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SYNOPSES OF NORTH-AMERICAN INVERTEBRATES.

XIV. The Hydromedusæ — Part I.

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Introductory.

The following synopsis was undertaken more than a year ago as a section of the "Synopses of North-American Invertebrates" now in course of publication. Various interruptions have delayed its completion at an earlier date.

While compiled largely from the author's notes and observations made upon the Hydrozoa of the Atlantic coast during a period of more than ten years, the form and method of presentation are patterned after the systematic works of Hincks, Allman, Haeckel, and von Lendenfeld. For many of the descriptive notes recourse has been had to L. Agassiz's *Contributions to the Natural History of the United States* and to A. Agassiz's *Catalog of the Acalephæ of North America*, as well as to those of the authors just named.

The synopsis is confessedly incomplete in several of the orders, specially upon the Campanularidæ and Leptomedusæ. It is, moreover, limited to a comparatively small range of hydrozoan life of American waters, chiefly of the northeastern Atlantic coast. Of that of the Pacific coast our present knowledge is still too limited to warrant even a provisional synopsis.

The Hydromedusæ comprise one of the three generally recognized classes of Cœlentera, of which the others are the Scyphomedusæ and Anthozoa. While the first two classes have been regarded as much more intimately related phylogenetically than has the third, it may be doubted whether after all their relation may not be quite remote, at least so much so as to warrant separate consideration. Hence slight, if any, reference

will be made to the Scyphomedusæ in considering possible relationships or phylogeny among the Hydromedusæ.

The Hydromedusæ may be distinguished by the following somewhat broad characteristics. In typical cases there is a more or less well marked alternation of generations, *i.e.*, a non-sexual, hydroid stage and a sexual, medusoid, stage. The latter are derived by a process of budding from the stem or hydranth of the hydroid as gonophores which may become free as medusæ or may exhibit varying phases of degeneration as medusoids or mere sporosacs, as in Clava, Campanularia, etc.

In many cases there may be exhibited proliferous medusæ from various portions of the parent medusa, as in Hybocodon. In rare cases one or other of these phases may be entirely lacking, as in Hydra, in which the medusa phase is wholly absent, or as in Rhegmatodes and many others the hydroid stage is apparently lacking.

Perhaps in no phylum of the animal world is there a more striking exhibition of polymorphism than among the Hydromedusæ. This seems to reach its climax in the Siphonophora, though in such forms as Hydractinia it is also evident.

In general the hydroid exhibits a sedentary habit quite in contrast with the free-swimming habit of the medusa. But here again are numerous exceptions. Hydra is capable of locomotion, as are also other hydroid forms, while as already indicated many medusæ are sessile and degenerate, and in the Siphonophora the entire polymorphic colony is free-swimming. In general the hydroids are colonial though with notable exceptions, as in Hydra and many others. While in general form the hydroid and medusoid present rather striking morphological differences, they may yet be reduced to a common and fundamental likeness. Both are of diploblastic structure, having a definite ectoblast and entoblast separated by a middle lamella, or mesogloea, which is a delicate, structureless membrane in the hydroid and in the medusa a rather massive, gelatinous structure, making up the bulk of the body and giving it the characteristic glassy appearance.

In the absence of definite knowledge concerning details of the life history of many of the Hydromedusæ, it is as yet

impossible to formulate any scheme of classification which shall bring into a single view the complete ontogenetic relations of the various hydroid and medusoid phases. In the present synopsis I have followed in the main that of Allman and Hincks for the hydroids and that of Haeckel for the medusæ, though in each there is not a little variation both as to the order of presentation as well as the nomenclature used.[1]

SYNOPSIS OF ORDERS OF HYDROMEDUSÆ.

I. Hydrariæ.

Polyps solitary, never forming colonies; no medusoids; sex-cells produced in ectoderm of polyps.

Of this order only a single well-defined genus is recognized, Hydra. The genera Protohydra and Microhydra are probably allied genera, but their affinities are too uncertain as yet to warrant definite classification. The former is of marine habit, the latter of fresh-water habit. Both are devoid of tentacles, and sexual reproduction, at least in the former, seems unknown.

Of the genus Hydra there are two well-distinguished species: *H. fusca* and *H. viridis*. Both abound in fresh waters of small lakes, ponds, and sluggish streams, associated with various aquatic plants, notably Lemna, various algæ, pond lilies, etc.

II. Hydrocorallinæ.

Colonial. Hydrosome comprising polyps of two forms, gastrozoids and dactylozoids, supported from a network of cœnosarcal hydrorhizæ, from the ectoderm of which is secreted a calcareous mass which is deposited over the spaces or meshes of the network. The colonies form incrusting, often arborescent, masses over shells, stems of Alcyonaria, or other support, often forming massive and fantastic shapes, as in the so-called "stag's horn coral." Only one genus is likely to come within the range of the present synopsis, namely, Millepora; and of this a single species, alcicornis.

III. Tubulariæ (Gymnoblastea).

The Tubulariæ are for the most part colonial hydroids, producing free medusæ, or medusoid gonophores, by budding. Hydroids devoid of

[1] Just as these notes were being put into final form for the press, I have been permitted to consult the manuscript of a forthcoming *Handbook of the Hydroida of the Woods Hole Region*, by Professor C. C. Nutting, for the privilege of which I am under grateful obligations.

hydrothecæ and gonangia. Sexual individuals when set free are known as Anthomedusæ. Medusæ ocellate, *i.e.*, the sensory bodies, are visual in character, and are located usually at the bases of the tentacles. Gonads borne in the tissues of the manubrium.

IV. CAMPANULARIÆ (Calyptoblastea).

Hydroids with hydrothecæ and gonangia. Colonial; propagating by budding both in development of hydrosome and in formation of gonosomes, the latter of which may become free as medusæ, or only partially develop as medusoids, with only rudimentary medusan organs. Medusæ with sensory organs of the vesiculate type, otocysts, borne upon the margin of the bell, usually between bases of tentacles. Gonads borne under the radial canals. Medusæ when free are Leptomedusæ.

V. TRACHOMEDUSÆ.

Hydromedusæ devoid of hydrosome (hypogenic), medusa developing directly from the egg; no alternation of generations known. Sensory organs chiefly tentaculocysts, containing endodermal otoliths. Gonads borne under radial canals. Medusæ generally somewhat hemispherical in shape, with thick mesoglœa. Radial canals, four, six, or eight, often centripetal.

VI. NARCOMEDUSÆ.

Hydromedusæ devoid of hydrosome (hypogenic), development of medusa being direct with no alternation of generations. Medusa rather flat in shape, and with radial canals in form of broad gastric pouches, which vary in number, as do also the tentacles, which are usually set at some distance up on the outer surface of the umbrella.

VII. SIPHONOPHORA.

Hydromedusæ with free-swimming, polymorphic colonies, produced by differential budding. The colonies of this order are characterized by an extreme specialization of the several types of individuals which comprise them. Reproductive products borne in gonophores which seldom become free.

KEY TO FAMILIES OF TUBULARIÆ.

Hydranth devoid of specialized receptacles, hydrothecæ. Sexual products not borne in closed gonangia.

1. Hydranths with scattered, filiform tentacles . . . . CLAVIDÆ, 1
2. Hydranths with single whorl of filiform tentacles:
   a. Hypostome conical, not abruptly differentiated.
      b. Colony regularly branched . . . . . BOUGAINVILLIDÆ, 3

b'. Colony not branched. Hydrorhiza of anastomosing canals, forming an incrusting base, overlaid with ectodermal cœnosarc.

c. Hydranths with sessile, fixed gonophores . HYDRACTINIDÆ, 5

c'. Hydranths producing free medusæ . . . PODOCORYNIDÆ, 6

a'. Hypostome trumpet-shaped or hemispherical . . EUDENDRIDÆ, 4

3. Hydranths with more than a single whorl of filiform tentacles :

a. Stem provided with definite sheath of horny perisarc.

b. Distal tentacles in two whorls . . . . . HYBOCODONIDÆ, 10

b'. Distal tentacles not in two whorls . . . . . TUBULARIDÆ, 9

a'. Stem not provided with definite sheath of perisarc, more or less definitely marked with longitudinal flutings or cœnosarcal channels CORYMORPHIDÆ, 8

4. Hydranths with scattered, somewhat spirally disposed, capitate tentacles only . . . . . CORYNIDÆ, 2

5. Hydranths with proximal circle of filiform tentacles, and with distal capitate tentacles on hypostome . . . . . PENNARIDÆ, 7

1. CLAVIDÆ.

Colonial, stems simple or branching, hydranths elongate, clavate, with numerous filiform tentacles irregularly disposed over the body. Gonophores borne upon hydranth, or on special branches, or occasionally arising from the hydrorhiza. Medusoids never free.

GENERA.

1. CLAVA. Colony of simple, unbranched individuals, devoid of perisarc, except near the base.

2. RHIZOGETON. Colony very similar to Clava. Gonophores arising from hydrorhiza.

3. CORDYLOPHORA. Colony profusely branched and with definite sheath of perisarc.

Clava leptostyla Ag.

Trophosome : Hydranths simple, with slender basal portion which arises from a filiform hydrorhiza protected by a delicate perisarcal covering, which extends slightly upon the bases of the polyps. Tentacles numerous, filiform, and scattered over the hydranth.

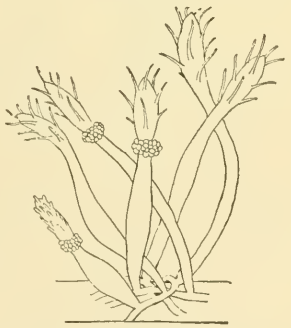

FIG. 1.— *Clava leptostyla* Ag. (Adapted from Allman.)

Gonosome : Gonophores in clusters at base of tentacles, medusoids never becoming free. Male gonads of a bright pinkish hue, similar, in general, to that of the colony. Female gonads of a rather distinctly purple color.

Habitat : Shallower waters on fucus, docks, sea wall, etc., at Cold Spring Harbor, Woods Holl, Hadley Harbor, etc.

Rhizogeton fusiformis Ag.

(*Contr. Nat. Hist. U. S.*, vol. iv.)

Trophosome: Colony much as in Clava. Hydranths of about ¼ inch in height, tentacles about twelve in number, borne on distal half of polyp.

Gonosome: Gonophores oval, arising from hydrorhiza on short peduncles, the whole invested by filmy perisarc.

Habitat: Rocky pools between tide marks, Massachusetts Bay.

Cordylophora lacustris Allman.

Trophosome: Colonial, profusely branching, hydranths with scattered filiform tentacles.

Gonosome: Gonophores borne on branches, ovate and with definite investment of perisarc.

Habitat: Brackish, and fresh waters in lagoons, ponds, etc.

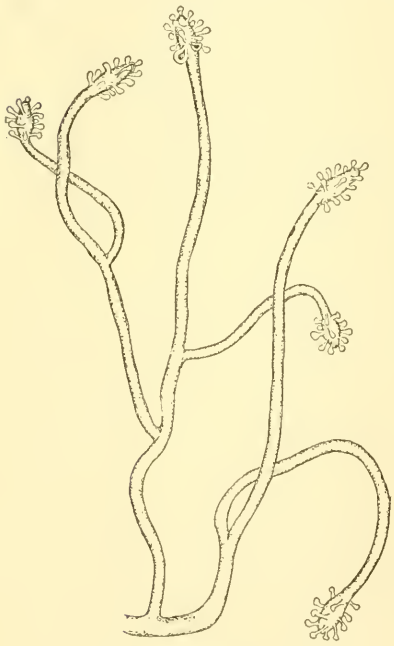

FIG. 2.—*Syncoryne mirabilis* Ag. (After Agassiz.)

2. CORYNIDÆ.

Colonial, hydranths with capitate tentacles only, scattered over the elongated bodies, or growing in indefinite whorls. Gonophores usually borne among the proximal tentacles, or from body of polyp and producing medusæ, which may become free or remain attached.

GENERA.

1. SYNCORYNE. Stem invested by definite perisarc; hydranths claviform.

2. CORYNITIS. Stem devoid of definite perisarc; hydranths sessile, with long, cylindrical bodies.

Syncoryne mirabilis Ag.

Trophosome: Branched, perisarc smooth or with only slight indication of annulations. Hydranths with numerous capitate tentacles.

Gonosome: Medusæ borne on hydranth body. These are of two forms, one free and developing earlier, hemispherical, with well-developed tentacles, with an ocellus at their base; the other fixed, tentacles rudimentary, and devoid of ocelli.

Corynitis agassizii McCr.

Trophosome: Colonial, not branched, hydranths with cylindrical, highly contractile bodies, and spirally arranged, capitate tentacles.

Gonosome: Gonophores growing low on body of hydranth or among the proximal tentacles. Medusæ almost spherical, the surface dotted with clusters of nematocysts. Marginal tentacles two or four, nodulated and swollen with batteries of nematocysts.

Habitat: Shells of Mytilis, usually overgrown with incrustations of Membranopora.

3. Bougainvillidæ.

Colonial, branching, with distinct perisarc. Hydranths with conical hypostome and a single whorl of filiform tentacles. Gonophores borne just below the hydranth. Medusæ with four radial canals, marginal tentacles either single or in clusters, and with ocelli at their bases.

GENERA.

1. Bougainvillia. Hydrocaulus with dense perisarc. Medusæ with clustered marginal tentacles and with branching oral tentacles.

2. Perigonimus. Stems with gelatinous perisarc. Medusæ with two marginal tentacles and without oral tentacles.

Bougainvillia superciliaris Ag.

Trophosome: Colony attaining a height of about two inches. Stem irregularly branched, branches annulated proximally. Hydranths with inconspicuous hypostome and from fifteen to twenty tentacles.

Fig. 3.—*Bougainvillia superciliaris* Ag. (After Agassiz.)

Gonosome: Gonophores borne mostly on pedicels from ultimate branches. Mature medusæ with heavy manubrium and branched tentacles, those of margin arising from conspicuous sensory bulbs. Colony light color with greenish tinge, hydranth light rose tint. Medusæ with yellowish manubrium tipped with red, sensory bulbs reddish orange.

Bougainvillia (*Margelis*) *carolinensis* McCr.

Trophosome: Colony sometimes eight to twelve inches high, usually much smaller. Stem profusely branching, with hydranths freely distributed on both stem and branches, and of elongate and flexible, subconical form. Tentacles about twelve.

Gonosome: Gonads borne on both stem and branches, often in clusters.

Medusæ much as in previous species, but with narrower and shorter hypostome. Colony light grayish tinged with dull green, hydranths with reddish tint. Medusæ with brick-red manubrium and sensory bulbs, ocelli black.

Habitat: Piles of docks, occasionally on seaweed and floating timbers.

Perigonimus.

Colonial, rarely attaining a height of more than ½ of an inch, simple or branched, perisarc usually gelatinous and extending to base of tentacles. Hydranths relatively large and with conical hypostome. Medusæ borne on hydranths or on stem or branches. bell-shaped and with two to four tentacles with bulbous bases.

Perigonimus jonesii.

(*American Naturalist*, vol. xxviii, p. 27.)

Trophosome: Colonial, branching freely, with thick, gelatinous perisarc, often wrinkled, extending to, or even including, the bases of tentacles. Hydranths with subconical hypostome, with about sixteen filiform tentacles, alternately elevated and depressed.

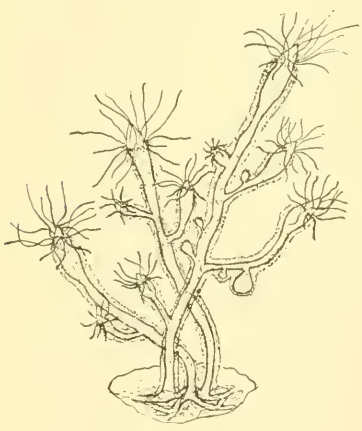

FIG. 4.—*Perigonimus jonesii.*

Gonosome: Medusæ ovoid or hemispherical, with four radial canals and ocelli, but having only two tentacles, which are often spirally coiled and disposed within the subumbrellar cavity.

Habitat: Found only upon the abdomen and legs of the spider crab, *Labinia marginata*, Cold Spring Harbor, L. I.

4. EUDENDRIDÆ.

Colonial, often branching with great profusion, becoming quite arborescent. Perisarc distinct, more or less annulated, attached by creeping hydrorhiza. Hydranths flask-shaped, with sharply differentiated, trumpet-shaped hypostome. Tentacles filiform, forming a single whorl about the base of the hydranth. Male gonophores borne in a verticil just beneath the tentacles of hydranth, which in some species become directly metamorphosed into gonophores. Female gonophores not verticillate, usually borne on body of hydranth, which often becomes transformed into gonophores with their peculiar spadiceous, finger-like coils enclosing the ova. The family includes a single genus, Eudendrium, fairly characterized in the accompanying cut. The following species are designated:

Eudendrium ramosum Linn.

Trophosome: Colony arborescent, much branched, attaining a height of from four to six inches. Branches rather symmetrical, pinnate and somewhat alternate, with similar sub-branches. Hydranths somewhat ovoid, with trumpet-shaped hypostome, and with single verticil of about twenty tentacles, some of which are often atrophied in male.

Gonosome: Sexes distinct, though often growing in approximate colonies. Gonophores of female somewhat pyriform and scattered, springing from body of hydranth or occasionally directly from stem. Male gonophores spring from base of hydranth close beneath the tentacles in moniliform clusters, each from three to four chambered. Color of male reddish, of female orange. Abundant on piles of docks, on racks, etc., in shallower waters.

