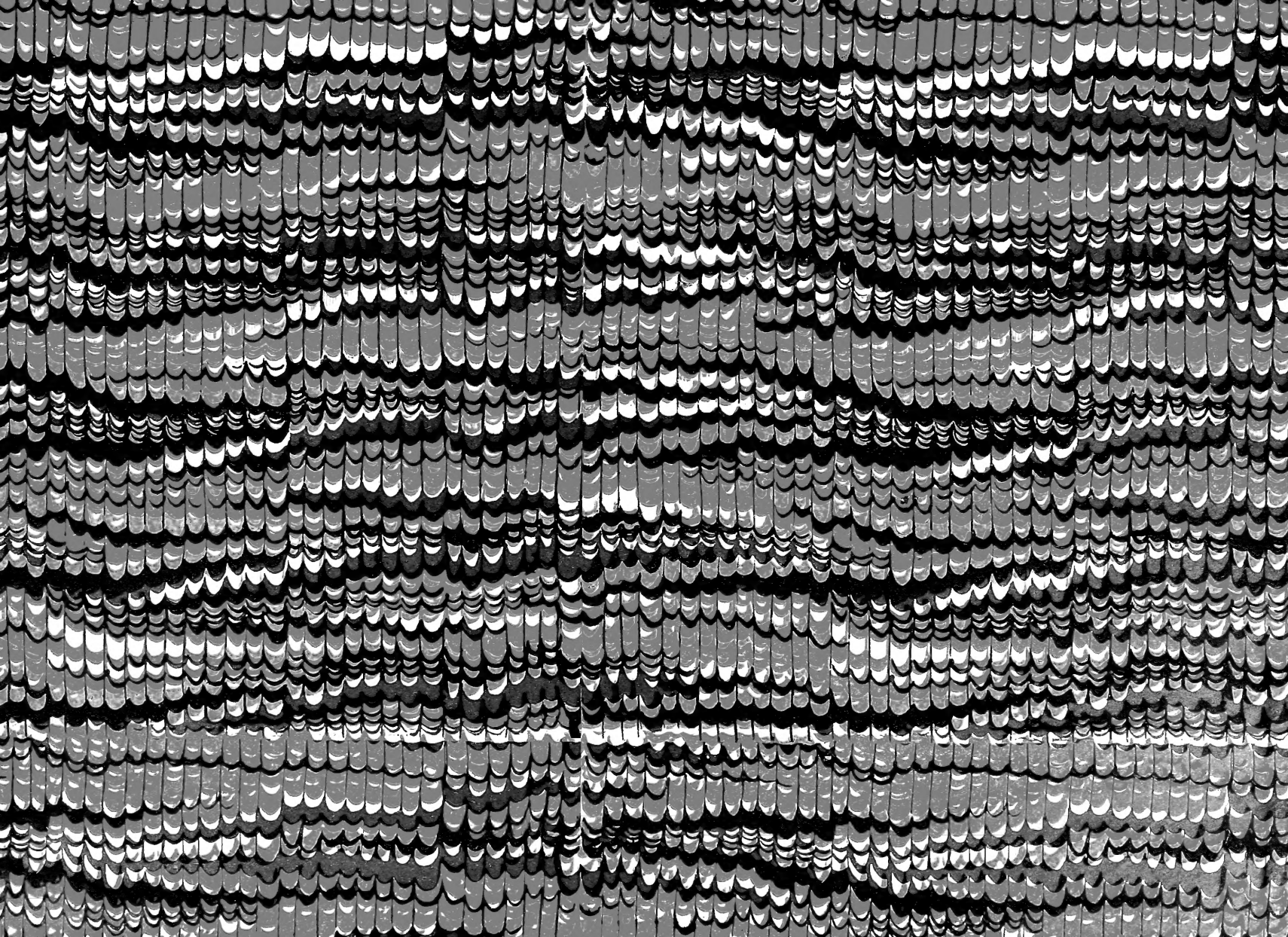

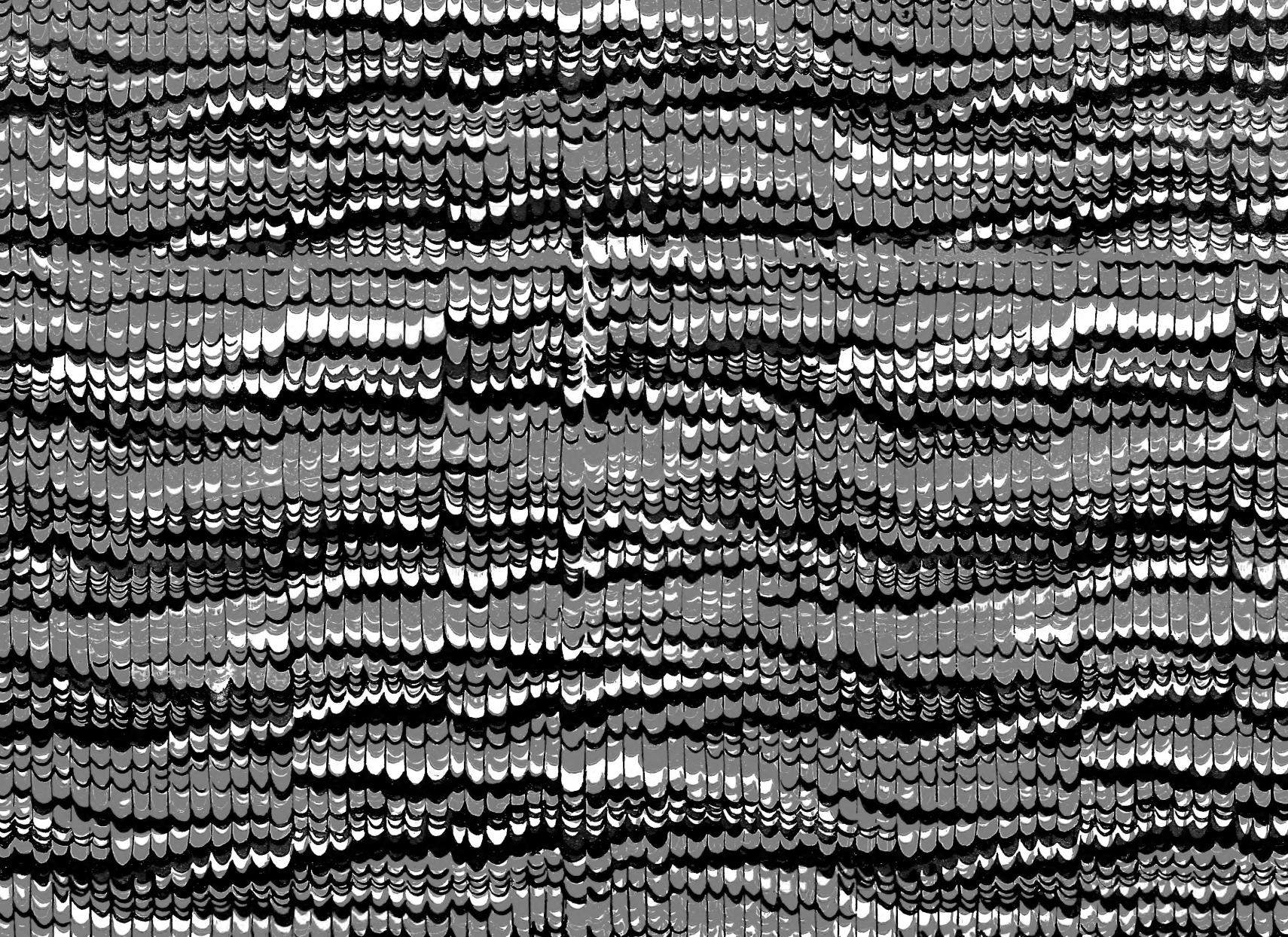

SMITHSONIAN INSTITUTION.
UNITED STATES NATIONAL MUSEUM.

SPECIAL BULLETIN.

AMERICAN HYDROIDS.

PART III.

THE CAMPANULARIDÆ AND THE BONNEVIELLIDÆ,

WITH TWENTY-SEVEN PLATES.

BY

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II

INTRODUCTORY NOTE.

During the 10 years which have elapsed since the publication of Part II of this work, in 1904, a number of new workers have arisen in the field of marine zoology and not a few of these have produced valuable works on the Hydroida and described many new species of Campanularidæ. It remains true, however, that no one has attempted to give a comprehensive account of American forms, although the west coast of North America has been the recipient of special attention by several able writers, such as Harry Beal Torrey and Charles McLean Fraser.

The east coast of North America has received but scant attention, and the South American hydroid fauna has been exploited almost exclusively by European writers, particularly Dr. Clemens Hartlaub and Dr. Elof Jäderholm. To both of these writers the author is indebted for specimens and literature.

Here, as in the case of Part II, comparatively few new species have been described, and the rather imposing array of 82 species of Campanularidæ is more the result of carefully consulting the literature of the subject both in America and abroad, and in obtaining material illustrating the forms therein described, than of the discovery of new species.

In the extensive bibliographic work involved, the author gratefully acknowledges courtesies by many private correspondents, and by the Librarians of the Congressional Library; the John Crerar Library in Chicago; the Field Columbian Museum, Chicago; the Harper Memorial Library, Chicago; and the Chicago Public Library.

In addition to the help rendered by the above-mentioned friends and institutions, I take pleasure in acknowledging the assistance of the following:

The directors of the British Museum (Natural History) for portions of some of the type specimens of Campanularidæ collected by the *Challenger;* the United States Bureau of Fish and Fisheries, for permission to include descriptions of new Campanularidæ found in their collections; Prof. Maurice Bedot, of Geneva; Mr. W. M. Bale, of Kew, Victoria; Dr. Armand Billard, Paris; Dr. Hjalmar Broch, Trondhjem, Norway; Mr. E. T. Browne, University College, London; Prof. Sydney J. Hickson, Manchester, England; Mr. Paul E. Kramp, Copenhagen; Mr. A. Kühn, Freiburg; Prof. G. M. R. Levinsen, Copenhagen; Mr. James Ritchie, Edinburgh; Mr. B. Saemundsson, Reykjavik, Iceland; Dr. E. Stechow, Munich.

I take pleasure also in expressing my obligation to the following American colleagues, who have generously aided me in the matter of literature or specimens, often both: Prof. Gary N. Calkins, Dr. C. M. Fraser, Dr. Charles W. Hargitt, Dr. A. G. Mayer, Dr. Harry Beal Torrey, and Prof. A. E. Verrill.

AMERICAN HYDROIDS.

SECTION III.—THE CAMPANULARIDÆ AND BONNEVIELLIDÆ.

MORPHOLOGY OF THE CAMPANULARIDÆ.

This family seems to be more unspecialized, on the whole, than either of the other families, Plumularidæ and Sertularidæ, thus far treated in this work, having neither the highly specialized phylactogonia and other gonosomal structures of the former nor, in many cases, the fixed sporosacs of the latter. If these sporosacs are really degraded medusæ, as claimed by Weismann,[1] they are more specialized than the medusæ that characterize many of the Campanularidæ and are hence evidence of the higher zoological rank of the Sertularidæ.

The members of the family Campanularidæ have engaged the attention and elicited the admiration of lovers of nature ever since the microscope revealed the elegant hydrothecæ, like fairy goblets, that characterize the group. John Ellis, in his "Essay towards a Natural History of Corallines" (1745), describes several species and his drawings show their characteristic features with rare fidelity.

> If we imagine minute crystalline chalices, crenated or plain round the margin and mounted on slender pedicels, twisted spirally or delicately ringed, which are all united and bound to the body on which they grow by the finest network of tubes, we have the form which the polypary assumes in one section of this exquisite group. In another the species are arborescent and sometimes of considerable size, their tree-like tufts presenting the most lovely shapes, the branches laden with the hyaline calycles (variously formed and adorned) and with the vase-like capsules, and the whole structure exhibiting an indescribable delicacy of texture and gracefulness of habit.[2]

McCrady[3] mentions but three colonial forms that belong to the family Campanularidæ as here used, but describes five medusæ belonging to his "group" Campanulariidæ. One of these, *Epenthesis folleata*, is probably the medusa of his hydroid *Clytia noliformis*.

Mayer[4] says that the hydroid of another, *Eucheilota ventricularis*, is a *Campanularia*. The hydroid of the two species of *Eutima* is a *Campanopsis*, and *Phortis gibbosa* has a hydroid form that can not be regarded as belonging to the Campanularidæ as used in this work.

Louis Agassiz[5] was the first American naturalist to give extended description and illustration to the colonial forms of the Campanularidæ. No more careful and accurate descriptions have ever been made of these forms than are found in this work, where the following species are described with the attention to detail so characteristic of the older Agassiz: *Clytia poterium* (=*Orthopyxis caliculata* of the present work), *Clytia bicophora*, *Clytia cylindrica*, *Laomedea amphora* (=*Campanularia amphora*), *Obelia commissuralis*, and *Eucope diaphana* (=*Obelia geniculata*). The figures illustrating these species in detail are by H. J. Clark and Sonrel, and these figures have not, in the opinion of the writer, been surpassed in beauty and fidelity to nature by any of the very numerous illustrations that have appeared during the half century

[1] Die Entstehung der Sexualzellen bei den Hydromedusen, 1883, p. 185.
[2] Hincks, British Hydroid Zoophytes, 1868, p. 137.
[3] Gymnopthalmata of Charleston Harbor, 1858, pp. 92–95.
[4] Medusæ of the World, vol. 2, 1910, p. 282.
[5] Cont. Nat. Hist. U. S., vol. 4, 1862, pp. 297–325. pls. 28, 31, and 33.

that has elapsed since the publication of Agassiz's monumental work. Nothing at all comparable with this work has been produced by any subsequent American writer on the Campanularidæ, considered from the standpoint of the colonial fixed forms rather than from that of the medusæ.

Alexander Agassiz,[1] in his "North American Acalephæ," adds but little to our knowledge of the morphology of this group, and most of the work done by subsequent writers in this country has been in the way of faunal lists and systematic discussions. An exception to this statement should, however, be made in the case of Dr. A. G. Mayer's beautiful monograph of the Medusæ of the World,[2] in which are a number of excellent descriptions and figures of medusæ of American hydroids belonging to the Campanularidæ, although that author places them in the family "Eucopiidæ," which contains several medusæ whose hydroid] forms would not go into the Campanularidæ as used in this work. A number of beautifully colored figures, both of medusæ and hydroid forms, are found in this work.

Many important treatises on the morphology of the Hydroida, including descriptions of species now known to occur in American waters, have been produced by European naturalists. Among the earlier writers to discuss morphological details was P. J. van Beneden,[3] who published some excellent descriptions and drawings giving details of structure of both trophosome and gonosome, including free medusæ, of several well known campanularians. He seems to have been among the first to clearly demonstrate the connection between the medusæ and hydroid colonies of this group.

The earliest recognition of this connection that I have found, however, is given by Johnston,[4] who describes how Mr. Peach, in 1842, demonstrated the connection between the medusæ and colonial forms of *Obelia dichotoma* and of a *Campanularia* which appears to have been *Clytia johnstoni*.

While Hincks[5] gives an excellent general account of the gross morphology of the Campanularidæ, the first comprehensive and detailed description must be accredited to Allman,[6] who discusses many points of interest concerning the Campanularidæ, including the true nature of the sex buds of the medusæ of *Clytia johnstoni*, the homology of the medusa and hydranth, details of the gonangia and gonophores of several species of *Campanularia*, *Obelia*, and *Gonothyræa*, the development of ova and spermatozoa in *Campanularia flexuosa*, the development of the hydranth and blastostyle in the same species, a masterly description of alternation of generation, and a study of the lithocysts of *Clytia johnstoni* and *Obelia geniculata*.

Haeckel's splendid monograph "Des Systemes der Medusen," 1880, contains brief descriptions of a few medusæ belonging to the genus *Obelia*, and descriptions and figures of *Eucope campanulata* and *Clytia johnstoni*.

Thallwitz[7] worked out with great care the origin of the spermatozoa in *Campanularia flexuosa*, and Weismann[8] describes and figures the origin of the ova in *Gonothyræa loveni*.

TROPHOSOME.

The colonies of the Campanularidæ are, in general, more simple than in the families previously described. While occasional specimens are found attaining a height of a foot or more,[9] the colonies are usually small and inconspicuous.

[1] Illustrated Catalogue of the Museum of Comparative Zoology, No. 2, 1865.

[2] Volumes 1 and 2, 1910.

[3] Mémoire sur les Campanulaires de la Côte d'Ostend, 1845.

[4] Hist. Brit. Hydroid Zooph., ed. 2, vol. 1, 1847, p. 119.

[5] British Hydroid Zoophytes, 1868.

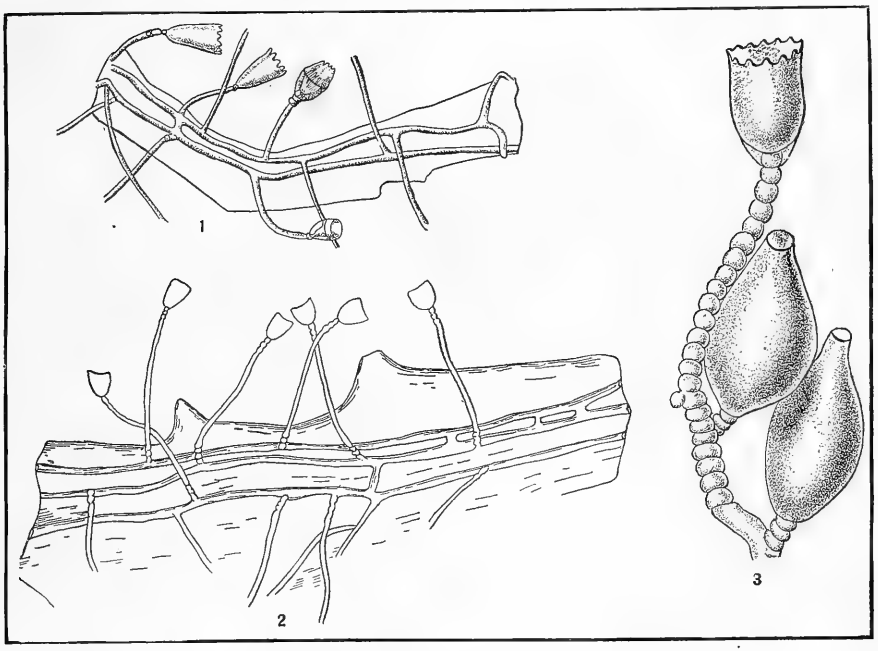
[6] Gymnoblastic Hydroids, part 1, 1871.

[7] Ueber die Entstehung der männlichen Keimzellen bei den Hydroiden, Jenaische Zeitschrift, vol. 18, 1885, p. 390, pl. 12.

[8] Die Entstehung der Sexualzellen bei den Hydromedusen, 1883, pl. 10, and explanation.

[9] Agassiz describes colonies of *Laomedea* (=*Obelia gelatinosa*) that were found growing to a height of 15 to 20 inches in the brackish waters of the Charles River near Boston.

Many species present the character of a simple rootstock from which spring undivided pedicels each bearing its goblet-shaped hydrotheca. The rootstocks themselves twine irregularly around the branches of other hydroids, algæ, and whatever other support may be available. In the genera *Campanularia, Clytia* (fig. 1), and *Obelia* these climbing rootstocks are usually quite irregular in their course. In *Orthopyxis* and *Silicularia* the algæ form the favorite means of support, and sometimes the rootstocks cover the surface of the broad leaves of *Laminaria*, for instance, with a reticulate pattern which is at times fairly regular (*Orthopyxis clytioides*



CREEPING ROOTSTOCK OF THE CAMPANULARIDÆ.

Fig. 1.—*Clytia sargassicola.*
Fig. 2.—*Orthopyxis clytioides.* (After Hartlaub.)
Fig. 3.—*Campanularia urceolata.*

(fig. 2) or *Silicularia reticularia*). At other times the leaves of *Laminaria* are traversed by bands of parallel rootstocks closely appressed together as in *Silicularia rosea.*

Again there are rootstocks that are closely and regularly annulated throughout and others that are smooth throughout; while still others combine these conditions, as in the case of *Orthopyxis caliculata,* where both the annulated and the smooth rootstocks are found in the same specimen. Torrey has noticed this in *Campanularia urceolata* (fig. 3)—

> A fact of some interest is the beautiful spiral annulation which appears on the hydrorhiza whenever it happens to grow for a space without touching the substratum. It seems clear that this striking heteromorphosis, and the change of form of the perisarc of the stolon are casually related to the presence or absence of a contact stimulus.[1]

I have noticed the same thing in the case of *Campanularia speciosa* Clark.

These creeping stolons appear to adhere to the substratum over which they grow by means of the adhesive quality of the perisarc rather than by sending out rootlets, as in many climbing

[1] The Hydroida of the Pacific Coast, 1902, p. 54.

vines. In some cases, e. g., *Campanularia speciosa*, they appear as if flattened out on the object over which they grow, thus increasing their adhesive surface and securing a correspondingly firm anchorage.

Some writers have contended that the stolon or rootstock is really a recumbent stem from which the pedicels arise, being confined to the uppermost side by the necessities of the case. In regard to such suggestions it seems to me that it is unnecessary to discuss these homologies from the fact that the various parts of the hydroid colony, branches, stem, stolon, hydrorhiza, etc., are really convertible terms. As I have said before:

> As a matter of fact, the subject of homology among Hydroida has been unnecessarily obscure because the whole group is so primitive that any one part is homologous with several others, or rather that the parts are not greatly or fundamentally differentiated. For instance, the creeping rootstock may properly be regarded as a portion of the hydrorhiza in many species; in many others it is considered a true stem, or hydrocaulus, which has adopted a procumbent habit; again, as we have just seen, it takes the guise of an accessory tube in a fascicled stem, which may in its distal portion adopt the further disguise of a branch or even a hydrocladium.[1]

The stem.—As already stated, the stem in most campanularians is monosiphonic. This is the situation in the numerous forms in which the creeping rootstock is regarded as a procumbent stem as well as in all cases where the stem is erect, with the exception of a few species discussed below. When erect and simple the stem is ordinarily divided into regular internodes with a group of annulations just above the origin of each branch or pedicel. In *Campanularia flexuosa* (fig. 5) the pedicel itself appears to be a curved upward extension of the internode below, producing an effect as if the stem itself were made up of a series of long pedicels curved alternately to the right and left.

In *Obelia geniculata* (fig. 4) the internodes are remarkably short and stout and much broadened at their distal ends so as to form a conspicuous shoulder upon which the pedicel appears to be emplanted; the perisarc being greatly thickened on the outer side of the stem below the insertion of the pedicel.

The stem is fascicled in but a few Campanularidæ. *Campanularia verticillata* (fig. 7) shows a unique condition in that the compound stem is made up of a bundle of closely adherent and almost exactly parallel tubes, each of which gives off a series of pedicels, these being so spaced that verticils of pedicels are produced at fairly regular intervals. Hargitt[2] says that he had found cœnosarcal connections between the tubes. I have been unable to satisfy myself of such connections; but, as I did not have fresh material to study, and as I well know Doctor Hargitt's scrupulous care in making and recording his observations, the facts are doubtless as stated by him.

The compound stems of the Campanularidæ differ from those of the Plumularidæ and Sertularidæ in being destitute of the "axial tube" always found in polysiphonic stems in these families.[3] Any of the component tubes may bear branches or pedicels in the Campanularidæ while only the axial tube bears these in the other families mentioned.

In examining a portion of the stem of *C. verticillata* in which the component tubes have been separated by boiling in a potash solution it is seen that a new tube may arise at almost any point by budding from an old tube. It seems as if in such cases the origin of a new tube were homologous with the origin of a pedicel; in the former case the new process becoming another tube adhering to the stem, and in the latter it remains free and terminated in a hydrotheca.

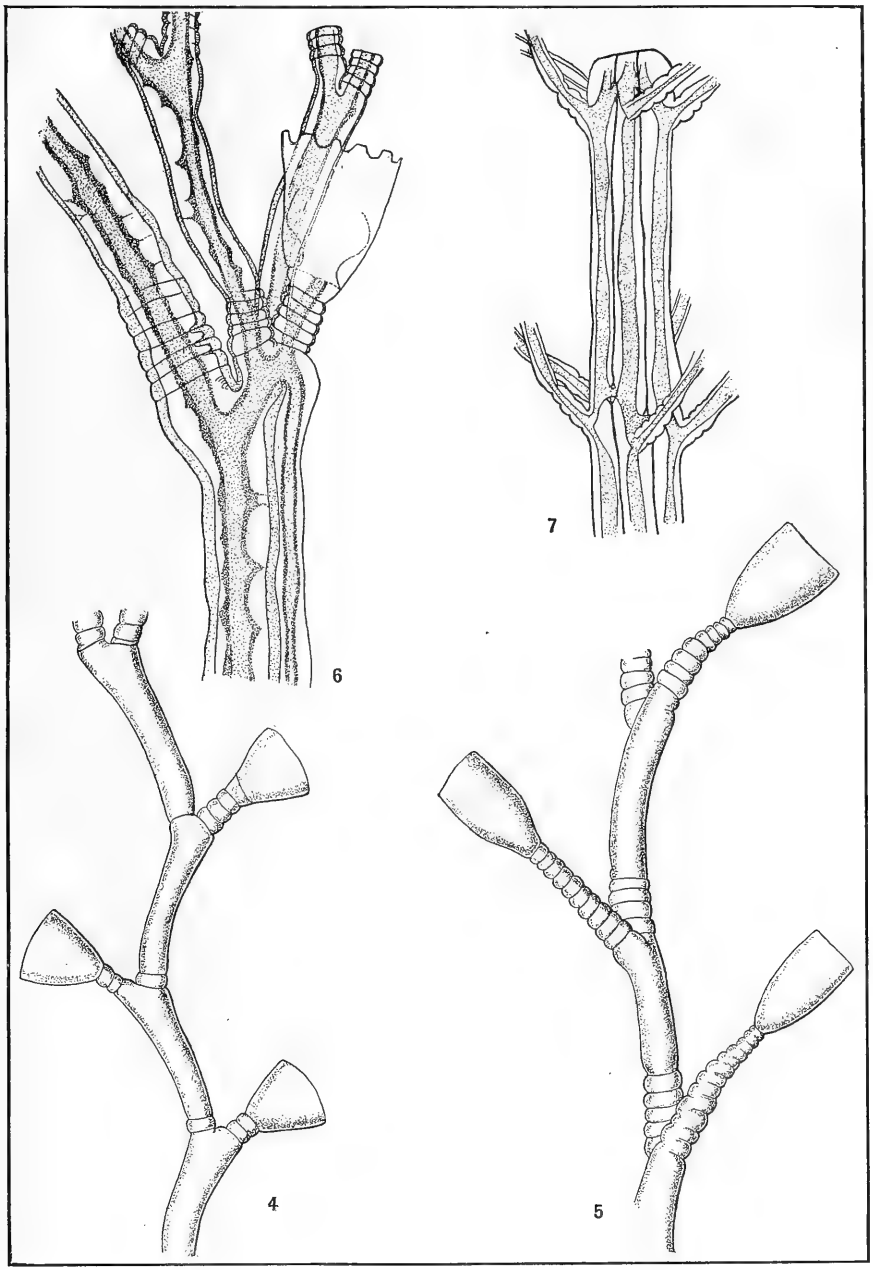
In *Clytia universitatis* is found another stem fascicled in the manner just described, and in this the writer was able to demonstrate cœnosarcal connections between the component tubes greatly resembling those described by Hargitt. Hartlaub[4] has made a very careful study of the compound stem of *Obelaria gelatinosa* (fig. 6) and has illustrated his work with admirable drawings. He finds that this stem is made compound by the aggregation of a number of sto-

[1] Part I, p. 7.

[2] A few Coelenterates of Woods Hole, Biological Bulletin, vol. 14, No. 2, p. 113, and fig. 17.

[3] See Part I, pp. 4–8, and Part II, pp. 5–7.

[4] Die Hydromedusen Helgolands, 1897, pp. 488–495, pl. 17.



STEMS OF THE CAMPANULARIDÆ.

Fig. 4.—*Obelia geniculata.*
Fig. 5.—*Companularia flexuosa.*
Fig. 6.—Fascicled stem of *Obelaria gelatinosa.*
Fig. 7.—Fascicled stem of *Campanularia verticillata.*

lons which arise from the stem tubes and are directed downward "basalwarts." In many cases these stolons arise at or immediately below the pedicel origins, reminding one of the condition that I have described as found in the polysiphonic stem of *Sertularella gayi*,[1] where the peripheral tubes were seen to have their origin as stolon-like offshoots from just below the bases of hydrothecæ. An examination of a specimen of *Obelaria gelatinosa* from Plymouth, England, shows that the hydrorhiza or root of the colony is composed largely of these downward growing stolons, as in the case of *Sertularella gayi*. Occasional cross connections of cœnosarc are also seen and these were most evident in connections with the branching of the stem or at the origin of the stolons. These however, were not truly cross connections, but merely the extensions of the cœnosarc of the stem into the branch or stolon. True cœnosarcal cross connections were also seen, however, by which one tube in the stem had direct communication with another.

In some cases one of these stolons will bear a pedicel with its hydrotheca at one end while the other end is growing downward on the surface of the compound stem, giving a curious appearance of being "stuck on".

In *Obelia plicata* the compound stem is composed of much stiffer, more rigid tubes, the perisarc being thick and of a dark color, reminding one of the stem of *Eudendrium*.

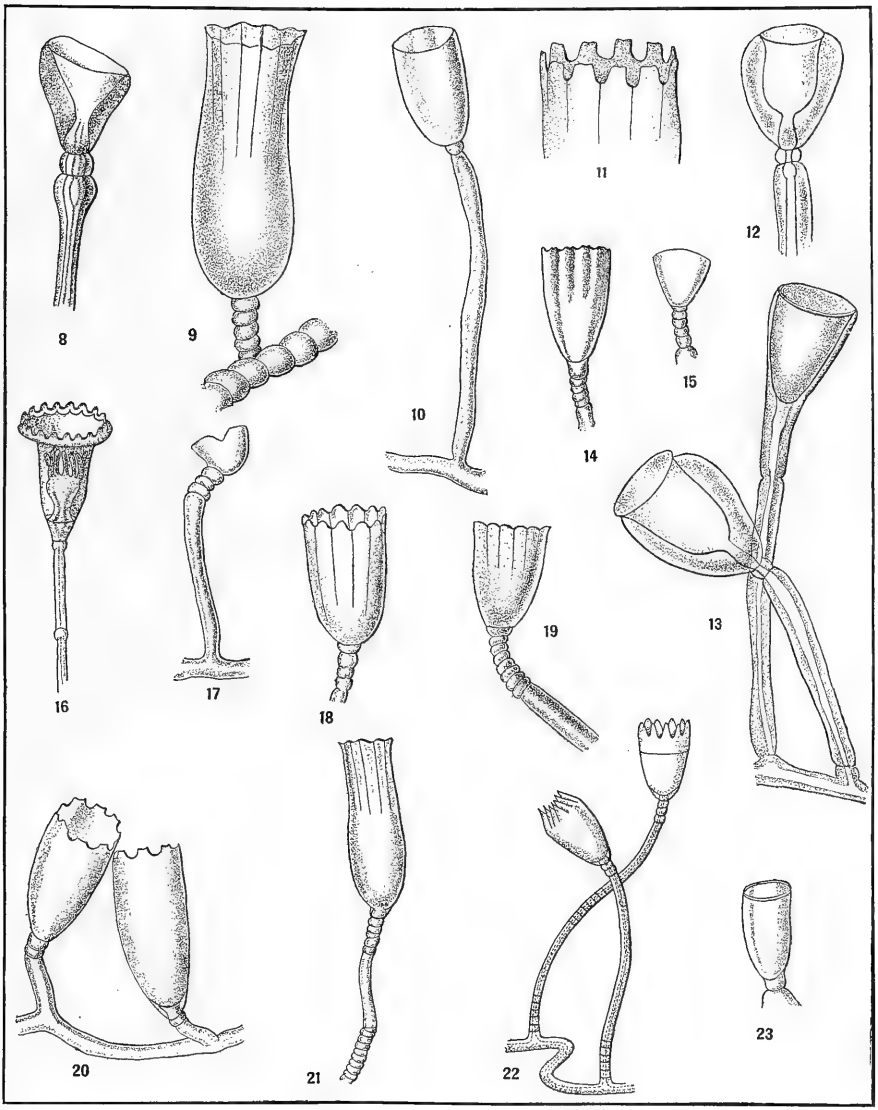
The branches.—Although containing a number of the simplest forms the family Campanularidæ includes many of the most intricately branching species found in the Hydroida. They differ from many of the Sertularidæ, however, in never showing the anastomoses of the branches which at times form the curious reticulate patterns found in the genus *Dictyocladium* and in the remarkable form described by Jäderholm under the name of *Sertularella mirabilis*.

In many species the main stem is often unbranched and bears a pedicel on each internode, the pedicels usually being alternate in position. Among the more profusely branching forms the genus *Obelia* shows the most striking examples. In *O. flabellata*, for instance, the branches are divided and subdivided dichotomously until the final ramifications are reduced to the most delicate tracery, each branch being like the palmate frond of a finely divided fern. *O. longissima* is even more slender and delicately branched, the branches having an approximation to a verticillate arrangement. In our *Obelia commissuralis* the branches are arranged in an ascending spiral and the branches themselves are geniculate, giving off ultimate branches of extreme delicacy.

The pedicels may be regarded as the ultimate branchings of the hydrocaulus. They vary in length from 11 mm. in *Campanularia spiralis* to practically nothing where the hydrothecæ are sessile, as in *Obelia marginata*. The chitinous perisarc of the pedicel is very greatly thickened in some species, particularly in *Orthopyxis* (fig. 13) and *Silicularia* (fig. 8). The surface may be perfectly smooth, as in *Campanularia ritteri* (fig. 10), or closely annulated throughout, as in *C. speciosa* (fig. 9). The most common arrangement is to have one or two annulations just below the hydrotheca and also at the base of the pedicel, leaving the median portion smooth; and there is very commonly a globular annulation just below the hydrotheca. In the branching forms the pedicels are usually shorter than in the simple campanularians, and they never show the remarkable thickening of the perisarc mentioned above.

The hydrothecæ.—There is much greater uniformity in the shape and size of these structures in the Campanularidæ than in either of the other families thus far considered in this work, and they differ from these latter also in the fact that with a few exceptions, notably in the genus *Silicularia* (fig. 8) they are radially symmetrical. Their typical form is campanulate, which gives the name to the family, and the variations in form are usually in lengthening or shortening the bell. In most cases they are longer than wide with the greatest diameter at the margin, although in exceptional cases, e. g., *Campanularia speciosa* Clark (fig. 9) the greatest width may be near the proximal end. The lengthening of the bell may result in a more or less tubular structure, as in *Campanularia ritteri* Nutting (fig. 10), where the sides are approximately parallel; or in an urceolate form, as in *C. speciosa*. Sometimes the outline in lateral view is subtriangular, as in *Obelia flabellata* (fig. 15), in which the hydrothecæ are often as wide as long.

[1] See Part II, p. 6.



HYDROTHECÆ OF THE CAMPANULARIDÆ.

Fig. 8.—*Silicularia rosea.* (After Allman.)
Fig. 9.—*Campanularia speciosa.*
Fig. 10.—*Campanularia ritteri.*
Fig. 11.—*Campanularia hincksii*, margin.
Fig. 12.—*Orthopyxis compressa.*
Fig. 13.—*Orthopyxis compressa.*
Fig. 14.—*Obelia austrogorgia.*
Fig. 15.—*Obelia flabellata.*
Fig. 16.—*Campanularia retroflexa.* (After Allman.)
Fig. 17.—*Silicularia hemispherica.*
Fig. 18.—*Campanularia grœnlandica.*
Fig. 19.—*Obelia dubia.*
Fig. 20.—*Campanularia brevicaulis.*
Fig. 21.—*Campanularia magnifica.*
Fig. 22.—*Campanularia ptychocyathus.* (After Allman.)
Fig. 23.—*Obelia marginata.*

The hydrothecal walls are usually quite thin and hyaline and often easily collapsible; but in *Orthopyxis* (fig. 12) and *Silicularia* (fig. 8) they are often enormously thickened, so much so that in the latter genus the hydranth is incapable of retracting within the lumen of the hydrotheca. In this latter genus also we meet with the peculiar bilaterally symmetrical hydrothecæ referred to above, in which the upper part is cut away in such a manner that the long axis of the margin is inclined at an oblique angle with the axis of the hydrotheca, the wall being much lower on one side than on the other. The excessive thickening of the hydrotheca in *Orthopyxis* caused a curious but natural misconception on the part of some of the earlier writers, particularly Hincks,[1] who believed that these hydrothecæ were double, one cup being set within the other, an optical effect due to the almost complete transparency of these structures.

There is often a great degree of variation in the amount of thickening of the hydrothecal walls in the same species and even in the same colony, as in *Orthopyxis compressa* (figs. 12, 13), in which some of the hydrothecæ are little thicker than in ordinary campanularians, while others are so thick as to be almost orbicular in outline. In *Silicularia hemispherica* (Allman) (fig. 17), the hydrotheca is shortened so that the lumen is hemispherical or bowl-shaped.

In a number of species the distal portion of the hydrothecal wall is longitudinally pleated, each pleat corresponding to one of the hydrothecal teeth. This is well shown in *Campanularia magnifica* (fig. 21), where the longitudinal folds may reach nearly to the hydrothecal base.

The margin of the hydrotheca is perfectly even in many species of *Obelia* and less commonly so in *Campanularia*, this condition being found occasionally in practically all genera. The toothed margin is also common throughout the family, the teeth varying from hardly evident marginal undulations (*Obelia dubia*) (fig. 19) to slender thornlike points, as in *Campanularia ptychocyathus* (fig. 22) or *Gonothyræa gracilis*. In some cases the teeth are bimucronate, as in *Obelia austrogorgia* (fig. 14) or *O. bicuspidata*, while in others they have squared-off or truncated ends, as in *Campanularia hincksii* (fig. 11).

One of the most remarkable modifications of the margin is found in *Campanularia retroflexa* Allman (fig. 16), in which "the margin is everted in a plane at right angles to the axis of the hydrotheca, and the teeth into which the rim is divided stand up from it parallel to the axis, thus suggesting the form of the escapement-wheel of a watch."[2]

In some of the more delicate species the upper part of the hydrotheca is so thin-walled as to be collapsible, the teeth bending inward and forming a sort of pseudo-operculum, as in *Campanularia ptychocyathus* Allman (fig. 22), while in others the rim is reinforced by a circular band of chitin, as in *Obelia marginata* (fig. 23). In *Obelia striata* Clarke the distal part of the hydrotheca is deeply fluted, the margin being broken up into a series of horizontal semicircular folds between which are inward-projecting teeth or vertical crests,[3] and in *Campanularia* (?) *obliqua* Clarke the marginal teeth are regularly pointed obliquely like the teeth of a saw.[4]

The diaphragm.—This structure has given rise to much discussion of late, mainly because of Levinsen's attempt to base a generic classification of the family Campanularidæ upon the characters of the diaphragm. He says:[5]

> In the species that have a creeping stolon, or whose stem is composed of a fascicle of parallel branching tubes, the diaphragm is composed of two different parts, namely, partly of a strong and ring-like process from the hydrotheca and partly of a thin chitinous membrane springing from the upper edge of this ring and which is secreted by the lower surface of the basal part of the hydranth and is plainly visible in an entirely empty hydrotheca. In all such specimens as are provided with a free branched stem the diaphragm never presents such a difference between an outer and an inner portion. This consists of a fairly solid horizontal chitinous plate which, as a rule, has the same thickness throughout.

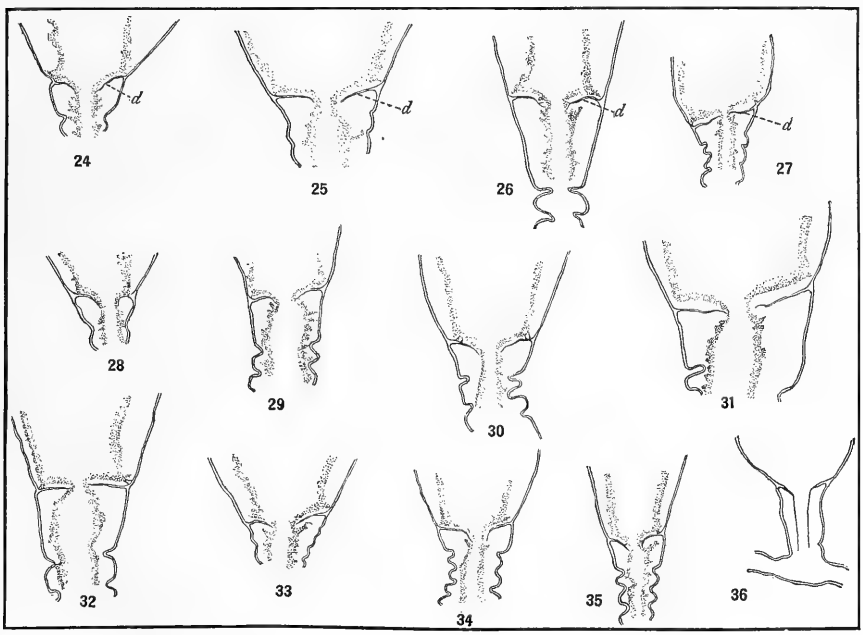
The above translation is by Mr. J. H. Paarmann, to whom the writer is under obligation for his painstaking sectioning of many species of Campanularidæ for the purpose of studying

[1] British Hydroid Zoophytes, 1868, p. 165.
[2] *Challenger* Reports, Hydroida, part 2, 1888, p. 21, pl. 11, fig. 1*a*.
[3] Memoirs Museum of Comparative Zoology, vol. 35, No. 1, 1907, p. 9, pl. 7, fig. 4.
[4] Idem, pl. 3, figs. 2, 3, and 4.
[5] Meduser, Ctenophorer og Hydroider fra Grönlands Vestkyst, 1893, p. 160.

the diaphragm and for the drawings which he has permitted me to use in this work. Mr. Paarmann undertook the investigation of the diaphragm as a part of his dissertation for the degree of master of science from the State University of Iowa, and the sections made by him are now deposited in the Museum of Natural History of the university and form the basis for the discussion of the diaphragm in the present work.

Levinsen says that all campanularians with a creeping rootstock or fascicled stem have a diaphragm which is composed of the two distinct parts spoken of above, and places all such species in the genus *Campanularia*. All species which have a diaphragm simple, i. e., not composed of two parts, he places in the genus *Laomedea*, regarding *Obelia*, *Gonothyræa*, etc., as subgenera of *Laomedea*.

This attempt to settle the much-involved classification of the Campanularidæ, like the similar attempt to settle the classification of the Sertularidæ by the use of the operculum,[1]



ILLUSTRATIONS OF SIMPLE DIAPHRAGMS OF THE CAMPANULARIDÆ. (All after Paarmann, MS.)

Fig. 24.—*Clytia bicophora.*
Fig. 25.—*Campanularia calceolifera.*
Fig. 26.—*Campanularia flexuosa.*
Fig. 27.—*Campanularia angulata.*
Fig. 28.—*Campanularia neglecta.*
Fig. 29.—*Campanularia amphora.*
Fig. 30.—*Obelia commissuralis.*
Fig. 31.—*Obelia dichotoma.*
Fig. 32.—*Gonothyræa loveni.*
Fig. 33.—*Obelia hyalina.*
Fig. 34.—*Obelia longissima.*
Fig. 35.—*Obelaria gelatinosa.*
Fig. 36.—?*Obelia longicyatha.*

d, Diaphragm.

has given rise to much protest on the part of subsequent writers. Schneider,[2] after a somewhat full discussion, concludes as follows:

Die diaphragmabeschaffenheit hat für die Systematik der Genera gar keine bedeutung.

Later, Calkins[3] discusses the matter with care and, in reference to Levinsen's statement that in free branching forms the diaphragm shows no such distinction of outer and inner parts, says:

The application of this latter differential in placing species leads only to confusion worse confounded.

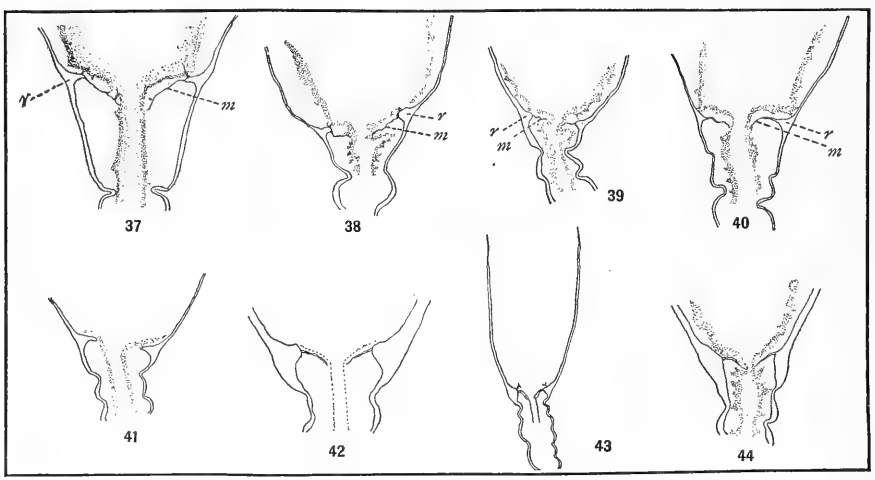
[1] See Part II, p. 20, of this work.
[2] Hydroidpolypen von Rovigno, 1897, p. 512.
[3] Some Hydroids from Puget Sound, 1899, p. 346.

and cites the branching forms *Campanularia gracilis* and *Obelia dichotoma*, in both of which he finds the diaphragm distinctly of two parts.

Mr. Paarmann's manuscript has never been published, and he has placed it in my hands to quote or use as I see fit. From it I quote the following:

At a little distance from the base of the hydrotheca is a chitinous shelf upon which the hydranth rests. This is the diaphragm. It may be either a disk-shaped or funnel-shaped membrane of extreme tenuity, or a complex structure composed of a ring-like portion adjoining the hydrothecal wall and a funnel-shaped structure attached to the edge of this "ring." The first I propose to call a simple diaphragm and the second a complex diaphragm. The simple diaphragm can with difficulty be seen in optical section of the hydrotheca, while the complex diaphragm is plainly distinguishable without sectioning (figs. 24–44).

Of 12 species of Campanularidæ sectioned and found to have a simple diaphragm, 10 were branched[1] and 2 (*Clytia bicophora* and *Obelia longissima*) were simple or fascicled. Of 7 species showing a complex diaphragm, 2 (*Obelia geniculata* and *O. flabellata*) were branched and 5 were simple or fascicled.[2] We find, then, so far as these species are concerned, that Levinsen's rule does not work in 4 out of 19 cases. In other words it fails in about one-fifth of the cases investigated. This criterion can, therefore, not be regarded as a satisfactory one for dividing the Campanularidæ into generic groups.



ILLUSTRATIONS OF COMPLEX DIAPHRAGMS OF THE CAMPANULARIDÆ. (After Paarmann, MS.)

Fig. 37.—*Clytia johnstoni.* Fig. 39.—*Campanularia hincksii.* Fig. 41.—*Obelia flabellata.* Fig. 43.—*Campanularia verticillata.*
Fig. 38.—*Campanularia verticillata.* Fig. 40.—*Obelia geniculata.* Fig. 42.—*Clytia noliformis.* Fig. 44.—*Clytia sargassicola.*
r, "ring"; *m*, "membrane".

One very striking failure of this criterion was found by the present writer in trying to differentiate the species *Clytia bicophora* Agassiz (fig. 24) and *C. johnstoni* (fig. 37).

No one, I think, would consider these two species as generically distinct. Indeed most recent writers and earlier, Hincks, consider them identical. They certainly agree in many details of both trophosome and gonosome. But in sectioning the hydrothecæ it was found that *C. bicophora* has a simple diaphragm, while *C. johnstoni* has a diaphragm that is distinctly complex. A structure that varies in species so nearly identical in nearly every other character seems to the writer to be an entirely insufficient character upon which to base generic distinctions.

