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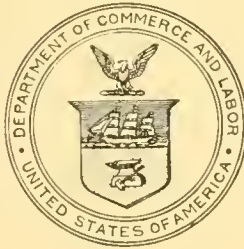
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CONTRIBUTIONS FROM THE BIOLOGICAL LABORATORY OF THE BUREAU OF FISHERIES
AT WOODS HOLE, MASSACHUSETTS.

THE MEDUSÆ OF THE WOODS HOLE REGION.

By CHARLES W. HARGITT,
Professor of Zoology, Syracuse University.

INTRODUCTION.

The present report forms one of a series projected by the director of the biological laboratory of the United States Bureau of Fisheries, the primary object being to afford such a biological survey of the region as will bring within easy reach of students and working naturalists a synopsis of the character and distribution of its fauna.

The work which forms the basis of this paper was carried on during the summers of 1901 and 1902, including also a brief collecting reconnaissance during the early spring of the latter year, thus enabling me to complete a record of observations upon the medusoid fauna during every month of the year, with daily records during most of the time. For parts of these records during late fall and winter I am chiefly indebted to Mr. Vinal N. Edwards, which it is a pleasure hereby to acknowledge. It is also a pleasure to acknowledge the cordial cooperation of the Commissioner, Hon. George M. Bowers, and of Dr. H. M. Smith, director of the laboratory in 1901 and 1902.

Most of the drawings have been made directly from life by the writer or under his personal direction. A few of those occurring in the text have been copied from various sources, due credit for these having been given in every case, so far as known.

Since the publication of "North American Aclephæ" by Alexander Agassiz in 1865 no connected and systematic account of the medusoid fauna of the north-eastern Atlantic coast has been undertaken. Various reports dealing only incidentally with this phase of the subject have been made from time to time by Prof. A. E. Verrill, notable among these being that known as "The Invertebrate Fauna of Vineyard Sound," in the Report of the United States Fish Commission for 1871; and a number of papers by J. Walter Fewkes have appeared in issues of the Bulletin of the Museum of Comparative Zoology, describing new species and incidentally giving some account of their morphology. More recent contributions are several articles by Mr. A. G. Mayer, in conjunction with Mr. A. Agassiz, dealing with various aspects of the subject, though not limited especially to this region—indeed, only touching it in a very general way.

While by reason of the peculiar interrelations of hydroids and medusæ the present paper may here and there touch to a limited extent a phase of the subject included in Nutting's "Hydroids of the Woods Hole region," it will not materially duplicate that work, but rather supplement and extend it, the two parts forming a fairly complete summary of the entire phylum, the Anthozoa alone excepted. The present paper will also include something in the nature of a synopsis of the development of representative forms, together with data as to habitat, seasonal variations, etc. The region covered will be about that already outlined by Nutting, namely within the limits of a single day's cruise from the Fisheries Station; for example, Cape Cod and Nantucket on the east, the Gulf Stream on the south, and Narragansett Bay or Long Island Sound on the west.

The order of presentation will follow substantially that adopted by the present writer in the "Synopsis of the Hydromedusæ," recently published in the American Naturalist, which follows in general order and nomenclature Haeckel's "System der Medusen," though without adherence to that or any special authority, except as noted in the body of the paper. While deploring the more or less chaotic condition of existing systems of taxonomy in relation to coelenterates, it has not seemed expedient to propose any radical changes at present, even if data were available for such an undertaking. A prerequisite thereto, and one open to students of the group everywhere, is the critical study of ontogeny. Unfortunately, this has not only been neglected in too many cases, but the tendency to devote attention to a single phase of the subject, for example, the *hydroid*, or on the other hand the *medusa*, has, perhaps indirectly, cultivated the neglect. It is greatly to be desired that in the future less emphasis be placed upon elaborate monographs of "Gymnoblastic Hydroids" or "System der Medusen," valuable as these have been, and more upon monographs of Hydromedusæ, or, in other words, monographic details of the ontogeny of species, constitution of genera, families, and orders, including also critical data as to the varietal effects of environment, nutrition, etc. Such monographs would afford final data from which a consistent and scientific taxonomy might be established.

Except in so far as necessary in order to obviate ambiguity, little effort has been devoted in the present report to details of synonymy, or to the unraveling of conflicting claims of priority, etc.

GENERAL ACCOUNT.

Under the general title of "Medusæ" are included animals of a remarkable range of size, habits, distribution, and life history. In size they vary from less than a millimeter in diameter in the adult condition, as in many of the Hydromedusæ, up to enormous specimens of Scyphomedusæ, more than 2 meters in diameter and with tentacles more than 30 meters in length.

One of the interesting anomalies associated with some of these animals is that notwithstanding their large size, no less than 99 per cent of the entire mass is composed of water, so that a specimen exposed upon a clean surface to the desiccating influence of sun and air would, after a few hours, leave hardly sufficient organic matter to identify the place. Such being the case it might not be a wholly unwarranted paradox to define a medusa as organized and animated sea water.

In habit most medusæ are marine, though a few are known to occur in fresh

waters of inland lakes. Most are free swimming at some time during their life history, yet not a few among both Hydromedusæ and Scyphomedusæ are permanently sedentary, some as degenerate sporosacs, others as polyp-like forms such as the Lucernariidæ. In distribution they range from a littoral to a pelagic life and from the surface to abyssal depths.

Under the head of Medusæ is also usually included a group of animals of similar form and habits, though of somewhat doubtful structural affinities, namely, the ctenophores or "comb jellies." While admitting a reasonable doubt as to their true morphological relations, the ctenophores may still be most conveniently recognized as a distinct class of medusæ and included within the present synopsis. Hence species indigenous to this region will be noted and briefly described.

Concerning the economic relations of medusæ very little is known. That they sustain intimate general relations to the varied forms of marine life can hardly be doubted. Their vast numbers, wide distribution, and more or less active life habits all support the general inference. The well-known cases of commensalism existing between medusæ and several species of fishes which follow them at times with more or less persistence, often taking refuge in the frills of the pendulous lobes of Scyphomedusæ, and resisting efforts to separate them, still further suggest the probability. Some fishes are said to feed upon the oral tentacles and margins, as well as the larger tentacles of the umbrella, which they tear off at times with great vigor. Often, however, the medusæ reverse the operation and devour the fishes. It does not seem likely that medusæ can afford any large measure of food for fishes in general, but several species of fish are known to feed upon them at times with great avidity. The horned dog-fish, *Squalus acanthias*, when first arriving at Woods Hole in the spring migration, in May, is said to feed largely on ctenophores. (H. M. Smith.) The sun-fish, *Mola mola*, and also the file-fish, *Aluteru schoepfii*, have been found by Mr. Vinal Edwards to have fed entirely on ctenophores and medusæ.

As a special case of mutualism between fishes and medusæ may be mentioned that of the young of the butter-fish, *Rhombus triacanthus*, found with *Dactylometra quinquecirra*. Whether this particular case is of more than temporary nature may be doubtful. So far as I am aware it is chiefly, if not wholly, limited to the period of the young fish. Another case of similar character is that of the Portuguese man-of-war, *Physalia pelagica*, with its commensal, the Portuguese man-of-war fish, *Nomus gnomorii*. In a single excursion in 1894 the United States Fish Commission collected 21 specimens of this fish, averaging 6 inches in length, all of which were found associated with *Physalia*. A dozen specimens of *Nomus* have been found under a single *Physalia*. (H. M. Smith.)

While the importance of medusæ as food for fishes may as yet be an open question, there can be no doubt, on the other hand, that fish, especially the fry, are an important article of food to many medusæ. Even small Hydromedusæ, such as *Gonionemus*, gorge themselves with fry frequently too large to be entirely swallowed, and large medusæ, like *Cyanea* and *Aurelia*, are often found with their stomachs filled with fish of considerable size, some of which are often in a partially digested condition. It is not rare to observe the capture of minnows by medusæ in the aquarium. In general, however, so far as my own observations go, the principal food source of the smaller medusæ is copepods, and since copepods also furnish

an important part of the food of fish fry, the relations of fish and medusæ in certain cases may be due to the relation of both to a common source of food.

In this connection may be noted another feature of medusoid life, namely, susceptibility to certain parasites. When working upon the regeneration of medusæ, I found several species of Protozoa very closely associated with them and, under the limitations of the aquaria, often exceedingly troublesome, seriously interfering with the progress of the experiments. This suggested the probability of a parasitic relation. I have also found several species of Hydromedusæ infested with a minute nematode, a species of *Distomum*, which in many cases was so abundant as to permeate almost every part of the medusa. The parasitism of a small actinian, a species of *Edwardsia*, on *Mucmiopsis leidyi*, is well known, though the entire history of the case is not yet fully determined.

The irregular and apparently capricious occurrence and distribution of medusæ has long been known but little understood. That many have a seasonal period there can hardly be reasonable doubt. Such for example is true of *Hybobodon*, *Sarsia*, *Tima*, *Pennaria*, etc., among Hydromedusæ, and *Dactylometra*, *Cyanea*, and to a less extent *Aurelia*, among Scyphomedusæ. Further consideration will be given to this in connection with the subsequent descriptions.

Agassiz has called attention to the gregarious habit noted among many medusæ at certain times and places (cf. Catalogue of North American Aculephæ, pp. 42, 46), and has sought to explain the phenomenon as due to breeding conditions. This seems to me a somewhat gratuitous assumption, as facts do not confirm it so far as my observations have gone. As I have elsewhere suggested, it seems much more probable that these aggregations may be quite as easily accounted for by the influence of prevailing winds, tides, etc. At no time have I seen *Cyanea* in greater numbers than in April, when the specimens were very small, hardly more than 2 to 3 inches in diameter, and sexually immature. A change in the direction of wind or tide would disperse them again within a day's time so that only by careful search could an isolated specimen here and there be noted. This is true likewise of many Hydromedusæ, which may often occur in large numbers for a day or two and then as suddenly disappear. The occurrence of some other species, however, is less easily explained. For example, *Rhegmatores tenuis* and *Staurophora laciniata* I have taken but twice at this station in ten years. Both of these being of littoral habitat their appearance could hardly be accounted for by a heavy wind from the direction of the open sea, as may be the case with pelagic forms like *Trachynema* or *Physalia*. When we know more definitely the details of the life history of such forms, light will undoubtedly be thrown upon this as well as many other more or less obscure phenomena concerning them.

A feature more or less similar to those just discussed is the apparently nocturnal habits of not a few medusæ. Whether the occurrence at the surface during the early evening or night can be said to constitute a definitely nocturnal habit may be an open question, but certain it is that there is here a fairly well-defined responsiveness to light and darkness. This has been experimentally demonstrated in several well-known cases—for example, *Gonionemus*, *Pennaria*, etc., where advantage has been taken of it to secure the discharge of ova at times other than those normal to the species. May there not be here also an explanation of a fact that has been often

observed—namely, that cloudy or foggy days are frequently better times for collecting from the surface than bright, clear weather? If, however, such a nocturnal, or negatively heliotropic, habit exist, we must seek the seat of response in different organs. If we may allow that sensory bulbs are present in *Gonionemus* and are visual, we shall be confronted with a variation of the problem in *Pennaria*, which is wholly devoid of such organs, and without sign of ocellar bodies. It should be noted in this connection that experiments on *Pennaria* as to the effects of darkness were entirely negative in results; at the same time no medusa known to me is more apparently responsive to twilight conditions in its liberation from the hydroid, and in the prompt discharge of its sexual products immediately after. I have elsewhere pointed out that *Pennaria* shows certain aspects of degeneration, and among them the visual organ may have been involved. If such has been the case, the process must have been a gradual one, during which the visual function may have become more or less generalized and distributed over the entire nervous organization, or to generalized sensory cells similar to those of many other well-known animals, as the earthworm, for instance.

The brilliant coloration of many medusæ is too well known to naturalists to need particular emphasis, and to the general reader it will suffice to refer to the accompanying plates, from some of which a better idea may be obtained than would be given by means of verbal description. Like several of the problems already raised, that of color is noteworthy, if not indeed among the most difficult associated with medusoid morphology, in connection with which it has usually been considered. As will be seen from the following discussion, there is good reason to believe that the most hopeful outlook for its solution lies along the line of physiology rather than morphology.

As already pointed out, many medusæ are apparently devoid of visual organs, and this fact alone would seem to preclude the usual explanation of coloration as found among animals possessing eyes of any marked acuteness. Again, it has been pointed out that many medusæ are of abyssal habit, where solar light is almost if not wholly absent, and where in creatures with or without eyes color as a physical feature must necessarily be of minimum value. Many naturalists have speculated upon these phenomena, and various theories have been proposed by means of which it was sought to bring them into some sort of harmony with our ordinary conceptions of color as a factor in adaptation and natural selection. It has been suggested that the absence of solar light at great depths is measurably compensated for in the presence of phosphorescence, a property known to be possessed by not a few abyssal animals, and that this is adequate for the recognition of colors, or to render colors variously protective.

While these views are interesting and somewhat suggestive, they seem to me to fall far short of affording even an approximation toward anything like a solution of the simplest aspects of the problem involved. That phosphorescence may afford some small measure of illumination when possessed by segregated groups of deep-sea forms may be true, but not more so than in the case of surface and littoral animals of similar properties. So far as I am aware, there has been little, if any, disposition to interpret phosphorescence among the latter as serving any such function; and while this alone may not disprove for it a function very different under the very

different condition of deep-sea life, the burden of proof rests upon those who make the claim. Whether available or not for animals with functional visual organs, however, it fails to touch the problem among creatures which, like many of the medusæ, are wholly devoid of such organs; but interesting as might be further discussion, the present is not the most appropriate place for the treatment of this and related problems, nor is their morphological aspect likely to afford more than mere plausibility. As suggested in a previous paragraph, it seems to me to be a physiological rather than a morphological question. This phase has been discussed by me elsewhere (cf. *Science*, Jan. 22, 1904), and the briefest summary is all that can be attempted here.

It was long ago pointed out by Darwin himself that color among lower forms could not have any value as a factor in natural selection; it was considered as an expression of the "chemical nature or minute structure of their tissues," and Wallace regarded color as "a normal product of organization" among such creatures. It has more recently been determined that among annelids, mollusks, and, indeed, among certain insects, coloration often results from the purely physiological processes of excretion, and I have shown that the same is probably true concerning the coloration of medusæ and other celenterates. Morgan and Stevens have demonstrated that among hydroids during regenerative processes pigmentary matters, which were first thought to have an important function, were in reality waste products in process of elimination. The marked changes of coloration often observed in these organisms under artificial environment have been shown to be associated with changed conditions of nutritive metabolism in some instances, while in others light has been found to be an important factor.

Similar observations and conclusions are not lacking concerning coloration among echinoderms, crustacea, and many other groups. Without seeking to discredit the value of color as a factor in adaptation among some of the highly specialized groups, I can not repress the conviction that its importance in this respect has been greatly overestimated.

SYSTEMATIC SYNOPSIS.

The medusæ comprise three fairly well differentiated classes, known as Hydromedusæ, Scyphomedusæ, and Ctenophora, and distinguishable by the following diagnostic characters.

I. HYDROMEDUSÆ.—Definite velum, gonads usually ectodermal and developed upon the walls of the manubrium or beneath the radial canals; sensory organs in the form of ocelli or otocysts, never modified tentacles. Polyp stage usually present, but devoid of gastric filaments or ridges, and producing medusæ or sporosacs by a process of budding.

II. SCYPHOMEDUSÆ.—Devoid of true velum; gonads always entodermal, and borne within the gastric pouches; sensory organs when present are usually entodermal and are perhaps modified tentacles. Polyp stage when present possessed of distinct gastric ridges and often filaments, and multiplying or metamorphosing by transverse fission to form the larval medusæ.

III. CTENOPHORA.—Devoid of nematocysts, locomotion by means of vibratile plates, which are arranged in eight meridional rows. Tentacles when present only two in number, adradially placed on opposite sides of the body.

THE HYDROMEDUSÆ.

The Hydromedusæ comprise some five fairly distinct orders:

1. ANTHOMEDUSÆ.—A more or less hemispherical umbrella, sometimes ovoid or conical; velum usually well developed, affording an effectual swimming organ, because of which these medusæ are

characterized by an active habit and quick vigorous movements lacking in many of the other orders. Sensory organs when present are on the bases of the tentacles as pigmented, ocellate structures, probably visual in function. Otcysts are entirely lacking in this order. The radial canals are usually four in number, rarely six or eight. Gonads are developed and borne on the walls of the manubrium, rarely extending somewhat upon the proximal portions of the radial canals.—*Nemopsis*.

II. LEPTOMEDUSÆ.—Compared with the Anthomedusæ the umbrella of medusæ of this order is usually flat and disk-like; velum smaller and more delicate, at times difficult to distinguish, so that in many of the species motion is somewhat sluggish, being produced as much through the general contraction of the umbrella as by the velum. Sensory organs, when present, are usually otcysts, rarely ocelli, more rarely both, or both may be lacking. Otcysts are usually borne between the bases of tentacles, sometimes upon the inner side of their bases, and are probably equilibrium organs rather than visual. Gonads are borne along the line of the radial canals, rarely extending to the manubrium and upon its sides.—*Tima*, *Nemopsis*.

III. TRACHOMEDUSÆ.—Usually devoid of a polyp stage, though the recent determination of this in *Gonionemus*, by Perkins, suggests the possibility of its occurrence in others. Sensory organs, when present, are otcysts, entodermal in their origin, ocelli usually lacking. Gonads borne upon the subumbrellar surface of the radial canals, often throughout their entire length. Umbrella usually hemispherical or bell-shaped; marginal tentacles usually numerous.

IV. NARCOMEDUSÆ.—Somewhat flattish, or disk-shaped umbrella, with tentacles set in socket-like receptacles high on the exumbrellar surface; radial canals usually in the form of flat, pouch-like diverticula of the stomach.

V. SIPHONOPHORA.—Comprising free-swimming polymorphic colonies, which are produced by budding from a medusoid individual. Gonads produced in specialized medusoid gonophores which seldom become free from the colony. The Siphonophora are characterized by an extreme degree of specialization found nowhere else among the coelenterates, so great indeed as to leave some doubt as to the homologies of some of the individuals.

ANTHOMEDUSÆ.

CODONIDÆ.—Manubrium cylindrical; mouth simple, devoid of lobes or tentacles; gonads borne on the manubrium, but not radially divided; radial canals four, narrow; marginal tentacles four, unbranched.

TIARIDÆ.—Manubrium quadrangular; mouth with four lobes, simple or fimbriated; gonads four or eight, radially disposed upon the manubrium; radial canals four, rather wide; marginal tentacles unbranched.

MARGELIDÆ.—Manubrium quadrangular, mouth usually simple or with four plain lip-like lobes, and with four or more simple or branched oral tentacles; gonads four or eight, borne on the manubrium; radial canals four, usually narrow; marginal tentacles unbranched.

CLADONEMIDÆ.—Manubrium usually quadrangular, mouth rarely simple, usually provided with oral lobes or tentacles; radial canals narrow; marginal tentacles variously feathered or branched.

Family CODONIDÆ.

KEY TO THE GENERA.

A. With two or four marginal tentacles, equally developed.

1. Tentacles and manubrium long, the latter extending far beyond the velum; bell hemispherical..... *Syncoryne*
2. Tentacles rather short and stout, capitate ends, manubrium with one or more constrictions, sometimes extending slightly beyond the velum; bell often conical..... *Diphyria*
3. Tentacles as in preceding, but clavate, and with a distinct ring of nematocysts between the base and club-like ends; bell rather high and with rounded projection..... *Diphyria*
4. Tentacles closely coiled in swimming; bell high and with eight rows of nematocysts..... *Ectophora*
5. Tentacles only two at liberation, four in maturity; bell oval or hemispherical, its surface dotted with nematocysts..... *Hydrichthys*
6. Tentacles rudimentary; bell elongate, oval..... *Pyrosoma*
7. Tentacles only two; bell hemispherical and with rounded apical projection..... *Pyrosoma*

B. With a single conspicuous tentacle, others rudimentary or unequally developed.

8. Large tentacle stout and subtriangular; other three rudimentary; bell elongate oval or rectangular in outline; manubrium short and thick *Euphysa*
9. A single large, long tentacle, two very small, one rudimentary; bell hemispherical, slightly asymmetrical *Corymorpha*
10. A single greatly enlarged tentacle, with thick base, from which secondary medusae are budded; bell evidently asymmetrical *Hybocodon*

SYNCORYNE Ehrenberg (in part, 1834).

Syncoryne mirabilis (L. Agassiz). Pl. V, fig. 1.

Sarsia mirabilis L. Agassiz, Memoirs American Academy of Arts and Sciences, Vol. IV, 1819, p. 221.

Coryne mirabilis L. Agassiz, Contributions to the Natural History of the United States, Vol. IV, 1862, pp. 185, 310.

Syncoryne mirabilis Allman, Monograph of the Gymnoblasic Hydroids, 1871, p. 278.

Sarsia mirabilis Haeckel, System der Medusen, 1879, p. 17.

Bell subhemispherical, very transparent, varying from 6 to 12 mm. in diameter. Tentacles 4, very long and filamentous, but capable of great contraction. Manubrium long and pendulous, extending far beyond the velum, but highly contractile, often coiled within the bell. Mouth simple. Gonads borne on the manubrium, at maturity enlarging this organ till it fills the bell cavity. A very common medusa, ranging in season from February to May.

Colors.—Bell very transparent, manubrium pale greenish, tentacular bulbs greenish about a brownish center, within which is located the black ocellus.

Distribution.—Fairly common throughout the region; reported by Fewkes as somewhat rare at Newport.

Syncoryne reticulata (A. Agassiz).

Syndictyon reticulatum A. Agassiz, in L. Agassiz, Contributions Natural History United States, Vol. IV, 1862, p. 340. North American Aculephae, 1865, p. 177.

Syncoryne reticulata Allman, Monograph of the Gymnoblasic Hydroids, 1871, p. 283.

Syndictyon reticulatum Haeckel, System der Medusen, 1879, p. 21.

Medusa very similar to the preceding, but said to be distinguished in younger stages by the spirally disposed nematocysts about the distal portions of the tentacles, and by the reticulated disposition of the nematocysts over the exumbrella. These characters said to disappear after maturity, when the species is chiefly distinguished by the permanently red-brown ocelli.

This medusa has not been distinguished by the present writer, nor have I seen it reported by recent students of the group. This brief description is taken from A. Agassiz's account (North American Aculephae, page 177-180).

Distribution.—Massachusetts Bay, Boston Harbor, Nahant (Agassiz, Clark).

Syncoryne producta Hargitt. Pl. I, fig. 1.

Coryne producta Hargitt, American Naturalist, Vol. XXXVI, 1902, p. 550.

Bell high hemispherical or ovate, 1.5 mm. in long diameter by 1 mm. in short diameter; tentacles 4, rather long and with prominent basal bulbs, which are orange colored with a central black ocellus. Manubrium long and distinctively sarsian in character, projecting far beyond the velum, but capable of great contraction, its terminal portion bulb-like, basal portion forming a gastric pouch; mouth simple. Gonads medusoid and borne in a whorl about the base of the manubrium. This is the first member of the genus from this region or from American waters known to produce proliferous medusae, as do Forbes's species, *Sarsia gemmifera* and *S. prolifera*.

Colors.—Bell very transparent; manubrium with basal portion orange; terminal bulbs proximal light sky-blue; distal green; tentacle bulbs orange, margined with delicate greenish; ocelli black.

Distribution.—A single specimen taken at Woods Hole.

DIPURENA McCrady (1857).

Dipurena strangulata McCrady. Pl. 1, fig. 2.

Dipurena strangulata McCrady, Proceedings of the Elliott Society of Natural History, Vol. I, 1857, p. 33. L. Agassiz, Contributions to the Natural History of the United States, Vol. IV, 1862, p. 341. A. Agassiz, North American Aculephae, 1865, p. 181. J. W. Fewkes, Bulletin of the Museum of Comparative Zoology, Vol. VIII, 1881, p. 155.

Stahleria strangulata Haeckel, Prodromus Systemae Medusarum, 1877, No. 15.

Dipurena strangulata Haeckel, System der Medusen, 1879, p. 23.

This medusa was first described by McCrady from Charleston Harbor. The only record of its subsequent occurrence within that region is that by Fewkes above cited. For several years I have taken medusæ at Woods Hole which differ in no essential respect from McCrady's species and which I consider identical.

Bell subhemispherical to half ovoid, very transparent, with firm walls; marginal tentacles 4, stout, rather stiff, and with evident terminal knobs, basal bulbs prominent, each with a single black ocellus on its outer central surface; manubrium usually long, though highly contractile and distinguished by one or more rather sharp constrictions, usually one at the base and another about the middle, suggesting the specific designation. Mouth simple or slightly lobed.