FIG. 5.
Eudendrium ramosum Linn.
(After Allman.)

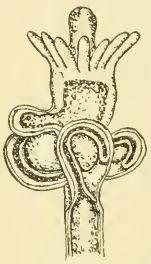

FIG. 6.

FIG. 5. — Colony.
FIG. 6. — Hydranth with gonophores.

Eudendrium dispar Ag.

(*Cont. Nat. Hist. U. S.*, vol. iv.)

Trophosome: Colony large, from three to five inches in height, stems more slender than in former, somewhat fascicled, extensively and variously branched and annulated. Hydranths vasiform, with about twenty-eight tentacles.

Gonosome: Sexes distinct. Gonophores of female of pinkish orange hue, variously clustered about the base of the more or less atrophied hydranth and from distal portion of stem. Habitat in deeper waters in Vineyard Sound, attached to rocks, shells, etc.

Eudendrium tenue A. Ag.

(*No. Am. Acalephæ*, p. 160.)

Trophosome: Colony very small, rarely exceeding an inch in height, branching irregularly, hydranths vasiform, borne on slender pedicels.

Gonosome: Male gonophores from two to four chambered, of pinkish color, clustered from bases of tentacles. Female gonophores bright orange in color, scattered over the branches and stem. Habitat on seaweed, etc., in shallower waters. Not abundant.

Eudendrium capillare Alder.

Of the distinctness of this species and *E. album*, listed by Professor Nutting, I have grave doubts. It seems to me that Alder's diagnosis of capillare coincides so closely with that of *E. tenue* as to render their identity highly probable. So also of *E. album*. Specimens taken at Woods Holl seem almost certainly identical with *E. tenue*, and therefore both should probably be merged under *E. capillare*, whatever slight differences there are being hardly greater than varied environment would easily explain.

5. HYDRACTINIDÆ.

The Hydractinidæ are so closely allied to the following family that it seems unfortunate that they were not originally merged: the only easily distinguishable difference being in the free medusæ of the latter in contrast with the fixed sporosacs of the former. In size, general habit, and morphology they are so closely identical that but for the gonosomes no difference would be recognizable, though in Podocoryne the hydrorhiza seems less definitely covered with naked cœnosarc, — but even this differs greatly in specimens from different localities.

In both polymorphism is a marked feature, at least three types of polyps being distinguishable:

1. Feeding hydranths (trophopolyps), whitish in color and with numerous filiform tentacles, frequently appearing in alternately elevated and depressed order.

2. Reproductive individuals (gonopolyps), more slender-bearing gonophores in clusters below the tentacles, which are fewer in number than in the first and imperfectly developed.

3. Spiral polyps, elongated individuals, wholly devoid of tentacles and with apex of body thickly beset with nematocysts.

The entire colony arises from an incrusting base which is thickly beset with jagged spines, the latter sometimes considered a fourth type of individual.

FIG. 7. — *Hydractinia echinata*. (Adapted from Hincks.)

Hydractinia echinata Fleming.

(Hydractinia polyclina Ag., *Cont. Nat. Hist. U. S.*)

Trophosome: Colony composed of numerous polyps, as given above.

Gonosome: Gonads as sessile sporosacs borne on distinct hydranths, gonopolyps, having but few tentacles. Medusoids never free.

Habitat: Usually found upon shells occupied by the hermit crab, but occasionally found upon fucus and occasionally also upon piles of docks.

6. Podocorynidæ.

Colony very similar to that of the Hydractinidæ, as given above. Hydranths with single whorl of filiform tentacles surrounding base of the conical hypostome.

Podocoryne carnea Sars.

Trophosome: Hydranths slender, pinkish-white in color, and with filiform tentacles.

Gonosome: Medusæ borne in clusters about the hydranth just below the whorl of tentacles. When set free the medusa is of marked bell-shape, with definite velum, short manubrium of reddish color, four radial canals from the bases of which arise eight marginal tentacles.

Habitat as in Hydractinia.

Stylactis.

Under this generic name Sigerfoos describes (*American Naturalist*, Vol. XXXIII) a hydroid having many points in common with the Podocorynidæ, and it should probably be classed under this family. He has given to it the specific name Hooperi (*cf. op. cit.*). The following definitive characters have been given of it:

Trophosome: Hydranths slender, with a length when fully expanded of about ¾ of an inch. Tentacles in single whorl, filiform, and of variable number, eighteen to twenty-five.

Gonosome: Gonophores borne upon specialized hydranths just below tentacles, and set free as medusæ having four radial canals, eight tentacles which are somewhat rudimentary, devoid of ocelli. Sexual products borne upon manubrium. Found on shells of *Stygnassa* (Illyanassa) *obsoleta*.

7. Pennaridæ.

Colony arborescent, pinnately branched, hydranths with two sets of tentacles, one proximal composed of ten to twelve, filiform, the other borne upon hypostome in two indefinite whorls, short and capitate.

Pennaria tiarella McCrady.

Trophosome: Colony attaining a height of from five to six inches, usually smaller in colonies attached to eelgrass or seaweed. Regularly branching, stem somewhat undulating, or geniculate in young colonies, regularly annulated just above branches, as are also the latter at point of origin. Hydranths large and flask-shaped, those terminating stem or branches appreciably larger than others.

Gonosome: Medusæ borne on hydranth body above the whorl of proximal tentacles. Medusæ liberated during early evening and discharging the sex products immediately thereafter. In many cases the ova are discharged before the liberation of the medusæ, as indeed are also the sperms.

Habitat: Abundant on piles of docks, floating timber, eelgrass, fucus, etc., usually in shallower waters. Development from June to October.

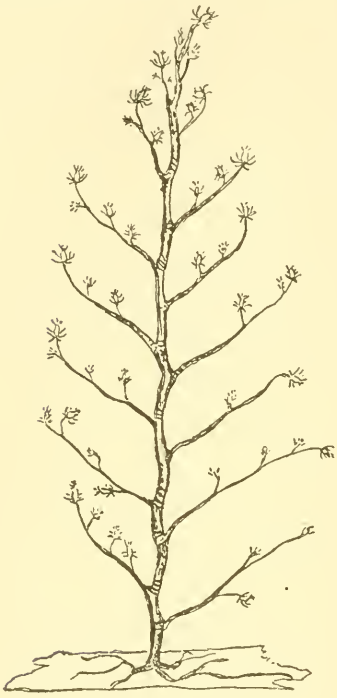

FIG. 8.

8. CORYMORPHIDÆ.

Usually solitary, though I have occasionally found definite colonial

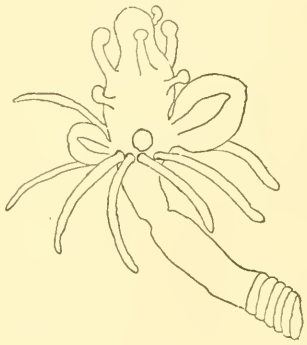

FIG. 9.

FIG. 8. — *Pennaria tiarella* McCr.
FIG. 9. — Hydranth enlarged, showing origin of medusæ.

buds arising direct from the hydrorhiza. Hydranths with proximal and distal whorls of filiform tentacles. Gonophores as free medusæ with four radial canals and with one to four marginal tentacles, one of which is usually much the larger.

Corymorpha pendula Ag.

(*Cont. Nat. Hist. U. S.*, vol. iv.)

Trophosome: Hydrocaulus from two to four inches in height, the fleshy cœnosarc traversed by longitudinal canals which ramify more or less near the base. Hydrorhiza an indefinite root-like expansion of the base, by which the whole is attached to the sandy substratum.

Hydranths flask-shaped, sharply distinct from stem. Proximal tentacles large, forming a single whorl at base of hydranth. Distal tentacles very contractile, forming alternating verticils about the base of the hypostome.

Gonosome: Medusæ borne on branched peduncles, arising just above the proximal tentacles, ovoid hemispherical, with single large and usually three rudimentary tentacles.

Hydroid bright pink in color, medusæ light yellowish, manubrium, tentacles, and bulbs pinkish.

Habitat: Sandy bottom in rather deep waters at various points in Vineyard Sound, Muskegat Channel, etc.

FIG. 10. — *Corymorpha pendula* Ag. (Modified from Allman.)

9. TUBULARIDÆ.

Hydrocaulus with definite perisarc, simple or irregularly branched. Hydranths flask-shaped, with proximal and distal whorls of filiform tentacles. Gonophores in form of fixed sporosacs, borne on branched peduncles.

Tubularia.

Generic description as given for family. The following species are given:

Tubularia couthouyi Ag.

(*Cont. Nat. Hist. U. S.*, vol. iv.)

Trophosome: Stems unbranched, attaining a height of from four to six inches. Hydranths large, often expanding an inch or more in diameter, with proximal whorl of thirty to forty filiform tentacles and a distal one of much smaller.

Gonosome: Gonophores as numerous, densely crowded racemes of pendulous sporosacs. Larvæ escaping as actinulæ. Hydranth and gonads bright pinkish red.

Habitat: On sandy bottoms dredged off Nobska Point, Vineyard Sound, and other similar places in the same locality.

Tubularia larynx Ellis and Solander.

Trophosome: Stems clustered, more or less branched, annulated. Height one to two inches. Stem forming a collar-like expansion just below hydranth, the latter bearing sixteen to twenty proximal filiform tentacles and a distal whorl of about the same number.

Gonosome: Gonads in pendulous clusters, similar to last. Color of hydranth and gonads rosy. Perisarc yellowish.

Tubularia spectabilis Ag.

(*Thamnocnidia spectabilis* Ag., *Cont. Nat. Hist. U. S.*)

Trophosome: Colony irregularly branched and sparsely annulated. Height three to four inches. Hydranths much as in former.

Gonosome: Comparable with former.

Tubularia tenella Ag.

(*Thamnocnidia tenella* Ag.)

Trophosome: Colony very small, rarely exceeding a height of one and one-half inches. Stem loosely branched and with indefinite annulations. Hydranths with tentacles about as in former.

Gonosome: Compare *T. larynx*. Color and habitat much as in last.

FIG. 11. — *Tubularia tenella* Ag.

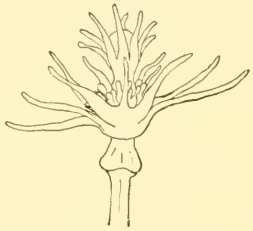

FIG. 12. — Single hydranth enlarged. (After Agassiz.)

FIG. 13. — *Tubularia crocea* Ag.

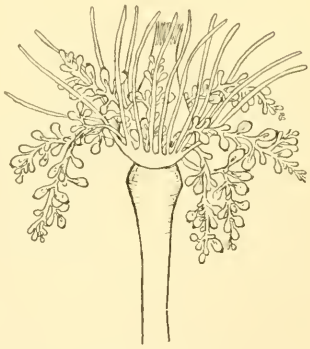

FIG. 14. — Hydranth with pendulous gonophores.

Tubularia crocea Ag.

(Parypha crocea Ag.)

Trophosome: Colonies growing in dense tufts of tangled stems of from three to four inches in height. Stems sparingly branched, with occasional indications of annulations. Hydranths with tentacles much as in former species, but numbering from twenty to twenty-four in each whorl.

Gonosome: Much as in the first species. Hydranths and gonads of rosy-red color, stem pale, whitish. Habitat. Growing in dense masses on piles of docks, floating timbers in harbors, and shallower waters.

Hypolitis perigrinus Murbach.

Under this name Murbach describes a hydroid taken at Woods Holl (*Quar. Journ. Mic. Sci.*, Vol. XLII), which would seem to have some affinities with the Tubularidæ. The following characters are summarized:

Trophosome: Colony consisting of simple hydranths with long hypostome and with distal and proximal whorls of filiform tentacles. Polyp free.

Gonosome: Gonads borne on hypostome just above proximal tentacles and occur singly in the type specimen. Sessile medusoids, somewhat terete in form and devoid of tentacular processes.

Fig. 15. — *Hybocodon prolifer* Ag. (After Agassiz.)

10. Hybocodonidæ.

Hydrocaulus unbranched, solitary, with definite perisarc and hydrorhiza. Hydranths large, with proximal and two distal whorls of filiform tentacles.

Hybocodon prolifer Ag.

(*Cont. Nat. Hist. U. S.*, vol. iv.)

Trophosome: Stems longitudinally striated, occasioned by cœnosarcal canals. Perisarc enlarged and annulated just below hydranth. Hydranth similar to those of the Tubularidæ, but with oral tentacles in two distinct whorls.

Gonosome: Gonophores closely attached to hydranth body just above proximal tentacles. Free medusæ with four radial canals, and with a single greatly enlarged tentacle from whose base a number of secondary medusæ successively bud, and from these still other groups of similar medusæ may arise.

Syracuse University.

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SYNOPSES OF NORTH-AMERICAN INVERTEBRATES.

XIV. The Hydromedusæ — Part II.

CHAS. W. HARGITT.

The Campanulariæ (Calyptoblastea).

The Campanulariæ are distinctively colonial Hydromedusæ, many of them most exquisitely beautiful and graceful forms. In size they vary from very minute forms barely visible to the unaided eye, to forms like Halecium, measuring from twelve to twenty inches or more in height. The hydranths are provided with specialized receptacles, hydrothecæ, into which they are capable of more or less complete retraction. Gonophores are produced by budding, and are provided with specialized receptacles, gonangia, similar in morphological features to the hydrothecæ. The gonophores may be liberated as free medusæ, or may remain fixed as medusoids, the sexual products maturing within the gonangium and later escaping as free larvæ or planulæ. When free, the medusæ are known as Leptomedusæ, characterized generally by a low, flat bell, marginal sense organs usually of the vesiculate type, with the gonads usually borne along the underside of the radial canals.

A classification of the Campanularidæ is almost, if not quite, impossible without the presence of the gonosome, which in many genera is the most distinctive differentiating feature. In the following synopsis this feature will be in constant requisition, and where it is absent in specimens the student is admonished as to the doubtful character of purely morphological determinations.

SYNOPSIS OF FAMILIES.

CAMPANULARIDÆ. Hydrothecæ campanulate, terminal, borne on distinct pedicels ; gonophores fixed or free-swimming. Hydranths with large and somewhat trumpet-shaped hypostome.

LAFŒIDÆ. Hydrothecæ deep tubular, sessile or pedicellate ; hydranths with conical hypostome.

HALECIDÆ. Hydrothecæ usually reduced to shallow, disk-like receptacles (hydrophores). Hydranths with conical hypostome. Gonophores as imperfectly developed medusoids.

SERTULARIDÆ. Hydrothecæ borne in double rows, adnate to hydrocaulus. Gonophores sessile.

PLUMULARIDÆ. Hydrothecæ arranged in single row only on side of hydrocaulus.

CAMPANULARIDÆ.

Synopsis of the Genera.

CLYTIA. Stems simple or rarely branched. Hydrothecæ deeply bell-shaped, with toothed margins, borne on long pedicels. Gonangia producing free medusæ having four marginal tentacles.

OBELIA. Stems regularly branched, hydrothecæ bell-shaped, with entire margins. Gonangia borne on stems and branches and producing free medusæ having numerous marginal tentacles.

CAMPANULARIA. Stems simple or branched. Hydrothecæ campanulate, with margins entire or variously toothed. Gonangia, medusæ as mere sporosacs, within which the sexual products develop and escape as free planulæ.

GONOTHYRÆA. Stems branching ; hydrothecæ campanulate and with toothed margins. Gonangia producing well-developed medusoids, which, while often furnished with tentacles and capable of protruding beyond the orifice of the gonangium, never become free, thus exhibiting an interesting intermediate stage between the first two genera and Campanularia.

Clytia Lamx. (in part).

Generic characters : Stem usually simple, attached by creeping hydrorhiza. Hydrothecæ devoid of operculum. Gonangia produced from stem or hydrorhiza and borne on pedicels which are usually beautifully annulated. Gonosome. Medusæ deeply bell-shaped and with four marginal tentacles when first liberated. Otocysts eight, two in each interradius. Both these and the tentacles increase in number with the age of the medusa.

1, *C. bicophora* Ag. (Fig. 16).

Trophosome : Colony rarely attaining a height of more than an inch, composed of simple or sparingly branched stems. Hydrothecæ deeply bell-shaped and numerously and sharply toothed, borne on elongate pedicels which have terminal annulations.

Gonosome : Gonangia symmetrically annulated and usually arising from the hydrorhiza. Medusæ when first liberated of hemispherical shape and with four tentacles and eight otocysts.

Habitat : Usually on fucus, occasionally on shells or other hydroids.

Fig. 16. — *Clytia bicophora* Ag. (After Agassiz.)

2, *C. cylindrica* Ag.

(*Cont. Nat. Hist. U. S.*, vol. iv.)

Trophosome : Stems simple, hydrothecæ tubular, small, deep, with sharply pointed teeth. Pedicels short, with proximal and distal annulations.

Gonosome : Gonangia oblong, somewhat flattened, devoid of annulation, producing free medusæ.

Habitat : Similar to last species.

3, *C. grayi* Nutting.[1]

Trophosome : Stem simple or irregularly branched, strongly annulated except in middle branch. Hydrothecæ very large, cylindrical. Numerous marginal teeth, rounded and not deeply cut. Hydranth with about twenty tentacles.

