Keys to Marine Invertebrates of the Woods Hole Region
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PHYLUM CNIDARIA

Introduction and Class Hydrozoa

The phylum Cnidaria is a large and complex group characterized by the production of nematocysts, by a tubular or cup-like body of two layers (ectoderm and endo- or gastroderm) separated by a mesogloeal layer, with the mouth as the sole opening to the digestive cavity, and by enormous diversity of form and life history. The best general account of the group is in Hyman's "The Invertebrates", Vol. 1. This phylum is often called the Coelenterata, but it now seems best to give up the latter term since it is used in some texts to include both Cnidaria and Ctenophora. The latter group is generally considered quite distinct, and is treated as a separate phylum in Chapter V of this manual.

The present chapter deals with the Class Hydrozoa, characterized in many, but not all, of its members by the development of both hydroid (polypoid) and medusoid stages or forms in their life cycles. This class is the most numerous and diverse of the cnidarian classes in the Woods Hole region.

The two other cnidarian classes are the Scyphozoa (Chapter III), most of whose members are large medusae, but which also includes an order (Stauromedusae) of attached forms, and the Anthozoa (Chapter IV). The latter is the largest of the cnidarian classes, but its members are mainly tropical, including corals and a host of related forms. In the Woods Hole region, sea anemones make up the bulk of the representation of anthozoans.

THE SESSILE HYDROZOA

The representation of sessile Hydrozoa in the waters of the Woods Hole Region is extremely good. But, unfortunately, the class Hydrozoa, and in particular the order Hydroida, has been plagued with a curious and troublesome double taxonomy. Students of the benthic fauna have developed one system of families, genera, and species based upon the polypoid or "hydroid" stages, while workers on the planktonic community have tended to develop a system based upon the medusae. Since in numerous instances polyp and medusa of a single species have received different generic and specific names, and since in many cases the life histories are not completely known, the problem of synonymizing these separate stages has been difficult and will continue so. Furthermore, when the attempt is made to bring polyp and medusa together under one name, the rule of priority may require that a less well known prior name replace a familiar later name. This does not bother systematists greatly, but is frustrating and exasperating to the non-specialist. The latter may take comfort, however, in the fact that progress toward a single integrated taxonomy is being made. An excellent example of enlightened systematic work based upon life history studies is to be seen in F. S. Russell's "The Medusae of the British Isles" (1953).

GLOSSARY OF SESSILE HYDROZOA

Adnate: One side of structure growing attached, as the hydrothecae of Sertularia.
Annulated: Possessing a ringed appearance.
Athecate: The hydranth is not protected by a chitinous cup or hydrotheca; gymnoblastic hydroids are athecate.
Blastostyle: Modified zooid (gonozooid) from which the medusoids are budded; may be protected by a surrounding theca (gonotheca or gonangium).
Calyptoblastea: The order of thecate hydroids, having each hydranth protected by a hydrotheca.
Capitate tentacle: Short tentacle with a very distinct terminal knob studded with nematocysts, as in Zanclea or Pennaria.

Colony: The thecate hydroid colony is always a polymorphic system, consisting of at least the gastrozooids (hydranths) or food-securing individuals, and the gonozooids or asexual individuals which produce by budding the sexual free or attached medusoids. The various zooids form a unit arising from a single planula larva and connected by stems and branches; rootlike structures attach the colony to the substrate. In most athecate hydroids the colony is not polymorphic, since all the hydranths alike produce medusa-buds, or else the medusa-buds are produced on certain areas of stolon or stem.

Dactylozooid: A mouthless polyp armed with nematocysts, and serving for protection or to aid in food catching, as in Podocoryne or Hydractinia.

Distal tentacles: The set of tentacles farthest from the stalk of gymnoblasts that possess two or more sets of tentacles.

Fascicled: Hydroids in which several stems of the colony are closely bound together into a bundle or fascicle, as in some species of Eudendrium

Filiform tentacle: Long threadlike tentacle, over which the nematocysts are usually evenly distributed.

Gastrozooid: A nutritive polyp; a hydranth.

Gonangium: The entire asexual reproducing individual of the hydroid colony, in calyptoblasteans composed of the protecting gonotheca, the blastostyle, and the medusoid forms which bud from the blastostyle.

Gonophores: Sexual individuals, which in calyptoblasteans arise asexually by budding from the blastostyle, being either free medusae or reduced to sporosacs; in gymnoblasteans they may arise from the stolons, hydranths, pedicels, or stems. However, Fraser calls the blastostyle, which bears the sexual zooids, a gonophore.

Gonotheca: The peridermal protective structure surrounding the blastostyle and gonophores in calyptoblasteans.