Colors.—Body of manubrium bright green margined with red or pink; tentacular bulbs reddish orange, terminal knobs bright reddish.

Distribution.—Common at Woods Hole, rare at Newport (Fewkes).

Dipurena conica A. Agassiz.

Dipurena conica A. Agassiz, in L. Agassiz's Contributions to the Natural History of the United States, Vol. IV, 1862, p. 341; North American Acælephie, 1865, p. 181.

Stableia conica Haeckel, Prodrömus Systemæ Medusarum, 1877, No. 16.

Dipurena conica Haeckel, System der Medusen, 1879, p. 24.

Bell conical to hemispherical, with rather firm aboral thickening; marginal tentacles 4, of same character as in preceding species; manubrium indistinguishable from preceding; mouth similar.

Colors.—Indistinguishable from preceding.

Distribution.—Buzzards Bay, Vineyard Sound, etc.

Medusæ answering in every particular to Agassiz's description have been taken constantly for many years, but associated with individuals which as clearly correspond with the preceding; and, what is more significant, these two forms graduate imperceptibly into each other in all essentials of shape, structure, etc. It seems altogether probable, therefore, that we have here simply a varietal form, which would hardly justify specific separation, and should probably be included under the above species.

DIPURELLA Hargitt (1902).

Resembling in some respects the preceding genus, these medusæ have marked differences in shape of bell, form of manubrium, and certain aspects of the tentacles, demanding generic distinction.

Dipurella clavata Hargitt. Pl. I, fig. 3.

Dipurella clavata Hargitt, Biological Bulletin, Vol. IV, 1902, p. 19.

Bell rather high, subrectangular in profile, with slight apical projection; sides of bell almost straight, thin, flexible, and capable of marked contraction both in long and short diameters. Surface of the exumbrella dotted rather promiscuously with clusters of nematocysts. Radial canals 4, rather wide and simple. Tentacles 4, unequally developed in the type specimen. This difference would seem to be due to immaturity, as is also indicated by the exumbrellar nematocysts. It will be noted from a comparison of the figures of this medusa and *Dipurena* that there is more or less similarity in the form and general aspects of the tentacles. Both are rather stout and rigid, both end in clavate knobs, both have similar basal bulbs. On the other hand the knobs of *Dipurella* are of a heavier and more club-like character, and in addition there is about the median portion of each tentacle a ring of nematocysts which are wholly peculiar to the latter species. The manubrium is sessile, rather short, with large gastric basal portion; mouth simple or slightly lobed.

Colors.—Chiefly restricted to the tentacles; terminal knobs with bright carmine-red center tinged with delicate green; basal bulbs duller orange, red, or brown; ocelli black; manubrium tinged with pale green.

Distribution.—A single specimen taken in Great Harbor. Size small, 2 mm. in height by about 1.5 mm. in width.

ECTOPLEURA L. Agassiz (1862).**Ectopleura ochracea A. Agassiz. Pl. II, fig. 1.**

Ectopleura ochracea A. Agassiz, in L. Agassiz, Contributions Natural History United States, Vol. IV, 1862, p. 343; North American Aculephæ, 1865, p. 191. Haeckel, System der Medusen, 1879, p. 22.

Bell elongate ovoid or pyriform, with thick aboral mesoglea, sides of uniform thickness, exumbrellar surface with eight meridional bands of nematocysts uniting at the apex. Radial canals 4, narrow, and communicating with a well-defined marginal canal. Tentacles 4, usually long and filamentous, though often coiled and contracted when taken in the tow. Size from 2 to 4 mm. in long diameter, by about half as wide. Manubrium large and flask-shaped.

Colors.—Manubrium yellowish on base and oral end, the latter often reddish; central portion reddish to pink. Tentacular bulbs of similar color; ocelli reddish brown.

Distribution.—Common throughout the region in midsummer.

HYDRICHTHYS Fewkes (1888).**Hydrichthys mirus Fewkes.**

Hydrichthys mirus Fewkes, Bulletin Museum Comparative Zoology, Vol. XIII, 1888, p. 224.

Bell oval or subspherical, its outer surface dotted here and there with clusters of nematocysts. Marginal tentacles 4 in adult specimens; only 2 when first liberated; tentacular bulbs reddish in color, but devoid of ocelli. Manubrium cylindrical, rather short; mouth simple.

Colors.—Bulbs of tentacles reddish-brown; manubrium yellowish to orange.

Distribution.—A single record, so far as known to the present writer, that of Fewkes above cited; the medusa taken from a fish at Newport.

PENNARIA Goldfus (1820).**Pennaria tiarella Ayres. Pl. III^a.**

Globiceps tiarella Ayres, Proceedings Boston Society of Natural History, Vol. IV, 1852, p. 193. L. Agassiz, Contributions to the Natural History of the United States, Vol. IV, 1862, p. 341.

Euceopne elegans Leidy, Marine Invertebrates of New Jersey and Rhode Island, 1855, p. 4, in Journal of Academy of Sciences, Philadelphia, Vol. III.

Pennaria tiarella McCrady, in Proceedings of Elliott Society of Natural History, Vol. I, 1857, p. 153. A. Agassiz, North American Aculephæ, 1865, p. 187.

Halocordyle tiarella Allman, Monograph of the Gymnoblæstie Hydroids, 1871, p. 369.

Globiceps tiarella Haeckel, System der Medusen, 1879, p. 39.

Bell high, elliptical or ovoid in outline; size 1.5 mm. high by 0.8 mm. broad. Radial canals 4 marked by lines of reddish pigment on the exumbrellar surface; marginal tentacles 4, very rudimentary. Manubrium spindle-shaped, about half as long as bell; mouth rudimentary, probably not functional. Gonads borne on manubrium and filling entire bell cavity at maturity. Sexual products discharged at once on liberation of the medusa from the hydroid—indeed, often before—in many cases the medusa never becoming free, but discharging the eggs or sperms and dying upon the branches. *Pennaria* seems to be just on the border line between the fixed and free gonophore phases not uncommon among the Tubulariidae. I have elsewhere discussed this feature of the species in more detail. (Cf. American Naturalist, Vol. XXXIV, p. 390, et seq.)

Colors.—General color, pale rosy pink; manubrium, chocolate-brown, reddish pigment along lines of radial canals. Ova vary from creamy white to orange.

Distribution.—General throughout the region in shallower waters; less common from deep waters. One of the commonest of our hydromedusæ, and exhibiting in striking way the characteristic alternation of generations. As previously shown (op. cit.), *Pennaria* exhibits interesting seasonal and environmental variations.

Specimens of *P. gibbosa* from Florida and Porto Rico, compared with *P. tiarella*, show hardly sufficient differences to warrant specific distinctness.

^a Figs. 3 and 4 drawn from life by H. B. Bigelow.

PERIGONIMUS Sars (1840).**Perigonimus jonesii** Osborn & Hargitt. Text ent.

Perigonimus jonesii Osborn & Hargitt, American Naturalist, Vol. XVIII, 1894, p. 27. Hargitt, Mittheilungen Zoologischen Station, Neapel, Bd. II, 1895.

Bell hemispherical, with slight apical projection, about as high as broad, 2 mm. or slightly more. Marginal tentacles 2, located on opposite sides, and with 2 additional tentacular bulbs at the intermediate points; tentacles highly retractile and often carried coiled within the bell cavity, especially when the medusa is disturbed. Velum well developed; manubrium short, subquadratic, and with simple, 4-lobed mouth. Gonads undeveloped in specimens taken, and showing no evidences of growth within a period of more than two weeks, during which they were kept in apparent health in the aquaria.

Habitat.—Found only on the legs and abdominal appendages of the common spider crab, *Libinia*, and taken from this source during several seasons.

Distribution.—Long Island Sound, originally taken at Cold Spring Harbor.

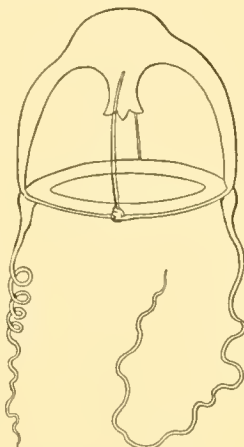
EUPHYSA Forbes (1848).**Euphysa virgulata** A. Agassiz.

Euphysa virgulata A. Agassiz, North American Aculephæ, 1865, p. 189. Haeckel, System der Medusen, 1879, p. 33.

Bell somewhat elongate oval or subrectangular in profile; tentacles 4, but unequally developed, one being much longer and heavier than the others; basal bulbs pinkish and extending upward along the radial canals for a short distance; manubrium short and thick, cylindrical, and with an accumulation of fat-like globules about its base; mouth simple; gonads borne upon the manubrium. In size the medusa is from 8 to 10 mm. in long diameter, slightly less in breadth.

Colors.—Bases of tentacles with bright pigment, extending up the radial canals; manubrium yellowish; bell transparent.

Distribution.—Nahant, Massachusetts Bay, Woods Hole.

*Perigonimus jonesii*.**HYBOCODON** L. Agassiz (1862).**Hybocodon prolifer** L. Agassiz. Pl. 11, fig. 2.

Hybocodon prolifer L. Agassiz, Contributions to the Natural History of the United States, 1862, Vol. IV, p. 243. A. Agassiz, North American Aculephæ, 1865, p. 193. Allman, Monograph of the Gymnoblasic Hydroids, 1871, p. 122. Haeckel, System der Medusen, 1879, p. 33.

Bell subhemispherical, unsymmetrical, being humped upon one side adjacent to the single large tentacle, the latter having a heavy, thick base and affording support for the proliferous secondary medusæ which bud asexually therefrom. The tentacle is very long, the terminal two-thirds being abundantly supplied with rings of nematocysts. Manubrium rather short, cylindrical, and with simple mouth. Gonads on walls of manubrium, where the ova develop directly into actinulae, several of which may be found in various stages of development at the same time.

Developing actinulae and budding medusæ are found at the same time, usually during the early spring—March to May—though proliferous medusæ seem to arise almost constantly, being present on specimens taken in August. An examination of the histology of the gonads shows aspects of oögenesis and development almost exactly similar to those exhibited in *Pennaria*, *Corymorpha*, *Tubularia crocea*, and others. Egg cleavage is so similar to that found in the last-named species as to be almost indistinguishable during corresponding phases. Ova which become active and begin development show the same phenomena of absorption of their fellows as Doflein has pointed out in *Tubularia mesembryanthemum* and Allen in *T. crocea*. It is not clear how fertilization occurs, since the early

development takes place wholly within the tissues of the manubrium, but it is presumably through the penetration of the ectoderm by the spermatozoon, as in several other tubularians.

Hybocodon is characterized by the presence of 5 meridional lines of orange or pinkish pigment over the exumbrella, two of them arising from the base of the large tentacle. Associated with these bands are batteries of nematocysts. A remarkable feature is the apparently gradual disappearance during late spring and summer of these bands, together with their nematocysts, both being wholly absent in specimens taken in August.

Colors.—Bell transparent; orange bands over the exumbrella, on base of tentacle, and on knobs at distal ends of radial canals; manubrium similarly colored at its base and oral end.

Distribution.—General throughout the region, though usually in greatest abundance within limited areas along the coast.

Hybocodon pendula (L. Agassiz). Pl. II, fig. 3.

Corymorpha pendula L. Agassiz, Contributions to Natural History United States, Vol. IV, 1862, p. 276. A. Agassiz, North American Acalephæ, 1865, p. 192.

Hybocodon pendula Haeckel, System der Medusen, 1879, p. 34; Hargitt, Biological Bulletin, Vol. IV, 1902, p. 20.

Monocaulus pendulus Allman, Monograph Gymnoblæstic Hydroids, 1871, p. 397.

Bell similar to that of preceding species, though but slightly unsymmetrical, medusa slightly larger; tentacles unequally developed, one rather large, the others much smaller, one being sometimes rudimentary. Manubrium very similar to that of preceding, and with gonads borne on the surface as in the former.

The hydroid of this medusa I have frequently taken at various places in and about Vineyard Sound and Muskeget Channel, and off Chatham, usually from sandy bottoms and at considerable depths. It is a most beautiful form and lives quite well for a few days in the aquarium. L. Agassiz stated that its medusæ were not liberated, but A. Agassiz later claimed this to have been a mistake and reported having taken the medusæ, though without direct evidence of their relation to the hydroid. Such has been my own experience. Hydroids with medusæ in all stages of development have often been taken, as have also free medusæ, from waters near where the hydroids were dredged, and at the same time, so that there seems to be little doubt as to their relations.

Colors.—Very similar to those of *H. prolifer*, though less bright.

Family TIARIDÆ.

KEY TO THE GENERA.

A. Marginal tentacles two or four.

1. Marginal tentacles four; bell with rounded apical projection *Protiara*
2. Marginal tentacles two; bell with rather sharp apical projection *Stomatopora*

B. Marginal tentacles numerous.

3. Bell with globular apical projection *Torris*
4. Bell without globular apical projection *Turritopsis*

PROTIARA Haeckel (1879).

Four perradial tentacles; manubrium with broad sessile base; gonads borne in four masses on the angles of the manubrium.

This genus was established by Haeckel to distinguish a medusa of synthetic characters, somewhat intermediate between the *Coloniidae* and the *Tiaridae* and indicated by him as the prototype of the latter family. I have elsewhere described briefly a medusa taken in the Woods Hole region which has characters quite similar to the genus under consideration.

Protiara haeckeli Hargitt. Text cut.

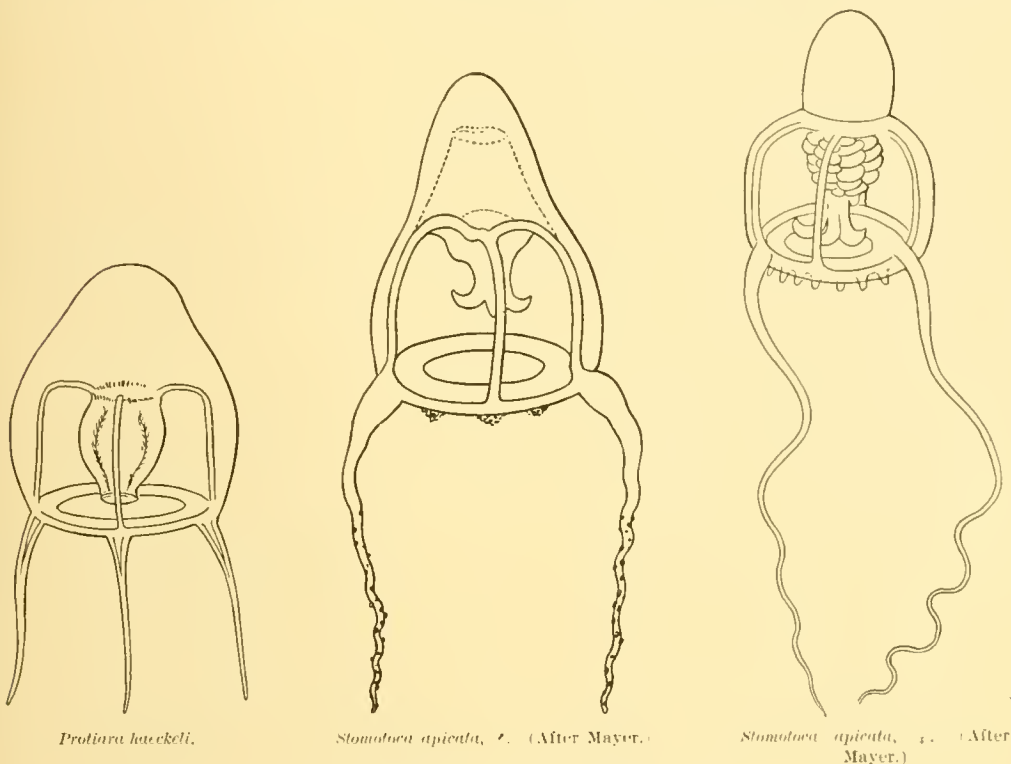
Protiara haeckeli Hargitt, Biological Bulletin, Vol. IV, 1902, p. 17.

Bell half-ovoid, with rather elongated apical projection; tentacles four, rather stout, slightly longer than bell, and with enlarged basal bulbs, the latter devoid of ocelli; velum well developed; manubrium prominent, gastric portion quadrate in cross section, and with the milk-white gonads borne on its

walls; mouth simple with slightly lobed lips. Height of bell from 2 to 4 mm. by slightly more than half as broad. Ontogeny entirely unknown.

Colors.—Bell very transparent, manubrium and gonads milk-white.

Distribution.—Off Gay Head and Nomans Land, Vineyard Sound. Several specimens were taken on two occasions during the summer (July and August) in the same general region.



STOMATOCA L. Agassiz (1862).

Stomatoca apicata (McCrady). Text cuts.

Saphonia apicata McCrady, Proceedings Elliott Society of Natural History, Vol. I, 1857, p. 129.

Stomatoca apicata L. Agassiz, Contributions Natural History United States, Vol. IV, 1862, p. 347.

Dinamutella carosa Fewkes, Bulletin Museum Comparative Zoology, Vol. VIII, 1881, p. 151.

Amphinema apicatum Haeckel, System der Medusen, 1879, p. 50.

This species presents rather striking sexual dimorphism; the male has a long tapering apical projection which is solid, while in the female it arises abruptly from the bell and is hollow. The colors of the two sexes also differ, the male showing a preponderance of green, while the female is dull brownish ochre. Radial canals wide, tentacles two, highly contractile and with prominent basal bulbs; rudimentary bulb-like processes at the intermediate radial points, and often interradial bulbs about the margin; manubrium large, quadratic in section, with broad base; gonads in four masses on manubrial walls; mouth with prominent everted lobes. —Ontogeny unknown.

Colors as indicated above. Distribution chiefly southward in Woods Hole region: Newport, R. I., etc. Mid-summer.

Stomatoca rugosa Mayer.

Stomatoca apicata Fewkes, Bulletin Museum of Comparative Zoology, Vol. VIII, 1881, p. 152.

Amphinema apicatum, Brooks, Studies Biological Laboratory Johns Hopkins University, Vol. II, 1883, p. 473.

Stomatoca rugosa Mayer, Bulletin Museum Comparative Zoology, Vol. XXXVII, 1900, p. 32.

Shape of bell similar to that of preceding species, but of larger size, 5 mm. high by 3 mm. broad,

and having a rugose manubrium. Tentacles similar in size and character to preceding; radial and circular canals wide, all with undulating outlines; velum well developed. The sexual dimorphism noted in the preceding seems to be lacking in this species.

Ontogeny.—Brooks has described this medusa (cf. op. cit.), as derived from a hydroid which he identified as *Perigonimus minutus* Allman.

Colors.—Bell transparent; tentacles and bulbs reddish as is also the manubrium.

Distribution.—Similar to the preceding.

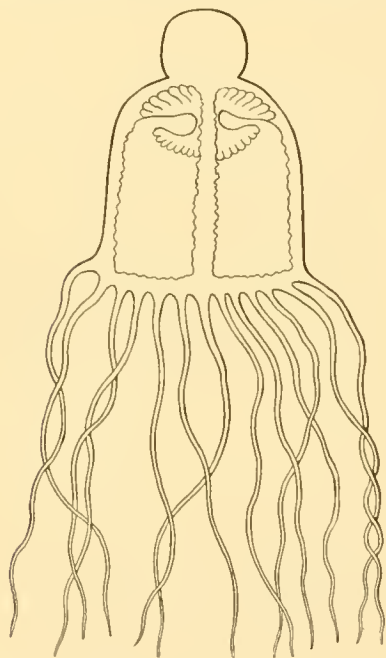
TURRIS Lesson (1837).

***Turris vesicaria* A. Agassiz. Text cut.**

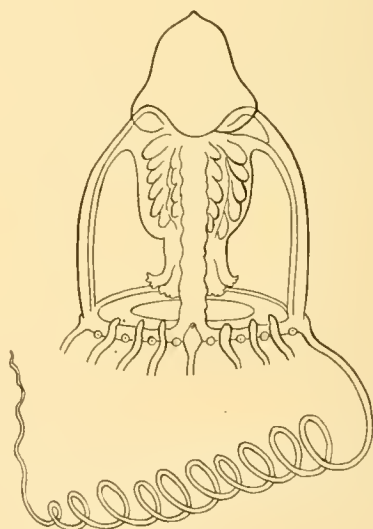
Turris vesicaria A. Agassiz, Proceedings Boston Society of Natural History, Vol. IX, 1862, p. 97; North American Aculephæ, 1865, p. 164.

Urtablena vesicarium Haeckel, System der Medusen, 1879, p. 64.

Medusa high, bell-shaped or hemispherical, with a prominent globular apical projection; tentacles numerous, each with broad basal enlargement bearing a single ocellus, and tapering to filamentous



Turris vesicaria. (After A. Agassiz.)



Turris episcopalis. (After Fewkes.)

ends; manubrium large and with prominent crenulated oral lobes; gonads borne on base of manubrium and extending somewhat upon the four radial canals. Edges of the latter and of the marginal canal irregular or jagged.

Colors.—Bell transparent, manubrium and gonads dull yellowish.

Distribution.—Nahant.

I have never taken this medusa, and the above description is condensed from that of A. Agassiz, who reports having taken it but once, and supposes it to be somewhat rare.

***Turris episcopalis* (Forbes). Text cut.**

Oceania episcopalis Forbes, British Naked-eyed Medusæ, 1848, p. 27.

Turris episcopalis Fewkes, Bulletin Museum Comparative Zoology, Vol. VIII, 1881, p. 147.

Medusa shaped somewhat like an inverted teacup and with a rather sharp apical projection. Radial canals 4, wide and with jagged edges; marginal tentacles 16, long and highly contractile,

with very short interposed tentacle-like structures; the long tentacles have prominent triangular bases, at the apex of which are borne bright crimson ocelli; between the bases of the long tentacles are 3 short tentacular processes and on each of these also is an ocellus, of color similar to those on the long tentacles.

All the tentacular organs are hollow, and have smooth surfaces. Manubrium large, with wide base. Gonads borne in conspicuous masses upon the upper portion of the manubrium; mouth large and with prominent, everted lobes.

Colors.—Bell transparent, pale milky white, tentacles pale yellow, ocelli crimson.

Distribution.—Newport, R. I.

This medusa is among the larger of the anthomedusæ and is said to be one of the most beautiful. I have not seen it, however, and the above description is condensed from that of Fewkes.

TURRITOPSIS McCrady (1857).

***Turritopsis nutricula* McCrady. Text cut.**

Turritopsis nutricula McCrady, Proceedings of Elliott Society of Natural History, Vol. I, 1857, p. 127.
L. Agassiz, Contributions to the Natural History of the United States, Vol. IV, 1862, p. 347. A. Agassiz, North American Aclephæ, 1865, p. 167.
Haeckel, System der Medusen, 1879, p. 66.

Modeeria multitentaculata Fewkes, Bulletin Museum Comparative Zoology, Vol. VIII, 1881, p. 143.

Turritopsis nutricula Mayer, Bulletin Museum Comparative Zoology, Vol. XXXVII, 1900, p. 38.

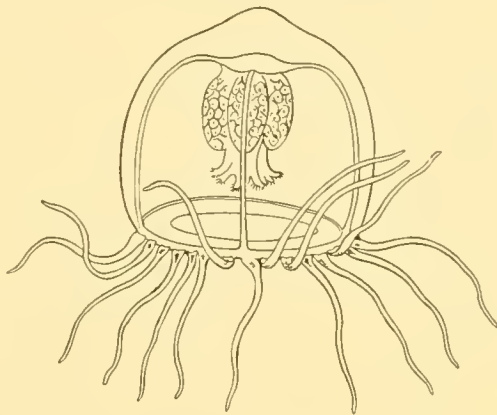
Medusa high-hemispherical, with rather thin walls; radial canals four, narrow; velum well developed. Marginal tentacles numerous and of equal size, each with a dark brown ocellus on the inner side of its base. Tentacles usually long and highly contractile. Manubrium large and

when bearing gonads on its basal portion fills nearly half the upper part of the bell. Mouth large and with four pairs of knobs plentifully loaded with nematocysts.

Ontogeny.—Brooks has described the development of this species in his memoir on North American Hydromedusæ.

Colors.—Bell transparent; tentacles with brownish bases; ocelli dark brown or blackish; gonads cinnamon-brown; manubrium dull yellow, sometimes streaked with brown or orange.

Distribution.—Occasionally taken at Woods Hole, Vineyard Sound, and southward.



Turritopsis nutricula.