The hydranth.—The hydranth shows great uniformity of structure throughout the Campanularidæ. It alone of all the calypteroblastic forms shows the so-called "trumpet-shaped" proboscis formed by an apparent deep constriction of the hydranth wall above the insertion of the

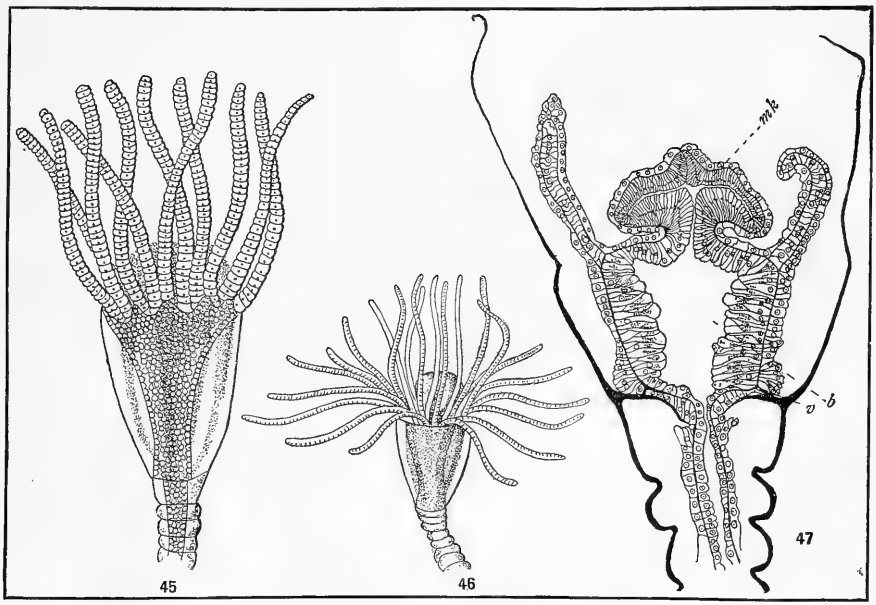
[1] *Campanularia calceolifera, C. angulata, C. flexuosa, C. neglecta, Obelia amphora, O. commissuralis, O. dichotoma, O. hyalina, Gonothyræa loveni,* and *gelatinosa obclaria.*

[2] *Campanularia verticillata, C. hincksii, Clytia johnstoni, C. noliformis,* and *C. sargassicola.*

tentacles and dividing the cavity into two well-defined chambers, the proboscidial and gastric chambers which may have distinct functions, as the histological character of their endoderm would seem to indicate, those of the gastric cavity proper being much larger and with distinctly larger nuclei than those lining the proboscidial cavity, as shown in fig. 47, taken from Kühn's excellent paper.[1]

In the retracted hydranth the proboscidial cavity is reduced to almost nothing, but in full expansion it is a cavity of considerable size. This same figure shows how the hydranth is anchored to the diaphragm on which it rests by extensions of the stutzlamelle.

The only other hydroid family whose hydranths have a trumpet-shaped proboscis is the Eudendridæ, a gymnoblastic group. It is the opinion of the writer that the characters of the



HYDRANTHS OF THE CAMPANULARIDÆ.

Fig. 45.—*Campanularia amphora*. Hydranth partly expanded.
Fig. 46.—*Campanularia flexuosa*. (From living specimen.)
Fig. 47.—*Campanularia flexuosa*. (After Kühn) showing histological details of a young hydranth. *b*, gastric cavity. *mk*, Lining of the proboscidial cavity. *v*, Chitinous connection between the "Stutzlamelle" and the diaphragm.

hydranth are of prime importance in the classification of this order, and that there is doubtless a relationship, either of community of descent or of direct descent the one from the other, between the Eudendridæ and the Campanularidæ. In such a form as *Eudendrium vaginatum* Allman, in which the perisarc of the stem is extended upward over the proximal part of the hydranth body, we see what might possibly be an incipient hydrotheca of the Campanularian type.

GONOSOME.

The gonangia bear a general resemblance to those of the Sertularidæ, although they are not so varied in form as in the latter family. None of them are ornamented with longitudinal ribs, as in *Thuiaria costata* Nutting, and none of them are armed with spine-like processes, as in *Diphasia tamariska* Linnæus. Nor are there any species exhibiting the complicated "marsupial chamber," as found in *Diphasia rosaceä*.

[1] Sprosswachstum und Polypenknospung bei den Thecophoren, 1909, pl. 17, fig. 7.

In regularly branching species of campanularians the gonangia are usually born on the stem and larger branches, often being placed in the axils of branchlets or pedicels. In forms growing from a creeping rootstock the gonangia often spring from the rootstock itself, without reference to the position of the pedicels.

Perhaps the simplest form of gonangium is the oblong-oval without distinct collar or neck, such as *Campanularia verticillata* (fig. 55) or *C. inconspicua*, or *C. flexuosa* (fig. 61). The first departure from this primitive form is in the production of a collar at the distal end, which is low and inconspicuous in *Obelia commissuralis* (fig. 48) and several other species of the same genus, and forms a rather conspicuous everted collar in *Clytia noliformis* (fig. 49). The beginning of a tubular "neck" is found in *Campanularia urceolata*, and this neck becomes long, tubular, and somewhat curved in such species as *Campanularia fusiformis* (fig. 57) and *C. magnifica* (fig. 54). In the Campanularidæ, as in many Sertularidæ, we find numerous instances of more or less conspicuously annulated gonangia. These annulations may appear simply as large, irregular rugosities, as in *Clytia noliformis* and *C. universitatis*, or as numerous and beautifully symmetrical annulations, as in *Clytia johnstoni* (fig. 56). These annulations are sometimes spirally arranged as in *Campanularia spiralis* (fig. 59). Some of these annulated gonangia remind one quite forcibly of Chinese lanterns in their general form.

Extracapsular sporosacs are found in a few forms of Campanularidæ, as in *Orthopyxis everta* (fig. 50). In this case the medusa ripens within the gonangium and discharges its contents into a globular or bladder-like structure surmounting the oral or mouth end of the gonangium. Certain species of *Silicularia* have greatly elongated gonangia, e. g., *S. rosea* and *S. divergens* (fig. 60), and in this genus the gonangial walls are often greatly thickened to correspond to the remarkably thickened walls of the hydrotheca.

There are a few strangely modified gonangia in this family, although they are not so highly specialized as in certain Sertularidæ, as in the genus *Diphasia*. One of the longest known and most remarkable of the strongly modified gonangia is found in the genus *Gonothyræa* (fig. 58), where it is a characteristic feature. We find here the unique extracapsular medusæ to which Allman has given the name "Meconidia."[1] These appear as sessile medusæ resting on the top of the gonangium, there being usually two or three such structures on the top of each gonangium. These meconidia are formed very much as ordinary gonophores on the blastostyle within the gonangium, appearing at first as mere hernia-like protrusions of the latter and several appearing in different stages of development on the same blastostyle. The oldest medusa is at the distal end of the blastostyle and is carried out through the end of the gonangium while still resting on the plug-like end of the blastostyle.

The meconidia, particularly in female colonies, bear the characteristic structures of medusæ, showing radial canals, proboscis, circular canal, and marginal tentacles. The ova are developed into planulæ within the meconidia and later escape through the oral end of the latter. In the male colony the medusa characters are more obscure, and large ovoid spermaries are developed, from which escape the spermatozoa in incredible numbers.

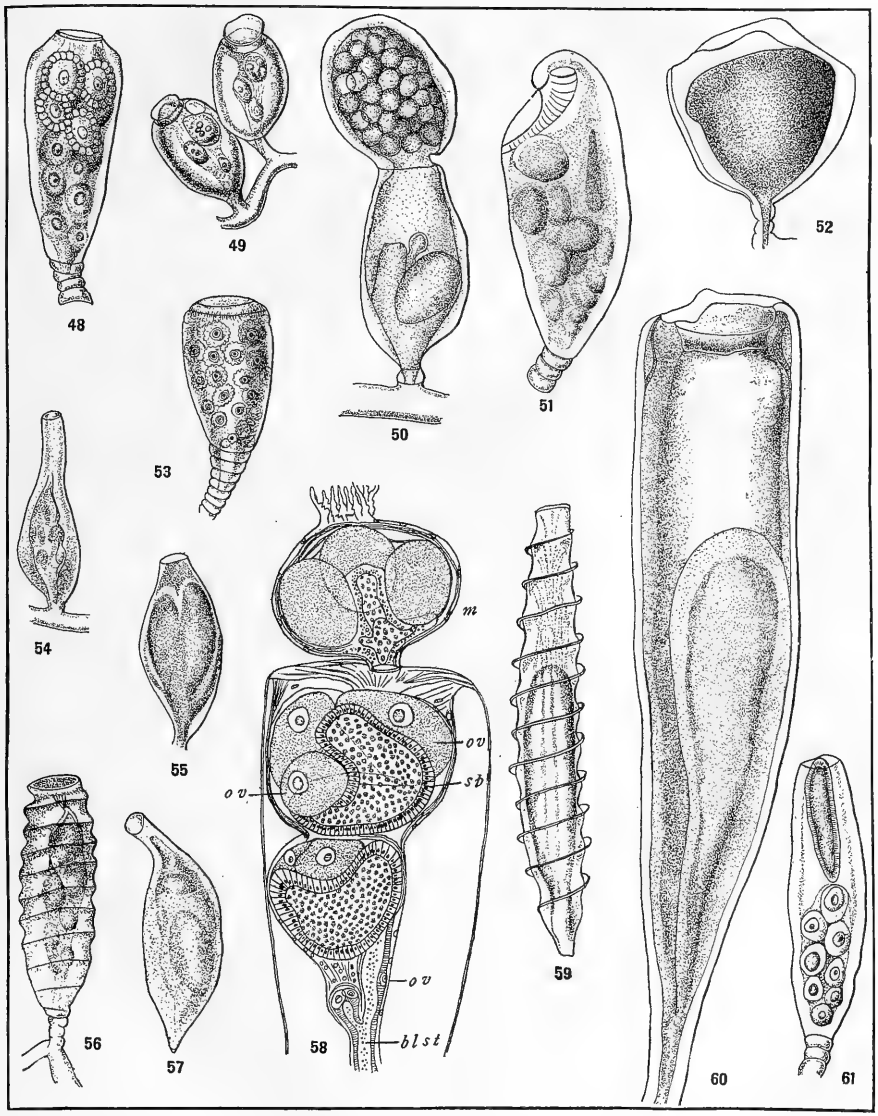
During the extracapsular existence of the meconidia their connection with the blastostyle is evident, the tubular cavity of the latter being in direct communication with canal systems of the former. This is the only instance known to the writer in which a sessile medusa is produced by a calypteroblastic hydroid, although such instances are not uncommon among the gymnoblastic forms.

Weismann[2] has carefully worked out the structural and histological details of these remarkable structures, and has graphically represented them in plate 10 of his monumental work.

A rather unusual form of gonangium is presented by *Orthopyxis compressa* (fig. 52), in which the very stout gonangium is laterally compressed so as to have the form of an elongated ellipse in cross section. Another very peculiar form is found in *Campanularia calceolifera* (fig. 51),

[1] Gymnoblastic Hydroids, 1871, p. 58.

[2] Die Entstehung der Sexualzellen bei den Hydromedusen, 1883, p. 131.



GONANGIA OF THE CAMPANULARIDÆ.

Fig. 48.—*Obelia commissuralis.*
Fig. 49.—*Clytia noliformis.*
Fig. 50.—*Orthopyxis everta* (showing acrocyst.)
Fig. 51.—*Campanularia calceolifera.*
Fig. 52.—*Orthopyxis compressa.*
Fig. 53.—*Obelia dubia.*
Fig. 54.—*Campanularia magnifica.*
Fig. 55.—*Campanularia verticillata.*
Fig. 56.—*Clytia johnston.*
Fig. 57.—*Campanularia fusiformis.*
Fig. 58.—*Gonothyræa loveni* (after Allman): *blst*, blastostyle; *m*, meconidium or sessile medusa; *ov*, ovum; *sp*, spadix.
Fig. 59.—*Campanularia spiralis.* (Much less magnified than other figures on this plate.)
Fig. 60.—*Silicularia divergens.*
Fig. 61.—*Campanularia flexuosa.*

which presents a bilateral symmetry more pronounced than any other that I have seen among the campanularian hydroids. The species was first described by Hincks,[1] and his excellent description has not been improved upon by subsequent writers. It is here quoted:

> They [the gonangia] are perfectly hyaline and of a unique and singularly graceful form. They are best described as slipper-shaped; but the upper extremity is curved into the most exquisite spiral, while the lower portion tapers rapidly toward the point of junction with the ringed stem. Immediately below the spiral a wide opening leads into the tubular passage by which the embryos make their escape, which bends upward within the capsule and terminates in a circular orifice near the top. The gonophores, which are numerous, form an elongated mass nearly filling the cavity of the gonotheca.

The curious introverted neck of these gonangia is a feature that is unique, so far as the writer knows, among the hydroida.

The gonophores.—These are entirely homologous with those commonly found among the Sertularidæ. The blastostyle usually occupies a central or axial position in the gonangium, and the gonophores arise as hernia-like protrusions from the blastostyle. As in the Sertularidæ, the end of the blastostyle is commonly expanded into a "plug" which fills the distal end of the gonangium. In *Campanularia* the ova or sporosacs are borne by gonophores which are budded directly from the blastostyle, and the ova develop directly into planulæ which later escape from the gonangium by rupturing the lid of the latter, or the lid is ruptured by some other means. In other genera in which there are no free medusæ the same general morphology of the gonophores prevails, the difference being largely in the number of gonophores which are produced as buds from the blastostyle. In *Campanularia* (fig. 61) these are numerous and usually borne on all sides of the blastostyle, while in *Gonothyræa* they are few and are borne on one side of the blastostyle (fig. 58). In all cases the distal gonophores are the older, and therefore discharge their sexual products in regular succession from above downward; or, rather, the growth of the blastostyle itself carries the gonophores from below upward as they mature.

In the genus *Obelaria* we find an exceptional state of affairs, in that the gonophores produce sexual products as usual, but the ova develop into planulæ outside of the gonangium, instead of inside as in *Campanularia*, the most nearly related group.[2] The single species of *Obelaria*, *O. gelatinosa*, was, until Hartlaub's work appeared, regarded as an *Obelia*, and its medusæ were described by numerous writers as having 16 tentacles at the time of liberation. This probably arose from the fact that this species was early confounded with *Obelia longissima*.

In the genus *Obelia* the gonophores are produced on all sides of the axial blastostyle and occur in great numbers, being very small in size, and often completely cover the blastostyle (fig. 48). The medusæ are discoid in shape, with four radial canals and eight lithocysts borne on the inner sides of the tentacle bases. The amazing number of medusæ given off from a single colony when there are hundreds of gonangia each liberating scores of these minute medusæ may account in part for the great abundance and extensive geographical distribution of many species of this genus.

In *Clytia* (fig. 49) the gonophores are not so numerous, as a rule, as in *Obelia*, but they are arranged around a central or axial blastostyle, as in that genus. The medusæ are usually larger than in *Obelia* and are at first almost globular in shape, with four radial canals and eight lithocysts placed between the tentacle bases. After liberation their form is more nearly hemispherical.

In *Orthopyxis* the blastostyle is branched and bears but one mature medusa at a time, and this one is relatively very large and more or less globular or campanulate or hemispherical in shape. The medusæ are so large as to crowd the blastostyle to one side, and are remarkable from the fact that they have neither manubrium nor tentacles, but agree with the medusæ of *Obelia* and *Clytia* in having eight lithocysts.

The medusæ.—Many campanularians differ from the Plumularidæ and Sertularidæ in the fact that they produce free-swimming medusæ which are very generally regarded as motile

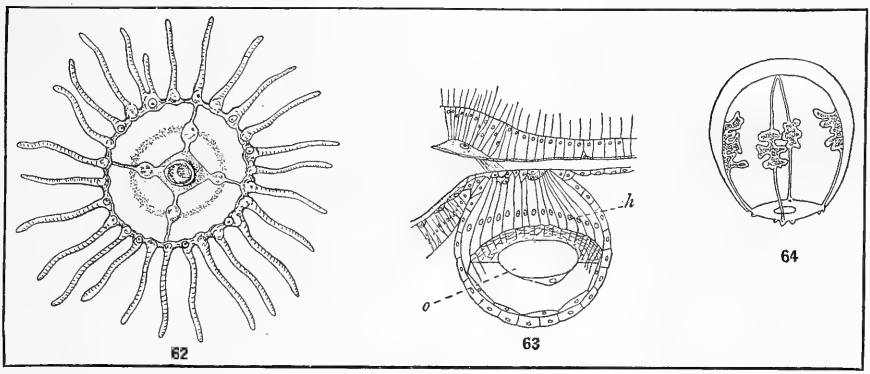
[1] Zooph. of South Devon and Cornwall, Ann. Mag. Nat. Hist., ser. 4, vol. 8, 1871, p. 78.

[2] Hartlaub has discussed this point at length in his Hydromedusæ Helgolands, 1897, p. 489.

gonophores, or, as Allman calls them, "phanerocodonic gonophores." The sessile gonophore or sporosac is homologically a degraded medusa and, in some cases at least, it is possible to trace in such a gonophore the various layers of the medusa in their proper sequence and relation[1].

While the medusa is structurally a sexual person of the colony, it has an additional function not subserved by the fixed gonophore—i. e., that of a "seed carrier" or distributer of the sexual elements. On this account Allman has given the name "planoblast" or "wandering bud" to the medusa.[2] This author has done more, perhaps, than any other to elucidate the morphology and homological significance of the various structures found in the Hydroids.

The typical medusa is composed of a gelatinous bell which may vary in shape from a nearly flat disk (fig. 62) to an almost complete sphere (fig. 64). From the center of the subumbrellar



MEDUSÆ OF THE CAMPANULARIDÆ.

Fig. 62.—*Obelia flabellata*.
Fig. 63.—Otocyst of *Orthopyxis campanularia*. (After von Lendenfeld.) *h*, velum; *o*, otolith.
Fig. 64.—*Agastra mira* (= *Orthopyxis caliculata*). (After Mayer.)

surface there usually hangs the manubrium which, in the Campanularidæ, is very simple in form, often being a knob-like body with the opening or mouth at its distal end. This mouth communicates with the gastric cavity centrally located in the bell. The four corners of the gastric cavity are drawn out into the four equidistant radial canals which pass down immediately above the subumbrellar surface to the ring canal which encircles the edge of the bell. The marginal tentacles are found in the medusæ of all campanularians except in the genus *Orthopyxis*.

All of the medusæ of the Campanularidæ belong to the order Leptomedusæ of Haeckel, defined as follows by Mayer: [3]

> Hydromedusæ which arise by alternation of generation from campanularian hydroids. The gonads are developed upon the radial canals. When present, the lithocysts are of ectodermal origin.

This author, however, uses the term "campanularian hydroid" so as to include a number of forms, e. g., CAMPANULINIDÆ, which do not come under the definition of Campanularidæ as used in the present work. All of the medusæ produced by the Campanularidæ as here understood would come under the family Eucopidæ as used by Mayer, who defines this family as "Leptomedusæ with lithocysts and with less than eight radial canals upon which the gonads are developed." [4]

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[1] See page 30 of the first part of this work for a discussion of the homology of the corresponding layers of a gonophore and medusa.

[2] *Challenger* Reports, Hydroida, part 2, 1888, p. xxvi.

[3] Medusæ of the World, vol. 1, the Hydromedusæ, 1910, p. 196.

[4] Idem, vol. 2, the Hydromedusæ, 1910, p. 231.

Most of the medusæ of the Campanularidæ belong to the subfamily of the Eucopidæ, the Obelinæ, characterized by the possession of eight adradial lithocysts and a manubrium without a peduncle. Medusæ of but three genera of this subfamily have been definitely identified with hydroid colonies. These are *Orthopyxis* Agassiz, *Agastra* Hartlaub, and *Obelia* Péron and Lesueur. In the present work *Agastra* is regarded as generically identical with *Orthopyxis* on account of the very great similarity of the hydroid stocks, and *Obelia* is retained.

One genus of Campanularidæ produces medusæ belonging to Mayer's second subfamily, the Phialinæ, characterized by having more or less than eight lithocysts and a manubrium with a well-developed peduncle. The well-known genus *Clytia* belongs to this group, its medusæ conforming to the diagnosis given above.

The homology existing between the medusa and the ordinary gonophore has already been referred to. The gonophore itself is generally regarded as a sexual offshoot from the blastostyle and the latter is generally looked upon as homologous with a hydranth without tentacles and ordinarily without a mouth.

Various authors have also drawn attention to the homologies which can be shown to exist between the medusa and the hydranth. If a medusa of simple form be inverted and compared with a hydranth it is quite evident that most of the parts of the one are strictly comparable with similar parts of the other. For instance:

The manubrium of the medusa is equivalent to the proboscis of the hydranth.

The gastric cavity of the medusa is homologous with the body cavity of the hydranth.

The bell of the medusa is comparable to the body of the hydranth in which the stutzlamella is immensely thickened to form the "jelly" of the medusa.

The tentacles (marginal) of the medusa are homologous with the tentacles of the hydranth.

There are two structures in the campanularian medusæ that have no homologues in the hydranth—i. e., the velum and the lithocysts. The former is an organ of locomotion that is not called for in the sessile hydranth, and the latter is a sense organ concerned primarily with orientation, a function not of great value in a fixed form.

The lithocysts (fig. 63) are found in all medusæ produced by the Campanularidæ, and constitute the first specialized sense organs that we have thus far encountered in our study of the Hydroida. They thus deserve more than a passing mention here.

These structures are ectodermal in origin and eight in number in all Campanularidæ with known hydroid stocks, except in the genus *Clytia* where there are 16 lithocysts in the adult medusa. In all Leptomedusæ they arise as folds of the velum near the margin of the bell and are therefore ectodermal. In *Obelia* they lie under the bases of the tentacles where the latter join the margin. In *Clytia* they are placed on the margin between the tentacle bases. In *Orthopyxis* they are eight in number equally spaced around the margin or, in *O. caliculata,* they are on the margin near the radial canals.

Within the globular lithocysts the otoliths (fig. 63, *o*) appear as calcareous concretions looking like glassy bodies, in many cases single, as in several species of *Obelia;* while in other cases, e. g., *Tiaropsis,* there are several of these bodies, in some cases arranged in a crescent, as represented by Mayer.[1] The ectodermal cells forming the inner wall of the lithocyst are supposed to be sensory. Von Lendenfeld found a number of columnar epithelial sense cells lining the otocyst on the side nearest the velum in *Orthopyxis campanularia* (fig. 63, *h*) and a lenticular otolith with a diameter of about half that of the cavity of the otocyst.[2] The otoliths are said to be suspended in a fluid and the movements or alterations in position of the medusa cause a corresponding movement of the suspended otoliths, bringing them in contact with the sense cells and thus serving a function in the orientation of the organism.

The radial canals are normally four in number in all medusæ that are known to be produced by campanularian colonies, and the gonads or ovaries are always found (when developed

[1] Medusæ of the World, vol. 2, the Hydromedusæ, 1910, pl. 32, fig. 9.

[2] Über Coelenteraten der Südsee, part 4, plate 32, fig. 35.

at all) suspended beneath the radial canals of which they appear to be outgrowths or diverticula. They are therefore endodermal in origin.

All medusæ produced by hydroid colonies have a double nerve ring, one above and one below the velum, and are thus in close connection with the otocysts and sense cells. The velum being the principal organ of locomotion, these nerve rings have doubtless been developed largely in connection with this function, and we therefore find a much more highly developed nervous system in the medusæ than has thus far been found in the colonial forms of hydroida. In comparison with the higher metazoa, however, the nervous equipment of the medusæ is exceedingly primitive.

The tentacles are confined to the margin, never being found in connection with the manubrium, as in many medusæ produced by the gymnoblastic colonies. They are all of much the same structure, being solid, with a core of endoderm enveloped by a structureless stutzlamella, and this latter, in turn, being inclosed in a cylinder of ectodermal cells, among which are embedded many cnidoblasts containing nematocysts.

Muscle cells lie just outside of the stutzlamella or supporting layer. The tentacles vary in number from 4 to 24, the former number being found in *Clytia* and the latter in several full-grown medusæ of the genus *Obelia*. Torrey has described a species, *Obelia purpurea*, which has from 110 to 160 tentacles. As has been said before, the genus *Orthopyxis* is without tentacles.

Sense bulbs appear as swellings on the tentacle bases in the genus *Clytia*. None of these contain definite eye spots, so far as I know, although they sometimes do contain a rather definite aggregation of pigment granules, the color being brown in *C. johnstoni* and green in *C. noliformis*, according to Brooks. These pigment spots have usually been associated with a rudimentary sense of sight, or rather of light detection.

Nematocysts are found rather abundantly scattered over the surface of the bell of *Clytia johnstoni*.

The alternation of generation among the hydroid medusæ has been discussed at length by several writers, perhaps the most extended treatment of the subject being that of Allman.[1] The whole subject, however, needs a careful reexamination, and the writer hopes to discuss the matter in connection with a future part of this work. It will suffice for the present to indicate the belief that the fixed hydranth form antedated the medusa form in the phylogeny of the group. The radial symmetry of the medusæ indicates a fixed origin, and, while there are cases in which actinules or hydranthlike forms develop into medusæ (*Cunoctantha octonaria*), there seems to be no well demonstrated case in which the medusa develops into a hydranth.

So far as the Campanularidæ are concerned, it seems evident that the medusæ are functionally but motile gonophores or mechanical distributors of the sexual elements, and that their use in the economy of the species is thus explained. How it comes, however, that such hydroid colonies as *Obelia* and *Campanularia*, practically identical as to their trophosomes, should differ so remarkably in their gonosomes—the one producing typically free medusæ and the other producing gonophores which produce planulæ direct—is more than our present knowledge enables us to explain.

If the gonophore is but a degraded medusa, as is claimed by many writers (and so explained in the present work), why is it that two genera living under practically identical conditions and having practically identical trophosomes in some cases should present in the one case typical functional medusæ and in the other the functionless degraded medusæ known as gonophores?

We become still more bewildered when we find it reported that a single species (*Orthopyxis caliculata*) has been found under certain conditions to produce free medusæ (*Agastra*) while under other conditions it produces sessile gonophores.[2]

Is it possible that genera arise in such a way?

[1] Gymnoblastic Hydroids, 1871, pp. 101–110.

[2] Giard, Compt. Rend. Soc. Biol., Paris, 1898, p. 17.

Again, how does it come about that two species (*Obelia longissima* and *Obelaria gelatinosa*), so nearly alike that they have repeatedly been mistaken for each other by experienced writers, differ so in their gonosomes that the former produces free medusæ with 16 marginal tentacles and the other produces sessile gonophores from which planulæ are produced which develop outside of the gonangium?[1]

DEVELOPMENT OF THE CAMPANULARIDÆ.

The origin of the sex cells is much like that described in the first part of this work in connection with the Plumularidæ. Weismann[2] has discussed this process in *Campanularia flexuosa* and in *Gonothyræa loveni* with his usual thoroughness. He finds that the ova originate in the endoderm of the stem in both of these species, later migrating into the blastostyle and finally into the gonophore. The spermatozoa, however, seem to have a different origin in the two species, arising, in *Campanularia flexuosa*, in the ectoderm of the blastostyle and of the ultimate twigs on which the gonangia appear. In *Gonothyræa loveni* the male sex cells arise in the endoderm of the branches. In this species Weismann found sterile gonophores even where the meconidia had been developed. In some cases male colonies bore gonangia with four to seven gonophores, all entirely destitute of spermaries.

The origin and maturing of the male sex cells in *Campanularia flexuosa* has been worked out in great detail by Thallwitz.[3] He confirms Weismann's description as to the origin of the spermatoblasts in the ectoderm of the ultimate twigs which bear the gonangia and described their development with great minuteness.

Hartlaub[4] has made a careful investigation of the origin of the sex cells in *Obelia*. He studied more particularly *O. adelungi*, a species found in Helgoland, and ascertained that sex cells are found in the ectoderm of the manubrium of the medusa, but that they really originate in the endoderm, passing into the ectoderm when approaching maturity. In the later stages of their development the ova move from the manubrium and take their final position under the radial canal. He finds that the sperm cells originate as indifferent sex cells seen at the first day of the free life of the medusa, and are located at the base of the manubrium, and, extending for one-third of the length of the radial canals, finally take their place in the spermaries, where they mature as sperm cells in the ectoderm. There thus appears to be fundamental agreement in the origin and growth of the ova and spermatozoa in this species of *Obelia*.

The Campanularidæ do not differ materially from the other families thus far discussed in the growth of the ovum into the free-swimming planula.

The formation of the colony after the fixation of the planula has been investigated with great care by Alfred Kühn,[5] who has worked with the following species of Campanularidæ: *Obelia geniculata, O. dichotoma, Gonothyræa loveni, Campanularia flexuosa,* and *Clytia johnstoni*. The following account is condensed from that given by Kühn:

The planula after settling to the bottom becomes transformed into the primary hydranth with a chitinous perisarc covering the pedicel and the hydrotheca covering the hydranth. Below the latter are the usual annulations of the perisarc. Below these annulations the cœnosarc is pressed outward against the perisarc, producing a bulging appearance at this point and indicating the location of the first budding ("spooss spitz") of another hydranth. By a repetition of this process the entire colony is built up.[6] In the development of the hydranth from one of these buds, the bud is prolonged until it forms a tubular process of cœnosarc covered with perisarc and usually annulated proximally (fig. 65). Later, the distal end of the tube is enlarged so as to form a cup-like expansion (fig. 66). The top as well as the sides of this cup, or hydrotheca,

[1] Die Hydromedusen Helgolands, 1897, p. 489.

[2] Die Entstehung der Sexualzellen bei den Hydromedusen, 1883.

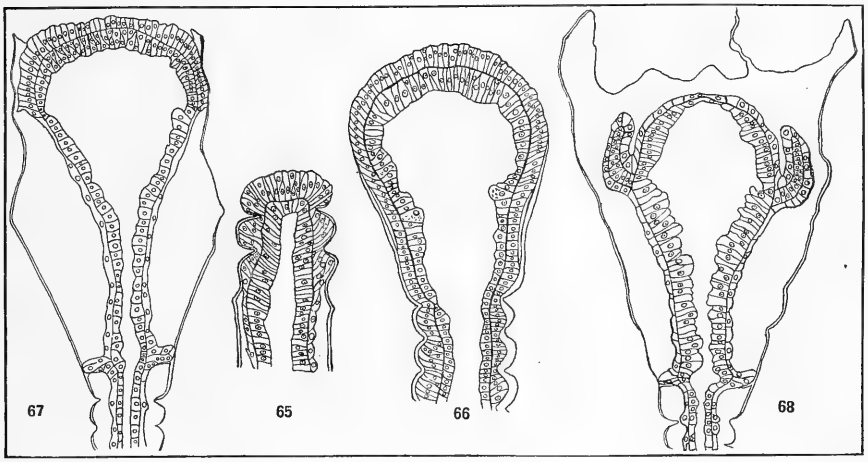
[3] Ueber die Entwicklung der männlichen Keimzellen bei den Hydroiden, Jenaische Zeitschrift, vol. 18, 1885, p. 390.

[4] Beobachtungen über die Entstehung der Sexualzellen bei Obelia, 1884.

[5] Sprosswachsthum und Polypenknospung bei den Thecophoren, 1909.

[6] Die ganze Kolonie besteht also aus einer Anzahl von aufeinanderfolgenden Polypen, von denen jeder durch Knospung vom vorhergehenden aus entstanden ist.

is covered with an investment of chitin, and the interior of the cup is in close contact with the ectoderm of the developing hydranth throughout, and the endoderm lines the cavity of the latter. Later the lower portion of the hydranth body becomes separated from the hydrothecal wall by a sort of shrinking (fig. 67), and this part of the hydranth has an outer layer of ectoderm much thinner than that which invests the upper or distal part, which shows an ectoderm composed of columnar cells in close contact with the upper part of the hydrothecal wall and with the thin periderm cap. At about this time the specific ornamentation of the hydrothecal margin is formed and, in the lower part of the hydrotheca, the diaphragm becomes differentiated. Around the distal end of the developing hydranth the rudiments of the tentacles are formed, the first indication being the appearance of a ring of endoderm cells around the inner



DEVELOPMENT OF THE CAMPANULARIAN HYDRANTH.

(After Kühn.)

Fig. 65. *Gonothyræa loveni*. Longitudinal section of a hydranth bud.
Fig. 66. *Obelia dichotoma*. Longitudinal section of an older bud.
Fig. 67. *Gonothyræa loveni*. Longitudinal section of a hydranth as it is beginning to separate from its hydrotheca.
Fig. 68. *Gonothyræa loveni*. Longitudinal section of a hydranth after the budding of the tentacles and before the formation of the mouth.

wall of the end of the developing hydranth, the cells being derived from the original endodermal lining of the gastric cavity. In places these endodermal cells "pile up" as it were into little cones representing the tentacle buds and pushing out the overlying ectoderm cells, the whole appearance being, as the author says, much like the vegetation point in plants. The tentacles then appear as widely separated swellings placed in a circle around the broad flattened end of the hydranth, and at the same time the end itself becomes dome-shaped and the tentacles become separated from the endoderm of the gastric cavity by a thin layer of stutzlamella (fig. 68). Later the dome-shaped proboscis becomes sharply constricted off at the bottom and the characteristic "trumpet-shaped" proboscis of the Campanularidæ is formed. Meanwhile the tentacles themselves assume their final histological arrangement of a central core or a single row of endodermal cells enveloped by a stutzlamella and ectoderm.

Before this occurs, however, the thin layer of chitin which has covered the distal end of the hydrotheca has been separated from the hydranth, so that the latter is now entirely free except from the diaphragm at its base.

As the hydranth approaches maturity, after the budding of the tentacles (fig. 47), a great differentiation appears in the endoderm cells. Those in the hypostome become very small and

cylindrical, forming a smooth surface; while those of the gastric cavity are broader and protrude into the cavity. In the oral end of the proboscis both cells layers are thinner, and here the mouth breaks through both layers and establishes communication with the interior. This occurs before the development of the trumpet-shaped proboscis.

This same writer treats of the phylogeny of the Thecophora and represents the Sertularidæ as having been derived from the Campanularidæ,[1] basing his conclusions exclusively on the method of budding and growth of the colony. With this conclusion the present writer is unable to agree, as it runs counter to that which, to his mind, is much more weighty evidence tending to show that the Sertularidæ can not have been derived from the Campanularidæ. A more logical argument, as it seems to the writer, can be based on the characters of the hydranth itself. As a general thing the nutritive persons seem much less easily modified than is the general form of the colony or what might be called the skeletal characters—i. e., the perisarc. The Scandinavian writer, Broch,[2] has separated the forms which come under the family Campanularidæ, as here used, from all other Calypteroblastea and placed them under a suborder which he calls "Thecophora Proboscoidea" on account of their trumpet-shaped proboscis. That the Campanularidæ differ from all the other families of Calypteroblastea more than these latter do from each other seems evident. The constant and striking character of the hypostome is confined to this group and the gymnoblastic family Eudendridæ.

That the trumpet-shaped proboscis is a specialization and therefore a departure from the original type is shown in sequence of events in the growth of the hydranth as described by Kühn in the work referred to,[3] and sketched on a previous page of the present work. In the course of this development the hydranth assumes first the form of hypostome characteristic of the Sertularidæ and afterwards takes on the characteristic trumpet shape of the Campanularidæ. This seems to be a very strong proof that the former can not be derived from the latter, as claimed by Kühn. If such a derivation were a fact, we would have a reversal of the ordinary procedure in embryological development that would be unexpected, to say the least.

Referring again to the similarity of the hydranth of the Campanularidæ to that of the Eudendridæ it may be worth while to call attention to the fact that in this latter family we have the nearest approach to the production of the hydrotheca that I have seen in the gymnoblastic hydroids. In *Eudendrium vaginatum* Allman the perisarc of the pedicel is produced upward and expanded into a cup-like form which covers the hydranth body up to a short distance below the tentacle bases. The proximal part of the female gonophore is protected in the same way by an expansion of the distal end of the perisarc covering the pedicel.[4] In this species the hydranth with its trumpet-shaped proboscis and its striking pseudo-hydrotheca reminds one very strikingly of a campanularian form. The pseudo-hydrotheca, however, seems to be attached to the hydranth throughout the extent of the former, not free as in the Campanularidæ.

In *Garveia annulata* Nutting we have a similar instance of a pseudo-hydrotheca in connection with a hydranth having a dome-shaped proboscis very similar to that found in the Sertularidæ. In discussing this species the describer says:[5]

> The structure that I have designated above as a "pseudo-hydrotheca" is of considerable morphological interest, for it may throw light on the origin of the hydrotheca. The extension of the chitinous perisarc of the stem over the body of the hydranth appears to be attached to the latter. A true hydrotheca would be formed if the perisarc around the hydranth body should become thicker and detached.

In the development of the hydranth as worked out by Kühn and described on a previous page it is seen that the hydrotheca is at first attached to the hydranth body throughout, and later becomes free. If ontogeny here follows the path of phylogeny it seems evident that such species as *Eudendrium vaginatum* and *Garveia annulata* represent the primitive condition of the hydrotheca.

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[1] Alfred Kühn, Sprosswachstum und Polypenknospung bei den Thecophoren, 1909, p. 465.

[2] Die Hydroiden der arktischen Meere, 1909, p. 183.

[3] Sprosswachstum und Polypenknospung bei den Thecophoren, 1909.

[4] See Nutting, Hydroids of the Harriman Alaska Expedition, 1901, pl. 15, figs. 3–6.

[5] Hydroids of the Harriman Alaska Expedition, 1901, p. 167.

It is, moreover, interesting to note that all of the calypteroblastic forms have hydranths that conform either to the *Garveia* or to the *Eudendrium* type;[1] that is, they have either dome-shaped or trumpet-shaped hypostomes and a single whorl of filiform tentacles.

A further differentiation of the hydrotheca in *Eudendrium vaginatum*, in which the chitinous investment would become free, would result in a colony very closely resembling the Campanularidæ, so far as the trophosome is concerned. It should also be noted in this connection that Kühn[2] has called attention to the resemblance existing between the Campanularidæ and Eudendridæ in the mode of growth of the colony, both being by means of the production of lateral buds from the stem or branch.

Indeed, there seems to be nothing in that writer's investigations that would militate against the view that the Campanularidæ may be derived from the Eudendridæ, or else that the two may have community of descent from some other form.[3]

SYSTEMATIC DISCUSSION OF THE CAMPANULARIDÆ.

Trophosome.—Calyces pediculate, campanulate or tubular, radially symmetrical, without operculum; but usually having the cavity separated from that of the pedicel by a diaphragm. Hydranth with a trumpet-shaped proboscis. Stem without distinct axial and peripheral tubes.

Gonosome.—Gonangia containing blastostyles from which either planulæ or medusæ may develop. In the latter case the medusæ are leptomedusæ.

The first mention I can find of this family name is by Johnston, who uses and defines the word "Campanulariadæ" in his British Zoophytes,[4] and indicates that he had previously used the same family designation in Transactions of the Berkshire Club, p. 107. He includes not only the Campanularians proper, but also "*Lafœa dumosa*" which would now go into the Lafoeidæ, and his definition "Embryos medusiform" would exclude all members of the genus *Campanularia*, which do not have medusiform embryos.

Louis Agassiz, 1862,[5] in discussing genera of the campanularian hydroids, recognizes the genera *Clytia, Orthopyxis, Campanularia, Tiaropsis, Laomedea, Obelia* and *Eucope*. But this author does not discuss the genera. In his Tabular View (p. 351), he does not present any designation which would be equivalent to the Campanularidæ of the present time, but mentions a number of families of medusæ among which are Eucopidæ, including *Eucopea* and *Laomedea*, and Oceanidæ, containing a number of campanularian forms, such as *Clytia, Platypyxis, Wrightia* (= *Calycella*), *Orthopyxis*, and *Hincksia* (= *Campanularia*).

Hincks in his classic work[6] gives the following: "Campanulariidæ. Hydrothecæ terminal, pedicellate, campanulate; polypites with a large, trumpet-shaped proboscis." He is not consistent in admitting under this definition the genera *Campanulina* and *Opercularella* which have hydranths with a typically conical proboscis. He admits the genera *Clytia, Obelia, Campanularia, Lovenella, Thaumantias, Gonothyræa, Campanulina*, and *Opercularella*.

Allman (1864)[7] gives a scholarly discussion of the classification of the hydroids in which he uses the word "Campanularidæ" in its present form. He recognizes the genera *Campanularia, Obelia, Laomedea, Hincksia, Gonothyræa, Trichydra, Calycella* and *Campanulina*.

Allman, in his Report on the Hydroida of the *Challenger* Expedition,[8] uses the spelling "Campanularidæ" and defines the family as follows: "Trophosome.—Hydrothecæ borne by peduncles, campanulate or tubular; hydrocaulus not enveloped by peripheral tubes.

[1] An exception to this statement must be made in connection with members of the family Bonneviellidæ to be described beyond.

[2] Sprosswachstum und Polypenknospung bei den Thecophoren, 1909, p. 391.

[3] Since writing the above the author has received the excellent monograph of Dr. E. Stechow Hydroidpolypen der japanischen Ostküste, München, 1913, in which the possibility of community of descent of the Campanularidæ and Eudendridæ is indicated in the table under the heading Systematische Betrachtung, p. 16.

[4] Second edition, vol. 1, 1847, p. 101.

[5] Cont. Nat. Hist. U. S., vol. 4, 1862, p. 297, *et seq.*

[6] British Hydroid Zoophytes, 1868, p. 137.

[7] Construction and Limitation of Genera among the Hydroids, Ann. Mag. Nat. Hist., ser. 3, vol. 13, 1864, p. 371.

[8] Part 2, 1888, p. 18.

"Gonosome.—Gonophores planoblasts or hedrioblasts." He uses the additional genera *Hypanthea, Calamphora, Hebella,* and *Halisiphonia.*

Marktanner-Turneretscher (1890)[1] gives the following definition of the family "Campanulariidæ."

Hydrotheken meist auf deutlichen, wenn auch kurzen Stielchen aufsitzend, von glocken- oder röhrenförmiger Gestalt. Hydrocaulus mono- oder polysiphon, im letzteren Falle aber keine axials Röhre vorhanden, von welcher die Stielchen sämmtlicher vorhandenen Hydrotheken entspringen, sondern mehrere Röhren gleichmässig an der Bildung von hydrothekentragenden Stielchen betheiligt.

This definition is practically the one adopted for the present work. He recognizes the genera *Campanularia, Obelia, Thyrocyphus, Eucopella, Hypanthia, Halisiphonia, Lafoeina, Calycella, Hebella, Opercularella,* and *Clytia.*

Levinsen, 1893,[2] removes the genera *Calycella, Campanulina, Lafoeina* and *Cuspedella* from the Campanularidæ and places them in the Campanulinidæ, and combines the genera *Obelia* and *Gonothyræa* in the old genus *Laomedea.*

Schneider, 1897,[3] uses the spelling "Campanularidæ" and combines Hincks's four families *Campanulariidæ, Campanulinidæ, Leptocyphidæ,* and *Lafoëidæ* in one, and includes practically all of the Campanularidæ as usually understood in the one genus *Campanularia;* a scheme which would lead to confusion worse confounded and render the work of the systematists in this group hopeless, except when he deals with a very limited number of forms. Even here his success would be due to ignorance rather than to scientific acumen.

No systematic treatise of serious import for our discussion appeared between 1897 and 1909, when two works of monographic form appeared from Scandinavian writers.

One of these, Jäderholm's,[4] is notable for its exceptionally fine plates, which, in the opinion of the writer, have never been surpassed in clearness and fidelity to the original, in works on the Hydroida. This author (p. 13) defines the family at some length and makes the possession of a well-defined diaphragm a family character. He recognizes and defines the following genera (pp. 16–20): *Clytia, Hebella, Thaumantias, Obelia, Gonothyræa, Campanularia, Galanthula* and gives well defined keys to the genera and to the species under each genus.

In the same year (1909) Broch[5] published another valuable contribution to our knowledge of this group. He defines the family Campanulariidæ at considerable length under the "Unterordnung Thecophora proboscoidea" and gives the historical review of the discussion of the systematic position and limitation of the family. He recognizes and defines the genera *Campanularia* and *Laomedea* (including the genera *Laomedea, Gonothyræa,* and *Obelia* of other authors). He thus goes to an extreme not found in the works of other writers in throwing together genera which are much more conveniently kept separate, in the opinion of the present writer. While there may be considerable argument on theoretical grounds for such a course it undoubtedly leads to unnecessary and practically unsurmountable difficulties when large numbers of species are to be handled and described.

Mayer, in his Medusæ of the World, vols. 1 and 2, the Hydromedusæ, 1910, has the last word thus far appearing on the systematic treatment of this group, considering the subject however from the medusæ standpoint. It is impracticable to homologize his system with that of writers on the Hydroida. The present writer after conference with Doctor Mayer[6] was compelled reluctantly to agree with him that the difficulties in the way of arriving at a satisfactory classification that would be available for systematists working both in the Hydroida and Hydromedusæ were such as to make the task impracticable in the present state of our knowledge.

[1] Hydroiden des k.k. naturhistorischen Hofmuseums, p. 203.

[2] Meduser, Ctenophorer og Hydroider fra Grönlands Vestkyst, p. 35.

[3] Hydropolypen von Rovigno, nebst Uebersicht über das System der Hydropolypen im Allgemeinen, Zoologische Jahrbücher, vol. 10, 1897, p. 505.

[4] Northern and Arctic Invert., pt. 4, Hydroiden, 1909.

[5] Die Hydroiden der arktischen Meere, p. 183.

[6] See Medusæ of the World, vol. 1, p. 3.

For instance, Mayer includes under his family "Eucopidæ" the genera *Eucopella*, *Campanulina*, *Obelia*, *Clytia*, and *Phortis*. Some of these (e. g., *Obelia* and *Clytia*) would come under Campanularidæ as used in the present work, and others such as *Campanulina* would find a place under Campanulinidæ. Again the medusæ which have the trophosome of *Campanularia* are placed by him in four separate genera—*Eucope*, *Mitrocoma*, *Eirene*, and *Tima;* and still another *Campanulina* trophosome produces medusæ which he puts in an entirely different family, the Æquoridæ (*Æquorea*).

The following generic names have become more or less intrenched in the literature of the Campanularidæ through the writings of recent authorities:[1] *Eucope, Galanthula, Campalaria, Thyroscyphus; Calamphora, Hypanthea, Eucopella, Halisiphonia, Laomedea, Hebella, Clytia, Campanularia, Obelia, Obelaria, Thaumantias, Gonothyræa, Silicularia,* and *Orthopyxis* (= *Hypanthea*). From the above list the following genera should, in the opinion of the writer, be dropped or referred to other families:

Eucope.—According to Mayer,[2] this genus of medusæ, dating from 1856, is produced from a *Campanularia* trophosome. The hydroid species by A. Agassiz should go into the genus *Obelia.*

Galanthula.—The diagnosis of the genus *Galanthula* of Hartlaub is as follows:[3]

Hydrorhiza kletternd, Hydranthen unverzweigt mit länglich eiförmigen, scharf abgesetzen Hydrotheken, Hydrotheken ohne Basalraum und ohne Rundversetzung am Diaphragma.

The character of the manubrium is not indicated in the drawings and the absence of the diaphragm is sufficient to exclude this genus from the family Campanularidæ as here used. This character is usually correlated with a conical hypostome and thus it is likely that we will find a further reason for excluding *Galanthula* from the Campanularidæ.

Campalaria.—This genus was established by Hartlaub[4] to accommodate a species which differs from *Campanularia* in having but one gonophore in a gonangium (instead of several) and in having the ova pass through their development outside of the gonangium. This genus is not found in American waters and need not be discussed here. The writer considers it of doubtful validity.

Thyroscyphus.—This genus has been referred to the Campanulinidæ by Levinsen[5] and Hartlaub.[6] Two species collected by the Bureau of Fisheries Steamer *Albatross* in the North Pacific which have been examined by me, serve to convince me that *Thyroscyphus* is closely allied to *Sertularella*. I would therefore refer the genus *Thyroscyphus* to the Sertularidæ.

Calamphora.—This genus, established by Allman in 1888,[7] undoubtedly has its closest affinities with *Sertularella* and should certainly be included in the Sertularidæ. The writer has a sketch of a specimen from the North Pacific, the basal part of which agrees with Allman's description of *Calamphora*, and the distal part is a true *Sertularella.*

Hypanthea.—Another genus described by Allman is characterized as follows:[8]

Trophosome.—Hydrothecæ borne each on the summit of a cylindrical peduncle, which springs from a creeping stolon, inoperculate, with the cavity so reduced by the great thickness of its chitinous walls as to be incapable of receiving the hydranth in retraction. *Gonosome.*—Gonophores in the form of simple sporosacs developed within chitinous gonangia, which spring, aggregated or scattered, from the creeping stolon.

Hartlaub[9] claims that *Hypanthea* is practically a synonym for *Silicularia*, Mayer, 1834, at least in part, and the present writer accepts his conclusion as apparently well grounded.

