velella* or the sexual clusters of *Physalia.* These clusters have a small axis, from the sides of which hang, in grape-like clusters, small, spherical, and ovate bodies resembling tentacular knobs, fastened by a delicate peduncle to an axis. The appended bodies are of two sizes, large and small; and, through the walls of the latter, radial structures which arise under the peduncle can be seen. All are snugly approximated to the outer wall of the animal, and, in one instance, a small fragment of what appears to be an Echinoderm test (*a*) was firmly grasped by them. No *external opening* into the *cavity* of the muscular base on which they hang was found, although carefully searched for, especially at the lower pole of the medusa. In cutting open one of the small spherical bodies (*gm.*) which arise from the side of the medusa I found it filled with a granular mass, which had some resemblance to the botryoidal clusters on the lower hemisphere of the medusa.

In studying the affinities of *Angelopsis* I was at first led to place it near *Pectyllis* and to compare (*mm.*) the lower thickened wall to a velum very much developed, so that the opening into the bell cavity was closed, and therefore hidden. In that comparison the clusters of grape-like bodies would be the sucker-like tentacles known in the Pectyllidæ. To this interpretation I have these objections: (1) If a bell opening exists it could not be found by continued search. (2) There are several of the knob-like bodies on each style, while in the sucker-armed tentacles of the Pectyllidæ each tentacle has a single sucker. It must be repeated, however, that the observation of the fragment of shell (*a*) in the grasp of these bodies shows that they are grasping organs. (3) There is no radial arrangement of organs, nothing to call a proboscis, and no numerical grouping in the botryoidal organs. (4.) Globular bodies like the "buds" (*gm.*) are unknown in any of the Pectyllidæ. Turned by these considerations to look elsewhere for the allies of *Angelopsis* I could only find them among Physophores like *Physalia*, but even here we meet great difficulties. The upper region of the animal is evidently a float, as its great cavity seems to indicate. The globular bodies (*gm.*) are unknown among Physophores. The thickened wall (*mm.*) may well be homologized with the portion of Physalia from which the polypites, sexual clusters, and tentacles arise, while the botryoidal clusters themselves, on the surface of this structure, represent the tentacles, polypites, and similar organs. Some of these are undoubtedly grasping organs, as the fragment (*a*) mentioned above shows. I do not suppose that my interpretation of these organs is wholly correct, but the affinities of *Angelopsis* seem to be more with *Physalia* and *Angela* than with any known medusæ.* We are reminded, in this difficulty in distinguishing whether the globular body is the bell of a medusa or the float of a Physophore, of a theory propounded by Metschnikoff, and supported on other grounds, that these two structures are in reality morphologically identical.

Family VELELLIDÆ, Eschscholtz, 1829.

Velella mutica, Bosc.

Velella is common in the Gulf Stream. In the Straits of Florida it is very abundant, while in higher latitudes it is recorded from off Hatteras,

* That there are many very striking differences between the new genus described above and *Angela*, is apparent. It is smaller than *Angela*, has not the apical "mamelonne," "garni de valvules claustrales," nor the "tubes digestifs." There are so many incongruous statements in Lesson's description that one suspects the whole account. About the only things which *Angelopsis* and *Angela* have in common is the very large float, the absence of the axis, and the basal tentacles. The propriety of my new name may be questioned, and it may seem better to form a generic name of different etymology. I have, however, retained in part the name given by Lesson, since this genus seems to me to occupy the place which he supposed *Angela* does, and as he expresses it, "fait le passage des physophores aux physales."

Nantucket, Bermuda, and Newport. I have many new localities for this medusa in the Gulf of Mexico and the Carribbean Sea. A young *Velella* was taken by the Albatross at the following station, north of Florida.

Catalogue number.	Station.	Locality— N. lat.	W. long.
		° ′ ″	° ′ ″
9291	2100	39 22 00	68 34 30

RATARIA (Young VELELLA?).

Catalogue number.	Station.	Locality— N. lat.	W. long.
		° ′ ″	° ′ ″
9323	2100	39 22 00	68 34 30

PORPITA LINNÆANA, Less.