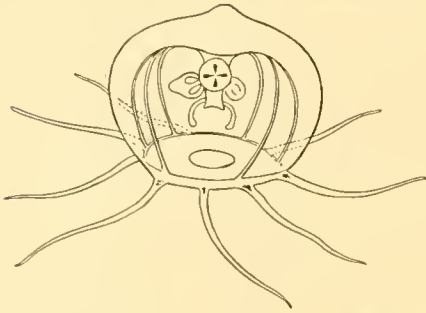
Family MARGELIDÆ.

KEY TO THE GENERA.

- | | |
|---|---|
| 1. Marginal tentacles 8, rarely 4, symmetrically disposed | } <i>Dysmorphosa</i>
<i>Podocoryne</i> |
| 2. Marginal tentacles 8, rudimentary | |
| 3. Marginal tentacles 8 to 16 | <i>Willia</i> |
| 4. Tentacles in 8 clusters | <i>Lizzia</i> |
| 5. Tentacles in 4 clusters | <i>Bougainvillia</i> |
| 6. Tentacles in 4 clusters, each margined by an erect, clavate pair | <i>Nemopsis</i> |

DYSMORPHOSA^a Philippi (1842).**Dysmorphosa (?) fulgurans** A. Agassiz. Text cut.

Dysmorphosa fulgurans A. Agassiz, North American Aclephae, 1865, p. 163. Haeckel, System der Medusen, 1879, p. 77.



Dysmorphosa fulgurans. (After A. Agassiz.)

Bell subhemispherical, with a slight conical apical projection; radial canals 4, simple and narrow; marginal tentacles 8 in adult specimens, only 4 in young; symmetrically disposed; manubrium of medium size, its oral end provided with 4 rather prominent tentacles; secondary medusae budded from the body of the manubrium in great numbers, this apparently the chief mode of reproduction, as I have not found the sexual products at any time. A. Agassiz says the number of medusae thus budded becomes so great at times as to afford a splendid phosphorescence. Ontogeny, not known with certainty.

Colors.—Bell transparent, bases of tentacles and tip of manubrium reddish orange, pigment at base of tentacles probably ocellate in nature. Young medusa buds pale bluish by reflected light.

Distribution.—Common generally throughout the region in July and August.

PODOCORYNE^a Sars (1846).**Podocoryne carnea** Sars. Pl. IV, fig. 5.

Podocoryne carnea Sars, Fauna Littoralis Norvegiae, Tome I, p. 4, 1846. Krohn, Archiv für Naturgeschichte, Bd. XVII, 1851, p. 226. Hincks, British Hydroid Zoophytes, 1868, p. 29. Allman, Monograph Gymnoblastic Hydroids, 1871, p. 349. *Dysmorphosa carnea* Haeckel, System der Medusen, 1879, p. 77.

General form very similar to the preceding species, with which it has been confused, unless upon fuller knowledge of the entire life history it should appear that the two forms are but dimorphic phases of one species. Their occurrence in the same region and season, however, makes this possibility somewhat doubtful.

Bell hemispherical with low arched aboral portion, entire exumbrella dotted with scattered clusters of nematocysts in young which disappear in the adult; 1 to 3 mm. in height and slightly more than half as broad. Marginal tentacles 4 in young medusa, but 4 additional interradial ones appear early, always remaining shorter than the perradials, however. Manubrium well developed, usually quadrate in section and with 4 oral tentacles which are tufted with clusters of nematocysts. Gonads borne on base of manubrium and apparently approaching maturity when the medusa is liberated from the hydroid.

Colors.—Bell very transparent, base of manubrium reddish-brown, gonads pale bluish, bright reddish-brown spots on perradial tentacular bases, duller ones on the interradials. It is somewhat doubtful whether these pigment spots are true ocelli.

Ontogeny.—Derived directly from the hydroid *Podocoryne*, the life cycle being easily traced on specimens kept in aquaria.

Distribution.—Generally the same as the preceding species and during essentially the same season.

^aThere can hardly be serious doubt as to the identity of these genera. Were there certainty as to the hydroid described by Philippi, the name *Dysmorphosa* should have recognition. In view of reasonable doubt on this point and the predominance of Sars' name in the literature, it seems best to give it right of way. Uncertainty as to ontogeny may warrant the former for Agassiz's species.

LIZZIA Forbes (1848).***Lizzia grata* A. Agassiz. Pl. I, fig. 4.**

Lizzia grata A. Agassiz, Proceedings Boston Society of Natural History, Vol. IX, 1862, p. 99. Fewkes, Bulletin Museum Comparative Zoology, Vol. VIII, 1881, p. 142. A. Agassiz, North American Aclephæ, 1865, p. 161.
Margellium gratum Haeckel, System der Medusen, 1879, p. 95.

Bell subconical with high, rounded apical projection. Marginal tentacles in 8 clusters, perradial clusters with usually 5 tentacles, interradials usually 3 in mature specimens, fewer in young. There are no ocelli. Manubrium of moderate size with 4 rather prominent oral lobes, which are slightly branched. Gonads form prominent clusters on the basal portion of the manubrium. This medusa, like *Dysmorphosa fulgurans*, produces medusæ by asexual budding from the body of the manubrium. Specimens are found with secondary medusæ in all stages of development. Like the species just cited, this form does not seem to produce sexual products and medusæ at the same time.

Ontogeny.—So far as known to me the hydroid stock of this medusa has not been traced. The phases in medusoid budding have been studied by Haeckel, Agassiz, Fewkes, and Forbes, and observations have been made by Claparede (Zeit. f. Wiss. Zool., Bd. X) on the development of the egg. The tentacles arise first from the perradial points, 3 from each; this is followed by the appearance of a single tentacle at each of the interradial points, to which are added later 2 more tentacles; finally 2 tentacles are added to each of the primary sets. It should be noted, however, that this rule has exceptions, considerable variation appearing in both the number and the order of appearance of the tentacles.

Colors.—Bell very transparent, tentacular bases pinkish, tending to brown and even blackish in rare cases.

Distribution.—Fairly common throughout the region. (Nahant, Massachusetts Bay, A. Agassiz; Newport, Fewkes.) I have repeatedly taken this medusa at Woods Hole, both in the open tow and with a small dip net in the eel pond. April to August.

BOUGAINVILLIA Lesson (1836).***Bougainvillia carolinensis* (McCrady), Pl. II, fig. 4.**

Hippocrene carolinensis McCrady, Proceedings Elliott Society Natural History, Vol. I, 1857, p. 164.
Margelis carolinensis L. Agassiz, Contributions Natural History United States, Vol. IV, 1862, p. 344. A. Agassiz, North American Aclephæ, 1865, p. 156.
Bougainvillia carolinensis Allman, Monograph Gymnoblæstic Hydroids, 1871, p. 316.
Margelis carolinensis Haeckel, System der Medusen, 1879, p. 89.

Bell subspherical, with very thick walls of great transparency; radial canals 4, very narrow. Marginal tentacles in 4 clusters of from 2 to 15 each, varying with age, arranged about a finely pigmented triangular base. Velum well developed; manubrium rather long and with dichotomously branching oral tentacles; gonads borne on walls of manubrium.

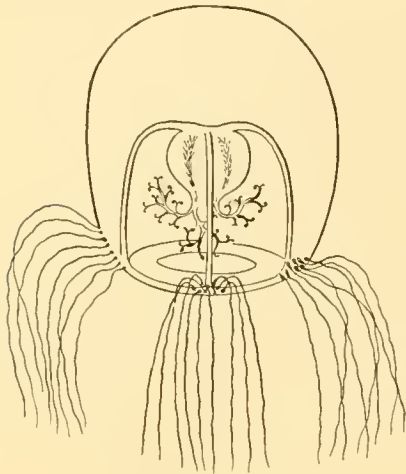
Ontogeny.—The medusa is derived directly from the hydroid of the same name. When first liberated the medusa is small, with rather thin-walled, hemispherical bell, and but 8 radial tentacles, 2 at each point. As growth takes place the bell becomes spherical and the mesoglea becomes greatly thickened, particularly over the aboral region. The oral tentacles, which at first are single, soon bifurcate, and this process repeats itself about three times, forming a somewhat complete series of oral tentacles. The adult medusa is from 8 to 10 mm. in diameter.

Colors.—The triangular pad from which the tentacles originate is bright reddish with green borders, the ocelli as many as the tentacles, forming a crescent of black points. The manubrium is of similar colors, pinkish about the base, bordered with green and with streakings of the same colors running lengthwise. There is, however, great variation in the color markings on this medusa.

Distribution.—Common generally throughout the region, though chiefly limited to shallower waters, where the hydroid evidently finds favorable environmental conditions. June to September.

Bougainvillia superciliaris L. Agassiz. Text cut.

- Hippocrene superciliaris* L. Agassiz, Memoirs American Academy of Arts and Sciences, Vol. III, 2d series, 1849, p. 250
 Stimpson, Marine Invertebrates of Grand Manan, 1853, p. 11, in Smithsonian Contributions to Knowledge, Vol. VI
Bougainvillia superciliaris L. Agassiz, Contributions to Natural History United States, Vol. IV, 1862, p. 289 and 344. A.
 Agassiz, North American Aculephæ, 1865, p. 153.
Hippocrene superciliaris Haeckel, System der Medusen, 1879, p. 92.

*Bougainvillia superciliaris.*

In general form and characteristics very similar to the preceding species, but of larger size and differing somewhat in shape and in the complexity of the oral tentacles as well as the disposition of the gonads. The marginal tentacles are also more numerous and of greater length. The manubrium is shorter and broader, and the gonads are crowded about its base instead of near the oral end, as in the former species. Size from 8 to 12 mm. in diameter in maturity.

Colors.—Less bright than in preceding species; sensory pads dull yellowish to orange, ocelli black, manubrium similarly colored, reddish orange distally.

Distribution.—Similar to that of preceding, but often taken from greater depths and farther offshore. June to September.

Bougainvillia gibbsi Mayer.

- Bougainvillia gibbsi* Mayer, Bulletin Museum Comparative Zoology, Vol. XXXVII, 1900, p. 5.

Medusa very similar to *B. carolinensis*, distinguished by Mayer by the relatively greater height of bell and by the shorter and broader manubrium. Moreover, the size is smaller, the marginal tentacles fewer in number, and the oral tentacles less complex.

Mayer records its occurrence at Newport, from July to October. He gives ample description in the article cited.

WILLIA Forbes (1848).

- Willisia* Forbes, British Naked-eyed Meduse, 1848, p. 19.
Willia L. Agassiz, Contributions to Natural History of the United States, Vol. IV, 1862, p. 346.

Willia ornata McCrady, Pl. I, fig. 5.

- Willia ornata* McCrady, Proceedings Elliott Society of Natural History, Vol. I, 1857, p. 149.
Willia ornata A. Agassiz, North American Aculephæ, 1865, p. 171.
Willia gemmifera Fewkes, Bulletin Museum Comparative Zoology, Vol. IX, 1882, p. 299.
Dyscannula dyspleura Haeckel, System der Medusen, 1879, p. 152.
Willietta ornata Haeckel, System der Medusen, 1879, p. 157.

Body of medusa rather low, bell-shaped, somewhat conical above, about twice as broad as high, and with rather firm walls. Radial canals only 4 at birth, later each of these branches as shown in the figure, finally resulting in from 12 to 16 terminal canals, which communicate with that of the margin. Tentacles likewise but 4 at birth, but increasing in number with the increase of radial canals, so that finally there may be 12 or more at maturity. Between the terminal branches of the canals are irregular lines of nematocysts, which pass upward on the outer surface of the bell for short distances. Manubrium well developed, mouth with 4 everted lobes. Gonads form prominent masses on the base of the manubrium, but never extend outward upon the radial canals. Ontogeny wholly unknown.

Color.—Ocelli reddish brown, gonads and manubrium pale greenish.

Distribution.—More or less common at irregular intervals. Occasionally taken in numbers in the Eel Pond and in the tow of the harbor.

Haeckel, in the System der Medusen (vide supra), has placed this form among the cannotid Leptomeduse, which seems to me to be wholly without warrant in so far as its more fundamental charac-

ters are concerned, the branching radial canals, perhaps, excepted. As will be noted, its shape, tentacles, ocelli, etc., are all distinctively Anthomedusan, and I have therefore ventured to place it among the Margelidæ. When its ontogeny comes to be known a different assignment may be required.

NEMOPSIS L. Agassiz (1849).

Nemopsis bachei L. Agassiz. Text ent.

Nemopsis bachei L. Agassiz, Memoirs American Academy Arts and Sciences, Vol. IV, 1849, p. 289; Contributions Natural History United States, Vol. IV, 1862, p. 345. A. Agassiz, North American Aculephæ, 1865, p. 149.

Nemopsis gibbesi McCrady, Proceedings Elliott Society Natural History, Vol. I, 1857, p. 160. Allman, Monograph Gymnoblepharidæ, 1871, p. 362.

Nemopsis bachei Haeckel, System der Medusen, 1879, p. 93.

This medusa, while similar in general aspects to the species of *Bougainvillia* above described, has several very distinctive differences, such as the disposition of the gonads beneath the radial canals, and also the pair of clavate marginal tentacles which arch over the clusters of long tentacles.

It is specifically distinguished by the height and the thickness of the walls and upper portion of the bell. The marginal tentacles are in 4 clusters, arranged about a bulbous pad, with a distinct series of ocelli at their bases and each cluster with a pair of erect, clavate, tentacular bodies. As in *Bougainvillia*, the tentacles vary in size and number with age, averaging about 7 or 8 in each cluster in mature specimens, the ends usually appearing to have clavate enlargements. Manubrium similar to the species already referred to, mouth with 4 complexly branched tentacles which are capable of great contraction, so that they may become almost indistinguishable. Gonads borne on basal portion of manubrium and in course of development extending beneath the radial canals, almost or quite the entire length in many cases.

Ontogeny.—Unknown.

Colors.—Sensory bulbs yellowish orange, gonads yellowish.

Distribution.—Common throughout the region, ranging in season from June to September.

STYLACTIS Allman (1871).

Stylactis hooperi Sigerfoos.

Stylactis hooperi Sigerfoos, American Naturalist, Vol. XXXIII, 1899, p. 802.

Bell globular, slightly elongate, about 1 mm. in height. Marginal tentacles 8, rudimentary, symmetrically disposed about the margin. Ocelli absent. Manubrium large, devoid of oral tentacles or lobes. Gonads borne in general mass about the manubrium; products discharged at once upon liberation of the medusa.

Ontogeny.—Derived directly from a small hydroid, having its habitat upon the shell of a living snail, *Hydrobia obsoleta*.

Distribution.—Originally described from Cold Spring Harbor, Long Island. Likely to be found within the present region.

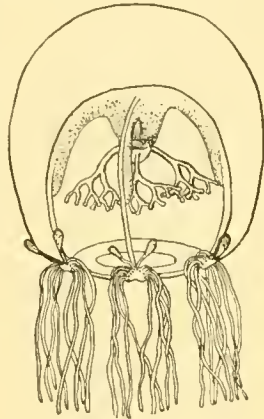
Family CLADONEMIDÆ.

KEY TO THE GENERA.

- | | |
|--|------------------|
| A. Marginal tentacles four, two rudimentary..... | <i>Gemmaria</i> |
| B. Marginal tentacles two..... | <i>Corynitis</i> |

GEMMARIA McCrady (1857).

Four simple radial canals, at the distal exumbrellar terminus of which are 4 clusters or bands of nematocysts. Marginal tentacles 2, at opposite perradial points, each long and with various knob-like and stalked clusters of nematocysts.



Nemopsis bachei.

Gemmaria cladophora A. Agassiz.^a

Gemmaria cladophora A. Agassiz, North American Aclephae, 1865, p. 184. Haeckel, System der Medusen, 1879, p. 104.

Bell subhemispherical to conical, with walls of varying thickness over different regions, giving to the subumbrellar cavity a form differing from that of the exumbrella. Marginal tentacles 4, 2 rudimentary, the other 2 long and abundantly supplied with batteries of nematocysts, many of which are stalked. Manubrium well developed and with the gonads borne on its proximal portion; mouth simple, with 4 slightly everted lips, richly supplied with nematocysts. Ontogeny unknown or doubtful.

Colors.—Tentacles light brownish, with orange pigmentation at the bases.

Distribution.—Massachusetts Bay, Agassiz. Woods Hole.

CORYNITIS McCrady (1857).*Corynitis agassizii* McCrady.^a

Corynitis agassizii McCrady, Proceedings Elliott Society Natural History, Vol. I, 1857, p. 132.

Gemmaria gemmosa McCrady, op. cit., p. 49.

Zanlea gemmosa McCrady, op. cit., ibid.

Halocharis spiralis L. Agassiz, Contributions Natural History United States, Vol. IV, 1862, p. 239.

Corynitis agassizii A. Agassiz, North American Aclephae, 1865, p. 185; Allman, Monograph Gymnoblasic Hydroids, 1871, p. 287; Murbach, Quarterly Journal Microscopical Science, Vol. 42, 1899, p. 354.

Corynitis agassizii Haeckel, System der Medusen, 1879, p. 49.

Bell elongate hemispherical, slightly higher than broad, about 2 mm. in height when liberated. Marginal tentacles 2, long, with broad base, the entire tentacle rough with batteries of nematocysts, many of which are stalked and erect like vorticellae, for which they might easily be mistaken upon casual examination. Radial canals 4, with rather conspicuous knots of nematocysts on the exumbrellar surface of their distal ends. Manubrium well developed, flask-like, with 4 oral lips, which are simple and slightly everted.

Ontogeny.—Derived directly from the hydroid stock, easily kept in aquaria. Habitat of hydroid, often on shell of *Mytilus*, fronds of sargassum, etc.

Distribution.—Buzzards Bay, Naushon (Agassiz); taken at docks of Fish Commission, Woods Hole, July.

LEPTOMEDUSÆ.

In contrast with the Anthomedusæ, the Leptomedusæ are usually characterized by a flatter and more disk-like umbrella, which is also often of more delicate texture, or thinner and softer; the velum is usually less developed; tentacles usually more numerous and with a more general disposition about the margin. Gonads almost always borne upon the radial canals. Ocelli may or may not be present; sensory bodies usually of the vesiculate type—otocysts.

THAUMANTIDÆ.—Radial canals 4 or 8; rarely more, always simple and unbranched. Tentacles usually numerous; ocelli usually present, otocysts usually lacking; manubrium usually short, with 4- to 8-lobed mouth; gonads in the form of undulating band-like organs along the radial canals.

CANNOTIDÆ.—Radial canals 4 or 6, branched or with lateral pinnate diverticula; tentacles usually very numerous; ocelli usually present, otocysts lacking; gonads usually spindle-like pouches on the radial canals; mouth with 4 or 6 oral lobes, which are sometimes rudimentary.

EURCOPIDÆ.—Radial canals always 4, simple and unbranched; tentacles usually numerous, at least 4; manubrium usually short and quadrate in section, with 4 oral lobes; ocelli absent, otocysts always present, usually 8 or more; gonads usually vesiculate bodies on the radial canals.

ÆQUEOREIDÆ.—Radial canals numerous, 8 to 16 or more, often 100, simple; tentacles at least 8, usually very numerous; otocysts always present, 8 or more; ocelli absent; gonads usually ribbon-like; manubrium varying from very short to long, oral lobes usually numerous and variously plaited or folded.

^a In a forthcoming paper (Mittheilungen Zoologischen Station Neapel, Bd. 16, 1904, S. 550), on some Hydromedusæ from the Bay of Naples, the present writer has taken occasion to express decided doubt as to the generic distinctness of these medusæ. It would seem more correct to regard them as related species.

Family THAUMANTHIDÆ.

KEY TO THE GENERA.

A. Radial canals, 4; marginal tentacles numerous and with basal cirri.....	<i>Laodicea</i>
B. Radial canals, 4; marginal tentacles numerous, but without basal cirri.....	<i>Staurostoma</i>
C. Radial canals, 8; marginal tentacles numerous, without basal cirri.....	<i>Melicertum</i>
D. Radial canals numerous, 16 to 32 or more; tentacles numerous, without basal cirri.....	<i>Orchistoma</i>

LAODICEA Lesson (1843).***Laodicea calcarata* A. Agassiz. Text cut.**

Laodicea calcarata A. Agassiz, in L. Agassiz, Contributions Natural History United States, Vol. IV, 1862, p. 350.

Lafaa calcarata A. Agassiz, North American Aculephæ, 1865, p. 122.

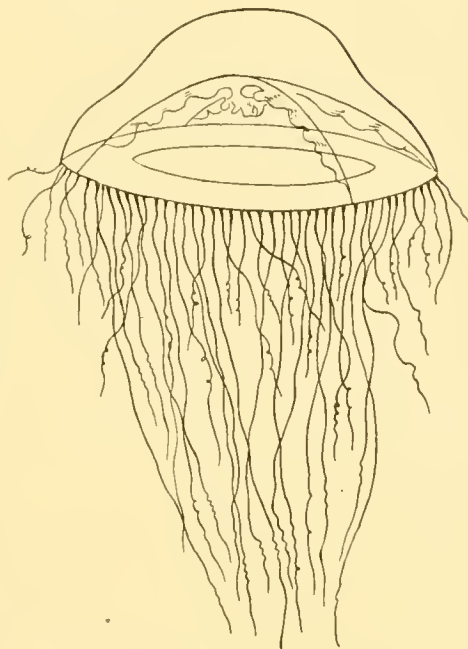
Laodicea calcarata Haeckel, System der Medusen, 1879, p. 131.

Bell broad, low dome-shaped, about twice as broad as high. Marginal tentacles very numerous and with swollen bases; interspersed with them are numerous tentacular spurs and cirri. Radial canals 4, along which the gonads are disposed in undulating masses. Manubrium rather short, with 4 plaited oral lobes. Velum well developed. Ocelli black pigment spots on bases of tentacles.

Ontogeny.—This medusa is derived from the hydroid stock of *Lafaa calcarata*. When first liberated it has but 2 tentacles, has a high, miter-shaped bell, and bears little resemblance to the adult. Growth seems to be rapid, other tentacles appear in rapid succession, and the bell gradually loses its earlier form and assumes the typical shape of the adult, with the various cirri, clubs, etc.

Colors.—Bell transparent; ovaries dull yellowish to brown; tentacles of similar color near the base, ocelli black.

Distribution.—Common throughout the region; usually taken in considerable numbers in the tow at Woods Hole during July and August.



Laodicea calcarata. After A. Agassiz.

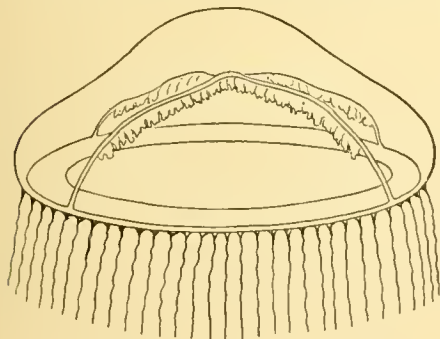
STAUROSTOMA Haeckel (1879).***Staurostoma laciniata* (L. Agassiz). Text cut.**

Staurophora laciniata L. Agassiz, Memoirs American Academy Arts and Sciences, Vol. IV, 1849, p. 300; Contributions Natural History United States, Vol. IV, 1862, p. 351. A. Agassiz, North American Aculephæ, 1865, p. 136.

Staurostoma laciniata Haeckel, System der Medusen, 1879, p. 130.

Bell low dome-shaped, about twice as broad as high, adult specimens attaining a diameter of 150 mm. or more, the average, however, only about 40 to 50 mm. Marginal tentacles very numerous; velum thin and delicate; manubrium indistinguishable, mouth early confluent with the genital folds, which are double along the ventral aspect of each radial canal, and are variously folded or crinkled; gonads develop

within the complicated folds just mentioned. Ocelli present as violet pigment spots on the bases of the tentacles, more prominent on young specimens.



Staurostoma laciniata. After L. Agassiz.

Ontogeny imperfectly known. Ova develop within the genital folds, the larvae being later discharged as actinulae.

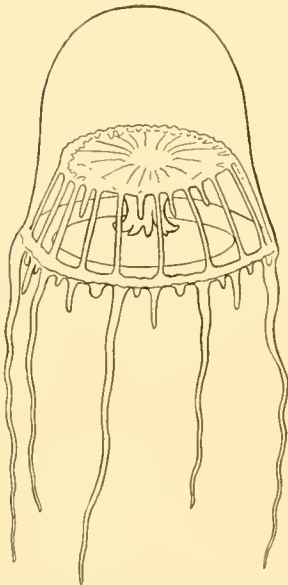
Colors.—Bell transparent, with bluish milky tint, genital folds and oral ridges of similar tints.