[1] Species formerly placed in the Campanularidæ, but now relegated to other families, e. g., Campanulinidæ and Lafoëidæ, are *not* included in this list.

[2] Medusæ of the World, vol. 1, 1910, p. 10.

[3] Beiträge zur Fauna der südöstlichen und östlichen Nordsee, vol. 3, pt. 6, Hydroiden, 1898, p. 110, Wissenschaftliche Meeresuntersuchungen, new ser., vol. 3, 1898.

[4] Die Hydromedusen Helgolands, 1897, p. 495.

[5] Meduser, Ctenophorer og Hydroider fra Grönlands Vestkyst, 1893, p. 34.

[6] Die Hydroiden der magalhaensischen Region und chilenischen Küste, 1895, p. 588.

[7] *Challenger* Reports, Hydroida, pt. 2, 1888, p. 28, and pl. 10.

[8] Idem, p. 25.

[9] Die Hydroiden der magalhaensischen Region und chilenischen Küste, 1895, p. 553.

Eucopella.—This genus, although very generally recognized at the present time, will have to be dropped in favor of the genus *Orthopyxis*. *Eucopella* was proposed in 1885, the type-species being *E. campanularia*, nearly allied to the familiar *Clytia caliculata* of authors. Agassiz in 1862 based his genus *Orthopyxis* on his *O. poterium*, which is now considered as *Clytia caliculata*. A further discussion of this matter will be found in connection with the formal discussion of the genus *Orthopyxis* on page 63.

Halisiphonia.—Another of Allman's genera based on the *Challenger* collections.[1] This does not come within the definition of the Campanularidæ as used in this work. The original definition is as follows:

Trophosome.—Hydrocaulus a monosiphonic stolon. Hydrothecæ tubiform, with entire margin, destitute of operculum, with the cavity directly continuous with that of the peduncle or stolon, and with the hydrothecal walls never adnate to the hydrocaulus. Hydranth with conical hypostome. *Gonosome.*—Gonangial capsules borne by the hydrocaulus.

The combination of absence of diaphragm and a conical hypostome would exclude the genus from the Campanularidæ.

Laomedea.—Broch (1909)[2] attempts to make a distinction between *Campanularia* and *Laomedea* on the basis of the hydrothecal diaphragm. He shows that in *Campanularia integra* there is a thickening of the hydrothecal walls below the hydranth, and that the apparent diaphragm is merely the basal portion of the stutzlamelle of the hydranth, while in *Laomedea geniculata* (Linnæus) there is a true diaphragm. It seems to me, however, that we have here a difference in degree and not in kind. The thickening of the walls in *Campanularia integra*, by being accentuated and more sharply localized would produce such a diaphragm as is shown in Broch's figure of *Laomedea geniculata*, and is not sufficient, in my opinion, to constitute a good generic character. I would therefore discard the highly unnatural genus *Laomedea* (as used by Broch), in which species of such very different gonosomes are included, and place the species in *Campanularia*, *Gonothyræa*, and *Obelia*.

Hebella.—This genus contains species with a well-defined diaphragm and a conical hypostome. This latter character is sufficient to take the genus out of the family Campanularidæ.

After eliminating these genera, the following remain to be considered: *Campanularia*, *Clytia*, *Obelia*, *Obelaria*, *Thaumantias*, *Gonothyræa*, *Silicularia*, and *Orthopyxis*.

It should be understood at the outset that it is clearly impossible to define the genera of hydroids on the basis of the trophosome alone, and this is particularly true of the Campanularidæ. Indeed, the gonosome is more useful than the trophosome in affording generic distinctions in this family. A combination of the two will in most cases yield a practicable generic distinction.

KEY TO THE GENERA OF CAMPANULARIDÆ.

Colonies always regularly branched.
- Gonangia with medusiform acrocysts which do not become free ..... *Gonothyræa.*
- Gonangia producing free medusæ ..... *Obelia.*
- Gonangia producing ova which develop outside ..... *Obelaria.*

Colonies unbranched, or if branched, with an upright stem which does not spring from a creeping rootstock.
- Gonangia containing fixed sporosacs ..... *Campanularia.*

Colonies unbranched and pedicels springing from a creeping rootstock.
- Gonangia producing free, hemispherical medusæ with eight lithocysts at birth ..... *Clytia.*
- Gonangia producing medusæ without lithocysts ..... *Thaumantias.*
- Hydrothecal walls greatly thickened.
  - Hydrothecæ unsymmetrical, not capable of containing the retracted hydranth ..... *Silicularia.*
  - Hydrothecæ usually symmetrical, capable of containing retracted hydranth ..... *Orthopyxis.*

It must be remembered that such keys as the above are merely conveniences and are not intended to point out the really important generic characters. These latter will be found in the definitions of the several genera.

[1] *Challenger* Reports, Hydroida, pt. 2, 1888, p. 30.
[2] Die Hydroiden der arktischen Meere, p. 183.

Distribution of American Campanularidæ.

	Geographical.																	Bathymetric (in fathoms).
	American.									European.								
	Atlantic.					Pacific.												
	Canadian region.	North Atlantic region. (U. S.).	West Indian region.	Brazilian region.	Patagonian and Antarctic region.	Arctic region.	Alaskan region.	Californian region. (Including Trop. S. A.)	South Pacific region. (Including Chile.)	Scandinavian and Arctic region.	British region.	Continental region.	Mediterranean region.	Siberian region (including Japan).	Indo-Pacific region.	Australasia.	African region.	
Campanularia amphora	+	+																1–10?
angulata		+																1–10?
brevicaulis			+															194
calceolifera		+									+							1–10
coronata			+															1–10?
denticulata							+	?+										1–10?
exigua								+			+	+	+					10–18
flexuosa		+								+	+	+	+	+				1–10?
fragilis		+									+	+						1–30
fusiformis								+										1–10?
gigantea		+								+	+		+					1–10?
grænlandica						+	+	+		+				+				1–746
hesperia								+										1–200
hincksii		+						+		+	+	+	+	+	+	+	+	10–144
integra	+	+				+	+	+	+	+	+	+	+	+	+	+	+	1–100
kincaidi							+											1–10
lævis						+												?
lennoxensis						+												12–25
macroscypha			+															28–373
magnifica																		50–72
marginata		+	+								+							21–440
neglecta		+																1–16
obtusidens									+									10–15
ptychocyathus				+														?
raridentata		?+										+	+		+			1–200
rigida								+										1–10?
ritteri							+											20
speciosa						+	+			+								6–120
spiralis															+			58
subrufa						+												57–88
tincta						+												21
tulipifera						+												57–150
urceolata							+	+										1–10?
verticillata	+	+				+	+	+		+	+	+		+				1–330
volubilis	+	+					+	+		+	+	+		+				1–110
Clytia attenuata								+										1–10?
bakeri								+										1–10?
bicophora																		1–10
cylindrica		+																1–10?
edwardsi		+																1–10?
fragilis		+						+							+			1–14
hendersoni			+															3
johnstoni	+	+				?		+			+	+	+	+			+	1–100
longicyatha		+														+		1–14
minuta		+	+														+	1–10
noliformis	+	+														+		1–10?
sargassicola			+															1–10?
universitatis																		1–10?
Orthopyxis caliculata	+	+				+	+	+	+	+	+	+	+	+	+	+	+	1–100
clytioides						+			+				+					1–10?
compressa						+		+										1–20
crenata						+										+		1–7
everta						+		+										10–42
Gonothyræa clarki							+				+							1–25
gracilis		+					+		+	+	+	+	+					1–110
inornata								+										1–25
loveni							+			+	+	+	+					1–55
Obelaria gelatinosa	+	+				+	+	+		+	+	+	+	+				1–30
Obelia austrogorgia																		1–10?
bicuspidata		+		+														1–30
borealis							+											1–10?
braziliensis				+														1–10
commissuralis		+						+										1–10?
corona								+										1–10?
dichotoma		+					+	+										1–65
dubia		+					+	+										1–10?
flabellata		+		+		+					+	+						1–25
fragilis									+									
geniculata	+	+	+		+			+	+	+	+	+	+	+		+		1–35
gracilis								+										1–10?
griffini								+										1–10?
hyalina			+											+		+		1–35
longissima	+	+			+				+	+	+	+	+					1–80
plicata							+	+			+							1–10?
surcularis								+										1–10
Silicularia atlantica				+														?
hemispherica					+													1–10?
pedunculata					+													1–10?
repens					+													1–10?
reticulata					+													1–10?
rosea					+											+		1–10?
Thaumantias inconspicua							+	+			+							1–10?

These regions are defined under the discussion of the distribution of the Sertularidæ on page 47 of part 2 of this work. The regions adopted for the Campanularidæ are practically the same as for the Sertularidæ, with the following exceptions:

The CALIFORNIAN region is extended to include the Pacific Coasts of tropical South America.

The SCANDINAVIAN region is extended to include the Arctic regions immediately north of Europe.

An "INDO–PACIFIC" and an "AFRICAN" region are added.

The North Atlantic coast of the United States appears from this showing to be richer in campanularian life than any other region, there being 30 species out of the 81 included in the American hydroid fauna, or 37 per cent. It is altogether probable, however, that if an equal amount of collecting had been done on the North Pacific coast there would be found to be as many or more species of hydroids from that region, including the Californian and Alaskan, as are known from the Atlantic coast.

The Californian region is extended southward to include the Pacific shores of tropical America, but this extension does not result in the addition of any hydroid species. Twenty-eight species have been found in this region, or about 34 per cent of the total American species. This showing is due to the extension of the known range of many Alaskan species southward, rather than the discovery of additional species on the Californian coasts.

Next in importance, so far as North American waters are concerned, comes the Alaskan region with 18 species, the Arctic with 12 species, and the West Indian and Canadian with 10 species each.

In South American waters the Patagonian and Antarctic region leads with 21 species, or about 27 per cent of the total of American Campanularidæ, while the South Pacific region, including Chile, has yielded but 8 species, or 10 per cent of the total. It must be remembered, however, that South American waters have been relatively but little explored and that the ultimate showing may be quite different.

In European waters the British region leads with 21 species, or 27 per cent of the entire number of known American Campanularidæ. It is of interest to note in this connection that 9 species, or 41 per cent, of the Californian forms are familiar British species. This seems to be further evidence of the meridianal distribution of the Hydroida from Polar regions to which the present writer has called attention in previous communications.[1]

The Patagonian (including the Antarctic) region proves to be almost as prolific in campanularian forms as the British region, yielding 21 species, or 27 per cent, of the entire list of American Campanularidæ, showing that this family has about twice as many representatives in the Patagonian region as has the Sertularidæ.

Two genera have their center of distribution in this region, i. e., the genera *Orthopyxis* and *Silicularia*, with an aggregate of 11 species. Of the remaining 10 species found in this region 5, *Campanularia integra*, *C. verticillata*, *Obelaria gelatinosa*, *Obelia geniculata* and *O. longissima*, are species of very wide distribution belonging to genera which are almost cosmopolitan.

The West Indian region is the home of 10 species, or 12 per cent, showing that the campanularians have a relatively poor proportion of species in our southern waters.

The Brazilian and African regions are apparently the poorest of all in representatives of this group. While this is doubtless largely due to lack of extensive exploration in these regions, it is nevertheless probably a fact that they are poor in campanularian life. We must, moreover, bear in mind the fact that this table includes only those Campanularidæ that are known to occur in American waters, and that a similar table prepared to illustrate the distribution of European forms would probably include a larger number of forms from the African region.

The remarkably wide distribution of individual species of hydroids is indicated in this table which shows no less than 30 species that are common to Europe and America. That is, nearly 38 per cent of American Campanularidæ are found also on the other side of the Atlantic.

[1] Papers from the Harriman Alaska Expedition, vol. 21, the Hydroids, 1901, p. 162. American Hydroids, pt. 2, 1904, p. 48.

Campanularia integra and *Orthopyxis caliculata* have the most extensive geographical distribution of all the American Campanularidæ, each being found in 14 of the 17 regions embraced in the table. It may be of interest to note that both of these have remarkably thickened hydrothecæ and both are comparatively shallow-water forms.

Doubtless the habit of growing on floating timbers, seaweed, etc., which characterizes so many campanularians will account, in some measure at least, for the wide distribution of many species, and the profusion of free-swimming medusæ produced by *Obelia* and some other genera is another factor leading to the same result.

Bathymetric distribution.—In comparing this table with the corresponding ones for the Plumularidæ (part 1, p. 501) and the Sertularidæ (part 2, p. 45), it at once appears that there are relatively many more shallow-water species in the Campanularidæ than in either of the other families thus far treated in this work.

It should be explained that in the table giving the bathymetric distribution of the Campanularidæ there are very many between-tide and shallow-water forms for which no data regarding depth can be found. In such cases the depth is given arbitrarily as "1–10 fath.," and in none of these cases has a depth greater than 10 fathoms been recorded, the context indicating that the species are found on seaweed or along the shores and have not been secured by dredging.

Thirty-eight species (or 49 per cent) of all American Campanularidæ are reported from depths not greater than 10 fathoms, while 57 (or 72 per cent) have not been reported from depths greater than 50 fathoms. Seventy-four of the 81 species have been found at a depth of less than 50 fathoms.

Adding to the table on page 49, part 2 of this work, the corresponding data concerning the Campanularidæ, we have the following comparison of the bathymetric distribution of the Plumularidæ, Sertularidæ, and Campanularidæ:

Comparative distribution at increasing depths.

Family.	Less than 50 fathoms.	Over 50 fathoms.	Over 100 fathoms.	Over 150 fathoms.	Over 200 fathoms.	Over 500 fathoms.	Over 1,000 fathoms.
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
Plumularidæ	50	63	49	40	28	5	3
Sertularidæ	75	40	30	26	16	6	3
Campanularidæ	94	23	19	9	6	0	0

This table shows at a glance that the Campanularidæ are relatively shallow-water forms as compared with the Plumularidæ and Sertularidæ.

The deepest haul which has yielded an American campanularian was at *Albatross* station 2415, lat. 30° 44′ N.; long. 79° 26′ W., where *Campanularia marginata* was found and a depth of 440 fathoms was reported. *Campanularia macroscypha* was found by the Bureau of Fisheries steamer *Albatross* at station 2664, lat. 29° 41′ N.; long. 79° 55′ W. at a depth of 373 fathoms, and *Campanularia verticillata* has been reported by Bonnevie from off the Norwegian coast at a depth of 328 fathoms.

Outside of the genus *Campanularia*, none of the Campanularidæ has been reported from a greater depth than 110 fathoms (*Gonothyræa gracilis*). *Clytia johnstoni* and *Eucopella caliculata* have been reported from 100 fathoms. The deepest known habitat for an *Obelia* is 80 fathoms, where *O. longissima* has been found, while no member of the genus *Silicularia* has been reported from a greater depth than 10 fathoms.

Genus CAMPANULARIA Lamarck (modified by Hincks).

Trophosome.—Colony branched or unbranched. Hydrothecæ usually strictly campanulate.
Gonosome.—Gonangia containing fixed sporosacs from which planulæ are directly developed.

Lamarck gives the following definition:[1]

Polypier phytoïde filiforme, sarmenteux, corné; à tiges fistuleuses, simples ou rameuses.
Calyces campanulés, dentés sur les bords, soutenus par des pédoncules longs et tortillés.

[1] Histoire Nat. Anim. sans Vert., vol. 2, 1836, p. 129.

The genus as thus described would include all of the Campanularidæ of later writers and is the type-genus of that family. Hincks, as was so often the case, saw the availability of the gonosome as a means of separating genera, and adds to his description of the trophosome the fact that the gonophores contain fixed sporosacs which mature their products within the capsule.

The type of this genus is *Campanularia verticillata.*

KEY TO THE AMERICAN SPECIES OF CAMPANULARIA.

Colonies regularly branched.
- Stem compound.
  - Pedicels arranged in verticils ..... *verticillata.*
  - Hydrothecæ sessile ..... *subrufa.*
- Stem monosiphonic.
  - Margin crenulated ..... *tulipifera.*
  - Margin bimucronate ..... *neglecta.*
  - Margin regularly toothed. Teeth about 7, acute ..... *obtusidens.*
  - Margin smooth.
    - Pedicels decidedly shorter than hydrothecæ.
      - Stem straight, hydrothecæ almost sessile ..... *rigida.*
      - Stem undulating, margin with thickened band. Hydrothecæ sessile ..... *marginata.*
      - Stem flexuose.
        - Hydrothecæ campanulate ..... *calceolifera.*
        - Hydrothecæ long and tubular ..... *fragilis.*
        - Branches from all sides of the stem ..... *amphora.*
    - Pedicels as long as hydrothecæ, or longer.
      - Stem geniculate ..... *angulata.*
      - Pedicels ordinarily about as long as hydrothecæ ..... *flexuosa.*
      - Pedicels ordinarily about twice as long as hydrothecæ ..... *exigua.*

Colonies not regularly branched.
- Margin smooth.
  - Hydrothecal walls greatly thickened below ..... *integra.*
  - Walls not noticeably thickened, hydrothecæ very large ..... *spiralis.*
  - Walls not thickened, hydrothecæ not so large ..... *ritteri.*
- Margin crenulated, gonangia bowl-shaped ..... *speciosa.*
- Margin crenulated, gonangia with tubular neck ..... *magnifica.*
- Margin toothed.
  - Hydrothecal walls with vertical lines or plications.
    - Hydrothecal teeth truncated at top, pedicels smooth ..... *hincksii.*
    - Hydrothecal teeth rounded, pedicels annulated ..... *grœnlandica.*
    - Hydrothecal teeth acuminate.
      - Walls thick and rigid, pedicels short ..... *tincta.*
      - Walls thin, pedicels long ..... *kincaidi.*
  - Hydrothecal walls neither lined nor plicated.
    - Pedicels not regularly annulated, smooth.
      - Hydrothecæ very large (2 mm. high), tubular ..... *macroscypha.*
      - Hydrothecæ very large, campanulate ..... *gigantea.*
      - Hydrothecæ medium or small.
        - Teeth sharply pointed ..... *variidentata.*
        - Teeth truncated above, or even emarginate.
          - Teeth 14 ..... *lævis.*
          - Teeth 8, bimucronate ..... *brevicaulis.*
    - Pedicels annulated.
      - Hydrothecæ obconical, upper walls collapsible ..... *ptychocyathus.*
      - Hydrothecæ typically urceolate, margins often reduplicated ..... *urceolata.*
      - Hydrothecæ large, campanulate, thin ..... *denticulata.*
      - Hydrothecæ deeply campanulate or tubular.
        - Gonangia flask-shaped.
          - Neck short tubular ..... *volubilis.*
          - Neck long tubular ..... *fusiformis.*
        - Gonangia cylindrical, annulated ..... *coronata.*
        - Twelve sharply pointed hydrothecal teeth ..... *hesperia.*

CAMPANULARIA VERTICILLATA (Linnæus).

Plate 1, figs. 1–3.

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Campanularia verticillata Kramp, Paul L., Hydroids collected by the *Tjalfe* Exped. to the West Coast of Greenland, 1913, p. 30.

Trophosome.—Colony erect, branched; stem and main branches polysiphonic.[1] Colony attaining a height of 14 inches, but usually considerably less. The pedicels originate in irregular whorls or verticels from the tubes of the polysiphonic stem and branches, there being usually 5 to 9 pedicels in one of these irregular whorls. Whorls about 2 mm. apart, as a rule; but they become less regular and more approximated toward distal ends of the branches, projecting at a wide angle from the stem or branch. A medium-sized branch consists of six tubes and the verticils are usually composed of six pedicels, one from each tube. The pedicels and hydrothecæ together measure about 2.5 mm. Pedicels often annulated throughout, but the annulations are more distant on the median portion than near the end. Just below the hydrothecæ are two deep annular constrictions rather near together, resulting in a globular appearance of the extreme distal end of the pedicel. The hydrothecæ are broadly campanulate, rather large and with rigid walls, the margin being ornamented with a regular series of usually 16 teeth which are more or less squared or truncated at the ends. There is a well-marked thickening of the hydrothecal walls near the bottom which constricts the hydrothecal cavity and forms a poorly differentiated basal chamber below the hydranth and has the effect of a diaphragm, indeed constitutes one in the opinion of the present writer.

Gonosome.—The gonangia are situated on the branches between the verticils of pedicels, being thickly scattered on all sides and more numerous than the pedicels in the specimen described. They are flask-shaped with a narrowed somewhat tubular neck that is usually unsymmetrically placed and ends in a round aperture. The gonangia are supported on short peduncles and are, on the average, about half the length of the pedicels. They contain simple blastostyles bearing simple sporosacs.

[1] Hargitt (1908) has shown that there are connections of cœnosarc between the tubes.

A specimen from off the Alaska coast (station 2850) is considerably larger than the one described, the whorls of pedicels are more distant and there are sometimes as many as nine pedicels in a whorl. This probably represents *Campanularia fascia* Torrey.[1] I find no difference, however, that can be regarded as specific. Another specimen (station 2858) from near Sitka, Alaska, depth 230 fathoms, is more bushy and dendritic in its habit, the branches often being more or less contorted like those of an oak tree. The gonangia are more slender, especially in the distal neck. Here again there is nothing that seems to justify a separation from *C. verticillata*. It is doubtless the form described as *C. circula* Clark.[2]

Distribution.—In American waters. Labrador (Packard); Nova Scotia (Nutting); New England coast (Verrill and Nutting); Bering Sea (Jäderholm); Alaska (Clark, Nutting); Puget Sound (Nutting); Californian coast (Torrey, Nutting). *Albatross* station 2850, lat. 54° 52′ N.; long. 159° 46′ W., 21 fathoms. *Albatross* station 2858, lat. 58° 17′ N.; long. 148° 36′ W., 238 fathoms. Kodiak Harbor (Harriman Exped.). Numerous stations along the Alaskan Coast (Nutting, manuscript).

General distribution.[3]— Sweden (Segerstedt), Norway (Bonnevie, Broch), North Sea (Broch); Iceland (Saemondsson); Greenland (Levinsen, Hartlaub); Spitzbergen (Marktanner-Turneretscher); Murman Sea (Jäderholm); White Sea (Schydlowsky); Barents Sea (Thompson); Polar Sea (Bergh); British Islands (Hincks and others); Helgoland (Hartlaub); Denmark (Levinsen); France (Billard); McMurdo Bay, Antarctic (Hickson and Gravely).

Bathymetric distribution.—Shallow water down to 600 meters off the Norwegian coast (Bonnevie), 230 fathoms off the Atlantic coast (Nutting).

This species as above indicated has a very extensive distribution throughout the Northern Hemisphere except in Asiatic waters. The extension of the species into the Antarctic regions rests on the form described as *C. verticillata* var. *grandis*, Hickson and Gravely. The author has seen one specimen from Japanese waters that is apparently of this species and if this is true the distribution should be extended to Asiatic waters.

CAMPANULARIA VOLUBILIS (Linnæus).

Plate 1, figs. 4–6.

Sertularia volubilis Linnæus, Systema Naturæ, ed. 10, 1758, p. 811.
Sertularia volubilis Houttuyn, Natuurlijke Historie, vol. 17, 1761-1773, p. 556.
Sertularia uniflora Pallas, Elenchus Zoophytorum, 1766, p. 121.
Sertularia volubilis Linnæus, Systema Naturæ, ed. 12, 1767, p. 1311.
Sertularia uniflora Boddaert, Lyst der Plant dieren, 1768, p. 151.
Sertularia uniflora Ellis, Philos. Trans. Royal Society, vol. 571, 1768, p. 434.
Sertularia volubilis Maratti, De Plantis Zoophytis, etc., 1776, p. 32.
Sertularia volubilis Fabricius, Fauna Grœnlandica, 1780, p. 444.
Sertularia uniflora Wilkins and Herbst, in Pallas, Characteristik der Thierpflanzen, 1787, p. 160.
Campanularia volubilis Esper, Die Pflanzenthiere, vol. 3, 1788–1830, p. 168.
Sertularia volubilis Gmelin, in Linnæus, Systema Naturæ, ed. 13, vol. 1, part 6, 1790, p. 3851.
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Sertularia volubilis Berkenhout, Synop. Nat. Hist. Gt. Britain, vol. 1, 1795, p. 218.
Sertularia volubilis Bosc, Histoire naturelle des Vers, vol. 3, 1802, p. 96.
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Sertularia volubilis Oken, Lehrbuch der Naturgeschichte, pt. 3, 1815, p. 92.
Sertularia volubilis Stewart, Elements of Nat. Hist. Animal Kingdom, ed. 2, vol. 2, 1817, p. 444.
Campanularia volubilis Schweigger, Handbuch der Naturgeschichte, 1820, p. 425.
Sertularia volubilis Fleming, Edinburgh Philos. Journ., vol. 2, 1820, p. 88.
Campanularia volubilis Risso, Histoire Naturelle, vol. 5, 1826, p. 309.
Sertularia volubilis Hogg, On the Nat. Hist. of the Vicinity of Stockton-on-Tees, 1827, p. 34.
Campanularia volubilis Fleming, Hist.Brit. Anim., 1828, p. 548.
Campanularia volubilis de Blainville, Manuel d'Actinologie, 1834, p. 472.
Sertularia volubilis Kirby, On the Hist., Habits, and Instincts of Anim., 1835, pp. xii, 169.

[1] Hydroids of the Pacific coast, 1902, p. 52.

[2] Proc. Philadelphia Acad. Nat. Sci., 1876, p. 213.

[3] The author desires here to state that he has made extensive use of the excellent monograph of Jäderholm, "Northern and Arctic Invertebrates, Hydroiden," 1909, in working out the distribution of the Campanularidæ. He has also availed himself largely of the data given in Broch's fine monograph "Die Hydroiden der Arktischen Meere," 1909.

Campanularia volubilis Milne Edwards, in Lamarck, Hist. Nat. Anim. sans Vert., 1836, p. 132.
Campanularia volubilis Templeton, Catalogue species of rayed animals found in Ireland, 1836, p. 466.
Campanularia volubilis Hassall, Cat. of Irish Zooph., 1841, p. 169.
Campanularia volubilis Hyndman, Ann. Mag. Nat. Hist., vol. 10, 1842, p. 20.
Campanularia volubilis Macgillivray, Cat. of Marine Zooph. found in the neighborhood of Aberdeen, 1842, p. 465.
Campanularia volubilis Thompson, Report on the Fauna of Ireland, 1844, p. 238.
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Campanularia volubilis Alder, Cat. Zooph. of Northumb. and Durham, 1857, p. 35.
Campanularia volubilis Greene, A Manual of the Subkingdon Cœlenterata, 1861, p. 94.
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Campanularia volubilis Verrill, Amer. Journ. Sci., vol. 7, 1874, p. 44.
Campanularia volubilis Hincks, Ann. Mag. Nat. Hist., ser. 4, vol. 13, 1874, p. 147.
Campanularia volubilis Mereschkowsky, Ann. Mag. Nat. Hist., ser. 5, vol. 2, 1878, p. 322.
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Campanularia volubilis Levinsen, Meduser, Ctenophorer og Hydroider fra Grönlands Vestkyst, 1892, p. 26.
Campanularia volubilis Crawford, Ann. Mag. Nat. Hist., ser. 6, vol. 16, 1895, p. 260.
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Campanularia volubilis Fraser, West Coast Hydroids, 1911, p. 31.
Campanularia volubilis Kramp, Hydroids of Danish Exped. to Northeast Greenland, 1911, p. 389.
Campanularia verticillata Kramp, Hydroids collected by the *Tjalfe* Exped. to the West Coast of Greenland, 1913, p. 29.

Trophosome.—Colony[1] consisting of a number of unbranched pedicels arising from a creeping rootstock. The rootstock is parasitic on *Sertularella polyzonias* and creeps irregularly over the branches and hydrothecæ of the latter. It is more or less annulated or twisted in places, but in general is quite smooth. The pedicels arise irregularly and vary greatly in height, but are seldom more than 1.5 mm. long. They are usually annulated throughout, the annulations often being oblique and thus giving a spirally twisted appearance described by Hincks.[2] The annulations on the distal part are often less close than on the proximal part of the pedicels. There is often a well-marked spherical annulation just below the hydrotheca. The hydrotheca is small, deeply campanulate or broadly tubular, a typical one being about $1\frac{1}{2}$ times as long as wide. The sides are parallel for the greater part of their length and the margin bears about 12 rather shallow but clean-cut teeth. The diaphragm is of the same type as described under *C. verticillata*, being a mere annular thickening of the perisarc near the bottom of the hydrotheca, which forms a constricted passage between the hydrothecal chamber and a small and not well defined basal chamber. The hydranths are of the usual campanularian type.

Gonosome.—Gonangia much as in *C. verticillata* but with a shorter neck, being flask-shaped with a narrow neck, round aperture and walls not regularly annulated. The sexual products mature in sporosacs before being extruded from the body.

This species was confused with *Clytia johnstoni* by several of the earlier writers, notably Johnston himself.[3] This was pointed out by Alder,[4] who described the species *C. johnstoni* to accommodate the form mistaken for *Campanularia volubilis* by Johnston.

Distribution.—American. Labrador (Hincks); Gulf of St. Lawrence (Packard); New England Coast (Verrill, Nutting, Hargitt); Pacific Coast, California (Torrey); Bering Sea (Station 3511, 39 fathoms); Bare Island, (Hartlaub).

General Distribution.—This species has a very wide circumpolar and north temperate distribution. Norway (Bonnevie); North Sea (Broch); Iceland (Saemondsson); Greenland (Levinsen); Spitzbergen (Marktanner-Turneretscher); Barents Sea (Thompson); White Sea (Schydlowsky); British Islands (Hincks, Alder and others); Helgoland (Hartlaub); Mediterranean Sea (Heller).

CAMPANULARIA INTEGRA Macgillivray.

Plate 1, fig. 7; plate 2, fig. 3.

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Campanularia integra Cocks, Contributions to the Fauna of Falmouth, 1849, p. 93.
Campanularia integra Maitland, Descriptio systematica animalium Belgii Septentrionalis, 1851, p. 43.
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Campanularia integra Thompson, Ann. Mag. Nat. Hist., ser. 2, vol. 11, 1853, p. 443.
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Campanularia integra McIntosh, Proc. Royal Soc. Edinburgh, vol. 5, 1866, p. 602.
Campanularia integra Hincks, British Hydroid Zoophytes, 1868, p. 162.
Campanularia integra Verrill, Proc. Amer. Assn. Adv. Sci., 1873, p. 364.

[1] The trophosome described is from station 3511, Bering Sea. The gonosome is described from a specimen from Eastport, Maine.

[2] British Hydroid Zoophytes, 1868, p. 161.

[3] Hist. Brit. Zooph., 1847, vol. 1, p. 107.

[4] Cat. Zooph. Northumb. and Durham, 1857, p. 35.

Campanularia integra CLARK, Alaskan Hydroids, 1876, p. 215.
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Campanularia integra BERGH, Goplepolyper fra Kara-Havet, 1887, p. 333.
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Campanularia integra HARTLAUB, Hydroiden aus den Stillen Ocean, 1901, p. 353.
Campanularia integra JÄDERHOLM, Hydroiden Schwed. Zool. Polar Exped., 1902, p. 9.
Campanularia integra JÄDERHOLM, Zur Kenntnis der Hydroiden fauna des Berings Meeres, 1907, p. 2.
Campanularia integra BILLARD, Hydroïdes de Madagascar, 1907, p. 340.
Campanularia integra JÄDERHOLM, Die Hydroiden des Siberischen Eismeeres, 1908, p. 10.
Campanularia integra FRASER, West Coast Hydroids, 1911, p. 31.
Campanularia integra (part) KRAMP, Report on Hydroids of the Danish Exped. to Northeast Greenland, 1911, p. 288.
Campanularia integra (part) KRAMP, Hydroids collected by the *Tjalfe* Exped. to the West Coast of Greenland, 1913, p. 28.
Campanularia integra STECHOW, Hydroidpolypen der japanischen Ostküste, pt. 2, 1913, p. 73.

Trophosome.[1]—Colony consisting of a creeping rootstock growing over a laminarian and sending off numerous lateral offshoots which extend in all directions over the surface of the plant. There are few, if any, regular annulations of the rootstock except where it branches. The pedicels are upright and irregularly distributed, attaining a height, with the hydrotheca, of about 5 mm. The pedicels are slender, more or less annulated throughout, although the annulations are unequally distributed and less closely set a short distance below the hydrothecæ. The annulations are often so oblique as to give a spiral effect. There is a globular annulation just below the hydrotheca. The hydrothecæ are broadly campanulate, usually flaring somewhat toward the margin. A typical one is about as high as wide at the margin. They vary considerably even in the same colony, sometimes being more tubular and considerably longer than wide. The margin is perfectly even and well defined and often reduplicated in the specimen described. The hydrothecal walls are thickened near the bottom, forming an internal ridge or shelf on which the hydranth rests and limiting an ill defined basal chamber. The hydranths have the ordinary campanularian structure.

Gonosome.—The gonangia are borne on the rootstocks, are oblong-oval in outline and regularly and strongly annulated; the annulations being oblique and imparting a spiral effect. Margin circular, wide and smooth. Pedicels short and smooth. Sexual products borne on fixed sporosacs.

The writer can not agree with Levinsen, Jäderholm, and Broch, in combining *C. caliculata* Hincks and *C. integra* Macgillivray in one species under the name of the latter. While it is true that an intergrading series of the hydrothecæ may be found, especially in taking calyces in all stages of growth (as in a large colony of *C. caliculata* where the thickening is largely a matter of age), the gonangia of the two are so different that their identity can not be assumed without a very serious stretch of the imagination.

Broch, who discusses this matter at length,[2] says that the gonangia of the two species intergrade, but I have seen no instance of the kind and, as the two may occur together, a very careful dissection would be necessary to place the matter beyond doubt. In general the hydrothecæ are noticeably smaller and thinner-walled in *C. integra*, and the gonangia more slender and distinctly annulated. It should be understood moreover that the present writer repudiates the idea that occasional intergradation in these low forms is sufficient ground for uniting species that are usually and perfectly distinguishable.

Distribution.—American. Labrador (Hincks); New England Coast (Agassiz and Hargitt); Alaska (Clark); Bering Sea (Jäderholm); Puget Sound (Nutting); *Albatross* station 2975, lat. 34° 01′ 30″ N.; long. 119° 29′ 00″ W., 36 fathoms, off southern California.

General distribution.—Sweden (Jäderholm); Norway (Broch); Spitzbergen (Jäderholm); White Sea (Schydlowsky); Arctic Sea (Bergh); Great Britain (Hincks and others); Mediterranean (Sars); Cape Verde Islands (Ritchie); Port Natal (Billard); Australia (Bale); New Zealand (Farquhar); Patagonia (Jäderholm); Chile and Straits of Magellan (Hartlaub); Japan (Stechow).

Bathymetric distribution.—One to 100 fathoms.

[1] Description of a specimen collected off Cape Ann by the United States Fish Commission.
[2] Die Hydroiden der arktische, Meere, 1909, p. 185.

CAMPANULARIA SPIRALIS, new species.[1]

Plate 2, fig. 1.

Trophosome.[2]—Colonies growing in dense masses around stems of other hydroids. Pedicels unbranched, springing from a creeping rootstock. Pedicels reaching a length of 11 mm., smooth for the most part, there being a few definite annulations just below the hydranth and often also at the base of the pedicel. Rarely the pedicel is more extensively annulated. The hydrothecæ are very large for this group, averaging about twice the length of *C. integra*, elongate-campanulate, more than twice as long as wide at the margin which is somewhat flaring and perfectly smooth. The actual measurement of a typical hydrotheca is 1.2 mm. in length. There is a thickening at the bottom of the hydrotheca as in allied species, but the hydrothecal walls in general are not extensively thickened. Hydranth of the usual campanularian type with a trumpet-shaped proboscis and about 24 tentacles.

Gonosome.—Gonangia growing almost sessile on the creeping rootstock, excessively elongated, attaining a length of 4.5 mm. and being about five and one-half times as long as broad. Its surface is deeply corrugated, the corrugations appearing as an ascending spiral and marked by an ascending spiral plate or flange that forms a conspicuous ornamentation. A long oval sporosac occupies a little more than the lower half of the gonangium, and this is embraced by a set of longitudinal bands which rise above it and break up distally with a number of fine strands attached to the inner surface of the gonangium.

Type-locality.—Station 4794, Staritschkof Island, Kamchatka, S. 70° W., 5 miles, 58 fathoms.

Type.—Cat. No. 34526, U.S.N.M. Cotype in the Museum of Natural History, State University of Iowa.

This species, although not known to be American, is included in the present work for purposes of comparison with allied forms. It is quite probable, moreover, that it will eventually be found in American waters.

CAMPANULARIA RITTERI Nutting.

Plate 2, fig. 2.

Campanularia ritteri NUTTING, Hydroids of Harriman Alaska Exped., 1901, p. 171.
Campanularia ritteri FRASER, West Coast Hydroids, 1911, p. 33.
Campanularia integra (part) KRAMP, Report on Hydroids collected by the Danish Exped. at Northeast Greenland, 1911, p. 388.
Campanularia ritteri (under name of *C. integra*) KRAMP, Hydroids collected by the *Tjalfe* Exped. to the West Coast of Greenland, 1913, p. 28.

Trophosome.[3]—Usually consisting of unbranched pedicels growing directly from a creeping rootstock, which is not regularly annulated. Pedicels long and slender, often from two to three times the length of the hydrotheca and with two or three annulations at their proximal end and a spherical annulation at the distal end. Otherwise they are usually without distinct annulation. The hydrothecæ are long for this genus, tubular, their sides being nearly parallel and with a round, perfectly smooth rim. Hydranths not present.

Gonosome.[4]—Gonangia large, tubular, about three times as long as wide, coarsely and regularly annulated, with the annulation nearly horizontal. Pedicel very short, borne on the rootstock and not annulated. Gonangial contents, numerous developing ova closely packed around the blastostyle.

Distribution.—This species is known only from the type locality, which is Juneau, Alaska, depth 20 fathoms, and from off the Californian coast, 31 fathoms. This resembles *C. spiralis* more nearly than any other species known to me, but the hydrothecæ and pedicels are smaller

[1] By the courtesy of the Hon. Geo. M. Bowers, late U. S. Commissioner of Fisheries, the writer has permission to include in this monograph the descriptions of a number of species of Campanularidæ which were to be included in a report on the Hydroids collected in the Northwest Pacific by the *Albatross* in 1906.

[2] Specimen from station 4794.

[3] Described from type-specimens from Juneau, Alaska.

[4] Described from a specimen from Station 2976 off the Californian coast; depth, 31 fathoms.

than in that species and the gonangia are much less slender and have the corrugations horizontal instead of spirally disposed.

CAMPANULARIA PTYCHOCYATHUS Allman.

Plate 2, fig. 4.

Campanularia ptychocyathus Allman, *Challenger* Reports, Hydroida, pt. 2, 1888, p. 20, pl. 10, figs. 2, 2*a*.

The following is the entire original description:

Trophosome.—Hydrocaulus a creeping stolon sending off at short intervals the peduncles of the hydrothecæ. Hydrothecæ obconical, deep, with the margin deeply dentate and with the walls for some distance below the orifice very thin and collapsible; peduncles long, annulated at intervals.

Gonosome.—Gonangia borne by the creeping stolon, destitute of annulation, deep, cylindrical, but narrowing towards the base, where they are supported on a short annulated peduncle, and with a constriction just below the wide truncated summit; orifice wide, circular, occupying the summit of the gonangium.

Locality.—Bahia, Brazil.

This species has not, I believe, been reported since its original discovery by the *Challenger*.

CAMPANULARIA DENTICULATA Clark.

Plate 3, figs. 6, 7.

Campanularia denticulata Clark, Proc. Acad. Nat. Sci., Philadelphia, 1876, p. 213.
Campanularia denticulata Nutting, Hydroids of Harriman Alaska Exped., 1901, p. 171.
Campanularia denticulata Fraser, West Coast Hydroids, 1911, p. 29.

Trophosome.[1]—Colony consisting of a creeping rootstock growing over other hydroids and giving off erect, usually, but not always, simple pedicels. The rootstock is intertwined around its support in a very complex manner, so that the pedicels are often in thick-set clumps. The rootstock is considerably thicker than the pedicels and its surface is smooth. The pedicels are exceedingly variable in length, but sometimes attain a length of 3 mm. They usually show three or four distinct large annulations at their distal ends and smaller but more numerous ones at their proximal ends and are commonly without regular annulations throughout their median portions. Exceptionally, however, they are annulated throughout. The hydrothecæ are rather large, campanulate, with walls quite thin and collapsible. The margin bears 12 to 16 sharply pointed teeth and the diaphragm is quite distinct, leaving a rather larger basal chamber than in the nearest allies of this species.

Gonosome.—The gonangia have hitherto been undescribed. They are borne sometimes on the rootstocks and sometimes on the pedicels. They are quite large, elongate-ovate in form, borne on a short annulated stalk, and have a very wide aperture which occupies the entire truncated distal end of the gonangium without any evident rim or collar. They contain from two to four developing ova or sporosacs.

Distribution.—The type-locality is Port Etches, Alaska; also reported from Orca, Alaska (Nutting), and San Pedro, California (Torrey). The latter identification, however, seems very doubtful to the present writer, judging from Torrey's description and figures.[2]

CAMPANULARIA HESPERIA Torrey.

Plate 3, fig. 5.

Campanularia hesperia Torrey, Hydroids of the San Diego Region, 1904, p. 12.
Campanularia hesperia Fraser, West Coast Hydroids, 1911, p. 31.

Trophosome.[3]—Colony consisting of a creeping rootstock which is undulating but not regularly annulated. Stems in the form of unbranched pedicels which are erect, rigid, shorter

[1] Description of a specimen from station 2865, lat. 48° 12′ N.; long. 122° 49′ W.; 40 fathoms.

[2] Torrey afterwards, 1904, decided that the species that he had called *C. denticulata* is really separate He describes it under the name of *Clytia universitatis*. Hydroids of the San Diego region, 1904, p. 19.

[3] Described from specimens sent by Doctor Torrey and labeled "*C. hesperia*, La Jolla, California, July, 1903"

proportionally than in many allied species. Pedicels with two or three annulations just below the hydrothecæ and a number at basal end. There are also usually one or two distinct groups of annulations on the median portions of the pedicels. Hydrothecæ deeply campanulate with straight lateral outlines, widening gradually from basal part to margin and nearly twice as long as broad.[1] There are 12 well marked, sharply pointed marginal teeth. The diaphragm is well marked and there is a proportionally large and deep basal chamber between the hydranth and the stem proper.

Gonosome.—Unknown.

Until the gonosome is found the present writer agrees with Doctor Torrey in assigning a specific name to this form although it may prove a synonym when the gonangia are known.

Distribution.—La Jolla, California, growing on alga.

CAMPANULARIA HINCKSII Alder.

Plate 3, figs. 3, 4.

Campanularia volubilis var. HINCKS, Ann. Mag. Nat. Hist., ser. 2, vol. 11, 1853, p. 180.
Campanularia hincksii ALDER, Cat. Zooph. Northumb. and Durham, 1857, p. 37.
Campanularia hincksii ALDER, Trans. Tyneside Nat. Field Club, vol. 3, 1858, p. 127.
Campanularia hincksii ALDER, Ann. Mag. Nat. Hist., ser. 3, vol. 5, 1860, p. 74.
Campanularia hincksii HINCKS, Ann. Mag. Nat. Hist., ser. 3, vol. 7, 1861, pp. 279, 281.
Campanularia hincksii HINCKS, Ann. Mag. Nat. Hist., ser. 3, vol. 8, 1861, pp. 152, 161.
Campanularia hincksii AGASSIZ, L., Cont. Nat. Hist. U. S., vol. 4, 1862, p. 354.
Campanularia hincksii ALDER, Tyneside Nat. Field Club, vol. 6, 1864, p. 193.
Campanularia hincksii ALLMAN, Ann. Mag. Nat. Hist., ser. 3, vol. 13, 1864, p. 372.
Campanularia hincksii ALDER, Nat. Hist. Northumb. and Durham, vol. 1, 1867, p. 50.
Campanularia hincksii NORMAN, Report of committee appointed for the purpose of exploring the coast of the Hebrides by means of a dredge, pt. 2, 1867, p. 199.
Campanularia hincksii HINCKS, British Hydroid Zoophytes, 1868, p. 162.
Campanularia hincksii NORMAN, Shetland final Dredging Report, pt. 2, 1869, p. 322.
Campanularia hincksii VERRILL, Proc. Amer. Ass. Adv. Sci., 1873, p. 364.
Campanularia hincksii MCINTOSH, Ann. Mag. Nat. Hist., ser. 4, vol. 13, 1874, p. 208.
Campanularia hincksii SARS, G. O., Bidrag til Kundskaben om Norges Hydroider, 1878, p. 34.
Campanularia hincksii WINTHER, Fortegnelse over de i Danmark og dets Nordlige Bilande fundna Hydroide Zoophyter, 1880, p. 263.
Campanularia hincksii BERGH, Goplepolyper fra Kara-Havet, 1887, p. 333.
Campanularia hincksii CRAWFORD, J. H., Ann. Mag. Nat. Hist., ser. 6, vol. 16, 1895, p. 260.
Campanularia hincksii BONNEVIE, Norwegian North Atlantic Exped., 1899, p. 72.
Campanularia hincksii NUTTING, Hydroids of the Woods Hole Region, 1901, p. 345.
Campanularia hincksii HARGITT, Synopsis of North Amer. Invert., pt. 1, 1901, p. 383.
Campanularia hincksii TORREY, Hydroida of the Pacific Coast, 1902, p. 53.
Campanularia hincksii TORREY, Hydroids of the San Diego Region, 1904, p. 13.
Campanularia hincksii JÄDERHOLM, Aussereuropaische Hydroiden, 1905, p. 268.
Campanularia hincksii BROWNE, Hydroids collected by the *Huxley* from the north side of the Bay of Biscay, 1907, p. 16.
Campanularia hincksii BILLARD, *Travailleur* et *Talisman*, Hydroïdes, 1907, p. 172.
Campanularia hincksii JÄDERHOLM, Northern and Arctic Invert., pt. 4, Hydroiden, 1909, p. 67.
Campanularia hincksii BROCH, Die Hydroiden der arktischen Meere, 1909, p. 235.
Campanularia hincksii FRASER, West Coast Hydroids, 1911, p. 31.
Campanularia hincksii BROCH, Hydroiduntersuchungen, No. 3, 1912, p. 49.
Campanularia hincksii STECHOW, Hydroidenpolypen der japanischen Ostküste, pt. 2, 1913, p. 77.

Trophosome.[2]—Colony consisting of a creeping rootstock which is smooth. Pedicels unbranched, long, slender, twisted at base, with two or three spherical annulations near the distal end and with the median portion smooth. Hydrothecæ deep, large, with parallel sides longitudinally lined, the lines running downward from between the marginal teeth, teeth large, square-topped, about 12 in number.

[1] Doctor Torrey in his description states that the hydrothecæ are less than half as broad as long, but his figure measures more than half as broad as long.

[2] There being no good specimen of this species at hand, the writer takes the following description from that of Hincks (British Hydroid Zoophytes, 1868, p. 162), adapting it in form to the other specific descriptions in the present work.

Gonosome.—Gonangia elongate-oval, with a wide truncated distal end and with distinctly but usually irregularly annulated walls, the annulations ordinarily being shallower than in *Clytia johnsoni*, a species which it greatly resembles. The ova are numerous and piled up like balls, forming an elongated central mass.

American distribution.—New England coast (Verrill, Nutting); Pacific coast, California, (Torrey); off Florida coast (Nutting MSS.).

General distribution.—British Islands (Alder and Hincks), Norway (Bonnevie), North Sea (Broch), Polar Sea (Bergh), Sweden (Segerstedt), Bay of Biscay (Browne), Mediterranean (Heller), Morocco (Billard), Azores (Jäderholm), West Africa (Billard), Japan (Stechow).

Bathymetric distribution.—10 to 444 fathoms. The latter depth is reported by Browne from the Bay of Biscay,[1] and is the greatest depth reported for any of the Campanularidæ.

The hydrothecæ of this species bear a close resemblance to those of *C. kincaidi* Nutting.

CAMPANULARIA GRŒNLANDICA Levinsen.

Plate 3, figs. 1, 2.