The following locality is the most northern latitude at which this medusa has been found in the Gulf Stream. South of this locality it becomes common.

Catalogue number.	Station.	Locality— N. lat.	W. long.
		° ′ ″	° ′ ″
9281	2039	38 19 26	68 20 20

CAMBRIDGE, MASS., *April*, 1885.

EXPLANATION OF PLATES.

LETTERING.

a. Anterior.
α. Fragment of Echinoderm test.
cav. Cavity.
cav. b. Cavity inclosed by thick muscular walls.
cav. p. Cavity of float.
col. sub. Subumbral radial elevations.
cor. Corona.
dis. cent. Central disk.
fos. cor. Coronal fossa.
fos. rad. Subumbral radial furrow.
g. Radial elevation on subumbral side of disk.
ga. Stomach.
gm. Globular enlargements (buds?)
i. cor. Internal corona.
lb. inter. Interradial lobe of stomach.
lb. per. Terradial lobe of stomach.
mg. lp. Marginal lappet.
mg. p. Marginal prominence.
mg. sb. Marginal sense-bodies.
mg. soc. Marginal socle.
mm. Muscular wall of the lower portion of the float, or base upon which the botryordal bodies hang.
mus. cor. e. Musculus coronalis externus.
mus. cor. i. Musculus coronalis internus.
mus. delt. Musculus deltoideus.
oa. Ovary.
or. Mouth.
per. Peronia.
per. o. Basal conical spur of tentacle.
pt. Pteron.
pycy. Pneumatocyst.
pyt. Polypite.
s. Stem.
sb. Marginal sense-body.
soc. Exumbral socle. These socles are probably homologous with the tentacular socles (soc. ta.) and the socles of the sense-bodies (soc. sb.) in *Atolla*.
soc. sb. Socle of marginal sense-body.
soc. ta. Socle of marginal tentacle.
som. Somatocyst.
sr. Sulcus radialis.
ta. Tentacle.
v. Velarium.

PLATE I.

Atolla Bairdii, from exumbral surface.

PLATE II.

The same from the subumbral side. Five marginal socles of sense-bodies on left side, with marginal lappets inward.

PLATE III.

Fig. 1. *Atolla Bairdii*, lateral view with exumbral surface thrown into perspective.
Fig. 2. Three tentacular socles and two rhopalia from the corona, showing their relation to the coronal furrow.

PLATE IV.

Atolla Verrillii, from exumbral side.

PLATE V.

Fig. 1. *A*. Quadrant of *A. Verrillii*, from subumbral side, with organs entire. *B*. Quadrant from exumbral side. *C*. Quadrant from subumbral side (Interradial), ovaries removed. *D*. Quadrant from subumbral side (Perradial), ovaries removed.
When the quadrants are entire there are twenty-two tentacles.

PLATE VI.

Fig. 1. *Nauphantopsis Diomedeæ*, lateral view.
Fig. 2. The same, exumbral view.

PLATE VII.

Fig. 1. *Ephyroides rotaformis*, exumbral surface.
Fig. 2. View of three exumbral socles (*soc.*), and three marginal lappets from exumbral surface.

PLATE VIII.