Gonosome : Gonangia oblong, conspicuously and regularly annulated, attached to creeping rootstocks.

Habitat : Growing on living worm tubes, composed of sand. Dredged from depth of 31 fathoms. The largest Clytia yet found in American waters.

Obelia Peron and Leseur.

Generic characters : Colony often plant-like, of whitish color, attached by creeping hydrorhiza ; hydrothecæ campanulate and devoid of operculum. Gonangia borne on stems and branches, producing free medusæ characterized by numerous marginal tentacles, four radial canals, and eight otocysts symmetrically disposed on the inner margin of each interradial quadrant.

[1] Condensed from Professor Nutting's original description.

1, *O. commisuralis* McCr. (FIG. 17).

Trophosome: Colony long, slender, profusely branching, branches spreading in graceful curves on each side of the main stem, which may attain a height of six to eight inches.

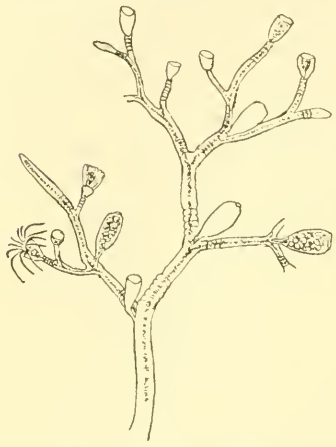

FIG. 17.—*Obelia commisuralis* McCr. (After Agassiz.)

Gonosome: Gonangia elongate, slender, obconical, opening by terminal, circular orifice arising from the base of the cone on a short conical neck. Medusæ when first liberated have sixteen marginal tentacles, four radial canals, beneath which later the gonads develop.

2, *O. dichotoma* Linn.

Trophosome: Colony rather small, stem slender, irregularly branched, annulated just distal to origin of branches, the latter annulated at irregular intervals. Hydrothecæ large, deeply campanulate, borne on annulated pedicels.

Gonosome: Gonangia axillary, slender and smooth, somewhat obconical, and similar to those of former species. Medusæ with sixteen tentacles, manubrium somewhat trumpet-shaped.

3, *O. flabellata* Hincks.

Trophosome: Stem filiform, alternately branching, giving the stem a somewhat zigzag character. Both stem and branches variously annulated. Hydrothecæ alternate, short, widely open and with entire margins, borne on tapering annulated pedicels.

Gonosome: Gonangia axillary, obovate, with tubular orifice. Medusæ?

4, *O. geniculata* Linn. (FIG. 18).

Trophosome: Colony inconspicuous, rarely attaining a height of more than an inch. Stem somewhat zigzag in form as in former species, but apparently jointed at each bend. Hydrothecæ obconical, rather short, with plain orifice, borne on short annulated pedicels.

Gonosome: Gonangia axillary, urceolate, borne on short pedicels. Medusæ discoid, with twenty-four tentacles when liberated, greatly increasing in number with age.

Habitat: Common along Massachusetts and north Atlantic coast, on Fucus and Laminaria.

5, *O. gelatinosa* Pallas.

Trophosome: Stems fascicled, rising from a fibrous hydrorhiza to a height of eight to ten inches. Branches opposite in pairs, which alternate with each other in vertical arrangement, presenting a verticillate appearance. Hydrothecæ small, borne on long slender, ringed pedicels, and having notched margins of a somewhat castellated form.

Gonosome: Gonangia axillary, ovate, flattened at distal end and provided with raised orifice. Medusæ with sixteen tentacles when liberated from gonangium.

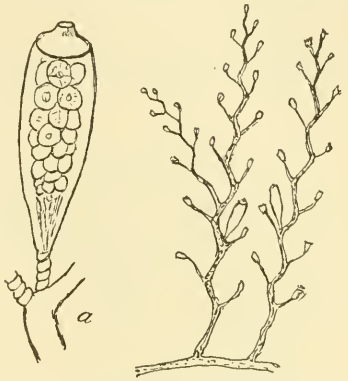

FIG. 18.—*Obelia geniculata* Linn. *a*, gonangium of same enlarged.

6, *O. longissima.*

7, *O. bicuspidata.*

8, *O. bidentata.*

Species 6, 7, 8 are listed from Professor Nutting's records, but have not been taken by the present writer.

Campanularia Lamx. (in part).

The generic characters are fairly explicit under the synopsis of genera.

1, *C. caliculata* Hincks.

(Clytia poterium Ag.)

Trophosome: Stem simple, of variable length, bearing a single hydrotheca which is campanulate, with entire margin, and with a thick wall forming a sort of diaphragm within the lower part, thus giving the appearance of a double-walled cup.

Gonosome: Gonangia irregular, oval in shape, with undulating outline and with wide circular aperture. Medusoids extremely degenerate. Larvæ escaping as free-swimming planulæ.

Habitat: Massachusetts Bay, Nahant, Nova Scotia, on seaweed, etc.

2, *C. hincksii* Alder.

Trophosome: Stems rather long, mostly simple; hydrothecæ large, deep, almost tubular, the margins scalloped with castellated teeth.

Gonosome: Gonangia ovate, elongate, somewhat narrowed toward extremity, irregularly annulated throughout, borne on short, smooth pedicels. Medusoids degenerate; ova forming a central mass within the capsule.

3, *C. volubilis* Linn.

Trophosome: Stems usually simple, long and somewhat twisted. Hydrothecæ deep and sub-tubular, margins with shallow undulations.

Gonosome: Gonangia flask-shaped, smooth, with an elongate neck borne on short pedicels.

Habitat: Frequently found growing upon other hydroids, usually in deep water. Gulf of St. Lawrence, Massachusetts coast, etc.

4, *C. neglecta* Alder.

Trophosome: Stems regularly branched, delicate, filiform, branches pinnate, both stem and branches more or less annulated. Hydrothecæ narrow, deep, borne on annulated pedicels and with marginal teeth bimucronate.

Gonosome: Gonangia axillary or on short pedicels which are annulated, pear-shaped.

The colony is very minute and inconspicuous.

5, *C. verticillata* Linn.

Trophosome: Colony composed of erect, fascicled stems, irregularly branched. Hydrothecæ bell-shaped, rather large, deep, with from ten to twelve teeth about the margins, borne on annulated pedicels.

Gonosome: Gonangia flask-shaped, smooth, borne on short pedicels and terminating in narrow orifice.

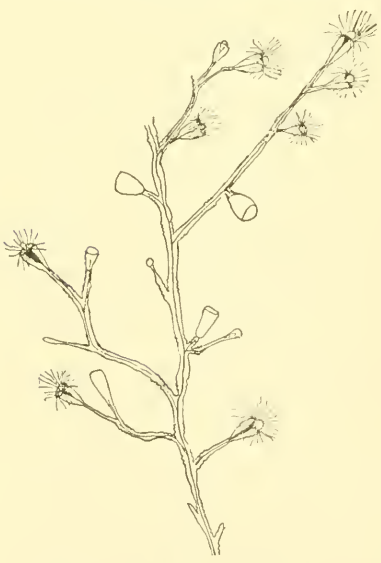

FIG. 19. — *Campanularia amphora* Ag. (After Agassiz.)

6, *C. amphora* Ag. (FIG. 19).

Trophosome: Colony resembling in general aspects that of *Obelia commisuralis*, attaining in some cases a height of four to six inches. Hydrothecæ campanulate, with entire margins, borne on annulated pedicels.

Gonosome: Female gonangia elongate, somewhat obconical, borne on short annulated pedicels and opening by a terminal aperture. Male gonangia elongate, oval or spindle-shaped. Medusoids more or less degenerate, never becoming free; the male, according to Agassiz, attaining a higher stage of development than the female. The embryo escapes from the gonangium as a free-swimming planula.

7, *C. angulata* Hincks (Fig. 20).

Trophosome: Stems slender, slightly branched, strongly geniculate or undulate in habit. Hydrothecæ alternate, campanulate, with entire margins, borne on long slender pedicels which arise at each flexure of the stem or branch.

Gonosome: Gonangia somewhat ovate, obscurely wrinkled, and terminated by a broad aperture. Colony small, varying from ½ to ¾ inch.

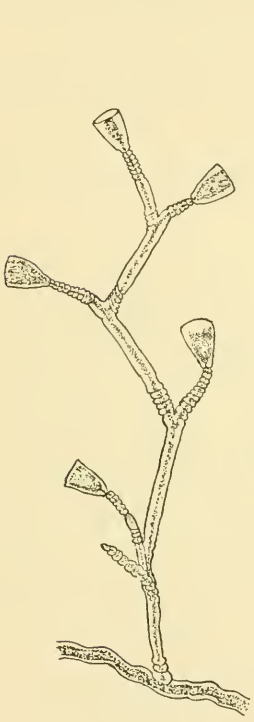

Fig. 20.

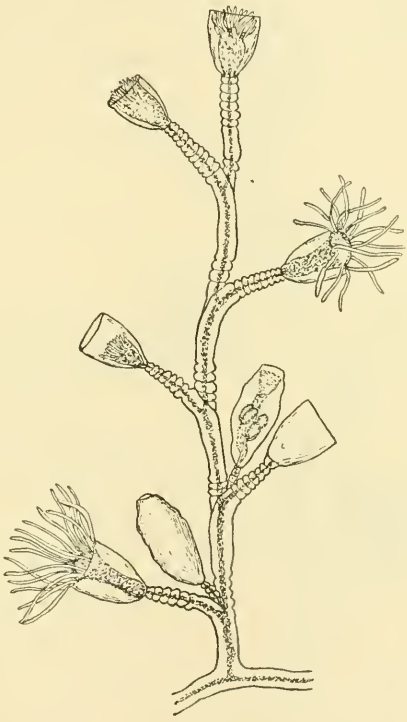

Fig. 21.

Fig. 20. — *Campanularia angulata* Hincks. (After Hincks.)
Fig. 21. — *Campanularia flexuosa* Hincks. (After Hincks.)

8, *C. flexuosa* Hincks (Fig. 21).

Trophosome: Stem flexuous, irregularly branched, annulated near the base and above the origin of branches. Hydrothecæ large, subcampanulate with plain margins, borne on long annulated pedicels.

Gonosome: Gonangia axillary, large, elongate, smooth, and borne on short annulated pedicels. Male gonangia sensibly smaller.

Professor Nutting has recorded the following species of which I have no data, and which therefore are merely noted.

C. minuta; *C. Edwardsii* Nutting; *C. calceolifera.*

Gonothyræa Allman.

1, *G. lovéni* Allman (FIG. 22).

Trophosome: Stems erect, somewhat flexuous, irregularly branched, and with annulations above each branch. Hydrothecæ deeply bell-shaped and with toothed margins, borne on short annulated pedicels.

Gonosome: Gonangia borne on short annulated pedicels, axillary, broadly obconical in outline.

Habitat: On fucus and other algæ, rocks, etc. Cold Spring Harbor, Woods Holl, etc.

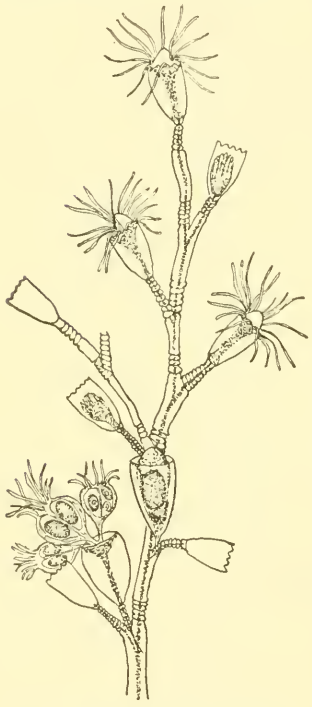

FIG. 22. — *Gonothyræa loveni* Allman. (After Hincks.)

2, *G. hyalina* Hincks.

Trophosome: Colony elongate, clustered, profusely branched, with flexuous stems giving off branches at each bend, "Branches erect, very tender and hyaline, sometimes of great length and much ramified." Hydrothecæ elongate, of delicate texture, with numerous marginal teeth and borne on annulated pedicels.

Gonosome: Gonangia oval, axillary, borne on annulated pedicels.

Habitat: On various hydroids, Tubularia, Halecium, etc. (Hincks).

3, *G. tenuis* Clark.

Noted from Nutting's list.

LAFŒIDÆ.

This family has been variously modified of late and by some replaced entirely. In the present synopsis I have chosen to follow in general the classification of Hincks, though recognizing its doubtful reliability in some respects.

Lafœa Lamx.

Stems simple or fascicled, attached by filiform hydrorhiza. Hydrothecæ tubular, with or without operculum. Gonangia oblong, often forming encrusting masses about the stem.

1, *L. dumosa* Flem. (Fig. 23).

Trophosome: Stem creeping, sometimes erect and fascicled; hydrothecæ tubular, margins devoid of teeth or operculum, usually sessile.

Gonosome: (?)

2, *L. calcarata* A. Ag. (Fig. 24).

Trophosome: Stems creeping, simple; hydrothecæ tubular, sessile.

Gonosome: Gonangia large, elongate, obovate or oblong, somewhat resembling those of certain campanularians. Medusæ large, transparent, with

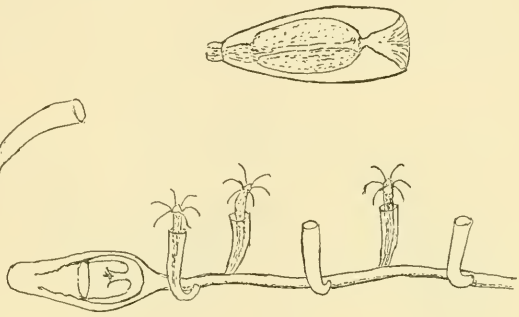

Fig. 23. Fig. 24.

Fig. 23. — *Lafœa dumosa* Flem. (After Hincks.)
Fig. 24. — *Lafœa calcarata* A. Ag. (Adapted from A. Agassiz.)

gonads suspended in folds beneath the radial canals; marginal tentacles numerous in mature specimens, only two when first set free.

Habitat: Usually parasitic upon sertularian hydroids.

3, *L. pygmæa* Alder.

Trophosome: Stem creeping; hydrothecæ minute, tubular, elongate, borne on very short annulated pedicels.

Gonosome: (?)

Habitat: Parasitic on various hydroids.

Halecidæ.

Of this family a single genus comes within the range of this synopsis: namely, the type genus, Halecium (Oken), the characters of which may be summarized as follows:

Trophosome: Colony more or less branched, attached by a creeping hydrorhiza. Hydrothecæ often shallow and disk-like, or funnel-shaped (hydrophores). In many species with double or triple margins due to

subsequent secretions as the hydranth grows, leaving the old hydrophore. In many cases the everted rim has on its inner margin a circle of small bright dots which are rather characteristic of the genus. Hydranths imperfectly retractile, elongate, and with conical hypostome.

Gonosome: Gonangia of varying aspects, showing distinctive differences between male and female and affording easy means of distinguishing the sexes. Medusoids imperfectly developed, never free.

1, *H. halecinum* Linn. (FIG. 25).

Trophosome: Colony erect, rather rigid, subflabellate in form. Hydrothecæ alternate, somewhat tubular in form, and with everted rims.

Gonosome: Gonangia borne in a series on the upper side of the branches; those of the male elongate, slender, somewhat spindle-shaped, tapering below

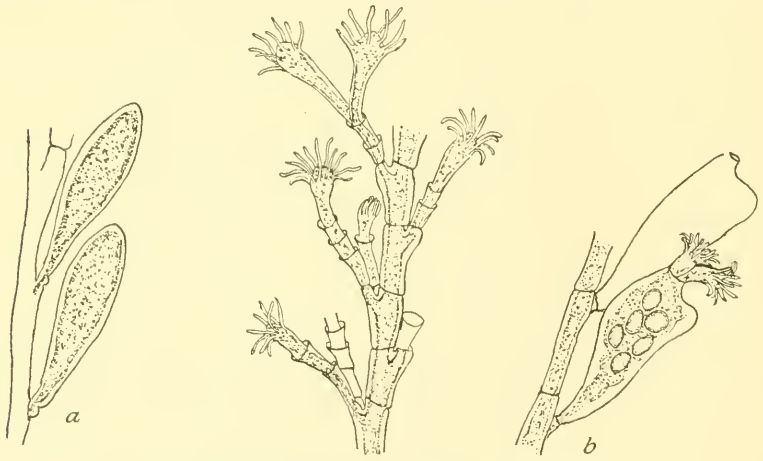

FIG. 25.—*Halecium halecinum* Linn. *a*, male; *b*, female gonangia of same (enlarged). (After Hincks.)

to their attachment by very short, slightly ringed pedicels. Female gonangia somewhat oblong, broader toward the distal end, and with tubular aperture nearer one margin.

2, *H. beanii* Johnston.

Trophosome: Colony of delicate, graceful form, somewhat dendritic, attaining a height of about two inches. Hydrothecæ with everted rims.

Gonosome: Gonangia arising from near the base of hydrothecæ; male, elongate oval; female, somewhat curved, with the aperture situated near the middle of the upper side.

3, *H. tenellum* Hincks.

Trophosome: Colony minute, extremely delicate; stems slender, often strongly annulated, branching irregularly. Hydrothecæ funnel-shaped and with everted margins.

Gonosome: Gonangia ovate, pedicellate.

4, *H. muricatum* Ell. and Sol.

Trophosome: Colony stout, dendritic, profusely branched, and with joint-like divisions, alternately from below which the hydrothecæ arise.