Campanularia grœnlandica Levinsen, Meduser, Ctenophorer og Hydroider fra Grönlands Vestkyst, 1893, p. 63.
Campanularia lineata Nutting, Hydroids from Alaska and Puget Sound, 1899.
Campanularia lineata Nutting, Hydroids of the Harriman Alaska Exped., 1901, p. 171.
Campanularia lineata Hartlaub, Hydroiden aus dem Stillen Ocean, 1901, p. 353.
Campanularia grœnlandica Jäderholm, Die Hydroiden des Siberischen Eismeeres, 1908, p. 10.
Campanularia grœnlandica Broch, Hydroiduntersuchungen I, Thecophora Hydroiden von dem nördlichen Norwegen, 1908, p. 32.
Campanularia grœnlandica Broch, Die Hydroiden der arktischen Meere, 1909, p. 187.
Campanularia grœnlandica Jäderholm, Northern and Arctic Invert., pt. 4, Hydroiden, 1909, p. 67.
Campanularia grœnlandica Fraser, West Coast Hydroids, 1911, p. 31.
Campanularia grœnlandica Kramp, Report on Hydroids of the Danish Exped. to Northeast Greenland, 1911, p. 390.
Campanularia grœnlandica Stechow, Hydroiden den Münchener Zoologischen Staatssammlung, 1912, p. 356.
Campanularia grœnlandica Kramp, Hydroids collected by the *Tjalfe* Exped. to the West Coast of Greenland, 1913, p. 29.

Trophosome.[2]—Colony growing from a creeping rootstock which branches profusely and winds around the stem of another hydroid, irregularly wavy but not distinctly annulated. The pedicels are rather long for this group, sometimes attaining a length of over 4 mm. They are closely and regularly annulated throughout their upper and median portions, and more sparsely annulated or even smooth on their basal parts. Usually, however, there are a few distinct annulations immediately above the pedicel origin, and sometimes the pedicels are closely annulated throughout. The hydrothecæ are large and marked by very strong longitudinal lines which originate between the hydrothecal teeth and pass straight downward following the surface of the hydrothecal wall to its bottom. The teeth are remarkably strong and clear cut, evenly rounded and usually 12 in number. The diaphragm is very near the bottom of the hydrotheca and consists of the annular shelf-like thickening of the hydrothecal walls so near the true bottom that it might easily escape notice.

Gonosome.—The gonangia are borne on the rootstock and are usually flask-shaped with a tubular neck and round narrow orifice. A typical one is about 2 mm. in height and about two and a half times as long as wide. The walls are often indistinctly corrugated, but are generally smooth. The gonangia contain fixed sporosacs.

Distribution.—The type-locality for this species is Davis Straits, 46 m. Other localities, Puget Sound (Nutting); Glacier Bay, Alaska (Nutting).

General distribution.—Coast of Norway (Broch), Siberian Sea (Jäderholm), Arctic Sea (Broch), West Greenland (Levinsen), White Sea (Schydlowsky), Japan (Stechow).

[1] Journ. of Marine Biological Assn., vol. 8, No. 1, Sept. 1907, p. 24.

[2] Description of a specimen collected by the *Albatross* in Bering Sea at station 4777, Semisopochnoi Island, r. t. S. 44° W., l. t. S. 4° W. about 12 miles (lat. 52° 11′ N.; long. 179° 49′ E.).

CAMPANULARIA KINCAIDI Nutting.

Plate 4, figs. 2, 3.

Campanularia kincaidi Nutting, Hydroids from Alaska and Puget Sound, 1899, p. 743.
Campanularia kincaidi Hartlaub, Hydroiden aus dem Stillen Ocean, 1901, p. 353.
Campanularia kincaidi Fraser, Hydroids of the West Coast of North America, 1911, p. 31.

Trophosome.[1]—Hydrocaulus springing from a creeping rootstock, unbranched. The pedicels are rather long and slender, from two to four times the length of the hydrotheca, annulated at the proximal and distal ends and often with one or two annulations in the middle. The hydrothecæ are small, considerably smaller than in allied species; tubular, being usually about three times as long as wide and with the hydrothecal walls almost parallel for about half their length; margin armed with from seven to ten long acuminate teeth; hydrothecal walls distinctly fluted, the vertical flutings corresponding in number to the teeth and extending downward from the margin to the basal third of the hydrotheca.

Gonosome.—Unknown.

This seems to be a very well marked species, in spite of considerable variation in the hydrothecal teeth. The general form and style of ornamentation is quite constant, and these hydrothecæ bear a very close general resemblance to those of *Obelia bicuspidata* Clark, but differ in the teeth, which are distinctly bimucronate in the latter species, while they are sharply pointed in *C. kincaidi*. This species differs from *C. hincksii* in being very much smaller and in having acuminate instead of square teeth, and from *C. grœnlandica* in shape and in the character of the teeth.

I take pleasure in naming this species in honor of Prof. Trevor Kincaid, who has done much to develop our knowledge of the marine fauna of the Puget Sound region.

Distribution.—Puget Sound (Nutting); Dodd's Narrows, Vancouver Island (Fraser)

CAMPANULARIA RARIDENTATA Alder.

Plate 4, fig. 1.

Campanularia raridentata (Alder MSS.) Hincks, Ann. Mag. Nat. Hist., ser. 3, vol. 8, 1861, p. 292.
Campanularia raridentata Alder, Ann. Mag. Nat. Hist., ser. 3, vol. 9, 1862, p. 315.
Campanularia raridentata Wright, On the Reproduction of Thaumantias inconspicua, Quart. Journ., 1862, p. 222.
Campanularia raridentata Alder, On the generative Zooid in Clavatella, 1863, p. 290.
Campanularia raridentata Allman, Trans. Tyneside Naturalists' Field Club, vol. 6, 1864, p. 290.
Campanularia raridentata Allman, Ann. Mag. Nat. Hist., ser. 3, vol. 13, 1864, p. 372.
Campanularia raridentata Alder, Nat. Hist. Trans. Northumb. and Durham, vol. 1, 1867, p. 50.
Campanularia raridentata Hincks, British Hydroid Zoophytes, 1868, p. 176.
Campanularia raridentata Allman, Gymnoblastic Hydroids, 1871, p. 97.
Campanularia raridentata McIntosh, Ann. Mag. Nat. Hist., ser. 4, vol. 13, 1874, p. 208.
Campanularia raridentata Verrill, Check-list of Marine Invert., 1879, p. 16.
Campanularia raridentata Billard, Contributions à l'étude des Hydroïdes, 1904, p. 174.
Campanularia raridentata Billard, *Travailleur* et *Talisman*, Hydroïdes, 1907, p. 173.
Campanularia raridentata Ritchie, The Marine Fauna of the Mergui Archipelago, The Hydroids, 1910, p. 809.
Campanularia raridentata Fraser, West Coast Hydroids, 1911, p. 32.
Campanularia raridentata Stechow, Hydroidpolypen der japanischen Ostküste, vol. 2, 1913, p. 72.

Trophosome.[2]—Colony consisting of unbranched pedicels springing from a creeping rootstock. Rootstock growing over specimens of *Campanularia universitatis* Torrey, very slender and delicate, without regular annulations and rising into a thickened hump just below the base of each pedicel. Pedicels distant, not branched. Pedicel and hydrotheca attaining a height of 1.5 mm.; pedicel varying greatly in length, usually with a group of annulations at each end with the intervening portion smooth. Occasionally, however, the pedicel is annulated throughout. Hydrothecæ long, campanulate, sometimes almost tubular; margin with 8

[1] Description of the type-specimen from Puget Sound.

[2] Description from specimens from Departure Bay, east coast of Vancouver Island, in collection of Dr. C. McLean Fraser.

to 10 rather prominent pointed teeth; diaphragm of the usual campanularian type with a rather deep basal chamber.

Distribution.—The type-locality for this species is Torquay, southeast coast of England. The other localities are almost all on the coast of Great Britain. Billard reports it from the French Coast "Baia de la Hague," and also as collected by the *Travailleur* and *Talisman* on the Atlantic coasts of Spain and Morocco. ? New England Coast (Verrill); Vancouver Island (Fraser); Mergui Archipelago (Ritchie); Japan (Stechow).

This species certainly resembles very closely *C. inconspicua* (Forbes) as described by Calkins, but also agrees very exactly with Hincks's figures and descriptions even in the bulbous swelling at the bases of the pedicels which Calkins regards as the main distinction (in the absence of the gonosome) between the two species.

CAMPANULARIA URCEOLATA Clark.

Plate 4, figs. 4, 5.

Campanularia cylindrica Clark (not Allman), Trans. Conn. Acad., vol. 3, 1876, p. 254.
Campanularia urceolata Clark, Proc. Acad. Nat. Sci. Philadelphia, 1876, p. 215.
Campanularia turgida Clark, Proc. Acad. Nat. Sci. Philadelphia, 1876, p. 213.
Campanularia reduplicata Nutting, Hydroids of the Harriman Alaska Exped., 1901, p. 172.
Campanularia urceolata Nutting, Hydroids of the Harriman Alaska Exped., 1901, p. 172.
Campanularia urceolata Torrey, Hydroida of the Pacific Coast, 1902, p. 54.
Campanularia volubilis (part) Broch, Die Hydroiden der arktischen Meere, 1909, p. 224.
Campanularia urceolata Fraser, West Coast Hydroids, 1911, p. 33.

Trophosome.[1]—Colony in the form of a creeping rootstock growing profusely over the stem and branches of other hydroids. Torrey has noted the interesting fact that the hydrocaulus, when free from the surface over which it grows, is closely annulated like the pedicels; but when the creeping rootstock is adherent to the host it is smooth and not annulated. The pedicels are closely annulated throughout, unbranched, rather thick-walled and stiff, attaining a height of about 3 mm. In the "*urceolata*" type proper they are often short, sometimes shorter than the hydrothecæ. Hydrothecæ exceedingly variable in shape, the typical ones being distinctly urceolate, about 1.5 times as high as broad, the margin with distinct rounded or undulating teeth about 14 in number. The bottom of the hydrotheca is thickened in such a way as to leave a basal chamber that looks much like an included last annulation of the stem. The "*reduplicata*" type of hydrotheca is narrower but about as long as the other, with the margin often reduplicated from one to three times.

Gonosome.—The gonangia vary from a roughly oval form with a wavy outline to ovoid regular forms with a short neck and even, round aperture. The contents are sporosacs.

Distribution.—The type-locality is Lituya Bay, Alaska (Clark); Yakutat Bay, Alaska (Nutting); California (Clark); San Francisco, Tomales Bay, and Pacific Grove, Cal. (Torrey); Puget Sound (Nutting).

I agree with Torrey that *C. urceolata* includes my *C. reduplicata.*

? CAMPANULARIA TULIPIFERA Allman.

Plate 5, fig. 1.

Campanularia tulipifera Allman, *Challenger* Reports, Hydroida, pt. 2, 1888, p. 20.
Campanularia tulipifera Jäderholm, Hydroiden aus antarktischen und subantarktischen Meeren, 1905, p. 15.

Trophosome.[2]—"Inpractvollen 10–12 cm. hohen Kolonien eingesammelt."[3] According to Allman's description and figures the stem is monosiphonic and the branches dichotomous.

[1] Description of specimen from Yakutat, Alaska, collected by the Harriman Alaska Expedition.

[2] Described from a fragment of a specimen sent to the author by Doctor Jäderholm labeled "the Burdwood Bank, Swedish Antarctic Exped."

[3] Jäderholm, Hydroiden aus antarktischen und subantarktischen Meeren, 1905, p. 15.

In the specimen before me but a single fragment of a branch is present from which three hydrothecæ arise from one side, although Allman describes them as alternate. The branch does not show any division into internodes. The hydrothecæ are very large (3.5 mm. in height by 1 mm. in diameter), tubular, with a gracefully everted margin which is very distinctly and beautifully crenulated, there being about 14 crenulations, although Allman gives but eight. These crenulations correspond to a series of longitudinal flutings of the hydrothecal walls which extend downward almost to the base. In two of the three hydrothecæ the margins are reduplicated, making a very beautiful ornamentation.

I am unable to detect any true diaphragm, although there is a sharp constriction which divides the hydrothecal cavity from that of the pedicel. The pedicel itself is very short, not more than one-fourth as long as the hydrotheca, and bears a constriction at each end, being otherwise smooth.

Gonosome.—Unknown.

The cœnosarc of the branch of the remaining portions of the hydranth is of a reddish chocolate-brown color.

Distribution.—The type is from off Heard Island, lat. 52° 4′ S.; long. 71° 22′ E. Depth 150 fathoms.

The only other locality that I have seen reported for this species is the one given by Jäderholm for the specimen described, i. e., Burdwood Bank, Falkland Islands.

At first sight this species closely resembles *C. speciosa* Clark, but it has very much larger hydrothecæ and an entirely different habit of growth. Until the gonosome is found the genus to which this form should be referred must be in doubt.

? CAMPANULARIA TINCTA Hincks

Plate 4, figs. 6, 7.

Campanularia tincta Hincks, Ann. Mag. Nat. Hist., ser. 3, vol. 5, 1861, p. 280.
Campanularia tincta Bale, Australian Hydroid Zoophytes, 1884, p. 57.
Campanularia tincta Hartlaub, Die Hydroiden der magalhaensischen Region und chilenischen Küste, 1905, p. 557.
Campanularia tincta Jäderholm, Schwedischen Südpolar-Exped., Hydroiden, 1905, p. 14.

Trophosome.[1]—Colony parasitic on a sertularian hydroid and consisting of a creeping rootstock, the surface of which is smooth although the rootstock itself is undulating in its course.

The pedicels are usually shorter than the hydrothecæ, although they are longer in specimens described by the authors cited and in the figure (pl. 4, figs. 6, 7) which was taken from a specimen kindly loaned by Doctor Hartlaub. The pedicels are irregularly ringed throughout. Hydrothecæ tubular, deep, the sides being approximately parallel, the walls very thick and rigid and the margin surrounded by about 10 sharp thorny teeth. The diaphragm is so near the bottom of the hydrotheca as to make the basal chamber appear as the distal annulation of the pedicel. There are well-marked pleats or ridges extending downward from the teeth to beyond the middle of the hydrotheca.

Gonosome.—Gonangia very large, having the general shape of a flattened cylinder; surface smooth in general, with indistinct annular rugosities sometimes showing particularly on the proximal part. The distal end is truncated with a wide opening, the margin of which is sometimes sunken below the general level of the end of the gonangium. The gonangial contents were not sufficiently well preserved for identification.

Distribution.—The type-locality is Australia, Falkland Islands, and Port Stanley, South America (Hartlaub). Bale reports it from Port Philip and Portland, Australia.

This species is evidently closely allied to *C. cylindrica* Allman, as Hartlaub shows in his figures. The specimen described is nearest, however, *C. tincta* of Hincks.

[1] Description of specimen from station 2776, Straits of Magellan, 21 fathoms.

CAMPANULARIA SUBRUFA Jäderholm.

Plate 5, figs. 2, 3.

Campanularia subrufa JÄDERHOLM, Mitteilungen ueber einige von den Schwedischen Antonktischen Exped., 1901–03, cingesommelte Hydroiden, 1904, p. 5.
Campanularia subrufa JÄDERHOLM, Hydroiden aus antarktischen und subantarktischen Meeren, 1905, p. 15.

Trophosome.[1]—Stem strongly polysiphonic. Branches irregularly disposed but mainly lateral in position, the ultimate ones being monosiphonic, divided into regular internodes each of which bears a hydrotheca on a strong process near its distal end. The hydrothecæ rest immediately upon this without any trace of a pedicel. Hydrothecæ alternate in position large, 1 mm. in height, deeply campanulate, although departing somewhat from the strict radial symmetry of most of the genus. They resemble a clay pipe in form, having the outer abcauline side more distinctly convex than the adcauline side, and the proximal portions bent downward as it approaches the stem. There is a distinct thickening of the hydrothecal wall on the abcauline side a short distance above the bottom of the hydrotheca. The margin is even and does not show the impressed band so characteristic of *C. marginata* (Allman). The rim is often slightly everted and there is no evident diaphragm. The hydranth has about 20 tentacles, and some hydranths in the specimen described are sufficiently well preserved to show a trumpet-shaped hypostome on dissection.

Gonosome.—Gonangia (female) 2.5 mm. high, obconical in shape with a broad truncated distal end and narrowing gradually to the proximal end. The walls are ornamented with regular sharply defined annulations. Gonangial contents, ova, thus showing that the species belongs to the genus *Campanularia.*

Distribution.—Jäderholm reports this form from Ludwig Philip's Land, Seymour Island; Shag Rocks and north of Joinville Land; 104 to 160 meters. All of these localities are in the Antarctic.

This species, having no diaphragm, goes with doubt into the family of Campanularidæ. The form of the proboscis, however, seems to the writer more important than the presence or absence of the diaphragm, and hence he places it in the Campanularidæ, and in the genus *Campanularia* on account of its producing ova without the intervention of medusæ.

? CAMPANULARIA MACROSCYPHA Allman.

Plate 5, fig. 4.

Campanularia macroscypha ALLMAN, Hydroids of the Gulf Stream, Mem. Mus. Comp. Zool., vol. 5, No. 2, 1877, p. 11.

Trophosome.[2]—Colony composed of unbranched pedicels springing from a creeping rootstock which forms a reticulate pattern on the surface of the stem of another hydroid. Hydrorhiza smooth, constricted where a branch springs from what appears to be the main stolon, otherwise without annulations. Pedicels and hydrothecæ together sometimes attaining a height of 11 mm., pedicels usually smooth, sometimes with irregular and distant annulations, always with a small spherical annulation just below the hydrotheca. Hydrothecæ large, sometimes attaining a height of 2.3 mm., tubular, from two to three times as long as broad and having a margin with twelve to fourteen very symmetrical clean-cut and evenly rounded teeth. Hydrothecal walls moderately thick with a strong annular thickening forming a circular shelf very near the bottom of the hydrotheca. Below this shelf is a relatively minute basal chamber. Hydranth apparently of the usual campanularian type with numerous (more than 20) tentacles.

Gonosome.—Unknown.

Distribution.—Type-locality, off Sand Key, Florida, 120 fathoms. *Albatross* station 2366, lat. 22° 28′ N.; long. 87° 2′ W.; 27 fathoms. *Albatross* station 2410, lat. 26° 47′ 30″ N.; long. 83° 25′ 15″ W.; 28 fathoms. *Albatross* station 2664, lat. 29° 41′ N.; long. 79° 55′ W.; 373 fathoms. *Albatross* station 2669, lat. 31° 9′ N.; long. 79° 33′ 30″ W.; 352 fathoms. *Albatross* station 2672, lat. 31° 31′ N.; long. 79° 05′ W.; 277 fathoms.

Bathymetrical distribution.—27 to 373 fathoms.

[1] The description of the general form of the colony and the gonosome is adapted from the original description of Jäderholm. The details of branches and hydrothecæ are taken from a fragment kindly sent me by Doctor Jäderholm labeled: "Graham region, Cape Seymour, Swedish Antarctic Expedition."

[2] Description of a specimen from station 2664, lat. 29° 41′ N.; long. 79° 55′ W., 373 fathoms.

CAMPANULARIA LÆVIS Hartlaub.

Plate 5, figs. 5, 6.

Campanularia lævis Hartlaub, Hydroiden der magalhaensischen Region und chilenischen Küste, 1905, p. 565.
Campanularia lævis Hickson and Gravely, Hydroid Zooph. of the National Antarctic Exped., 1907, p. 25.

Trophosome.[1]—Colony consisting of a creeping rootstock from which unbranched pedicels arise. The rootstock is smooth and slender. Pedicels long, in one case attaining a length of 8 mm.; smooth, for the most part, but showing on the distal end a series of what appear to be short nodes, the upper part of each node being broadened. Below each hydrotheca is a small but distinct disk-shaped annulation. The hydrothecæ are large tubular, the sides being parallel for the greater part of their length and the lower portion forming a semicircular outline; margin with 14 deeply-cut teeth, each of which is flattened on top and has a considerable portion of its opposite sides parallel. The hydranth cannot be studied in the specimen described, but Hartlaub says that it bears about 27 tentacles.

Gonosome.—Gonangia borne on the rootstock, oblong-oval in form, about 3 mm. long and four times as long as broad, the upper end being squarely cut off and the lower end passing insensibly into the short smooth peduncle. The gonangial walls are smooth and their contents are indeterminable in specimen studied, although in one case there is what appears to be a sporosac.

Distribution.—The type-locality is Calbuco, Chile.

The present writer doubts very seriously the identity of this species with the one described under the same name by Hickson and Gravely.[2] Neither the hydrothecæ nor gonangia represented in the figures (pl. 4, fig. 26) are sufficiently like *C. lævis* to be placed in that species.

? CAMPANULARIA BREVICAULIS, new species.

Plate 6, figs. 1, 2.

Trophosome.[3]—The fragmentary colony is growing over *Sertularella cylindritheca* and consists of a slender creeping rootstock which appears to be without annulations. The pedicels are in every case considerably shorter than the hydrothecæ and usually not more than half as long, smooth, with the exception of one or two annulations just below the hydrotheca. There are no annulations nor constrictions where the pedicel joins the rootstock. The hydrothecæ are of moderate size, deeply campanulate, almost tubular, in form, with the proximal end narrowing gradually to meet the pedicel, and the margin is ornamented with usually eight broad truncated teeth in the ends of which show a concave profile, giving a turreted appearance. The diaphragm is well marked and the basal chamber subspherical in shape.

Gonosome.—Unknown.

Although but a mere fragment of this form was secured it differs so materially from any other known to the writer that it seems best to give it a specific name. The combination of turreted teeth with very short pedicels does not occur elsewhere among the unbranched species of *Campanularia.*

Distribution.—The type-locality given above, which is between Havana and Yucatan, depth 194 fathoms, is the only locality from which the species is known.

Type.—Cat. No. 34527, U.S.N.M.

[1] Description taken from a specimen kindly loaned the author by Doctor Hartlaub labeled "Calbuco, Dec. 1894."

[2] Hydroid Zooph. of the National Antarctic Exped., 1907, p. 25.

[3] The type-specimen is a fragment from station 2326, lat. 23° 11′ 45″ N.; long. 82° 18′ 54″ W., between Havana and Yucatan, 194 fathoms.

? CAMPANULARIA GIGANTEA Hincks.

Plate 6, fig. 3.

Campanularia gigantea HINCKS, Ann. Mag. Nat. Hist., ser. 3, vol. 18, 1866, p. 297.
Campanularia gigantea HINCKS, British Hydroid Zoophytes, 1868, p. 174.
Campanularia gigantea VERRILL, Check-list of the Marine Invert. 1879, p. 16.
Campanularia gigantea JÄDERHOLM, Northern and Arctic Invert., pt. 4, Hydroiden, 1909, p. 69.

The writer never having seen this species contents himself with quoting the description given by Hincks in his British Hydroid Zoophytes (p. 174):

Stems delicate, of a very light horn-colour and papyraceous texture, annulated at the base and below the calycle, irregularly and sparingly branched; branches erect, copies of the primary shoot, sometimes themselves branched; hydrothecæ of enormous size, deeply campanulate, very wide at the top and for some way below it, and then tapering off gradually, length about double the greatest width, the rim cut into broad and blunt teeth; gonothecæ unknown.

Distribution.—Lamlash Bay, Arran, Great Britain (Hincks); Mediterranean (Pieper); Atlantic Coast North America (Verrill); West Coast of Sweden (Jäderholm).

The gonosome being unknown, the genus in which this species should be placed is indeterminable.

? CAMPANULARIA OBTUSIDENS Jäderholm.

Plate 6, fig. 4.

Campanularia obtusidens JÄDERHOLM, Hydroiden aus den Küsten von Chile, 1904, p. 2.

The writer has not seen specimens of this species and confines himself to a somewhat condensed and free translation of the original description by Jäderholm.

Trophosome.—Colonies a height of 3 cm., growing from a creeping rootstock on a tubularian stem. The stems are strongly geniculate and give forth many regularly alternating branches in the same plane. The individual internodes of the latter are strongly annulated proximally and from the distal end of each springs either a twig or a pedicel. Internodes 1 to 1.5 mm. long. The younger internodes are more slender. Hydrothecæ are 0.3 mm. to 0.6 mm. long with alternating pedicels, the shorter pedicels being annulated throughout while the longer ones are annulated at the end with a smooth middle portion. Hydrothecæ bell-shaped, thick-walled, margin 0.45 mm. in diameter. There are usually 12 broad, low, rounded teeth and the hydrothecæ are ornamented with longitudinal lines as in *C. hincksii* Alder, extending from the margin to the middle or a little below. Diaphragm thin, often oblique.

Gonosome.—Wanting.

The type and only known locality is Guaitecas Island, Melinca, Chile, 10 to 15 fathoms.

CAMPANULARIA MARGINATA (Allman).

Plate 6, figs. 5–7.

Obelia marginata ALLMAN, Memoirs Mus. Comp. Zool., vol. 5, No. 2, 1877, p. 9.
Obelia marginata CLARKE, Bull. Mus. Comp. Zool., vol. 5, No. 10, 1879, p. 241.
Obelia marginata FEWKES, Bull. Mus. Comp. Zool., vol. 8, No. 7, 1881, p. 128.
Campanularia insignis ALLMAN, *Challenger* Reports, Hydroida, pt. 2, 1888, p. 19.
Obelia marginata VERSLUYS, Hydraires Calyptoblastes dans la Mer des Antilles, 1899, p. 30.
Obelia marginata JÄDERHOLM, Aussereuropäische Hydroiden, 1903, p. 269.
Obelia marginata NUTTING, Narrative Bahama Exped., 1905, p. 87.
Campanularia insignis CONGDON, Hydroids of Bermuda, 1907, p. 469.
Leptoscyphus insignis RITCHIE, Two unrecorded *Challenger* Hydroids from the Bermudas, 1909, p. 3.
Lytoscyphus marginatus BILLARD, Hydroïdes du British Muséum, 1910, p. 8.

Trophosome.[1]—Colony with a straggling habit, attaining a height of 20 cm. The main stem is straight and continuous to the top of the colony, giving off lateral branches throughout its length, some of which bear branchlets. The branches are rather stiff in habit and undulating almost to the point of geniculation throughout, divided into regular internodes each of which

[1] Description of a colony from *Albatross* station 2406, Gulf of Mexico, lat. 28° 46′ N.; long. 84° 49′ W., depth 26 fathoms.

bears a hydrotheca on a shoulder-like process near its distal end. The hydrothecæ are very large, thick-walled and almost sessile, about 1.5 mm. in height. Their shape approaches the obconoid, but there is some curve to the lateral profile. In some cases, however, they are almost tubular. They are ordinarily about two-thirds as wide as deep, with margins smooth and encircled by what appears to be a narrow impressed band. The hydrothecæ are slightly unsymmetrical, basally bending slightly toward the proximal end of the branch, the interior of the curved portion constituting the basal chamber. The diaphragm is evident, but the passage from the hydrothecal to the basal chamber is rather broad. There is often, but not usually, a single very short annulation between the basal chamber and the shoulder of the stem internode which bears the hydrotheca. The hydranth has numerous tentacles, 24 or more, and a hypostome which appears to be of the usual trumpet-shaped character of this family; but which is so strongly retracted in preserved specimens as to be a mere disk resting upon the body above the tentacle bases.

Gonosome.[1]—"I found two types of gonothecæ, the one was cylindrical and divided into about five lobes by regular and broad furrows, the other form was ovoid with a constricted opening and a single male gonophore."

Distribution.—The type-locality is Loggerhead Key, off the Florida Coast, 9 fathoms. Other localities, mostly West Indian, are as follows: 10 miles north of Zoblos Island (Clarke); Sand Key (Fewkes); off Bermudas (Allman); near the Tortugas, 11 meters (Versluys); Anguilla, Antilles, 100–150 fathoms (Jäderholm); Bermudas (Ritchie, Congdon); off Florida Coast (Nutting). *Albatross* station 2334, lat. 23° 10′ 42″ N.; long. 82° 18′ 24″ W., 67 fathoms; *Albatross* station 2406, lat. 28° 46′ N.; long. 84° 49′ W., 26 fathoms; *Albatross* station 2408, lat. 28° 28′ N.; long. 84° 25′ W., 21 fathoms; *Albatross* station 2413, lat. 26° N.; long. 82° 57′ 30″ W., 24 fathoms; *Albatross* station 2415, lat. 30° 44′ N.; long. 79° 26′ W., 440 fathoms; *Albatross* station 2767, lat. 43° 03′ N.; long. 58° 56′ W., 52 fathoms.

Bathymetric distribution.—Shallow water to 440 fathoms.

This species has given rise to considerable controversy. Billard [2] contends that it is the same as *C. juncea* of Allman; Ritchie, 1909, considers the two species distinct and Billard (Hydroïdes du British Muséum, 1910, p. 8) concedes the point after further consideration. The present writer after the comparison of the two species feels confident that these later writers were correct in their conclusions.

CAMPANULARIA FLEXUOSA (Hincks).

Plate 7, figs. 1–6.

Laomedea gelatinosa var. *a* JOHNSTON, Brit. Hydroid Zooph., 1847, p. 104.
Laomedea gelatinosa var. *a* GRAY, List Brit. Anim., vol. 1, London, 1848, p. 85.
Laomedea flexuosa ALDER, Ann. Mag. Nat. Hist., ser. 2, vol. 18, 1856, p. 440.
Laomedea flexuosa ALDER (Hincks MSS.) Cat. Zooph. Northumb. and Durham, 1857, p. 32.
Laomedea flexuosa ALLMAN, Ann. Mag. Nat. Hist., ser. 3, vol. 4, 1857, p. 137.
Laomedea flexuosa HINCKS, Ann. Mag. Nat. Hist., ser. 3, vol. 8, 1861, p. 260.
Laomedea flexuosa KIRCHENPAUER, Abh. Gebiete Naturwiss. Verein, Hamburg, vol. 4, pt. 3, 1862, p. 17.
Laomedea flexuosa NORMAN, Report 31st meeting Brit. Ass. Adv. Sci., 1862, p. 152.
Laomedea flexuosa ALLMAN, Report on the present state of our knowledge of the reproductive system in the Hydroids, 1864, p. 364.
Laomedea flexuosa ALLMAN, Ann. Mag. Nat. Hist., ser. 3, vol. 13, 1864, p. 273.
Campanularia flexuosa HINCKS, British Hydroid Zoophytes, 1868, p. 168.
Campanularia flexuosa VERRILL, Proc. Amer. Ass. Adv. Sci., 1873, p. 364.
Campanularia flexuosa VERRILL, Invertebrate Animals of Vineyard Sound, 1873, p. 726.
Campanularia flexuosa VERRILL, Amer. Jour, Sci., vol. 7, 1873, pp. 44, 133.
Campanularia flexuosa SCHULZE, Nordsee-Exped. Coelenteraten, 1874, p. 129.
Campanularia flexuosa MCINTOSH, Ann. Mag. Nat. Hist., ser. 4, vol. 13, 1874, p. 208.
Campanularia flexuosa VERRILL, Check-list Marine Invert., 1879, p. 17.
Campanularia flexuosa WINTHER, Fortegnelse over de i Danmark Hydroide Zoophyter, 1880, p. 238.
Campanularia flexuosa DE VARENNE, Sur la Reproduction des Polypes Hydraires, 1882, pp. 11-57.

[1] Description taken from Congdon, Hydroids of Bermuda, 1907, p. 469.

[2] Sur les Haleciidæ, Campanulariidæ et Sertulariidæ de la Collection du *Challenger*, 1908, p. 1356.

Campanularia flexuosa Weismann, Enstehung der Sexualzellen bei den Hydromedusen, 1883, p. 144.
Campanularia flexuosa Thallwitz, Ueber die Entwicklung der männlichen Keimzellen bei den Hydroiden, 1885, p. 290.
Campanularia flexuosa Bourne, Hydroids of Plymouth, 1890, p. 394.
Campanularia flexuosa Marktanner-Turneretscher, Hydroiden des k. k. naturhistorischen Hofmuseums, 1890, p. 205.
Laomedea (Obelia) flexuosa Levinsen, Annulata Hydroidæ, etc., 1893, p. 368.
Campanularia flexuosa Crawford, Ann. Mag. Nat. Hist., ser. 6, vol. 16, 1895, p. 160.
Campanularia flexuosa Nutting, Notes on Plymouth hydroids, 1896, p. 147.
Campanularia flexuosa Hartlaub, Die Hydroiden Helgolands, 1897, p. 451.
Campanularia flexuosa Bonnevie, Norwegian North Atlantic Exped., 1899, p. 71.
Campanularia flexuosa Nutting, Hydroids of the Woods Hole Region, 1900, p. 348.
Campanularia flexuosa Hargitt, Synopsis N. A. Invert., 1901, p. 385.
Campanularia flexuosa Billard, Contributions à l'étude des Hydroïdes, 1904, p. 173.
Campanularia flexuosa Browne, Biscayan Plankton, Medusæ, 1906, p. 171.
Campanularia flexuosa Billard, Mission des Pêcheries de la Côte Occidentale d'Afrique, 1906, p. 73.
Campanularia flexuosa Jäderholm, Northern and Arctic Invert., pt. 4, Hydroiden, 1909, p. 68.
Laomedea flexuosa Broch, Die Hydroiden der arktischen Meere, 1909, p. 227.
Campanularia flexuosa Bedot, Hydroïdes de Roscoff, 1911, p. 219.

Trophosome.[1]—Colonies growing from an irregular mass of ascidian tests, worm tubes, etc. Stems attaining an average height of about 3 cm., usually unbranched but not infrequently divided into two or more straggling branches, each of which resembles the main stem. The stem is flexuous, giving off alternate pedicels from the convex sides of the curves, and divided into internodes each of which bears a pedicel on its distal end which appears to be a continuation of the curved internode itself. There are a few, usually two to five, annulations at the base of each internode. The pedicels are normally short, annulated throughout and decreasing in size from proximal to distal end. They are ordinarily about as long as the hydrothecæ. The terminal hydrotheca is usually borne on a pedicel which is longer than the others and has its median portion devoid of annulations and somewhat turgid. The hydrothecæ are usually typically campanulate in form but vary greatly in length, the outline being sometimes almost triangular but averaging about as described by L. Agassiz under name of *Laomedea amphora*, about one-third longer than broad. The margin is entire, but often sinuous when viewed from above. The diaphragm is well marked and the basal chamber large. The hydranths are not present in the specimens described but are of the regular campanularian type with a trumpet-shaped hypostome and the tentacles are quite numerous, being from 24 to over 30 in number, and their bases are connected by a thin web as shown in plate 7, fig. 6.

Gonosome.—The gonangia (female) are large, subcylindrical, gradually tapering below to a closely annulated short pedicel and abruptly truncated or squared off above. The gonangium is 3 to 4 times as long as the hydrotheca and 4 to 5 times as long as broad. The ova are thickly crowded around the blastostyle and develop into planulæ within the gonangium. The walls of the gonangium are often irregularly wrinkled transversely and the upper part of the gonangial cavity is often filled with a cœnosarcal plug which sometimes has the form of an inverted funnel. The male gonangia are smaller, more slender, and their distal ends are often narrowed into an imperfect neck.

Distribution.—American: New England Coast (Agassiz, Verrill, Nutting). General: British Islands (Hincks, Alder, Norman); Norway (Bonnevie); Iceland (Saemondsson); White Sea (Schydlowsky); Denmark (Levinsen); Helgoland (Hartlaub); France (Billard); Mediterranean (Pieper); Morocco (Billard).

CAMPANULARIA NEGLECTA (Alder).

Plate 8, figs. 1, 2.

Laomedea neglecta Alder, Cat. Zooph. Northumb. and Durham, 1857, p. 33.
Laomedea neglecta Greene, A Manual of the Sub-Kingdom Coelenterata, 1861, p. 94.
Laomedea neglecta Hincks, Cat. Zooph. South Devon and Cornwall, 1861, p. 290.

[1] Description of a specimen collected by the author at Plymouth, England.

Laomedea neglecta ALDER, Report on Zoophytes, Trans. Tyneside Naturalists' Field Club, vol. 5, 1863, p. 237.
Laomedea neglecta HINCKS, Ann. Mag. Nat. Hist., ser. 3, vol. 2, 1863, p. 47.
Laomedea neglecta WRIGHT, Observations on Brit. Zooph., 1863, p. 252.
Laomedea neglecta ALLMAN, Construction and Limitation of Genera among the Hydroids, 1864, p. 373.
Campanularia neglecta HINCKS, British Hydroid Zoophytes, 1868, p. 171.
Campanularia neglecta SCHULZE, Nordsee-Exped., 1872, p. 130.
Campanularia neglecta VERRILL, Proc. Amer. Ass. Adv. Sci., 1873, p. 364.
Campanularia neglecta MERESCHKOWSKY, Ann. Mag. Nat. Hist., ser. 5, vol. 2, 1878.
Campanularia neglecta WINTHER, Fortegnelse over de i Danmark Hydroide Zoophyter, 1879-80, p. 337.
Campanularia neglecta NUTTING, Notes on Plymouth Hydroids, 1896, p. 147.
Campanularia neglecta NUTTING, Hydroids of the Woods Hole Region, 1901, p. 346.
Campanularia neglecta BROWNE and RUPERT, On the Marine Fauna of the Isles of Scilly, 1904, p. 129.
Campanularia neglecta BROCH, Hydroidenuntersuchungen, No. 3, 1911, p. 52.

There being no suitable specimen at hand for description the following is compiled from the technical description of Hincks[1] together with his remarks in the species.

Trophosome.—Colony $\frac{2}{10}$ of an inch in height, stem filiform, flexuose, giving off alternate pedicels and with 4–7 annulations on the stem above each pedicel origin. Pedicels annulated proximally and distally, usually longer than the hydrothecæ. Hydrothecæ deeply campanulate, about twice as long as broad and with about 8 bimucronate marginal teeth. Hydranth with 15–16 slender tentacles.

Gonosome.—Gonangia pyriform, axillary or borne on the pedicels with a short annulated stalk. Gonangial contents a blastostyle with a sporosac. An acrocyst is formed in which the ova develop into the planula stage.

Distribution.—American: Woods Hole Region (Nutting); New England Coast (Verrill). General: Type-locality is Cullercoats and Tynemouth, in the north of England. Other localities, Devon and Cornwall (Hincks); North Sea (Schulze); Denmark (Winther); Scilly Isles (Browne and Rupert).

CAMPANULARIA MAGNIFICA Fraser.

Plate 8, figs. 3, 4.

Campanularia magnifica FRASER, Hydroids from Vancouver Island and Nova Scotia, 1913, p. 164.

Trophosome.[2]—Pedicels unbranched, springing from a creeping rootstock which is not regularly annulated. Pedicels usually longer than those of *C. speciosa*, sometimes three times the length of the hydrotheca, usually annulated throughout. Hydrothecæ deeply urceolate or tubular, considerably more slender than in *C. speciosa*. Hydrothecæ large, attaining a length of 2.5 mm. Margin evenly fluted or crenulated with usually 10–12 elevations and depressions. The distal part of the hydrotheca is marked by parallel lines running down from the margin and reaching about one-third the length of the hydrotheca. Hydrothecæ $3\frac{1}{2}$ to 4 times as long as broad.

Gonosome.—Gonangia borne in the creeping rootstock with a very short pedicel and slender ovate body produced distally into a slender tubular neck ending in a round orifice. Gonangia approximately as long as the hydrothecæ and about three times as long as broad, gonangial walls sometimes corrugated. Gonangial contents (of another specimen, off Newfoundland) ova, showing that the species is a *Campanularia*.

Distribution.—Type-locality, off Canso, Nova Scotia, 50 fathoms. Other specimens are from station 2699, off Newfoundland, 72 fathoms.

The drawings of this species had been made and referred to *C. speciosa*, until Doctor Fraser made drawings of a specimen of *C. speciosa* from the Shumagin Islands and compared them with the present species. The most marked difference, however, is in the gonosome, the gonangia being of entirely diverse types.

[1] British Hydroid Zoophytes, 1868, p. 171.
[2] Description of specimens collected from a depth of 50 fathoms, East of Canso, Nova Scotia, by C. M. Fraser.

? CAMPANULARIA SPECIOSA Clark.

Plate 8, fig. 5.

Campanularia speciosa Clark, Alaskan Hydroids, 1876, p. 214.
Campanularia crenata Allman, New Genera and Species of Hydroids, 1876, p. 258.
Campanularia speciosa Levinsen, Meduser, Ctenophorer og Hydroider fra Grönlands Vestkyst, 1893, p. 25.
Campanularia speciosa Nutting, Harriman Alaska Exped., 1901, p. 171.
Campanularia speciosa Broch, Die Hydroiden der arktischen Meere, 1909, p. 171.
Campanularia speciosa Jäderholm, Northern and Arctic Invert., pt. 4, Hydroiden, 1909, p. 188.
Campanularia speciosa Fraser, West Coast Hydroids, 1911, p. 33.

Trophosome.[1]—Colony consisting of a creeping rootstock, from which unbranched pedicels arise. Rootstocks not annulated, with thick perisarc. Pedicels of varying length, sometimes as much as twice as long as the hydrotheca, at others considerably shorter than the hydrotheca, usually regularly annulated throughout, the annulations being often oblique and thus giving the spirally twisted appearance mentioned by Levinsen. There is a single considerably smaller annulation just below the hydrotheca. Hydrothecæ urceolate-elongate, about 2 mm. in height and about 2½ times as high as wide. The lower portion is gibbous, the walls gradually narrowing until the least diameter is found about one-fourth the height of the hydrotheca below the margin; the upper part of the hydrotheca expands gracefully to the margin which is bordered with 8 to 14 crenulations which appear evident when viewed from above. The walls are plicated longitudinally for almost their upper third, the ridges of the plications passing downward from the rounded convex portions of the crenulations. The diaphragm is quite inconspicuous and down close to the hydrothecal base, and the opening between the hydrotheca and basal chamber rather broad.

Gonosome.—The gonangia are relatively small, only about half the height of the hydrotheca, obconic in shape, subtriangular in outline with the opening occupying the whole of the broad distal end. The whole might be described as bowl-shaped, the bowl having rather straight flaring sides, and standing in its natural position.

Distribution.—Type-locality, Yukon Harbor, Big Koniushi, Shumagin Islands, 6 to 20 fathoms. Reported also from Yakutat Bay, Alaska (Nutting); Greenland (Levinsen); Japan (Allman); Arctic Sea (Broch); and Spitzbergen (Jäderholm). 120 fathoms is the greatest depth, reported by Broch.

This species is also doubtfully assigned to the genus *Campanularia*, the shape of the proboscis and contents of the gonangia being unknown.

CAMPANULARIA EXIGUA (Sars).

Plate 8, figs. 6–8.

Laomedea exigua Sars, Bidrag til Kundskaben om Middelhavets Littoral-Fauna, 1857, p. 159.
Laomedea exigua Allman, Construction and Limitation of Genera among the Hydroids, Ann. Mag. Nat. Hist., ser. 3, vol. 13, 1864, p. 373.
Campanularia exigua van Beneden, Récherches sur la Faune littorale de Belgique, 1867, p. 163.
Campanularia exigua Hincks, British Hydroid Zoophytes, 1868, p. 172.
Campanularia exigua Calkins, Some Hydroids from Puget Sound, 1876, p. 353.
Campanularia exigua Hartlaub, Hydroiden aus dem Stillen Ocean, 1901, p. 353.
Campanularia exigua Fraser, West Coast Hydroids, 1911, p. 30.

Trophosome.[2]—Colony consisting of several stems growing from a creeping rootstock. The stems are flexuose and bear a group of 3 to 5 annulations above the origin of each pedicel. Pedicels regularly alternate, varying considerably in length, usually about twice the length of the hydrotheca but often not longer than the latter. When comparatively long they are annulated at both ends; but when short they are annulated throughout, their diameter decreasing distally. The

[1] Description of a specimen collected at the Shumagin Islands, Alaska, by Dr. W. H. Dall.
[2] Description of a specimen mounted on a slide kindly loaned the author by Dr. G. N. Calkins, marked "Puget Sound."

hydrothecæ are triangular in outline, funnel-shaped, with an even margin, the diaphragm is delicate but evident and the basal chamber high. The hydranth is of the usual campanularian type, with about 20 tentacles.

Gonosome.[1]—Gonangia borne on the stem near the axil of the pedicel, small, long, with truncated distal end and gradually narrowing basally. There are two rows of ova developing on the blastostyle and extending nearly its whole length, there being about 6 to each row, the largest being at the top.

Distribution.—Mediterranean at Messina (Sars); Belgium (van Beneden); British Coasts, Dorset (Hincks); Puget Sound (Calkins).

So far as is known Puget Sound is the only American locality from which this species is reported. It has not been reported from waters north of England in the Atlantic, and hence has a very exceptional distribution.

? CAMPANULARIA FRAGILIS (Hincks).

Plate 9, fig. 1.

Laomedea fragilis Hincks, Ann. Mag. Nat. Hist., ser. 3, vol. 11, 1863, p. 46.
Campanularia fragilis elongata van Beneden, Faune litt. de Belgique, Polypes, 1866, p. 164.
Campanularia fragilis Hincks, British Hydroid Zoophytes, 1868, p. 175.
Campanularia fragilis elongata Verrill, Proc. Amer. Ass. Adv. Sci., 1873, p. 364.

Trophosome.[2]—Colony minute, consisting of a single flexuose stem which is unbranched and is divided into rather obscure internodes, each of which bears a pedicel on a process from near its distal end. Pedicels very short, less than half the length of the hydrotheca, annulated throughout and decreasing regularly in size from the proximal to the distal end. The hydrothecæ are quite small, tubular, about three times as high as wide, and with an even, noneverted rim. There is a diaphragm low down toward the bottom of the hydrotheca. Hydranths with an ovoid hypostome and about 20 tentacles.

Gonosome.—Unknown.

Distribution.—Type-locality, Ilfracombe; British coast, Plymouth (Nutting); ? Coast of Belgium (van Beneden); New England Coast (Verrill).

This very well marked and delicate little campanularian seems to have very generally escaped notice on the British coast since Hincks wrote his great work on British Hydroid Zoophytes in 1868. Verrill reports it, but does not give any description.

CAMPANULARIA CALCEOLIFERA Hincks.

Plate 9, figs. 2–4.

Campanularia calceolifera Hincks, Ann. Mag. Nat. Hist., ser. 4, vol. 8, 1871, p. 78.
Campanularia calceolifera Clark, Hydroids from the New England Coast, 1876, p. 60.
Campanularia calceolifera Nutting, Hydroids of the Woods Hole Region, 1900, p. 348.
Campanularia calceolifera Hargitt, Synopsis of N. A. Invert., 1901, p. 386.
Campanularia calceolifera Fraser, New England Hydroids, 1912, p. 43.

Trophosome.[3]—Colony 2.9 cm. in height, consisting of a cluster of stems springing from a creeping rootstock. Stems ordinarily unbranched but sometimes breaking up into several branchlets which resemble the main stem; erect, flexuose, divided into regular internodes each of which bears a pedicel on a shoulder projecting from near its distal end. There is a series of three or four regular annulations on each internode just above this shoulder. The pedicels are regularly alternate, usually shorter than the hydrothecæ. Hydrothecæ campanulate with slightly flaring margins and an even rim. They are one and a half times as deep as wide at the margin and have a distinct diaphragm and a deep basal chamber. The hydranth has a trumpet-shaped proboscis and about 20 tentacles.

[1] There is a single gonangium on the specimen, which was overlooked by Calkins in his description.
[2] Description of specimen collected at Plymouth, England, by the writer.
[3] Description of colony collected at Woods Hole, Massachusetts, by Mr. George Gray.

Gonosome.—Gonangia borne on the stems, being ordinarily inserted in the axils of the pedicels and sometimes apparently on the basal portion of the pedicel rather than on the stem proper. They are of unique shape, being oblong-ovate in general form but with part of the laterodistal portion excavated and apparently introverted, producing a curved tube with horizontally striated walls and with a round aperture at its inner, and a crescent-shaped opening at its outer end. The contents of the gonangium are a blastostyle and ova in various stages of development up to and including fully formed planulæ. These structures are all inclosed in a delicate sack-like membrane which seems to open into the round inner aperture of the tube described above.

Distribution.—The type-locality is Salcombe Bay, southwest coast of England. It has also been reported from the New England coast by Clark, Nutting, Hargitt, and Fraser.

CAMPANULARIA AMPHORA (L. Agassiz).

Plate 9, figs. 5–7.

Laomedea amphora Agassiz, L., Cont. Nat. Hist. of U. S., vol. 4, 1862, p. 311, pl. 30, figs. 13–18.
Campanularia amphora Agassiz, A., The acalephan fauna of the Southern Coast of Mass., Proc. Boston Soc. Nat. Hist., vol. 8, 1862, p. 224.
Campanularia amphora Allman, Construction and Limitation of Genera among the Hydroids, Ann. Mag. Nat. Hist., ser. 3, vol. 13, 1864, p. 345.
Campanularia amphora Clark, Mind in Nature, 1865, p. 284.
Campanularia amphora Hincks, Zoophytes, Quart. Journ. Sci., vol. 2, 1865, p. 401.
Laomedea amphora Fewkes, Embryological Monographs, vol. 3, 1884, pl. 3, figs. 17 and 18.
Campanularia amphora Nutting, Hydroids of the Woods Hole Region, 1901, p. 347.