Distribution.—Very common at times at Woods Hole and in adjacent waters. Agassiz reports the species extremely abundant at Nahant, Boston Harbor, and Massachusetts Bay during early spring, May and June. Its occurrence seems to be somewhat erratic, however, as I have taken specimens but twice within recent years.

MELICERTUM *A. Agassiz (1862).*

Melicertum campanula A. Agassiz.

Melicertum campanula A. Agassiz, in L. Agassiz, Contributions to Natural History United States, Vol. IV, 1862, p. 349; North American Aculephae, 1865, p. 130. Haeckel, System der Medusen, 1879, pp. 136-7.



Orchistoma tentaculata. After Mayer

Medusa bell-shaped, about as high as broad, capable of considerable change of form by erratic contractions of the umbrella. Marginal tentacles numerous in the adult, but the young resemble *Laodicea* in having but 2, later acquiring others. Radial canals 8 in the adult, only 4 in early life. Manubrium much as in *Laodicea*, oral lobes 8, with sinuous edges.

Ontogeny.—Medusa derived directly from the hydroid stock. Its development has been followed by A. Agassiz (op. cit., p. 134).

Color.—Bell light ochre; gonads and bases of tentacles brownish.

Distribution.—Massachusetts and northward (L. and A. Agassiz). So far as I am aware, the medusa has not been recorded at Woods Hole, though likely to be found at any time.

ORCHISTOMA Haeckel (1879).

Orchistoma tentaculata Mayer. Text ent.

Orchistoma tentaculata Mayer, Bulletin Museum Comparative Zoology, Vol. XXXVII, 1900, p. 8.

Mayer describes an immature specimen taken at Newport which has the following specific characters: Bell slightly flaring near the margin, gelatinous substance of upper portion very thick; marginal tentacles 32, in various stages of development, the longest about one and one-half times the height of bell and with hollow basal bulbs; radial canals, 16 functional ones, and 16 others in process of development; velum well developed; manubrium flat and shallow, with 8 lips; gonads undeveloped.

Colors.—Bell transparent, basal bulbs of tentacles a delicate green.

A medusa taken at Woods Hole, resembling this in many respects, I have considered as probably the young of *Rhegmastodes*.

«This generic term was apparently first employed by Oken in 1816 (Lehrh. der Naturgeschichte), and the very similar term *Melicerta* was proposed by Peron & Lesueur in 1809 in designating a Greenland medusa, presumably identical with that later described by Oken. In 1829 Eschscholtz, under the binomial here used, described with somewhat more detail and accuracy a medusa quite similar. Fabricius, however (Fauna Greenlandica, 1780, p. 366), had used the same specific term in describing probably the same, or a similar medusa.

Haeckel has shown (System der Medusen, p. 139), that all these earlier accounts were either so inadequate or inaccurate as to leave serious doubt whether the medusa described by A. Agassiz (op. cit.) with critical detail was identical with that of the earlier accounts. He therefore proposes to credit both the generic and specific terms to the latter, and so designates them in his account (op. cit.). While in strict conformity with established usage the priority of the older descriptions should have recognition, I have accepted Haeckel's version and leave a final adjustment for those having larger concern in problems of synonymy.

Family CANNOTIDÆ.

Radial canals with numerous, pinnate, blind diverticula *Ptychogena*

PTYCHOGENA A. Agassiz (1865).***Ptychogena lactea* A. Agassiz.**

Ptychogena lactea A. Agassiz, North American Aculephæ, 1865, p. 137. Haeckel, System der Medusen, 1879, p. 117.

Bell dome-shaped, about twice as broad as high, with rather thick walls; marginal tentacles numerous and filamentous; radial canals 4, lateral walls with numerous pouch-like diverticula; gonads variously folded and disposed beneath the canals; gastric cavity very flat, quadrate in form; mouth large, but devoid of definite lobes or lips. The medusa seems wholly devoid of sensory organs of any sort.

According to Agassiz, from whose account this description has been condensed, this is a deep-sea form, seldom coming to the surface, and when doing so apparently killed by the action of the light. Ontogeny unknown.

Colors.—Gonads, radial canals, and tentacles milk white.

Distribution.—Massachusetts Bay. The occurrence of this species within the immediate region of Woods Hole has not been reported, so far as I am aware, though it is likely to be taken at almost any time.

Family EUCOPIDÆ.

KEY TO THE GENERA.

- A. Marginal tentacles 4, sometimes with lateral cirri.
 - 1. Manubrium very long, extending beyond velum *Eutima*
 - 2. Manubrium short, tentacles with lateral basal cirri *Eucheilota*
 - 3. Manubrium short, tentacles devoid of basal cirri *Clytia* (juv.)
- B. Marginal tentacles 16 or more.
 - 4. Manubrium long, bell hemispherical *Tima*
 - 5. Manubrium short, bell discoid, otocysts on bases of tentacles *Obelia*
 - 6. Manubrium short, bell hemispherical, otocysts between bases of tentacles *Clytia* or *Epanthesis*
 - 7. Manubrium short, oral lips variously fimbriated *Tiaropsis*
 - 8. Manubrium short, 12 otocysts, tentacles with interposed cirri *Phialis*
 - 9. Manubrium short quadrate, 16 marginal tentacles, with 16 interposed otocysts *Epanthesis*
 - 10. Manubrium short, oral lobes plain, tentacles more than 16, two otocysts between each pair *Oceania*

EUTIMA McCrady (1857).***Eutima mira* McCrady. Pl. IV, fig. 1.**

Eutima mira McCrady, Proceedings Elliott Society Natural History, Vol. I, 1857, p. 190. L. Agassiz, Contributions, Natural History United States, Vol. IV, 1862, p. 360. A. Agassiz, North American Aculephæ, 1865, p. 116. Haeckel, System der Medusen, 1879, p. 191.

Medusa low, bell-shaped, about twice as wide as high, walls of bell very flabby, collapsing almost at once on being taken from the water. Size of adult 15 to 20 mm. in wide diameter. Marginal tentacles 4, very long and tapering to mere threads; each has a larger base with a pair of distinct cirri, though these are often so closely coiled as to escape attention. The velum is extremely delicate and perhaps little functional as an organ of locomotion, which is chiefly accomplished by rhythmic contractions of the entire bell. The manubrium is very long and pendulous, extending beyond the bell-margin two or three times its height. There is a long gelatinous peduncle, only the distal fifth constituting the gastric portion. The mouth is 4-lobed with strongly eversible lips, which form a disk-like organ not unlike the sucking disk of a leech. Gonads are borne along the median portion of the canals. The 8 otocysts are disposed about the margin of the bell, each containing several otoliths arranged in the form of crescents. Within each marginal quadrant there are also 3 rudimentary tentacles, each with its pair of cirri, which are also rudimentary, and slight swellings which appear to be of similar character. Ontogeny unknown.

Colors.—Bell very transparent, basal portion of tentacles pale green by reflected light, but a beautiful rose color by transmitted light, an interesting character which is possessed by many other medusæ. The distal portion of the manubrium is also greenish with a pale pinkish hue, and the same color though less distinct, is found in the gonads.

Distribution.—Very common at Woods Hole and in Vineyard Sound during August.

Eutima limpida A. Agassiz.

Eutima limpida A. Agassiz, in L. Agassiz, Contributions Natural History United States, Vol. IV, 1862, p. 262; North American Aculephæ, 1865, p. 116. Haeckel, System der Medusen, 1879, p. 191.

This medusa is very similar in general aspects to the preceding species, if indeed it may not be found upon a more critical comparison to be identical, or perhaps a regional variety. Its size seems to me the only distinctive difference, though the tentacles are said to be shorter and to have the basal enlargement. Agassiz gives the size of adults as nearly 2 inches broad by about $\frac{1}{2}$ inch high. He describes the otcysts also as of unusual size, easily visible to the naked eye.

In many years of collecting about Nanshon I have never taken this medusa, nor do I find it reported by other collectors. May it not be that some unusually large specimens afforded the occasion for this specific distinction?

Distribution.—Buzzards Bay, Nanshon (A. Agassiz).

EUCHEILOTA McCrady (1857).**Eucheilota ventricularis** McCrady. Pl. IV, fig. 4.

Eucheilota ventricularis McCrady, Proceedings Elliott Society Natural History, Vol. I, 1857, p. 187.

Eucheilota L. Agassiz, Contributions to Natural History of United States, 1862, Vol. IV, p. 353.

Eucheilota ventricularis A. Agassiz, North American Aculephæ, 1865, p. 74. Haeckel, System der Medusen, p. 179, 1879.

Bell subhemispherical, broader than high. Marginal tentacles 4 perradial, with 4 somewhat rudimentary interradial, each set with a pair of basal cirri. The interradial tentacles afterward develop and adradial tentacles appear with later maturity, but none of the specimens taken by me showed these, and they are therefore absent in the figure given. Velum well developed. Gonads in spindle-like masses on the distal third of the radial canals. Ontogeny unknown.

Colors.—Bell transparent, tentacular bases and manubrium bright green by reflected light.

Distribution.—Fairly common in the waters adjacent to Woods Hole, and at Newport (Fewkes).

Eucheilota duodecimalis A. Agassiz. Pl. IV, fig. 3.

Eucheilota duodecimalis A. Agassiz, in L. Agassiz, Contributions Natural History United States, Vol. IV, 1862, p. 353; North American Aculephæ, 1865, p. 75.

Phidium duodecimale Haeckel, System der Medusen, 1879, p. 180.

Medusa similar in form to the preceding species, but distinguished by having but 4 long tentacles with their lateral cirri, and by the presence of 12 otcysts, 3 between each two tentacles.

Distribution.—Similar to the preceding species.

CLYTIA Lamouroux (1812).**Clytia bicophora** L. Agassiz. Text ent.

Clytia bicophora L. Agassiz, Contributions to Natural History of United States, Vol. IV, 1862, pp. 304, 354. A. Agassiz, North American Aculephæ, 1865, p. 78.

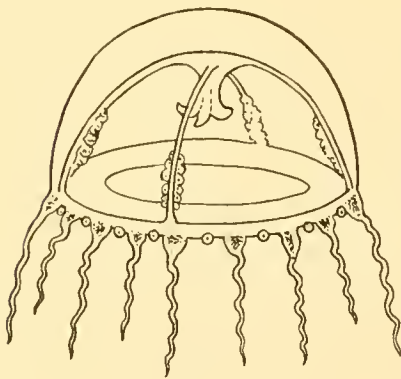
Epenthesis bicophora Haeckel, System der Medusen, 1879, p. 181.

Medusa variable in form and other characters with development, at first inclined to be globular, later hemispherical. Marginal tentacles at first but 4; at maturity, 16. Velum fairly well developed, though narrow. Otcysts 8, disposed on either side of the perradial tentacles.

Ontogeny.—From hydroid *Clytia bicophora*.

Colors.—Bell, transparent; ovaries and tentacle bases, brownish.

Distribution.—Not especially abundant, though frequently taken at various points within the region. Frequent in the tow at Woods Hole.



Clytia bicophora.

Clytia nolliformis (McCrady).

Campanularia nolliformis McCrady, in Proceedings Elliott Society of Natural History, Vol. I, 1857, p. 194.

Campanularia volabilis Leidy, Marine Invertebrates, New Jersey and Rhode Island, 1855, p. 6.

Clytia cylindrica L. Agassiz, Contributions to Natural History of United States, Vol. IV, 1862, p. 306.

Platypicis cylindrica A. Agassiz, North American Aclephae, 1865, p. 80.

Epenthesis bicophora Haeckel, System der Medusen, 1879, p. 184.

This medusa resembles the preceding species so closely in most respects that Haeckel has included both under his *Epenthesis bicophora*, and it seems likely that they are identical. Only occasionally have I taken a specimen that seemed to differ sufficiently to warrant separate classification, though the hydroids seem to be fairly distinct.

Distribution as of preceding.

TIMA Eschscholtz (1829).

Tima formosa L. Agassiz. P. IV, fig. 2.

Tima formosa L. Agassiz, Contributions to Natural History of United States, Vol. IV, 1862, p. 362. A. Agassiz, North American Aclephae, 1865, p. 113. Haeckel, System der Medusen, 1879, p. 205. Fewkes, Bulletin Museum Comparative Zoology, Vol. VIII, 1881, p. 157.

This splendid medusa, one of our most beautiful encopids, has a bell-shaped umbrella about as high as broad. Size in maturity about 50 to 60 mm. Body of bell rather thick and heavy, particularly in aboral region. Marginal tentacles numerous, with bulbous bases. Manubrium long, capable of protrusion beyond the velum, though usually about on a level therewith. Radial canals 4, rather wide, with gonads extending the entire length and downward upon the elongated peduncle of the manubrium. Mouth with 4 fimbriated eversible lobes. Ootocysts numerous and symmetrically distributed about the margin, each containing several otoliths.

Fewkes has called attention (Bulletin Museum Comparative Zoology, Vol. VIII, p. 157) to the fact that specimens are often devoid of the gastric and oral portions of the manubrium. I have frequently noted the same thing, and have suspected that it might be due to voracious fishes, some of which are known to feed upon the oral lobes, etc., of the Scyphomedusae. Whatever the cause, it seems to prove of small inconvenience to the medusa, as the organ is soon regenerated.

Ontogeny.—The ontogeny of *Tima* has been traced by A. Agassiz (cf. North American Aclephae, p. 115), who has reared the hydroid from the eggs discharged by the medusa in aquaria. The characteristic phases of development, through planulae to polyps and hydroid colonies, occupied some six months, at the end of which the colonies were very minute tufts, barely visible to the naked eye.

Colors.—While the bell is quite transparent, the milk-white gonads and mouth lobes render the medusa very conspicuous. The tentacles also are white, with a delicate rosy pink in many specimens.

Distribution.—Rather general throughout the region—Cape Cod, Vineyard Sound, Woods Hole, Buzzards Bay, Newport, etc. I have taken the species only during early spring—April and May. It has been reported by Agassiz in March, June, October, and December. Facts seem to indicate the sexual season as rather distinctively spring.

OBELIA Peron & Lesneur (1804).

The genus *Obelia*, as at present defined by most authors, is much more comprehensive than was understood by Forbes, McCrady, and Agassiz. As now constituted it comprises medusae having the following characteristics:

Eight adradial ootocysts, which are borne on the inward projecting bases of the marginal tentacles of that region; marginal tentacles numerous, 12 to 24, or even 100 or more. Velum rudimentary, bell flat and freely eversible, the medusae often swimming more or less freely in that condition.^a

The extremely variable stage of development at which the medusae leave the gonothecae, sometimes with 12, 16, 24, or even 48 tentacles, sometimes with the gonads already well developed, sometimes without any traces of them, render very difficult any certain determination of species; and the same variable tendencies of the hydroid stocks but add to the difficulties of the problem. Hence, in comparatively few cases may we feel even a reasonable assurance that the species usually recognized as distinct are entitled to that rank.

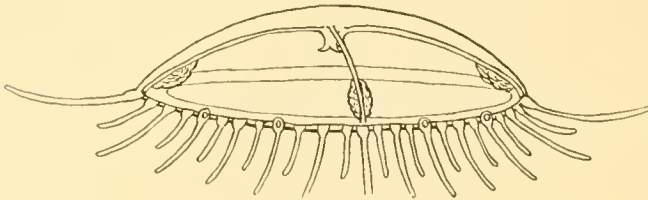
^aAs will be noted, this definition includes what by earlier writers were recognized as the genera of *Eutopa* and *Obelia*, chiefly.

Obelia commissuralis McCrady.

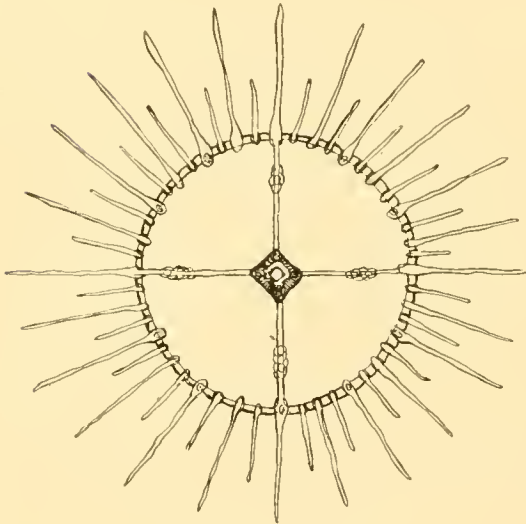
Laomedea gelatinosa Stimpson, Marine Invertebrates of Grand Manan, 1853, p. 8, in Smithsonian Contributions to Knowledge, Vol. VI.

Laomedea dichotoma Leidy, Marine Invertebrates of New Jersey and Rhode Island, 1855, p. 6, in Journal Academy Natural Sciences of Philadelphia, Vol. III, 2d series.

Obelia commissuralis McCrady, Proceedings Elliott Society of Natural History, Vol. I, 1857, p. 197. L. Agassiz, Contributions to Natural History of United States, Vol. IV, 1862, pp. 315, 351. A. Agassiz, North American Aclephae, 1865, p. 91, in Bulletin Museum Comparative Zoology, Vol. I. Haeckel, System der Medusen, 1879, p. 174.



Obelia diaphana.



Obelia diaphana. Oral view

Bell flat and discoid; marginal tentacles 16 at liberation; gonads borne on distal half of radial canals; manubrium cylindrical, mouth four-lobed. Size of medusa about 1 mm. at time of liberation. Developed from hydroid of same name.

Distribution.—Everywhere throughout the region. Hydroid found on various species of *Fucus*, and very prolific, hundreds of medusae being discharged from a small colony within a few hours at the breeding season.

Obelia diaphana (L. Agassiz.) Text cuts.

Thaumantias diaphana L. Agassiz, Memoirs American Academy of Arts and Sciences, Vol. IV, 1843, p. 300.

Europe diaphana A. Agassiz, in L. Agassiz, Contributions to Natural History of United States, Vol. IV, 1862, p. 322. North American Aclephae, 1865, p. 83.

Obelia diaphana Allman, Annals and Magazine of Natural History, Vol. XIII, 1861, p. 372. Haeckel, System der Medusen, 1879, p. 175.

Medusa flat, discoid, with usually 24 tentacles at liberation, later as many as 200 or more. Size about 1 mm. at birth, becoming as much as 5–6 mm. at maturity. Manubrium cylindrical, with four-lipped mouth, lips short. Gonads usually absent at birth, becoming pyriform at maturity, and borne on distal third of radial canals.

Development as in preceding species, the young sometimes occurring in almost incredible numbers. Hydroid stock very similar to preceding species.

Distribution as of preceding. Common everywhere.

Obelia gelatinosa (Pallas).

Sertularia gelatinosa Pallas, Elenchus Zoophytorum, 1766, p. 116.

Laomedea gelatinosa Lamarek, Animaux sans Vertebres, Tome II, 1817, p. 131. Lamouroux, Histoire des Polypiers Coralligènes Flexible, 1816, p. 92.

Laomedea gigantea A. Agassiz, North American Aclephae, 1865, p. 94.

Obelia gelatinosa Haeckel, System der Medusen, 1879, p. 176.

Obelia dichotoma Allman, Annals and Magazine of Natural History, Vol. XIII, 1861, p. 372.

Medusa much as preceding as to general form, tentacles, etc. Tentacles at birth 16 (Hincks), 24 (Haeckel). Manubrium and gonads about as in preceding species. Development from hydroid stock of same name, which, in contrast to those of both the previous species, is very large, attaining a height of a foot or more.

Distribution.—Less common than preceding, though taken throughout region.

Obelia pyriformis (A. Agassiz.)

Eucopa pyriformis A. Agassiz, North American Aculephæ, 1865, p. 88.

Lammedia pyriformis Leidy, Marine Invertebrate Fauna New Jersey and Rhode Island, in Journal Academy Sciences, Philadelphia, 1855, p. 6.

Obelia pyriformis Hæckel, System der Medusen, 1879, p. 175.

Medusa flat, discoid, with 24 tentacles at birth; gonads also present at this period, pear-shaped and borne on proximal half of radial canals. Ootocysts somewhat larger than in some of the preceding species and usually slightly to one side of the tentacular base. Manubrium globular with simple mouth devoid of lobes or lips.

Development.—From hydroid of same name, having its habitat chiefly on eel-grass or in similar surroundings.

Distribution.—Somewhat general throughout the region.

Obelia fusiformis (A. Agassiz.)

Eucopa (?) *fusiformis* A. Agassiz, North American Aculephæ, 1865, p. 90.

Eucopa (?) *divaricata* A. Agassiz, op. cit. p. 91.

Obelia fusiformis Hæckel, System der Medusen, 1879, p. 177.

Medusa very similar to former species, but with 48 tentacles at birth, when also the gonads are well developed and of fusiform shape along the length of the radial canals. Manubrium quadrate in shape, with four-lipped mouth.

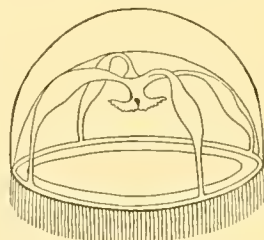
Development.—From hydroid of same name.

Distribution.—Massachusetts Bay, Nahant (Agassiz). I have not identified this medusa from the Woods Hole region, and there may be a question as to its specific distinctness, since Agassiz has himself expressed doubt on this point.

TIAROPSIS L. Agassiz (1849).**Tiaropsis diademata** L. Agassiz. Text cut.

Tiaropsis diademata L. Agassiz, Memoirs American Academy Arts and Sciences, Vol. IV, 1849, p. 289. Contributions Natural History United States, Vol. IV, 1862, p. 308. A. Agassiz, North American Aculephæ, 1865, p. 69. Hæckel, System der Medusen, 1879, p. 188.

Bell hemispherical, or low dome-like, about half as high as broad. Marginal tentacles very numerous in maturity, though comparatively few when the medusa is liberated. They are always short, forming a delicate fringe upon the margin of the bell. Pigment spots occur at the bulbous bases of the tentacles, and are probably ocellar in character. Eight ootocysts are present, distributed between the tentacles, 2 in each quadrant and between the radial canals, each containing black otoliths. The velum is narrow and very delicate. Gonads spindle-shaped, disposed beneath the median radial canal region. Manubrium very short, with four fimbriated oral lobes. Ontogeny unknown.



Tiaropsis diademata. After A. Agassiz.

Colors.—Bell pale bluish milky tint, gonads darker.

Distribution.—Massachusetts Bay, Boston Harbor; occasionally taken at Woods Hole, March to May.

OCEANIA Peron & Lesueur (1809.)

Oceania as a generic term has been largely superseded by most European writers upon Hydromedusæ, and Hæckel has designated it as obsolete, merging the medusæ formerly classed under it into other genera, as *Epenthesis*, or instituting new genera which better define the characters of those forms. Several American authors have likewise abandoned the use of *Oceania* as a generic name, but still others, notably A. Agassiz and Mayer, have continued to use it in something of its earlier sense. To the present author it has seemed expedient to continue to use it, though recognizing its growing obsolescence. As at present defined by Agassiz and Mayer, it would seem to differ from *Epenthesis* chiefly in the presence of two ootocysts between each two marginal tentacles, and in its larger number of the latter.

Oceania languida A. Agassiz. Pl. V, fig. 2.

Oceania languida A. Agassiz, in L. Agassiz, Contributions to Natural History of United States, Vol. IV, 1862, p. 353; North American Aculephæ, 1865, p. 70.

Phididium languidum Haeckel, System der Medusen, 1879, p. 188.

Bell rather low, symmetrically arched, walls very thin and delicate, collapsing when taken from the water. Velum also very narrow and delicate. Marginal tentacles numerous in adult, usually 32 or more, with about 2 otocysts between the bases of each two. Gonads elongate masses along the distal half of the radial canals, or when fully mature extending almost to the manubrium, the latter very short and with four-lobed mouth. Tentacular bulbs large and oval in form. The medusæ are sluggish in temperament, moving languidly, often simply drifting; when disturbed, or even without apparent disturbance, they often contract the margins of the bell, folding the body into an aspect of collapse. This species is very abundant in the Woods Hole region, particularly in middle or late summer. In size it varies from 15 to 20 mm. in broad diameter, with about half the height.

The ontogeny of this medusa is somewhat doubtful. Haeckel assigns it to *Campanulinus languida*. I have never been able to determine definitely its entire life history.

Colors.—Bell very transparent; tentacle bulbs brownish with green center; gonads likewise greenish brown; manubrium streaked with greenish.

Distribution.—Rather general throughout the region, June to September.

Oceania singularis Mayer.