Gonosome: Gonangia ovate, borne on short pedicels, roughly marked with linear ridges of spinous processes.

Eastport, Me. (Verrill).

SERTULARIDÆ.

Synopsis of Genera.

SERTULARIA. Colony plant-like, stems more or less branching, jointed, attached by creeping hydrorhiza. Hydrothecæ in double rows, strictly opposite, usually devoid of operculum. Gonangia with plain margins.

SERTULARELLA. Colony resembling somewhat the former. Hydrothecæ in double rows, but distinctly alternate, with toothed margins and with an operculum composed of several pieces. Gonangia strongly annulated throughout, slightly dissimilar in the two sexes.

DIPHASIA. Colony more or less branching, stem jointed, hydrothecæ opposite, a pair to each internode and often with a valve-like operculum. Gonangia scattered, differing in shape in the two sexes, those of female large, often divided into segments above, male smaller and with central tubular aperture.

THUIARIA. Stem somewhat plant-like, jointed; hydrothecæ in double series sub-opposite, but deeply immersed in the substance of stem and branches.

HYDRALLMANIA. Stems flexuous or somewhat spirally inclined. Hydrothecæ alternate, placed on front of branches, and curved alternately to right and left.

Sertularia Linn.

Generic characters given above.

1, *S. pumila* Linn. (FIG. 26).

Trophosome: Stems straight or slightly curved, simple or branched; branches opposite; both stem and branches divided into short internodes, each bearing a pair of hydrothecæ, the latter opposite, tubular, and somewhat contracted toward the aperture, which faces outward and is more or less cleft or notched.

Gonosome : Gonangia more or less oval, sessile, with marginal rim. Male gonangia somewhat more slender, and regular in outline.

Habitat : One of our commonest sertularians, found attached to fucus, etc., between tide marks and in tide pools.

2, *S. cornicina* McCr.

Trophosome : Colony very small, composed chiefly of unbranched stems, which rarely attain a height of more than ½ inch. Hydrothecæ appearing as lateral emarginations with slightly divergent apertures. Hydranths slender, with about sixteen tentacles.

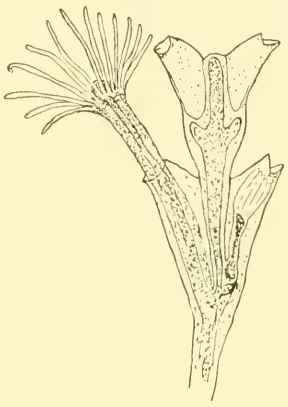

FIG. 26. — *Sertularia pumila* Linn. (After Agassiz.)

Gonosome : Gonangia ?

The above description is condensed and modified from that of McCrady (*Proc. Elliott Soc.*, Vol. I, p. 204).

3, *S. argentea* Ell. and Sol.

Trophosome : Colony of bushy and slightly wavy stems, perisarc dark and horny; branching, alternate, and somewhat dichotomous. Hydrothecæ short, urn-shaped, tapering toward the free and divergent aperture, which is small and oblique.

Gonosome : Gonangia broad, obovate, tapering toward the base ; aperture circular, and usually with two divergent spines.

Habitat : Usually from deeper waters, growing on shells, stones, etc., sometimes found near tide marks. Recorded from various points along the New England coast.

4, *S. cupressina* Linn.

Trophosome : Colony slender, elongated. Stems rather stout and straight, alternately branched and dichotomously sub-branching. Hydrothecæ tubular, transparent, somewhat alternate, and adherent throughout most of their length, slightly divergent toward the aperture, which is wide and bilabiate.

Gonosome : Gonangia elongate, tapering toward base, and with prominent spine at each side of the aperture, which is slightly raised and central.

Habitat : Less abundant than the former species, though with similar distribution.

Sertularella Gray.

Generic characters given in above synopsis.

1, *S. rugosa* Linn.

Trophosome : Colony small, simple, or sparingly and irregularly branched ; stems annulated. Hydrothecæ crowded, strongly annulated transversely, and with four marginal teeth.

Gonosome : Gonangia large, ovate, strongly annulated, and with a four-toothed aperture.

2, *S. gayi* Lamx.

Trophosome : Stems erect, with alternate branches, somewhat obliquely jointed. Hydrothecæ somewhat urn-shaped, one to each internode, usually wrinkled, and with narrower, divergent, four-toothed aperture.

Gonosome : Gonangia elongate, ovate, tapering toward the small, two-toothed aperture. Usually strongly annulated in upper portion, the lower smooth.

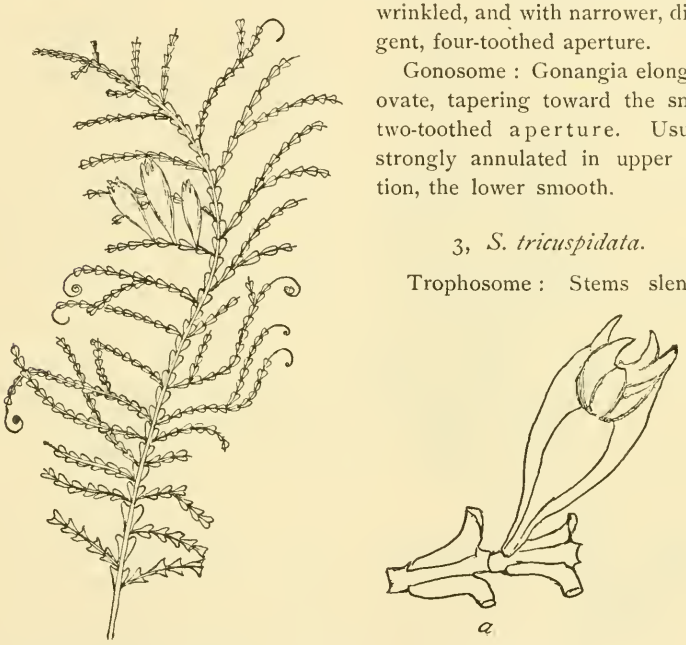

FIG. 27. — *Diphasia fallax* Johnst. (After Hincks.) *a*, ♀ gonangium of same (enlarged).

3, *S. tricuspidata.*

Trophosome : Stems slender, alternately branched, often bipinnate near the ends. Hydrothecæ cylindrical, smooth, slightly everted, with a three-toothed orifice.

Gonosome : Gonangia large, with strongly transverse ridges and with a plain, funnel-shaped opening.

Diphasia Ag.

1, *D. fallax* Johnston (FIG. 27).

Trophosome : Stems thick, sparingly branched, branches alternate, often terminating in tendril-like bodies. Hydrothecæ short, tubular, with upper part slightly divergent, and with wide, smooth orifice.

Gonosome : Gonangia differ in the two sexes. Male elongate, slender, tapering toward base and expanding toward orifice, which bears four stout spines. Female gonangium oval, deeply cleft above into four leaf-like segments, larger than male.

2, *D. rosacea* Linn.

Trophosome : Stems slender and delicate, branches alternate and with internodes constricted at the base. Hydrothecæ long, tubular, with upper portion free and divergent toward the aperture, which is oblique and entire.

FIG. 28. — *Hydrallmania falcata* Linn. (After Hincks.)

Gonosome : Gonangia slightly different in the sexes ; female pear-shaped, elongate, borne on short pedicels and marked with eight longitudinal ridges, each terminating above in a spinous process. Male somewhat curved toward base, with similar longitudinal ridges terminating in spinous teeth about the slender tubular orifice.

Thuiaria Flem.

A single species of this genus comes within the present synopsis.

Thuiaria thuja Flem.

Trophosome : Stem and branches rather rigid, somewhat zigzag in shape, and annulated near the base. Perisarc black or very dark in color. Hydrothecæ smooth, ovate at base and tapering toward the distal end.

Gonosome : Gonangia smooth, pyriform, and with circular slightly emarginate aperture.

Hydrallmania Hincks.

Hydrallmania falcata Linn. (FIGS. 28, 29).

(Sertularia falcata.)

Trophosome : Stems flexuous, slender, sometimes spirally inclined. Branches alternate, regularly pinnate and plume-like, arising just above

each joint. Hydrothecæ tubular, closely appressed, arranged in rows along the pinnæ, and with plain oblique aperture.

Gonosome: Gonangia ovate, tapering toward the base, and with a tubular orifice.

Habitat: Shells, stones, etc., generally distributed from Grand Manan, Massachusetts Bay, and southward.

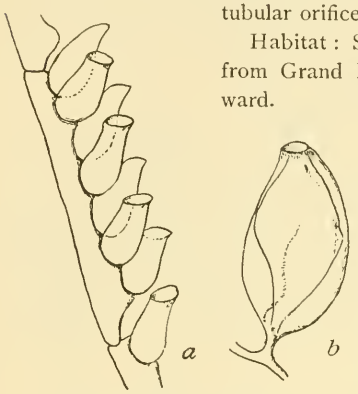

FIG. 29.—*Hydrallmania falcata* Linn. *a*, hydrothecæ; *b*, gonangium.

PLUMULARIDÆ.

Synopsis of genera. Modified and condensed from Nutting's Monograph of the Plumularidæ.

ANTENNULARIA. Colony more or less arbuscular, stem simple or branching, jointed, attached by massive hydrorhiza. Branching somewhat verticillate or scattered; hydrothecæ cup-shaped; nematophores trumpet-shaped. Gonangia borne in axils of branches, unilateral.

MONASTÆCHAS. Colony dichotomously branched, stem not fascicled, hydrocladia arising from upper sides of branches, otherwise resembling Plumularia, from which it differs in the entire absence of cauline hydrothecæ. Gonangia oval in shape and with terminal aperture.

SCHIZOTRICHA. Colony branching, branches pinnately arranged, hydrocladia often forked. Gonangia borne on stem or hydrocladia.

CLADOCARPUS. Stem simple or fascicled. Nematophores not trumpet-shaped, definitely fixed to hydrothecæ or branches. Gonangia borne on stem or hydrocladia.

Antennularia Linn.

1, *Antennularia antennina* Linn. (FIG. 30).

Trophosome: Colony growing in dense clusters of upright stems, often eight to ten inches high, stems simple or sparingly branched, obscurely jointed, each internode bearing a cluster of hydrocladia. Hydrothecæ small, cup-shaped, and with slightly everted margins.

Gonosome: Gonangia ovate, borne singly in axils of hydrocladia. Aperture subterminal.

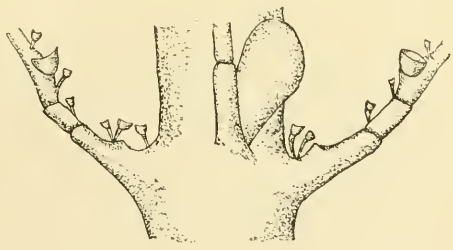

FIG. 30.—*Antennularia antennina* Linn. Portion of stem and hydrocladia (enlarged). (After Nutting.)

2, *A. americana* Nutting.

Similar to former, but usually from deeper water and apparently of exceedingly variable character.

3, *A. rugosa* Nutting.

Trophosome : Colony unbranched, attaining a height of six inches. Hydrocladia in verticils of six or eight, borne on stout processes of the stem and with proximal ends reinforced on the lower sides by a thickening of the perisarc. Internodes long and irregular, further subdivided by numerous irregularly disposed septal thickenings, which resemble joints, giving the appearance of many internodes, where in reality there is but one. Hydrothecæ small, short, cylindrical, and supported below by a thickening of the internode.

Monastæchas quadridens McCr.

Trophosome : Colony subflabellate in form, dichotomously branched, attaining a height of about six inches. Stem not fascicled, with indistinct internodes and branching at irregular intervals, those bearing hydrocladia being divided into long internodes, each of which bears a hydrocladium at its distal upper side. Hydrothecæ large, campanulate.

Gonosome : Gonangia sac-like, borne on short processes below hydrothecæ, and each protected by a pair of nematophores.

Habitat : Various stations along the North Atlantic coast, and from Marthas Vineyard southward.

Schizotricha Allman.

Hydrocladia pinnately disposed, often branching once or more. Two species come within the range of this synopsis.

1, *S. tenella* Verrill.

Trophosome : Colony branched dichotomously, attaining a height of about two inches. Stems clustered or fascicled, divided into alternately longer and shorter internodes, the latter bearing each a hydrotheca and a hydrocladium. Hydrocladium slender, often branched, proximal internodes short, and without hydrothecæ, which are subcylindrical.

Gonosome : Gonangia of curved shape, tapering at base and gradually enlarged toward the distal end, somewhat resembling cornucopiæ.

Habitat : Gay Head, Vineyard Sound, New Haven, Greenport, R. I., Woods Holl, Vineyard Haven.

2, *S. gracillama* Sars. (Fig. 31).

Trophosome : Stem sparingly branched, having a height of about two inches and somewhat fascicled. Branches divided into regular internodes, each of which bears a hydrocladium on a short, stout process near its distal end. Hydrocladia alternate, branching dichotomously twice or more beyond its proximal internode. Hydrothecæ small, cup-shaped.

Gonosome : Gonangia borne in pairs on the stems in the axils of the hydrocladia, and also at the forks of the latter, cylindrical in shape, tapering at proximal ends, sessile.

Habitat : Shallower waters, New England coast.

Fig. 31.

Fig. 32.

Fig. 31. — *Schizotricha gracillima* Sars. Branched hydrocladium (enlarged). (After Nutting.)

Fig. 32. — *Cladocarpus flexilis* Verrill. Portion of hydrocladium (enlarged). (After Nutting.)

Cladocarpus Allman.

Stem simple or fascicled. Hydrothecæ deep and with smooth margins or with lateral sinuations, and with one or two anterior teeth. A single species comes within the range of this synopsis.

C. flexilis Verrill (Fig. 32).

Trophosome : Colony long, slender, sparsely branching, stem not fascicled, attaining a height of about nine inches. Hydrocladia distinct, slightly sinuous, divided into rather slender internodes, each with a number of septal ridges back of hydrothecæ, which are deep, tubular, nearly straight, and with a single anterior tooth at the aperture.

Gonosome : Gonangia numerous, borne on stem and bases of hydrocladia, oblong-ovate, with latero-terminal orifice.

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SYNOPSES OF NORTH-AMERICAN INVERTEBRATES.

XIV. The Hydromedusæ — Part III.

CHARLES W. HARGITT.

Medusæ.

The Medusæ (medusoids, medusiform persons, gonophores, gonozooids) of this class of cœlenterates may be designated as in general of the form of a more or less transparent bell, or saucer-shaped disk, varying in size from the almost microscopic to organisms of fifteen inches or more in diameter.

The comparison of the medusa with a bell is fairly good, its body being similar in form in typical cases to the body of the bell, the manubrium corresponding to the clapper. A similar comparison with an umbrella is almost equally appropriate, if not superior. In this case the body of the medusa would correspond to the extended disk of the umbrella, the manubrium to the handle, and in some respects the radial canals are comparable with the ribs of the umbrella, while the numerous tentacles of some species are somewhat comparable with the marginal fringe often seen upon a lady's parasol. In further keeping with this comparison the outer, aboral portion of the medusa bell has been designated as the exumbrella, the inner, concave portion of the bell as the subumbrella. The mouth is located at the terminal, pendent portion of the manubrium, and through the tubular canal as an œsophagus communicates with the gastric pouch or stomach, from which radiate the gastric or chymiferous canals, by means of which the digested food matter is distributed over the body and through the circular or circumferential canal to the marginal organs.

At first sight there might seem to be little in common between the medusa and hydranth, either as to form, structure,

habit, etc.; but a closer scrutiny will reveal so intimate a fundamental likeness in all essentials as to demonstrate clearly the homological equivalent of every feature, some of the accessory or sensory structures alone excepted; and since these are not constant features they may clearly be disregarded in the comparison. Differences as to form and habits may be considered as adaptations to the characteristic functions of a free and motile organism.

In keeping with the synopsis of orders already given, that of the several families and genera of Medusæ will be taken up in their respective order.

ANTHOMEDUSÆ.

The Anthomedusæ are generally of more or less hemispherical form or sometimes of an elongate or subconical outline. All are possessed of a definite, muscular velum; sensory organs or ocelli borne on bulbs located at the bases of the tentacles, about which there is usually a colored pigment rendering them quite conspicuous, are usually present; otocysts are not present. The radial canals are generally four in number, rarely six or eight; gonads are developed and borne on the walls of the manubrium.

SYNOPSIS OF FAMILIES.

I. CODONIDÆ. Mouth-opening simple, devoid of tentacles or lobings; gonads not radially divided, but forming a circular, continuous tissue about the manubrium; marginal tentacles unbranched.

II. TIARIDÆ. Mouth-opening provided with simple or frilled oral lobes; with four or eight distinct manubrial gonads; marginal tentacles unbranched.

III. MARGELIDÆ. Mouth-opening surrounded with four or more simple or branched oral tentacles; four or eight manubrial gonads; marginal tentacles unbranched.

IV. CLADONEMIDÆ. Mouth-opening rarely simple, usually provided with oral lobes or tentacles; marginal tentacles variously feathered or branched.

Key to the Genera.

CODONIDÆ.