Gonozooid: Another term applied to any individual of the colony which buds off sexual individuals such as free medusae or the various degrees of reduced, attached sporosacs.

Gymnoblastea: The order of athecate hydroids, lacking protective thecae about the hydranths.

Hydranth: The hydranth (gastrozooid) is the feeding member of the colony, having a terminal mouth surrounded by tentacles; may be either sessile or stalked.

Hydrocaulus: The hydrocaulus is the main stem of that type of colony in which the budding of new hydranths can take place on the stalks of the older hydranths. This gives rise to erect, branched colonies. The term hydrocaulus is sometimes used to refer to the type of colony developed in the above way, in contrast to rhizocaulus, in which the new hydranths are developed from the stolons only.

Hydrocladium (-ia): Lateral branch(es) growing from the hydrocaulus.

Hydrorhiza: The rootlike structure, which may be more or less simple or a mass of tangled tubes, attaching the colony to substrate.

Hydrotheca: The peridermal, cuplike structure that surrounds the hydranth, and into which the hydranth may be drawn when disturbed.

Medusoid form: Inclusive term applied to the various types of sexual zooids (gonophores); it includes (1) free medusae with velum, tentacles, radial canals, and manubrium (Bougainvillia, Podocoryne, Obelia); (2) gonophores (eumedusoid) that resemble developing medusae but have no tentacles or other marginal structures, and which in some forms break away but soon die, since they lack a mouth; however, in most cases they remain attached (Tubularia); (3) gonophores (cryptomedusoid) that are still further reduced, lacking radial canals and other obvious medusoid structures (Clava); and (4) the most reduced type, in which the sex cells ripen directly on the sides of the blastostyle (Sertularia). Types 2, 3, and 4 are often called sporosacs. The condition in Hydra is not unlike that in Sertularia, but there is no differentiated blastostyle.

Nematophore: The small, highly modified zooid (dactylozooid) of protective function which is characteristic of the family Plumulariidae (e.g. Schizotricha)

Operculum: A lid closing the hydrotheca or gonotheca when the zooid is drawn in (Calyptoblastea).
Pedicel: The stalk that bears a hydrotheca.
Proximal tentacles: The circlet of tentacles nearer the stalk in gymnoblasts that have two or more whorls of tentacles.
Rhizocaulus: See discussion under hydrocaulus.
Sessile: Hydrotheca or other structure attached directly to stem or branch of colony; lacking a pedicel (Schizotricha, Sertularia).
Sporosacs: Reduced gonophores that do not develop into free medusae, but remain attached and produce the gametes (Clava, Hydractinia).
Stolons: Tubular or rootlike processes that extend over the substrate; the stolons are a part of the hydrorhizal system.
Thecate: Hydroids that possess a protective, cuplike hydrotheca which surrounds the hydranth, as in the Calyptoblastea.
Zooid: A general term applied to any of the several types of individuals or "persons" of the hydroid colony.

KEY TO THE MORE COMMON HYDROIDS

Modified after key and check list used by Invertebrate Zoology Course from 1942 through 1946. The assistance of Dr. Sears Crowell, Dr. Frank Gwilliam, Dr. Kay Petersen, and several others in this 1964 revision is gratefully acknowledged. Figure references in this key are to Plate 2.

1. Hydranth naked, lacking a protective cup (hydrotheca) into which it can be retracted (but perisarc may extend to base of tentacles in Bougainvillia)(fig. 1) . . . . . Suborder GYMNOBLASTEA 2
1. Hydranth with a protective hydrotheca into which it can be withdrawn (but cup much reduced in Halecium)(figs. 18, 19) . . . . . Suborder CALYPTOBLASTEA 20

2. Hydranths with filiform tentacles only 3
2. Hydranths with distinctly capitate tentacles only 19
2. Hydranths with both filiform and capitate tentacles (distal scattered capitate, basal filiform whorls); bushy colony, dark perisarc, pink hydranths (fig. 2) . . . . . Pennaria tiarella

3. Filiform tentacles scattered on hydranth (Clavidae) 4
3. Filiform tentacles in distinct whorls 6

4. Very small (2 cm or less) pinkish growths, sparsely branched or with slender hydranths arising from a stolon. Free medusae arise singly on short pedicels with perisarc near bases of hydranths . . . . . Turritopsis nutricula*
4. Gonophores (reduced medusoids or sporosacs) in clusters below tentacles or as ovoid bodies on branching stems 5

5. In very low salinity or fresh water; colony branching, perisarc brownish; gonophores ovoid, borne on stem below hydranths (fig. 11) . . . . . Cordylophora lacustris
5. In marine or nearly marine salinities, pink hydranths in clusters arising from basal stolons; clustered sporosacs below tentacles . . . . . Clava leptostyla
5. (Note: a rare species, the large (2-3 cm) solitary Acaulis primarius also has scattered filiform tentacles and sporosacs)

*A form answering this general description but with sporosacs instead of free medusae was taken in 1963, but is as yet unidentified.