Oceania singularis Mayer, Bulletin Museum Comparative Zoology, Vol. XXXVII, 1900, p. 7.

Medusa with straight, sloping sides, and with a rather sharply constricted apical region, somewhat lens-shaped. Marginal tentacles 16, with large hollow basal bulbs, the tentacles rather short and abundantly supplied with nematocysts. There are also 16 rudimentary tentacles and 32 otocysts, 2 between the bases of each two rudimentary tentacles, each otocyst with a single otolith. Manubrium rather long, quadrate in form, and with four-lobed mouth. Ontogeny unknown.

Colors.—Bases of tentacles greenish, distal portions brownish, gonads of turquoise tinge.

Distribution.—Newport, R. I. (Mayer).

EPENTHESIS McCrady (1857).*Epenthesis folleata* McCrady. Pl. V, fig. 3.

Epenthesis folleata McCrady, Proceedings Elliott Society of Natural History, Vol. I, 1857, p. 191.

Oceania folleata L. Agassiz, Contributions to Natural History United States, Vol. IV, 1862, p. 353. A. Agassiz, North American Aculephæ, 1865, p. 70.

Enenthesis folleata Haeckel, System der Medusen, 1879, p. 184.

Low, sub-hemispherical bell about two-thirds as high as broad, with firmer walls than in preceding species. Marginal tentacles 16 in mature specimens, with 16 otocysts alternating therewith, tentacles with rather large basal bulbs. Velum rather narrow but fairly firm in texture. Gonads form elliptical masses on the distal half of the radial canals. Manubrium moderately developed, quadrate in shape, mouth with four everted lips. Ontogeny unknown.

Colors.—Basal bulbs of tentacles greenish by reflected light, or brownish by transmitted light. Gonads similarly colored, though paler. Manubrium more or less streaked with light green.

Distribution.—Common in Vineyard Sound, Woods Hole, etc., from July to September.

PHIALIS Haeckel (1877).*Phialis cruciata* (A. Agassiz).

Halopsis cruciata A. Agassiz, North American Aculephæ, 1865, p. 102.

Phialis cruciata Haeckel, System der Medusen, 1879, p. 181; Prodrömus Systemæ Medusarum, 1877.

Bell low hemispherical, somewhat broader than high, about 30 to 40 mm. broad in adults. Marginal tentacles rather numerous, and with interposed cirri. Otocysts 12, three between each two radial canals. Manubrium rather short, with quadrate base, and with four-lobed mouth and everted lips. Gonads linear along the course of the radial canals. Ontogeny unknown.

Colors.—Bell light pinkish, as are also the gonads.

Distribution.—Nahant, Massachusetts Bay. This medusa has not been taken within the region in question, though likely to occur there.

Family ÆQUOREIDÆ.

KEY TO THE GENERA.

- A. Radial canals 8 or more, often lobed or forked near proximal ends *Halopsis*
 B. Radial canals 12, manubrium very short and flat, oral lobes long, simple or crinkled *Stomobrachium*
 C. Radial canals usually numerous, 16 to 32, sometimes 100 or more.
 1. Manubrium very short or even indistinguishable, with simply a crenulated oral margin. *Rhegmatoles*
 2. Manubrium well developed, oral lobes plain *Equorea*
 3. Manubrium large and with complexly plaited oral lobes *Zygodactyla*

HALOPSIS A. Agassiz (1863).***Halopsis ocellata* A. Agassiz.**

Halopsis ocellata A. Agassiz, Proceedings Boston Society Natural History, Vol. IX, 1863, p. 219; North American Aculephæ, 1865, p. 99. Haeckel, System der Medusen, p. 217, 1879.

Bell low and evenly arched, 3 or 4 times as broad as high. Tentacles very numerous and capable of great contraction and extension, with numerous alternating cirri. Radial canals 4 in young specimens, increasing from 12 to 20 in adults. Otcysts large and numerous, composed of double rows of otoliths, and symmetrically disposed along the margin of the bell. Manubrium very short, with four-lobed mouth. Gonads form elongate masses along almost the entire length of the canals.

Agassiz has noted the occurrence of double manubria in specimens of this form, particularly where there is an extension of the gastric pouch in one plane of the medusa, attributes this appearance to a tendency to or "beginning of transverse fission." This inference seems to me hardly warranted without clearer evidence of such fission among medusæ. I have occasionally found the same appearance in smaller medusæ, for example, *Oceania languida* and *Gonionemus*, in which so far as I am aware there has never been noted any tendency to fission. G. T. Hargitt has found frequent examples of such double manubria and mouths in individuals undergoing regeneration of excised parts. (Cf. Biological Bulletin, Vol. IV, p. 6 et seq.)

Agassiz has made observations upon the development of this species. (Cf. Proceedings Boston Society Natural History, Vol. IX, p. 219.)

Distribution.—Nahant, Mass., Bay (Agassiz). This medusa has not been taken at Woods Hole recently, nor elsewhere in the southern part of the region, so far as known to me.

STOMOBRACHIUM Brandt (1838).***Stomobrachium tentaculatum* L. Agassiz.**

Stomobrachium tentaculatum L. Agassiz, Contributions to Natural History of United States, Vol. IV, 1862, p. 361. A. Agassiz, North American Aculephæ, 1866, p. 98. Haeckel, System der Medusen, 1879, p. 224.

Bell low, evenly arched; radial canals 12, gastric portion of manubrium very flat, mouth with 4 rather triangular lobes which are variously frilled or folded. Tentacles very numerous, but short and devoid of any considerable contraction or extension. Gonads linear in form and disposed along the several canals. Ontogeny unknown.

Colors.—The medusa is almost wholly devoid of color.

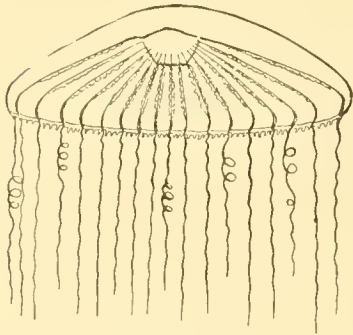
Distribution.—Massachusetts Bay (Agassiz). I have occasionally taken at Woods Hole what may have been fragments of the somewhat firm gelatinous portions of this medusa.

RHEGMATODES A. Agassiz (1862).***Rhegmatoles tenuis* A. Agassiz. Text cut.**

Rhegmatoles A. Agassiz, in L. Agassiz Contributions to Natural History of United States, Vol. IV, 1862, p. 361.
Rhegmatoles tenuis A. Agassiz, North American Aculephæ, 1865, p. 95. Haeckel, System der Medusen, p. 223, 1879.

Bell very low and flat with evenly rounded exumbrellar surface. Radial canals numerous, from 30 to 40 or more in mature specimens, mostly simple, but exhibiting numerous variations, as spurs, anastomosing branches, etc. Marginal tentacles numerous and evenly disposed, rather filiform and capable of

great contraction, during which they are often characteristically coiled, and with a broader base, above which is a tubular, spur-like flap; numerous rudimentary tentacular bodies interposed between



Rhematodes tenuis.

the long tentacles. Gonads in double-linear series along the course of the radial canals, extending from slightly beyond the gastric cavity to about the same distance from the marginal canal. Manubrium almost lacking, gastric pouch very flat, mouth a simple crinkled rim about the edge of the gastric pouch. Otocysts numerous and variously interposed between the bases of the tentacles.

In general habits this medusa is sluggish, swimming languidly by only irregularly intermittent pulsations of the bell margins. The velum is but poorly developed. It varies in size from 25 to 70 mm., the average being about 40 to 50 mm. Ontogeny wholly unknown.

Distribution.—Not uncommon throughout the region, but very erratic. During the summer of 1900 it was very abundant at Woods Hole; in 1901 it was entirely absent; in 1902 a very few specimens were taken.

ÆQUOREA Peron & Lesueur (1809).

Æquorea albida A. Agassiz.

Æquorea albida A. Agassiz, in L. Agassiz Contributions Natural History of United States, Vol. IV, 1862, p. 359. A. Agassiz, North American Acalephæ, 1865, p. 110. Hæckel, System der Medusen, 1879, p. 221.

Bell somewhat less than hemispherical, tending to conical above. Radial canals very numerous, 80 to 100, or even more. Marginal tentacles, about three between each two adjacent canals, and each with a superposed spur similar to *Rhematodes*. Manubrium better developed than in preceding, gastric portion very flat and wide, mouth simple or somewhat crenulated when contracted. Gonads disposed along the entire course of the radial canals. In size this medusa varies about as the preceding species. Ontogeny entirely unknown.

Distribution.—Not uncommon in and about Woods Hole during late summer and autumn.

ZYGODACTYLA Brandt (1838).

Zygodactyla grønlandica (Peron & Lesueur).

Medusa æquorea, Fabricius, Fauna grønlandica, 1780, p. 364.

Æquorea grønlandica Peron & Lesueur, Tableau des Meduses, etc., in Annales du Museum, Vol. XIV, 1809, p. 339.

Zygodactyla grønlandica L. Agassiz, Contributions Natural History of United States, Vol. IV, 1862, p. 360. A. Agassiz, North American Acalephæ, 1865, p. 103.

Rhacostoma atlantica, L. Agassiz, Proceedings Boston Society Natural History, Vol. III, 1862, p. 342.

Polycanna grønlandica Hæckel, System der Medusen, 1879, p. 232.

This is one of the largest of the Hydromedusæ, sometimes measuring a foot or more in diameter, and about one-third as high. The bell is rather low and evenly arched above. Radial canals very numerous, 100 or more. Marginal tentacles also numerous, like the preceding species, usually three between each two adjacent canals, and with similar superposed spurs. Manubrium very large, extending beyond the bell margin; gastric portion very broad; oral portion comprising highly complex plaited folds and frills. Gonads in double-linear series along the course of the radial canals. Ontogeny unknown.

Colors.—Manubrium, gonads, and tentacles dull whitish.

Distribution.—Greenland (Fabricius). Maine to Massachusetts (Agassiz). Occasionally found in Vineyard Sound and Buzzards Bay in late summer and autumn.

THE TRACHOMEDUSÆ.

PETASIDÆ.—Radial canals 4; manubrium without peduncle, mouth usually simple, occasionally 4 fimbriated lobes; gonads variously folded or undulating, suspended beneath radial canals. Tentacles numerous, usually solid. Otocysts variously distributed between bases of tentacles.

TRACHYNEMIDÆ.—Radial canals 8; manubrium long, devoid of peduncle, with mouth four-lobed. Gonads 8, borne beneath radial canals. Sensory organs, otocysts with central otolith.

AGLAURIDÆ.—Radial canals 8, manubrium long, with short distal bell-shaped stomach, and gelatinous peduncle; mouth usually four-lobed, rarely simple. Gonads usually rather long and cylindrical, borne on radial canals or manubrium. Tentacles always solid. Sensory organs usually free.

CERYONIDÆ.—Radial canals 4 or 6, manubrium long and pendulous, with terminal stomach; peduncle gelatinous, radial canals extending usually the entire length. Gonads usually flat and leaf-like, borne on the subumbrella beneath radial canals. Tentacles of three series: Primary, occurring during young stage, perradially distributed, and solid; secondary, interr radially disposed, also solid, and usually disappearing by atrophy; tertiary, the final series, hollow and communicating with the marginal canal. Sensory organs are otocysts, each with a central otolith.

Family PETASIDÆ.

A single genus under this family comes within this region—namely, *Gonionemus*, which was by Haeckel referred to the cannotid Leptomedusæ (cf. *System der Medusen*, p. 146). Later and more detailed knowledge both of the structure and life history of *Gonionemus* has clearly demonstrated its trachynemid affinities. While it does not easily come within the current limitations of the Petasidæ, the genus seems most closely related here, and it appears upon the whole better to enlarge the scope of the present family than to establish an additional one.

GONIONEMUS A. Agassiz (1862).

Gonionemus murbachii Mayer. Pl. VI, fig. 1.^a

Gonionemus vertens A. Agassiz, *North American Aclephæ*, 1865, p. 128; in *Contributions Natural History United States*, Vol. IV, 1862, p. 350.

Gonynema vertens Haeckel, *System der Medusen*, 1879, p. 147.

Gonionemus murbachii Mayer, *Bulletin Brooklyn Institute Arts and Sciences*, Vol. I, 1901, p. 5.

Gonionema murbachii, Yerkes, *American Journal of Physiology*, Vol. VII, 1902, p. 181. Perkins, *Johns Hopkins University Circular*, May, 1902.

This species was first described by A. Agassiz in 1862, from the Pacific coast. In 1895 a species was found at Woods Hole and supposedly identified with the Pacific species by Murbach, but it has since been classed as a distinct species by Mayer.

Gonionemus murbachii may be characterized as follows: Bell somewhat less than a hemisphere, though in early life, and even in many specimens approaching maturity, it is almost if not quite hemispherical. Manubrium rather short, seldom extending to the velum, quadrangular in shape, with 4 prominent and delicately frilled oral lobes. Radial canals 4, though many specimens are found with 5, 6, or even 2 and 3. (Cf. paper on Variation in Hydromedusæ, by writer, *Biol. Bull.*, Vol. II, 1902.)

Gonads extending under radial canals in undulating folds. Tentacles numerous, 50 to 80 or more in fully developed specimens, and with prominent basal bulbs of brownish color delicately tinged with bright green. Each tentacle with a prominent suctorial pad near the tip, at which point the tentacle often presents a sharp knee-like angle. Sensory bodies, or otocysts, each with a central otolith, variously distributed between the bases of the tentacles.

Ontogeny.—The life history and development of this medusa has recently been worked out with much care by H. F. Perkins, who has thus shown that there is a well-defined, though lowly organized hydroid generation, from which presumably, the medusæ are derived by asexual budding.

Color.—Bell transparent, radial canals and gonads yellowish-brown, manubrium brownish.

Distribution.—Chiefly in the vicinity of Woods Hole, Vineyard Haven, and adjacent waters.

^a The figure is faulty in some respects, but a better substitute was not available.

Gonionemus has afforded some extremely interesting ecological phenomena. Its most congenial habitat seems to be in small protected pools or ponds, such as the Eel Pond at Woods Hole, which has only a narrow connection with the harbor, and being surrounded by dwellings, receives garbage and other wastes which must render its waters more or less foul. Eel grass grows luxuriantly in the shallower portions, and in this the meduse seem to find favorable conditions for lodgment and at the same time abundant food, such as small crustaceans, fish-fry, etc. Thousands of specimens are taken annually from this pond for use in the laboratory and elsewhere, but without apparently diminishing the numbers. When taken elsewhere, as at Vineyard Haven, the conditions have been very similar. The adaptation of the species to such a habitat has seemed to fit it for aquarium life, which in turn has made possible a most remarkable and varied amount of experimental work on coelenterate physiology, as the abundant literature of the past few years amply attests.

Family TRACHYNEMIDÆ.

Radial canals 8, simple; no blind centripetal canals; otcysts 16 *Rhopalonema*

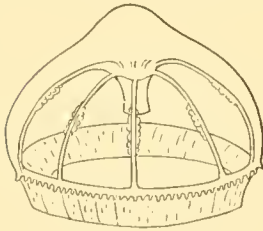
RHOPALONEMA Gegenbaur (1856).

Rhopalonema typicum (Maas). Text cut.

Homocnemum typicum Maas, Memoirs Museum Comparative Zoology, Vol. XXII, 1897, p. 22.

Rhopalonema typicum A. Agassiz & Mayer, Memoirs Museum Comparative Zoology, Vol. XXVI, p. 152. Hargitt, Biological Bulletin, Vol. IV, 1902, p. 15.

Bell hemispherical in general shape, with a low, rounded apical projection. Average size about 9 mm. in broad diameter by about 6 mm. in height. Radial canals 8, with the slightly developed gonads borne about the mid-region of their subumbrellar course. Manubrium urn-shaped and with slightly flaring oral margins. Velum well developed and capable of extension outward, a condition often assumed normally. Marginal tentacles were lacking on the specimens taken, though a fairly regular series of basal fragments indicated about the usual number characteristic of the species. Those of the region adjacent to the radial canals seemed to have been of larger size than the others. No otcysts were distinguishable on the specimens. In view of the solvent action of strong formalin on these bodies in other cases it may not be unlikely that a similar effect resulted in the present case, for this condition prevailed with almost all the specimens of the collection. Ontogeny entirely unknown.



Colors.—Bell quite transparent, but with an evident iridescence; manubrium dull white, as were also the gonads in the preserved specimens.

Distribution.—Region of Gulf Stream, fragments taken in the tow in Vineyard Sound. The occurrence of the species in this comparatively high Atlantic latitude may seem extraordinary, if not improbable, but there do not seem to be sufficient grounds for considering the specimens as distinct from the species here indicated. Maas has described *R. typicum* from the west coast of Mexico (cf. Memoirs Museum Comparative Zoology, Vol. XXII), and Agassiz and Mayer have recently recorded it from the tropical Pacific (cf. op. cit., Vol. XXVI, No. 3).

It should be noted that the specimens taken in Vineyard Sound were all more or less damaged, as already indicated. More perfect specimens and in larger numbers may afford grounds for a different conclusion from that here expressed.

Family AGLAURIDÆ.

KEY TO THE GENERA.

- A. Gonads 8.
 1. Gonads borne on radial canals *Aglantha*
 2. Gonads borne on manubrium *Aglaura*
 B. Gonads 4, or sometimes 2.
 3. Gonads 2, on opposite sides of umbrella *Persu*

AGLAURA Peron & Lesueur (1809).***Aglaura hemistoma*** Peron & Lesueur. Text cut.

Aglaura hemistoma Peron & Lesueur, Tableau des Méduses, 1809, p. 351.

Aglaura peronii Leuckart, Archiv für Naturgeschichte, Jahrgang 22, 1856, p. 10.

Aglaura hemistoma var. *nausicaa* Maas, Die Ceraspedoten Medusen der Plankton-Expedition, 1893, p. 26. Hargitt, Biological Bulletin, Vol. IV, 1902, p. 14.

Medusa in form of a cylinder, somewhat octagonal as viewed from either pole. Average size 4 mm. in height by about half as broad. Radial canals 8, extending downward upon the long gelatinous manubrium, which hangs freely in the subumbrellar cavity for about two-thirds its extent. Gastric portion rather short and with prominent four-lobed oral lips. Gonads, 4 or 5 in number, are suspended as finger-like processes from the lower portion of the gelatinous peduncle. Velum well developed and normally having the aspect shown in the figure, though often infolded in similar form within the bell. The tentacles were in nearly every case entirely lacking or so badly distorted as to make impossible any accurate determination of either their number or character; usually, however, the basal portions showed with sufficient clearness to enable a recognition of their presence, and by comparing a number of specimens an approximation as to the number was possible, as shown in the figure. Ontogeny entirely unknown.

Colors.—Bell very transparent; oral portion of the manubrium pale reddish; gonads pale brownish to yellow, or whitish.

Distribution.—Region of the Gulf Stream, some 60 miles south of Marthas Vineyard.



Aglaura hemistoma.

AGLANTHA Haeckel (1879).***Aglantha digitalis*** (O. F. Muller). Text cut.

Medusa digitale O. F. Muller, Prodrömus Zoologica Danica, 1766, p. 233. Fabricius, Fauna Groenlandica, 1780, p. 366.

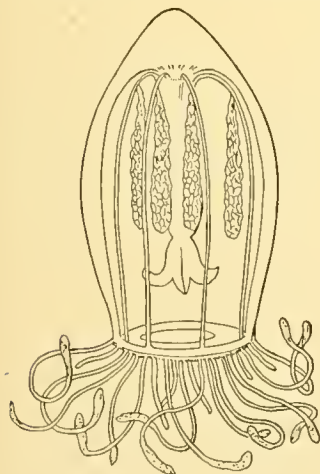
Meliceria digitale Peron & Lesueur, Tableau des Méduses, 1809, p. 352.

Efrene digitale Eschscholtz, System der Acalephen, 1829, p. 95.

Circe rosea Forbes, British Naked-eyed Meduse, 1848, p. 34. L. Agassiz, Contributions Natural History United States, Vol. IV, 1862, p. 349.

Trachynema digitale A. Agassiz, North American Acalephæ, 1865, p. 57.

Aglantha digitalis Haeckel, System der Medusen, 1879, p. 272.



Aglantha digitalis. After A. Agassiz.

Medusa elongate bell-shaped, with rather sharp apical projection. Radial canals 8, rather wide and extending downward upon the long gelatinous peduncle. Marginal tentacles numerous, but fragile and in many cases detached, apparently by the medusa when brought into captivity. Otocysts 4, with reddish colored otoliths. Gonads 8, suspended like sausages from the upper portion of the radial canals. Velum strong and usually folded within the bell cavity. Gastric portion of the manubrium comparatively small, mouth with four everted lips. The medusa presents different aspects at varying ages, as pointed out by A. Agassiz, the young being shorter and more spherical. Adult specimens 25 to 35 mm. high. Ontogeny entirely unknown.

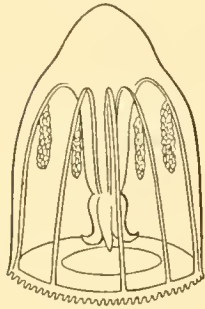
Colors.—Bell transparent, slightly pinkish, gonads milky white.

Distribution.—Taken at various points within the region, chiefly Woods Hole, March to May. Reported by Agassiz from Massachusetts Bay; by Fabricius from Baffins Bay.

Aglantha conica Hargitt. Text cut.

Aglantha conica Hargitt, Biological Bulletin, Vol. IV, 1902, p. 21.

Bell high, with rather sharp apical projection which is slightly constricted at its base in many specimens. Bell walls rather firm, and when compressed tending to wrinkle longitudinally, a condition which often appears also in preserved specimens. Manubrium long and pendulous, though not reaching the velum; peduncle gelatinous; gastric portion much as in the preceding species, as, indeed, are other general characters. Radial canals 8, extending the length of the peduncle. Gonads 8, cylindrical and suspended from the upper portion of the radial canals. Velum well developed and the chief, if not sole, organ of locomotion; movements quick and erratic, the medusa darting with arrow-like swiftness through the water. Tentacles apparently numerous, but mostly lacking in the specimens taken, notwithstanding the effort to distinguish them on living specimens. Those present rather short and blunt. No marginal organs (otocysts) distinguished even in living specimens.



Aglantha conica.

In many respects the specimens resemble very much the preceding species and were at first taken for the young. A comparison as to size and sexual maturity, however, seems to show undoubted specific distinctness as elsewhere pointed out. Average size from 5 to 6 mm. high by about half as wide.

Ontogeny entirely unknown.

Colors.—Bell very transparent, with only the slightest iridescence by reflected light.

Distribution.—Taken chiefly off Nantucket; in fewer numbers at another time off Chatham, Mass. Collections were made with the open net at depths of from 12 to 20 fathoms. August.

Family GERYONIDE.**KEY TO THE GENERA.**

1. Three centripetal canals between each pair of radials *Liriope*
2. One centripetal canal between each pair of radials *Glossocodon*

LIRIOPE Lesson (1843).***Liriope scutigera* McCrady.**

Liriope scutigera McCrady, Proceedings Elliott Society of Natural History, Vol. I, 1857, p. 208.

Liriantha scutigera Haeckel, System der Medusen, 1879, p. 287.

Bell hemispherical, with thick walls. Radial canals narrow, 4 in number. Manubrium very long, extending far beyond the margin; mouth simple, devoid of lobes; lips small, fringed with nematocysts, short gastrostyle protruding from the mouth. Tentacles long, hollow, very flexible, and with nematocysts arranged in definite rings. Otocysts 4, each with a club-shaped organ. Gonads flat and spindle-shaped in outline, disposed beneath the radial canals. Ontogeny unknown.

Distribution.—Newport, R. I. (Fewkes).

***Liriope cerasiformis* Lesson. Pl. V, fig. 4.**

Liriope cerasiformis Lesson, Histoire Naturelle Zoophytes Acalephes, 1843, p. 332. Haeckel, System der Medusen, 1879, p. 289. Maas, Craspedoten Medusen der Plankton-Expedition, 1893, p. 35. Hargitt, Biological Bulletin, Vol. IV, 1902, p. 16.

Liriope exigua (et *cerasiformis*) Haeckel, Familie der Geryoniden, 1864, p. 24.

Bell subhemispherical, with firm, rather thick walls; size averaging about 10 mm. broad by slightly more than half as high. Radial canals 4, quite distinct, centripetal canals 12, 3 between each two radials. The centripetal canals are only evident upon very critical examination, and this may account for their absence from the earlier accounts of McCrady and the later one by Fewkes, from which a part of the description of the preceding species is condensed. The central of these canals is rather long and narrow with rounded apex, the lateral ones are about half as long and of similar shape. The marginal canal is wide, and communicates freely with both the radial and centripetal canals.