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

1. Tentacles and manubrium long and slender, the latter extending much beyond the velum; bell hemispherical . . . . Coryne
2. Tentacles rather short, stout, and capitate; manubrium extending but slightly beyond velum; bell conical . . . . . Dipurena
3. Tentacles rather stout and closely coiled, bell elongate hemispherical and with eight rows of nematocysts . . . . . Ectopleura
4. Tentacles only two at liberation, four in maturity . . Hydricthys
5. Tentacles very rudimentary, bell oblong . . . . . Pennaria
6. Bell hemispherical, with slight conical apical projection, tentacles two, often coiled within bell when disturbed . . . Perigonimus

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

1. Large tentacle stout and triangular, other three rudimentary; manubrium short and thick . . . . . Euphysa
2. A single large and long tentacle, two very small, and one rudimentary; bell hemispherical and slightly asymmetrical Corymorpha
3. Bell evidently asymmetrical; a single very large tentacle with enlarged base, from which bud proliferously secondary medusæ, other tentacles very rudimentary . . . . . Hybocodon

TIARIDÆ.

A. Marginal tentacles two, opposite.

1. Bell with rather pointed apical projection . . . . . Stomotoca

B. Marginal tentacles numerous.

1. Bell with large, globular, apical process . . . . . Turris
2. Bell without globular apical process . . . . . Turritopsis

MARGELIDÆ.

1. Marginal tentacles eight, symmetrically distributed { Dysmorphosa / Podocoryne }
2. Marginal tentacles eight, rudimentary . . . . . Stylactis
3. Tentacles in eight clusters . . . . . Lizzia
4. Tentacles in four clusters . . . . . Bougainvillia
5. Tentacles in four clusters, each with an erect clavate pair Nemopsis

Cladonemidæ.

A. Radial canals simple.

1. Marginal tentacles two, fringed with stalked nematocysts, bell with subconical apical projection . . . . . Gemmaria
2. Tentacles as in 1, bell hemispherical, without projection Corynitis

B. Radial canals branched.

Marginal tentacles in eight pairs . . . . . Willia

Coryne mirabilis Ag. (Fig. 33).

Bell elongate hemispherical, four to six mm. in diameter; manubrium very long, protruding far beyond the velum, but highly contractile; tentacles likewise very long and filamentous, but capable of great contractility; gonads borne upon body of manubrium and at maturity filling entire bell cavity or even protruding beyond the velum. Fairly common during early spring and summer, swimming near the surface. Hydroid generation, — *Ibid.*

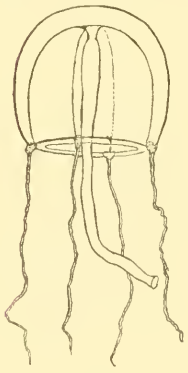

Fig. 33.

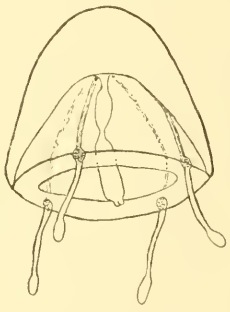

Fig. 34.

Fig. 33. — *Coryne mirabilis* Ag.
Fig. 34. — *Dipurena conica* A. Ag.

Dipurena conica A. Ag. (Fig. 34).

Bell conical or subhemispherical; marginal tentacles four, rather thick and with knob-like ends, and with prominent basal bulbs, each with a single ocellus; manubrium elongate, often extending beyond the velum, the basal portion constricted or narrowed, gastric cavity small, oral opening plain. Size from three to four mm. Common during midsummer. Buzzards Bay, Vineyard Sound, etc.

McCrady (*Proc. Elliott Soc.*, Vol. I) describes from Charleston Harbor two other species of Dipurena, namely, *D. strangulata* and *D. cervicata*, but I find no record of them as occurring elsewhere.

Ectopleura ochracea A. Ag. (Fig. 35).

Bell elongate hemispherical, of nearly uniform thickness, except at the aboral pole, which becomes somewhat conical and correspondingly thicker. In size the medusa varies from four to six mm. Marginal tentacles four,

from the base of which lines of nematocysts extend over the bell to the apex; tentacular bulbs of purplish orange color and each with an ocellus; manubrium rather large and spindle-shaped, of yellowish color.

Hydricthys mirus Fewkes.

Bell oval or subspherical, its outer surface dotted with nematocysts; radial canals four, wide; marginal tentacles four in mature specimens, only two in specimens at liberation; tentacular bulbs reddish in color but without ocelli. The original description was from specimens taken from a colony attached to a fish taken at Newport; other than this I find no records of it. (Cf. *Bull. Mus. Comp. Zoöl.*, Vol. XIII, p. 224.)

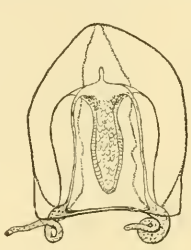

FIG. 35.

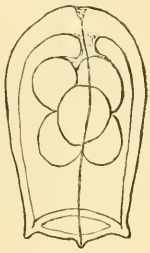

FIG. 36.

FIG. 35. — *Ectopleura ochracea* A. Ag. (After A. Agassiz.)
FIG. 36. — *Pennaria tiarella* McCr.

Pennaria tiarella McCr. (FIG. 36).

Bell oblong oval, of small size, about two mm. in height and half as broad; radial canals four, narrow, but rather conspicuously marked by lines of pinkish pigment; marginal tentacles very rudimentary from the four tentacular bulbs, which are devoid of ocelli; gonads borne on the walls of the manubrium, and as they approach maturity filling the entire cavity of the bell. The eggs and sperms are discharged promptly upon the medusa becoming free and even before; indeed, in many cases the medusæ are never liberated, as I have elsewhere shown. Color of a general reddish pink or rosy, manubrium a chocolate brown; ova vary in color from pale creamy white to rather bright orange.

Specimens of *P. gibbosa* from Florida and Porto Rico seem to me to be scarcely distinguishable from *P. tiarella*. Hydroid, — Pennaria.

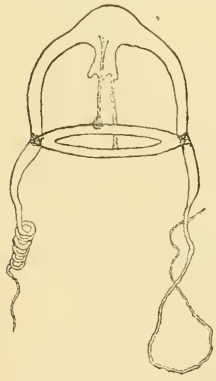

FIG. 37. — *Perigonimus jonesii.*

Perigonimus jonesii Osborn and Hargitt (FIG. 37).

(*American Naturalist*, 1894, p. 27.)

Bell hemispherical, with slight conical apical projection; marginal tentacles two, with four marginal bulbs; tentacles highly retractile and often withdrawn and coiled within the bell cavity when the medusa is irritated. Though these medusæ were kept under observation for several weeks, no gonads were developed.

Habitat: Found upon the legs and abdominal somites of the common crab, Labinia, from which it was repeatedly taken during several seasons. Hydroid, — Perigonimus.

Euphysa virgulata A. Ag.

Bell elongate oval, or quadrangular in outline; tentacles rather heavy and unequally developed, one being much longer and heavier than the others; bases with a pinkish band extending upward along the radial canals for a short distance; manubrium cylindrical with simple oral margins and of yellowish color; gonads upon the sides of manubrium. In size the medusa is from ten to twelve mm. in diameter, of rather active habit and fairly common. Nahant, Massachusetts Bay, and southward.

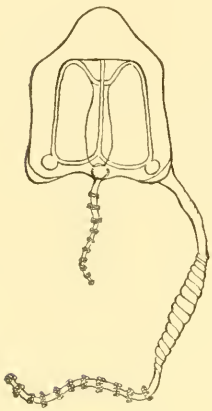

FIG. 38. — *Corymorpha pendula* Ag. (After Agassiz.)

Corymorpha pendula Ag. (FIG. 38).

Bell somewhat unsymmetrical, oblong with subconical apex; tentacles unequally developed, one being quite long and heavy, the others much smaller; manubrium similar to the preceding, both in form and color; bases of tentacles of pinkish color; size from five to six mm. Common along the coast, hydroids dredged from waters of Vineyard Sound, Massachusetts Bay, etc. Hydroid generation, — Corymorpha.

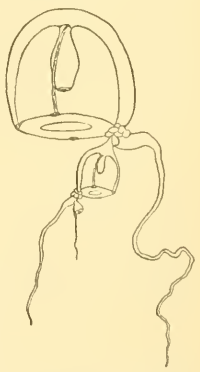

FIG. 39. — *Hybocodon prolifer* Ag.

Hybocodon prolifer Ag. (FIG. 39).

Bell similar to preceding, but with marked asymmetry; a single marginal tentacle of large size, with very thick basal portion, from which there bud proliferously secondary medusæ, which in turn similarly bud tertiary medusæ, several generations in this way being present upon the parent medusa. In other aspects very similar to the preceding. Hydroid generation, — Hybocodon.

Stomotoca apicata Ag. (FIG. 40).

Bell rather open and shallow, with an elongate conical projection at the apex; radial canals four; marginal tentacles two, which are long and slender and highly retractile; manubrium also retractile, with a four-lobed

oral margin. Color: manubrium, yellow or cream-color, base of tentacles purplish. Male often with green manubrium. Hydroid (?).

Stomotoca rugosa Mayer.

General form of the medusa similar to the preceding; apical projection sometimes long, sometimes short and blunt; size about five mm. in height by three mm. broad; two long marginal tentacles and fourteen rudimentary ones; radial canals four; velum well developed. Distinguished from *S. apicata* in part by the distinctively different color, which in this species is of a brick-red at tentacular bases and manubrium, while in the preceding (*S. apicata*) the manubrium is greenish or straw-colored in the male and dull ochre in the female, and the tentacle bases in male are purplish and in female ochre. Hydroid generation, — a Perigonimus.

Habitat: Common at Newport, R. I., and southward.

(Condensed from Mayer's description. *Bull. Mus. Comp. Zoöl.*, Vol. XXXVII, No. 1, p. 4.)

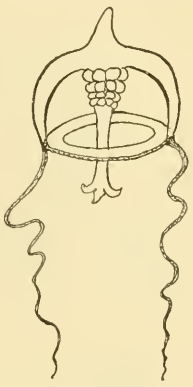

FIG. 40. — *Stomotoca apicata* Ag. (After McCrady.)

Turris vesicaria A. Ag. (FIG. 41).

Bell hemispherical, with large globular projection at its apex; marginal tentacles numerous; bases broad and with a single ocellus on each; tentacles tapering rapidly from the base and becoming delicate and filamentous; manubrium large and with four fimbriated oral lobes; gonads borne upon the base of manubrium and even extending somewhat upon the radial canals, the walls of which are notched and variously irregular, as are also the walls of the marginal canal.

(Condensed from description of A. Agassiz, *No. Am. Acalephæ*, p. 164.)

Hydroid generation, — a Turris (?).

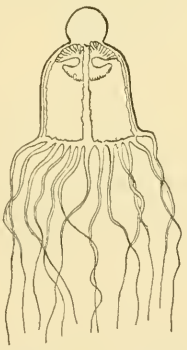

FIG. 41. — *Turris vesicaria* A. Ag. (After A. Agassiz.)

Turritopsis nutricula McCr. (FIG. 42).

Bell high-hemispherical or subspherical; radial canals four; velum broad; marginal tentacles varying from four to thirty or more, depending upon stages of maturity; a reddish ocellus at bases of tentacles; manubrium large but not

FIG. 42. — *Turritopsis nutricula* McCr. (After McCrady.)

reaching beyond the velum; gonads of reddish orange color and arranged in four masses upon the manubrium. Hydroid generation, — a Dendroclava.

Dysmorphosa fulgurans A. Ag. (FIG. 43).

Bell subhemispherical, with slight conical apical projection; radial canals four; marginal tentacles eight, symmetrically disposed; manubrium of medium size, its oral end provided with four rather prominent tentacles; from the body of the manubrium secondary medusæ bud off with great profusion, their numbers at times becoming so great as to afford a splendid phosphorescence (A. Agassiz). Hydroid (?).

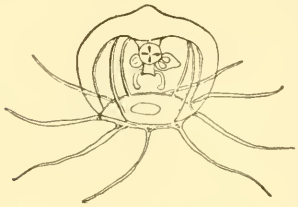

FIG. 43. — *Dysmorphosa fulgurans* A. Ag. (After A. Agassiz.)

Podocoryne carnea Sars (FIG. 44).

Medusa oval or bell-shaped or subglobular, form variable; exumbrella surface dotted with nematocysts; size about five mm. in height by slightly more than half as broad; marginal tentacles eight, four radial, four *interradial*, instead of all *radial*, as stated in Part I in describing the gonosome of Podocoryne, the latter shorter; pinkish ocelli at bases of tentacles; manubrium of medium size, though extensible to velum, of quadrangular form, with four oral lobes tipped with nematocysts; gonads borne on base of manubrium.

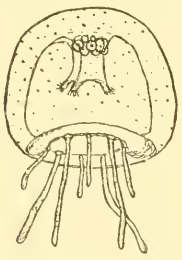

FIG. 44. — *Podocoryne carnea* Sars.

This medusa has been confused with the preceding, which has usually been designated as the product of Podocoryne. This is, however, a mistake. Podocoryne, so far as I am aware, never produces proliferous medusæ from the manubrium, as is the case with Dysmorphosa. I have often followed the direct liberation of the medusæ from the hydroid, and they have even at that time sex products well developed. Bunting has also noted the same thing. (Cf. *Journ. Morph.*, Vol. IX.)

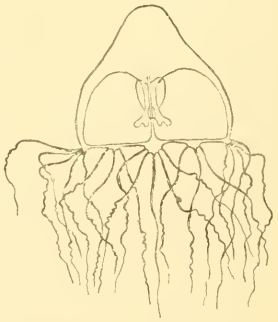

FIG. 45. — *Lizzia grata* A. Ag. (After A. Agassiz.)

Lizzia grata A. Ag. (FIG. 45).

Bell subconical, its apex obtusely rounded; radial canals four; marginal tentacles in eight clusters, the radial groups with five each, the interradial groups with three, in mature specimens; young with only radial tentacles, one at each radius; there are no ocelli;

manubrium of medium size, with four prominent and branched oral tentacles; gonads form prominent masses on body of manubrium. Hydroid (?).

Bougainvillia (*Margelis*) *carolinensis* Ag. (Fig. 46).

Bell subspherical, wall becoming very thick over the aboral part; radial canals four, inconspicuous; marginal tentacles in four clusters, of about ten each; in young specimens just liberated there are but two in each group and the bell is less globular, while the oral tentacles are simple; later these become dichotomously branched about three times; ocelli are grouped about the base of each of the four triangular sensory bulbs. One of the commonest of our Medusæ, reaching at maturity a size of about eight mm. Color greenish or greenish-blue. Hydroid, — *Ibid.*

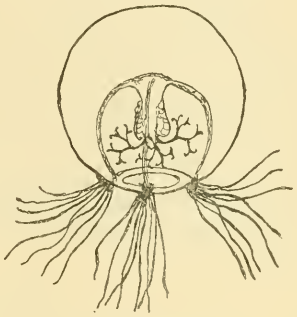

Fig. 46. — *Bougainvillia carolinensis* Ag.

Bougainvillia superciliaris Ag.

In general form and aspect very much like the preceding species, but of larger size and different shape, being somewhat obovate; the marginal tentacles are also more numerous as well as longer, a character common also to the oral tentacles, while the manubrium is broader and shorter. Ocelli as in the former. Of yellowish color. Hydroid, — *Ibid.*

Bougainvillia gibbsii Mayer.

Very similar to the preceding, distinguished according to Mayer by the relatively greater height and smaller width, and by the short and broad manubrium, which in cross-section is cruciform. (Cf. *Bull. Mus. Comp. Zoöl.*, Vol. XXXVII, No. 1, p. 5.) Hydroid (?).

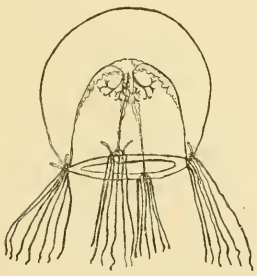

Fig. 47. — *Nemopsis bachei* Ag.

Nemopsis bachei Ag. (Fig. 47).

In general characters Nemopsis has many features in common with Bougainvillia, such as shape, mode of development, etc. The more distinctive differences are to be found in the number and character of the marginal tentacles, more particularly in the pair of erect, clavate ones which spring laterally from the tentacular bulbs, as shown in the figure. Again, the gonads present characteristic differences, arising from the basal portion of the manubrium and extending beneath the radial

canals, in some cases almost the entire length. Ocelli are present and like those in the preceding genus. In color the sensory bulbs are yellowish or orange, as are also the gonads. In size mature specimens vary from six to ten mm. Hydroid (?).

Stylactis hooperii Sigerfoos.

(*American Naturalist*, vol. xxxiii, p. 801.)

Bell globular, slightly elongate, about one mm. in long diameter; radial canals four; marginal tentacles eight, very rudimentary, symmetrically distributed about the margin; ocelli absent; manubrium large, devoid of oral tentacles or lobes; velum narrow; gonads borne in a general mass about the manubrium; genital products discharged at once on liberation of the medusa, which is quite active for a brief time following its liberation, but dies soon after discharge of eggs or sperms.

Habitat: Colony taken from shell of live snail, *Illyanassa obsoleta*. Hydroid, — *Ibid.*

Gemmaria cladophora A. Ag.

Bell hemispherical or subconical, walls rather thick, but varying in different regions, giving to the bell cavity a shape different from that of the external outline; radial canals four; marginal tentacles four, but two rudimentary, the larger abundantly provided with nematocysts, many of which are stalked; tentacular bulbs brownish, with orange pigment at bases; manubrium large, with basal conical portion separated by a sharp constriction from the oral portion, which has a flaring, quadrangular opening. Hydroid (?).