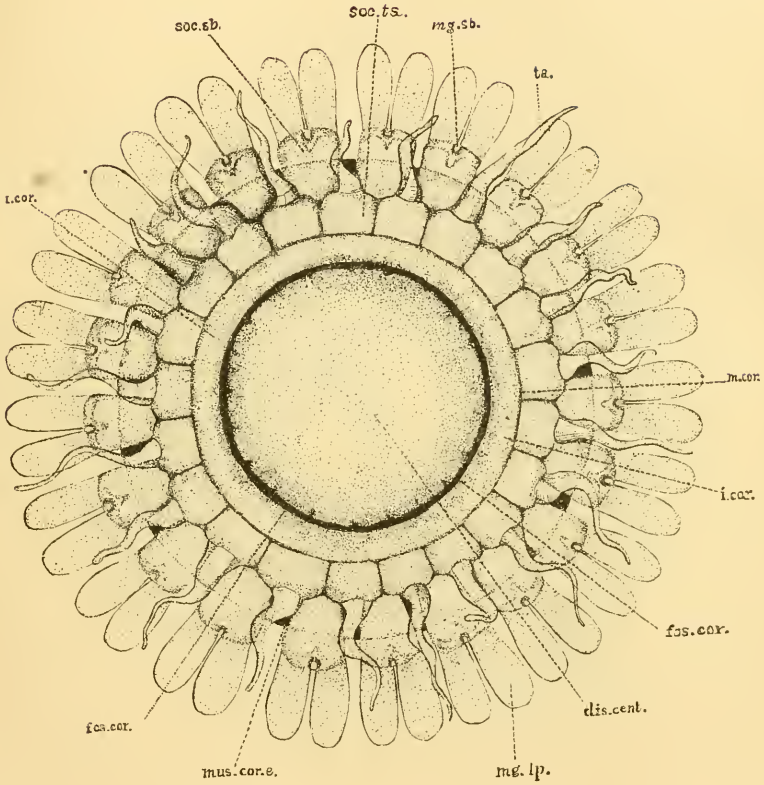
Fig. 1. *Halicreas minimum*, exumbral surface.
Fig. 2. The same, subumbral surface.
Fig. 3. The same, with more thickly tuberculated marginal prominence.
Fig. 4. Side view of *Halicreas*.

PLATE IX.

Fig. 1. *Solmaris incisa*, life size, divided into four quadrants, of which (1) shows the disk from above, with velariam entire and turned downward; (2, 4) the disk from above, with the velarium broken up into "marginal lappets" (*mg. lp.*); (3) bell from below (subumbral).

PLATE X.