Trophosome.[1]—Colony 15 cm. in height, main stem simple but so covered with parasitic growth that its details can not be made out. Branches given off on all sides of the main stem, but not regularly. There are groups of annulations above each branch origin and the branches often subdivide into branchlets which tend to be lateral and alternate in position and bear groups of annulations above each branchlet and pedicel origin. The pedicels are alternately disposed in general (but this is often interfered with by an irregular distribution) and are usually annulated throughout and much shorter than the hydrothecæ. The pedicels bearing distal hydrothecæ are often much longer, sometimes several times as long, as the hydrothecæ, and the median portion bulges distinctly on one side. The hydrothecæ are deeply campanulate, with an even rim, and are often 1.5 times as long as broad. The diaphragm is well defined and the basal chamber moderately deep. The hydranth has from 24 to 28 tentacles.

Gonosome.[2]—The gonangia (female) is a lengthened oval truncated at the top and bearing developing ova on all sides of the blastostyle. Male gonangia much more slender, terete in form, with a narrow terminal aperture.

Distribution.—Type-locality, Massachusetts Bay. Found also at numerous points on the coast from Grand Manan, New Brunswick, to Newport, Rhode Island. It has not been reported outside of this region.

? CAMPANULARIA RIGIDA (A. Agassiz).

Laomedea rigida Agassiz, A., North Amer. Acalephæ, 1865, p. 93.
Campanularia rigida Clark, Hydroids of the Pacific Coast, 1876, p. 251.
Campanularia rigida Torrey, Hydroida of the Pacific Coast, 1902, p. 11.
Campanularia rigida Fraser, West Coast Hydroids, 1911, p. 32.

This species has never received adequate description, neither has it been figured. It is quite probable that it is identical with some species more recently described, e. g., *Clytia bakeri* Torrey, but this cannot be demonstrated. The following is the original description:

This species is remarkable for its peculiar mode of growth. At first glance it would readily be mistaken for a species of Dynamena, so regular is the succession of the hydræ along the stem, and also on account of the absence of branches.

[1] Description of a specimen collected by Vinal Edwards from New Bedford wharf.

[2] Not present in the specimen described. The above description is gleaned from Agassiz's figures, Contributions to Nat. Hist. of United States, vol. 4, 1862, pl. 30, figs. 13–18.

The sterile and reproductive hydræ are found on the sides of the main stem, attached by a very short pedicel, and alternate so regularly on each side that its Campanularian nature is noticed only after a careful examination. The sterile hydræ resemble those of *Laomedea amphora*, while the reproductive calycles are identical in shape with those of *Obelia commissuralis*. The main stems of a cluster are crowded together, and attain a height of three to four inches.

Distribution.—Type-locality is San Francisco, California.

As indicated above this description could well be applied to *Clytia bakeri*, but there is nothing to indicate whether it is a *Campanularia* or a *Clytia*. No illustration is available for this species.

CAMPANULARIA ANGULATA (Hincks).

Plate 10, fig. 1.

Laomedea angulata Hincks, Cat. Zooph. South Devon and Cornwall, Ann. Mag. Nat. Hist., ser. 3, vol. 8, 1861, p. 261.
Loamedea angulata Allman, Construction and Limitation of Genera among the Hydroids, Ann. Mag. Nat. Hist., ser. 3, vol. 13, 1864, p. 373.
Campanularia angulata Hincks, British Hydroid Zoophytes, 1868, p. 170.
Campanularia angulata Verrill, Proc. Amer. Ass. Adv. Sci., 1873, p. 364.
Campanularia angulata Winther, Fortegnelse over de i Danmark Hydroider, 1879–80, p. 239.
Campanularia angulata Fraipont, Ann. Mag. Nat. Hist., ser. 5, vol. 5, 1880, p. 265.
Campanularia angulata de Varenne, Sur la Reproduction des Polypes Hydraires, 1882, p. 77.
Campanularia angulata Crawford, Ann. Mag. Nat. Hist., ser. 6, vol. 16, 1895, p. 260.
Campanularia angulata Nutting, Hydroids of the Woods Hole Region, 1901, p. 347.
Campanularia angulata Hargitt, Synopsis of N. A. Invert., 1901, p. 385.
Campanularia angulata Villard, Contributions à l'étude des Hydroïdes, 1904, pp. 47, 65, 173.
Campanularia angulata Bedot, Hydroïdes de Roscoff, 1911, p. 219.
Campanularia angulata Fraser, New England Hydroids, 1912, p. 43.

Trophosome.[1]—Colony 1.4 cm. in height and consisting of a number of stems arising from a creeping rootstock. Stems usually simple but not seldom branched, in which case the branches resemble the stems. Stems geniculate, divided into regular long internodes, each of which bears a pedicel at its distal end and two or three annulations on its proximal end. Pedicels alternate, often as long as the hydrothecæ, and annulated throughout. They often diminish in diameter from the proximal to the distal end. Hydrothecæ campanulate, deeper than broad (1½ times as deep as broad) with an even rim which is hardly at all everted. The diaphragm is distinct and the basal cavity rather deep.

Gonosome.—Gonangia borne on the rootstock, elongate oval in shape; but with the walls often irregularly distorted by the pressure of the gonangial contents. There is a round terminal aperture with hardly any evident neck or collar. The contents are developing ova or spermatozoa without trace of medusoid structure.

Distribution.—The type-locality is Isle of Man, on *Zostera marina*. It has also been reported from Jersey (Norman); St. Andrews Bay, Scotland, and North of Ireland (W. Thomson); other European localities are Denmark (Winther); coast of France (de Varenne).

The only reported occurrences of this species in American waters are Woods Hole, Massachusetts (Nutting), and Casco Bay, Maine (Fraser).

The greatly produced terminal branch, etc., described by Hincks has been studied by de Varenne under the name "Organe en forme de vrille." This appears to be somewhat similar to the phenomena discussed by the author under the head of "Stoloniferous Reproduction" in his American Hydroids, Part I, the Plumularidæ, 1900, p. 42. These structures were not found in the specimens from Woods Hole.

CAMPANULARIA CORONATA Clarke.

Plate 10, figs. 2–4.

Campanularia coronata Clarke, Bull. Mus. Comp. Zool., vol. 5, No. 10, 1879, p. 242.

Trophosome.[2]—Colony consisting of a creeping rootstock growing over a woody stem. Rootstock undulating but not regularly annulated. Pedicels unbranched, sometimes attaining

[1] Description of a specimen collected by the author at Woods Hole, Massachusetts.
[2] Description of specimen collected by Lieut. J. F. Moser on the coast of Florida.

a length of as much as 3 mm. but usually much shorter, with a number of distinct annulations in distal end and also at base, the intervening portion being smooth. The hydrotheca is rather slender, sometimes almost tubular, narrowing gradually at its proximal end and with the margin armed with 7 to 12 very deeply cut, strong teeth which are acuminate and well defined. The diaphragm is quite near the bottom of the hydrotheca and is thin but evident without sectioning. The hydrotheca is usually ¼ to ⅜ as long as the pedicel.

Gonosome.—Gonangia almost cylindrical with a truncated top and base tapering to a short stout peduncle. Gonangial walls deeply and evenly corrugated much as in *Clytia johnstoni*. The gonangial contents are not well defined, but the gonophores appear to bear sporosacs.

Distribution.—Type-locality, 10 miles north of Sablos Island, West Indies, Great Bahama Banks, on seaweed (S. U. I. Bahama Exped.); Cape Romanos, Florida.

The character on which Clarke based his specific name, spherical swellings on edge of aperture leading from hydrotheca to stem, is one that is apt to be inconstant.

CAMPANULARIA FUSIFORMIS Clark.

Plate 10, fig. 5.

Campanularia fusiformis Clark, Hydroids of the Pacific Coast, 1876, p. 254.
Campanularia fusiformis Torrey, Hydroida of the Pacific Coast, 1902, p. 52.
Campanularia fusiformis Fraser, West Coast Hydroids, 1911, p. 30.

Trophosome.[1]—Colony in the form of a creeping rootstock growing on a colony of *Bimeria*. Rootstock much shorter than the pedicels and tortuous but not regularly annulated, except where it projects in long tendrillike processes beyond the supporting body; in which case it is closely and regularly annulated. Pedicels usually annulated throughout, the annulations being ordinarily very regular and the pedicel ending in a spherical annulation just below the hydrotheca. A typical pedicel and hydrotheca together measure 2 mm. in length. Hydrothecæ rather slender, sometimes approaching a tubular shape, with parallel sides. The margin is armed with usually 12 rather blunt, rounded teeth. Not infrequently, however, specimens on the same colony will in some cases have well-marked teeth and in others the margin will be perfectly smooth. In the latter case it sometimes seems as if a toothed margin had been made smooth by the filling in of perisarc between the teeth but in other hydrothecæ there is a perfectly smooth rim with no such appearance. The diaphragm is of the ordinary type for this genus.

Gonosome.—The gonangia are typically fusiform or oval in general outline with the distal ends produced into a more or less pronounced tubular, sometimes curved, neck with a round terminal aperture. Proximally they are abruptly rounded and supported on a short pedicel. The length of a typical gonangium is 1.4 mm. and the gonangial contents appear to be sporosacs.

Distribution.—Type-locality, Vancouver Island; also reported from Bay of Monterey, California, by Doctor C. W. Anderson, and from Dillons's, California, and Point Reyes, California, by Torrey.

This species, as Torrey mentions, is closely related to *C. urceolata*, differing mainly in the smaller and much more slender hydrothecæ. None of the hydrothecæ show the typical urceolate form of that species. The shape of the gonangium, especially the tubular neck, indicates that this species is a *Campanularia*.

?CAMPANULARIA LENNOXENSIS Jäderholm.

Plate 10, figs. 6–7.

Campanularia lennoxensis Jäderholm, Aussereuropaïsche Hydroiden, 1903, p. 268.

The writer has not seen this species and therefore contents himself with the following free and somewhat condensed translation from the original description as given by Jäderholm:

A very small species. Hydrorhiza creeping, thin and irregularly branched, .12 to .14 mm. in diameter. From this spring the short upright unbranched pedicels which are from .29 to .43 mm. long and are more or less distinctly

[1] Description of specimen received from Doctor Torrey, collected at Dillons, California, July 7, 1898.

annulated throughout. Under each hydrotheca is a distinct globular annulation. Both the pedicel wall and that of the hydrorhiza are strongly thickened. Hydrothecæ campanulate, .34 to .40 mm. long and .2 mm. in diameter at the margin. Hydrothecal walls very strongly and evenly thickened except on the distal portion which is thin-walled and ornamented with 10 well developed teeth. At the base of the hydrotheca the thickened wall forms a more or less well developed diaphragm. Hydranth small, entirely retracted within the small hydrothecæ.

Gonangia borne on the hydrorhiza and distinguished for their proportionally large size, their even surface and their remarkably thickened walls. Length about 1 mm. and width .5 mm. They gradually diminish in size toward the base where they pass into a short pedicel. Their distal ends are truncated and have a moderately high collar around the opening.

Distribution.—The type-locality is Lennox Island, Patagonia, 12 to 28 fathoms (Jäderholm).

Genus CLYTIA Lamouroux (modified by Hincks).

Clytia Lamouroux, Histoire des Polypiers Coralligènes Flexibles, 1816, p. 200.
Campanularia (part) Lamarck, Hist. Nat. Anim. sans Vert., vol. 2, 1836, p. 129.

The original definition for this genus is as follows:

Polypier phytoïde, rameux, filiforme, volubile ou grampant; cellules campanulées, pedicelées; pedicelles longs ordinairement contournés.

Agassiz [1] revives this name and applies it to the section of the Lamarckian genus *Campanularia* to which *Campanularia johnstoni* Hincks belongs. He does not, however, define the genus.

Hincks [2] was the first to give a satisfactory definition to this genus, the main distinction being found in the gonosome, the gonangia producing medusæ with four radial canals, four marginal tentacles and eight lithocysts. It is only by this means that the genus can be differentiated from *Campanularia, Obelia, Gonothyræa,* etc.

A definition which will serve the present purpose may be stated as follows:

Trophosome.—Colony often simple but always consisting of a creeping rootstock from which spring pedicels which are not regularly branched as a rule. Hydrothecæ campanulate, hydranths with trumpet-shaped proboscis.

Gonosome.—Gonangia producing bell-shaped or hemispherical medusæ which have a small manubrium, 4 tentacles at liberation, and 8 lithocysts.

KEY TO THE SPECIES OF CLYTIA FOUND IN AMERICAN WATERS.

Colony consisting of stems bearing branches or pedicels.
- Margin smooth ..... *bakeri.*
- Margin toothed.
  - Marginal teeth keeled and pedicels short ..... *hendersoni.*
  - Marginal teeth not keeled.
    - Pedicels bent upward at base, long.
      - Gonangia not annulated, hydrothecæ deeply campanulate ..... *attenuata.*
      - Gonongia annulated, hydrothecæ not deeply campanulate, small ..... *minuta.*
    - Pedicels not abruptly bent upward at base.
      - Pedicels long, smooth in median part.
        - Stem simple ..... *edwardsi.*
        - Stem fascicled below ..... *longicyatha.*
      - Pedicels extensively annulated.
        - Pedicels given off from all sides of stem ..... *universitatis.*
        - Pedicels alternate, one to each internode ..... *fragilis.*

Colony consisting of usually unbranched pedicels springing from a rootstock.
- Hydrothecæ typically campanulate.
  - Distal part of hydrothecæ very thin and collapsible ..... *sargassicola.*
  - Distal part of hydrothecæ not thin and collapsible.
    - Pedicels short, gonangia flask-shaped ..... *noliformis.*
    - Pedicels long, gonangia cylindrical, deeply and regularly annulated.
      - Diaphragm complex ..... *johnstoni.*
      - Diaphragm simple ..... *bicophora.*
- Hydrothecæ cylindrical ..... *cylindrica.*

[1] Cont. to Nat. Hist. U. S., vol. 4, 1862, p. 354.
[2] British Hydroid Zoophytes, 1868, p. 140.

CLYTIA JOHNSTONI (Alder).

Plate 11, figs. 1–6.

Sertularia volubilis Ellis and Solander, Nat. Hist. Zooph., 1786, p. 51.
Clytia volubilis Lamouroux, Histoire des Polypiers Coralligènes Flexibles, 1816, p. 202.
Campanularia volubilis Lamarck, Hist. Nat. Anim. sans Vert., 1816, vol. 2, p. 113.
Campanularia (*Sertularia*) *volubilis* Goldfuss, Handbuch der Zoologie, vol. 1, 1820, p. 89.
Clytia volubilis Lamouroux, Hist. Nat. des Zooph., Encyclopédie méthodique, vol. 2, 1824, p. 202.
Campanularia volubilis Johnston, Trans. Nat. Hist. Soc. Northumb. and Durham, Newcastle, vol. 2, pt. 1, 1832, p. 255.
Campanularia volubilis Johnston, Hist. of Berwickshire Nat. Club, vol. 1, 1834, p. 107.
Campanularia volubilis Johnston, Hist. Brit. Zooph., 1838, p. 154.
Campanularia volubilis Couch, An Essay on the Zooph. of Cornwall, 1841, p. 48.
Campanularia volubilis van Beneden, Mémoire sur les Campanulaires de la Côte d'Ostend, 1844, p. 40.
Campanularia volubilis Couch, Cornish fauna, pt. 3, 1844, p. 40.
Campanularia volubilis van Beneden, Un mot sur la mode de Reproduction des animaux inférieurs, 1847, p. 457.
Campanularia volubilis Johnston, Hist. Brit. Zooph., ed. 2, 1847, p. 107.
Capsularia volubilis (part) Gray, List Brit. Anim., 1848, p. 86.
Campanularia volubilis Cocks, Contributions to the Fauna of Falmouth, 1849, p. 93.
Clytia volubilis Duchassaing, Animaux radiaires des Antilles, 1850, p. 22.
Campanularia volubilis Hincks, Ann. Mag. Nat. Hist., ser. 2, vol. 10, 1852, p. 84.
Campanularia volubilis Gosse, A Naturalist's Rambles on the Devonshire Coast, 1853, p. 296.
Campanularia volubilis Gegenbaur, Zur Lehre vom Generationswechsel und der Fortpflanzung bei Medusen und Polypen, 1854, p. 161.
Campanularia volubilis Thompson, Ann. Mag. Nat. Hist., ser. 2, vol. 14, 1854, p. 313.
Campanularia volubilis Gosse, Manual of Marine Zoology, vol. 1, 1855, p. 25.
Campanularia johnstoni Alder, Cat. Zooph. Northumb. and Durham, 1857, p. 36.
Campanularia johnstoni Wright, On reproduction by Ova from the Medusoid of Campanularia johnstoni, 1858, p. 367.
Campanularia johnstoni Alder, Ann. Mag. Nat. Hist., ser. 3, vol. 3, 1859, p. 353.
Campanularia johnstoni Allman, Additional Observations on the Morphology of the Reproductive Organs in the Hydroid Polyps, 1859, p. 315.
Campanularia johnstoni Hincks, On a New Species of Laomedea; with remarks on the genera Campanularia and Laomedea, 1859, p. 126.
Campanularia volubilis McCrady, Gymnopthálmata of Charleston Harbor, 1859, p. 92.
Campanularia johnstoni Wright, Observations on Brit. Zooph., 1861, p. 255.
Campanularia johnstoni Greene, A Manual of the Sub-kingdom Cœlenterata, 1861, p. 94.
Campanularia johnstoni Hincks, Cat. Zooph. South Devon and South Cornwall, Ann. Mag. Nat. Hist., ser. 3, vol. 8, 1861, p. 291.
Campanularia volubilis (part) Agassiz, L., Cont. Nat. Hist. U. S., vol. 4, 1862, p. 354.
Campanularia johnstoni Agassiz, L., Cont. Nat. Hist. U. S., 1862, vol. 4, p. 354.
Campanularia johnstoni Alder, Suppl. Cat. Zooph. Northumb. and Durham, 1863, p. 237.
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Campanularia johnstoni Allman, Construction and Limitation of Genera among the Hydroids, 1864, p. 372.
Clytia johnstoni Agassiz, A., North Amer. Acalephæ, 1865, p. 79.
Campanularia johnstoni Agassiz, A., North Amer. Acalephæ, 1865, p. 79.
Clytia volubilis Agassiz, A., North Amer. Acalephæ, 1865, p. 79.
Campanularia johnstoni Parfitt, Cat. Fauna Devon, 1866, p. 12.
Campanularia johnstoni Alder, Nat. Hist. Trans. Northumb. and Durham, vol. 1, 1867, p. 50.
Clytia volubilis van Beneden, Recherches sur la Fauna littorale de Belgique, 1867, p. 166.
Campanularia johnstoni van Beneden, Recherches sur la Fauna littorale de Belgique, 1867, p. 94.
Campanularia volubilis van Beneden, Recherches sur la Fauna littorale de Belgique, 1867, p. 146.
Campanularia johnstoni Norman, Report 36th Meeting Brit. Ass. Adv. Sci., 1867, p. 199.
Campanularia johnstoni Allman, Report 37th Meeting Brit. Ass. Adv. Sci., 1868, p. 78.
Campanularia volubilis Heller, Zoophyten und Echinodermen des adriatischen Meeres, 1868, p. 46.
Clytia johnstoni Hincks, British Hydroid Zoophytes, 1868, p. 143.
Campanularia volubilis Dönitz, Ueber einige niedere Seethiere, 1869, p. 11.
Campanularia johnstoni Norman, Report of 38th Meeting Brit. Ass. Adv. Sci., 1869, p. 32.
Campanularia volubilis Herklots, Natuurlijke Historie van Nederland, vol. 2, 1870, p. 398.
Campanularia johnstoni Allman, Gymnoblastic Hydroids, 1871, p. 23.
Clytia (*Campanularia*) *volubilis* du Plessis, Evolution médusipare de Clytia (Campanularia) volubilis, 1871, p. 167.
Clytia johnstoni Hincks, Suppl. Cat. Zooph. South Devon and South Cornwall, 1871, p. 79.
Clytia volubilis Metzger, Die wirbellosen Meeresthiere der ostfriesischen Küste, 1871, p. 35.
Clytia johnstoni Sars, G. O., Bidrag til Kundskaben om Norges Hydroider, 1873, p. 35.

Clytia johnstoni VERRILL, Invertebrate Animals of Vineyard Sound, 1873, p. 408.
Clytia johnstoni VERRILL, Proc. Amer. Ass. Adv. Sci., 1873, p. 364.
Clytia johnstoni SCHULZE, Nordsee Exped., 1874, p. 128.
Clytia johnstoni VERRILL, Amer. Jour. Sci., vol. 8, 1874, p. 44.
Clytia johnstoni MCINTOSH, Ann. Mag. Nat. Hist., ser. 4, vol. 13, 1874, p. 206.
Clytia johnstoni VERRILL, Amer. Jour. Sci., vol. 9, 1875, p. 414.
Clytia johnstoni CLARK, Alaskan Hydroids, 1876, p. 212.
Clytia johnstoni WINTHER, Fortegnelse over de i Danmark Hydroide Zoophyter, 1879, p. 234.
Clytia johnstoni BOURNE, Hydroids of Plymouth, 1889–90, p. 394.
Clytia johnstoni MCINTOSH, Ann. Mag. Nat. Hist., ser. 6, vol. 5, 1890, p. 303.
Clytia johnstoni PICTET, Hydraires d'Amboine, 1893, p. 28.
Clytia johnstoni CRAWFORD, Hydroids d'Amboine, 1893, p. 16; 1895, p. 260.
Clytia johnstoni HARTLAUB, Die Hydromedusen Helgolands, 1897, p. 502.
?*Clytia johnstoni* CALKINS, Hydroids of Puget Sound, 1899, p. 348.
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Clytia grayi NUTTING, Hydroids of the Woods Hole Region, 1901, p. 344.
Clytia johnstoni BROWNE and RUPERT, Isles of Scilly, 1904, p. 25.
Clytia johnstoni HARTLAUB, Die Hydroiden der magalhaensischen Region und chilenischen Küste, 1905, p. 555.
Clytia johnstoni BILLARD, *Travailleur* et *Talisman*, Hydroïdes, 1907, p. 167.
Campanularia johnstoni BROCH, Die Hydroiden der antarktischen Meere, 1909, p. 227.
Clytia johnstoni RITCHIE, Suppl. Rept. Hydroids of Scottish Nat. Antarctic Exped., 1909, p. 71.
Clytia volubilis MAYER, Medusæ of the World, vol. 2, The Hydromedusæ, 1910, p. 266.
Clytia johnstoni FRASER, West Coast Hydroids, 1911, p. 36.
Clytia johnstoni BEDOT, Hydroïdes de Roscoff, 1911, p. 219.
Clytia johnstoni STECHOW, Hydroiden der Münchener Zoologischen Staatssammlung, 1912, p. 352.
Campanularia (*Clytia*) *johnstoni* BROCH, Hydroidenuntersuchungen, No. 3, 1912, p. 50.

Trophosome.[1]—Colony consisting of a creeping rootstock from which unbranched or sparingly branched pedicels arise. The pedicels sometimes attain a length of 5 mm. They are smooth, for the most part, with usually 3–6 annulations at the distal and a more numerous group of annulations at the proximal end. The rootstock is smoother and of greater diameter than the pedicels. Hydrothecæ campanulate with rounded bottom and gradually increasing diameter to the margin, about 1.5 times as long as wide. The margin is ornamented with 16 well-marked teeth, which are rounded at their ends. The diaphragm is strong, thicker than usual, and the basal chamber well shown. Hydranth with a trumpet-shaped proboscis and about 16 tentacles.

Gonosome.—Gonangia borne on short pedicels springing from the creeping rootstock, cylindrical in form, with rounded ends and walls regularly and extensively annulated. They are usually from 2.5 to 3 times as long as wide. Their distal ends are abruptly truncated and closed with a disk-shaped membrane resting on a distinct collar. The gonangia bear developing medusæ. At the time of liberation these are almost hemispherical in shape and are characterized by having 4 radial canals, 4 marginal tentacles, and 8 lithocysts.

Distribution.—The type-locality, if we regard the first specimens described by Alder as distinguished from *C. volubilis* of authors as the types, is the northeast coast of England. It is one of the most widely distributed of the Campanularidæ, being common on both sides of the Atlantic in temperate latitudes. It is found in shallow water, and, being abundant, is well known. It has been reported by various writers from the Mediterranean to Scandinavian shores of Europe. More northern localities are northern Norway (Sars), west of Spitzbergen (Jäderholm), and Iceland (Saemondsson). On American coasts its most northern Atlantic record is Labrador (Whiteaves). The most southerly American record that I have is *Albatross* station 2311, lat. 32° 55′ N., long. 77° 54′ W., near Charleston, South Carolina. Clark's Alaskan record seems of doubtful validity. Hartlaub reports this species from New Zealand.

Bathymetric record, 1 to 100 fathoms.

This species cannot retain the name *C. volubilis* because this name was first applied to another form by Linnæus in 1758. *C. volubilis* Linnæus and *C. volubilis* Lamouroux are different species, although they have been greatly confounded by authors. A careful examination will reveal the fact that *C. volubilis* Linnæus is a *Campanularia* and *C. volubilis* Lamouroux is a *Clytia*.

[1] Description of specimens collected at Grand Manan, New Brunswick, by C. C. Nutting.

CLYTIA BICOPHORA Agassiz.

Plate 12, figs. 1–3.

Clytia (Trochopyxis) bicophora L. Agassiz, Cont. Nat. Hist. U. S., vol. 4, 1862, p. 304.
Clytia bicophora L. Agassiz, Cont. Nat. Hist. U. S., vol. 4, 1862, p. 345.
Clithia bicophora A. Agassiz, Proc. Boston Soc. Nat. Hist., vol. 8, 1862, p. 225.
Clytia bicophora A. Agassiz, North Amer. Acalephæ, 1865, p. 79.
Epenthesis bicophora Haeckel, Syst. der Medusen, 1879, vol. 1, p. 184.
? *Epenthesis folleata* Fewkes, Bull. Mus. Comp. Zool., vol. 9, No. 8, 1882, p. 298.
Clytia bicophora Nutting, Hydroids of the Woods Hole Region, 1901, p. 343.
Clytia bicophora Hargitt, Synopsis N. A. Invert., Hydromedusæ, vol. 2, 1901, pp. 381, 588.

Trophosome.[1]—Colony consisting of unbranched and sparingly branched pedicels springing from a creeping rootstock and attaining a height of about 4 mm. The unbranched pedicels sometimes attain a length of 3 mm. Pedicels usually annulated at their proximal and distal ends and bare throughout their median portions. These pedicels are not infrequently branched once and rarely branchings of the second order are found; but by far the greater number are simple and their diameter is less than that of the rootstock from which they spring. Hydrothecæ closely resembling those of *C. johnstoni*, but considerably smaller, being but half the length of the hydrothecæ of the latter species, of which, indeed, they are almost perfect miniatures in form except in the possession of a simple instead of a complex diaphragm. Marginal teeth rounded, 12 to 14 in number. The distal portion of the hydrothecal wall is thin and collapsible and when the hydranth is retracted a number of longitudinal folds appear corresponding to the number of the teeth.

This is a feature that I have not seen in *C. johnstoni* and, in connection with the character of the diaphragm, affords a structural character sufficient to separate the species.

Gonosome.[2]—Gonangia usually borne on the rootstock but sometimes on the pedicels, especially when they are branched, oblong ovoid in shape, with the distal end abruptly truncated and with the walls deeply and regularly annulated as in *C. johnstoni*. The gonangia are about $2\frac{1}{2}$ times as long as broad, and their diameter is just about equal to the height of the hydrothecæ.

Gonangial contents.—Developing medusæ.

Medusæ.—The adult medusæ, according to Alexander Agassiz,[3] are hemispherical in shape, $\frac{1}{4}$ inch in diameter, with 16 marginal tentacles, 8 lithocysts, and 4 radial canals beneath which hang the purse-like ovaries. Agassiz says that this medusa is hardly distinguishable from that of *Clytia johnstoni*.

Distribution.—This species is found on the New England coast from the Bay of Fundy to Buzzards Bay. (Agassiz, Nutting, Hargitt.)

After considerable hesitation, the writer considers it advisable to acknowledge the specific identity of this form, which many writers, beginning with Hincks, have considered to be identical with the well-known European form, *Clytia johnstoni*. The diagnostic marks of *Clytia bicophora* are the comparatively small size of the hydrothecæ, the presence of a simple instead of a complex diaphragm, and the tenuity of the hydrothecal walls.

There is much uncertainty regarding the distribution of this form on account of its similarity to the European species, it being extremely likely that it has been mistaken for the latter species in some of the American records.

[1] Description of a specimen collected by the writer at Woods Hole, Massachusetts.
[2] Description taken from another specimen.
[3] North Amer. Acalephæ, 1865, p. 78, fig. 110.

CLYTIA NOLIFORMIS (McCrady).

Plate 11, figs. 7–10.

Campanularia noliformis McCrady, Gymnopthalmata of Charleston Harbor, 1859, p. 92.
Platypyxis cylindrica (part) A. Agassiz, in North Amer. Acalephæ, 1865, p. 80.
Epenthesis folleata (medusa form) Brooks, Studies from Johns Hopkins Biological Laboratories, vol. 2, 1882, p. 138.
Clytia noliformis Pictet, Hydraires d'Amboine, 1893, p. 31.
Clytia noliformis Nutting, Hydroids of the Woods Hole Region, 1901, p. 343.
Clytia simplex Congdon, The Hydroids of Bermuda, 1907, p. 471.
Clytia volubilis Hargitt, Hydroids of Woods Hole, 1909, p. 373.
Clytia folleata (medusa form) Mayer, Hydroids of the World, vol. 2, Hydromedusæ, 1910, p. 264.
Clytia simplex Stechow, Hydroiden der Münchener Zoologischen Staatssammlung, 1912, p. 352.

Trophosome.[1]—Colony consisting of a creeping rootstock from which unbranched pedicels arise. Rootstocks sometimes irregularly and coarsely annulated, but usually smooth. The pedicels are short, none in the specimen described being more than twice as long as the hydrotheca, excessively annulated at the ends and sometimes throughout their length, stiff and strong. Hydrothecæ conoid in shape with the margin much wider than the basal parts and the sides often nearly straight, although they may be slightly bulging. The margin bears about 14 very strongly developed teeth, deeply cleft in some cases and much more shallow in others, with evenly rounded points or ends. Diaphragm low, not strongly marked. In specimens collected by the author in the Gulf Stream the living hydranths were a light clear green due to a symbiotic alga.

Gonosome.[2]—Gonangia flask-shaped, with well-marked collar and lid. The general form is ovoid, but the flaring collar gives it an appearance which can well be termed urn-shaped, a word used in this connection by McCrady in his original description. Developing medusæ are seen within the gonangia. The medusæ are described and figured by Mayer under the name *Clytia folleata*. A condensed description is as follows:

Bell hemispherical or slightly flatter. Tentacles 16, 4 radial canals, 16 closed marginal lithocysts. Velum well developed, manubrium about half as long as bell cavity, with four simple lips. Gonads very near the ring canal.

Distribution.—The type-locality is Charleston Harbor. It has been found also on floating sargassum weed in the Gulf Stream. According to Mayer the medusæ are very abundant off the southern coast of New England in summer and off the Dry Tortugas, Florida, in the spring. It has also been found off the Bermudas by Congdon, in the Bay of Amboina by Pictet, and on the Japanese coast by Stechow.

The above-described species fits the original description by McCrady very closely, and appears distinctly different from *Clytia cylindrica* Agassiz.

CLYTIA SARGASSICOLA, new species.

Plate 12, figs. 8, 9.

Trophosome.[3]—Colony consisting of a creeping rootstock from which arise unbranched pedicels bearing hydrothecæ, pedicels rather long and slender with a disk-shaped internode just below the hydrotheca followed by one or more rather indistinct annulations. There are a few faint annulations near the proximal end of the pedicel. Hydrothecæ campanulate, subcylindrical, with sides not flaring and with 12–15 rounded marginal teeth. Hydrothecæ about 1.5 times as long as broad and the lower part of the hydrothecal wall distinctly thickened forming a sort of pseudodiaphragm. Distal portion of walls very thin and collapsible, this portion being differentiated from the thicker part by a circular line which is evident when the thin part is folded over the retracted hydranth. The arrangement is the same as is illustrated by

[1] Description of specimens sent me by Doctor Osborn, labelled Beaufort, North Carolina.

[2] Described from a specimen collected by the Bahama Expedition from the State University of Iowa, growing on seaweed in the Gulf Stream off the Carolinas.

[3] Description of a specimen taken from the surface on the southern edge of the Gulf Stream by the Bahama Expedition from the State University of Iowa, May 9, 1893.

Allman's figure of *Campanularia ptychocyathus*.[1] (See text figure 22, p. 7.) Hydranths with 24 tentacles and a trumpet-shaped proboscis.

Gonosome.—Gonangia rather short and stout, subcylindrical, annulated throughout, with a very short pedicel and a broad terminal aperture closed by an operculum. Gonangia about $1\frac{1}{2}$ times as long as broad and $1\frac{3}{4}$ times as long as the hydrotheca. Each gonangium contains a single large globular developing medusæ with four radiating canals, four tentacles, and developing ovaries.

The gonosome differs from that of any other *Clytia* that I have seen.

Distribution.—Known only from specimens growing over sargassum weed obtained from the southern edge of the Gulf Stream.

Type.—Cat. No. 34529, U.S.N.M.

In Museum of Natural History, State University of Iowa, cotype.

CLYTIA CYLINDRICA L. Agassiz.

Plate 12, figs. 6, 7.

Clytia (*Platypyxis*) *cylindrica* L. Agassiz, Cont. Nat. Hist. U. S., vol. 4, 1862, p. 306.
Platypyxis cylindrica L. Agassiz, Cont. Nat. Hist. U. S., vol. 4, 1862, p. 354.
Platypyxis cylindrica A. Agassiz, North Amer. Acalephæ, 1865, p. 80.
Clytia cylindrica Nutting, Hydroids of the Woods Hole Region, 1901, p. 343.
Clytia volubilis (part) Mayer, Medusæ of the World, vol. 2, The Hydromedusæ, 1910, p. 216.

Trophosome.[2]—Colony consisting of a simple or sparingly branched stem springing from a creeping rootstock and growing over a plumularian hydroid. Total height of longest stems about 5 mm. Branching when present, entirely irregular and straggling. Pedicels varying greatly in length, with middle portion smooth and groups of annulations at the ends. The hydrotheca is tubular or cylindrical in shape, the basal end rounding rather abruptly to meet the pedicel. The hydrothecal margin is armed with about 12 sharply pointed teeth. The diaphragm is not well defined in the specimen studied, but appears to be quite low, leaving a small basal chamber.

Gonosome.—The gonangia are borne on the rootstock and also on the stem near the origins of the pedicels. They are quite slender for this genus, and often have their basal portions curved. When viewed laterally, they are somewhat flattened, so as to be oval rather than round in section, and almost sessile with a few annulations at the extreme base. Their distal end is truncated, sometimes showing a narrow flaring collar around the margin. Gonangial contents, a blastostyle with a row of developing medusæ. Medusæ (according to A. Agassiz) much flatter than those of *C. johnstoni*.

Distribution.—Type-locality, Massachusetts Bay (Agassiz, L.); also reported from Nahant, Buzzard's Bay, and Naushon, coast of Massachusetts.

In the opinion of the writer this species is distinct from *C. noliformis* (McCrady), the hydrothecæ being not "conical" but truly cylindrical. It also appears to differ in the character of the medusæ. Brooks[3] regards this species as distinct from *C. noliformis*.

CLYTIA LONGICYATHA (Allman).

Plate 12, figs. 4, 5.

Obelia longicyatha Allman, Hydroids of the Gulf Stream, 1877, p. 10.
Clytia longicyatha Pictet, Hydraires d'Amboine, 1893, p. 28, pl. 2, figs. 22, 23.
Clytia longicyatha Billard, *Travailleur* et *Talisman*, Hydroïdes, vol. 8, 1907, p. 168.

This species has not been seen by the author. The following is the original description by Allman:

[1] *Challenger* Reports, Hydroida, pt. 2, pl. 10.
[2] Description of a specimen from the Gulf Biological Station, Cameron, Louisiana.
[3] According to Mayer, Medusæ of the World, vol. 2, the Hydromedusæ, 1910, p. 265.

Trophosome.—Hydrocaulus attaining a height of nearly an inch, fascicled below, alternately branched; main stem annulated for a short distance above each ramulus; ramuli annulated at their origin; hydrothecal peduncles of moderate length, more or less annulated. Hydrothecæ narrow, deep, nearly cylindrical above, and then tapering towards the base; the orifice cut into about twenty acute, deep, narrow teeth.

Gonosome.—According to the description and figure of Pictet[1] the gonangia are obconic with smooth walls, about as long as the hydrothecæ, and the blastostyle bears two opposite rows of bell-shaped medusæ.

Type-locality.—Off Florida Reef, 90 fathoms, specimens found attached to *Halecium macrocephalum* (Allman). Found also by Pictet in the Port of Amboina, 1 meter, and by Billard, south of Gulf of Cadiz, 60 meters, and off Cape Spartel, Morocco, 112 meters.

A specimen that is referred with considerable doubt to this species is figured on plate 12, fig. 5. It is evidently a young colony with an unfascicled stem. It greatly resembles *C. longicyatha* in mode of branching, annulations, pedicels, and shape of hydrothecæ. The latter, however, are slightly stouter than in *longicyatha*, and have the rim ornamented with 12 to 14 sharply pointed teeth corresponding to an equal number of longitudinal ridges which occupy about the upper third of the hydrothecal margin, thus giving a regularly pleated appearance resembling that of *Obelia bicuspidata*. The original describer of *C. longicyatha* mentions the fact that it is "a very delicate species, with the hydrothecæ thin and compressible." The thin texture of the hydrothecal wall may allow of its being thrown into folds or pleats when the hydrothecæ are absent or retracted and thus to present the appearance shown in plate 12, fig. 5.

This specimen was secured by the Bahama Expedition of the State University of Iowa, from off Key West at a depth of 5½ fathoms. It was growing on a colony of *Idia pristis*.

Dr. C. M. Fraser also found this species at Beaufort, North Carolina, on floating gulf weed.

CLYTIA BAKERI Torrey.

Plate 13, figs. 1, 2.

Clytia bakeri Torrey, Hydroids of the San Diego Region, 1904, p. 16.
Clytia bakeri Torrey, Univ. of Calif. Publications, Zool., vol. 2, 1906, p. 323.
Phialium bakeri Torrey, Univ. of Calif. Publications, Zool., vol. 6, 1909, p. 21.
Clytia bakeri Mayer, Medusæ of the World, vol. 2, The Hydromedusæ, 1910, p. 262.
Eucheilota bakeri Mayer, Medusæ of the World, vol. 2, The Hydromedusæ, 1910, p. 495.
Clytia bakeri Fraser, West Coast Hydroids, 1911, p. 34.

Trophosome.[2]—Colony consisting of a number of erect stems arising from a creeping rootstock on a living *Donax*. Stems about 1 cm. high, usually unbranched, the basal portion being regularly annulated, the annulations resembling segments. Higher up these annulations decrease in number and throughout the distal part of the stem there is a fairly regular series of internodes, each bearing a pedicel on a sort of shoulder projecting from its distal end. Throughout this portion the stem is slightly flexuose. The pedicels are very short, always shorter than the hydrothecæ. Ordinarily they have a single discoid or globular annulation just below the hydrotheca, and, in the nonproximal parts of the stems, there are two or even three such annulated pedicels. The hydrothecæ are triangular in outline with a smooth rim, or at least without regular teeth. There is a well marked thick diaphragm which restricts the passage of the cœnosarc from hydranth to stem to a very small aperture. The hydranth has a trumpet-shaped proboscis and about 20 tentacles.

Gonosome.—The gonangia are borne on the front and back of the stem, sometimes singly and sometimes in opposite pairs. They are long, rather slender, with the distal end truncated and much the largest and gradually diminishing in size from distal end to base. They are almost sessile, being joined to the stem by a very short pedicel. My specimens do not show the "bottle-nosed" apertures described by Torrey, but the entire end seems to be covered

[1] Hydraires d'Amboine, 1893, p. 28.

[2] Description of specimens collected by the writer on "Long Beach" near La Jolla, California, growing on shells of living *Donax*.

with a membrane that ruptures for the passage of the medusæ. Gonangial contents developing medusæ which are described as follows by Mayer, 1910: "When set free the bell is oval, thin-walled, with 2 well-developed and 2 small, immature tentacles. 4 radial-canals. 2 gonads, 4 lithocysts. Cirri flank the basal-bulbs of the large tentacles."

Type-locality.—Pacific Beach, near San Diego, California. In the surf, also found at times in great quantities at Long Beach and Torrey Pines Beach, near La Jolla, California.

This is perhaps the only known instance of hydroids being present on living bivalves.

CLYTIA EDWARDSI (Nutting).

Plate 13, figs. 3, 4.

Campanularia johnstoni Calkins, Some Hydroids from Puget Sound, 1899, p. 349.
Campanularia gracilis[1] Calkins, Some Hydroids from Puget Sound, 1899, p. 350.
Campanularia edwardsi Nutting, Hydroids of the Woods Hole Region, 1901, p. 346.
Campanularia edwardsi Torrey, Hydroids of the San Diego Region, 1904, p. 11.
Clytia edwardsi Fraser, West Coast Hydroids, 1911, p. 34.
Clytia edwardsi Fraser, Notes on Some New England Hydroids, 1912, p. 44.
Clytia edwardsi Stechow, Hydroidpolypen der japanischen Ostküste, vol. 2, 1913, p. 69.

Trophosome.[2]—Colony profusely but irregularly branched and attaining a height of 2.5 cm. Stem, branches, and pedicels all exceedingly attenuated and without any regular disposition, although the pedicels show a tendency to occur in pairs springing from opposite sides of the branch. The branches are smooth, except for a group of four or five regular annulations at their bases. Pedicels sometimes as much as 7 mm. in length and perfectly smooth, except for a group of three to six annulations just below the hydrotheca and a more numerous group at the base. Hydrothecæ elongate, campanulate, approaching a tubular form, being sometimes three times as long as wide. Margin armed with 12 to 14 sharply pointed teeth. There is a well marked diaphragm and a rather deep basal chamber.

Gonosome.[3]—Gonangia borne on the stem and branches usually in the axils of the pedicels, elongate obconoid in shape in some cases, almost tubular in others, and about 1.5 mm. in length and three to five times as long as wide. The walls are rather rudely and irregularly annulated throughout. On the blastostyle are seen several developing medusæ which seem to be semi-globular in shape with four (?) tentacles and a well-developed proboscis.

Distribution.—Type-locality, Woods Hole, Massachusetts (Nutting); reported by Torrey from the mouth of San Diego Bay; and by Fraser from Vancouver Island; Japan (Stechow). If I am right in considering *Campanularia gracilis* of Calkins to be a synonym for this species its range should also include the Puget Sound region.

Doctor Fraser's specimens were directly compared with the type from Woods Hole, Massachusetts, and were indistinguishable so far as the trophosome was concerned. Since writing the above Doctor Fraser has found the gonosome on specimens from the Woods Hole region and regards them as identical with those above described.

CLYTIA ATTENUATA (Calkins).

Plate 13, fig. 5.

Campanularia attenuata Calkins, Some Hydroids from Puget Sound, 1899, p. 350.
Clytia attenuata Fraser, West Coast Hydroids, 1911, p. 34.

Trophosome.[4]—Colony growing in tufts of stems springing from a creeping rootstock. These stems attain a height of about 9 mm. and are usually smooth, although there is an occasional annulation above a pedicel origin. The branching is very straggling and irregular, each branch from the main stem usually being a single long slender pedicel. Sometimes two branches occur. The pedicels are long and slender and are bent abruptly upward near their bases so as to lie

[1] Name preoccupied.
[2] Described from a type-specimen collected at Woods Hole by the author.
[3] Described from a specimen from Departure Bay, Vancouver Island, collected by Dr. Charles McLean Fraser.
[4] Description of one of Calkins's specimens mounted on a slide and kindly loaned me by Doctor Calkins.

parallel with the stem and attain a length of about 3 mm. There is usually a group of 3–5 annulations immediately below the hydrotheca and a similar group of 5–10 annulations near the base. The hydrothecæ are deeply campanulate, less than twice as long as broad and have the margin ornamented with a series of 10–12 deeply cut rounded teeth. The diaphragm is well marked and basal chamber rather deep. The hydranth has a trumpet-shaped proboscis and about 24 tentacles.

Gonosome.—The gonangia are borne on the stem and basal portion of the pedicels. They are of comparatively large size, oblong-ovoid in shape, and their walls are not annulated. There is a large terminal aperture surrounded by a low band-like collar. Upon the blastostyle are growing three to five developing medusæ, the largest of which are orbicular in form and show 4 tentacles and an oval manubrium.

Distribution.—Type-locality, Port Townsend, Scow Bay, on red algæ. Doctor Fraser has also found specimens at Vancouver Island.

CLYTIA MINUTA (Nutting).

Plate 14, figs. 1–4.

Campanularia minuta Nutting, Hydroids of Woods Hole Region, 1901, p. 345.
Clytia minuta Fraser, Notes on New England Hydroids, 1912, p. 44.

Trophosome.[1]—Colony about 6 mm. in height, branching in an irregular and straggling manner, the stem giving rise to distant but irregularly spaced pedicels and being smooth for the most part, but with compact groups of 6 or 8 annulations just above the pedicel insertions, or at the basal end of each stem internode. The pedicels are quite variable in length but are often three or four times as long as the hydrothecæ, annulated throughout, diminishing gradually in diameter toward their distal ends and bending abruptly upward near their bases as in the preceding species. Occasionally the middle part of the pedicel is smooth with the distal and proximal ends closely annulated. The hydrothecæ are small, campanulate, not quite 1.5 times as deep as wide and with about 7 very sharp rather distant teeth. The diaphragm is rather low and the basal chamber of moderate size.

Gonosome.[2]—"The gonangium bears a strong resemblance to the gonangium of *C. johnstoni*. It grows either from stolon or from the main stem. It is oval or obvate in shape and has corrugations similar to that of *C. johnstoni*."

Distribution.—Type-locality, Woods Hole, Massachusetts, where it was found growing on old stems of an *Obelia*. It has recently been reported again from the same locality by Fraser who found it growing on *Eudendrium* and *Tubularia*.

The calyces of this species are much like those of *C. raridentata* Alder, but the branching and annulations of the pedicels are quite different from that species.

CLYTIA UNIVERSITATIS (Torrey).

Plate 14, figs. 5–6.

Campanularia denticulata Torrey, Hydroida of Pacific Coast, 1902, p. 51.
Clytia universitatis Torrey, Hydroids of the San Diego Region, 1904, p. 19.
Clytia universitatis Fraser, West Coast Hydroids, 1911, p. 36.

Trophosome.[3]—Colonies in bushy tufts, irregularly branched and attaining a length of 12 cm., in my specimen, but Torrey states that they are sometimes 200 mm. in height. The stem and main branches are fascicled, much as in *Campanularia verticillata*. Many of the branches are long and erect and give off irregularly disposed pedicels from all sides, but not in regular whorls as in *Campanularia verticillata*. The pedicels are rather long and slender, for a branched campanularian, being about 2 mm. long in typical specimens. They are regularly annulated

[1] Description of type colony collected at Woods Hole, Massachusetts, by the author.
[2] Description copied from that of Fraser, Notes on New England Hydroids, 1912, p. 44.
[3] Description of specimens sent me by Doctor Torrey, labelled "San Diego Bay, July 15, 1904."

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throughout, the annulations being often more sparse in the median portion, and decrease regularly in size from the proximal to the distal ends. The hydrothecæ are deeply campanulate, the distal parts being almost tubular, and are more than twice as long as wide. The margin bears about 14 well marked, pointed teeth and there is a well-defined diaphragm and rather low basal chamber. The hydranth has a trumpet-shaped proboscis and about 24 tentacles.

Gonosome.—The gonangia are borne on the stem and branches. They are oblong ovoid in shape with the distal end abruptly truncated. The walls are often somewhat corrugated transversely, but not regularly annulated. They are about 1.25 times as long as the hydrothecæ and somewhat broader. Gonangial contents, developing medusæ, the details of which can not be made out. Torrey says that the oldest have 4 tentacles.