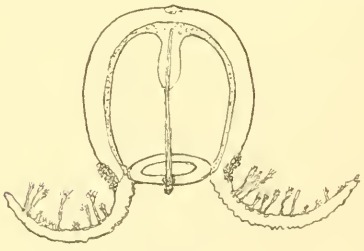

FIG. 48. — *Corynitis agassizii* McCr. (Adapted from McCrady.)

Corynitis agassizii McCr. (FIG. 48).

(Gemmaria gemmosa McCr.)

Bell elongate-hemispherical or obovate; marginal tentacles two, thick and fringed with an abundance of stalked nematocysts and batteries scattered over the tentacles from base to tip; radial canals four, with clusters of nematocysts at their marginal termini; velum well developed; manubrium of medium size, somewhat conical in shape. Mature specimens from one to two mm. in diameter.

Habitat: Taken from shells of Mytilis, etc. Hydroid, — *Ibid.*

Willia ornata McCr. (Fig. 49).

Body of medusa bell-shaped or conical, with blunt apical projection; marginal tentacles sixteen in mature specimens, arising from the terminals of the branched radial canals; primary canals four in young specimens, which by repeated branching become sixteen, and the development of the tentacles follow the same course of development, appearing after the several divisions of the canals; manubrium rather stout and with lobed oral margins. Intermediate between each pair of tentacles an undulating line of nematocysts, "knotted cords," passes upward on the bell. Hydroid (?).

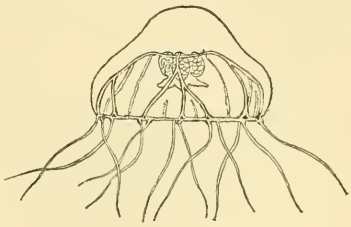

Fig. 49.— *Willia ornata* McCr. (After A. Agassiz.)

(Adapted from McCrady's description, *Proc. Elliott Soc.*, Vol. I, p. 149.)

LEPTOMEDUSÆ.

As compared with the Anthomedusæ, the Leptomedusæ are generally flatter and more disk-like; the velum is usually smaller, and the texture of the bell is softer. Ocelli may or may not be present; otocysts may or may not be present; the gonads are borne upon the radial canals.

SYNOPSIS OF FAMILIES.

I. Thaumantidæ. Ocelli present, but no otocysts; radial canals four or eight (rarely more), always simple and unbranched.

II. Cannotidæ. Without either otocysts or ocelli; radial canals four or six, which are branched or pinnate.

III. Eucopidæ. Otocysts always present, eight or more; ocelli usually absent; radial canals usually four, simple and unbranched.

IV. Æquoridæ. Otocysts always present; radial canals numerous, at least eight, often a hundred or more, usually simple, rarely branched.

Key to Genera.

Thaumantidæ.

A. Radial canals four; marginal tentacles numerous, and with basal cirri . . . . . Lafœa

B. Radial canals eight; marginal tentacles numerous, but without basal cirri . . . . . Melicertum

Cannotidæ.

Radial canals four, each with lateral, sometimes pinnate, branches which end blindly. A single genus within the range of this synopsis so far as known to the writer . . . . . Ptychogena

Eucopidæ.

A. Marginal tentacles four, sometimes with lateral basal cirri.

1. Manubrium very long, extending much beyond velum . Eutima
2. Manubrium short, tentacles with basal cirri . . . . Eucheilota
3. Manubrium short, tentacles devoid of basal cirri . . Clytia (Juv.)

B. Marginal tentacles sixteen or more.

1. Manubrium long, bell hemispherical . . . . . Tima
2. Manubrium short, bell disk-like, otocysts on bases of tentacles Obelia
3. Manubrium short, mouth plain, bell hemispherical, otocysts between bases of tentacles . . . . . Clytia
4. Manubrium short and with fimbriated oral lobes . . . Tiaropsis
   (*a*) With 16 tentacles . . . . . Epenthesis
5. Manubrium short and with oral lobes plain.
   (*b*) With more than 16 tentacles . . . . . Oceania

Æquoridæ.

A. Radial canals eight or more, often lobed or divided at their bases Halopsis

B. Radial canals numerous, twelve to one hundred or more.

1. Manubrium very short, often indistinguishable, and with crenulated oral margin . . . . . Rhegmatodes
2. Manubrium well developed, oral margin lobed but plain Æquorea
3. Manubrium large and with complex and fimbriated oral lobes Zygodactyla

Lafœa calcarata A. Ag. (Fig. 50).

Bell broad, somewhat conical or dome-shaped, marginal tentacles numerous, somewhat swollen at base, long and filamentous, and interspersed with tentacular spurs, clubs, and cirri; gonads suspended in convoluted masses beneath radial canals, of milky or yellowish color; manubrium short and with convoluted oral lobes. When first liberated, the medusa is small and with only two tentacles, others appearing with growth; ocelli are located upon the bases of the tentacles. Size about 20 mm. in diameter. Hydroid, — *Ibid.*

Melicertum campanula Esch.

Medusa bell-shaped or subconical; marginal tentacles very numerous, long, and filamentous, but devoid of basal cirri; radial canals eight at maturity, four in young specimens; gonads suspended in sinuous folds beneath radial canals; manubrium much as in preceding, with oral lobes sinuously convoluted; color of bell light ochre, tentacles and gonads much darker. Reported from Greenland, Grand Manan, Nahant, etc., A. Ag. Newport Harbor, May Mayer. Hydroid (?).

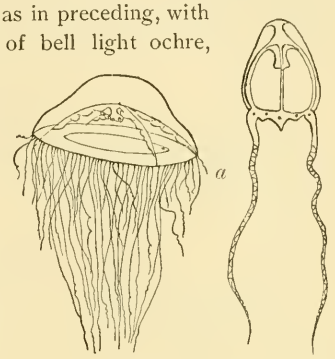

FIG 50.—*Lafœa calcarata* A. Ag. *a*, a young medusa of same. (After A. Agassiz.)

Ptychogena lactea A. Ag.

Bell the small segment of a sphere, walls rather thick; radial canals four, but with sides variously notched and in the medial portions increasing to extended lateral diverticula; tentacles very numerous and filamentous; gonads variously folded and disposed beneath radial canals; devoid of either ocelli or otocysts. According to A. Agassiz (p. 137, *N. A. Acalephæ*), from whose account both this and the preceding description are condensed, this medusa lives chiefly at considerable depths, and exposure to light or increased temperature rapidly disintegrates it. Hydroid (?).

Eutima mira McCr. (FIG. 51).

Medusa broadly bell-shaped, tending to conical; marginal tentacles four, long and tapering from an enlarged base; numerous minute tentacular processes distributed about the margin; otocysts eight, symmetrically disposed; manubrium very long, extending far beyond the velum, and terminating in an everted, somewhat frilled margin; gonads disposed beneath radial canals. Hydroid (?).

FIG. 51.—*Eutima mira* McCr. (After McCrady.)

Eutima limpida A. Ag.

Medusa much as in preceding species, but with both manubrium and tentacles shorter, the latter without the basal swellings of the former and the oral margin less frilled; broad diameter one to two inches, height much less; otocysts large and with numerous lithocysts. Hydroid (?).

Eucheilota ventricularis McCr.

Bell of medusa hemispherical; radial canals four, wide and with the gonads extending their entire length; marginal tentacles twelve to twenty in mature specimens, only four at liberation of medusa; manubrium short, tubular, of yellowish color with reddish central portion; gonads similar in color; otocysts eight, with lithocysts arranged in an arc. Hydroid (?).

Eu. duodecimalis A. Ag. (FIG. 52).

Medusa similar to preceding species, but with twelve otocysts and with only four long tentacles, each with a pair of lateral cirri at the base; gonads borne on distal half of radial canals. Hydroid (?).

Clytia bicophora Ag. (FIG. 53).

Medusa variable in appearance with age; when first liberated, the bell is rather globular, later becoming flattened and finally at maturity being hemispherical; diameter about five mm.; radial canals four, beneath which the gonads, which are dull brown in color, extend from base of the short manubrium about to their middle portion; marginal tentacles eight, with intermediate tentacular buds; otocysts eight. Hydroid, — *Ibid.*

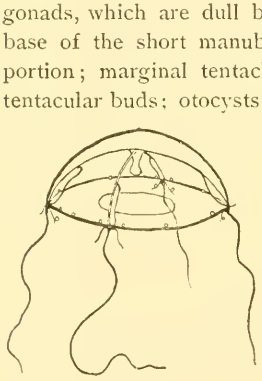

FIG. 52.

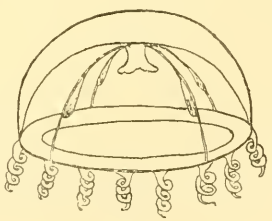

FIG. 53.

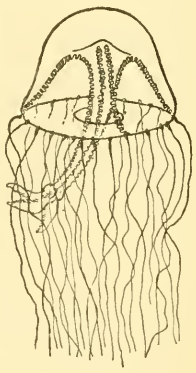

FIG. 54.

FIG. 52. — *Eucheilota duodecimalis* A. Ag. (After A. Agassiz.)
FIG. 53. — *Clytia bicophora* Ag. (After A. Agassiz.)
FIG. 54. — *Tima formosa* Ag. (After A. Agassiz.)

C. nolliformis McCr.

Medusa much as in preceding; marginal tentacles four in young specimens, increasing in number with age; otocysts eight, between bases of tentacles; manubrium short and with four oral lobes. Hydroid (?).

Tima formosa Ag. (FIG. 54).

Medusa bell-shaped or elongate hemispherical; marginal tentacles numerous, long, filamentous, and with bulbous bases; radial canals four, and with convoluted, pouch-like gonads extending their entire length;

otocysts symmetrically distributed about the margin, between the tentacular bases; manubrium large and long, extending beyond the velum, and terminating in a series of fringed, lip-like lobes. Hydroid (?).

Obelia Per. & Les.

Generic characters: Medusa flat and disk-like; marginal tentacles numerous, projecting slightly inward at the base; otocysts eight, borne on base of tentacles at the inner portion; manubrium short and somewhat quadrate. Medusæ often swimming with everted bell.

O. geniculata Linn. (Fig. 55).

Medusa flat; marginal tentacles twenty-four at liberation; gonads as oval bodies beneath middle of radial canals. Hydroid, — *Ibid.*

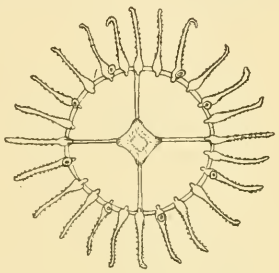

Fig. 55. — *Obelia geniculata* Linn.

O. longissima Pallas.

Very similar to preceding. Hydroid, — *Ibid.*

O. flabellata Hincks.

(Eucope polygena A. Ag.)

In general aspects indistinguishable from the preceding species. Hydroid, — *Ibid.*

O. gelatinosa Pallas.

(Laomedia gigantea A. Ag.)

In general feature similar to former, but with only sixteen tentacles at liberation. Hydroid, — *Ibid.*

O. dichotoma Linn.

Indistinguishable from *O. gelatinosa*. Hydroid, — *Ibid.*

O. commisuralis McCr.

In general features very like the preceding species, but with tentacles somewhat more slender and elongated. Hydroid, — *Ibid.*

Tiaropsis diademata Ag. (Fig. 56).

Medusa ovoid when young, becoming hemispherical at maturity; radial canals four; marginal tentacles very numerous, the larger with swollen bulbous bases; otocysts eight, situated between bases of tentacles and with otoliths in form of arc; gonads extending beneath radial canals; manubrium short, with terminal lobes complexly fimbriated. Hydroid (?).

Oceania languida A. Ag. (FIG. 57).

Medusa ovoid when set free, becoming hemispherical at maturity; radial canals four; marginal tentacles numerous in adult specimens; otocysts eight, situated near bases of tentacles in young specimens, but becoming numerous as medusæ mature, increasing in number according to A. Agassiz by subdivision of the primary otocysts; gonads of brownish or pink or green color, and borne on distal portions of canals. Hydroid (?).

Oceania carolinæ Mayer.

Bell less than a hemisphere, about 14 mm. in diameter; marginal tentacles sixteen, with large hollow basal bulbs, also numerous rudimentary tentacular bulbs interspersed; otocysts 64, symmetrically disposed; manubrium flask-shaped, and with four simple oral lobes; gonads borne on distal portions of radial canals; tentacular bulbs bright yellow-green. Charleston Harbor.

(Condensed from Mayer's description, *Bull. Mus. Comp. Zoöl.*, Vol. XXXVII, No. 1.)

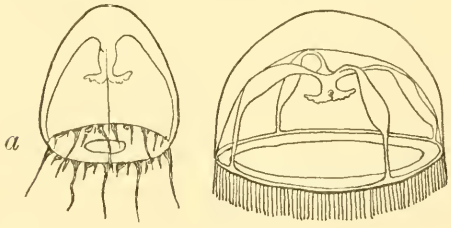

FIG. 56.

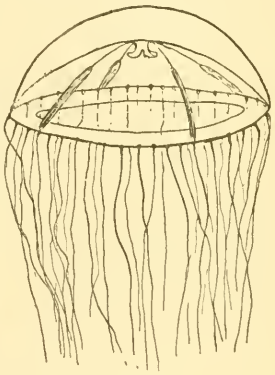

FIG. 57.

FIG. 56. — *Tiaropsis diademata* Ag. (After A. Agassiz.) *a*, young medusa of same.
FIG. 57. — *Oceania languida* A. Ag. (After A. Agassiz.)

O. singularis Mayer.

Bell about two mm. in diameter, with lens-shaped apical projection; marginal tentacles 16, with hollow basal bulbs, and with 16 rudimentary tentacles symmetrically disposed; otocysts 32; gonads borne on upper portion of radial canals; colors of tentacular bulbs and radial canals in region of gonads turquoise-green. Newport Harbor, R. I.

(Condensed from Mayer's description; cf. *op. cit.*)

Epenthesis foleata McCr.

(Oceania foleata Ag.)

Medusa with low, subhemispherical bell, about five mm. in diameter; marginal tentacles sixteen, rather slender and with well-developed basal

bulbs; otocysts alternating with bases of tentacles; manubrium short and with four recurved oral lobes; gonads borne upon lower portions of canals. Manubrium, gonads, and sensory bulbs light greenish in color. Hydroid (?).

Halopsis ocellata A. Ag.

Bell low and flat in mature specimens, though somewhat hemispherical in young medusæ; radial canals twelve to twenty in mature specimens; marginal tentacles very numerous and highly contractile, and with interspersed cirri; otocysts numerous and with numerous otoliths arranged in double rows; manubrium short, with four recurved sinuous oral lobes. Hydroid (?).

(Condensed from description of A. Agassiz, *N. A. Acalephæ*, p. 99.)

H. cruciata A. Ag.

Under this name A. Agassiz briefly describes a medusa having but four radial canals, a hemispherical bell, comparatively few tentacles, and otherwise so unlike the preceding as to render its generic, if not family, affinities wholly distinct. Not having access to specimens, it is merely listed without further comment. Hydroid (?).

Rhegmatodes tenuis A. Ag. (Fig. 58).

Bell low, with rounded aboral surface and with margins distinctly incurved; radial canals numerous, varying from twenty to forty or more in specimens examined; canals usually simple, but with many variations exhibiting connecting branches and anastomoses; marginal tentacles numerous, rather long and filiform, tapering rapidly from a somewhat broad base, above which is a tubular spur-like flap; tentacles, like the radial canals, increase with age, the larger extending from the termini of the canals, while intermediate are smaller ones with still smaller intermediate tentacular rudiments; gonads suspended in double rows along the surface of the canals; manubrium extremely short, often indistinguishable from the very shallow gastric pouch, and with its oral margin delicately crenulated; otocysts numerous.

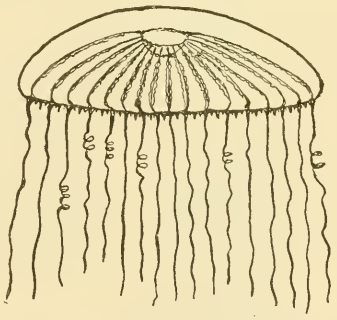

Fig. 58. — *Rhegmatodes tenuis* A. Ag.

In habit these medusæ are rather sluggish, swimming or floating near the surface and rarely exerting more than two or three pulsations of the bell or small velum in succession. Hydroid (?).

R. floridanus Ag.

Very similar to the preceding, though smaller, and of southern range.

Æquorea albida A. Ag.

Bell subhemispherical, tending to conical above; radial canals very numerous, and with two or three marginal tentacles borne between each; otocysts also numerous, spherical, and containing several small otoliths; above the base of each of the larger tentacles is a tentacular spur, similar to those of Rhegmatodes; manubrium short and with simple oral lobes. In size mature specimens vary from one to two inches in diameter. Not uncommon in the vicinity of Buzzards Bay during later summer. Hydroid (?).

Zygodactyla grœnlandica Ag.

This is one of the largest of the Hydromedusæ, sometimes measuring twelve to fifteen inches in diameter; bell rather low and flat; radial canals very numerous; marginal tentacles long and very contractile, and several between the terminals of the radial canals; above the bases of the tentacles are conical spurs quite similar to those of the two preceding genera; manubrium large and elongated, extending beyond the velum when fully expanded, and with densely frilled or fimbriated oral lobes; gonads borne along the lines of the canals as in the former genera. Habitat from Greenland, Maine, Massachusetts, southward. Hydroid (?).