6. Hydranths with a single whorl of filiform tentacles 7
6. Hydranths large and showy, with two whorls of filiform tentacles, the proximal longer than distal 15
6. (Note: the minute pelagic hydroid Margelopsis gibbesi consists of a single swimming hydranth , with 2 subequal whorls of tentacles, and bearing medusa-buds).

7. Colonies arising from a basal mat of stolons, and without perisarc around stems of zooids (Hydractiniidae) 8
7. Colonies erect or branching, with perisarc extending out to bases of hydranths, or even to bases of tentacles 10

8. Hydrorhizal spines rough; gonophores are sporosacs, borne on individuals (gonozooids) with reduced tentacles; colonies common on shells occupied by hermit crabs, but also on rocks, piles, etc; color varies from white to salmon (fig. 17) . . . . . Hydractinia echinata
8. Hydrorhizal spines smooth; gonophores are free medusae, borne on gonozooids with well developed tentacles (to see released medusae, let colony stand overnight in a small container of cool sea water) 9

9. Medusae with 8 well developed tentacles and unripe when liberated (fig. 15). Colony contains "spiral zooids" (tentacle-less defensive individuals; look for these within the aperture of the snail shell, close to the hermit crab occupant, fig. 16); color white to pink; generally on shells of Nassarius trivittatus occupied by hermit crabs. . . . . Podocoryne carnea
9. Medusae with ripe gonads but rudimentary tentacles at time of release. No spiral zooids in colony. Forms a sparse colony, generally on shells of living Nassarius obsoletus . . . . . Stylactis hooperi

10. Perisarc ends below hydranths; hydranths with trumpet shaped hypostomes; gonophores are sporosacs (fig. 12) . . . . . Eudendrium 11
10. Perisarc continued as a thin expansion over base of hydranth up to tentacles; hypostome conical; free medusae liberated; at time of liberation medusae show 4 pairs of tentacles (fig. 1) . . . . . Bougainvillia 14

11. Main stem fascicled (fig. 12), colonies branched, bushy and fairly large 12
11. Main stems not fascicled; colonies small and sparsely branched 13

12. Tentacles of gonozooids (hydranths bearing gonophores) showing little or no reduction; male gonophores 2- or 3-chambered . . . . . Eudendrium ramosum
12. Gonozooids bearing gonophores tend (at least in some to be reduced ("aborted") (fig. 12); male gonophores 4- or 5-chambered . . . . . Eudendrium carneum

Plate 2

HYDROZOA

Sources: Fraser (F), from living specimens (S). Scale bars all 1 mm, approximately. Somewhat simplified.

Fig. 1. Bougainvillia carolinensis, with medusae; note perisarc (unstippled) up to tentacles (S).