Type-locality.—San Pedro Bay, California. This species has not been reported from any other locality except San Diego Bay, California.

CLYTIA FRAGILIS Congdon.

Plate 15, fig. 1.

Clytia fragilis CONGDON, The Hydroids of Bermuda, 1907, p. 470.

Trophosome.[1]—Colony 9 mm. in height (Congdon's specimens were 12.18 mm). The basal portion is lacking, and the specimen divides into two subequal branches near its proximal end. These branches are divided into sinuous internodes each of which bears a pedicel near its distal end and a group of annulations on its basal portion. The pedicels are alternate in position, about as long as the hydrothecæ or longer, diminishing in diameter from the proximal to the distal end and extensively annulated, sometimes completely so. In most cases, however, there is a median smooth portion. The hydrothecæ are deeply campanulate, almost tubular, often more than twice as long as broad. The margin is armed with about 12 acutely pointed teeth which sometimes appear to be the terminations of compressed ridges which lie vertically on the distal part of the hydrothecal walls. The diaphragm is evident and rather high.

Gonosome.—Gonangia borne on the stem near the axils of the pedicels. They are rather slender, obconical in shape with the greatest diameter at the distal truncated end. They are about twice as long as the hydrothecæ, and are borne on a very short annulated pedicel. Gonangial contents developing medusæ, according to Congdon. They were not in condition to study in the specimen described.

Distribution.—Type-locality, Bermuda Islands, growing on *Pennaria tiarella*. *Albatross* station 2283, lat. 35° 21′ 20″ N.; long. 75° 23′ 50″ W., 14 fathoms. *Fish Hawk* station 6059, Mayaguez Harbor, Porto Rico, 7 fathoms.

CLYTIA HENDERSONI Torrey.

Plate 15, figs. 2, 3.

Clytia hendersoni TORREY, Hydroids of the San Diego Region, 1904, p. 18.
Clytia hendersoni FRASER, West Coast Hydroids, 1911, p. 35.

Trophosome.[2]—Colonies consisting of upright stems springing from a creeping rootstock. Stems often irregularly branched, in which case the branches conform in detail to the stems from which they spring. Height of stem 9 mm. Stem usually flexuose with a group of annulations above each pedicel origin. Pedicels alternate, shorter than the hydrothecæ, annulated throughout and forming a very acute angle with the stem. Hydrothecæ large, deeply campanulate, approaching a tubular form, about twice as long as broad. The margin bears 12–14 very long, slender-pointed teeth the points of which are often turned inward and braced by a sort of heel on the outer side. The diaphragm is high and strongly marked, bearing a large basal chamber. Hydranth with about 24 tentacles.

[1] Description of a specimen collected by the U. S. Fish Commission Porto Rico Expedition at station 6059.

[2] Description of a specimen kindly sent the author by Doctor Torrey from San Diego Bay, California, the type-locality.

Gonosome.—Gonangia borne in the axils of the pedicels and also on the rootstocks, oblong ovate in general shape, with their distal ends abruptly truncated. Their walls are sometimes sinuous in outline but not regularly annulated, and their pedicels usually show two annulations. Gonangial contents, developing medusæ with 4 tentacles.

Locality.—The type-locality is San Diego Bay, 3 fathoms, where they are found growing on sponges and algæ. This is the only known locality.

Genus ORTHOPYXIS L. Agassiz (practically=EUCOPELLA von Lendenfeld).

Louis Agassiz uses *Orthopyxis* as a subgeneric name in his Contributions to the Natural History of the United States,[1] where, under the name of *Clytia* (*Orthopyxis*) *poterium* he gives an elaborate description of what is now regarded as the well-known *Clytia caliculata* of authors. He nowhere describes the subgenus *Orthopyxis,* but raises the name to generic rank on page 355 of the same work.

His son, Alexander Agassiz, followed him in this, using the name *Orthopyxis poterium,* as his father did, for the *Clytia caliculata* of authors.[2]

Neither of these authorities gave any description whatever to the genus, or subgenus, *Orthopyxis,* but the older Agassiz very carefully described and illustrated the type-species.

I can not find that any author has used the name *Orthopyxis* since 1865. Von Lendenfeld, in 1885,[3] proposed the generic name *Eucopella* to accommodate a species which he very elaborately described and figured under the name *Eucopella campanularia.*

This species, which he makes the type of the genus *Eucopella,* agrees entirely with *Clytia caliculata* of authors in the remarkable thickening of the hydrothecal walls, but not in the bilateral symmetry of at least part of the hydrothecæ. Indeed there is a strong suspicion that von Lendenfeld's *Eucopella campanularia* is identical with *Clytia caliculata.*

Von Lendenfeld's generic description of his *Eucopella* is as follows:

> Die Polypstocke bestehen aus einen Hydrorhiza, von welcher unverzweigt Hyrocauli abgehen. Die Nahrpolypen werden von becherformigen Hydrotheken umschlossen. Die medusen sprossen an verzweigten Polypstylen.

It seems evident that the law of priority demands that the genus *Orthopyxis* of Agassiz should stand, and that the genus *Eucopella* of von Lendenfeld should be abandoned.[4]

It seems to the present writer that the thickening of the hydrothecal walls in this and allied forms is a good generic character. The fact that individual hydrothecæ in several species do not show this character does not necessarily militate against this view, as they are ordinarily thickened when mature and the thin walls of some individual ones may be regarded as a developmental feature, or as one due to certain unfavorable conditions. The fact that typical calyces in these species are enormously thickened, a character not found in normal hydrothecæ of other species of *Clytia,* renders this character in the opinion of the writer available in generic definition. The following definition is here adopted for this genus:

Trophosome.—Colony consisting of unbranched pedicels springing from a creeping rootstock. Pedicels, rootstocks and hydrothecæ usually greatly thickened so that the cavity of the latter is greatly decreased.

Gonosome.—Gonangia ovoid or compressed, not greatly lengthened and attenuated. Medusæ borne on branched blastostyles and without tentacles or manubrium.

The type-species of this genus is *Orthopyxis caliculata* (Hincks).

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[1] Volume 4, 1862, p. 297.

[2] North Amer. Acalephæ, 1865, p. 81.

[3] Zeitsch. Wissensch. Zool., vol. 5, 1885, p. 658.

[4] In a private letter Dr. W. M. Bale, the well-known writer on Australian hydroids, strongly urges the correctness of this view.

KEY TO AMERICAN SPECIES OF ORTHOPYXIS.

Hydrothecal margin toothed, in typical specimens.
  Margin often everted, teeth not conspicuous ..... *everta.*
  Margin not everted, teeth conspicuous ..... *crenata.*
Hydrothecal margin smooth.
  Annulations of pedicels oblique, when present ..... *caliculata.*
  Annulations not oblique.
    Usually one globular distal annulation to pedicel ..... *compressa.*
    Two to four annulations ..... *clytioides.*

ORTHOPYXIS CALICULATA (Hincks)

Plate 15, fig. 4.

Campanularia caliculata HINCKS, Ann. Mag. Nat. Hist., ser. 2, vol. 11, 1853, p. 178.
Campanularia caliculata THOMPSON, Ann. Mag. Nat. Hist., ser. 2, vol. 11, 1853, p. 443.
Campanularia caliculata GOSSE, Manual Marine Zoology, vol. 1, 1855, p. 25.
Campanularia caliculata M. SARS, Bidrag til Kundskaben om Middlehavets Littoral-Fauna, 1857, p. 158.
Campanularia brevicyphia SARS, Bidrag til Kundskaben om Middlehavets Littoral-Fauna, 1857, p. 158.
Campanularia caliculata GREENE, A Manual of the Sub-kingdom Coelenterata, 1861, p. 44.
Clytia (*Orthopyxis*) *poterium* L. AGASSIZ, Cont. Nat. Hist. U. S., vol. 4, 1862, pp. 297, 355.
Campanularia caliculata ALLMAN, Proc. Roy. Soc. Edinburgh, vol. 4, 1862, p. 64.
Laomedea caliculata ALLMAN, Report on the present state of our knowledge of the reproductive system in the Hydroids, 1864, p. 368.
Clytia poterium ALLMAN, Report on the present state of our knowledge of the reproductive system in the Hydroids, 1864, p. 371.
Campanularia brevicyphia ALLMAN, Ann. Mag. Nat. Hist., ser. 3, vol. 13, 1864, p. 372.
Laomedea poterium ALLMAN, Ann. Mag. Nat. Hist., ser. 3, vol. 13, 1864, p. 373.
Laomedea caliculata ALLMAN, Ann. Mag. Nat. Hist., ser. 3, vol. 13, 1864, p. 373.
Orthopyxis poterium A. AGASSIZ, North Amer. Acalephæ, 1865, p. 223.
Orthopyxis poterium HINCKS, British Hydroid Zoophytes, 1868, p. 164.
Laomedea (*Clytia*) *poterium* ALLMAN, Gymnoblastic Hydroids, 1871, p. 45.
Laomedea caliculata ALLMAN, Gymnoblastic Hydroids, 1871, p. 48.
Campanularia caliculata COUGHTRY, Ann. Mag. Nat. Hist., ser. 4, vol. 17, 1876, p. 25.
Campanularia everta CLARK, Trans. Conn. Acad. of Sci., vol. 3, 1876, p. 253.
Campanularia caliculata VERRILL, Check-list of Marine Invert., 1879, p. 16.
Campanularia caliculata JICKELI, Der Bau der Hydroidpolypen, pt. 2, 1883, p. 631.
Campanularia caliculata BALE, On some new and rare Hydroids in the Australian Museum Collection, 1888, p. 755.
Campanularia caliculata MARKTANNER-TURNERETSCHER, Hydroiden des k. k. naturhist. Hofmuseums, 1890, p. 204.
Campanularia caliculata FEWKES, Guide to collectors, 1891, p. 37.
Campanularia integra LEVINSEN, Meduser, Ctenophorer og Hydroider, 1893, p. 26.
Campanularia caliculata BONNEVIE, Norwegian N. A. Exped., 1897, p. 72.
Agastra mira (medusa) HARTLAUB, Wissen. Meeresuntersuch. Meere Kiel, Helgoland, new ser., vol. 2, 1897, p. 504.
Campanularia caliculata (medusa) GIARD, Comp. Rend. Soc. Biol., Paris, ser. 10, vol. 5, 1898, p. 17.
Campanularia caliculata CALKINS, Some Hydroids from Puget Sound, 1899, p. 351.
Campanularia poterium NUTTING, Hydroids of Woods Hole Region, 1901, p. 344.
Campanularia caliculata HARTLAUB, Hydroiden aus den Stillen Ocean, 1901, p. 353.
Campanularia caliculata HARGITT, Synopsis N. A. Invert., 1901, p. 383.
Campanularia caliculata JÄDERHOLM, Aussereuropaïsche Hydroiden, 1905, p. 265.
Campanularia everta HARTLAUB, Die Hydroiden du magalhaensischen Region und chilenischen Küste, 1905, p. 560.
Campanularia caliculata BROCH, Nordsee-Hydroiden, 1905, p. 10.
Campanularia caliculata RITCHIE, Hydroids from the Cape Verde Islands, 1907, p. 503.
Campanularia caliculata BROCH, Hydroiduntersuchungen, I, 1908, p. 31.
Campanularia integra (part) JÄDERHOLM, Northern & Arctic Invert., pt. 4, Hydroiden, 1909, p. 65.
Campanularia integra (part) BROCH, Hydroiden der arktischen Meere, 1909, p. 185.
Eucopella caliculata FRASER, West Coast Hydroids, 1911, p. 36.
Campanularia caliculata STECHOW, Hydroiden der Münchener Zoologischen Staatssammlung, 1912, p. 357.

Trophosome.[1]—Colonies consisting of numerous unbranched pedicels springing from a creeping rootstock which is tortuous, but not regularly annulated, and very thick-walled; the chitinous walls of the tubular rootstocks often being thicker than the lumen of the tube itself. The pedicels also are very thick-walled and spring at irregular distances from the rootstock. The pedicels and hydrotheca combined attain a height of as much as 5 mm. Pedicels sometimes closely annulated throughout, sometimes merely wavy and rarely almost smooth. In all cases

[1] Specimen from Yakutat, Alaska, collected by the Harriman Alaska Expedition.

they bear one or more annulations at the top and bottom, the former showing a spherical annulation just beneath the hydrotheca, as in *C. integra*. The hydrothecæ vary greatly in shape and in thickness of walls. In some cases they seem identical with those of *C. integra*, being longer than broad and thin-walled, compared with typical hydrothecæ of *C. caliculata*. The walls, however, are never as thin in my specimens as they are in typical *C. integra*. All intergradations are found between the form just described and calyces which are broader than long with their walls enormously thickened so as to present the appearance which led Hincks in his original description to describe them as "campanulate, having an interior cup."[1] These hydrothecæ are sometimes broader than long. In all cases the walls are thickened near the bottom, forming an annular shelf upon which the hydranth rests. The hydranth is of the regular campanularian type.

Gonosome.[2]—Gonangia elongate oval with the distal end truncated and the proximal end passing gradually into a short peduncle. The walls are coarsely and unevenly corrugated, the corrugations being shallow. The gonangia often show internal longitudinal bands, typically four in number. These canals are branched, according to Hincks. The medusa is the *Agastra mira* of Hartlaub, according to Giard, and is described by Mayer as follows:

Bell somewhat higher than wide, 1 mm. high, with scattered isolated nematocysts over exumbrella. Gelatinous substance quite thick and of equal thickness everywhere except at the apex, where there is a deep, narrow, funnel-shaped depression. No tentacles, but 4 minute, pigmented bulbs. 8 adradial lithocysts, each with a single concretion. 4 narrow radial-canals and a ring-canal. No stomach, the radial-canals either ending blindly at inner apex of bell-cavity or fusing at one point at this place. The gonads are elongate, irregularly arranged, sac-shaped evaginations upon both sides of the middle parts of each radial-canal.[3]

Distribution.—North American: Labrador (Hincks); New England Coasts (Verrill); Davis Straits (Levinsen); California Coast (Torrey); Alaska (Nutting); Puget Sound (Calkins); Bering Sea (Jäderholm). General: Norway (Bonnevie); Arctic Sea (Broch); Greenland (Levinsen); Iceland (Saemondsson); Spitzbergen (Marktanner-Turneretscher); Sweden (Jäderholm); British Coasts (Hincks, Allman); Mediterranean (Sars); New Zealand (Coughtry); Japan (Inaba); Africa, Port Natal (Billard); Patagonia (Jäderholm); Magellan Straits and Chile (Hartlaub); Australia (Bale). Bathymetric distribution, 1 to 100 fathoms.

This appears to be one of the most cosmopolitan of the Campanularidæ.

ORTHOPYXIS COMPRESSA (Clark).

Plate 15, figs. 5–10.

Campanularia compressa Clark, Proc. Acad. Nat. Sci. Philadelphia, 1876, p. 214.
Campanularia caliculata Calkins, Hydroids from Puget Sound, 1899, p. 351.
Clytia compressa Nutting, Hydroids of the Harriman Alaska Exped., 1901, p. 170.
Clytia compressa Torrey, Hydroida of the Pacific Coast, 1902, p. 58.
Clytia compressa Torrey, Hydroids of the San Diego Region, 1904, p. 17.
Campanularia compressa Hartlaub, Die Hydroiden der magalhænsischen Region und chilenischen Küste, 1905, p. 562.
Campanularia compressa Jäderholm, Hydroiden aus antarktischen und subantarktischen Meeren, 1905, p. 14.
Campanularia integra (part) Jäderholm, Northern and Arctic Invert., pt. 4, Hydroiden, 1909, p. 65.
Campanularia compressa Fraser, West Coast Hydroids, 1911, p. 37.

Trophosome.[4]—Colony consisting of unbranched pedicels springing from a creeping rootstock. Pedicels and rootstocks not regularly annulated, but with greatly thickened perisarc. Pedicels sometimes attaining a height of 6 mm., smooth with usually a globular annulation just below the hydrotheca. Hydrothecæ sometimes without greatly thickened walls and triangular in shape. Others have excessively thickened walls, so that the outline becomes ovoid, the inner

[1] Ann. Mag. Nat. Hist., ser. 2, vol. 11, 1853, p. 178.

[2] Not present in specimen described. The present description is based on the figures given by L. Agassiz (under name of *Clytia poterium*) in Cont. Nat. Hist. U. S., vol. 4, 1862, pl. 18.

[3] Medusæ of the world, vol. 2, the Hydromedusæ, 1910, p. 234.

[4] Specimen from Orca, Alaska, collected by the Harriman Alaska Expedition.

surface being typically campanulate in outline. The margin is always even, never regularly dentated. When the walls are greatly thickened the basal chamber assumes the outline of a bell handle.

Gonosome.—Gonangia very much compressed laterally, being often as broad as long when viewed from the broad side. The specimens were not in a condition to make a satisfactory study of their internal structure practicable. The writer has seen in other specimens indication of medusæ in the gonangia. Torrey (1902) figures a medusa with 4 tentacles just escaping from the gonangium. Another specimen labeled Shumagin Islands (see plate 11, fig. 10) shows a large medusa with 4 radial canals.

Distribution.—Shumagin Islands, 6 to 20 fathoms on *Laminaria* (Clark); Orca, Alaska (Nutting); San Diego, California (Torrey); Smith Channel, Straits of Magellan (Jäderholm).

Clark's specimens from Shumagin Islands show gonangia with developing medusæ greatly resembling the figures given by Calkins for his *Campanularia caliculata* from Puget Sound.[1] Male gonophores are very much like the figure given by von Lendenfeld for *Eucopella campanularia*,[2] the branched processes of the radial canal showing very plainly.

ORTHOPYXIS CLYTIOIDES (Lamouroux).

Plate 16, figs. 1, 2.

Tubularia clytioides Lamouroux, in Freycinet, L. de, Voyage autour du Monde exécuté sur les corvettes de S. M. *l' Uranie* et la *Physicienne*, 1824, p. 620.
Silicularia clytioides Meyen, Über das Leuchten des Meeres, 1834, p. 206.
Tubularia cycloides Milne Edwards, in Lamarck, Hist. Anim. sans Vert., ed. 2, vol. 2, 1836, p. 135.
? *Silicularia gracilis* Milne Edwards, in Lamarck, Hist. Anim. sans Vert., ed. 2, vol. 2, 1836, p. 135.
Campanularia clytioides Hartlaub, Die Hydroiden der magalhaensischen Region und chilenischen Küste, 1905, p. 563.
Campanularia clytioides Ritchie, Supplementary Rept. on Hydroids of the Scottish Nat. Antartic Exped., 1909, p. 71.
Campanularia clytioides Billard, Révision des Espèces Types d'Hydroïdes de la Collection Lamouroux, 1909, p. 311.

Trophosome.[3]—The colony consists of upright unbranched pedicels growing from a creeping rootstock which forms a reticulate pattern over an alga. The rootstock is smooth and usually runs straight from point to point on the alga, and sends off branches at right angles so that a pattern of wide squares or parallelograms is formed. The rootstocks are thick-walled, leaving but a narrow central tube for the cœnosarc, and are pinched at the points of origin of the side branches. The pedicels attain a height of about 3 mm., are rather slender, thick-walled, not regularly annulated except at their distal ends where there are usually 2 to 4 annulations separated by sharp constrictions. There are always 2 or 3 globular annulations just below the hydrotheca, separated from the latter by a very sharp constriction at which point the hydrotheca is very easily broken off. There are almost always several (4–8) regular annulations at the basal end of the pedicels, while the median portion is usually smooth.

The hydrothecæ are campanulate, even-rimmed and thick-walled, the lower part of the walls being greatly thickened to produce an internal annular shelf forming a diaphragm on which the hydranth rests and dividing off a basal chamber which is better marked than in other species of the genus that I have seen.

Gonosome.—Unknown.

Hartlaub says this species can be distinguished from *Campanularia integra* and *Eucopella caliculata* by the fact that the annulations of the pedicels are straight and not twisted or oblique.

Distribution.—Azores and Sargasso Sea (Meyen); Straits of Magellan (Hartlaub). All the specimens are on floating algæ (*Sargassum*).

[1] Some Hydroids from Puget Sound, 1896, pl. 2, fig. 11c.
[2] Ueber Coelenteraten der Südsee, pl. 31, fig. 24.
[3] Description based on mounted slide of this species kindly loaned the writer by Dr. C. Hartlaub. Specimen from the Straits of Magellan.

ORTHOPYXIS CRENATA (Hartlaub).

Plate 16, figs. 3–5.

Eucopella crenata HARTLAUB, Hydroiden aus dem Stillen Ocean, 1901, p. 364.
? *Eucopella crenata* HARTLAUB, Die Hydroiden der magalhaensischen Region und chilenischen Küste, 1905, p. 568.
? *Eucopella crenata* BILLARD, *Travailleur* et *Talisman*, Hydroïdes, 1907, p. 176.

A specimen sent me by Doctor Hartlaub and labeled "*Eucopella crenata* P. Pantalon" does not agree with the original description,[1] in that the hydranth is smaller than the hydrotheca and completely retracted within it. The following description is a translation of that given by Hartlaub:

Hydrorhiza forming a moderately broad network. Hydranths (pedicels?) scattered, unbranched, up to 5 mm. high. Pedicels moderately thick, very variable in length, partly smooth, partly obliquely annulated, always with a globular constriction below the hydrotheca. Hydrothecæ very variable in size, in the thickening of their walls and n form. Their margin is usually plainly toothed (about 12–14 teeth). Hydrothecal walls partly or completely thickened, with the exception of their distal end, which is bent outward and very thin-walled. The hydranths are sometimes much larger than the hydrotheca and then are but partially retractile. Gonangia large, strongly compressed with a wide rounded end, thick-walled with a sinuous surface, with a short smooth pedicel springing from the hydrorhiza, containing two well developed medusæ with easily recognizable mature sex-cells.

Distribution.—Hartlaub thinks that this species is identical with a form described as a "*Campanularia* allied to *C. caliculata*" from New Zealand, by Coughtry,[2] and also another form described by the same writer as "*Campanularia* allied to *C. integra*," also from New Zealand.[3] It hardly seems likely to the present writer that the form *E. crenata* is identical with *C. caliculata* var. *makrogona* Lendenfeld, as suggested by Hartlaub.[4]

It appears then likely that the distribution includes New Zealand, the type-locality being Rangitoto Island and Terra del Fuego (Hartlaub). This species is doubtless close to *E. everta* (Clark) and may be identical with it. The hydrothecæ of the latter species is much larger than those of *C. crenata*, as a comparison with a slide from Hartlaub shows.

Bathymetric distribution, 1 to 7 fathoms.

ORTHOPYXIS EVERTA (Clark).

Plate 16, figs. 6–8.

Campanularia everta CLARK; Trans. Conn. Acad., 1876, vol. 3, p. 253.
Campanularia everta TORREY, Hydroida of the Pacific Coast, 1902, p. 51.
Campanularia everta TORREY, Hydroids of the San Diego Region, 1904, p. 12.
Campanularia everta HICKSON and GRAVELY, National Antarctic Exped., 1907, p. 24.
Campanularia everta FRASER, West Coast Hydroids, 1911, p. 37.

Trophosome.[5]—Colony growing over a laminarian in the form of a creeping rootstock which forms a reticulate pattern. Pedicels unbranched, sometimes attaining a height of 5 mm. They vary greatly in extent of annulation, some being almost smooth and others closely annulated throughout, but always show the spherical annulation below the hydrotheca. Both the rootstocks and pedicels have their periderm greatly thickened. Hydrothecæ exceedingly variable, as Doctor Torrey[6] has said: "The rim of the hydrothecæ may or may not be everted. It is usually but not always crenate. The wall of the hydrotheca may be very thick or very thin, and is either straight or convex in profile." Except for the frequent occurrence of a regularly dentated margin, the hydrothecæ can not be distinguished from that of *O. compressa* and might readily be mistaken for that species.

[1] "Der Kopf des hydranthen manchmal viel grösser als den Kelch und dann nur theilweise in denselben zurückziehbar." Hydroiden aus dem Stillen Ocean, 1901, p. 365.
[2] Ann. Mag. Nat. Hist., ser. 4, vol. 17, 1876, p. 25.
[3] Trans. New Zealand Institute, vol. 7, 1875, p. 292.
[4] See Some new and rare Hydroids in the Australian Museum, by W. M. Bale, 1888, p. 755.
[5] Description of specimen from Dr. H. B. Torrey, labeled "Monterey, Calif."
[6] Hydroida of the Pacific Coast, 1902, p. 51.

Gonosome.—The gonangia are small, regularly oval in outline, somewhat compressed, about one and one-half times as long as wide at greatest diameter and about one and three-fourths times as high as the average hydrotheca. The female gonangia, at least, contain medusæ which eject their ova into an acrocyst without liberating the medusæ. The details of the medusæ can not be made out in the specimens. Medusoid characters are much less evident in the male gonangium.

Distribution.—San Diego, California (Clark); Pacific Grove, California (Torrey); McMurdo Bay, Antarctic (Hickson and Gravely).

Bathymetric distribution 1 to 42 fathoms.

This species is closely allied to *O. compressa* from which it is separated by the distinctly dentate margin of the characteristic hydrothecæ, and the smaller size and more slender proportions of the gonangia.

Genus GONOTHYRÆA Allman.

Gonothyræa Allman, Ann. Mag. Nat. Hist., ser. 3, vol. 13, 1864, p. 374.

The original definition of this genus has not been improved upon by subsequent writers and is as follows:

Trophosome.—Hydrocaulus branching, rooted by a filiform hydrorhiza; hydrothecæ bell-shaped, with entire or serrated margin, and destitute of operculum; tentacula surrounding the base of a large, very contractile metastome.

Gonosome.—Gonophores adelocodonic. Sporosacs in the form of imperfect medusæ (meconidia), carrying round the rudimental codonostome a circle of filiform tentacula, and, when mature, supported on the summit of the gonangium, where they lie entirely external to its cavity.

KEY TO AMERICAN SPECIES OF GONOTHYRÆA.

Margin with teeth which are squared off at top..... *loveni.*
Teeth sharply pointed..... *gracilis.*
Teeth very shallow..... *clarki.*
Margin without teeth..... *inornata.*

GONOTHYRÆA LOVENI (Allman).

Plate 17, figs. 1–2.

Sertularia dichotoma (part) Houttuyn, Natuurlyke Historie, 1761–73, vol. 17, p. 565.
Sertularia contorta Shaw, Vivarium naturæ, etc., 1813, p. 789, pl. 962.
Campanularia dichotoma Lister, Philos. Trans. Royal Soc., pt. 2, 1834, p. 386.
Sertularia dichotoma Lister, Philos. Trans. Royal Soc., pt. 2, 1834, p. 372.
Sertularia geniculata Loven, Bidrag til Kännedomen of Slägtena Campanularia och Syncoryna, 1835, p. 261.
Campanularia geniculata Loven, Bidrag til Kännedomen of Slägtena Campanularia och Syncoryna, 1835, p. 281.
Campanularia geniculata van Beneden, Mémoire sur les Campanulares de la Côte d'Ostend, 1844, p. 34.
Campanularia dichotoma van Beneden, Recherches sur l'embryogenie des Tubulaires, 1844, p. 41.
Campanularia geniculata Steenstrup, Untersuchungen über das Vorkommen des Hermaphodistismus in der Natur, 1846, p. 65.
Campanularia geniculata Lütken, Nogle Bemaerkninger om Medusernes Systematiske, etc., 1850, p. 32.
Campanularia geniculata Schultze, Ueber der männlichen Geschlechtstheile der Campanularia geniculata, 1850, p. 52.
Campanularia geniculata Gegenbauer, Zur lehre vom Generationswechsel und der Fortpflanzung bei Medusen und Polypen, 1854, p. 163.
Campanularia geniculata Lindström, Om utwecklingen of Sertularia pumila Linnaeus, 1855, p. 370.
Laomedea geniculata Greene, On the Acalephae of the Dublin Coast, 1859, p. 249.
Campanularia geniculata Sars, M., Bidrag til Kundskaben om middlehavets Littoral-Fauna, 1857, p. 161.
Laomedea dichotoma Wright, Observations on Brit. Zooph., 1858, p. 450.
Campanularia dichotoma Wright, Observations on Brit. Zooph., 1858, p. 453.
Laomedea flexuosa Allman, Notes on the Hydroid Zooph., Ann. Mag. Nat. Hist., ser. 3, vol. 4, 1859, p. 138.
Laomedea loveni Allman, Notes on the Hydroid Zooph., Ann. Mag. Nat. Hist., ser. 3, vol. 4, 1859, p. 138.
Laomedea flexuosa Allman, Additional observations on the reproductive organs in the Hydroid Polypes, 1859, p. 310.
Campanularia flexuosa Allman, Additional observations on the morphology of the reproductive organs of Hydroid Polypes, 1859, p. 316.
Laomedea dichotoma Sars, M., Ann. Mag. Nat. Hist., ser. 3, vol. 8, 1861, p. 359.
Laomedea geniculata Sars, M., Ann. Mag. Nat. Hist., ser. 3, vol. 8, 1861, p. 359.
Campanularia loveni Greene, A Manual of the Sub-Kingdom Coelenterata, 1861, p. 44.

Laomedea loveni Hincks, Ann. Mag. Nat. Hist., ser. 3, vol. 7, 1861, p. 260.
Laomedea loveni Wright, Observations on Brit. Protozoa and Zooph., Ann. Mag. Nat. Hist., ser. 3, vol. 8, 1861, p. 126.
Laomedea flexuosa Allman, on the structure of the reproductive organs in certain Hydroid-Polypes, Proc. Royal Soc. Edinburgh, vol. 4, 1862, p. 56.
Laomeda loveni Kirchenpauer, Die Seetonen der Elbmündung, 1862, p. 23.
Laomeda loveni Norman, Report 31st Meeting Brit. Ass. Adv. Sci., 1862, p. 152.
Laomedea loveni Alder, Suppl. Zooph. Northumb. and Durham, 1863, p. 237.
Campanularia geniculata Sars, Bemærkninger over fire norske Hydroider, 1863, p. 34.
Campanularia geniculata Allman, Report of 33rd meeting Brit. Ass. Adv. Sci., 1864, p. 381.
Gonothyræa (*Laomedea*) *loveni* Allman, Report of 33rd Meeting of Brit. Ass. Adv. Sci., 1864, p. 376.
Laomedea loveni Allman, Report of 33rd Meeting of Brit. Ass. Adv. Sci., 1864, p. 375.
Gonothyræa loveni Allman, Report of 33rd Meeting of Brit. Ass. Adv. Sci., 1864, p. 374.
Gonothyræa loveni Hincks, Quart. Journ. Sci., vol. 2, 1865, p. 412.
Campanularia geniculata van Beneden, Recherches sur la Fauna littorale de Belgique, 1867, p. 150.
Campanularia dichotoma van Beneden, Recherches sur la Faune littorale de Belgique, 1867, p. 150.
Gonothyræa loveni Hincks, British Hydroid Zoophytes, 1868, p. 181.
Gonothyræa loveni Hincks, Pop. Sci. Review, vol. 8, 1869, p. 45.
Gonothyræa loveni Norman, Shetland final Dredging Report, vol. 2, 1869, p. 322.
Gonothyræa loveni Allman, Gymnoblastic Hydroids, 1871, p. 55.
Gonothyræa loveni Verrill, Proc. Amer. Ass. Adv. Sci., 1873, p. 364.
Gonothyræa loveni McIntosh, Ann. Mag. Nat. Hist., ser. 4, vol. 13, 1874, p. 209.
Gonothyræa loveni Schulze, Nordsee Exped., Coelenteraten, 1874, p. 130.
Gonothyræa tenuis Clark, New and rare species of Hydroids from the New England Coast, 1876, p. 61.
Gonothyræa loveni Winther, Fortegnelse over de i Danmark Hydroider, 1879–80, p. 220.
Gonothyræa loveni de Varenne, Sur la Reproduction des Polypes Hydraires, 1882, pp. 31, 62.
Gonothyræa loveni Weismann, Entstehung der Sexualzellen bei den Hydromedusen, 1883, p. 131.
Gonothyræa loveni Thallwitz, Ueber die Entwicklung der mannlichen Keimzellen bei den Hydroiden, 1885, p. 426.
Laomedea (*Gonothyræa*) *loveni* Levinsen, Meduser, Ctenophorer og Hydroider fra Grönlands Vestkyst, 1893, p. 170.
Gonothyræa loveni Crawford, Ann. Mag. Nat. Hist., ser. 6, vol. 16, 1895, p. 260.
Gonothyræa loveni Nutting, Notes on Plymouth Hydroids, 1896, p. 3.
Gonothyræa loveni Hartlaub, Die Hydromedusen Helgolands, 1897, p. 451.
Gonothyræa loveni Nutting, Hydroids of the Woods Hole Region, 1901, p. 352.
Gonothyræa loveni Hargitt, Synopsis of N. A. Invert. Hydromedusæ, part 2, 1901, p. 386.
Gonothyræa loveni Billard, Contribution à l'étude des Hydraires, 1904, p. 172.
Gonothyræa loveni Jäderholm, Northern and Arctic Invert., pt. 4, Hydroiden, 1909, p. 64.
Laomedea loveni Broch, Die Hydroiden der arktischen Meere, 1909, p. 228.
Gonothyræa loveni Bedot, Hydroides de Roscoff, 1911, p. 219.
Gonothyræa loveni Stechow, Hydroiden der Münchener Zoologischen Staatssammlung, 1912, p. 356.

The synonymy of this species is greatly confused on account of the fact that early writers gave the name *Sertularia dichotoma* to two distinct species, i. e., *Gonothyræa loveni* and *Obelia dichotoma*. The priority, however, seems to be in favor of *Sertularia dichotoma* (Linnæus) 1758, which is the original name given to *Obelia dichotoma*.

Trophosome.[1]— Colony consisting of a clump of branched stems attaining a height of 3 cm., although Allman mentions colonies 3 or 4 inches in height. The stems are quite irregularly branched, the details of the branches agreeing with those of the stem from which they spring. Stem and branches flexuose, with a series of 3 to 6 annulations immediately above each pedicel origin. Pedicels alternate, shorter than the hydrothecæ, gradually diminishing in diameter from proximal to distal end, and annulated throughout. The hydrothecæ are gracefully campanulate in form, gradually curved from about half their height to the base and the margin is ornamented with 10–12 sharply cut shallow teeth whose ends are squared off, thus giving a castellated appearance. The diaphragm is very low, leaving a scarcely appreciable basal chamber.

Gonosome.—Gonangia borne near the axis of the pedicels and often in pairs. They are obconic in form, fully developed ones being about 1.5 times as long as the hydrothecæ and not quite twice as long as broad. The distal end is abruptly truncated and bears from 2–6 of the

[1] Description of a specimen collected by the writer near Plymouth, England.

peculiar medusa-form "extra capsular sporosacs" of Hincks, characteristic of the genus. These are globular in general form. Allman, in reference to their resemblance to poppy seeds has called these structures "meconidia." They are supported on short pedicels which rest in a plug-like expansion of the blastostyle which fits into the top of the gonangium. The meconidia show four well-marked radial canals, and a cluster of numerous short, finger-like tentacles is borne on their distal ends. Within these capsules the ova develop into planulæ which then escape and lead a free life. In the male colonies the spermatozoa are developed from sporosacs within the meconidia. Inside of the gonangium is a blastostyle upon which are often seen the meconidia developing, the oldest one being above and the youngest below. Hincks[1] says that the tentacles borne on the male meconidia are smaller and less numerous than those on the female.

Distribution.—The type-locality for this species can hardly be determined with accuracy, but was probably on the British coast. It has been reported repeatedly from British shores. Several Scandinavian localities are given—e. g., Norway by Sars; Sweden (Broch, Jäderholm); Greenland (Levinsen); North Sea (Hartlaub); Denmark (Levinsen); Helgoland (Hartlaub); Belgium (van Beneden); Mediterranean (Baboc, according to Jäderholm).

American records are given for the New England coast by Verrill and Nutting. A specimen was also sent to the writer from the coast of Rhode Island by Dr. H. C. Bumpus. The species has not been reported from the Pacific nor from the South Atlantic.

Bathymetric distribution, 1 to 55 fathoms.

GONOTHYRÆA GRACILIS (Sars).

Plate 17, fig. 3.

Laomedea gracilis Sars, Beretning om en i Sommeren 1849 forletagen Zoologistk Reise i Lofoten og Finmarken, 1851, p. 138.
Laomedea (Campanularia) gracilis Sars, G. O., Bidrag til Kundskaben om middlehavets Littoral-Fauna, 1857, p. 161.
Laomedea gracilis Hincks, Cat. of Zooph. South Devon and South Cornwall, Ann. Mag. Nat. Hist., ser. 3, vol. 8, 1861, p. 260.
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Gonothyræa gracilis Hincks, British Hydroid Zoophytes, 1868, p. 183.
Gonothyræa gracilis Hincks, Suppl. Cat. Zooph. South Devon and South Cornwall, Ann. Mag. Nat. Hist., ser. 4, vol. 8, 1871, p. 80.
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Gonothyræa gracilis McIntosh, Ann. Mag. Nat. Hist., ser. 4, vol. 13, 1874, p. 209.
Gonothyræa gracilis Verrill, Amer. Journ. Sci., 1875, p. 42.
Gonothyræa gracilis Winther, Fortegnelse de i Danmark Hydroiden, 1879–80, p. 240.
Gonothyræa gracilis Segerstedt, Bidrag til kannedomen om Hydroid-Fauna ud Sveriger Vestkust, 1889, p. 13.
Gonothyræa gracilis Crawford, Ann. Mag. Nat. Hist., ser. 6, vol. 16, 1895, p. 260.
Gonothyræa gracilis Hartlaub, Die Hydromedusen Helgolands, 1897, p. 451.
Gonothyræa gracilis Hartlaub, Hydroiden aus dem Stillen Ocean, 1901, p. 353.
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Gonothyræa gracilis Hartlaub, Die Hydroiden du magalhaensischen Region und chilenischen Küste, 1905, p. 583.
Gonothyræa gracilis Ritchie, On Collections of the Cape Verde Island Marine Fauna, Hydroids, 1907, p. 503.
Gonothyræa gracilis Jäderholm, Northern and Arctic Invert., pt. 4, Hydroiden, 1909, p. 64.
Laomedea gracilis Broch, Die Hydroiden der arktischen Meere, 1909, p. 228.
Laomedea gracilis Broch, Hydroidenuntersuchungen, No. 3, 1912, p. 53.

Trophosome.[2]—Colony branched in a sparing and irregular manner, about 8 mm. in height Main stem slender, with 5 to 8 annulations some distance above each branch origin. The branches and pedicels are abruptly bent upward at their origin, forming an acute angle with the stem or

[1] British Hydroid Zoophytes, 1868, p. 183.
[2] Description of a specimen collected near Beaufort, North Carolina, by C. M. Fraser.

branch from which they arise and showing a group of usually 8 to 10 annulations near the bases. The pedicels are long and slender, with 3 to 6 annulations at their distal ends. Hydrothecæ deeply campanulate, almost tubular and about three times as long as wide, and having their margins ornamented with 12 or 14 very sharply pointed teeth.

Gonosome.—Gonangia borne both on the rootstock and stems, oblong oval in shape, with the distal end truncated and the proximal end tapering toward the annulated pedicel. The extra capsular sporosacs are absent from the specimen described, but are characteristic of the species, and, according to Sars, they each contain two ova in female colonies.

Distribution.—American. New England coast (Verrill); Beaufort, N. C. (Fraser).

General. Norway (Sars); Sweden (Segerstedt); Denmark (Winther); Helgoland (Hartlaub); Belgium (van Beneden); British coasts (Hincks); Cape Verde Islands (Ritchie); Chilean coast (Hartlaub); French coast (Billard); Mediterranean (Sars).

Calkins erroneously reports this species from Puget Sound, mistaking it for a species belonging to another genus, *Clytia edwardsi*.

Bathymetric distribution, 1 to 110 fathoms.

GONOTHYRÆA CLARKII (Marktanner-Turneretscher).

Plate 17, fig. 4.

Gonothyræa hyalina Clark, Alaskan Hydroids, 1876, p. 215.
Laomedea (*Gonothyræa*) *clarkii* Marktanner-Turneretscher, Hydroiden von Ost-Spitzbergen, 1895, p. 408.
? *Gonothyræa hyalina* Hartlaub, Hydroiden aus dem Stillen Ocean, 1901, p. 358.
Gonothyræa clarki Torrey, Hydroida of the Pacific Coast, 1902, p. 55.
Gonothyræa clarkii Jäderholm, Northern and Arctic Invert., pt. 4, Hydroiden, 1909, p. 65.
Gonothyræa clarkii Fraser, West Coast Hydroids, 1911, p. 36.

Trophosome.[1]—Colonies consisting of a tuft of upright stems growing on a common base. Stems sinuous, dark horn-brown proximally, lightening distally. Branching irregular, but with a tendency to an alternate arrangement, some of the branches themselves branching. In some cases there is a tendency toward dichotomous branching. Stem and branches with groups of usually 2 or 3 annulations just above the origins of branches or pedicels, sometimes more numerous. Pedicels alternate, ordinarily much shorter than the hydrothecæ, but often distinctly longer, in which case there is usually a median smooth part with both ends annulated. Hydrothecæ slender, deeply campanulate, their upper portions being almost tubular. The lower part narrowing gradually to meet the stem. The margin bears a number of very shallow and usually uneven teeth. Diaphragm distinct, leaving a rather large basal chamber. Hydranths with a trumpet-shaped hypostome and numerous tentacles.

Gonosome.—The gonangia are borne on the stem, branches, and sometimes on the base of the colony. Ordinarily they are in the axils of hydrothecæ or branches. They are obconical in form, rather slender with a flattened top on which medusoid meconidia, usually two or three in number, rest. These latter show no radial canals, but have a cluster of fingerlike tentacles on the distal end. Within the gonangium is a blastostyle bearing from 1 to 5 developing meconidia.

Distribution.—The type-locality for this species is Davis Bay, East Spitzbergen. Reported also from Alaska at several stations down to 25 fathoms (Clark); and Californian coast at Oakland (Torrey). This species illustrates one of the few instances in which two authors have given the same name to the same species. Marktanner-Turneretscher and Torrey having each named this form after Clark who originally identified it as *Gonothyraea hyalina*. Specimens apparently of this species sent me from Puget Sound by Prof. Trevor Kincaid are very profusely branched, and attain a height of 5 in. Vancouver (Fraser).

[1] Description of a specimen kindly sent me by Dr. H. B. Torrey, from Oakland, California.

? GONOTHYRÆA INORNATA Nutting.

Plate 17, figs. 5-7.

Gonothyræa inornata Nutting, Hydroids of the Harriman Alaska Exped., 1901, p. 175.
Gonothyræa inornata Fraser, West Coast Hydroids, 1911, p. 37.

Trophosome.[1]—Colony consisting of a tuft of upright branches springing from a common stem. Height 3.6 cm. The stem proper is very short, almost immediately breaking up into a number of long, delicate upright branches. The branches often themselves branching in a dichotomous manner, slightly flexuose and rather thick, although often quite translucent. Immediately above each pedicel origin the stem bears usually 2 or 3 strongly marked annulations. The pedicels are alternate, about the length of the hydrothecæ, annulated throughout, usually with 8 to 12 annulations and decreasing in diameter from basal to proximal ends. They are erect in posture, being nearly parallel with the branch from which they spring. The hydrothecæ are subtriangular in outline, obconical in form, usually about 1.3 times as long as broad. The margin is even, without regular teeth or ornamentation of any kind. The margin of one hydrotheca is about on a level with the base of the pedicel next above it.

Gonosome.—Gonangia borne in the axils of the pedicels, rather slender, ovate or obconical in form, the upper part of the walls sometimes slightly wrinkled transversely, and with a flattened top, upon which, in the older ones, rests a round sack-like "meconidium" or more properly acrocyst without medusoid features, containing developing planulæ or sporosacs. In less mature gonangia a single one of these sacklike structures is supported on a blastostyle in the upper part of the gonangium.

Distribution.—Known only from the type-locality, Yakutat Bay, Alaska.

There is some doubt regarding the systematic position of this species, but on the whole it appears to be most nearly allied to *Gonothyræa,* from which it differs in having no medusoid features to the meconidia.

Genus OBELIA Péron and Lesueur, modified by Hincks.

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Obelia and *Eucope* A. Agassiz, North Amer. Acalephæ, 1865, pp. 83, 91.
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Obelia McCrady, Gymnopthalmata of Charleston Harbor, 1857, p. 94.
Obelia Hincks, British Hydroid Zoophytes, 1868, p. 146.
Laomedea (part) Broch, Die Hydroiden der arktischen Meere, 1909, p. 189.

With the exception above noted all writers since McCrady (1857) that I have consulted have used the name *Obelia* in its modern sense. While McCrady was the first writer to identify the hydroid form of this genus with the medusa described by Péron and Lesueur, Hincks in his British Hydroid Zoophytes (1868) was the first one to cast the definition in modern form.

The following definition will serve for the present work.

Trophosome.—Colony branched; hydrothecæ companulate, with a distinct diaphragm. Hydranths with a trumpet-shaped proboscis.

Gonosome.—Gonangia borne on stems and branches and producing medusæ with a disk-like form, short four-lipped proboscis, 8 lithocysts and usually 8 or more marginal tentacles at liberation.

KEY TO AMERICAN SPECIES OF THE GENUS OBELIA.

Main stem fascicled.
Marginal teeth bicuspidate.....*bicuspidata.*
Marginal teeth not bicuspidate.
Pedicels not less than one-third length of hydrothecæ.....*fragilis.*
Pedicels more than one-third length of hydrothecæ.....*plicata.*

[1] Description of a specimen from the type-locality, Yakutat Bay, Alaska, collected by the Harriman Expedition.

Main stem simple.
  Hydrothecal margin with bimucronate teeth.
    Hydrothecal wall plicated above ..... *austrogorgia.*
    Hydrothecal wall not plicated ..... *corona.*
Hydrothecal margin even or undulating.
  Pedicels borne in pairs, the two individuals of a pair arising from the same side of a branch ..... *gracilis.*
  Pedicels not regularly in pairs.
    Stem geniculate.
      Pedicels borne on pronounced shoulders of stem ..... *geniculata.*
      Shoulders absent or inconspicuous.
        Margin undulating, slightly plicated ..... *dubia.*
        Margin smooth, not plicated.
          Pedicels annulated throughout ..... *hyalina.*
          Pedicels smooth on median portion ..... *braziliensis.*
    Stem distinctly flexuose ..... *surcularis.*
    Stem neither distinctly geniculate nor flexuose.
      5 to 8 annulations above each branch and pedicel origin ..... *dichotoma.*
      5 or less annulations above each branch and pedicel origin.
        Branches from all sides of stem ..... *commissuralis.*
        Branches alternate or opposite.
          Ultimate branchings regularly dichotomous ..... *flabellata.*
          Branchings regularly alternate.
            Branches form flabellate structure ..... *longissima.*
            Branches not distinctly flabellate ..... *griffini.*
          Branchings very irregular, tending to form flabellate structure, no hydrothecal teeth ..... *borealis.*

OBELIA GENICULATA (Linnæus.)

Plate 18, figs. 1–5.