TRACHOMEDUSÆ.

The synoptic characters of this order have already been given. Of representatives there are comparatively few which come within the range of the present synopsis. No details of arrangement under appropriate families will therefore be undertaken in this connection, but the genera and species will be noted so far as known, and some placed provisionally under the order, of whose exact affinities there is doubt. Hydroid generation suppressed.

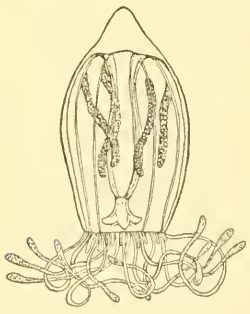

FIG. 59. — *Trachynema digitale* A. Ag. (After A. Agassiz.)

Trachynema digitale A. Ag. (FIG. 59).

Medusa elongate bell-shaped, the apex rather sharply conical; radial canals eight, rather wide; tentacles numerous and somewhat fragile; otocysts four, rather large, and with colored otoliths; gonads eight, finger-like and suspended from the upper portions of the radial canals. Size of

mature specimens about one inch in long diameter and about half as broad. Reported from Baffins Bay, Massachusetts Bay, Nahant, A. Ag.; Newport Harbor, April, Mayer.

Gonionemus murbachii Mayer. (Fig. 60).

Medusa with low hemispherical bell when in repose, but subconical when in active motion and contraction; radial canals four, prominent and with line of brownish pigment over their course; marginal tentacles numerous, varying from sixteen to eighty or more, rather long but capable of being greatly contracted; rather prominent basal bulbs of brownish color tinged with pale green; a characteristic of the tentacles is the presence of adhesive or suctorial pads a short distance from the tips, beyond which they

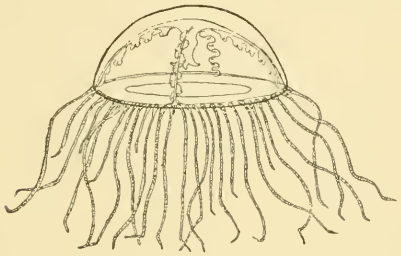

Fig. 60

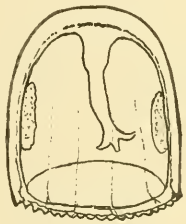

Fig. 61.

Fig. 60. — *Gonionemus murbachii* Mayer.
Fig. 61. — *Persa incolorata* McCr. (Modified from McCrady.)

often are bent at a sharp angle; manubrium of moderate size, quadrate in form and with prominent frilled oral lobes; gonads suspended in sinuous folds beneath the radial canals; otocysts present in variable numbers and disposed between the bases of the tentacles.

Persa incolorata McCr. (Fig. 61).

Bell thimble-shaped, walls thin, the entire medusa colorless except the pale yellowish gonads, which are oval and attached to the walls of two opposite radial canals, of which there are eight, only two of which are very definite; margin of the bell devoid of tentacles, but nodulated by the presence of batteries of nematocysts.

(Condensed from McCrady's account, *Gymn. Charl. Harb.*, p. 104.)

Liriope scutigera McCr.

Described by McCrady (*op. cit.*, p. 106) from Charleston Harbor, and noted by Mayer from Florida (*Bull. Mus. Comp. Zoöl.*, Vol. XXXVII, No. 2, p. 64). Also from Newport Harbor, by latter observer.

NARCOMEDUSÆ.

No representatives of this order have been taken by the present writer along our northeastern coast, and but few have been even reported from within the range of this synopsis. The following records and references may therefore suffice:

Cunoctantha octonaria McCr. Charleston Harbor. *Proc. Elliott Soc.*, Vol. I.

Cunoctantha incisa Mayer. Tortugas. *Bull. Mus. Comp. Zoöl.*, Vol. XXXVII, No. 2, p. 66.

Æginella dissonema Hæck. Tortugas. *Op. cit.*, p. 66.

SIPHONOPHORA.

Of Siphonophora recorded from northeastern Atlantic waters, by far the larger number are products of the Gulf Stream, very few, if any, being indigenous faunal elements. Those more familiar and of commoner record may be grouped under the following sections:

A. Disconectæ. Siphonophora with discoidal pneumatophore, but devoid of nectophores or bracts.

1. *Velella mutica* Bosc. Pneumatophore an elliptical or oblong disk, usually with an oblique vertical crest, and with the several zooids attached to the lower surface. Common in subtropical regions and in Gulf Stream, upon the latter of which they are occasionally borne northward to the New England coast.
2. *Porpita linnæana* Less. Pneumatophore a circular disk, but without a vertical crest. Otherwise similar to former and of similar habits and distribution.

B. Calcyonectæ. Siphonophora without pneumatophore, but with one or more nectophores.

1. *Diphyes pusilla* McCr. Polygastric, with two nectophores at the apex of a long tubular trunk.
2. *D. formosa* Fewk. Cf. *Report on Medusæ of Gulf Stream Region.* Commissioner of Fish and Fisheries, 1884, p. 963.
3. *D. bipartita* Costa. Reported by Mayer (*Bull. Mus. Comp. Zoöl.*, Vol. XXXVII, p. 74) from Newport, R. I.
4. *Agalmopsis carum* A. Ag.
   Nanomia cara A. Ag. Polygastric, with long tubular trunk and with numerous siphons and bracts.
5. *Agalma okenii* Esch.
6. *Spheronectes gracilis* Haeck. Reported by Fewkes from Newport, R. I. (*Bull. Mus. Comp. Zoöl.*, Vol. VIII, p. 166.)
7. *Gleba hyppopus* Forsk. Reported by Fewkes off Marthas Vineyard. (*Rept. U. S. Comm. Fish and Fisheries*, 1884, p. 963.)

C. Cystonectæ. With large vesicular pneumatophore only, no nectophores or bracts.

Physalia pelagica Bosc. Common along the coast, occasionally taken at the Bay of Fundy. The well-known Portuguese-man-of-war. One of the most conspicuous of the siphonophores, and with long graceful tentacles which are loaded with batteries of nematocysts of highly venomous character.

In the foregoing synopsis only incidental notice has been made of synonomy, any details on this line being incompatible with the purpose and limits of the paper.

It is a pleasure to acknowledge in this connection my obligations to Dr. Alfred G. Mayer, of the Brooklyn Institute, who has kindly reviewed the manuscript of Part III of this synopsis, and offered suggestions, and from whose various recent papers on Medusæ I have been able to extend the list of species in several cases.

I desire also to acknowledge the services of my son George, who has copied most of the figures and has under my direction drawn most of those made directly from nature.

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SYNOPSIS OF NORTH AMERICAN INVERTEBRATES.

XIV. Part IV. The Scyphomedusæ.

CHAS. W. HARGITT.

The following synopsis is a continuation of that upon Hydromedusæ which appeared as XIV of the *American Naturalist* series, during April, May and July, 1901.

As in the preceding parts, while depending largely upon my own records of the Scyphomedusæ, I have at the same time drawn freely upon the literature wherever found, but chiefly Hæckel's "System der Medusen" and to a less extent Mayer's numerous papers. (*Bull. Mus. Comp. Zoöl.*) Fewkes papers, chiefly of the same series, including also L. Agassiz, "*Contr. Nat. Hist. United States*," 1862, and A. Agassiz' "Catalog N. A. Acalephæ," 1865.

In only a few cases has any attempt been made to present accounts of the synonymy of the several species, and then only so much as might serve to obviate ambiguity.

In general form, habit, structure and distribution the Scyphomedusæ have much in common with the Hydromedusæ and probably sustain a more intimate relation to them than to any other cœlenterate Class.

They may however be somewhat sharply distinguished by the following characters:

1. Absence of a true velum. The velarium of the Cubomedusæ has important structural differences, though doubtless serving an identical function.

2. Sense organs when present are modified tentacles, variously designated as tentaculocysts, rhopalia, etc.

3. Entodermic origin of sexual products.

In development there is general correspondence between this and the preceding Class. In some the medusa arises by direct

(hypogenic), development from the egg; while in others, and by far the larger number, development is indirect (metagenic), exhibiting perfectly evident alternation of generations; in this case however, involving a distinct metamorphosis, the polyp giving rise to a free-swimming ephyra which is in turn transformed directly into a medusa. It should also be noted that asexual budding is, unlike that of the former class, by the transverse fission of the polyp body into a series of disks which become free as ephyræ, as already noted. Direct asexual budding from medusoid organs, common in many Hydromedusæ, is unknown among the Scyphomedusæ.

SYNOPSIS OF THE ORDERS.

I. STAUROMEDUSÆ. Scyphomedusæ with vasiform or sub-conical umbrella. In some cases sedentary, attached by an aboral peduncle or stalk. Wholly devoid of sensory organs, but with eight tentacles or tentacular organs which serve as anchors. Stomach with four wide gastric pouches which communicate with a marginal canal. Gonads in four crescentic loops on the floor of the gastric pouches.

II. PEROMEDUSÆ. Scyphomedusæ with bell more or less conical in shape and with a usually well-developed horizontal constriction which divides it into two regions; an aboral, resembling quite remarkably the apical projection of the bell of certain Hydromedusæ; the marginal portion, which is eight or sixteen lobed and bearing tentacles and rhopalia or tentaculocysts. Stomach capacious with four gastric pouches which are separated by narrow septa, and extending into a circular sinus. Gonads much as in the former order.

III. CUBOMEDUSÆ. Scyphomedusæ with a distinctively quadrate umbrella, provided with a well-defined velarium, which is supported at the radial angles by thickenings or frenulæ. Marginal tentacles four, interradially disposed, and with four perradial rhopalia. Bases of tentacles often provided with wing-like expansions, pedalia.

IV. DISCOMEDUSÆ. Scyphomedusæ with shallow, or disk-shaped, eight lobed umbrella. Marginal sense organs eight, per- and interradially disposed about the margin. Tentacles often very numerous. Manubrium often very large, pendulous and complexly frilled or plaited. Stomach with four to eight or more gastric pouches, within which are borne the gonads.

The medusæ of this order are often of large size. Specimens of Cyanea reaching a diameter of from four to six feet in some cases and with tentacles having an extent of more than fifty feet when fully extended. The average size however, even of this species, is very much smaller, as will be noted later.

Synopsis of Families of Stauromedusæ.

I. Tesseridæ. Margin of umbrella devoid of definite lobes or anchors; the umbrella attenuated at the apex into a hollow stalk, which in some genera serves as a means of attachment; eight tentacles, four of which are perradial and four interradial.

So far as known no representatives of this family come within our range.

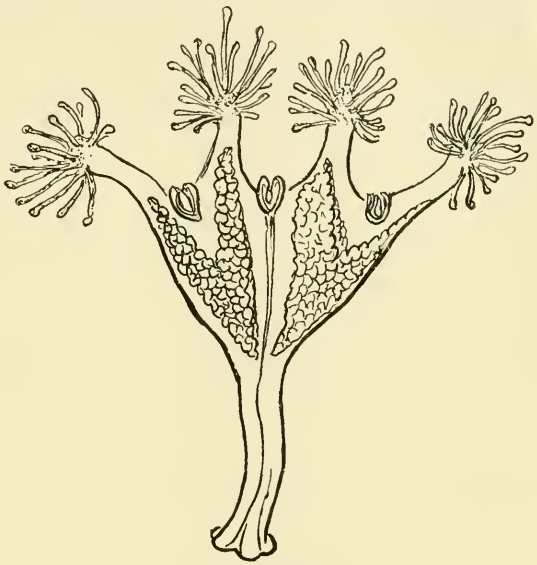

Fig. 1. *Halichystus auricula* Clark.

II. Lucernaridæ. Margin of umbrella definitely lobed, each terminating in tufts of delicate knobbed tentacles; exumbrella attenuated at the apex as an organ of attachment; margin of umbrella with eight tentacles, arranged as in previous family, but sometimes modified as anchors.

Key to the Genera.

A. Without gastrogenital pockets in the sub-umbrella wall of the radial pouches.

1. Umbrella with 8 marginal anchors . . Haliclystus.
2. Umbrella without marginal anchors . . Lucernaria.

B. With four perradial gastrogenital pockets in the subumbrellar wall of the four radial pouches.

3. Margin of umbrella with 8 anchors . . Halicyathus.

Haliclystus auricula Clark. 1863.

Fig. 1.

Haliclystus auricula, Clark, 1863, 1878.
" " A. Ag. 1865.
" primula, Hæckel, 1877.
Lucennaria " " 1865.
Haliclystus auricula, " 1880.

Umbrella octangular-pyramidal, umbrella stalk quadrate-prismatic, approximately as long as the bell height. Eight arms, arranged in pairs; four perradial sinuses broader and deeper than the four interradials: each arm with from 100–120 tentacles; eight large marginal anchors.

Color.— Very variable, often including almost every tint of the spectrum, though generally having a single color.

Size.— Broad diameter 20–30 mm. Height, including stalk, 20–30 mm.

Distribution.— From Massachusetts Bay northward to Maine, etc.

Haliclystus salpinx Clark. 1863.

H. salpinx Clark, 1863.
H. salpinx A. Ag. 1865.
Lucernaria salpinx Hæckel, 1865.
Haliclystus salpinx Hæckel, 1880.

Umbrella octangular, stem quadrate, prismatic, with four interradial longitudinal muscles: eight arms, symmetrically disposed, each with a tuft of 60–70 slender tentacles. Marginal anchors very large about as long as the arms.

Distribution.— Chiefly Northeastern Atlantic coast.

Lucernaria quadricornis O. F. Müll. 1776.

Umbrella flat funnel-shaped or quadrate-pyramidal, approximately twice as broad as high. Stem cylindrical, single-chambered, about as long as the bell-height and with four interradial longitudinal muscles. Eight arms arranged in pairs, the four perradial sinuses of the bell margin as broad and deep as the four interradials. Each arm with from 100–120 tentacles.

Color.— Variable, gray, green, yellowish brown to red-brown.

Size.— Umbrella 50–60 mm., height including stalk, 50–70 mm.

Distribution.— As in Haliclystus.

Halicyathus lagena Hæckel. 1880.

Lucernaria auricula Fabr. 1780.
L. typica Greene 1858.
L. fabricii L. Ag. 1862
L. lagena Hæckel 1865.
Manania auricula Clark, 1863.
M. auricula A. Ag. 1865.
M. lagena Hæck. 1877.
Halicyathus lagena Hæck. 1880.

Bell deep flask-shaped, about twice as high as broad; stalk slender cylin

drical, single chambered, much longer than height of bell. Arms eight, arranged in pairs, not longer than broad; each arm with 60–70 delicate tentacles. Eight marginal anchors.

Color. — Black or dark brown, occasionally reddish- or yellowish-brown.

Size. — 5–7 mm., height including stem, 20–30 mm.

Distribution. — Eastport, Me. (Stimpson), Swampscott, (Ag.), Greenland.

Synopsis of the Families and Genera of Peromedusæ.

Family Periphyllidæ. Rhopalia 4, marginal lobes 16, tentacles 12.
Family Pericolpidæ. Rhopalia 4, marginal lobes 8, tentacles 8.

A single genus only of the Peromedusæ is represented within the range of the present synopsis, namely, Periphylla and under this three species have been recorded.

Generic characters: — Umbrella with four perradial, buccal pouches and with four basal funnels; gastric pouches with two rows of filaments.

Periphylla, hyacinthina Steenstrup. 1837.

Fig. 2.

Umbrella bell-shaped, about as broad as high; marginal lobes nearly right-angled truncated below; the eight tentacle lobes with about the same marginal dimensions as the rhopalial lobes; tentacles about double the length of the bell-height. Manubrium extending to the base of the marginal lobes, and about double as broad as high.

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

Distribution. — Greenland, Steenstrup, Gulf Stream 90–100 miles S. E. off Martha's Vineyard (Fewkes).

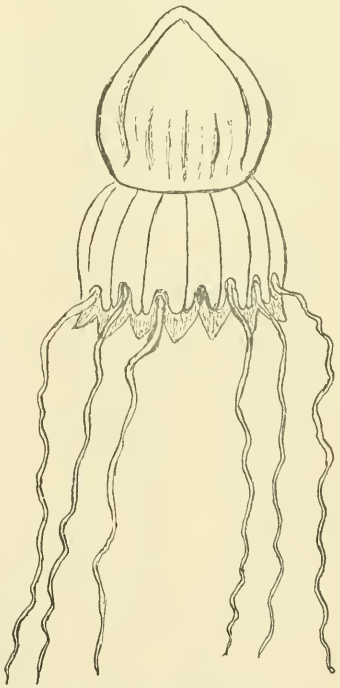

Fig. 2. *Periphylla peronii* Hæckel.

Periphylla humilis Fewkes. 1884.

Bell low conical, diameter twice that of height. Rhopalia 4, provided with protecting hood; marginal tentacles 12, of yellow color. Color of exumbrella brown, rough and opaque; central disk and corona rather uniform brownish in color.

Distribution.— Off Martha's Vineyard as for previous species.

Periphylla peronii Hæckel, 1880.

Charibdea periphylla, Per. & Les. 1809.
C. periphylla, L. Ag. 1862, Cont. Nat. Hist. U. S.
Stomolophus periphylla, Fewkes?

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

Distribution.— Tropical Atlantic, (L. Agassiz), St. George's Bank (S. I. Smith).