Marginal tentacles 4 on adult specimens; younger specimens often with well-developed interradial tentacles, the gradual disappearance of which is easily traceable in a series of specimens of increasing ages. Nematocysts of tentacles disposed in regular annulations with intermediate perfectly smooth spaces. Manubrium long, extending far beyond the velum; gastric portion rather short and bell-shaped, with slightly quadrate oral lips, beyond which protrudes the pointed gastrostyle. Gonads flat and heart-shaped, and disposed about midway beneath the radial canals. Ontogeny wholly unknown.

Colors.—Bell quite transparent, gonads and manubrium dull whitish in formalin specimens.

Distribution.—Region of the Gulf Stream, taken in surface tow.

GLOSSOCODON Haeckel (1864).

Glossocodon tenuirostris (L. Agassiz). Text ent.

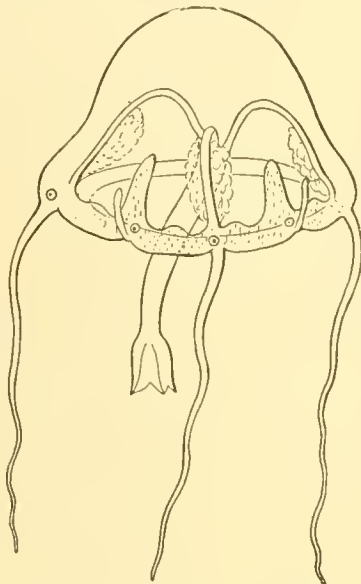
Liriope tenuirostris L. Agassiz, Contributions to Natural History of United States, Vol. IV, 1862, 365.

Glossocodon tenuirostris Fewkes, Bulletin Museum Comparative Zoology, Vol. IX, 1882, p. 278. Mayer, Bulletin Museum Comparative Zoology, Vol. XXXVII, 1900, p. 165.

Bell somewhat similar to *L. scutigera*, but more globular; also single broad centripetal canals alternating with the 4 radial canals, which are themselves rather wide and prominent. The marginal tentacles present the same aspects of modification as to number, etc., as in *Liriope cerasiformis*, only the 4 perradial being permanent in the adult medusa. Manubrium very long and pendulous, extending far beyond the bell margin; mouth 4-lipped, fringed with nematocysts.

Colors.—Bell transparent, gastric portion of manubrium reddish.

Distribution.—Chiefly in subtropical waters; reported by Mayer as occasionally taken at Newport. I have not seen this species, the above description being abridged from that of Fewkes.



Glossocodon tenuirostris. After Mayer.

THE NARCOMEDUSÆ.

So far as I am aware, only two, or at most three, families of this order are represented in this region, and these by very few species. Diagnostic characters of the families are given below, but no keys to the genera will be necessary as in families of large numbers.

Family CUNANTHIDÆ.

Wide, pouch-like radial canals, which connect by double peronial canals with the marginal canal. Otoporpe on the bases of the sensory bodies.

CUNINA Eschscholtz (1829).

Cunina discoides Fewkes.

Cunina discoides Fewkes, Bulletin Museum Comparative Zoology, Vol. VIII, 1881, p. 161.

Medusa flat, lens-shaped, transparent, with smooth exumbrella. Tentacles 14, stiff, solid, and usually carried at right angles to the vertical line of bell. Manubrium very small or wanting. Otocysts located on the lower margin of the collar-like structure called by Fewkes the subumbrella.

Distribution.—Occasionally found at Newport. This account is condensed from Fewkes's description, the medusa being unknown to me.

Family PEGANTHIDÆ.

No radial canals or gastric pouches, but peronial canal present. Otoporpe as in preceding.

Family ÆGINIDÆ.

Double peronial canals connecting the gastric pouch with the marginal canal. Interradial pouches present. Otoporpe lacking.

ÆGINA Eschscholtz (1829).

Ægina pachyderma (A. Agassiz). Text cut.

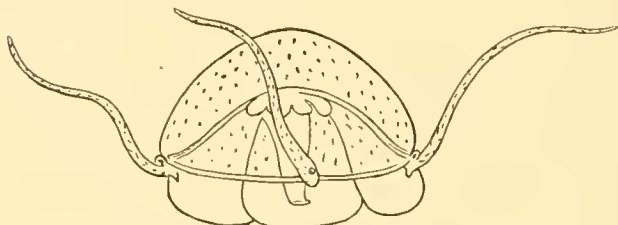
Campanulla pachyderma A. Agassiz, North American Aculephæ, 1865, p. 52.

Ægina pachyderma Haeckel, System der Medusen, 1879, p. 339.

Bell somewhat conical, slightly broader than high, 1.5 mm. by 1 mm. Marginal tentacles 4, rather long and arched, with numerous clusters of nematocysts, and with ocellate spots on the bulbous base of each. Manubrium well developed, conical in shape, and with plain mouth, genital pouches 8, symmetrically disposed about the manubrium base. Radial and marginal canals well defined.

Color.—Bell dull yellowish, with darker spots scattered over the surface; tentacle basis brownish red.

Distribution.—Nahant, September (Agassiz).



Ægina pachyderma. After A. Agassiz.

I have not seen this medusa, the above description being compiled from that of Agassiz.

Family SOLMARIDÆ.

No marginal or peronial canals; sometimes radial canals or modified radial canals. Otoporpe absent.

SOLMARIS Haeckel (1879).

Solmaris tetranema Hargitt. Text cut.

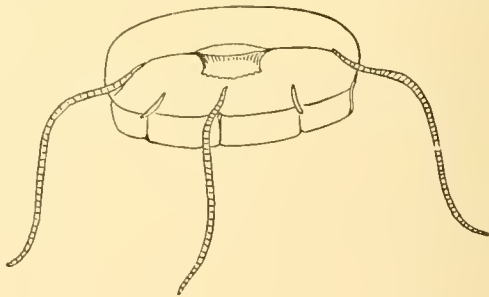
Solmaris Haeckel, System der Medusen, 1879, p. 355.

Solmaris tetranema Hargitt, Biological Bulletin, Vol. IV, 1902, p. 18.

Bell flat, discoid, about three times broader than high, 9 mm. by 3 mm. Exumbrellar surface convex, of firm consistency, and with a soft, flexible collar region indefinitely marked off from the former. Medusa without circular or peronial canals. Velum fairly developed. Gastric pouches small, and without distinguishable radial canals.

No signs of gonads present. Tentacles 4, of similar size and inserted high upon the sides of the bell, terminating proximally in sharp inwardly directed ends; tentacles stiff over proximal half, but attenuate and rather flexible distally, the endodermal cells in this region seeming much less crowded than proximally. Alternating with these primary tentacles were what appeared to be 4 undeveloped or rudimentary tentacles. At first these were thought to be associated with sensory bodies, but the absence of otcysts or similar structure seems to indicate their tentacular nature.

A single specimen was obtained near the Gulf Stream and had the appearance of immaturity; being also somewhat damaged, accurate determination was not practicable, yet I have proposed for it the provisional name "*tetranema*," indicative of the number of tentacles.



Solmaris tetranema.

SIPHONOPHORA.

Almost, if not all, the members of this order likely to be taken in the Woods Hole region are incidental rather than integral faunal factors, borne hither by tropical currents or prevailing winds from seaward. The proximity of the Gulf Stream and its general course are undoubtedly the most dominant influences in transporting various subtropical faunal elements to these waters.

The following synopsis furnishes hardly more than a convenient check list of species of which I have been able to find records, and only a comparatively few of which I have personally taken during the more than ten years of observation and collecting within the region.

The order Siphonophora comprises three fairly distinct suborders or sections.

DISCONNECTÆ.

With discoidal pneumatophore, but devoid of nectophores or bracts.

VELELLA Bosc (1802).**Velella mutica** Bosc.

Velella mutica Bosc, Histoire Naturelle des Vers, Tome II, 1802, p. 158. L. Agassiz, Contributions Natural History United States, Vol. IV, 1862, p. 366. A. Agassiz, North American Aclephæ, 1865, p. 216.

Armenista mutica Haeckel, Siphonophora Challenger Report, Zoology, Vol. XXVIII, 1888, p. 84.

Velella mutica Mayer, Bulletin Museum Comparative Zoology, Vol. XXXVII, 1900, p. 71.

Pneumatophore an elliptical or oblong disc, usually with an oblique vertical crest, and with numerous zooids suspended from its lower surface. Color of radial canals and manubrium often brilliant ochraceous. Occasionally taken in Vineyard Sound, Buzzards Bay, and off Newport.

PORPITA Lamarck (1816).**Porpita linnæana** Lesson.

Porpita linnæana Lesson, Histoire Naturelle des Zoophytes Aclephes, 1843, p. 589.

L. Agassiz, Contribution Natural History United States, Vol. IV, 1862, p.

366. A. Agassiz, North American Aclephæ, 1865, p. 218. Mayer, Bulletin

Museum Comparative Zoology, Vol. XXXVII, 1900, p. 72.

Pneumatophore a circular disc but devoid of vertical crest, otherwise similar in general aspects to the preceding.

Distribution.—Occasionally taken at Woods Hole, Vineyard Sound, Newport, R. I., etc.

CALYCONNECTÆ.

Without pneumatophores, but with one or more nectophores.

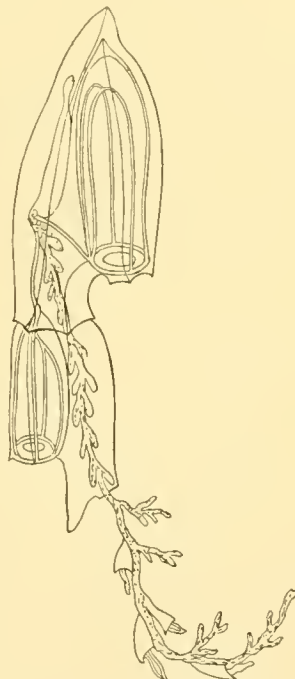
DIPHYES Cuvier (1817).**Diphyes bipartita** Costa. Text cont.

Diphyes bipartita Costa, Genere Diphya, 1840, p. 4.

Diphyes acuminata Fewkes, Bulletin Museum Comparative Zoology, Vol. VI, 1880, p. 142.

Diphyes bipartita Chun, Siphonophoren der Kanarischen Inseln, 1888; Siphonophoren der Plankton-Expedition, 1897, p. 24. Mayer, Bulletin Museum Comparative Zoology, Vol. XXXVII, 1900, p. 74.

This species is widely distributed throughout the tropical Atlantic and not infrequently drifts into the bays of the region from the Gulf Stream. Mayer records it as often taken at Newport in late summer. Specimens were taken off the borders of the Gulf Stream during 1902. Figure 25, after Mayer, gives a good general impression of the shape of this medusa, but no figure can give the remotest idea of its delicacy or motions.



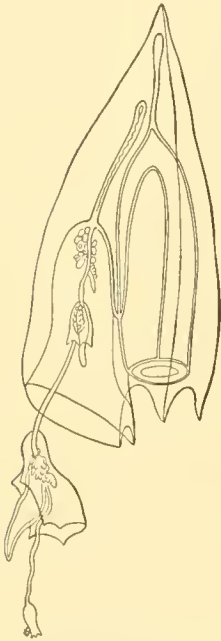
Diphyes bipartita. After Mayer.

DIPHYOPSIS Haeckel (1888).**Diphyopsis campanulifera** Eschscholtz. Text cut.

Diphyopsis campanulifera Eschscholtz, System der Acalephen, 1829, p. 137.

Diphyopsis campanulifera Chun, Die Siphonophoren der Kanarischen Inseln, 1888; Die Siphonophoren der Plankton-Expedition, 1897, p. 26. Mayer, Bulletin Museum Comparative Zoology, Vol. XXXVII, 1900, p. 75.

This form is similar in general characters and distribution to the preceding. The accompanying figure, after Mayer, gives an idea of its general shape and size. Chun regards it as an extremely variable species, both in the size and proportions of the colony. It is frequently taken in the deeper tows, particularly south of Marthas Vineyard and in the region of Nantucket.



Diphyopsis campanulifera.
After Mayer.

CUPULITA Quoy & Gaimard (1827).**Cupulita cara** (A. Agassiz).

Nanomia cara A. Agassiz, North American Acalephæ, 1865, p. 200.

Agalma elegans Fewkes, (?) Report U. S. Fish Commission 1884, p. 964, 1886.

Cupulita cara Chun, Die Siphonophoren der Plankton-Expedition, 1897, p. 103.

This is a large siphonophore, of a generally boreal habitat. The description of Agassiz (vide supra) is quite full, with good figures, including also accounts of its development, which obviates the necessity of fuller details here.

HIPPOPODIUS Quoy & Gaimard (1827).**Hippopodius luteus** Quoy & Gaimard.

Hippopodius luteus Quoy & Gaimard, in Annales des Sciences Naturelles, Tome X, 1827, p. 172.

Gleba hippopus Fewkes, Report U. S. Fish Commission 1884, 1886, p. 963.

Hippopodius luteus Chun, Die Siphonophoren der Plankton-Expedition, 1897, p. 34.

Occasionally taken within the region adjacent to the Gulf Stream, but rarely, if at all, near to the coast.

ANTHOPHYSA Mertens (1829).**Anthophysa formosa** (Fewkes).

Athyobia formosa Fewkes, Bulletin Museum Comparative Zoology, Vol. IX, 1882, p. 271.

Anthophysa formosa Chun, Die Siphonophoren der Plankton-Expedition, 1898, p. 61.

This species was first described by Fewkes from the Tortugas, and has not since been recorded out of that general region till reported by Chun (vide supra). Haeckel has described under the name of *Anthophysa darwini* what is apparently the same species.

During the summer of 1902 a single specimen of this interesting siphonophore was taken south of Marthas Vineyard. It agrees in general characters with the descriptions of both Fewkes and Chun. In size it is intermediate between the specimens they described, being about 4 mm. in diameter, and about the same in height.

SPHÆRONECTES Huxley (1859).**Sphæronectes gracilis** (Claus). Text cut.

Monophyes gracilis Claus, Schriften Zoologischer Institut Wien, 1874, p. 29.

Diplophysa incrmis Fewkes, Bulletin Museum Comparative Zoology, Vol. VI, 1881, p. 143.

The figure given herewith will afford a generally sufficient means of identification. Fewkes reports the species from Newport, R. I. Other than this I am not aware that it has been found within this region.

CYSTONECTÆ.

With large vesicular pneumatophore only, no nectophores or bracts.

PHYSALIA Lamarck (1801).**Physalia pelagica** Bosc.

Physalia pelagica Bosc, Histoire Naturelle des Vers, Tome II, p. 168, 1802.

Physalia arcthusa Tilesius, in Krusensterns Reise, 1812, p. 91.

Physalia caravelle Eschscholtz, System der Acalephen, 1829, p. 160.

Physalia pelagica Lamarck, Animaux sans Vertèbres, 2d edition, 1840, p. 92.

Huxley, Oceanic Hydrozoa, 1859, p. 100.

Physalia arcthusa L. Agassiz, Contributions to Natural History of the United States, 1862, p. 335. Chun, Die Siphonophoren der Plankton-Expedition, 1897, p. 89.

This is, for several reasons, the best known of siphonophores. Its large size and conspicuous float, and long and numerous tentacles with their powerful batteries of nematocysts, have combined to render the species noteworthy. These alone are generally sufficient for its easy identification. The large and beautifully colored pneumatophore, capable of nice adjustments to wind and wave, the graceful and pendulous tentacles, the languid, passively floating habit of the creature, and last, if not least, its venomous repute, render its presence a center of eager interest to observers. It is a fairly familiar object in Vineyard Sound and adjacent waters, at times as many as fifty specimens being taken during a single cruise within a few miles of Woods Hole.



Sphæronectes gracilis. After Mayer.

THE SCYPHOMEDUSÆ.

In general form, structure, habits, and distribution the Scyphomedusæ have much in common with the Hydromedusæ and probably sustain a much closer relation to them than to any other of the coelenterate classes. As a rule they are of larger size, somewhat sluggish in habits, the margin of the umbrella is more or less evidently lobed, and there is usually a large manubrium which is provided with large oral lobes, often complexly fimbriated or plaited. The body is also usually much thicker and more rigid than in the Hydromedusæ, and in some of the orders it is provided with a well-organized muscular system.

As in the Hydromedusæ there is usually a well-defined alternation of generations, though with notable exceptions in some of the orders, and in all there seems to be a tendency toward the suppression of the nonsexual stage, which is frequently quite inconspicuous and more or less temporary. In contrast with this phase in the Hydromedusæ, the metamorphism is usually more extended and arises differently—namely, by a process of transverse fission, known as strobilization, the entire body of the polyp constricting into a series of segments which eventually become free larval

jelly-fishes known as ephyrae. These in turn pass by an insensible metamorphism directly into medusae. Direct asexual budding from the adult medusae is very rare in this class, though quite common in the former. Here the medusa seems the predominant phase in the life history, while quite the reverse is frequently the case with the Hydromedusae, where the hydroid is often large, long lived, and conspicuous, the medusa small, rudimentary, or entirely suppressed.

The following morphological characters are usually sufficient for the distinction of the two classes:

1. Absence of a true velum. The velarium of the Cubomedusae has important structural differences, though doubtless serving essentially similar functions.
2. The sexual organs and products of entodermic origin.
3. Gastric filaments usually distinct.
4. Sense organs, when present, are perhaps modified tentacles, known as tentaculoecysts, or rhopalia.

There are four clearly distinguishable orders of Scyphomedusae, characterized as follows:

I. STAUROMEDUSÆ.—Vasiform or subconical umbrella. The medusa sedentary in some cases, attached by an aboral peduncle or stalk. Wholly devoid of sensory organs, but provided with 8 tentacles or tentacular organs which serve as anchors. Stomach with 4 wide gastric pouches, which communicate with a marginal canal. Gonads in four crescentic loops on the floor of the gastric pouches.

II. PEROMEDUSÆ.—Umbrella more or less conical in shape and with usually a well-developed horizontal constriction which divides the body into two regions—an aboral, which often resembles very much the apical projection of many Hydromedusae; and a basal or marginal portion, which is 8 or 16 lobed and bears tentacles and rhopalia. Stomach capacious, with 4 gastric pouches which are separated by narrow septa and extend into a circular sinus. Gonads much as in the former order.

III. CUBOMEDUSÆ.—A distinctively quadrate body or umbrella, which is provided with a definite velarium supported at the radial angles by thickenings or frenulae. Marginal tentacles 4, interradially disposed, their bases often provided with wing-like expansions known as pedalia; rhopalia 4, perradially disposed.

IV. DISCOMEDUSÆ.—A shallow, or disk-shaped, eight-lobed umbrella. Marginal sense organs 8, per- and interradially disposed about the margin. Tentacles often very numerous. Manubrium frequently large and with pendulous oral lobes variously plaited or crenulated. Stomach usually large, with 4 to 8 or more gastric pouches, within which the sexual organs are borne in gastrogenital pockets.

The medusae of this order are often of large size, many specimens of *Cyanea* reaching a diameter of 3 to 4 or even 6 feet and having tentacles of 50 to 60 feet or more in length when fully extended. The average size, however, even in this genus, is generally much smaller.

By far the greater number of Scyphomedusae are members of this order, as will be seen in the following list of genera and species found within the region under discussion; and this is true of other regions as well.

STAUROMEDUSÆ.

TESSARIDÆ.—Margin of umbrella devoid of lobes or anchors, apex attenuated into a hollow stalk, which in certain genera serves as a means of attachment; tentacles 8, 4 of which are perradial and 4 interradiial.

So far as known to me, no representatives of this family come within this region.

LUCERNARIIDÆ.—Margin of umbrella definitely lobed, each lobe terminating in a tuft of delicate, knobbed tentacles. Exumbrella attenuated at the apex as an organ of attachment; margin of umbrella with 8 tentacles, arranged as in the preceding family, but in some cases modified as anchors.

Family LUCERNARIIDÆ.

KEY TO THE GENERA.

- A.—Without gastrogenital pockets in the subumbrellar wall of the radial pouches.
 1. Umbrella with 8 marginal anchors.....*Haliclystus*
 2. Umbrella without marginal anchors.....*Lucernaria*
 B.—With 4 perradial gastrogenital pockets in the subumbrellar wall of the 4 radial pouches.
 3. Margin of umbrella with 8 anchors.....*Haliclythus*

HALICLYSTUS Clark (1863).***Haliclystus auricula*** Clark. Text cut.

Haliclystus auricula Clark, Journal Boston Society Natural History, Vol. VII, 1863, p. 559; A. Agassiz, North American Acalephæ, 1865, p. 63; Lucernaria and Their Allies, 1878, p. 13, in Smithsonian Contributions to Knowledge, Vol. XXIII. Hæckel, System der Medusen, 1879, p. 389.

Haliclystus primula Hæckel, Prodromus Systeme Medusarum, 1877, No. 375.

Umbrella octangular to pyramidal, stalk quadrate, approximately as long as the bell height; 8 arms, arranged in pairs; 4 perradial sinuses, broader and deeper than the 4 interradials, each arm with from 100 to 120 tentacles; 8 large marginal anchors. Size, broad diameter, 20–30 mm.; height, including stalk, about the same.

Colors.—Variable, often including every tint of the spectrum. Usually, however, the color is simple.

Distribution.—Massachusetts Bay northward.

Haliclystus salpinx Clark (1863).

Haliclystus salpinx Clark, Journal Boston Society Natural History, Vol. VII, 1863, p. 563. A. Agassiz, North American Acalephæ, 1865, p. 64. Hæckel, System der Medusen, 1879, p. 388.

Umbrella octangular, stem quadrate to prismatic and provided with 4 interradial longitudinal muscles. Eight arms symmetrically disposed, each with a tuft of 60–70 tentacles. Marginal anchors very large and about as long as the tentacles.

Distribution.—Chiefly northeastern Atlantic coast.

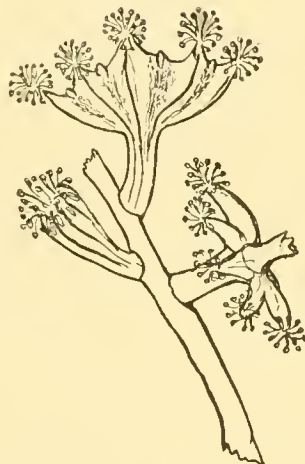
LUCERNARIA O. F. Muller (1776).***Lucernaria quadricornis*** O. F. Muller.

Lucernaria quadricornis O. F. Muller, Prodromus Zoologia Danica, 1776. M. Sars, Fauna Littoralis Norvegiæ, 1846. L. Agassiz, Contributions Natural History United States, Vol. IV, p. 175, 1862. Clark, Journal Boston Society Natural History, Vol. VII, 1863, p. 552. A. Agassiz, North American Acalephæ, p. 62, 1865. Hæckel, System der Medusen, 1879, p. 390.

Umbrella flat funnel-shaped to quadrate pyramidal, about twice as broad as high. Stalk cylindrical, single-chambered, about as long as the bell height and with 4 interradial longitudinal muscles. Eight arms, arranged in pairs; the 4 perradial sinuses of the bell margin as broad and deep as the 4 interradials; each arm with 100 or more tentacles. Diameter of umbrella about 50 mm.; height, including stock, slightly greater.

Colors.—Variable, gray, green, yellowish-brown to reddish.

Distribution.—About as for *Haliclystus*.



Haliclystus auricula. After A. Agassiz.

HALICYATHUS Haeckel (1879).**Halicyathus lagena Haeckel.**

Lucernaria auricula Fabricius, Fauna groenlandica, 1780, p. 341.

Lucernaria fabricii L. Agassiz, Contributions to Natural History of United States, Vol. IV, 1862, p. 176.

Manania auricula Clark, Journal Boston Society Natural History, Vol. VII, 1863, p. 542; A. Agassiz, North American Aculephae, 1865, p. 62.

Manania lagena Haeckel, Prodromus Systemae Medusarum, 1877, No. 381.

Halicyathus lagena Haeckel, System der Medusen, 1879, p. 394.

Umbrella deep, flask-shaped, about twice as high as broad; stalk slender, cylindrical, single-chambered, much longer than height of bell. Arms 8, arranged in pairs, not longer than broad, each with 60 to 70 delicate tentacles. Eight marginal anchors. Diameter 5 to 7 mm.; height, including stalk, 20 to 30 mm.

Colors.—Black to dark brown, occasionally reddish.

Distribution.—Eastport, Me. (Stimpson); Swampscott, Mass. (Agassiz).