2. Pennaria tiarella, hydranth with gonophores (medusae with rudimentary tentacles (S).

3. Clytia edwardsi, hydrotheca and gonangium (F).

4. Clytia johnstoni, gonangium (F).

5. Schizotricha tenella, detail of lateral branchlet with hydrotheca and 4 nematophores (S). To scale of fig. 10.

6. Zanclea costata, hydranth (S).

7. Campanularia flexuosa, short internodes, immature and ripe gonangia (S).

8. Campanularia calceolifera, hydranth (tentacles schematic) and male gonangium, long internodes (S).

9. Same, female gonangium.

10. Sertularia pumila, opposite, adnate, hydrothecae (S).

11. Cordylophora lacustris, with young gonangium (S).

12. Eudendrium carneum, fascicled stem, gonophores on gonozooid with "aborted" tentacles (S).

13. Obelia sp., a "bottle-necked" gonangium (F).

14. Calycella syringa, hydrotheca with operculum (S).

15. Liberated medusa of Podocoryne carnea (S).

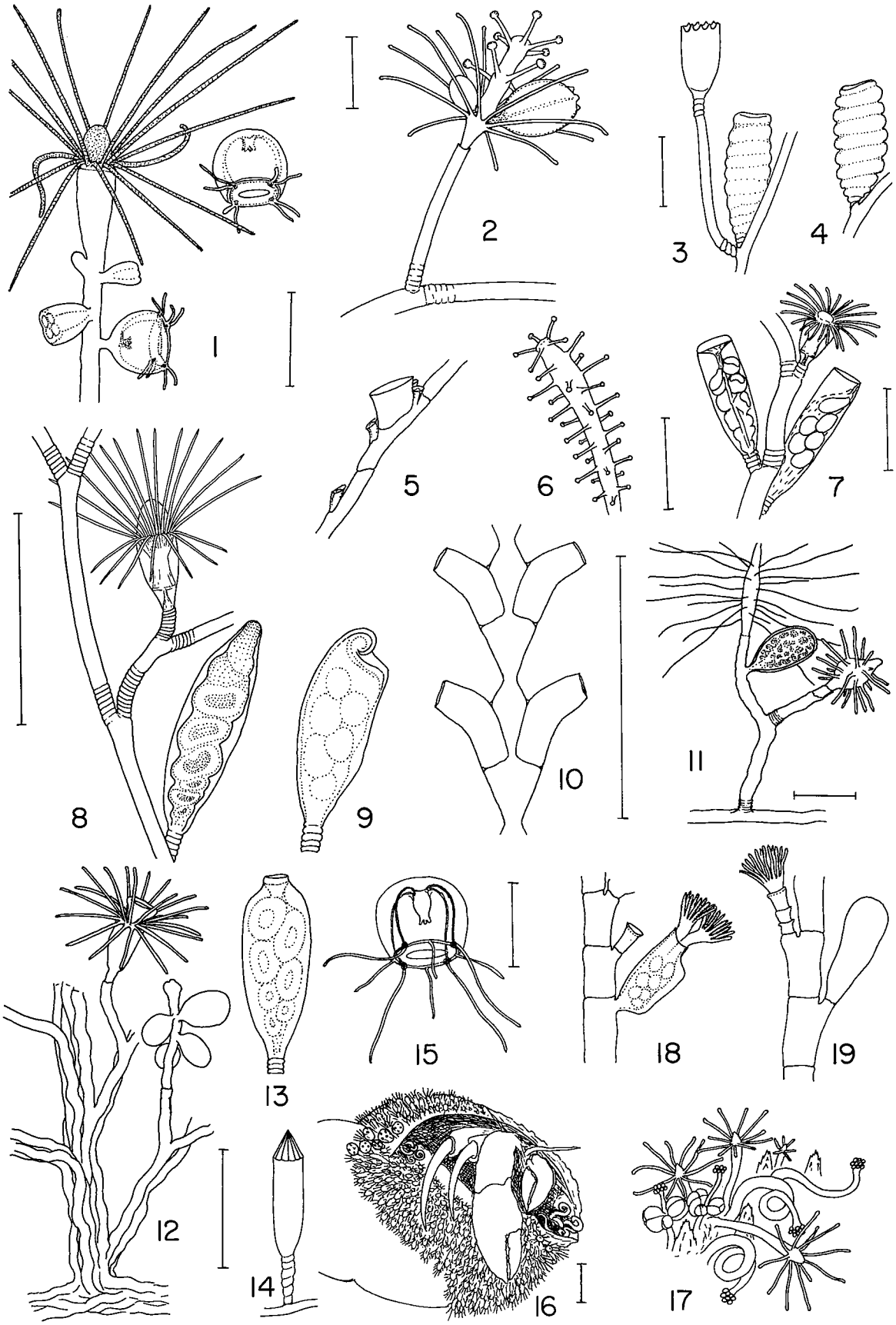
16. Part of colony of Podocoryne on shell used by hermit crab. Note medusa-buds at left, and spiral zooids at angles of shell aperture (those at right slightly enlarged) (S).

17. Individuals of Hydractinia echinata, among roughened spines. Note that neither the reduced tentacles of dactylozooids and gonozooids nor the feeding tentacles are classed as capitate (S).

18. Halecium halecinium, female gonangium bearing pair of hydranths (F).

19. Same, with gastrozooid and male gonangium (F).

Plate 2



13. Tentacles of gonozooids not completely reduced; male gonophores 2- or 3-chambered; colony small (1/2 inch), whitish . . . . . Eudendrium album
13. Male gonophores borne on fully reduced zooids; colony pink, 1/2 to 1 inch high . . . . . Eudendrium tenue

14. Stout bushy growths; stems fascicled; greenish perisarc, reddish hydranths; tentacles in extension long, tapering, and seeming to point in all directions; 2-8 inches high; medusae budded singly from branches (fig. 1). This is the Bougainvillia hydroid generally collected . . . . . Bougainvillia carolinensis
14. Delicate sparse growth with a single whorl of filiform tentacles (Russell). This species is well known by its medusa, but the status of the hydroid at Woods Hole is not clear . . . . . Bougainvillia superciliaris