Fig. 1. Polypite of *Pterophysa grandis*.
Fig. 2. The same, from convex side.
Fig. 3. The same, from concave side, slightly inclined to observer.
Fig. 4. *Angelopsis globosa*, lateral view.
Fig. 5. Section of last, showing interior.
Fig. 6. Stem (portion) of *Rhizophysa uvaria*, with float.
The drawings of all the figures were made from nature by the author.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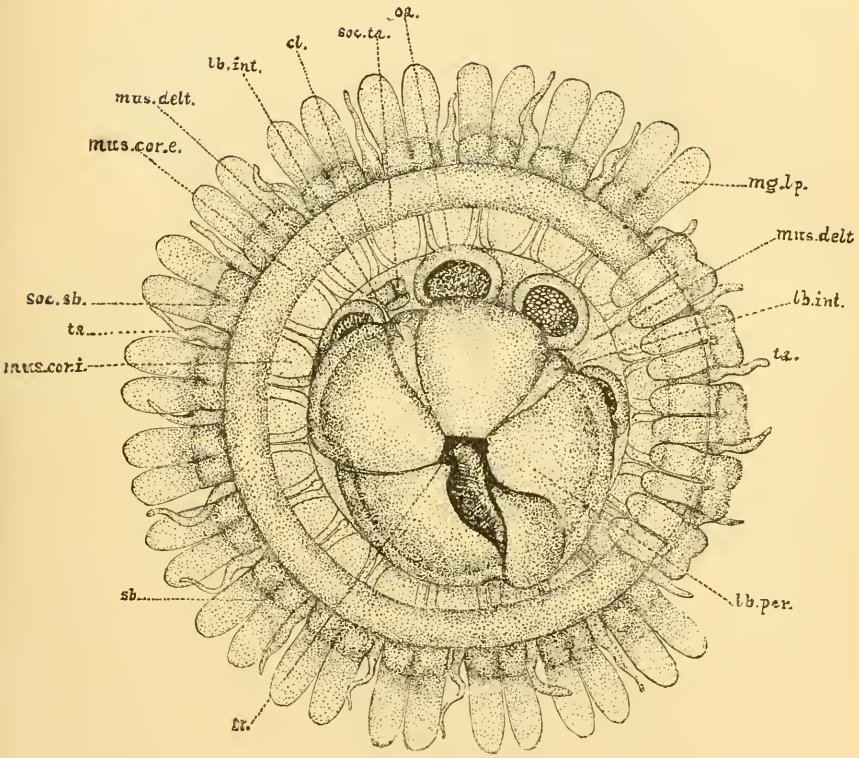
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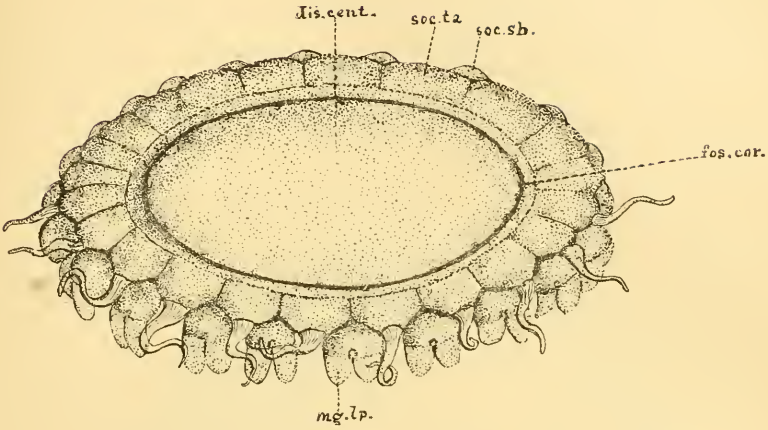
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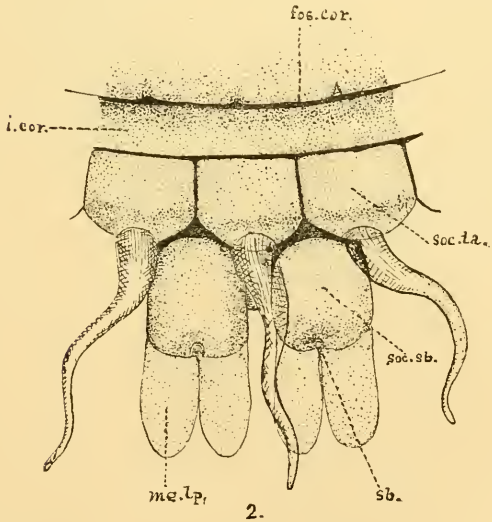
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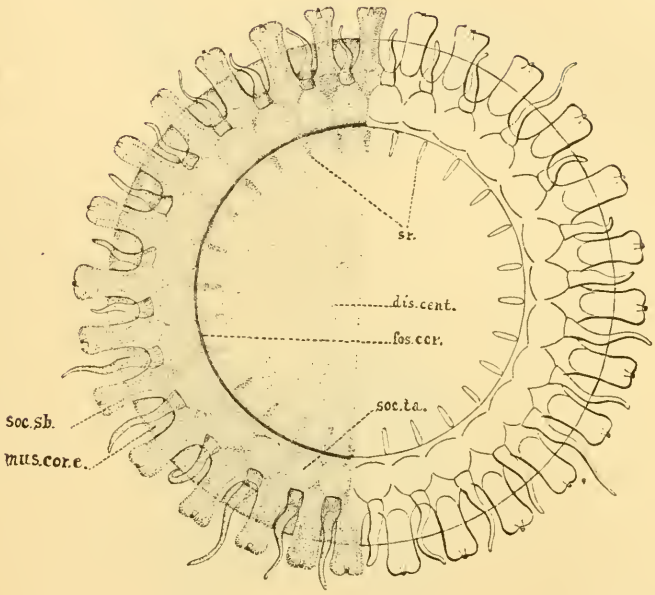