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Sertularia geniculata Hogg, On the Nat. Hist. of the vicinity of Stockton on Tees, 1827, p. 33.
Campanularia geniculata Fleming, Hist. Brit. Anim., 1828, p. 548.
Sertularia geniculata Delle Chiaje, Memorie sulla storia e notomia degli animali senza vertebre, 1822–30, vol. 4, p. 126.
Laomedea geniculata Blainville, Article "Zoophytes" in Dictionaire des Sciences naturelles, vol. 60, 1830, p. 439.
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Campanularia geniculata Johnston, Descriptive catalogue of the recent zooph. found on the Coast of N. Durham, 1832, p. 255.
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Obelia geniculata Hincks, Pop. Sci. Rev., 1869, p. 231.
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Campanularia geniculata Schulze, Ueber den Bau und die Entwicklung von Cordylophora lacustris, 1871, p. 21.
Laomedea geniculata Spagnolini, Catalogo degli acalefi discofori del Golfo di Napoli, 1871, p. 186.
Obelia geniculata Schulze, Nordsee Exped., 1872, p. 129.
Obelia geniculata Verrill, Invertebrate Animals of Vineyard Sound, 1873, p. 727.
Obelia geniculata Verrill, Proc. Amer. Ass. Adv. Sci., 1873, p. 364.
Obelia geniculata Verrill, Amer. Journ. Sci., 1874, p. 41.
Obelia geniculata Verrill, Amer. Journ. Sci., 1874, p. 133.
Obelia geniculata Winther, Fortegnelse over de i Danmark Hydroida, 1877–80, p. 235.
Obelia geniculata Merejkowsky, Ann. Mag. Nat. Hist., ser. 5, 1878, p. 323.
Obelia geniculata Verrill, Check-list of Marine Invert., 1879, p. 16.
Obelia geniculata de Varenne, Sur la Reproduction des Polypes Hydraires, 1882, p. 49.
Obelia geniculata Hamann, Organismus du Hydroidpolypen, 1882, p. 54.
Obelia geniculata Fewkes, Embryological Monographs, vol. 3, 1884, pl. 3, fig. 5*a*.
Obelia geniculata Allman, *Challenger* Reports, Hydroida, pt. 2, 1888, p. 23.
Obelia geniculata Bourne, Hydroids of Plymouth, 1889–90, p. 394.
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Obelia geniculata Crawford, Ann. Mag. Nat. Hist., ser. 6, vol. 16, 1895, p. 260.
Obelia geniculata Nutting, Notes on Plymouth Hydroids, 1896, p. 2.
Obelia geniculata Hartlaub, Die Hydromedusen Helgolands, 1897, p. 451.
Obelia geniculata Versluys, Hydraires Calypteroblastes de la mer des Antilles, 1899, p. 30.
Obelia geniculata Hargitt, Synopsis of N. A. Invert., 1901, p. 382.
Obelia geniculata Hartlaub, Hydroiden aus dem Stillen Ocean, 1901, p. 302.
Obelia geniculata Nutting, Hydroids of the Woods Hole Region, 1901, p. 351.
Obelia geniculata Torrey, Hydroida of the Pacific Coast, 1902, p. 59.
Obelia diaphana Browne, Ann. Mag. Nat. Hist., ser. 7, vol. 9, 1902, p. 281.
Obelia geniculata Billard, Contributions à l'étude des Hydroïdes, 1904, p. 166.
Obelia geniculata Jäderholm, Hydroiden aus den Küsten von Chili, 1904, p. 2.
Obelia diaphana Hargitt, Bull. U. S. Bureau of Fisheries, vol. 24, 1904, p. 48.
Obelia geniculata Torrey, Hydroids of the San Diego Region, 1904, p. 15.
Obelia geniculata Hartlaub, Résultats du voyage du S. Y. *Belgica*, Hydroiden, 1904, p. 5.
Obelia geniculata Broch, Nord-See Hydroiden, 1905, p. 12.
Obelia geniculata Hartlaub, Die Hydroiden der magalhaensischen Region und chilenischen Küste, 1905, p. 581.
Obelia geniculata Jäderholm, Aussereuropäische Hydroiden, 1905, p. 270.
Obelia geniculata Jäderholm, Hydroiden aus antarktischen und subantarktischen Meeren, 1905, p. 16.
Obelia geniculata Hickson and Gravely, National Antarctic Exped., The Hydroids, 1907, p. 30.
Obelia geniculata Ritchie, Hydroida of the Scottish Nat. Antarctic Exped., 1907, p. 528.
Laomedea (*Obelia*) *geniculata* Broch, Hydroiden der arktischen Meere, 1909, p. 190.

Obelia geniculata JÄDERHOLM, Northern and Arctic Invert., pt. 4, Hydroiden, 1909, p. 62.
Obelia geniculata MAYER, Medusæ of the World, vol. 2, 1910, p. 250.
Obelia geniculata FRASER, West Coast Hydroids, 1911, p. 39.
Obelia geniculata STECHOW, Hydroidpolypen der japanischen Ostküste, part 2, 1913, p. 70.

Trophosome.[1]—Colonies growing from a creeping rootstock on a laminarian and attaining a height of 14 mm. Stems usually unbranched, regularly geniculate and divided into regular internodes, each of which bears a strong projecting shoulder or expansion on its distal end where it is much broader than at its proximal end, the internodes sometimes being rudely triangular in outline. The outer side of each internode has a remarkable thickening of the perisarc which reaches its maximum just below the insertion of the pedicel, and which is very well illustrated by Hincks in figure 1*a*, plate 25 of his "British Hydroid Zoophytes." The branches, when present, are like the stem. Pedicels alternate, very short, usually shorter than the hydrothecæ, with usually 3 to 5 annulations and the diameter decreasing rapidly from proximal to distal end. Hydrothecæ rather broadly campanulate, often triangular in outline and with a strongly marked, perfectly even margin. The diaphragm is well marked.

Gonosome.—The gonangia are usually borne in the axils of the pedicels. They are oblong-ovate in shape, the distal end being broader than the proximal and sometimes showing a sort of shoulder, beyond which it rapidly narrows to a short conical neck terminating in a small round aperture. Within the gonangia are numerous developing medusæ thickly crowded around a central blastostyle. Medusæ, at liberation, with a disk-shaped bell, 16–24 marginal tentacles, a short, square-lipped manubrium, 4 radial canals under which the ovaries are hung, and 8 lithocysts on the lower sides of the bases of 8 of the tentacles. Adult medusæ are described by Mayer[2] as differing from the freshly liberated ones mainly in the greater size (6 mm. in diameter), about 100 stiff tentacles and the position of the ovaries which lie nearer the margin than the gastric cavity.

Distribution.—This is one of the most widely distributed of all the hydroids, and one of the best known. It was originally reported from British coasts, and has been found in practically all suitable localities on European shores from the Mediterranean to the polar region and on the Atlantic coast of America south to the West Indies (Versluys). On the west coast of America it has been reported from San Diego, California (Torrey). It has been reported by various writers from the Antarctic, Terra del Fuego, Straits of Magellan, coast of Chile. In the Western Pacific it is reported from Japan, Philippine Islands, Australia, New Zealand, Moluccas, Aru Islands, Malay Archipelago, etc.

It is therefore world-wide in distribution, and being a shallow-water form, has probably been collected more frequently than any other species.

It is probable that the habit of growing on floating seaweed, timbers, etc., together with its profuse production of medusæ has had much to do with the success of this species in attaining a cosmopolitan distribution.

Bathymetric distribution, 1 to 35 fathoms.

OBELIA HYALINA Clarke.

Plate 18, figs. 6–7.

Obelia hyalina CLARKE, Bull. Mus. Comp. Zool., vol. 5, No. 10, 1879, p. 241.
Obelia hyalina VERSLUYS, Hydraires Calyptoblastes recueillis dans les Mer des Antilles, 1899, p. 39.
Obelia hyalina PICTET and BEDOT, Hydraires provenant des campagnes de *l'Hirondelle*, 1900, p. 8.
Obelia hyalina THORNLEY, Ceylon Pearl Oyster Report, The Hydroida, 1904, p. 113.
Obelia hyalina CONGDON, Hydroids of the Bermudas, 1907, p. 468.
Obelia hyalina BILLARD, *Travailleur* et *Talisman*, Hydroïdes, 1907, p. 170.
Obelia congdoni HARGITT, Hydroids of Woods Hole, 1909, p. 375.
? *Obelia hyalina* STECHOW, Hydroiden der Münchener Zoologischen Staatssammlung, 1912, p. 354.

Trophosome.[3]—Colony delicate, consisting of a number of stems springing from a creeping rootstock, and attaining a height of 1 cm. Stem simple, rather feebly but regularly geniculate,

[1] Description of a specimen collected at Woods Hole, Massachusetts, by the author in 1904.
[2] Medusæ of the World, vol. 2, the Hydromedusæ, 1910, p. 250.
[3] Description of specimen collected by C. M. Fraser at Beaufort, North Carolina.

with a slight shoulder at the distal end of each internode and 3 or 4 annulations above each shoulder. Pedicels alternate, borne on the "shoulders" referred to, longer than the hydrothecæ and annulated throughout. Hydrothecæ small, exceedingly delicate in structure, varying considerably in shape, being sometimes campanulate and sometimes triangular in outline, margin entire, diaphragm very low and indistinct.

Gonosome.—Gonangia borne in the axils of the pedicels, elongate obconical in shape, with a wide terminal aperture surmounting a broad, conspicuous collar. They vary greatly in size, being from twice to four times the length of the hydrothecæ. Contents, developing medusæ of the *Obelia* type.

Distribution.—The type-locality is 10 miles north of Zoblos Island. Reported from Bermudas (Congdon); Woods Hole, Massachusetts (Hargitt); Beaufort, North Carolina (Fraser). The species is also reported from Ceylon (Thornley); West Indies (Versluys); Eastern Atlantic, Gulf of Cadiz, Morocco, and Azores (Billard); and Fingal, 130 meters (Pictet and Bedot).

Bathymetric distribution, 1 to 68 fathoms.

OBELIA BRAZILIENSIS (Meyen).

Plate 18, figs. 8, 9.

Campanularia braziliensis Meyen, Über das Leuchten des Meeres, 1834, p. 198, pl. 32, fig. 5.
Obelia braziliensis Hartlaub, Die Hydroiden der magalhaensischen Region und chilenischen Küste, 1905, p. 581.

The writer has not seen this species, and presents the following description, which is taken partly from the original description of Meyen and partly from his figures:

Trophosome.—Colony small and delicate, growing from a creeping rootstock on floating sea weed. Stem not fascicled, geniculate, bearing usually alternate branchlets or pedicels and usually with 3 annulations just above the origins of branchlets or pedicels. Pedicels long, with 2 or 3 distal annulations and a group of 3 to 5 at the proximal end. Hydrothecæ regularly campanulate, usually deeper than wide and with an even margin. Hydranth with about 16 tentacles.

Gonosome.—Gonangia borne in the axils of branchlets and pedicels, elongate ovate in shape, more than twice as long as broad, and ending distally in a round aperture which is slightly elevated on a sloping neck which passes insensibly into the shoulderlike distal end of the body of the gonangium. In the specimen figured there is an annular constriction about one-third the way up the gonangial wall.

I have seen no account of the gonangial contents. Hartlaub places it in the genus *Obelia*, and it is therefore probable that medusæ have been demonstrated.

Distribution.—Found growing profusely on floating sea weed, especially on Fucus, off the Brazilian coast (Meyen).

OBELIA DUBIA Nutting.

Plate 19, fig. 1.

Obelia dubia Nutting, Hydroids of the Harriman Alaska Exped., 1901, p. 174.
Obelia dichotoma (part) Hartlaub, Die Hydroiden der magalhaensischen Region und chilenischen Küste, 1905, p. 580.
Obelia dubia (=*Obelia dichotoma* Hincks) Mayer, Medusæ of the World, vol. 2, the Hydromedusæ, 1910, p. 248.
Obelia dubia Fraser, West Coast Hydroids, 1911, p. 39.

Trophosome.[1]—Colony attaining a height of about 3–4 inches; stem sparingly branched, the main stem and larger branches sinuous or slightly geniculate, giving forth pedicels singly or in opposite pairs at the bends. Pedicels rather long and annulated throughout, the stem also more extensively annulated than in most species of the genus. Hydrothecæ large, tubular, with very shallow undulations around the margin, from between which lines run down for a short distance on the surface of the hydrothecæ.

Gonosome.—Unknown.

Distribution.—Orca, Alaska (Harriman Alaska Expedition). Puget Sound specimen from Kincaid. Hartlaub[2] may be right in considering this species as *O. dichotoma*, but the present writer prefers to retain it on the strength of the more tubular hydrothecæ and much larger pedicels of the Alaskan form.

[1] As the writer has no specimen of this species at hand, the description is copied from his original description of this form.

[2] Die Hydroiden der magalhaensischen Region und chilenischen Küste, 1905, p. 580.

OBELIA GRACILIS Calkins.

Plate 19, figs. 2–4.

Obelia gracilis Calkins, Some Hydroids from Puget Sound, 1899, p. 353.
Obelia gracilis Hartlaub, Hydroiden aus dem Stillen Ocean, 1901, p. 353.
Obelia gracilis Mayer, Medusæ of the World, vol. 2, The Hydromedusæ, 1910, p. 253.
Obelia gracilis Fraser, West Coast Hydroids, 1911, p. 39.

Trophosome.[1]—Colony erect 11 mm. in height. Stem simple. Main stem flexuose, giving off pedicels at the bends. Pedicels usually in pairs, both individuals of a pair, however, being given off from the same side of the stem, the pairs alternating in position. The two pedicels of a pair are of unequal length, one being noticeably shorter than the other; the longer being as much as twice the length of the hydrotheca, while the shorter is less than half the length of the hydrotheca. Each bears two or more annulations at its base. The hydrothecæ are large, campanulate, with sinuous margin and a well-marked diaphragm. Those with the shorter pedicels being noticeably larger than those with the longer pedicels.

Gonosome.—The gonangia are borne in the axils of the pedicels, one to each pair of the latter. They are much elongated, "club shaped," as Calkins says, with a distinct collar, the blastostyle is covered on all sides by the very numerous medusa buds. According to Calkins the medusæ have 28 marginal tentacles.

Distribution.—The type and only known locality is Scow Bay, Port Townsend Harbor, Puget Sound.

Bathymetric distribution, 1 to 10 fathoms (?).

? OBELIA PLICATA Hincks.

Plate 19, figs. 5, 6.

Obelia plicata Hincks, British Hydroid Zoophytes, 1868, p. 159.
Obelia plicata Norman, Shetland final Dredging Report, vol. 2, 1869, p. 256.
Obelia plicata Marktanner-Turneretscher, Hydroiden des k. k. naturhist. Hofmuseums, 1890, p. 208.
Obelia plicata Nutting, Hydroids from Alaska and Puget Sound, 1899, p. 741.
Obelia plicata Calkins, Some Hydroids from Puget Sound, 1899, p. 357.
Obelia plicata Nutting, Hydroids of Harriman Alaska Exped., 1901, p. 173.
Obelia plicata Hartlaub, Hydroiden aus dem Stillen Ocean, 1901, p. 351.
Obelia plicata Mayer, Medusæ of the World, vol. 2, 1901, p. 353.
Obelia plicata Fraser, West Coast Hydroids, 1911, p. 32.
Laomedia (Obelia) dichotoma (part) Broch, Hydroidenuntersuchungen, No. 3, 1912, p. 54.

Trophosome.[2]—Colony considerably broken, but attaining a height of 16.5 cm. the main stem and the longer branches are fascicled. The component tubes being not so numerous and larger than in *Obelaria gelatinosa*. The branches become simple in their distal parts and almost white in color. The nonfascicled parts of the branches are annulated just above the origin of the branchlets and pedicels, the annulations being in groups of usually 3 or 4. The pedicels are attenuate, shorter than the hydrothecæ and annulated throughout. The hydrothecæ are deeply campanulate and much like those of *O. dichotoma*. The margin is entire.

Gonosome.—Gonangia like those of *O. dichotoma* (Marktanner-Turneretscher).

Distribution.—The type-locality is Shetland (J. G. Jeffreys, according to Hincks). Great Cumbray, Scottish coast (Frauenfeld, according to Marktanner-Turneretscher); Puget Sound and Orca, Alaska (Nutting); Juneau, Alaska (Kincaid). This species is very close to *O. dichotoma*, from which it differs mainly in the fascicled stem.

Bathymetric distribution, 1 to 10 fathoms?.

[1] Description of a specimen from Puget Sound mounted on a slide, kindly loaned the author by Prof. Gary N. Calkins, the discoverer of the species.

[2] The specimen described is from Unalaska, Alaska, where it was collected from piles by Prof. Trevor Kincaid, Sept., 1897.

OBELIA CORONA Torrey.

Plate 20, figs. 1–2.

Obelia corona TORREY, Hydroids of the San Diego Region, 1904, p. 14.
Obelia corona MAYER, Medusæ of the World, vol. 2, The Hydromedusæ, 1910, p. 253.
Obelia corona FRASER, West Coast Hydroids, 1911, p. 38.

Trophosome.[1]—Colony very small, about 4 mm. in height growing from a creeping rootstock and symbiotic on a sponge. Stem short, monosiphonic, strongly flexuose or even geniculate, but without the broad shoulder-like process upon which the pedicels are seated as in *O. geniculata.* There is a group of annulations just above each pedicel origin. Sometimes pedicels are borne directly on the rootstock. Pedicels alternate, usually short, consisting of 2 or 3 strong annulations. The pedicels of terminal hydrothecæ are long, sometimes twice as long as the hydrotheca, with two or three annulations on the distal end and several on the proximal end, the median part being smooth. Hydrothecæ quite large, in proportion to size of the colony, deeply campanulate, usually about twice as long as broad and with the margin ornamented by 10 or 12 well-marked bimucronate teeth which are well separated and clearly cut. The diaphragm is well-marked and rather low.

Gonosome.—The gonangia are borne both on the stem and creeping rootstock. They are oblong-ovate in form, the distal end being the broader and the proximal end narrowing to the short annulated pedicel. There is a very short, inconspicuous collar and a very broad aperture. The gonangia are about 1½ times as long as the hydrothecæ and contain typical medusæ of the genus *Obelia.*

Distribution.—The type-locality is the only one known, San Diego Bay, California, where it is found on a sponge growing on piles under wharves.

Bathymetric distribution, 1 to 10 fathoms.

I can not agree with Mayer when he says[2] referring to this species "Probably a variety of *O. geniculata* with toothed margins to the hydrothecæ." On the contrary *O. corona* bears but little resemblance to the well-known *O. geniculata* when details are considered. It seems to the present writer to be an unusually well-defined species.

OBELIA AUSTRO-GEORGIÆ Jäderholm.

Plate 20, figs. 3–4.

Obelia austro-georgiæ JÄDERHOLM, Mitteilungen ueber einige von den Schwedischen Antarktischen Exped. 1901–03, eingesammelte Hydroiden, 1904, p. vii.
Obelia austro-georgiæ JÄDERHOLM, Hydroiden aus antarktischen und subantarktischen Meere, 1905, p. 17.

Trophosome.[3]—Colony (the basal part lacking) 8 mm. in height, stem simple, erect, and curved with an abrupt bend opposite the origin of each branch or pedicel. Branching sparse and irregular, the branches bearing the pedicels and curving abruptly above each pedicel base. Both stems and branches bear well-marked groups of annulations above the branch and pedicel origins, the number of annulations in a group being usually 5 or 6. The pedicels are quite short and look like the continuation of the branch from which they spring, this appearance being due to the abrupt curve in the branches already referred to. The pedicels are usually less than one-quarter the length of the hydrothecæ and bear 3 to 6 strong annulations. The hydrothecæ are rather large for this genus, rather slender, funnel-shaped; about twice as long as wide at the margin. The margin is ornamented with about 14 sharply cut, turreted, or rather, bimucronate teeth, between which sharply defined vertical lines run down the hydrothecal wall sometimes for about one-quarter the length of the latter. These lines give a pleated appearance to some of the hydrothecæ. The diaphragm is somewhat oblique, in side view, and

[1] Description of specimen kindly sent me by Doctor Torrey, the original describer of the species, from San Diego Bay, the type-locality.

[2] Medusæ of the World, vol. 2, 1904, p. 242.

[3] Description of a specimen (cotype) sent me by Dr. Elof Jäderholm and labeled "Obelia austro-georgiæ mihi, Sudgeorgien, Cumberland Bay, 1902, Svenska antarkt. Exped."

the basal chamber rather deep. The hydrothecæ are not so delicate and are longer than those of *Obelia bidentata* Clarke which they otherwise resemble.

Gonosome.—Unknown.

Distribution.—The type-locality is Cumberland Bay, South Georgia. No other locality is known.

Bathymetric distribution, 1 to 10 fathoms.

OBELIA BICUSPIDATA Clark.

Plate 20, figs. 5–6.

Obelia bicuspidata+*O. bidentata* Clark, On New and Rare species of Hydroids, Trans. Conn. Acad., vol. 3, 1876, p. 58.
Obelia bicuspidata+*O. bidentata* Nutting, Hydroids of the Woods Hole Region, 1901, p. 351.
Obelia bidentata Hargitt, Synopsis N. A. Invert., Amer. Nat., 1901, p. 383.
Obelia bidentata Jäderholm, Aussereuropaischen Hydroiden, 1905, p. 270.
Obelia bidentata Mayer, Medusæ of the World, vol. 2, the Hydromedusæ, 1910, p. 254.

Trophosome.[1]—Colony 2.1 cm. in height, base lacking. The stem and main branches are strongly fascicled. Branches very irregular in disposition, most of the larger ones springing from one side of what appears to be the main stem. The smaller branches and distal parts of the longer ones are monosiphonic and the branchlets are alternate and bear groups of annulations above the origin of the branchlets and pedicels. The pedicels are regularly alternate in position and vary in length from one-quarter to one-half the length of the hydrothecæ, the terminal pedicels being still longer. The hydrothecæ are large, long, almost tubular, sometimes 3 times as long as broad. The hydrothecal walls show strong longitudinal lines, as if they were pleated, particularly evident in the distal two-thirds of the hydrotheca. The margin is ornamented by a circlet of bidentate teeth 14 to 20 in number. The vertical lines pass downward from between these teeth. The diaphragm is low, leaving a small basal chamber.

Gonosome.[2]—Not heretofore described. Gonangia borne in the axils of the pedicel, very minute, about half the height of the hydrothecæ, obconic in shape with distal end broad and truncated, collar wanting. The blastostyle bears what appear to be developing medusæ of the *Obelia* type.

Distribution.—Type-locality for *O. bicuspidata* Clark, Thimble Islands, Long Island Sound; for *O. bidentata* Clark, Greenport, Long Island. The species has been reported from near Woods Hole, Massachusetts (Nutting), and from Cape Frio, Brazil (30 fathoms), by Jäderholm.

These two species *O. bicuspidata* and *O. bidentata* were described in the same paper by Clark. In the opinion of the writer they are identical and the priority should be given to the first name given by Clark, which is *Obelia bicuspidata*.

OBELIA DICHOTOMA (Linnæus).

Plate 20, fig. 7.

Sertularia dichotoma Linnæus, Systema Naturæ, ed. 10, 1758, p. 812.
Sertularia dichotoma (part) Houttuyn, Natuurlyke Historie, vol. 7, 1761–73, p. 565.
Sertularia dichotoma Linnæus, Systema Naturæ, ed. 12, 1767, p. 1312.
Sertularia dichotoma Maratti, De Plantis Zoophytes et Lithophytes, 1776, p. 34.
Sertolaria dichotoma Cavolini, Memoria per servire dell astoria di Polipi marini, 1785, p. 194.
Sertularia dichotoma (part) Wilkens and Herbst, in Pallas, Charakteristik der Thierpflanzen, 1787, p. 159.
Sertularia dichotoma Gmelin, in Linnæus, Systema Naturæ, ed. 13, 1788–1893, p. 3855.
Sertularia dichotoma Berkenhout, Synopsis of Nat. Hist. of Gt. Britain and Ireland, vol. 1, 1795, p. 218.
Sertularia dichotoma Bosc, Hist. Nat. des Vers, 1802, vol. 3, p. 99.
Sertularia dichotoma Turton, British Fauna, 1807, p. 215.
Sertularia dichotoma Jameson, Cat. animals of the Class Vermes, 1811, p. 564.
Laomedea (sertularia) dichotoma Lamouroux, Nouveau Bull. des Sci. par la Soc. philomatique, vol. 3, 1812, p. 184.

[1] Description of one of Clark's cotypes sent me by Professor Verrill and labeled "*Obelia bidentata* Clark, Greenport, Long Island, Aug. 5, 1874. Piles of Wharf."

[2] Described from a specimen collected by C. M. Fraser at Beaufort, North Carolina.

Campanularia dichotoma LAMARCK, Hist. Nat. Anim. sans Vert., 1816, vol. 3, p. 113.
Laomedea dichotoma LAMOUROUX, Histoire des Polypiers Coralligènes Flexibles, 1816, p. 207.
Sertularia dichotoma STEWART, Elements Nat. Hist. of the Animal Kingdom, 1817, vol. 2, p. 446.
Sertularia dichotoma SCHWEIGGER, Beobachtungen auf natürlichen Reisen, 1819, p. 19.
Laomedea dichotoma DESLONGCHAMPS, Hist. Naturelle des Zoophytes ou Animaux Rayonnés, 1824, p. 482.
Sertularia dichotoma BENNET and OLIVIER, Naamlyst van Wormen in Nederland aanwezig, 1826, p. 193.
Campanularia dichotoma GRANT, Edinburgh New Philos. Journ., 1826, p. 150.
Campanularia dichotoma RISSO, Hist. Naturelle, 1826, p. 309.
Laomedea dichotoma RISSO, Hist. Naturelle, 1826, p. 309.
Sertularia dichotoma HOGG, Nat. Hist. of the vicinity of Stockton on Tees, 1827, p. 33.
Campanularia dichotoma FLEMING, Hist. Brit. Anim., 1828, p. 548.
Campanularia dichotoma STARK, Elements of Nat. Hist., vol. 2, 1828, p. 441.
Campanularia dichotoma DELLE CHIAJE, Memoria sulla storia e notomia degli animalia senza vertebre, 1828–29, vol. 4, p. 126.
Laomedea dichotoma BLAINVILLE, Manuel d'actinologie, 1834, p. 449.
Laomedea dichotoma BLAINVILLE, "Zoophytes" in Dictionaire des Sciences Naturelles, 1830, p. 439.
Campanularia dichotoma CUVIER, Le Règne Animal, vol. 3, 1830, p. 300.
Campanularia dichotoma JOHNSTON, Trans. Nat. Hist. Soc. Northumb., Durham, and Newcastle-on-Tyne, vol. 2, 1832, p. 255.
Campanularia dichotoma CUVIER, Le Règne Animal, Zoophytes (Milne Edwards), 1830, pl. 66.
Campanularia dichotoma MEYEN, Über das Leuchten des Meeres, 1834, p. 193.
Campanularia dichotoma GRANT, Outlines of Comparative Anat., 1835–1841, p. 10.
Campanularia dichotoma M. EDWARDS, in Lamarck, Hist. Nat. Anim. sans Vert., ed. 2, 1836, p. 132.
Campanularia dichotoma TEMPLETON, A catalogue of species of rayed animals found in Ireland, 1836, p. 466.
Laomedea dichotoma COSTA, Catalogo di Zoofiti, 1839, p. 185.
Laomedea dichotoma COUCH, An Essay on Zooph. of Cornwall, 1841, p. 46.
Laomedea dichotoma HASSALL, Ann. Mag. Nat. Hist., vol. 6, 1841, p. 169.
Sertularia dichotoma DELLE CHIAJE, Animali senza vertebre del Regno di Napoli, 1841–1844, vol. 5, p. 143.
Laomedea dichotoma MACGILLIVRAY, Ann. Mag. Nat. Hist., vol. 19, 1842, p. 465.
Campanularia dichotoma WESTENDORF, Ann. de la Soc. Medico-chirugricale de Bruges, vol. 4, 1843, p. 21.
Laomedea dichotoma COUCH, Cornish Fauna, 1844, p. 37.
Laomedea dichotoma THOMPSON, Report on Fauna of Ireland, Invertebrata, 1844, p. 283.
Laomedea dichotoma var. A. JOHNSTON, Hist. Brit. Zooph., 1847, p. 102.
Laomedea dichotoma var. A. GRAY, List Brit. Anim., 1848, p. 83.
Laomedea dichotoma LANDSBOROUGH, List of Zooph. found in the West of Scotland, 1848, p. 233.
Laomedea dichotoma var. A. COCKS, Cont. to the fauna of Falmouth, 1849, p. 93.
Laomedea dichotoma DESOR, Proc. Boston Soc. Nat. Hist., vol. 3, 1848–1851, p. 66.
Campanularia (*Laomedea*) *dichotoma* MAITLAND, Descriptio systematica animalium Belgii Septentrionalis, 1851, p. 44.
Laomedea dichotoma LANDSBOROUGH, A popular history of Brit. Zooph., 1852, p. 158.
Campanularia dichotoma KÖLLIKER, Polypen-Quallen, Zeitsch. f. wiss. Zool., vol. 4, 1853, p. 300.
Laomedea dichotoma IRVINE, Cat. Zooph. found in Dublin Bay, 1854, p. 245.
Laomedea dichotoma GOSSE, Manual of Marine Zool., 1855, p. 24.
Laomedea dichotoma GOSSE, Tenby: a seaside holiday, 1856, p. 24.
Laomedea dichotoma THOMPSON, Nat. Hist. of Ireland, vol. 4, 1856, p. 24.
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Laomedea dichotoma ALLMAN, Edinburgh New Philos. Journ., new ser., vol. 9. 1859, p. 314.
Laomedea dichotoma ALLMAN, Notes on Hydroid Zooph., Ann. Mag. Nat Hist., ser. 3, vol. 8, 1861, p. 170.
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Laomedea dichotoma KIRCHENPAUER, Die Seetonnen der Elbmündung, 1862, p. 23.
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Laomedea dichotoma ALDER, Report on Zooph., Trans. Tyneside Nat. Field Club, vol. 6, 1864, p. 193.
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Laomedea dichotoma ALLMAN, Report on the present state of our knowledge of reproductive system of Hydroida, 1864, p. 400.
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Campanularia dichotoma Hincks, On New British Hydroida, Ann. Mag. Nat. Hist., ser. 3, vol. 17, 1865, p. 297.
Laomedea dichotoma Parfitt, Additions to Zooph. of Devonshire, Ann. Mag. Nat. Hist., ser. 3, vol. 18, 1866, p. 11.
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Laomedea dichotoma van Beneden, Recherches sur la Fauna littorale de Belgique, 1867, p. 154.
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Obelia dichotoma Hincks, British Hydroid Zoophytes, 1868, p. 156.
Laomedea dichotoma Herklots, Natuurlyke Historie van Nederland, 1870, p. 399.
Laomedea dichotoma Allman, Gymnoblastic Hydroids, 1871, p. 28.
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Campanularia dichotoma Metzger, Die wirbellosen Meeresthiere der ostfriesischen Küste, 1871, p. 35.
Obelia dichotoma Verrill, Proc. Amer. Ass. Adv. Sci., 1873, p. 364.
Obelia dichotoma Schulze, Nordsee Expedition, 1874, p. 129.
Obelia dichotoma Winther, Fortegnelse over de i Danmark Hydroider, 1879–80, p. 237.
Obelia dichotoma Marktanner-Turneretscher, Hydroiden des k. k. naturhist. Hofmuseums, 1890, p. 209.
Laomedea (Obelia) dichotoma Levinsen, Annulata, Hydroida, etc., 1893, p. 369.
Campanularia dichotoma Bonnevie, Norwegian North Sea Exped., 1898, p. 26.
Obelia dichotoma Calkins, Some Hydroids from Puget Sound, 1899, p. 356.
Obelia dichotoma Hargitt, Amer. Nat., 1901, p. 382.
Obelia dichotoma Hartlaub, Hydroiden aus dem Stillen Ocean, 1901, p. 353.
Obelia dichotoma Nutting, Hydroids of the Harriman Alaska Exped., 1901, p. 173.
Obelia dichotoma Torrey, Hydroida of the Pacific coast, 1902, p. 57.
Obelia dichotoma Billard, Cont. à l'étude des Hydroides, 1904, pp. 90, 170.
Obelia dichotoma Torrey, Hydroids of the San Diego Region, 1904, p. 15.
Obelia dichotoma Billard, Régénération de l'Obelia dichotoma, 1905, p. 1048.
Obelia dichotoma Bourne, Frith of Clyde medusæ, 1905, p. 769.
Obelia dichotoma=O. australis Hartlaub, Die Hydroiden der magalhaensischen Region und chilenischen Küste, 1905, p. 580.
Obelia dichotoma Billard, *Travailleur* et *Talisman*, Hydroïds, 1907, p. 169.
Obelia dichotoma Jäderholm, Northern and Arctic Invert., pt. 4, Hydroiden, 1909, pl. 63.
Laomedea dichotoma Broch, Die Hydroiden der arktischen Meere, 1909, p. 229.
Obelia dichotoma Mayer, Medusæ of the World, vol. 2, Hydromedusæ, 1910, p. 246.
Laomedea (Obelia) dichotoma (part) Broch, Hydroidenuntersuchungen, No. 3, 1912, p. 54.
Obelia dichotoma Fraser, West Coast Hydroids, 1911, p. 38.
Obelia dichotoma Stechow, Hydroiden der Münchener Zoologischen Staatssammlung, 1912, p. 356.

Trophosome.[1]—Colony consisting of an upright stem 3.5 cm. in height and giving off irregular lateral branches, some of which again branch in a dichotomous manner. Stem and branches sometimes straight and sometimes sinuous in outline and with a group of usually 5 to 8 symmetrical annulations above the origin of each branch or pedicel. Pedicels alternate, short, considerably shorter then the hydrothecæ and not appreciably diminishing in size from the proximal to the distal ends. There is often a single pedicel in the axil of each branch. Hydrothecæ deeply campanulate with very slightly curved sides, so that they approach a triangle in outline. Margin without teeth, but sometimes with slight indications of pleatings, which sometime produce a series of sinuosities around the margin resembling very low rounded teeth. The diaphragm is low but evident and the cœnosarcal connection between hydranth and pedicel is broad.

Gonosome.[2]—"Gonothecæ axillary, slender, smooth, widening from the base upward and terminating above in a raised, somewhat conical aperture." The medusa when liberated are "about 1 mm. wide and usually have 16 (occasionally 24) tentacles. The four gonads are adjacent to the manubrium or the 4 radial canals, but at the end of three days they are seen to have migrated outward to the middle of the 4 radial canals."[3]

[1] Description of specimen collected by the author at Plymouth, England, in 1895.

[2] Lacking in the specimen described and in all others in the possession of the writer. The description given above is taken from that of Hincks's British Hydroid Zoöphytes, 1868, p. 156.

[3] Mayer, Medusæ of the World, vol. 2, the Hydromedusæ, 1910, p. 246.

Distribution.—This species, like the last, has a very extensive distribution, having been reported by many writers from the British Isles, Scandinavia, the Arctic Sea, North Sea, coasts of France, Mediterranean and Adriatic Sea.

It is mentioned by several writers as found on our New England coast, but it is not known from the southern United States or West Indian region. In the Pacific it has been reported from Alaska to San Diego, in southern California. Hartlaub (1905, p. 580) reports this species from St. Paul Island, regarding *Obelia australis* von Lendenfeld as a synonym of *O. dichotoma*. If he is correct in this decision, the range of the species must be extended to New Zealand. The present writer, however, does not feel at all certain of the identity of *O. australis* and *O. dichotoma*.

A specimen without gonosome but apparently of this species was secured by the *Albatross* at station 3531, off San Francisco, California, at a depth of 59 fathoms, and Billard reports it from the Gulf of Cadiz at a depth of 65 fathoms.

OBELIA COMMISSURALIS McCrady.

Plate 21, figs. 1–5.

Obelia commissuralis McCrady, Gymnopthalmata of Charleston Harbor, 1859, p. 95.
Obelia commissuralis L. Agassiz, Cont. Nat. Hist. U. S., vol. 4, 1862, p. 315.
Obelia commissuralis A. Agassiz, The Acalephan fauna of the southern coast of Mass., Proc. Bost. Soc. Nat. Hist., vol. 8, 1862, p. 225.
Obelia commissuralis Allman, Construction and Limitation of Genera, Ann. Mag. Nat. Hist., ser. 3, vol. 13, 1864, p. 372.
Obelia commissuralis A. Agassiz, On the mode of development of the marginal tentacles of the free medusæ of some Hydroids, Proc. Bost. Soc. Nat. Hist., vol. 9, 1865, p. 91.
Obelia commissuralis A. Agassiz, North Amer. Acalephae, 1865, p. 86.
Obelia commissuralis Verrill, Invertebrate Animals of Vineyard Sound, 1873, p. 728.
Obelia commissuralis Brooks, Studies Biol. Lab. Johns Hopkins Univ., vol. 2, 1882, p. 176.
Obelia commissuralis Fewkes, Embryological monographs, III, Acalephæ, Mem. Mus. Comp. Zool., vol. 9, 1884, pl. 3, figs. 1–5.
Obelia commissuralis Hargitt, Synopsis N. A. Invert., Amer. Nat., 1901, p. 382.
Obelia commissuralis Nutting, Hydroids of the Woods Hole Region, 1901, p. 382.
Obelia commissuralis Torrey, Hydroida of the Pacific Coast, 1902, p. 56.
Obelia commissuralis Hargitt, Medusæ of the Woods Hole Region, 1905, p. 48.
Obelia commissuralis Mayer, Medusæ of the World, vol. 2, Hydromedusæ, 1910, p. 244.
Obelia commissuralis Fraser, West Coast Hydroids, 1911, p. 38.

Trophosome.[1]—Colony 9.5 cm. high, consisting of a simple slender stem, from which numerous compound branches are given off on all sides, forming a beautiful, profusely branched colony. The main branches are branched, often dichotomously, several times and bear groups of annulations above each branch or pedicel origin. The pedicels are alternate and, as described by Mayer, "arise simply, not from distinct swollen, shoulder-like enlargements of the stem." They are often but not always shorter than the hydrothecæ and are usually annulated throughout, but sometimes have a median bare portion. The hydrothecæ are deeply campanulate, with an even rim and well-marked diaphragm. The polyps in this specimen are beautifully expanded and show 24–30 tentacles and a pyriform proboscis.

Gonosome.—The gonangia are borne in or near the axils of branches and pedicels. They are oblong-ovate in shape, with a distinct distal shoulder and narrow collar surrounding the disk-shaped operculum. They are borne on short annulated pedicels and contain developing medusæ. "When set free the young medusa usually has 16 tentacles and no trace of gonads" (Mayer).

Distribution.—Type-locality, Charleston Harbor. The species is common on the Atlantic coast of United States north of this point. It has also been reported by Torrey from San Francisco, California. This species is carefully described and figured by L. Agassiz.[2]

Bathymetric distribution, 1 to 10 fathoms (?).

[1] Description of a colony collected by Mr. George Gray, at Woods Hole, Massachusetts.
[2] Cont. Nat. Hist. U. S., vol. 4, p. 315, pls. 33, 34.

OBELIA SURCULARIS Calkins.

Plate 22, figs. 1–2.

Obelia surcularis Calkins, Some Hydroids from Puget Sound, 1899, p. 355.
Obelia surcularis Hartlaub, Hydroiden aus dem Stillen Ocean, 1901, p. 353.
Obelia surcularis Mayer, Medusæ of the World, vol. 2, The Hydromedusæ, 1910, p. 353.
Obelia surcularis Fraser, West Coast Hydroids, 1911, p. 40.

Trophosome.[1]—Colony 17 mm. in height, consisting of a single regularly branched stem. Main stem slender, flexuose, regularly branched with two or three rather feebly defined annulations above each branch origin. Branches regularly alternate and often ending in greatly elongated tendril-like filaments which are clavate at the ends.[2] The branches resemble the main stem in structure and bear alternate pedicels. The pedicels are short usually less than half the length of the hydrothecæ, are very thin and hyaline and show irregular faint corrugations or annulations. They taper regularly in size from proximal to distal end. Hydrothecæ in the form of inverted cones with slightly bulging sides. The margin is entire and the diaphragm is very low and there is no distinct basal chamber. Hydranths of the usual campanularian type with about 24 tentacles.

Gonosome.—Gonangia borne on the branches in the axils of pedicels or branches. They are slender, with their diameters increasing to the distal end where it is about one-third of the total height. There is often a well-defined rim around the shoulder of the gonangium, above which is a short sloping collar surrounding the terminal aperture. The gonangia are filled with numerous medusa buds which surround the blastostyle. Calkins says the mature medusæ have 24 tentacles.

Distribution.—The type and only known locality is Scow Bay, Port Townsend Harbor, Washington.

Bathymetric distribution, 1 to 10 fathoms (?).

OBELIA FLABELLATA (Hincks).

Plate 22, figs. 3–4.

Campanularia flabellata Hincks, On new British Hydroida, Ann. Mag. Nat. Hist., ser. 3, 1866, vol. 18, p. 297.
Obelia flabellata Hincks, British Hydroid Zoöphytes, 1868, p. 157.
Obelia flabellata Verrill, Invertebrate Animals of Vineyard Sound, 1873, p. 728.
Obelia flabellata Winther, Fortegnelse over de i Danmark Hydroider, 1874–80, p. 237.
Obelia flabellata Merejkowsky, New Hydroida from Ochotsk, etc., Ann. Mag. Nat. Hist., ser. 5, vol. 1, 1878, p. 323.
Laomedea (Obelia) flabellata Levinsen, Meduser, Ctenophorer og Hydroider fra Grönlands Vestkyst, 1893, p. 27.
Obelia flabellata Hartlaub, Die Hydromedusæ Helgolands, 1897, p. 451.
Obelia flabellata Hargitt, Synopsis N. A. Invert., Hydromedusæ, No. 2, Amer. Nat., vol. 35, 1901, p. 382.
Obelia flabellata Nutting, Hydroids of the Woods Hole Region, 1901, p. 350.
Obelia flabellata Jäderholm, Northern and Arctic Invertebrates, pt. 4, Hydroiden, 1909, p. 62.
Laomedea longissima (part) Broch, Die Hydroiden der arktischen Meere, 1909, p. 229.
Obelia plana Mayer, Medusæ of the World, vol. 2, The Hydromedusæ, 1910, p. 249.
Obelia flabellata Stechow, Hydroiden der Münchener Zoologischen Staatssammlung, 1912, p. 356.

Trophosome.[3]—Colony 4.2 cm. in height, main stem flexuose, monosiphonic, dark brown in color, lightening distally and with a series of 3 or 4 annulations above each branch or pedicel origin. Branches alternate, themselves branching dichotomously until each branch with its ramifications presents a flabellate form. Pedicels alternate, very short, usually much shorter than the hydrothecæ and annulated throughout. Hydrothecæ campanulate, short, subtriangular in outline and with an entirely even rim. The hydrothecal walls are thick and the outlines firm and pronounced.

[1] Description of a specimen from Dr. Gary N. Calkins, the original describer, labeled "Puget Sound."

[2] This structure greatly resembles that described by the author in his discussion of "Stoloniferous reproduction." American Hydroids, part 1, The Plumularidæ, 1900, p. 43. It is not unlikely that the condition found in *Obelia surcularis* is a temporary one, and not a specific character.

[3] Description of specimen collected by the "Albatross" from station 2765, lat. 36° 43′ S.; long. 56° 23′ W., 10.5 fathoms, east coast South America.

Gonosome.[1]—"Gonothecæ axillary, ovate, somewhat flattened at the top, with a short tubular orifice, attached by a ringed stalk." Medusæ with 24 tentacles at liberation. The gonads are near the bases of the gastric pouches, as viewed from above.[2] There are 8 lithocysts.

Distribution.—Common in shallow water on British and Norwegian coasts. Also reported from Denmark (Winther); Ochotsk (Hartlaub); Greenland (Levinsen); Helgoland (Hartlaub); New England coast, North America (Verrill, Nutting); and from the east coast of South America (Nutting).

Bathymetric distribution, 1 to 25 fathoms.

OBELIA BOREALIS Nutting.

Plate 22, figs. 5–7.

Obelia borealis Nutting, Hydroids of the Harriman Alaska Exped., 1901, p. 174.
Obelia borealis Mayer, Medusæ of the World, vol. 2, the Hydromedusæ, 1910, p. 249.
Obelia borealis Fraser, West Coast Hydroids, 1911, p. 38.

Trophosome.[3]—Colony 23 cm. high. A short distance above its base it divides into two subequal branches which are practically main stems. Main stems simple, although in places branchlets may be intertwined with them. The branches are usually comparatively short and irregularly arranged, opposite sometimes, but usually alternate, and sometimes tending to a verticellate arrangement. The branches are themselves divided into branchlets which often give off pedicels in pairs or alternately, but usually in an irregular manner. The branches with their ramifications tend to assume a flabellate form, and, as is usual in this genus, there are groups of annulations above each branch and pedicel origin. The pedicels are usually short and annulated throughout, but when terminal are much longer than the hydrothecæ and only the ends are annulated. Hydrothecæ large, in the shape of elongated cones, the walls being but slightly curved in profile. The margin is entire and the diaphragm well marked.

Gonosome.[4]—Gonangia borne in the axils of the branches and branchlets; oblong ovate, truncated above, having a collar in mature specimens; aperture apparently very large, pedicels strongly annulated. The gonangia of the specimens examined were filled with developing medusæ of the regular *Obelia* type.

Distribution.—Type-locality, Yakutat, Alaska. Also found at Bering Island and Sitka, Alaska (specimens from United States National Museum), Puget Sound (specimen from Prof. Trevor Kincaid). A fine specimen was collected by the U. S. R. S. *Corwin*, lat. 70° 15′ 10″ N.; long. 162° 55′ W.

Bathymetric distribution, 1 to 10 fathoms.

OBELIA LONGISSIMA (Pallas).

Plate 23, figs. 1–3.

Sertularia longissima Pallas, Elenchus Zoophytorum, 1766, p. 119.
Sertularia longissima Boddaert, in Pallas, Lyst der Plant-Dieren, 1768, p. 149.
Sertularia longissima Gronovius, Zoophylacium gronovianum, vol. 3, 1781, p. 357.
Sertularia longissima Oken, Lehrbuch der Naturgeschichte, vol. 3, 1815, p. 92.
Sertularia longissima Ehrenberg, Abh. Akad. Wissens. Berlin, 1832, 1834, p. 297.
Campanularia gelatinosa van Beneden, Mémoire sur les campanulaires de le Côte d'Ostend, 1844, p. 33.
Laomedea dichotoma var B. Johnston, Hist. Brit. Zooph., 1847, p. 102.
Laomedea dichotoma var B. Gray, List Brit. Anim., 1848, p. 83.
Laomedea dichotoma var B. Cocks, Contributions to the Fauna of Falmouth, 1849, p. 93.
Campanularia gelatinosa Krohn, Ueber Podocoryne carnea Sars, etc., 1851, p. 267.
Campanularia gelatinosa Gegenbauer, Zur Lehre von Generationwechsel und der Fortpflanzung bei Medusen und Polypen, 1854, p. 163.

[1] Not present in the specimen described. The description given above is quoted from Hincks, British Hydroid Zoöphytes, 1868, p. 157.

[2] Description of specimens kindly sent me by Doctor Hargitt, presumably from Woods Hole, Massachusetts.

[3] Description of a specimen from Bering Island.

[4] Description copied from the original description of the species.

Laomedea dichotoma B. Alder, A notice of some new genera and species of Brit. Hydroid Zooph., Ann. Mag. Nat. Hist., ser. 2, vol. 18, 1856, p. 360.
Laomedea dichotoma Alder, Description of 3 new Brit. Zooph., Ann. Mag. Nat. Hist., ser. 2, vol. 18, 1856, p. 440.
Laomedea longissima Alder, Cat. Zooph. Northumb. and Durham, 1857, p. 31.
Laomedea longissima Hincks, Cat. Zooph. South Devon, etc., Ann. Mag. Nat. Hist., ser. 3, vol. 8, 1861, p. 154.
Laomedea gelatinosa var *ramulosa* Kirchenpauer, Die Seetonen du Elbmündung, 1862, p. 18.
Laomedea longissima Kirchenpauer, Die Seetonen du Elbmündung, 1862, p. 23.
Laomedea longissima Alder, Report on Zooph., Trans. Tyneside Naturalist Field Club, vol. 5, 1863, p. 290.
Laomedea longissima Alder, Suppl. to Cat. Zooph., Trans. Tyneside Naturalists Field Club, vol. 5, 1863, p. 237.
Laomedea dichotoma Allman, Report 33rd Meeting Brit. Ass. Adv. Sci., 1864, p. 412..
Sertularia longissima Allman, Notes on Hydroida, Ann. Mag. Nat. Hist., ser. 3, vol. 14, 1864, p. 62.
Laomedea gelatinosa A. Agassiz, North Amer. Acalephæ, 1865, p. 82.
Laomedea longissima Parfitt, Additions to the Zooph. of Devonshire, Ann. Mag. Nat. Hist., ser. 3, vol. 18, 1866, p. 11.
Laomedea longissima Alder, Report on Zooph., Nat. Hist. Trans. Northumb. and Durham, vol. 1, 1867, p. 49.
Laomedea longissima Alder, Report on Zooph., Trans. Tyneside Naturalists Field Club, vol. 6, 1867, p. 193.
Campanularia gelatinosa van Beneden, Recherches sur la Fauna littorale de Belgique, 1867, p. 148.
Obelia longissima Hincks, British Hydroid Zoophytes, 1868, p. 154.
Obelia longissima Norman, Shetland final Dredging Report, vol. 2, 1869, p. 322.
Laomedea gelatinosa Herklots, Natuurlyke Historie van Nederland, 1870, p. 400.
Obelia longissima Allman, Gymnoblastic Hydroids, 1871, p. 169.
Obelia longissima Verrill, Invertebrate Animals of Vineyard Sound, 1873, p. 728.
Obelia longissima Verrill, Amer. Jour. Sci., vol. 7, 1874, p. 44.
Obelia longissima McIntosh, Ann. Mag. Nat. Hist., ser. 4, vol. 13, 1874, p. 207.
Obelia longissima Clark, Alaskan Hydroids, 1876, p. 212.
Obelia longissima Verrill, Check list of Marine Invert., 1879, p. 16.
Obelia polystyla Haeckel, Lyst du Medusen, 1879, p. 117.
Obelia longissima Crawford, Ann. Mag. Nat. Hist., ser. 6, vol. 16, 1895, p. 260.
Obelia longissima Nutting, Hydroids of the Woods Hole Region, 1901, p. 351.
Obelia longissima Hargitt, Synopsis N. A. Invert., 1901, p. 383.
Laomedea longissima Saemundsson, Bidrag til Kundskaben om de islandske Hydroider, 1902, p. 58.
Laomedea longissima Billard, Cont. à l'étude des Hydroides, 1904, p. 23.
Laomedea longissima Hartlaub, Hydroids of Magellan Straits, 1905, p. 582.
Laomedea longissima Billard, Expéd. Antarctique Française, 1906, p. 11.
Laomedea longissima Ritchie, Hydroids of Scottish Nat. Antarctic Exped., 1907, p. 528.
Laomedea (Obelia) longissima Levinsen, Medusen, Ctenophorer og Hydroider fra Grönlands Vestkyst, 1893, p. 27.
Obelia longissima Jäderholm, Northern and Arctic Invert., pt. 4, Hydroiden, 1909, p. 63.
Laomedea longissima Broch, Hydroiden der arktischen Meere, 1909, p. 229.
Obelia longissima Mayer, Medusæ of the World, vol. 2, 1910, p. 225.