15. Zooids solitary, not commonly found; liberate free medusae 16
15. Zooids generally in branching form or clustered; medusa-buds not released 17

16. Zooid with perisarc very weak or lacking; large (1-4 inches) . . . . . Corymorpha pendula
16. Zooid with obvious brown perisarc; single or slightly branched; about 24 short distal (oral) tentacles, 30 longer proximal tentacles; easily mistaken for Tubularia until medusae seen . . . . . Ectopleura dumortieri

17. Colony branching; stems extensively annulated; hydranths bright pink; colonies not large (1 to 1.5 inches) . . . . . Tubularia larynx
17. Colonies are clusters of long stems, unbranched or sparsely branched; stem annulated only at intervals 18

18. Grows as a dense cluster of many sparsely or unbranched stems; hydranths rose colored; 3-5 inches high . . . . . Tubularia crocea
18. Forms clusters of unbranched stems up to 7 inches tall; hydranths scarlet; up to an inch across tentacles when expanded; generally not found alive in summer . . . . . Tubularia couthouyi

19. Colonies of very small, elongated hydranths with perisarc visible only at base; numerous capitate tentacles scattered over hydranths (fig. 6), with an apical whorl of 4-6 tentacles; color pink; height about 1 cm; free medusae budded from hydranths, below tentacles . . . . . Zanclea costata
19. Irregularly branching colonies, with shorter bodied hydranths bearing about 16 capitate tentacles; free medusae produced from hydranth body close to tentacles . . . . . Sarsia tubulosa

20. Hydrothecae on pedicels or wineglass-like stems (fig. 3, 8) 21
20. Hydrothecae lacking stems ("sessile", "adnate"), closely appressed to stem or branch (fig. 5, 10) 31

21. Hydrotheca, as expected, large enough to enclose hydranth 22

21. Hydrotheca aberrant in being very shallow saucer or funnel-shaped, usually marked by circlet of bright beadlike dots, not covering hydranths (fig. 19); stem fascicled; fanlike branching colony up to 10 inches high; female gonangia in rows on upper side of branches, each surmounted by a pair of hydranths (fig. 18) . . . . . Halecium halecinum

22. Hydrotheca tubular, and provided with a conical operculum of toothlike flaps (fig. 14); family Campanulinidae, a difficult group of very small forms, of which the most common local form may be Calycella syringa, a tiny ($1/8$ inch) species found on other hydroids, bryozoans, etc.

22. Hydrotheca bell or wine-glass shaped, with inner diaphragm or annular thickening at base of hydranth, but lacking operculum (closing device): A very numerous family . . . . . Campanulariidae 23

Cautionary note: The only basic way to define the genera of Campanulariidae is by their sexual stages. "It appears to be impossible to construct generic characters for the Campanulariidae on the basis of the trophosome. The classification of the group is unnatural and unsatisfactory in the extreme, but this is not the place to attempt its rectification". (Nutting, 1901, p. 344).

a. Produce free medusae having 4-8 tentacles at time of release . . . . . Clytia (=Phialidium)
b. Produce tiny free medusae with 12-16 tentacles at time of release . . . . . Obelia
c. Medusoids are very reduced and remain in gonotheca; hydrotheca with annular thickening at base . . . . . Campanularia
d. Medusoids are extruded from gonotheca in a sac (acrocyst) but are not released; hydrotheca with thin diaphragm at base of hydranth . . . . . Gonothyraea (=Laomedea)

23. Colonies consisting of unbranched or not regularly branched growths arising from a more or less extensive hydrorhizal system; hydrothecal margins toothed; gonangia borne on hydrorhiza and ringed (annulated), Japanese lantern fashion (figs. 3, 4); release 4-8 tentacled medusae . . . . . Clytia 24

23. Colonies regularly branching (at least in terminal twigs); gonangia not ringed 25

24. Colony of unbranched (or occasionally branched) white growths arising from extensive rootstock; height about $1/4$ inch; hydrothecal rim with ca. 16 rounded teeth; gonangia deeply ringed (fig. 4) . . . . . Clytia johnstoni

24. Colony white, profusely branched but without clear main stem; height about 1 inch; hydrothecal rim with 12-14 sharp teeth; gonangia irregularly ringed (fig. 3) . . . . . Clytia edwardsi

25. Gonangia liberate small medusae with 12-16 tentacles; several species, of which only 3 are in key . . . . . Obelia 26
25. Gonangia contain the reduced medusoids (sporosacs) which are never released; only 4 of the several species are in key . . . . . Campanularia 28
25. Gonangia extrude the reduced medusoids inside a sac (acrocyst) . . . . . Gonothyraea (=Laomedea) loveni

Note: Of the campanulariid genera occurring at Woods Hole, Laomedea and Obelia can be distinguished by the possession of a thin diaphragm in the hydrotheca at the base of the hydranth. In the others (Clytia and Campanularia) this basal structure has the form of a ring shaped thickening.