These four descriptions are compiled chiefly from those of Agassiz, Haeckel, Stimpson, and Clark. The species are only rarely found within the Woods Hole region.

PEROMEDUSÆ.

Only a single genus of the Peromedusæ is known to come within the limits of this region, and that but rarely, specimens being drifted in currents of the Gulf Stream.

Generic characters.—Umbrella with 4 perradial, buccal pouches and with 4 basal funnels; gastric pouches with 2 rows of filaments.

PERIPHYLLA Steenstrup (1837).**Periphylla hyacinthina Steenstrup.**

Periphylla hyacinthina Steenstrup, Acta Musei Hafniensis, 1837. Haeckel, Systemae der Medusen, 1879, p. 119. Fewkes Report U. S. Fish Commission 1884, p. 933.

Umbrella bell-shaped; the 8 tentacle lobes with about the same marginal dimensions as the rhopalia lobes. Length of tentacles about twice the bell-height. Manubrium extending to base of the marginal lobes, and about twice as broad as long.

Colors.—Exumbrella reddish, pedalia and marginal lobes red to violet, tentacles bluish (Haeckel).

Distribution.—Greenland (Steenstrup); Gulf Stream south off Marthas Vineyard (Fewkes).

Periphylla humilis Fewkes.

Periphylla humilis Fewkes, Report U. S. Fish Commission 1884, p. 931.

Umbrella low, conical, diameter twice that of height. Rhopalia 4, provided with protecting hoods. Marginal tentacles 12, yellowish in color. Exumbrella brown, rough and opaque; central disk and corona usually uniform brownish.

Distribution.—As of preceding species.

Periphylla peronii Haeckel.

Charybdea periphylla L. Agassiz, Contributions Natural History United States, Vol. IV, 1862, p. 173. Peron and Lesneur, Tableau des Meduses, 1809, p. 332. Verrill, Report U. S. Fish Commission 1871, p. 724.

Periphylla peronii Haeckel, System der Medusen, 1879, p. 420.

Umbrella low-conical, about as broad as high. Marginal lappets 16, 8 tentacular and 8 ocular. Tentacles long and stout, about as broad at base as the marginal lappets. Manubrium about as broad as long, and somewhat cubical in shape.

Distribution.—Tropical Atlantic (L. Agassiz); Georges Bank (S. I. Smith).

CUBOMEDUSÆ.

Of the Cubomedusæ only a single family has representatives in this region, so far as I am aware, and of this but a single genus and species occurs. Other examples are likely to occur, however, under favorable circumstances.

CHARYBDEA Peron & Lesueur (1809).

Charybdea verrucosa Hargitt. Pl. V, fig. 5^a.

Charybdea verrucosa Hargitt, American Naturalist, Vol. XXXVI, July, 1902, p. 559.

Several specimens of this species were taken by the author at Woods Hole in the summer of 1901 and were briefly described (vide supra). The following are distinctive characters:

Bell ovoid in outline as seen in profile, cuboid as viewed from either pole. Size 4-5 mm. in height by 2-3 mm. in width. Surface of bell dotted somewhat irregularly with light brownish, warty clusters of nematocysts. Rhopalia 4, perradially located and set in rather deep pockets arched by protecting hoods. Tentacles 4, interradial, spindle-shaped, and deeply annulated. Velarium well developed, but devoid of any distinguishable canals and supported by frenulae on the inner perradial corners of the subumbrella. Gonads undeveloped in the specimens, which were likewise without distinguishable gastric filaments.

Colors.—Light amber-brown, with deeper brown on the tentacles.

As pointed out in the original description, the specimens show many contrasts as compared with to typical species of *Charybdea*. This may be due in part to the immaturity of the specimens, as already suggested. Mayer has described a similar species from the Tortugas which he likewise considers immature, and he makes the same suggestion concerning a somewhat similar form described by Fewkes. This assumption may in a measure account for certain of the negative characters noted, but it has seemed to me doubtful whether it adequately accounts for all. In the absence of specimens in sufficient numbers to warrant a decisive determination, however, the matter must of necessity rest where it is for the present.

Two species described by Mayer from the Tortugas—namely, *Charybdea aurifera* and *C. punctata*—were based on single specimens, which, being regarded as immature, as above mentioned, leaves the same doubt as in reference to *C. verrucosa*. A comparison of Mayer's description and figures (cf. Bul. Mus. Com. Zool., XXXVII, No. 2) will show many points of similarity, though at the same time evident points of difference.

DISCOMEDUSÆ.

CANNOSTOMÆ.

Discomedusæ with simple quadrate mouth, devoid of oral lobes or tentacles. Marginal tentacles short, solid.

ERYTHRÆ.—Radial pouches usually 16, broad and simple; no marginal canal. Chiefly deep-sea forms, though occasionally taken at the surface.

LIXERGIDÆ.—Radial pouches broad, terminating in numerous branching, blind distal canals.

SEMOSTOMÆ.

Discomedusæ with quadrate mouth and with elongated oral arms or lobes which are often complexly folded and frilled. Marginal tentacles hollow, often very long. Marginal lobes of umbrella usually 8.

ELMARIDÆ.—Radial canals of small size, but usually numerous and branching, the branches often anastomosing into an intricate network and finally uniting with a definite marginal canal.

CYANEIDÆ.—Radial canals broad and pouch-like, and with numerous blind, lobular canals; no marginal canal. Marginal lobes 8-16, rarely more.

PELAGIDÆ.—Radial canals rather broad and pouch-like, but simple and without ramifying branches; no marginal canal. Marginal lobes usually 16.

RHIZOSTOMÆ.

Discomedusæ in which the mouth early becomes more or less overgrown and obliterated by the 8 root-like oral arms, into which the gastric cavity extends. Openings to the outer surface through various funnel-like mouths on the edges and surfaces. There are no marginal tentacles.

TORTUMIDÆ.—Radial canals 8-16, narrow and with anastomosing branches. Marginal canal absent. Rhopalia 8-16. Suctorial funnels on the outer surface of the oral arms.

PLEMIDÆ.—Radial canals 8-16, occasionally more, variously branching and anastomosing. Rhopalia 8. Suctorial funnels on both inner and outer surfaces of the oral arms.

^a Drawn by H. B. Bigelow.

Family EPHYRIDÆ.

KEY TO THE GENERA.

- | | |
|---|----------------------|
| 1. Gonads 4, lobular pouches 16, 8 ocular and 8 tentacular | <i>Bathyluca</i> |
| 2. Gonads 4, simple, horseshoe-shaped; marginal lobes 16-32 | <i>Ephyroides</i> |
| 3. Gonads 8, symmetrically disposed; lobular pouches 16, ocular | <i>Nausithoe</i> |
| 4. Gonads 8, symmetrically disposed; lobular pouches 32, 16 ocular, 16 tentacular | <i>Nauphantopsis</i> |
| 5. Gonads 8, arranged in pairs; lobular pouches numerous | <i>Atolla</i> |

BATHYLUCA Mayer (1900).**Bathyluca solaris** Mayer.

Bathyluca solaris Mayer, Bulletin Museum Comparative Zoology, Vol. XXXVII, 1900, p. 2.

Umbrella rather flat and thick, aboral surface dotted with batteries of nematocysts; marginal lappets 24; tentacles 16, long and hollow; rhopalia 8; manubrium cruciform, simple, devoid of arms or appendages. Gonads 4, horseshoe-shaped; 4 subgenital pits beneath them on the subumbrel wall. Stomach large and with 16 gastric pouches, 8 of which extend to the ocular lobes and 8 to the tentacular lobes.

Colors.—Disk translucent, slightly bluish; clusters of nematocysts dull yellowish-brown; tentacles slightly greenish.

Distribution.—Narragansett Bay, R. I. Condensed from Mayer's description, which is the only record for this region.

EPHYROIDES Fewkes (1884.)**Ephyroides rotaformis** Fewkes.

Ephyroides rotaformis Fewkes, Report U. S. Fish Commission 1884, p. 949.

Fewkes describes what he considers both a new genus and species. The generic characters are not definite, no mention being made as to gonads, radial pouches, etc. The following description is condensed from the report above cited:

Umbrella flat discoid, and viewed from the aboral aspect comprises three zones—"discus centralis," "zona coronalis," "zona marginalis." The last-named zone is marked by definite marginal lappets of large size with rounded outlines twice as long as broad and 16 in number. Interposed between the lappets are a similar number of gelatinous elevations—"socles"—ending a short distance from the deepest point of the marginal incision of the discus centralis and zona coronalis. The marginal lappets are supported at their base by a pair of gelatinous socles.

NAUSITHOE K  lliker (1853).**Nausithoe punctata** K  lliker.

Nausithoe punctata K  lliker, Zeitschrift fur Wissenschaftliche Zoologie, Vol. IV, 1853, p. 323. L. Agassiz, Contributions Natural History United States, Vol. IV, 1862, pp. 122, 167. Mayer, Bulletin Museum Comparative Zoology, Vol. XXXVII, 1900, p. 67.

Reported by Mayer from the Bahamas and Tortugas, and therefore likely to be found in the Woods Hole region, though not yet recorded there.

NAUPHANTOPSIS Fewkes (1884).**Nauphantopsis diomedea** Fewkes.

Nauphantopsis diomedea Fewkes, Report U. S. Fish Commission 1884, p. 944-946.

From fragmentary specimens collected by the *Albatross* in the Gulf Stream, Fewkes has described this genus and species as new. The following brief synopsis of characters is taken from the report cited.

Umbrella high disk-shaped, with somewhat vertical walls, as in *Linerges*. Exumbrella divided into a central disk and a peripheral corona by a shallow coronal furrow. Corona crossed by 32 radial furrows alternating with same number of radial rounded elevations. Marginal lappets 32, rectangular in shape with rounded free angles. Tentacles 24, long and flexible, arising from the incision between the marginal lappets. Rhopalia 8 (?).

Distribution.—Latitude 38, longitude 69; depth 2,033 fathoms.

ATOLLA Haeckel (1879).**Atolla bairdii** Fewkes.

Atolla bairdii Fewkes, Report U. S. Fish Commission 1884, p. 936.

Umbrella disk-like, with aboral center convex. Marginal lappets 44, marginal tentacles 22, each supported by a gelatinous "sode." Rhopalia 22, situated in notches between the lappets. Manubrium large, with simple mouth; gastric pouches 22.

Color.—Slightly bluish, with rust-colored patches, especially on the border of the coronal furrow.

Distribution.—Gulf Stream, latitude 35–38, longitude 72–75.

Atolla verrilli Fewkes.

Atolla verrilli Fewkes, Report U. S. Fish Commission 1884, p. 939.

Umbrella flat discoid, 6 to 8 times broader than high. Marginal tentacles 22 to 28, with the same number of interposed rhopalia. Marginal lappets same in number as tentacles and rhopalia combined. The umbrella is divided into two regions, a central disk and a peripheral corona, separated by a coronal furrow. In some specimens the consistency was quite cartilaginous.

Color.—A slightly bluish tinge.

Distribution.—Gulf Stream, latitude 38–40, longitude 68–71; depth from 373 to 2,369 fathoms.

Family LINERGIDÆ.

LINERGES Haeckel (1879).**Linerges mereurius** Haeckel.

Linerges mereurius Haeckel, System der Medusen, 1879, p. 495. Fewkes, Report U. S. Fish Commission 1871, p. 950. Mayer, Bulletin Museum Comparative Zoology, Vol. XXXVII, 1900, p. 68.

Reported as very common in Straits of Florida by Fewkes, and by Mayer as abundant in the Bahamas and Tortugas. Its occurrence within our portion of the Gulf Stream is therefore quite probable, though not yet recorded.

Family ULMARIDÆ.

KEY TO THE GENERA.

1. Rhopalia 8; tentacles numerous, short, borne on under margin of umbrella outside the velar lappets.....*Aurelia*
2. Rhopalia 16; tentacles numerous, long, in 16 clusters on the lower margin within the velar lappets.....*Phacellophora*

AURELIA Peron & Lesueur (1809).**Aurelia flavidula** Peron & Lesueur. Pl. VI, fig. 2, and text ent.

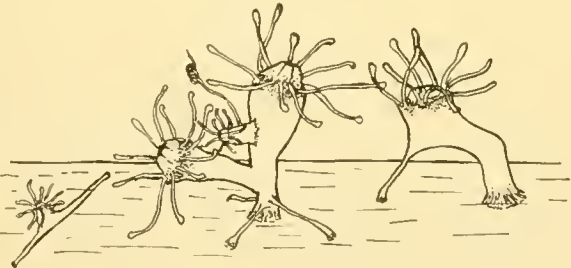
Aurelia flavidula Peron & Lesueur, Tableau des Meduses, etc., 1809, p. 359. Lesson, Histoire Naturelle des Zoophytes Acalephes, 1843, p. 376.

Medusa aurita Fabricius, Fauna Groenlandica, 1780, p. 363. Gould, Report Invertebrates of Massachusetts, 1841, p. 348.

Medusa flavidula Gould, op. cit.

Aurelia flavidula L. Agassiz, Contributions Natural History United States, Vol. IV, 1862, pp. 51, 160. A. Agassiz, North American Acalephæ, 1865, p. 42. Haeckel, System der Medusen, 1879, p. 555.

Umbrella flat and disk like, somewhat arched above; margin normally 8-lobed and with 8 rhopalia which are symmetrically disposed in the sinuses of marginal lobes. Marginal tentacles numerous, but short, forming a delicate fringe about the entire margin except at the marginal sinuses. Radial canals 16, of three sorts—perradial and interradial, each of these branching and anastomosing freely, and adradial, 8 in number, simple and unbranched, passing directly from the gastric pouches to the marginal canal. Manubrium quadrate, with oral arms about as long as the bell-radius, rather broad and heavy proximally, but terminating in slender pointed crenulated ends; entire margins of arms more or less folded or scalloped and richly supplied with nematocysts. In life the oral arms are carried in an extended position, much as shown in the plate. Gonads



Scyphostome of *Aurelia flavidula*.

escent-shaped organs, located upon the floor of the gastric pouches and giving the medusa a distinctive appearance not easily confused with any of the Scyphomedusæ likely to be found within the region.

Aurelia exhibits interesting aspects of variability, particularly in the radial canal system, the marginal lobes, rhopalia, and gonads. Browne (1901) has shown this in some detail in *A. aurita*. An examination of several hundred specimens of adult *Aurelia flavidula* shows a very similar condition, a ratio of variation as high as 20 to 25 per cent, and an examination of more than a thousand of the ephyrae of this medusa gives a like result. Details upon this point will be given in another contribution dealing specifically with this feature.

Colors.—A rather dull-colored medusa, the umbrella being almost transparent with pale yellowish pink, slightly more noticeable in the region of the gonads, which share in the same general color; the tentacles are dull reddish occasionally. There is often noticeable a bluish opalescence over the entire exumbrella.

Distribution.—This is one of the commonest of the Atlantic coast medusæ and ranges from Maine to New York. It is most abundant during early summer along the New England coast. Its life history has been described by Agassiz (Contributions Natural History United States). The breeding season seems to extend throughout most of the spring and summer. Smith (Museum Comparative Zoology, Vol. XXII, p. 115) has worked out the early embryology with much care. The scyphistoma period remains somewhat uncertain. In this stage the larvæ certainly in some cases live through the winter season and become free ephyrae in early April and May, when I have taken them in all stages of metamorphism. I have kept the polyps for weeks during the summer in aquaria, and while they budded and stolonized freely, they showed no signs of strobilization. The text cut shows one such colony, which was reared in a small dish upon my laboratory table.

PHACELLOPHORA Brandt (1835).

Phacellophora ornata (Verrill).

Callinema ornata Verrill, American Journal Arts and Sciences, 1869, p. 117. Annals and Magazine Natural History, Vol. IV, 1869, p. 160.

Phacellophora ornata Haeckel, System der Medusen, 1879, p. 643.

Umbrella flat and disk-shaped, rather thick and rounded aborally, the exumbrellar surface covered with wart-like papillæ; walls transparent and with prominent radial canals which are of two sorts, one branching and anastomosing, the other simple and straight, each 16 in number. Margin with 16 lobes deeply incised, within the sinuses of which is located a prominent rhopalium. Tentacles numerous and of varying size and length, arising from the under surface of the margin beneath the circular canal. Manubrium large and pendulous and with prominent plaited oral arms. Gonads 8, in prominent pouches within the gastric cavity. Specimens vary in size from 10 to 18 inches in diameter.

Distribution.—Taken at Eastport, Me., by Verrill and later by Fewkes, from whose description (Bulletin Comparative Zoology, Vol. XIII) this account is chiefly compiled. So far as known to me the species has not been taken in the Woods Hole region, but, like others of similar range, its occurrence is not improbable.

Family CYANEIDÆ.

Rhopalia 8; tentacles very numerous and long, disposed in 8 clusters, each comprising several rows *Cyanea*

CYANEA Peron & Lesueur (1809).

Cyanea arctica Peron & Lesueur.

Cyanea arctica Peron & Lesueur, Tableau des Meduses, etc., 1809, p. 362. L. Agassiz, Contributions Natural History United States, Vol. IV, 1862, pp. 87, 162. A. Agassiz, North American Academie, 1865, p. 44. Haeckel, System der Medusen, 1879, p. 530.

Medusa capillata Fabricius, Fauna Groenlandica, 1780, p. 364.

Cyanea capillata Eschscholtz, System der Medusen, 1829, p. 68.

Cyanea postelsii Gould, Report Invertebrates of Massachusetts, 1841, p. 347. Stimpson, Marine Invertebrates Grand Manan, 1853, p. 11.

Cyanea fulva L. Agassiz, op. cit. A. Agassiz, op. cit.

Cyanea varicolor L. Agassiz, op. cit. A. Agassiz, op. cit.

Umbrella flat and discoid, with a central aboral convexity; marginal lobes 8, with 16 or more secondary lappets. Marginal tentacles very numerous, in 8 clusters composed of several series of rows, the tentacles very long. This is one of the largest of our medusæ, often reaching a diameter of several feet, and with tentacles 50 feet or more in length when fully extended. The stomach is large, and there are normally 16 gastric pouches, 8 ocular, rather small and somewhat triangular, and 8 tentacular, much broader. The gonads are massive, extending the genital pouches into pendulous sacs hanging about the margin of the manubrium, which is long and with complex oral arms hanging in plaited folds within the circle of tentacles.

Cyanea, like *Aurelia*, presents numerous variations, not only in numerical and structural features, but in color, size, etc.

Colors.—Umbrella brownish to purplish, alternating with areas of transparency over the exumbrellar surface. Gonads yellowish white; tentacles variously colored, yellowish, orange, brown.

Distribution.—Almost the entire coast from Maine to North Carolina or beyond. This species is rather distinctively an arctic medusa, and is most abundant in early spring, though occasionally occurring in midsummer.

L. Agassiz has described two other species of *Cyanea*, namely, *C. fulva* and *C. versicolor*. I have not been able to recognize any constant differences of sufficiently marked character to warrant the conclusion of their specific distinctness. Collections made from a wide range of New England coast waters and southward to the Gulf Stream show every feature of intergradation among these supposed species and the preceding so fully as to preclude any definite line of separation between them. It would seem doubtful whether they were even entitled to varietal distinction, so intimate is the blending of varietal characters among medusæ taken within the same region.

Family PELAGIDÆ.

KEY TO THE GENERA.

- | | |
|--|---------------------|
| 1. Marginal tentacles 8; marginal lobes 16 | <i>Pelagia</i> |
| 2. Marginal tentacles 24; marginal lobes 32 | <i>Chrysaora</i> ? |
| 3. Marginal tentacles 40, less in young specimens; marginal lobes 48 | <i>Dactylometra</i> |

DACTYLOMETRA L. Agassiz (1862).

Dactylometra quinquecirra (Desor). Pl. VII, fig. 2.

Pelagia quinquecirra Desor, Proceedings Boston Society Natural History, Vol. III, 1848, p. 76.

Dactylometra quinquecirra, L. Agassiz, Contributions to Natural History of United States, 1862, Vol. IV, pp. 125, 166. A. Agassiz, North American Aclephæ, 1865, p. 48. Haeckel, System der Medusen, 1879, p. 518.

Umbrella rather high and arched aborally, much as in *Pelagia*, disk about three times as broad as high. Manubrium long and pendulous, and with 4 slender oral arms, which are more or less frilled, as in the preceding. Rhopalia 8, marginal tentacles 40, marginal lobes 48. The tentacles are arranged in the adults with 5 between each 2 rhopalia. In immature specimens there are usually but 3 in these octants. Gonads in 4 masses within the gastric pouches, beneath each of which is a rather large subgenital pit on the subumbrellar surface. In size this medusa varies in the adult from 80 to 150 mm. in broad diameter.

Colors.—In general, similar to those of *Pelagia cyanella*, though generally less brilliant, the various lines being paler and somewhat more delicate. Exumbrella delicate bluish, mottled with reddish brown, fading into yellowish; tentacles reddish to orange; oral arms pale pinkish, varying to bluish.

Distribution.—Rather more limited than either *Aurelia* or *Cyanea*. It is a common medusa at Woods Hole, in Buzzards Bay, Vineyard Sound, and at Nantucket.

Like several of the previous species, *Dactylometra* exhibits more or less variation. According to Mayer (Bulletin Museum Comparative Zoology, XXXII, No. 7), the tertiary tentacles arise invariably on either side of the ocular lappets. In several specimens examined during the summer of 1902 they were found to arise at intermediate points between the primary and secondary sets. Again, according to the same observer, the tertiary tentacles appear only as the medusa approaches sexual maturity, and after attaining a diameter of 130 mm. On the contrary, I have found them well developed in specimens having a diameter of only 40 mm. and where no gonads were yet developed. The variation in the number of marginal lobes also was found to be about the same as in the previously mentioned species.

PELAGIA Peron & Lesueur (1809).

Pelagia cyanella Peron & Lesueur. Pl. VII, fig. 1.

Pelagia cyanella Peron & Lesueur, Tableau des Meduses, etc., 1809, p. 349. Eschscholtz, System der Acalephen, 1829, p. 75. L. Agassiz, Contributions Natural History United States, Vol. IV, 1862, p. 164. A. Agassiz, North American Acalephæ, 1865, p. 47. Haeckel, System der Medusen, 1879, p. 507.

Umbrella somewhat dome-shaped, or subhemispherical; marginal lobes 16, with 8 rhopalia and 8 tentacles symmetrically disposed in the sinuses of the marginal lobes. Gonads 8, forming conspicuous pouch-like masses within the gastric pouches of the tentacular radii. Manubrium large and pendulous, with 4 variously frilled oral arms approximately as long as the tentacles.

Colors.—Disk translucent bluish, sprinkled with reddish brown dots over the exumbrellar surface, though more numerous near the margins and along certain radial areas, and forming crescent-like loops on the marginal lappets; manubrium similarly mottled on the outer edges of the arms, inner edges and frills delicate flesh colored; tentacles dull madder red to brownish red. Gonads pale purplish. Like *Dactylometra*, the color of *Pelagia* is more or less variable in different specimens.

This is a rare medusa in this region, only two specimens having been taken recently, both southward from Marthas Vineyard in the region of the Gulf Stream. Distribution chiefly pelagic.

According to Agassiz (above citation) the development of this medusa is direct, skipping the polyp and strobila stages and transforming directly from the planula to the ephyra and medusa.

CTENOPHORA.^a

While there continues to be widespread uncertainty as to the exact systematic relations of the ctenophores, there can be little doubt as to their more or less general relationship with the coelenterate phylum, hence their inclusion in the present synopsis.

In general they may be considered free-swimming medusoid coelenterates of pelagic habit, wholly destitute of the polyp phase of the preceding classes. Moreover, there is lacking any tendency to a colonial habit, so characteristic of the pelagic siphonophores, budding or proliferous asexual reproduction being unknown among them. Ciliary locomotion, so characteristic a larval condition in the former group, continues throughout the entire life of ctenophores, though the cilia become greatly modified, appearing as plates occupying definite meridional areas over the body. Tentacles may be entirely lacking, and when present are but two in number and located on opposite sides of the body, in perradial planes, and capable of contraction within lateral pockets. Again, nematocysts, so distinctive a feature of the classes previously described, are wholly lacking here, though certain cells of the ectoderm of the tentacles, known as adhesive cells, may possibly be regarded as homologous with them, and may aid in taking prey.

The gastrovascular system is well developed. The stomodeum, or so-called stomach, is usually large and opens above into the principal cavity of the canal system, the so-called funnel, or infundibulum. This divides into 8 terminal branches occupying adradial positions at their peripheral extremities. The stomach and funnel planes of the body are at right angles, and comprise the perradial planes known, respectively, as stomach and funnel planes. There are no signs of gastral filaments.