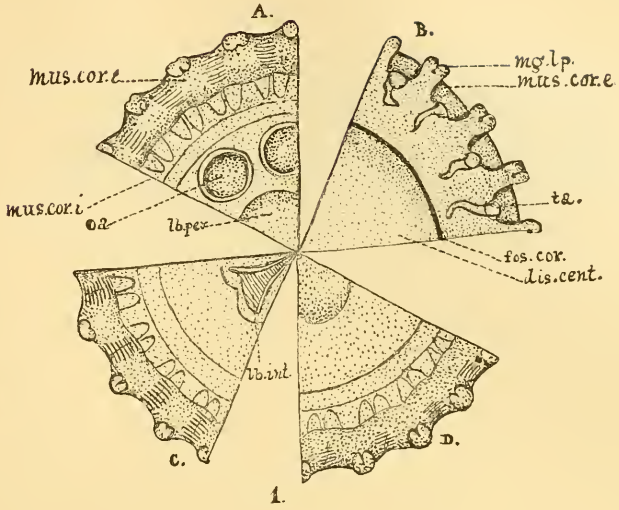
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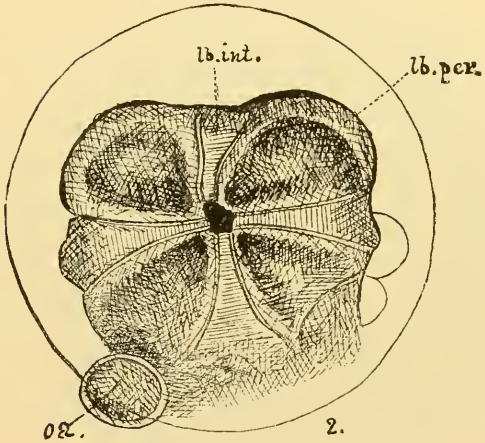
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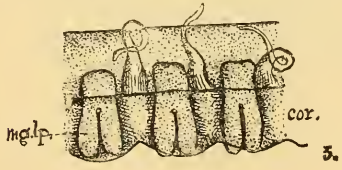
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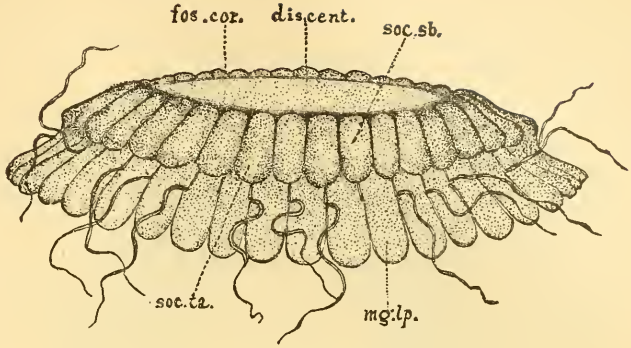
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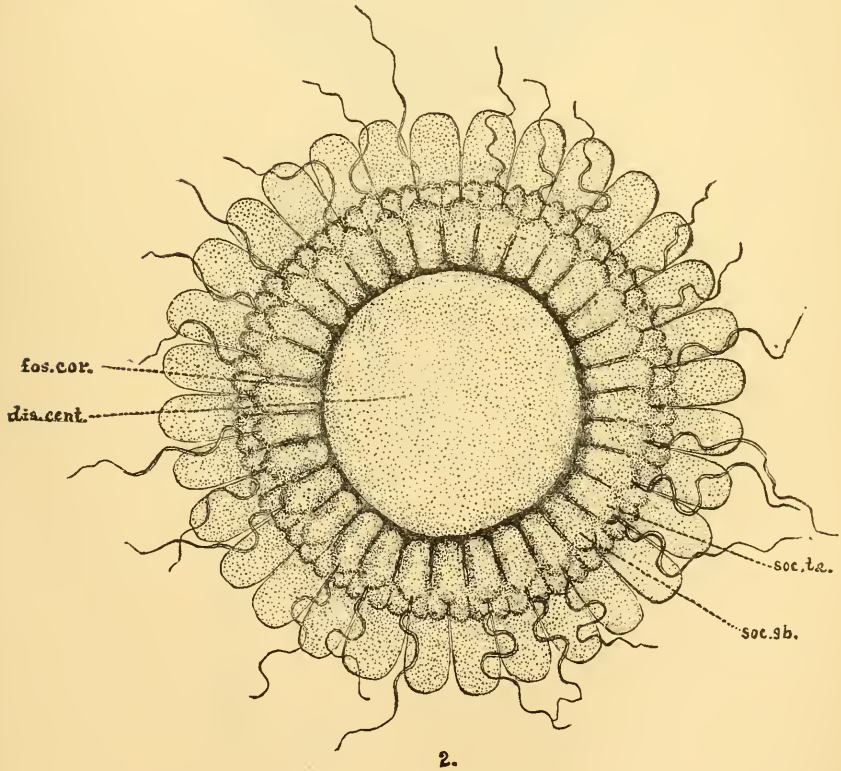
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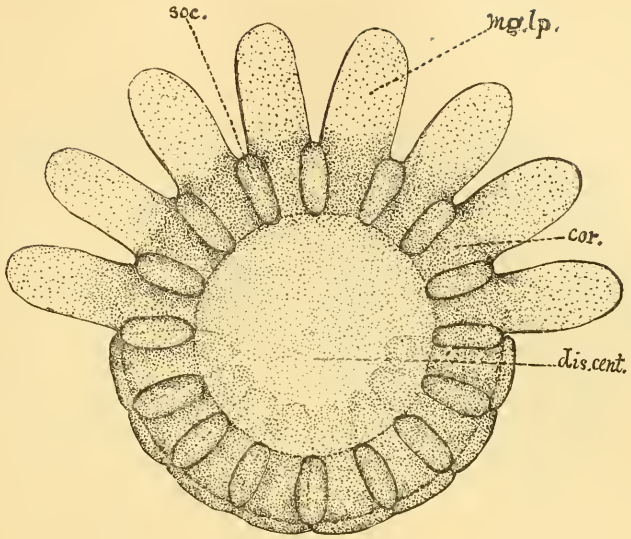