26. Main stem simple; hydrothecae smooth, shallow, toothless; gonangia with constricted opening, "bottle necked" (fig. 13) 27
26. Main stem fascicled; hydrothecae deep, longitudinally ribbed, with 14-20 double-pointed teeth on rim; gonangia with opening not constricted; colony may exceed 30 inches . . . . . Obelia bicuspidata

27. Colony of stiff, short (1 inch or less) unbranched, zigzag (geniculate) stems with short, stout internodes and hydranths set alternately, in one plane; gonangia about 5 times length of hydrothecae . . . . . Obelia geniculata
27. Colony much branched, with long slender internodes; gonangia about 3 times length of hydrothecae; height of colony 6-8 inches . . . . . Obelia commissuralis

28. Main stem with many branches, which rebranch; gonothecae with very small apertures; colony in absence of gonangia closely resembles Obelia commissuralis; height about 6 inches . . . . . Campanularia amphora
28. Stem bearing only pedicels, or a few branches 29

29. Stem brownish and stout, with short internodes (4-5 times as long as thick, fig. 7); height about 1.5 inches; gonothecae of tubular form with apertures not constricted . . . . . Campanularia flexuosa
29. Main stems slender with longish internodes (7-8 times as long as thick, fig. 8); gonangia with specialized apertures 30

30. Stem strongly zigzag (geniculate); height about $^3/_4$ inch; gonangia irregularly wrinkled, bottle-necked . . . . . Campanularia angulata
30. Stem flexuose (weakly zigzag); height up to 1.5 inch; female gonangia with a distinctive folded-over tip (fig. 9); male gonangia bluntly fusiform and irregularly bulging (fig. 8) . . . . . Campanularia calceolifera

31. Hydrothecae adnate on one side only of stem or branches (family Plumulariidae); the species commonly taken has a white, delicate feathery colony, 1-3 inches high; tiny special zooids (nematophores) form small spout-like extensions set along branches between hydrothecae (fig. 5); gonangia curved, set among branches . . . . . Schizotricha tenella
31. Hydrothecae arranged on both sides of stem or branches (Sertulariidae) 32

32. Hydrothecae set as opposite pairs (genus Sertularia); in the commonest local species, the members of each pair of hydrothecae not in contact (fig. 10); gonotheca bottle-necked, not annulated; dark brown, stiff growths, usually on seaweeds; 0.5-1.5 inches high . . . . . Sertularia pumila

32. Hydrothecae set in alternating fashion 33

33. Pinnately-branching brown colony, up to 12 inches tall; hydrothecae with tubular necks, smooth-rimmed . . . . . Abietinaria abietina

33. Colony dichotomously branching; a handsome bushy form ("squirrel-tail hydroid") with silvery branches, up to 12 inches tall; hydrothecal rims elevated into two opposite teeth . . . . . Thuiaria argentea

ANNOTATED LIST OF HYDROIDS IN THIS KEY

In view of the large number of species alleged by Nutting and Fraser for this region, it would be premature to attempt a complete list. The experimentalist should be aware that species not on this list may be expected to turn up, that a given genus, e.g. Tubularia, might be represented in Supply Department collections by different species at different seasons, and that some species and even genera in certain families, notably Campanulariidae, are impossible to identify without sexually mature ("fruiting") material.

Abietinaria abietina (Linnaeus, 1758). Dredged.

Acaulis primarius Stimpson, 1854. Rare, in dredgings north of Cape.

Bougainvillia carolinensis (McCrady, 1858). On rocks, pilings, algae; common.

Bougainvillia superciliaris (L. Agassiz, 1849). Status unclear. According to Russell (1953), hydroid is tiny, with ca. 6 filiform tentacles in a whorl, hydranths arising singly from stolon. Nutting (1901), following Agassiz, described hydroid as up to 2 inches high with 15-20 tentacles, but did not see it himself. If this species occurs here, it may occur chiefly as the medusa.

Calycella syringa (Linnaeus, 1767). Common on other hydroids, bryozoans, algae, but inconspicuous because of small size.

Clava leptostyla L. Agassiz, 1862. Most commonly in small clusters on Ascophyllum nodosum in low intertidal; of rather local, sporadic occurrence.

Campanularia amphora (L. Agassiz, 1862). Common in shallow water. Easily confused with Obelia commissuralis.