FAMILIES OF CUBOMEDUSÆ:

Of the Cubomedusæ only a single Family has been represented by species within the range of this synopsis, namely Charibdeidæ, and under this but a single genus and species.

Charybdea verrucosa Hargitt, 1902. Fig. 3.

Several specimens were taken at Woods Holl during the summer of 1902 and have been described by the present writer, *Am. Nat.* July, 1902. Bell ovoid in outline, as seen in profile, cuboid viewed from the aboral pole. Size from 2 to 3 mm. in short diameter by 4 to 5 mm. in the height. Surface dotted irregularly with light brownish, warty clusters of nematocysts. Rhopalia 4, preradially located, set in rather deep pockets, and shielded by projecting hoods. Tentacles short and spindle-like, with deep annulations, interradially situated. Velarium well-devel-

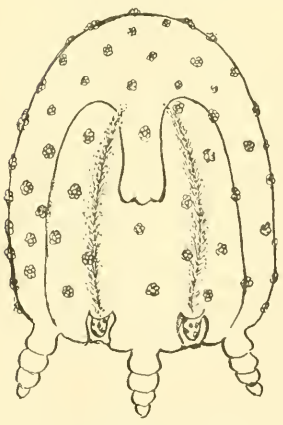

FIG. 3. *Charybdea verrucosa* Hargitt.

oped, but without distinguishable canals, supported by frenulæ on the inner perradial corners of the sub-umbrella. Gonads were undeveloped, and no distinguishable gastric filaments were present.

In color the specimens were light amber being darker on the tentacles.

As pointed out in the description before cited, the specimens under consideration show many points of difference or contrast as compared with typical Charybdea species. Mayer who has described a similar species from the Tortugas ascribes this to immaturity. This has seemed to me somewhat doubtful, and some hesitancy was entertained as to whether they probably come within the Charybdeidæ; but in the absence of specimens in sufficient numbers or undoubted maturity it seems impossible to more definitely settle the problem.

Mayer has described two species from the Tortugas, namely, *C. aurifera* and *C. punctata*. Both species were based on single specimens and both seemed immature. Hence the same doubt rests upon these as upon the previous species. A comparison of Mayer's figures, *Bull. Comp. Zool.*, XXXVII, No. 2, will show many points of similarity and suggests close relationships.

Synopsis of Sub-orders and Families of Discomedusæ.

Sub-order 1. Cannostomæ.

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

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

Family Linergidæ. Radial pouches broad, terminating in numerous branching, blind distal canals.

Sub-order 2. 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 usually 8.

Family Ulmaridæ. 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.

Family CYANEIDÆ. Radial canals broad and pouch-like, and with numerous ramifying, blind, lobular canals; no circular canal; 8–16, rarely more, marginal lobes.

Family PELAGIDÆ. Radial canals rather broad but simple and without ramifying branches; no marginal canal; usually 16 marginal lobes.

Sub-order 3. RHIZOSTOMÆ.

Discomedusæ in which the mouth early becomes more or less overgrown and obliterated by the 8 root-like oral arms; gastric cavity extending into the oral arms and opening by funnel-like mouths on the edges and surfaces. Devoid of marginal tentacles.

Family TOREUMIDÆ. Radial canals 8–16, narrow and with anastomosing branches; devoid of marginal canal; rhopalia 8–16. Suctorial funnels on the outer (dorsal) surface of the oral arms.

Family PILEMIDÆ. Radial canals 8–16, occasionally more, variously branching and anastomosing; rhopalia 8. Suctorial funnels on both outer and inner surfaces (dorsal and ventral), of the oral arms.

KEY TO THE GENERA.

EPHYRIDÆ.

1. Gonads four, simple, horse-shoe-shaped; devoid of marginal lobes or lobular pouches . . . . . Ephyra
2. Gonads 4, Lobular pouches 16; 8 ocular, 8 tentacular. Bathyluca.
3. Gonads 8, symmetrically disposed; 16 lobular pouches, ocular, Nausithoë.
4. Gonads 8, symmetrically disposed; 32 lobular pouches, 16 ocular, 16 tentacular, ... Nauphanta.
5. Gonads 8, arranged in pairs; lobular pouches 64–128, number indefinite, ... Atolla.
6. Gonads 4, two-lobed, with interradial septum . . . . . Linerges.

ULMARIDÆ.

7. Rhopalia 8; tentacles numerous, short, borne on under margin of the umbrella without the velar lappets; oral arms 4, simple but with the margins fringed with nematocysts, ... Aurelia.
8. Rhopalia 16; tentacles numerous, long, in 16 clusters on the lower margin within the velar lappets . . . . . Phacellophora.

CYANEIDÆ.

9. Rhopalia 8; tentacles very numerous, long, arranged in 8 clusters, each comprising several rows. Oral lobes four, but highly folded and fringed, ... Cyanea.

PELAGIDÆ.

10. Marginal tentacles 8; marginal lobes 16. . . . . Pelagia.
11. Marginal tentacles 24; marginal lobes 32. . . . . Chrysaora.
12. Marginal tentacles 40; immature specimens. often less in younger individuals; marginal lobes 48, ... Dactylometra.

Ephyroides rotaformis Fewkes. 1884.

Report U. S. Fish Commission, p. 949.

Among medusæ of the Gulf Stream Fewkes has described what is considered by him a new genus and species of an Ephyra-like medusa.

The generic characters given are somewhat indefinite, no mention being made as to gonads, radial pouches, sense organs, etc. The following brief notes are condensed from the above cited report:

Umbrella flat discoid, and viewed from the aboral pole 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 and abutting the line of junction of the discus centralis and zona coronalis. The marginal lappets are supported at their base by a pair of gelatinous "socles."

Distribution. —

Nausithoë punctata Koll.

Bull. Mus. Comp. Zoöl. Vol. XXXVII, p. 67.

Umbrella flat, 9–10 mm. broad. Marginal tentacles 8, stiff, about 7 mm. long. Rhopalia 8, alternating with the tentacles. Marginal lappets 16, long and flexible; gastric pouches 16, simple, and extending to the lappets. Mouth simple, quadrate, devoid of lobes or tentacles.

Distribution. — Bahama and Tortugas Islands. (Mayer.)

Nauphantopsis diomedeæ Fewkes. 1884.

Op. cit. p. 946.

From a fragmentary specimen collected by the Albatross in the Gulf Stream Fewkes has proposed the new genus and species here mentioned. The following very brief synopsis of characters are condensed from his description. Report U. S. Fish Commission 1884.

Umbrella high disk-shaped, with marginal walls probably somewhat vertical. Marginal lobes 32. Tentacles 24, rhopalia probably 8.

Distribution. — Lat. 38° N., long. 69° W.; depth 2.033 fathoms.

Atolla bairdii Fewkes. 1884.

Report U. S. Fish Commission, p. 936.

Umbrella disk-like with aboral center convex. Marginal lappets 44. Marginal tentacles 22, each supported by a gelatinous "socle." 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, between N. lat. 35–38; W. long. 72–75. One specimen from the depth of 991 fathoms, the other from surface.

Arolla verrilii, Fewkes. 1884.

Op. cit. p. 939.

Umbrella flat discoid, six to eight times broader than high.

Marginal tentacles 22 to 28, with same number of interposed rhopalia.

Marginal lappets same number as the combined number of tentacles and rhopalia.

Distribution.— Between lat. 38–40; long. 68–71; from depth of from 373 to 2,369 fathoms.

Linerges mercurius Hæckel. 1880. Fig. 4.

Op. cit. p. 950.

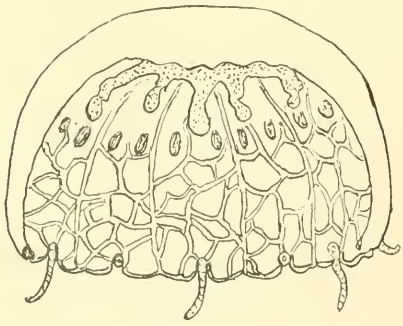

FIG 4. *Linerges mercurius* Hæckel.

Umbrella mitre-shaped, with arched crown and usually vertical sides, diameter about twice that of height. Lobular canals bowed and rounded out. Tentacles cylindrical. Gonads horseshoe-shaped. Size 12 to 16 mm. broad. 6 to 10 mm. high.

Distribution.— Bahama and Tortugas Islands (Mayer). Gulf of Mexico. Straits of Florida (Fewkes).

Bathyluca solaris Mayer. 1900.

Bull. Mus. Comp. Zool., XXXVII, p. 2.

Umbrella flat and rather thick, aboral surface dotted with batteries of nematocysts. Marginal lappets 24; tentacles 16, long and hollow. Rho-

palia 8. Manubrium cruciform, simple, devoid of arms or appendages. Gonads 4, horseshoe-shaped, beneath which on the subumbral wall are four open sub-genital pits. Stomach large and with 16 gastric pouches, eight of which extend to the ocular lobes and eight to the tentacular lobes.

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

Aurelia flavidula Per. & Les. Fig. 5.

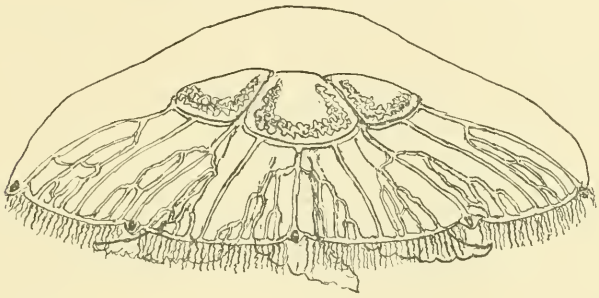

Fig. 5. *Aurelia flavidula* Per. & Les.

Umbrella flat and disk-like, somewhat arched above; margin normally eight-lobed and with eight rhopalia located in the marginal sinuses. Many variations from the normal octamerous form are found in some collections reaching as high as 25%.

Marginal tentacles numerous, short, forming a delicate fringe about the entire margin except at the rhopalial sinuses. Radial canals 16, of three sorts, per- inter- and adradial; the first two series branching and anastomosing freely, the last usually straight and simple from its origin to its junction with the marginal canal.

Manubrium cruciform in cross section, and with four long oral arms which are more or less fimbriated and the margins bearing numerous batteries of nematocysts. Gonads crescentic in form, borne upon the floor of the four gastric pouches.

Color.—Aurelia is among the duller colored of the Scyphozoa, the bell being quite transparent, but with a bluish opalescence. The gonads present a pale pinkish hue, though the ova are almost clear white as examined singly.

Distribution.—Aurelia is one of the commonest of the Atlantic coast medusæ and ranges from the coast of Maine to Florida. It is most abundant during the early summer or spring along most of the New England coast, though fairly abundant northward till late in summer. Its breeding habits seem to be somewhat continuous during most of the summer. The scyphistoma stage is a somewhat extended one, probably lasting over the entire winter season. Kept for weeks in aquaria they showed no signs of metamorphism. I have taken them in all stages of strobilization during

April and early May, when ephyræ were being discharged in great numbers. During the summer season the polyps bud and stolonize very freely, from a single scyphistoma a colony of many individuals arising within a space of ten days. Figure shows such a colony reared within a watch-glass aquarium.

Aurelia marginata L. Ag. 1862.

Cont. Nat. Hist. U. States, Vol. IV.

Umbrella flat dome-shaped to hemispherical, three times as broad as high. Mouth-arms relatively small, considerably shorter than the umbrella radius. Gonads very large.

A southern medusa, reported by Agassiz from Key West, Florida.

Callinema ornata, Verrill. 1869.

Umbrella flat and disk-shaped, rather thick and aborally rounded: the exumbrella 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 which is located a conspicuous rhopalium. Tentacles numerous and of varied size and length, arising from the under surface of the margin beneath the marginal canal. Manubrium large and pendulous and with prominent folded oral lobes, somewhat like those of Cyanea. Gonads 8, in prominent pouches within the gastric cavity. In size specimens vary from 10–18 inches in diameter. Distribution, taken at Eastport, Maine, by Verrill, and later by Fewkes, from whose account this description is condensed. *Cf. Bull. Mus. Comp. Zoöl.* Vol. XIII, No. 7.

Cyanea arctica, Per. & Les.

Umbrella flat and disk-like, with a central aboral convexity, with 8 principal lobes and 16 or more secondary lappets; ocular pouches small subtriangular, tentacular pouches two or three times as broad as the ocular.

Color. — Radial pouches purplish to brownish; oral lobes deep chocolate brown; gonads yellowish white; tentacles variably colored, yellowish, orange, purplish or brown.

Size. — From 100 to 500 mm. in diameter, though in many cases larger. A. Agassiz notes one having a size of seven feet and with tentacles more than 100 feet in length.

Distribution. — Almost the entire Northeast coast of the United States.

L. Agassiz has described two additional species, namely, *C. fulva*, and *C. versicolor*. These are of doubtful distinctness, variation in size and coloration being the chief differences clearly recognizable. Collections

made from a wide range of New England coast waters show every feature of intergradation between the several extremes and sufficiently establish the fact that at most only *C. versicolor*, of the Carolina coast, has possibly a varietal distinctness.

In this connection it is pertinent to refer to the morphological variation in the common species. *C. arctica*, which is nearly as marked as in Aurelia, including variation in the radial symmetry, number of gonads, oral arms, etc. Variation in color is sufficiently indicated in the references just given.

Pelagia cyanella Per. & Les. Fig. 6.

Fig. 6. *Pelagia cyanella* Per. & Les.

Umbrella disk-like, with rather highly arched aboral surface; marginal lobes 16, and with 8 rhopalia and 8 tentacles symmetrically and alternately disposed at the lobular sinuses. Gonads 8, forming conspicuous pouch-like masses within the gastric pouches of the tentacular radii. Manubrium large and pendulous, with four frilled oral arms approximately as long as the tentacles.

Color.— Disk translucent bluish tint, sprinkled with reddish-brown pigment spots over the entire exumbrellar surface, the more numerous near

the margin and forming crescents at the marginal lobes: manubrium similarly mottled on the outer edges of the arms, inner edges and frills delicate flesh-colored; tentacles a dull, madder-red; gonads pale purplish.

Two specimens of this medusa have been taken in the Woods Holl region recently, the last in July, 1902, some 65 miles south of Marthas Vineyard. According to Agassiz, Contr. Nat. Hist. U. S., the development of this medusa is direct, skipping the fixed polyp and strobila stages.

Dactylometra quinquicirri L. Ag.

Umbrella rather high and arched aborally much as in Pelagia, disk three to four times as broad as high. Manubrium long and pendulous with slender oral arms, which are more or less frilled as in *P. cyanell.* Rhopalia 8, marginal tentacles 40, marginal lobes 48. In arrangement five tentacles are located between each pair of rhopalia in adult specimens, though in some cases only three are present, particularly in small specimens. Gonads in four masses within the gastric pouches, and beneath each gonad in the subumbral wall is a prominent subgenital pit.

Color.— In general much like Pelagia, though less brilliant, the various hues being paler and somewhat more delicate. Exumbrella delicate bluish, mottled with reddish brown fading into yellowish; tentacles reddish to orange; oral arms pale pinkish with bluish tint variously blended, making this medusa one of the most beautiful among the Pelagidæ.

Distribution.— Is less extended than that of Aurelia or Cyanea. It is quite common in Buzzard's Bay, Vineyard Sound, Nantucket.

Like several of the preceding Dactylometra exhibits considerable variation. According to Mayer, *Bull. Mus. Comp. Zool.* Vol. XXXII, No. 7, the tertiary tentacles arise on either side of the ocular lappets. In several specimens examined during the past summer this was not found to be the case. On the contrary they sprang in every case examined between the primary and secondary sets. Again according to the same observer the tertiary tentacles only appear when the medusæ approximate maturity, and after attaining a size of 130 mm. in diameter. On the contrary I found them well developed in specimens having a size of only 40 mm. and where no gonads were developed. There was also noted the same variation in the marginal lobes and other organs which have been noted in connection with species previously noted.

Dactylometra lactea L. Ag. 1862.

This is a southern medusa, no record of its occurrence north of Florida having come to my notice. In general aspects it is much like the preceding species, though of smaller size. Its color is milk-white with a purplish iridescence, and with yellowish dots over the exumbrella. It has been reported from the Bahama and Tortugas Islands, from the Gulf of Mexico, and from the coast of South America.

Cassiopea frondosa Lamarck. 1817.
Polyclonia frondosa L. Ag. *Cont. Nat. Hist. U. S.* 1862.

Umbrella disk-like, arched, about three times as broad as high, with 12 distinct, broad, ocular radial stripes. Margin with 12 broad velar lobes. Manubrium approximately as long as the bell-radius, very stout, pinnæ of mouth arms variously parted and distally plumose or frondose.

Color.— Bluish to olive-green; arms greenish or yellowish, with whitish terminal filaments.

Distribution.— Coast of Florida, Tortugas Islands, etc.

Stomolophus meleagris L. Ag. 1862.
Contr. Nat. Hist. U. S.

Umbrella high, arched, more than hemispherical, with 8 deep ocular incisions, and with 96 marginal lappets.

Color.— Whitish-blue, the margins becoming yellowish-brown, margin lappets dark-brown.

Size.— About five inches broad by about three inches high.

Distribution.— Southern Atlantic coast, Savannah, Charleston, etc.

Syracuse University,
The Zoölogical Laboratory,
Feb. 10, 1903.