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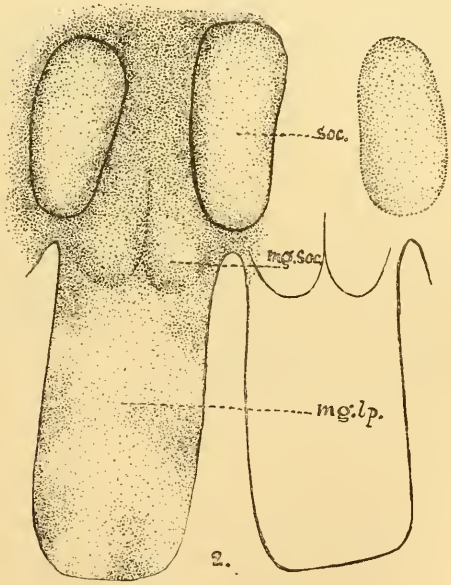

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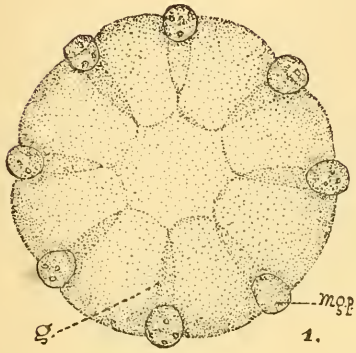

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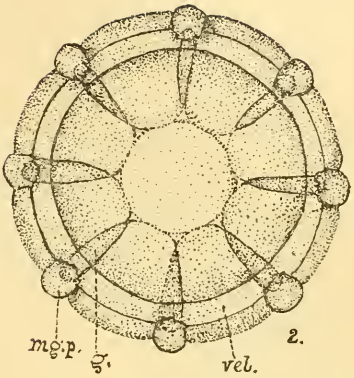

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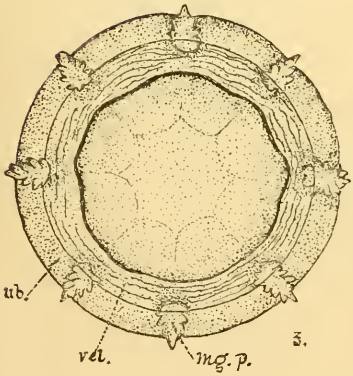

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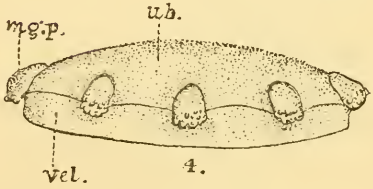