Campanularia angulata (Hincks, 1861). Reported on Zostera.

Campanularia calceolifera Hincks, 1871. Common on Mytilus, seaweeds, and pilings. The unique folded-over tip of female gonangium makes identification certain.

Campanularia flexuosa (Alder, 1856). On pilings, rocks, algae. Very common.

Clytia edwardsi (Nutting, 1901). On pilings, etc.

Clytia johnstoni (Alder, 1857). (=Clytia bicophora Nutting, 1901). The medusae produced by the hydroid genus Clytia are known as Phialidium and Russell refers Clytia johnstoni in British waters to Phialidium hemisphericum Linnaeus. The disposition of the local Clytia johnstoni should await proper study. The hydroid is found locally on intertidal brown algae and on rocks.

Note: Clytia differs from Campanularia essentially only in the degree of development of its medusa. It is possible that future practice will be to include Clytia within the genus Campanularia.

Cordylophora lacustris Allman, 1844. An important experimental animal and the only typical colonial hydroid found in fresh water. On pilings, under floats, and in culverts in ponds and passages in areas of low salinity.

Corynitis agassizi, see Zanclea costata.

Corymorpha pendula L. Agassiz, 1862. Dredged quite rarely, from soft bottoms.

Ectopleura dumortieri (Van Beneden, 1844). (=Ectopleura ochracea L. Agassiz, 1862). This is generally seen as the medusa. The hydroid is a solitary form resembling Tubularia, but producing free-swimming medusae.

Eudendrium album Nutting, 1898. Small, inconspicuous; on rocks, piles, algae.

Eudendrium carneum Clarke, 1882. A conspicuous species, with red hydranths and gonophores. This and the next species are common laboratory examples of hydroids with greatly reduced medusoids. On piles and algae.

Eudendrium ramosum Linnaeus, 1758. Also conspicuous. One of the commonest shallow water forms on rocks and piles, and in deeper water.

Eudendrium tenue A. Agassiz, 1865. Shallow water, on piles.

Gonothyraea (=Laomedea) loveni (Allman, 1859). On shells, stones, pilings, floats, in shallow water.

Halecium halecinum (Linnaeus, 1767). Common in shallow water on shells, stones, etc.

Hydractinia echinata (Fleming, 1828). Very common on shells of Littorina (see Crowell, 1945) and other snails occupied by hermit crabs, and also on rocks and piles. Seems quite variable, both in roughness of spines and in color, which varies from pure white to a rich salmon.

Laomedea, see Gonothyraea.

Obelia bicuspidata Clark, 1876. As with other campanulariids, generic identification of Obelia may be impossible without mature material. On Zostera, piles, and in deeper water.

Obelia commissuralis McCrady, 1858. Widespread in shallow water on various substrates.

Obelia geniculata (Linnaeus, 1758). Grows profusely on floats, piles, and Laminaria; on the latter the extensive stolon system is conspicuous.

Pennaria tiarella (Ayres, 1854). A common and conspicuous species in clear shallow water under rock ledges, etc. A favorite laboratory animal. Bears reduced medusae with 4 rudiments of tentacles. Medusae may be released, or may discharge gametes while still attached. In laboratory this is usually seen between 7 and 9 P.M.

Podocoryne carnea Sars, 1846. Generally collected on shells of Nassarius trivittatus used by hermit crabs (see Crowell, 1945), although not confined to this shell. Color pink to pure white. An important experimental animal in recent years. Since Podocoryne differs from Hydractinia mainly in the development of a free medusae, it is possible that future practice will be to include both in the genus Hydractinia.

Sarsia tubulosa (Sars, 1835). This species is probably not to be found at Woods Hole in summer. Sumner et al. cite records of its abundance in March and April, with the medusae most common in April and May. The hydroid has not been included in the keys and lists of the Invertebrate Zoology Course for at least 25 years. The free medusa is one of a difficult group and Russell includes Syncoryne mirabilis (L. Agassiz, 1849) as a synonym of Sarsia tubulosa.

Schizotricha tenella (Verrill, 1874). The delicate feathery form is easily recognized. Common on pilings.

Sertularia pumila Linnaeus, 1758. Common on intertidal brown algae in protected waters.

Stylactis hooperi Sigerfoos, 1899. Occurs on shells of living mud snails (Nassarius obsoletus). Since Stylactis, like Podocoryne, differs from Hydractinia mainly in the degree of development of its medusa, it is possible that future practice will be to include all three within the genus Hydractinia.

Syncoryne mirabilis, see Sarsia tubulosa.