The muscular system is but slightly developed as such, though there are numerous muscular fibers intricately distributed through the mesoglea. Many of these fibers are curiously branched and polynucleated.

^aThis account presents merely the briefest synopsis of the species found within the region.

The nervous system, or rather tissue, seems chiefly limited to the aboral pole and concentrated about the sensory body (otocyst?), whose function is probably that of equilibrium.

In form the Ctenophora are for the most part ovoid, pyriform, or spherical organisms, of extreme delicacy of texture, making it almost impossible to lift a specimen from the water without its dissolving into a bit of formless slime. *Cestus*, or Venus's girdle, is a rare exception to the usual shape already indicated. In this form the body is greatly extended in the stomach plane and flattened in the funnel plane.

Ctenophores are hermaphrodite, the gonads being borne on opposite sides of the canals. Development is direct for the most part, in only a few cases showing metamorphic phases.

The Ctenophora are distinguishable into two fairly well-defined sections, namely, those with tentacles and those without tentacles, or

TENTACULATA.—With more or less evident tentacles, at least during the earlier larval history.

NONTENTACULATA.—Devoid of tentacles during entire life history.

TENTACULATA.

ORDER CYDIPPIDÆ.

Body more or less spherical or cylindrical, with two simple or pinnate tentacles which are retractile within lateral pockets. Aboral pole without wing-like processes.

Family MERTENSIIDÆ.

Body somewhat compressed in the gastric plane, subtentacular ridges longer than the subgastric.

MERTENSIA Lesson (1843).

Mertensia ovum (Fabricius).

Beroë ovum Fabricius, Fauna Groenlandica, 1780, p. 362.

Cydlippe ovum Eschscholtz, System der Acalephen, 1829, p. 25.

Beroë pileus Scoresby, Arctic Regions, 1820.

Mertensia scoresbyi Lesson, Histoire Naturelle des Zoophytes Acalephes, 1843.

Mertensia ovum A. Agassiz, North American Acalephæ, 1865, p. 26. Chun, Die Ctenophoren der Plankton-Expedition, 1898, p. 10.

Body subspherical to pyriform, from 16 to 18 mm. in diameter. According to A. Agassiz this species is distinguished by a peculiar whirling motion in swimming, and by a distinct pinkish color; body somewhat flattened. Only rarely taken at Woods Hole; commoner northward.

Family PLEUROBRACHIIDÆ.

Body pyriform to spherical; subtentacular and subgastric ridges of about equal length.

PLEUROBRACHIA Flemming (1822).

Pleurobrachia pileus (Fabricius).

Beroë pileus Fabricius, Fauna groenlandica, 1780, p. 361. Flemming, History British Animals, 1828, p. 504.

Cydlippe pileus Eschscholtz, System der Acalephen, 1829, p. 24.

Pleurobrachia rhododactyla L. Agassiz, Memoirs American Academy, Vol. IV, 1849, p. 314.

Pleurobrachia pileus L. Agassiz, Contributions to Natural History of the United States, Vol. III, 1860, p. 203. Chun, Die Ctenophoren Plankton-Expedition, 1898, p. 15.

Very similar to the preceding species, size 18 to 20 mm.; nearly spherical in form; tentacles long and feathered or pectinate; the 8 series of vibratile plates prominent. One of the commonest of our early ctenophores, as well as one of the most beautiful and of a firmer texture than any others of this order, making it possible to preserve fairly well specimens that have been properly killed.

Distribution.—Chiefly northward, though common during early spring in Woods Hole and adjacent waters.

ORDER LOBATA.

Body compressed laterally; that is, gastric plane longer than that of the funnel. Oral region with 2 lateral lobes, and with 4 auricles. Tentacles in lateral furrows.

Family LESUEURIIDÆ.

Marginal lobes somewhat rudimentary, auricles long and ribbon-like.

LESUEURIA M. Edwards (1841).

Lesueuria hyboptera A. Agassiz (1865).

Lesueuria hyboptera A. Agassiz, North American Aclephæ, 1865, p. 23. Chun, Die Ctenophoren der Plankton-Expedition, 1898, p. 22.

Body large and nearly rectangular as viewed from the broad aspect. Aboral pole deeply pitted with sensory body at its bottom. Very transparent and highly phosphorescent. Somewhat like *Mnemiopsis*, though distinguishable by the greater flattening and by the rectangular aspect.

Distribution.—Newport, R. I., Woods Hole, Massachusetts Bay.

Family BOLINIDÆ.

Lobes of medium size, auricles short.

BOLINA Mertens (1833).

Bolina alata L. Agassiz.

Bolina alata L. Agassiz, Memoirs American Academy Arts and Sciences, Vol. IV, 1849, p. 349. Contributions to Natural History United States, Vol. III, 1860, p. 268. A. Agassiz, North American Aclephæ, 1865, p. 15. Chun, Die Ctenophoren der Plankton-Expedition, 1898, p. 23.

Similar in general form and size to *Mnemiopsis*, but more distinctly compressed.

Described by Agassiz as one of the commonest species in Massachusetts Bay, it is, however, rather rare south of Cape Cod, being seldom found at Woods Hole.

Family MNEMIIDÆ.

Lobes large and arising from about the level of the funnel, which is also the level of origin of the auricles, and these are long and ribbon-like.

MNEMIOPSIS L. Agassiz (1860).

Mnemiopsis leidyi A. Agassiz.

Mnemiopsis leidyi A. Agassiz, North American Aclephæ, 1865, p. 20. Fewkes, Bulletin Museum Comparative Zoology, Vol. IX, p. 291.

This is one of our largest and commonest ctenophores, specimens often measuring 100 mm. or more in polar diameter by about half that width in narrow diameter. The marginal lobes are long and pendulous, extending far below the mouth level. As seen in profile the outline is somewhat triangular, specially when fully expanded. In contraction the lobes are curved inward, closing tightly over the mouth and giving an oval outline to the animal. The tentacles are rudimentary in the adult, though quite well developed in the young. *Mnemiopsis* is brilliantly phosphorescent, emitting sudden flashes of light when disturbed at night by a dipping oar or other cause.

Common throughout the region, and usually very abundant during summer and early autumn.

ORDER CESTIDÆ.

Body greatly elongated and ribbon-like.

CESTUS Lesueur (1813).**Cestus veneris** Lesneur.

Cestus veneris Lesueur, Nouveau Bulletin de la Société Philomatique, 1813, p. 281. Chun, Ctenophoren Plankton-Expedition, 1898, p. 20.

This is a distinctively tropical species and rarely found beyond a tropical range. It has been reported by S. I. Smith from Georges Bank, and A. Agassiz has reported fragments of a single specimen found at Newport, R. I.

NONTENTACULATA.

Ctenophora wholly devoid of tentacles.

Only the order Beroida, family Beroidæ, has representatives in this region. The body is ovoid, usually somewhat compressed laterally. Mouth very large, opening into a capacious stomach. Radial canals with lateral and variously anastomosing branches.

BEROE Browne (1756).**Beroe ovata** Bosc. Text cut.

Beroe ovata Bosc, Histoire Naturelle des Vers, 1802, p. 149. Fewkes, Bulletin Museum Comparative Zoology, Vol. IX, p. 251.

Idgia ovata Lesson, Histoire Naturelle Zoophytes Acalephes, 1843, p. 134.

Idgiopsis clarkii L. Agassiz, Contributions Natural History United States, Vol. III, 1860, pp. 288, 296.

Idgiopsis affinis L. Agassiz, Contributions Natural History United States, Vol. III, 1860, pp. 288, 296.

One of our finest ctenophores. Body large, measuring 40–70 mm. in polar diameter, with about half the width. Margins plain and capable of slight evagination or contraction. Radial canals 8, extending to the margin and otherwise connected with numerous anastomosing lateral branches. Ciliary areas prominent and of beautiful pinkish hue.

Common at Woods Hole in 1901, though seldom taken in any considerable numbers.

Beroe cucumis Fabricius.

Beroe cucumis Fabricius, Fauna Grœnlandica, 1780, p. 361. Eschscholtz, System der Acalephen, 1829, p. 36. Chun, Ctenophoren der Plankton-Expedition, 1898, p. 26.

Idgia borealis Lesson, Natural History der Zoophytes Acalephes, 1843, p. 134.

Media arctica Lesson, Natural History der Zoophytes Acalephes, 1843, p. 134.

Idgia roseola L. Agassiz, Contributions Natural History United States, Vol. III, 1862, pp. 270 and 290.

Idgia cucumis A. Agassiz, North American Acalephæ, 1865, p. 36.

This, like the preceding, is a most beautiful ctenophore, of splendid roseate hue, varying in size from 15–20 mm. in polar diameter, with about half the breadth. In general aspects it is much like the preceding, though much smaller and more brightly colored.

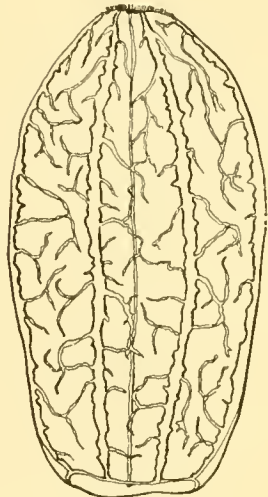
Range, according to Verrill, from Vineyard Sound to Labrador. Reported by Agassiz from coast of New England. Taken by the writer in 1902 off Crab Ledge, near Chatham, Mass.

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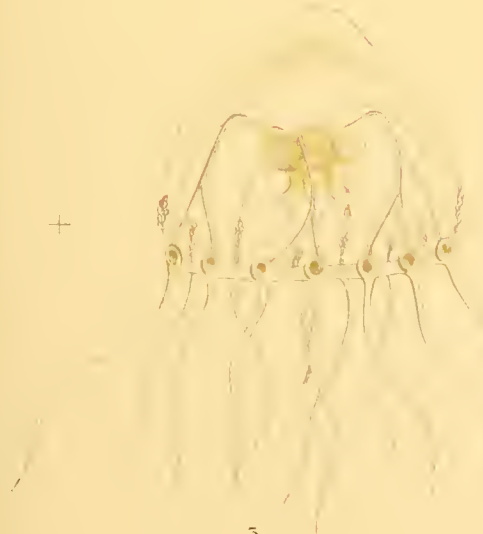
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5

1. SYNCORYNE PRODUCTA.

2. DIPURENA STRANGULATA.

3. DIPURELLA CLAVATA

4. LIZZIA GRATA.

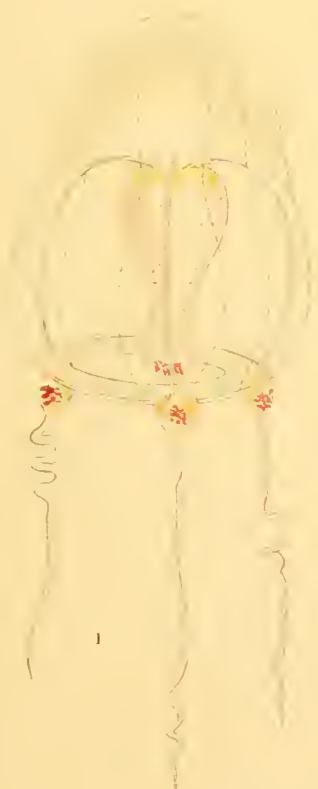
5. WILLIA ORNATA.



3



12



1



4

1. ECTOPLEURA OCHRACEA.
2. HYBOCODON PROLIFER

3. HYBOCODON PENDULA
4. BOUGAINVILLIA CAROLINENSIS.



PENNARIA TIARELLA.

1 MALE

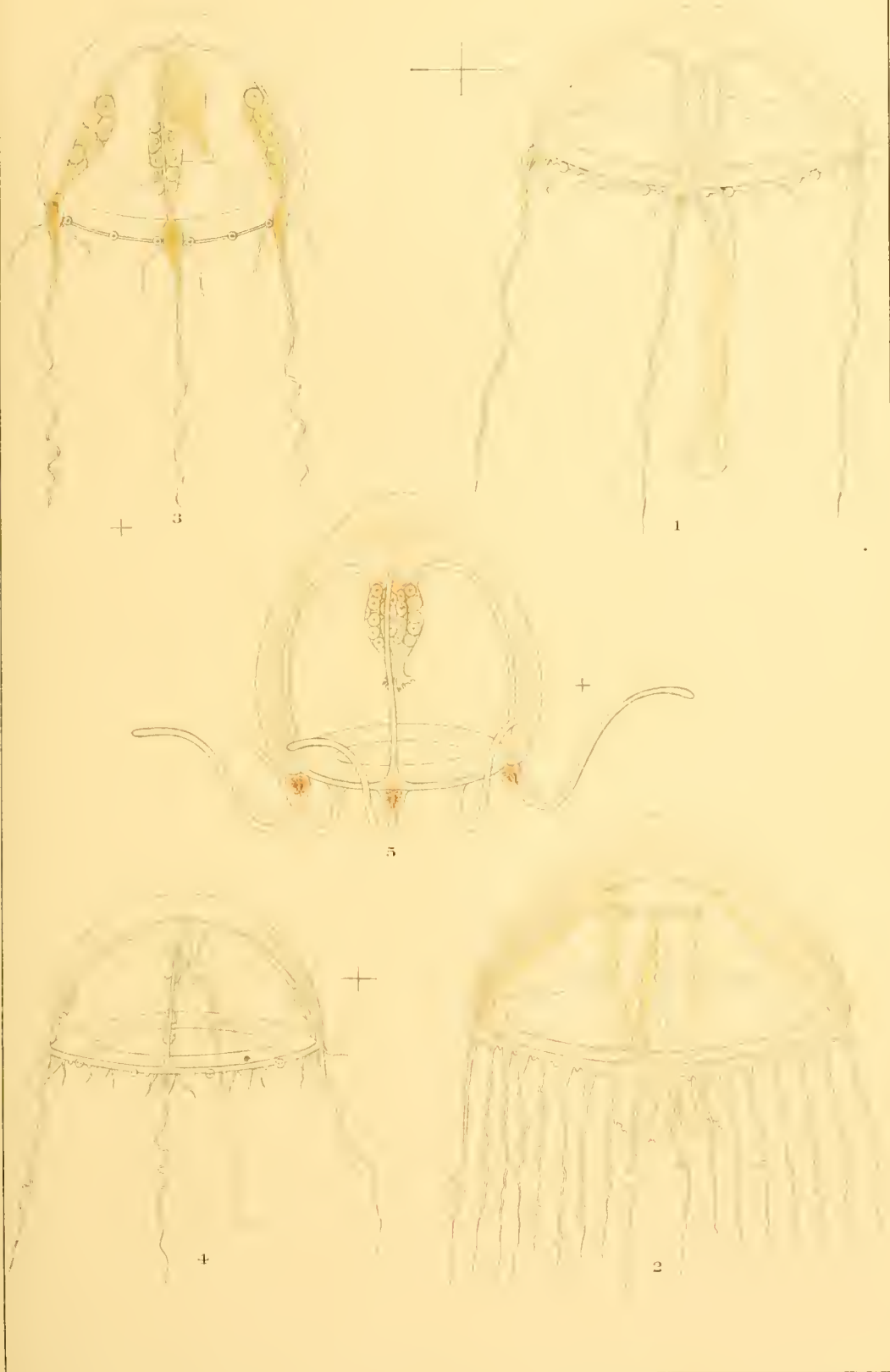
3 HYDROID

2 FEMALE.

4 PORTION OF COLONY.

5 SINGLE HYDRANTH WITH MEDUSOID.

WILLIAMS & CO. N.Y.



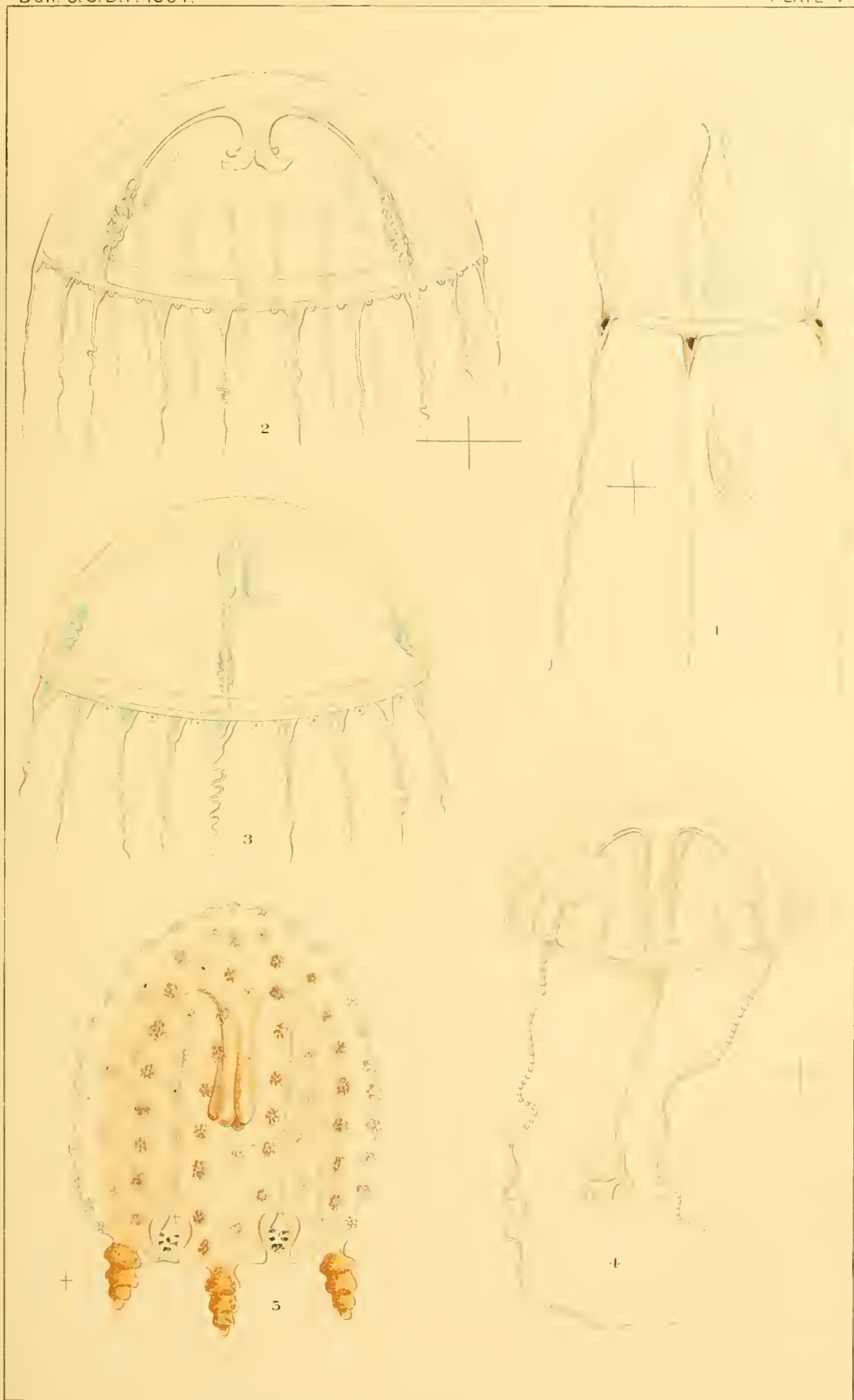
1. EUTIMA MIRA.

2. TIMA FORMOSA.

3. EUCHEILOTA DUODECIMALIS.

4. EUCHEILOTA VENTRICULARIS.

5. PODOCORYNE CARNEA



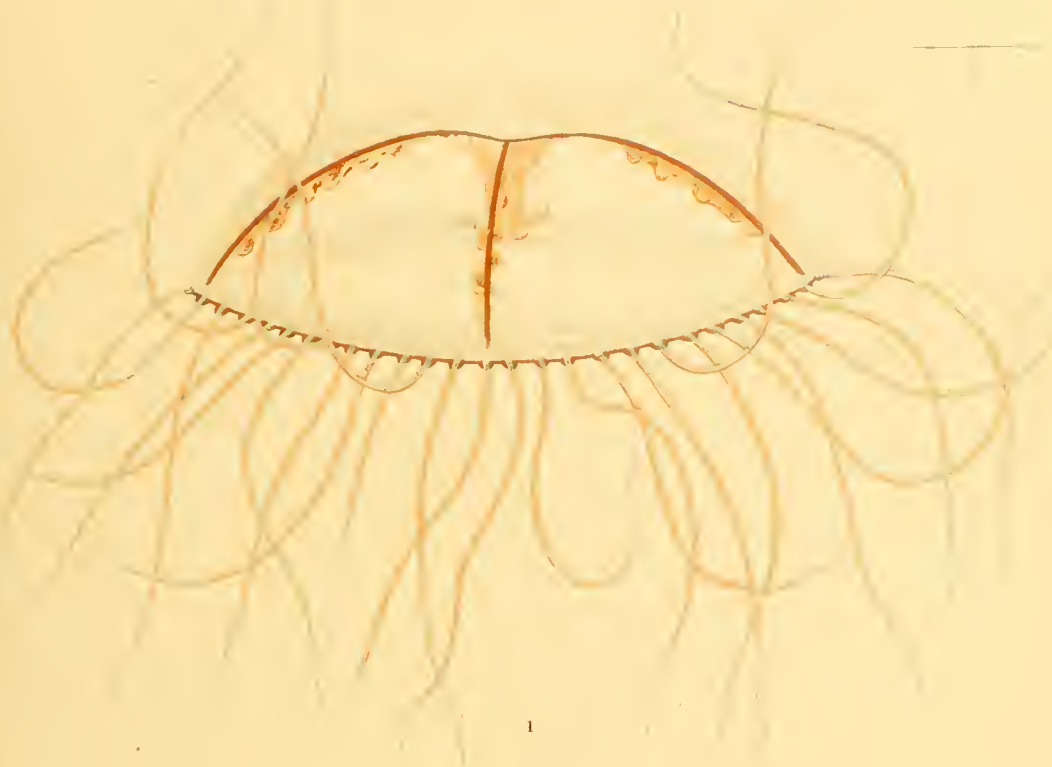
1. SYNCORYNE MIRABILIS

2. OCEANIA LANGUIDA.

3. EPENTHESIS FOLLEATA

4. LIRIOPE CERASIFORMIS

5. CHARYBDEA VERRUCOSA.

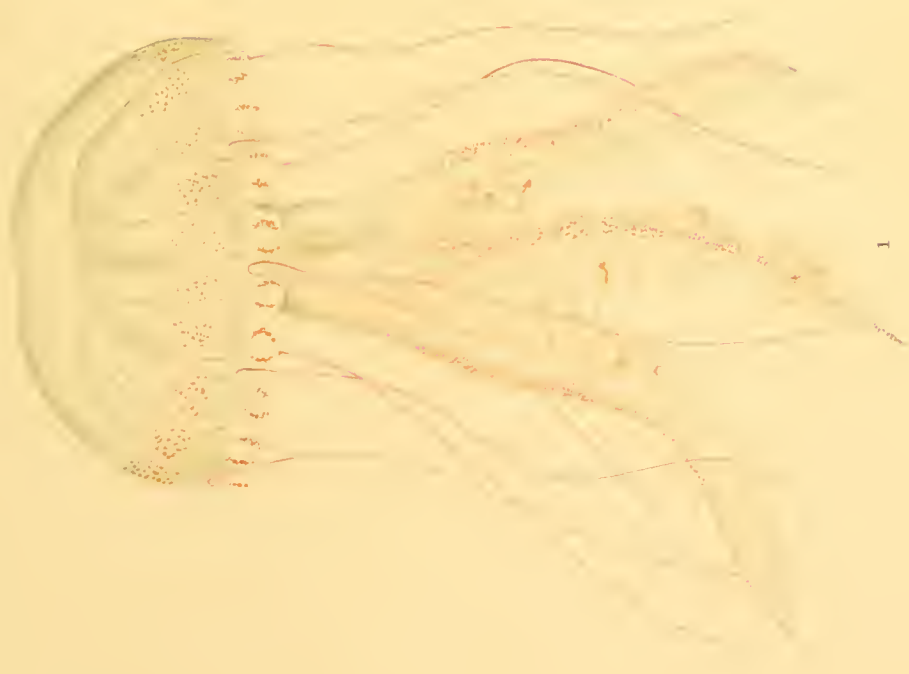


1



2

1. GONIONEMUS MURBACHII. 2 AURELIA FLAVIDULA.



1



2

1. PELAGIA CYANELLA. 2. DACTYLOMETRA QUINQUECIRRA.