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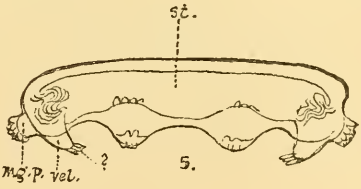

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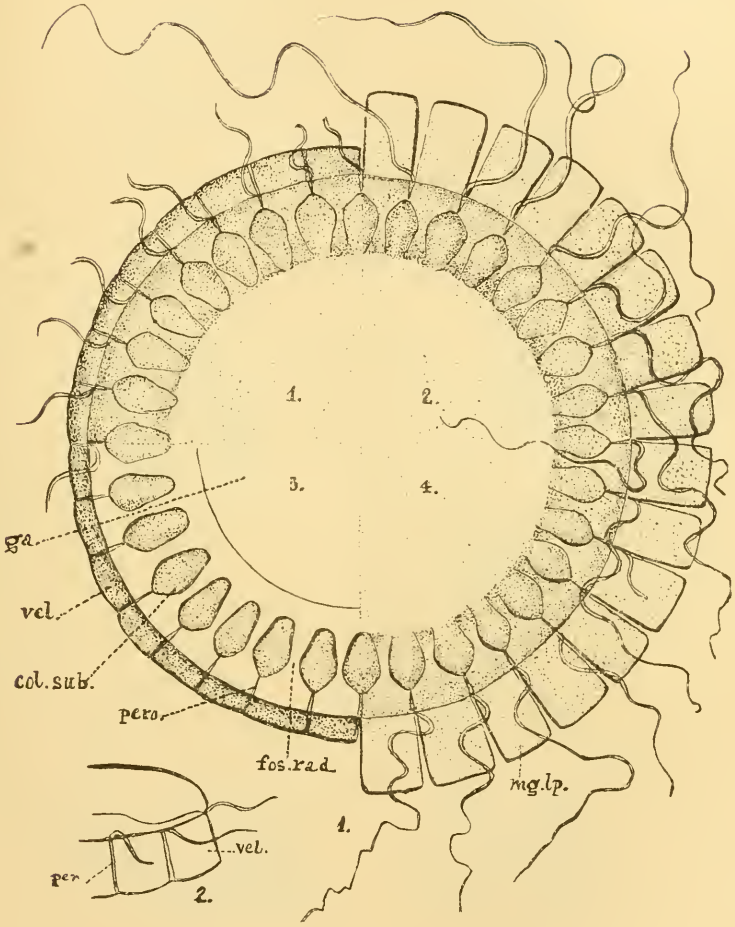
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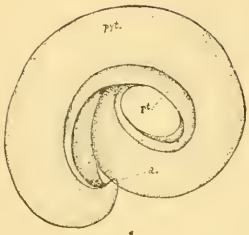
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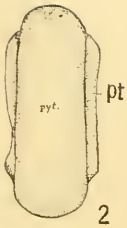
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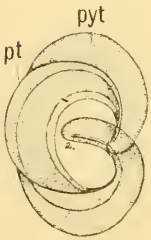
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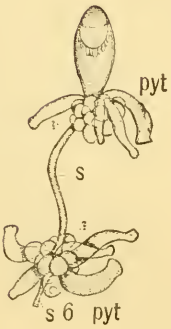
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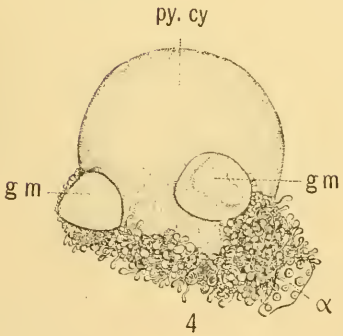
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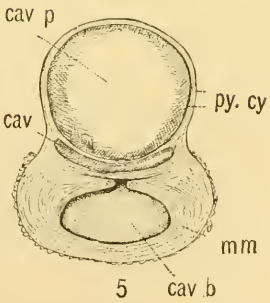
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