Thuiaria argentea (Linnaeus, 1758). Dredged, but usually dead and empty when taken in summer.

Tubularia: A difficult genus, but very important in experimental work. Specific identification is often inadequate, an unfortunate situation when results of different authors have to be compared. Experimentalists using Tubularia would do well to record date, water temperature, and place of collection of laboratory material. Nutting lists five species; this key, three:

Tubularia couthouyi L. Agassiz, 1862. On sandy or stony bottom. This large and beautiful species has generally died off by summer.

Tubularia crocea (L. Agassiz, 1862). Subtidal, on pilings, sometimes in brackish water. The same species is thought to occur in the Oakland Estuary (San Francisco Bay). This is the species most used experimentally.

Tubularia larynx Ellis and Solander, 1786. On rocks, piles, and algae.

Turritopsis nutricula (McCrady, 1856). This is generally seen as the medusa. The hydroids are small and inconspicuous.

Zanclea costata Gegenbaur, 1856. The work of Russell makes it seem probable that the hydroid "Corynitis agassizi" and the medusa Gemmaria gemmosa as recorded from Woods Hole should be referred to Zanclea costata. This is found abundantly on the red bryozoan nodules obtained by dredging.

HYDROMEDUSAE

Numerous small medusae occur seasonally in the plankton of Woods Hole and adjacent waters, but their identification is a matter of considerable difficulty. One may identify a good many simply by reference to the illustrations in Hargitt (1905), but there remain problems of synonymy because life histories of medusae were not well worked out at that time, and indeed are still very incompletely known. Reference should be made to Mayer's "Medusae of the World" (1910). A useful guide to the generic identification is the "Pictorial key to species of British Medusae", pp. 42-45 in the excellent volume by Russell (1953). In the present manual, no key has been attempted.

1. Order HYDROIDA (includes most of the local hydromedusans):

   a. Suborder ANTHOMEDUSAE: These are the medusae of the gymnoblastic or athecate hydroids, and are characterized by a deep, bell shaped form, lacking statocysts, and with the gonads born on the manubrium. The medusae of Bougainvillia and Podocoryne are typical examples (Plate 2, figs. 1 and 15).
   b. Suborder LEPTOMEDUSAE: These are the medusae of such of the calyptoblastic or thecate hydroids as produce medusae (most do not). They are of flattened form with gonads born on the radial canals, and ectodermal statocysts. Obelia and Phialidium (=Clytia) are examples.
   c. Suborder LIMNOMEDUSAE: This group is not recognized as such by Hyman (1940) and is given ordinal rank by Russell (1953). It includes the well known Craspedacusta sowerbii, of sporadic occurrence in fresh waters; its polyp stage is the minute, tentacle-less "Microhydra". Another very famous representative, and the subject of much experimental work at Woods Hole, is Gonionemus vertens A. Agassiz, 1862. This was once very abundant in the Eel Pond, but it became very scarce in the Woods Hole region with the dying off of the eel grass (Zostera) about 1930, and, despite the general return of the grass, is now of rather sporadic and unpredictable occurrence. In some summers thousands may be seen in shallow, protected bays on Martha's Vineyard; in other years very few may be taken. Most of the Woods Hole papers on this species refer to it as Gonionemus murbachi, which Kramp (1959) regards as a synonym of G. vertens.

2. Order TRACHYLINA (Suborders TRACHYMEDUSAE and NARCOMEDUSAE): Trachyline medusae are generally oceanic and seldom taken in the inshore waters near Woods Hole. They lack a true hydroid stage, or may have a parasitic larval development; adults may have a distinctive scalloped bell margin, or tentacles inserted above the margin. Russell's pictorial key may be helpful if members of this group are encountered.

The last two groups to be mentioned are commonly called "siphonophores". These (sensu lato) are floating or swimming colonies containing both polypoid and medusoid individuals. The recent trend in classification is to split this

group into two orders:

3. Order CHONDROPHORA, allied to the tubularian hydroids, and represented in this region only by rare examples of the "purple sailor", Velella velella (Linnaeus), which has an oval float with diagonal vertical sail, and the somewhat similar Porpita porpita (Linnaeus), which lacks a sail.

4. Order SIPHONOPHORA proper, represented locally by the "Portuguese man-of-war", Physalia physalia (Linnaeus), which is well known and easily recognized by its large purple and rose irridescent float. Physalia may be quite common in Vineyard Sound in certain summers, especially after long periods of southeast storms. However, experimentalists are advised that in occasional summers it is virtually not to be found. The sting is severe and, although they may be picked up by the float, they should be handled with caution and avoided by swimmers. Other siphonophores are of rare or occasional occurrence.

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