Trophosome.[1]—Colony 13.2 cm. in height and consisting of a central undulating stem very dark brown proximally and lightening distally. Branches alternate and themselves often branching and resembling the main stem in detail. There are usually 3 to 5 annulations above the origin of each branch, branchlet, and pedicel. Pedicels varying considerably in length and sometimes longer than the hydrothecæ, annulated throughout. Hydrothecæ deeply campanulate, with regularly but slightly curved outlines and the margins armed with very low teeth which are not always evident.

Gonosome.—The gonangia are borne in the axils of the branches, branchlets, and pedicels, shaped like a slender urn or Pompeian water jar, broadening from the base to the shoulder, where the sides contract to form a short curved neck ending in a small aperture. The gonangial contents are developing medusæ, usually a dozen or more appearing in the same gonangium. The medusæ have 20 to 24 tentacles when liberated and according to Mayer (1910) can not be distinguished, when mature, from other medusæ of this genus.

Distribution.—This species is common on both sides of the North Atlantic where it extends northward to Iceland (Saemundsson) and Greenland (Levinsen), Arctic Ocean (Jäderholm); and southward to the coast of France (Billard). It has been reported from the New England coast by Verrill and Nutting and from the Pacific coast of Alaska by Clark. Hartlaub reports it from Chile and the Straits of Magellan, Ritchie from Gough Island and the South Orkneys and Billard from the Antarctic.

Bathymetric distribution, 1 to 80 fathoms.

[1] Description of a specimen from Plymouth, England.

OBELIA GRIFFINI Calkins.

Plate 23, figs. 4–5.

Obelia griffini Calkins, Some Hydroids from Puget Sound, 1899, p. 357.
Obelia griffini Hartlaub, Hydroiden aus dem Stillen Ocean, 1901, p. 353.
Obelia griffini Mayer, Medusæ of the World, vol. 2, the Hydromedusæ, 1910, p. 252.
Obelia griffini Fraser, West Coast Hydroids, 1911, p. 39.

Trophosome.[1]—Colony 21 mm. in height, consisting of a branched main stem with its ramifications. Main stem irregularly flexuose and with usually 3 or 4 strong annulations above each branch origin. Branches like the stem and alternate in position. The branches bear alternate pedicels which are usually annulated throughout their length and are almost always shorter than the hydrothecæ. Some of the pedicels which appear to be incipient branches are much longer, sometimes more than twice as long as the hydrotheca. Hydrothecæ smaller than the preceding. The hydrothecæ are deeply campanulate with almost parallel sides and an even margin, sometimes almost triangular in lateral view. Diaphragm well defined, leaving a rather deep basal chamber.

Gonosome.—The gonangia are borne in the axils of the pedicels and are elongate-ovate in shape and about three times as long as the hydrothecæ. They have a well-defined shoulder at the distal end, and a distinct collar surrounding the aperture. The developing medusæ are not so numerous as in *O. gracilis* and according to Calkins have about 24 tentacles at birth.

Distribution.—The type and only known locality is Puget Sound. The exact locality is not given by Calkins nor is it stated on the label of the specimen described.

OBELIA FRAGILIS Calkins.

Plate 23, fig. 6.

Obelia fragilis Calkins, Some Hydroids from Puget Sound, 1899, p. 355.
Obelia fragilis Mayer, Medusæ of the World, The Hydromedusæ, vol. 2, 1910, p. 252.
Obelia fragilis Fraser, West Coast Hydroids, 1911, p. 39.

Trophosome.[2]—Stems growing from a creeping rootstock parasitic on *Aglaophenia struthionides*. Stem fascicled. As mounted, the length is 16 mm. Manner of branching difficult to ascertain in specimen which is much distorted, but it appears to be alternate, 3 to 5 rings on the stem above each branch origin. Branches long and slender with a pedicel in the axil of each. Pedicels, save the axillary ones, distant and alternate, very short, giving the hydrothecæ the appearance of being sessile, and annulated and exceedingly slender and delicate. Hydrothecæ deeply campanulate, with very thin walls, margin not easily made out but apparently even, or irregularly sinuous. The diaphragm is well defined and the basal chamber continuous with the stem cavity.

Gonosome.—Not known.

Distribution.—The type-locality is Port Townsend Harbor, Puget Sound. No other locality has been recorded.

Genus OBELARIA Hartlaub.

Obelaria Hartlaub, Die Hydromedusen Helgolands, 1897, p. 489.

The following is a translation of the original definition of this genus:

> Stem branched in a treelike manner, compound, springing from a felted spongy rootstock. Hydrothecæ campanulate, without operculum. Hydranth with a protruding contractile proboscis. Gonangia borne on the stem and twigs, containing sporosacs. The development of the egg takes place outside of the gonangium.

This genus differs from *Obelia* in the fact that it does not produce medusæ, and from *Campanularia* in the fact that the planula is developed outside, instead of within, the gonangium.

[1] Description of a colony mounted on a slide and kindly loaned the writer by Dr. Gary N. Calkins, the original describer of this species.

[2] Description of type specimen, kindly loaned the author by Doctor Calkins.

OBELARIA GELATINOSA (Pallas).

Plate 24, figs. 1–5.

Sertularia gelatinosa Houttuyn, Natuurlyke Historie, 1761–73, vol. 17, p. 564.
Sertularia gelatinosa Pallas, Elenchus Zoophytorum, 1766, p. 116.
Sertularia gelatinosa Boddaert, Lyst der Plant Dieren, 1768, p. 145.
Sertularia gelatinosa Wilkens and Herbst, in Pallas, Charakteristik der Thierpflanzen, 1787, p. 156.
Sertularia gelatinosa Gmelin, in Linnæus, Systema Naturæ, ed. 13, 1788–93, p. 3851.
Sertularia gelatinosa Bosc, Hist. Nat. des Vers., 1802, vol. 3, p. 96.
Halicium (*Sertularia*) *gelatinosa* Oken, Lehrbuch der Naturgeschichte, vol. 3, 1815, p. 92.
Laomedea gelatinosa Lamouroux, Hist. des Polypiers Coralligènes Flexibles, 1816, p. 208.
Sertularia gelatinosa Stewart, Elements Nat. Hist. of the Anim. Kingdom, 1817, vol. 2, p. 444.
Sertularia gelatinosa Fleming, Observations on the Nat. Hist. of S. gelatinosa, Edinburgh Philos. Journ., vol. 2, 1821, p. 84.
Sertularia gelatinosa Fleming, The philosophy of Zoology, 1822, vol. 2, p. 616.
Laomedea gelatinosa Deslongchamps, in Lamouroux, Introd. a l'Histoire des Zoophytes et Animaux Rayonnés, 1824, p. 482.
Campanularia gelatinosa Fleming, Hist. Brit. Anim., 1828, p. 549.
Laomedea gelatinosa de Blainville, Article "Zoophytes" in Dictionnaire des Sciences Naturelles, vol. 60, 1830, p. 439.
Campanularia gelatinosa Johnston, Trans. Nat. Hist. Soc. Northumb., Durham, and Newcastle-on-Tyne, vol. 2, pt. 1, 1832, p. 254.
Campanularia gelatinosa Johnston, Illustrations in Brit. Zooph., Mag. Nat. Hist., vol. 5, 1832, p. 631.
Laomedea gelatinosa de Blainville, Manuel d'Actinologie, 1834, p. 475.
Campanularia gelatinosa Milne Edwards, in Lamarck, Hist. Nat. Anim. sans Vertèbres, ed. 2, vol. 2, 1836, p. 134.
Laomedea gelatinosa Johnston, Hist. Brit. Zooph., 1838, p. 152.
Laomedea gelatinosa Thompson, Additions to the Fauna of Ireland, Ann. Mag. Nat. Hist., vol. 5, 1840, p. 251.
Laomedea gelatinosa Couch, An Essay on the Zooph. of Cornwall, 1841, p. 47.
Laomedea gelatinosa Gould, Report on Invert. of Mass., 1841, p. 350.
Laomedea gelatinosa Hassall, Ann. Mag. Nat. Hist., vol. 6, 1841, p. 169.
Laomedea gelatinosa Gray, List of Brit. Anim., 1841, p. 85.
Laomedea gelatinosa Hassall, Ann. Mag. Nat. Hist., vol. 7, 1841, p. 281.
Laomedea gelatinosa Hassall, Ann. Mag. Nat. Hist., vol. 8, 1842, p. 342.
Laomedea gelatinosa Macgillivray, Ann. Mag. Nat. Hist., vol. 9, 1842, p. 165.
Campanularia gelatinosa Krohn, Arch. Anat. Physiol. und Wiss. Medizin, 1843, p. 177.
Laomedea gelatinosa Couch, Cornish Fauna, pt. 3, 1844, p. 39.
Laomedea gelatinosa Thompson, Report on Fauna of Ireland, 1844, p. 283.
Laomedea gelatinosa var. *β*. Johnston, Hist. Brit. Zooph., 1847, p. 104.
Campanularia gelatinosa Leuckart, Verzeichniss der zur Fauna Helgolands gehörenden wirbellosen Seethiere, 1847, p. 138.
Laomedea gelatinosa var *β*. Gray, List Brit. Anim., pt. 1, 1847, p. 85.
Laomedea flemingi Gray, List Brit. Anim., pt. 1, 1848, p. 85.
Laomedea gelatinosa Landsborough, List of Zooph. in Proc. Philos. Soc., Glasgow, vol. 2, 1848, p. 233.
Campanularia gelatinosa Desor, Ann. des Sci. Nat., vol. 3, 1849, p. 207.
Campanularia (*Laomedea*) *gelatinosa* Maitland, Descripiio Systematica Animalium Belgii, etc., 1851, p. 45.
Laomedea gelatinosa Sars, Beretning om en i Sommeren 1849 foretagen Zoologisk Reise i Lofoten og Finmarken, Nyt Mag. for Naturvidenskaberne, vol. 6, 1851, p. 130.
Laomedea gelatinosa Hincks, Notes on Reproduction of Campanularidæ, Ann. Mag. Nat. Hist., ser. 2, vol. 10, 1852, p. 55.
Laomedea gelatinosa Landsborough, A popular history of Brit. Zooph., 1852, p. 161.
Laomedea gelatinosa Gosse, Naturalist's Rambles on Devonshire Coast, 1853, p. 434.
Laomedea gelatinosa Sars, Bemærkninger over det Adriatiske Fauna, Nyt Mag. for Naturvidenskaberne, vol. 7, 1853, p. 379.
Laomedea gelatinosa Irvine, Cat. Zooph. in Dublin Bay, Nat. Hist. Review, vol. 1, 1854, p. 245.
Laomedea gelatinosa Stimpson, Synopsis Marine Invert. Grand Manan, Smiths. Cont. Knowl., vol. 6, 1854, p. 8.
Laomedea gelatinosa Gosse, Manual of Marine Zoology, 1855, p. 24.
Laomedea gelatinosa Templar, Some remarks on the Marine Fauna of the South of Devon, The Zoologist, vol. 13, 1855, p. 4576.
Laomedea gelatinosa var. *β*. Alder, Descriptions of three new Brit. Zooph., Ann. Mag. Nat. Hist., ser. 2, vol. 18, 1856, p. 440.
Campanularia gelatinosa Huxley, Medical Times Gazette, vol. 33, 1856, p. 564.
Laomedea gelatinosa Thompson, Nat. Hist. of Ireland, vol. 4, 1856, p. 458.
Laomedea gelatinosa Greene, On the Acalephæ of the Dublin Coast, Nat. Hist. Review, vol. 4, 1857, p. 249.

Laomedea gelatinosa SARS, Bidrag til kundskaben om middlehavets Littoral Fauna, Nyt Magazin for Naturvidenskaberne, vol. 3, 1857, p. 159.
Laomedea gelatinosa ALDER, Cat. Zooph. Northumb. and Durham, 1858, p. 33.
Laomedea gelatinosa HINCKS, Cat. Zooph. South Devon and South Cornwall, Ann. Mag. Nat. Hist., ser. 3, vol. 8, 1861, p. 155.
Laomedea gelatinosa KIRCHENPAUER, Die Seetonnen der Elbmündung, 1862, p. 6.
Laomedea flemingii, KIRCHENPAUER, Die Seetonnen der Elbmündung, 1862, p. 22.
Laomedea gelatinosa PACKARD, List of Animals dredged near Caribou Island, Southern Labrador, Can. Nat. and Geologist, vol. 8, 1863, p. 4.
Sertularia gelatinosa ALLMAN, Notes on the Hydroida, Ann. Mag. Nat. Hist., ser. 3, vol. 14, 1864, p. 62.
Laomedea pacifica A. AGASSIZ, North Amer. Acalaphæ, 1865, p. 94.
Laomedea gigantea A. AGASSIZ, North Amer. Acalephæ, 1865, p. 94
Laomedea gelatinosa MCINTOSH, Observations on the Marine Zoology of Northwest Outer Hebrides, Proc. Roy. Soc., Edinb., vol. 5, 1866, p. 602.
Laomedea gelatinosa HELLER, Zoophyten und Echinodermen, 1868, p. 45.
Obelia gelatinosa HINCKS, British Hydroid Zooph., 1868, p. 151.
Campanularia gelatinosa DONITZ, Sitzber. d. Ges. Naturforsch., 1869, p. 11.
Obelia gelatinosa NORMAN, Shetland final Dredging Report, II, Rept. 38th Meeting Brit. Ass. Adv. Sci., 1869, p. 322.
Campanularia gelatinosa METZGER, Die wirbellosen Meeresthiere der ostfriesischen Küste, 1871, p. 35.
Obelia gelatinosa VERRILL, Invertebrate Animals of Vineyard Sound, 1873, p. 728.
Obelia gelatinosa SCHULZE, Nordsee Exped., 1874, p. 129.
Obelia gelatinosa BERGH, Gopelpolyper fra Kara-Havet, 1877, p. 333.
Obelia gelatinosa WINTHER, Fortegnelse over de i Danmark Hydroiden, 1879–80, p. 236.
Obelia gelatinosa FEWKES, Guide to Collector, Bull. Essex, Inst., vol. 23, 1891, p. 23.
Laomedea (*Obelia*) *gelatinosa* LEVINSEN, Annulata, Hydroidæ, Anthozoa, Porifera, Videnskab. Udb. Hauchtogter, 1893, p. 369.
Obelia castellata CLARK, Bull. Mus. Comp. Zool., vol. 25, 1894, p. 73.
Obelia gelatinosa CALKINS, Some Hydroids from Puget Sound, 1896, p. 357.
Obelaria gelatinosa HARTLAUB, Die Hydromedusen Helgolands, 1897, p. 488.
Campanularia gelatinosa BONNEVIE, Hydroids of the Norwegian North Atlantic Exped., 1899, p. 71.
Obelaria gelatinosa HARTLAUB, Hydroiden aus dem Stillen Ocean, 1901, p. 353.
Obelia gelatinosa HARGITT, Synopsis N. A. Invert., Hydromedusæ, pt. 2, Amer. Nat., vol. 35, 1901, p. 383.
Obelia gelatinosa NUTTING, Hydroids of the Woods Hole Region, 1901, p. 351.
Obelia gelatinosa WHITEAVES, A catalogue of the Marine Invertebrata of Eastern Canada, 1901, p. 23.
Obelia gelatinosa JÄDERHOLM, Aussereuropaische Hydroiden, 1905, p. 271.
Campanularia gelatinosa JÄDERHOLM, Northern and Arctic Invert., pt. 4, Hydroiden, 1909, p. 70.
Laomedea gelatinosa BROCH, Die Hydroiden der arktischen Meere, 1909, p. 226.
Obelia gelatinosa MAYER, Medusæ of the World, vol. 2, The Hydromedusæ, 1910, p. 244.
Obelia gelatinosa FRASER, West Coast Hydroids, 1911, p. 39.
Obelaria gelatinosa STECHOW, Hydroiden der Münchener Zoologischen Staatssammlung, 1912, p. 356.

Trophosome.[1]—Colony 14.5 cm. in height, consisting of a central stem from which branches are given off on four sides and nearly at right angles with the stem. The branches are usually in pairs, each pair being at right angles with the one above and below. The stem and larger branches are polysiphonic, composed of an aggregation of slender tubes, some of which have a hydrotheca at one end and a partially free lobulated termination at the other, as if they were glued on to the stem or branch. The main branches ramify profusely so that the ultimate branches form rather close clumps. The terminal twigs are filiform, often geniculate and bear alternate pedicels above each of which is a group of annulations. The pedicels are short, usually considerably shorter than the hydrothecæ, annulated throughout and decreasing in diameter from the proximal to the distal end. The hydrothecæ are small and delicate, campanulate and their margins bear about 8 to 10 turreted teeth, each of which is either square on top or with two distal denticles. The diaphragm is evident and of the usual campanularian type.

Gonosome.—The gonangia are borne in the axils of the branches and pedicels, are oblong-ovate in form, averaging about three times as long as broad, and have usually a narrow collar and a comparatively large aperture. They contain developing ova or spermaries and *not* developing medusæ.

[1] Description of a specimen from the Marine Biological laboratory at Plymouth, England.

Distribution.—This is a very abundant species in shallow water on British and European coasts as well as on the Atlantic Coast of the United States from Labrador to the Carolinas. It has been reported from the Mediterranean (Heller) and the coasts of France (Beltencourt, according to Broch). Numerous authorities report it from northern waters, e. g., Norway, (Bonnevie); Iceland (Saemundsson); Shetland Islands (Norman); Arctic Sea (Bergh).

American records are also numerous, it being reported on the Atlantic coast from Labrador (Packard); New England (Verrill, Fewkes, etc.). The records from the Pacific coast are widely scattered, e. g., Puget Sound (Calkins); California (Jäderholm); Patagonia (Jäderholm); Central American coast, Pacific (Clarke).

This species has been very carefully studied and figured by Hartlaub (Hydromedusen Helgolands, 1897) who considered its gonosome so different from that of other Campanularidæ that he instituted for it the genus *Obelaria*. He claimed that the species does not produce medusæ; but this view does not seem to be corroborated by other writers, although it is confirmed by the specimens before me.

It seems evident that the species figured and described as *C. gelatinosa* by van Beneden is the same as that described as *Obelia longissima* by Hincks.

Bathymetric distribution, 1 to 30 fathoms.

Genus SILICULARIA Mayen (part).

Silicularia MAYEN, Über das Leuchten des Meeres, 1834, p. 204.
Hypanthea ALLMAN, *Challenger* Reports, Hydroida, pt. 2, 1888, p. 25.

Trophosome.—Hydrothecal walls greatly thickened, leaving a cavity too small to admit of complete retraction of the hydranth. Hydrothecæ often bilaterally symmetrical owing to an oblique margin.

Gonosome.—Gonangia (male) very long and slender. Female gonangia contain fixed sporosacs which produce planulæ.

The above definition is practically that of Allman as given for his genus *Hypanthea*, founded on *Challenger* specimens. The generic name *Silicularia* was applied, however, in 1834 to a species clearly coming within the genus defined as *Hypanthea* by Allman.

Hartlaub, in his "Die Hydroiden der magalhaensischen Region und chilenischen Küste" (1905, pp. 371, 372), gives a very interesting discussion of this genus, throwing some doubt on its validity as defined by Allman, but nevertheless accepting it in his work. The present writer has not sufficient material of this genus to undertake an independent investigation and contents himself with the above definition.

This genus is found only in the Southern Hemisphere, and most of the species are in the subantarctic region.

KEY TO THE AMERICAN SPECIES OF SILICULARIA.

Hydrothecæ regularly campanulate ..... *pedunculata.*
Hydrothecæ with oblique margins.
  Creeping stolons parallel, contiguous ..... *rosea.*
  Stolons not closely contiguous and parallel, forming an open irregular mesh ..... *reticulata.*
    Lumen of hydrothecæ nearly hemispherical ..... *hemispherica.*
    Lumen of hydrothecæ not hemispherical.
      Male gonangia longer than the female ..... *repens.*
      Male gonangia shorter than the female ..... *atlantica.*

SILICULARIA PEDUNCULATA (Jäderholm).

Plate 24, figs. 6–8.

Campanularia pedunculata JÄDERHOLM, Archives de Zoologie expérimentale et générale, 4e serie, vol. 3, 1904, p. vi.
Silicularia divergens HARTLAUB, Die Hydroiden der magalhaensischen Region und chilenischen Küste, 1905, p. 578.
Silicularia pedunculata JÄDERHOLM, Hydroiden aus antarktischen and subantarktischen Meeren, 1905, p. 18.

Trophosome.[1]—The rootstock is not present in the specimen described, but according to Hartlaub the stolon is broader and thinner-walled than the pedicel walls. Pedicels long, slender,

[1] Description of a specimen mounted on a slide and kindly loaned me by the describer of the species, Dr. C. Hartlaub.

with a globular annulation just below the hydrotheca and several other annulations below this. There are also a number of irregular annulations at the proximal end, leaving a considerable portion of the pedicel bare. Hydrothecæ regularly campanulate, not bilaterally symmetrical as in other *Silicularieæ*, margin smooth, calicular walls extensively thickened, especially on lower parts, much as in *Eucopella caliculata*.

Gonosome.—Gonangia (female) long, slender, gradually increasing in size to the truncated distal end. According to Hartlaub, these are immature forms, the older ones being longer and tapering at each end. The gonangia are borne on distinct pedicels of considerable length which are irregularly annulated or wavy throughout.

Locality.—The type material was collected by von den Steinen in South Georgia at ebb tide under stones.

The character of the gonosome indicates that this is a *Silicularia*. In other respects it is a *Eucopella*.

SILICULARIA ROSEA Meyen.

Plate 25, figs. 1–2.

Silicularia rosea Meyen, Über das Leuchten des Meeres, 1834, p. 204.
Hypanthea georgiana Pfeffer, Jahrb. wiss. Anst. Hamburg, vol. 6, pt. 2, 1888, p. 54.
Hypanthea aggregata Allman, *Challenger* Reports, Hydroida, 1888, p. 26.
Silicularia rosea Hartlaub, Die Hydroiden der magalhaensischen Region und chilenischen Küste, 1905, p. 572.
Silicularia rosea Jäderholm, Hydroiden aus antarktischen und subantarktischen Meeren, 1905, p. 17.

Trophosome.[1]—The rootstocks consist of thick closely applied parallel strands, from which spring slender stalked hydranths and female gonophores, the latter often thickly aggregated. The pedicels of the hydrothecæ considerably overtop the gonangia, are thinner than the rootstock, thick-walled, entirely smooth, joined basally to the rootstock by a conical termination; at their distal end, below the globular annulation separating them from the hydrothecæ, somewhat thickened. Hydrothecæ are sometimes slender, sometimes short and thick-walled, bilaterally symmetrical and with a very constricted hydrothecal cavity.

Gonosome.—The female gonangia are tubular, relatively small, short, plainly pediceled, and also with conical basal terminations. They are sometimes feebly curved, sometimes straight, their lateral outline sometimes slightly turgid. The extensive thickening of their walls extends from the rounded distal ends to their basal terminations.

Male gonophores very long and slender (specimens from South Georgia).

Distribution.—South Georgia on *Macrocystis gigantica* (van den Steinen), South Africa and near Cape Horn (Meyen).

SILICULARIA RETICULATA (Hartlaub).

Plate 25, figs. 3–4.

Eucopella reticulata Hartlaub, Die Hydroiden der magalhaensischen Region und chilenischen Küste, 1905, p. 569.

Trophosome.[2]—Rootstocks forming an open irregular mesh of creeping fibers which are much thicker than the pedicels. Pedicels smooth, about 6 mm. high, somewhat thickened distally and abruptly constricted at their basal insertion. Immediately below the hydrotheca is a globular annulation of considerable size. Hydrothecæ bilaterally symmetrical, very variable in form, foreshortened in length, with the lateral outline lower on one side.

Gonosome.—Gonangia (female) strongly compressed, rounded distally, horn-shaped in outline, with short pedicel, short and broad, thick-walled only proximally and in the pedicel.

Locality.—Found on a smooth-leaved laminarian at Port Williams, Falkland Island.

It seems to the present writer that this species should go into the genus *Silicularia*, with which it agrees in nearly all generic characteristics, until an examination of suitable material shows the character of the gonangial contents.

[1] No specimen of this species being available, the description is taken from Hartlaub's notes on the type specimen found in the Berlin Museum (Die Hydroiden der magalhaensischen Region und chilenischen Küste, 1905, p. 573).

[2] Description taken from that of the original describer, Hartlaub, there being no material accessible to the writer.

SILICULARIA ATLANTICA (Marktanner-Turneretscher).

Plate 25, fig. 5.

Hypanthia atlantica MARKTANNER-TURNERETSCHER, Hydroiden des k. k. naturhist. Hofmuseums, 1890, p. 211.
Silicularia atlantica HARTLAUB, Die Hydroiden der magalhaensischen Region und chilenischen Küste, 1895, p. 580.

Trophosome.[1]—Hydrorhiza in the form of creeping, threadlike rootstock, sparingly branched on the folds of a thallus of an alga. Pedicels 1 to 5 mm. long, about .18 mm. in diameter, with thickened walls, with a globular annulation separating it from the hydrotheca. Hydrothecæ with greatly thickened walls, their form greatly resembling that of *Eucopella campanularia* von Lendenfeld, margin strongly oblique; length .35 to 6 mm. and breadth across margin .3 to .63 mm.

Gonosome.—Female gonangia borne on short pedicels compressed above, reaching a height of 2.7 mm. and a diameter of .67 mm. at the widest part. Male gonangia are much smaller than the female and their pedicels usually longer; their length in the swollen part reaches 1.7 mm., and the pedicel .38. Their diameter is about .25 mm.

The writer also describes the occurrence of one hydrotheca above another on the same pedicel as figured by Mereschkowsky as occurring in *Clytia poterium.*

Locality.—The type-specimen is from lat. 6° S.; long. 38° W.; collected by Dr. A. Wolf. No other specimens of this species have been reported.

SILICULARIA REPENS (Allman).

Plate 25, fig. 6.

Hypanthea repens ALLMAN, Descriptions of some new species of Hydroida from Kerguelen's Island, Ann. Mag. Nat. Hist., ser. 4, vol. 17, 1876, p. 115.
Hypanthea repens MARKTANNER-TURNERETSCHER, Hydroiden des k. k. naturhist. Hofmuseums, 1890, p. 211.
Silicularia repens HARTLAUB, Die Hydroiden der magalhaensischen Region und chilenischen Küste, 1905, p. 572.

Trophosome.[2]—Peduncles about one-fourth inch high, springing at intervals from a creeping stolon, with a globular annulus just below the hydrotheca, but otherwise smooth. Hydrothecæ obconical with very oblique margin, their cavity forming distally a shallow cup, which is prolonged as a narrow cylindrical tube downward through the axis of the hydrotheca.

Gonosome.—Gonangia elongated, narrow, passing gradually into a short peduncle which springs from the creeping stolon; colonies monœcious, the male gonangia surpassing in height the hydrothecal peduncles, fusiform, opening on the summit by a narrow circular orifice; the female shorter than the male, scarcely narrowing toward the distal extremity, where there is a wide orifice.

Habitat.—Swains Bay (Kerguelen).

SILICULARIA HEMISPHERICA Allman.

Plate 25, figs. 7–8.

Silicularia hemispherica ALLMAN, *Challenger* Reports, Hydroida, pt. 2, 1888, p. 27.
Silicularia hemispherica HARTLAUB, Die Hydroiden der magalhaensischen Region und chilenischen Küste, 1905, p. 576.
Silicularia hemispherica JÄDERHOLM, Hydroiden aus antarktischen und subantarktischen Meeren, 1905, p. 18.
Silicularia hemispherica RITCHIE, Hydroids of the Scottish Nat. Antarctic Exped., 1906, p. 529.

Trophosome.[3]—Colony growing from a creeping rootstock which is thick-walled and of considerably greater diameter than the pedicels. The rootstocks do not lie parallel to each other (according to Hartlaub). The pedicels vary from a little more than the height of the hydrotheca to four times the height of the latter. They are thick-walled, and bear from one to three deep annulations immediately below the hydrothecæ.

[1] No material of this species being at hand, the writer takes the above description from the original by Marktanner-Turneretscher.

[2] In the absence of material representing this species the writer quotes entire the original description of Allman.

[3] Description made partly from a fragment of the type collected by the *Challenger* and partly from Hartlaub's notes on specimens taken from Terra del Fuego.

The hydrothecæ are almost hemispherical in outline and are quite different from those described by Hartlaub. They are thick-walled and the margin bears a deep sinuation or notch which dips down nearly half way to the bottom of the hydrotheca in the *Challenger* specimen. The hydrothecal lumen is much restricted and much too small to accommodate the retracted hydranth.

Gonosome.—Gonangia borne on the rootstock. The single gonangium on the *Challenger* specimen is very different from the descriptions of Allman and Hartlaub. It is broadly vasiform, with flaring margin, and is borne on a short, thick-walled pedicel. Gonangial contents.—Ova. Hartlaub[1] says that the male gonangia are very slender and overtop the female gonangia, their longer stem gradually passing into the capsule proper, and that the spadix is strongly branched (in the female). In many gonangia he found free planulæ.

Distribution.—Falkland Islands (Allman); South Terra del Fuego Archipelago, Navarin Island (Michaelsen).

Genus THAUMANTIAS Eschscholtz.[2]

Trophosome.—Colony simple or branched, hydrothecæ campanulate, with a distinct diaphragm. Proboscis trumpet-shaped.

Gonosome.—Medusæ with 4 radial canals and 4 or more marginal tentacles. Manubrium with 4 simple lips. No marginal sense-clubs nor lithocysts.

The trophosome of this genus offers no distinguishing character, being much like that of numerous campanularians. The character of the medusæ, particularly the absence of lithocysts, offers sufficient grounds for the retention of the genus.

THAUMANTIAS INCONSPICUA Forbes.

Plate 25, fig. 9.

Thaumantias inconspicua Forbes, Monograph of the British Naked-eyed Medusæ, 1848, p. 52, pl. 8, figs. 3*a*, 3*b* (medusæ only).
Thaumantias inconspicua Wright, Quart. Journ. Micr. Sci., new ser., vol. 2, 1862, p. 221.
Thaumantias inconspicua Hincks, British Hydroid Zoophytes, 1868, p. 179.
Campanularia inconspicua Calkins, Some Hydroids from Puget Sound, 1899, p. 349.
Phialidium hemisphæricum Mayer, The Medusæ of the World, vol. 2, 1910, p. 266.
Thaumantias inconspicua Fraser, West Coast Hydroids, 1911, p. 40.

Trophosome.[3]—Pedicels growing from a creeping rootstock, together with *Lafoea.* In some cases these pedicels are branched, but there is no regularity whatever in the mode of branching, and the usual mode of growth is in the form of unbranched pedicels. These are of the ordinary campanularian type, annulated above and below, with a smooth median portion. Hydrothecæ deeply campanulate, the greater part of their sides being parallel and the base evenly rounded. There are usually 7 (7 to 9) well-marked marginal teeth which are rather sharply pointed at the tips, and not rounded as in many forms. "The hydranth rests upon an elevated annular ridge near the outer edge of the diaphragm" (Calkins).

Gonosome.[4]—Gonangia borne on annulated pedicels arising from the creeping rootstock and enlarging to meet the hydrothecal base. The gonangia are oblong ovate in shape and about twice as long as the hydrotheca, with a round terminal aperture without collar. The blastostyle bears four medusæ which are hemispherical and show numerous marginal tentacles. The adult medusæ, according to Hincks, has 4 radial canals, a short quadrate manubrium, and numerous (16 to 40) marginal tentacles, with a tawny sense-bulb at the base of each. There are no lithocysts.

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[1] Die Hydroiden der magalhaensischen Region und chilenischen Küste, 1905, p. 576.

[2] System der Acalephen, Berlin, 1829, p. 102. "Ventriculus simplex, brachiis destitutus, Canali ventriculi quatuor clavati, Cirrhi marginalis pleures basi bulbosi."

[3] Description of specimen collected by C. M. Fraser, San Juan Archipelago, Pacific Coast of British Columbia. The specimens were compared with those collected by Calkins.

[4] Description taken from text and figures given by Calkins in his Some Hydroids from Puget Sound, 1899, p. 349, pl. 2, fig. 8.

Distribution.—British Coasts (Wright, Hincks, and others); Puget Sound (Calkins); Atlantic Coast, United States (Fraser, MSS.). Mayer[1] considers this species as identical with *Phialidium hemisphæricum* (Gronovius) and states that the hydroid "is probably a *Campanulina*" and refers to Hincks[2] where he (Mayer) is doubtless misled by a figure of *Lovenella clausa* on the opposite page from the description of *Thaumantias inconspicua*. This figure, however, has no reference to *Thaumantias* at all and the hydroid form of *T. inconspicua* is, as above shown, indistinguishable from *Campanularia*. It is true that Brown and Mayer both describe the medusæ of this form as having lithocysts, but Hincks distinctly says that they are absent and bases his genus on that fact. It does not seem likely that so careful an observer as Hincks would fail to see these structures. It seems more probable that Hincks and van Beneden were describing different medusæ, and that the latter writer was describing a *Campanulina* while Hincks had a form whose hydroid phase was indistinguishable from *Campanularia*.

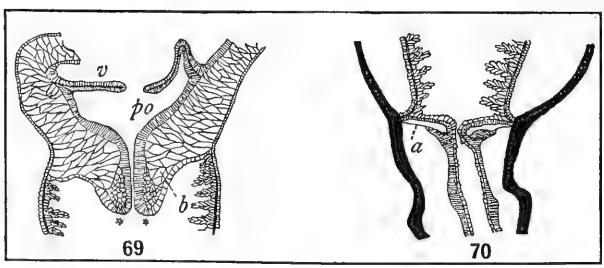
Family BONNEVIELLIDÆ Broch.

Bonneviellidæ Broch, Hydroiduntersuchungen II, Zur Kenntniss der Gattungen Bonneviella und Lictorella, 1909, p. 197.

The original definition of this family is entirely satisfactory and will be adopted here. The following is a translation:

Bonneviellidæ; Calypteroblastic hydroids with a well-marked veloid, so that a preoral cavity is formed.

The present writer has made an examination of longitudinal sections of his "*Campanularia regia*," a close relative of *Bonneviella grandis* (Allman), type of the family, and has been able to confirm the observations of Broch. A membrane, which the writer had previously regarded as the proboscis, stretches from the tentacle bases above the real oral surface. The center of this membrane is perforated by a round aperture directly over the true oral opening. The "preoral cavity" (fig. 69, *p o*) thus formed is lined throughout with ectoderm, thus showing a remarkable approach to the gullet or esophagus of zoantharians in its structure. The "veloid" (fig. 69, *v*) or membrane itself is composed of two layers of ectoderm separated by a stutzlamella.



STRUCTURAL DETAILS OF BONNEVIELLA GRANDIS.
(After Broch.)

Fig. 69.—Oral region and upper part of gastric cavity. *b*, Tentacle base; *p. o.*, pre-oral cavity; *v*, vellum; * * *, opening from mouth to gastric cavity.
Fig. 70.—Basal region, showing connection of hydranth with the hydrotheca. *a*, Diaphragm.

Aside from this remarkable and important character this form would have to be removed from the family Campanularidæ on account of not having the trumpet-shaped proboscis characteristic of that family. Indeed it has no proboscis at all, the real oral surface being actually a depression whose lowest point is occupied by the mouth.

KEY TO AMERICAN SPECIES OF BONNEVIELLA.

Hydrothecæ tubular, with everted margins.
  Gonangia lageniform, longitudinally ribbed..... *grandis.*
  Gonangia cylindrical, transversely corrugated.
    Hydrothecæ large, up to 3.5 mm. long..... *regia.*
    Hydrothecæ immense, up to 10.7 mm..... *superba.*
Hydrothecæ campanulate, margin not everted..... *ingens.*

[1] Medusæ of the World, vol. 2, 1910, p. 266–267. [2] British Hydroid Zoophytes, 1868, p, 179.

Genus BONNEVIELLA Broch.

Bonneviella Broch, Hydroiduntersuchungen, II, Zur Kenntniss der Gattungen Bonneviella und Lictorella, 1909, p. 197.
Bonneviella Broch, Die Hydroiden der arktischen Meere, 1909, p. 230.

Trophosome.—Hydranth with a single row of tentacles connected by a veloid. Food cavity lined with ectoderm. The branched colony arising from a rhizocaulon.

Gonosome.—(Gonangia scattered over the stem or in groups on rootstock.[1]) Gonophores sessile. Colonies sexually distinct.

BONNEVIELLA GRANDIS (Allman).

Plate 26, fig. 1.

Campanularia grandis Allman, Diagnosis of New Genera and Species of Hydroida, 1876, p. 259.
Lafoea gigantea Bonnevie, The Norwegian North Atlantic Exped., Hydroida, 1899, p. 68.
Lafoea gigantea Broch, Bergens Museums Aarbog, 1905, p. 15.
Bonneviella grandis Broch, Hydroiduntersuchungen, II, 1909, p. 198.
Bonneviella grandis Broch, Die Hydroiden der arktischen Meere, 1909, p. 230.
Campanularia grandis Jäderholm, Northern and Arctic Invert., pt. 4, Hydroiden, 1909, p. 70.

Trophosome.[2]—Stem compound, consisting of 4 to 6 straight, thick-walled, parallel, smooth-surfaced tubes which seem to be closely adherent throughout and from which the pedicels arise in an entirely irregular manner. The stem reminds one of a magnified stem of *Campanularia verticillata.* The specimen at hand is incomplete and broken, but the portion remaining is about 3 inches long. Pedicels short, as compared with the hydrothecæ, being 3 mm. in length in the specimen described, and with a single subglobular annulation just below the hydrotheca. Otherwise the pedicel is practically smooth. Hydrothecæ very large, a typical one being 5 mm. long, and a little more than twice as long as broad, urceolate in shape, with a distinctly flaring margin which is smooth and slightly sinuous. The greatest diameter of the hydrotheca is below its middle and below this it rounds into an approximately hemispherical basal portion. The hydranth is so retracted that its characteristic features can not be ascertained.

Gonosome.[3]—Gonangia springing in a dense cluster from the aggregated basal tubes, nearly sessile, lageniform, with strong longitudinal ridges, slightly exceeding a quarter of an inch in height.

Distribution.—Type-locality, Cape. St. John, Japan. Otherwise the distribution is exceedingly uncertain, owing to various writers confounding it with *B. regia* Nutting. North Atlantic Exped., station 164, 800 meters. West of Lofoten, Norway (Bonnevie). Lat. 64° 17′ 5″ N.; long. 14° 44′ 75″ W., between Iceland and Greenland (Broch).

According to Allman's description and figures the gonosome is in the form of clusters of spindle-shaped gonangia, while Bonnevie figures it as scattered.

BONNEVIELLA REGIA (Nutting).

Plate 26, figs. 2–4.

Campanularia regia Nutting, Hydroids of the Harriman Alaska Exped., 1901, p. 172.
Bonneviella grandis (part) Broch, Die Hydroiden der arktischen Meere, 1909, p. 230.
Campanularia grandis (part) Jäderholm, Northern and Arctic Invert., pt. 4, Hydroiden, 1909, p. 70.

Trophosome.[4]—Colony consisting of a densely aggregated mass of rootstocks growing over an ascidian stem and a colony of *Lafœa fruticosa.* Pedicels unbranched, usually shorter than the hydrothecæ, but occasionally much longer. There is often a distinct swelling a short distance below the hydrotheca, otherwise the pedicel is quite smooth. Hydrothecæ very large, often attaining a length of 3.5 mm. and about 3.5 times as long as broad. They are tubular

[1] Added by the present writer.
[2] Description of a specimen labeled "*Campanularia grandis* Allman, Tsugar. Str." I believe the specimen is one sent me in exchange by Dr. Elof Jäderholm.
[3] Description taken from the original by Allman.
[4] Description of specimens from station 4778, Bering Sea, lat. 52° 12′ N.; long. 179° 52′ E., 43 fathoms.

in shape, but their contours are gracefully curved, the basal portion being broader, gradually narrowing in central parts and again broadening toward the distinctly everted margin. The margin itself is smooth. The diaphragm is low and the basal chamber small. The hydranth has the characteristic structure of this family, the real mouth being depressed considerably below the level of the general oral surface. This, which one would naturally consider as the proboscis, unless sections were examined, is a dome-shaped or conical structure with an apical aperture and a lining of ectoderm. In section it reveals the two layers of ectoderm with a stutzlamella between them; the tentacles are numerous.

Gonosome.—The gonangia grow in clumps or clusters, resembling those of *Lafoea*, but are not so closely aggregated as is usual in that genus. They are usually less than half as high as the hydrothecæ and are cylindrical, with very distinct annulations 5 or 6 in number. The distal end is truncated. The whole gonangium greatly resembles the common form found in campanularians, e. g., *Clytia johnstoni*. The gonangia contain developing medusæ, the special characters of which can not be made out.

Distribution.—Type-locality, Orca, Prince William Sound, Alaska. Also found by the *Albatross* at the following stations: Station 4778, lat. 52° 12′ N.; long. 179° 52′ E., 43 fathoms (Bering Sea); station 4803, lat. 46° 42′ N.; long. 151° 45′ E., 229 fathoms (off Kamchatka); station 4804, lat. 46° 42′ N.; long. 151° 47′ E., 229 fathoms (off Kamchatka); station 4809, lat. 41° 18′ N.; long. 140° 8′ 40″ E., 207 fathoms (Sea of Japan). Nearly every writer who has mentioned this species since it was originally described has regarded it as a synonym of *Bonneviella grandis*. Upon direct comparison of the two forms, however, they are seen to be very distinct and undoubtedly good species. In the trophosome there is a striking difference in the character of the stem, *B. grandis* having a true fascicled stem made up of straight, closely adherent tubes, while the stem in *B. regia* is an aggregation of distinct rootstocks which are usually plainly separate. The hydrothecæ differ not only in size, those of *B. grandis* being much larger and more robust than in *B. regia;* but they differ still more remarkably in texture, the hydrothecæ of *B. grandis* being coarse and somewhat opaque as is usually the case in *Lafoea*, while those of *B. regia* are so exquisitely transparent and delicate that, in spite of their large size, they are hard to make out with a hand lens when in a small vial. The gonosome differs even more than the trophosome, that of *B. grandis* consisting of terete and longitudinally ribbed gonangia, while those of *B. regia* are cylindrical and transversely corrugated.

BONNEVIELLA SUPERBA, new species.

Plate 27, figs. 1–3.

Trophosome.—Colony consisting of a tangled mass of partly adherent tubes which form an axis or stem from which single pedicels arise. This pseudo-stem is interwoven with a mass of other hydroids, mostly sertularians. Pedicels strong, stiff, attaining a length of 2.5 cm. and a diameter of over 1 mm. They are perfectly smooth, for the most part, but are constricted near their origin and just below the hydrotheca. Hydrothecæ enormous, in one case attaining a length of 1.7 cm.; probably the longest hydrotheca known. The diameter near the margin is 6 mm. The general shape is deep campanulate rather than tubular, diminishing gradually below until it passes into the pedicel and flaring at the margin above. Margin perfectly smooth. There is no real diaphragm, although there appears to be one, as the bottom of the hydranth is free from the hydrothecal floor. There is no chitinous shelf, however.

The hydranths are very large, with a single circlet of smooth tentacles. There is no proboscis, the surface, which would, without histological investigation be taken for the oral disk, being almost perfectly flat. A longitudinal section of a hydranth shows that this apparent oral surface is in reality the "veloid" of Broch and that it covers a distinct preoral chamber of considerably greater size than that of *B. grandis*, which is, as in that species, lined with ectoderm. Below this and perhaps partly surrounding its conical lower part is the gastric cavity, lined with convoluted endoderm

Gonosome.—The gonangia are in an aggregated cluster of cylindrical bodies growing from a tangled mass, much as in the case of various species of *Lafoea*. Individual gonangia attain a length of 6 mm. and a diameter of 1.5 mm. They are rudely annulated throughout, there being 7 broad corrugations in the one described. There is a broad neck, almost as broad as the rest of the gonangium, and an abruptly truncated end. The structure is supported on a short pedicel. The gonangial contents have generally discharged or are partially disintegrated so that a satisfactory investigation can hardly be made.

Distribution.—The type and only known specimen is from station 3480, Bering Sea, lat. 52° 06′ N.; long. 171° 45′, 283 fathoms.

Type.—Cat. No. 34528, U.S.N.M.

This remarkable species shows, in its gonosome, a close approach to the Lafoeidæ, while the internal anatomy of the hydranth shows its true place to be in the Bonneviellidæ. It also shows a still closer approach to the Anthozoa than does *B. grandis*.

? BONNEVIELLA INGENS, new species.

Plate 27, fig. 4–5.

Trophosome.—Colony 7 cm. in height, with a fascicled stem which is straight, unbranched, and 3 mm. in diameter. In another specimen the stem is formed of an agglutinated mass of tubes 8 mm. in diameter. The pedicels spring singly and irregularly from this mass of stems, are irregularly annulated, and sometimes attain a length of 16 mm. The annulations are usually rather distant, but deep, resembling irregular segmentations of the unusually thick perisarc. The hydrothecæ are very large, being 6 mm. in length and a little more than 3 mm. in diameter, their greatest width being about one-third the distance from the base to the margin. They gradually decrease in diameter to the perfectly even margin and round out basally to meet the pedicel. There is a well-marked diaphragm upon which the hydranth rests and a sharp annular constriction separating the hydranth from the stem. The hydrothecæ are occupied by what appear to be degenerating hydranths, which do not show sufficient differentiation of structure to afford a basis for description. The structure consists of a funnel-shaped body, the broad end of which acts as a plug closing the distal end of the hydrotheca, the plug appearing in lateral view as a broad, heavy band just below the margin. The hydranth body narrows below into a comparatively thin stalk and then suddenly expands to form the hydranth base which rests on the diaphragm.

Gonosome.—Unknown.

Distribution.—The type and only known specimens of this remarkable campanularian are from *Albatross* station 4803, Simushir Island, N. 59° W., 9 miles, 229 fathoms.

Type.—Cat. No. 34576, U.S.N.M.

This station, being in the vicinity of the Kurile Islands, is not in American territory; but zoologically these islands appear to be an extension of the Aleutian chain and hence this species may be included, doubtfully, in the American fauna.

On account of the imperfect condition of the hydranths this species is placed in the Bonneviellidæ with considerable doubt. Longitudinal sections of one of the hydranths were inconclusive as regards the presence or absence of the preoral cavity and "veloid" of Broch. The tissues were not sufficiently well preserved to yield satisfactory histological results.

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An asterisk (*) preceding a title indicates that the work has not been seen by the writer. In practically all such cases the citation is made on the authority of "Matériaux pour servir à l'histoire des Hydroïdes" by Maurice Bedot, a work which has proven to be exceptionally accurate by the many hundreds of references that have been verified by the present writer.

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A faunal list.
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EXPLANATION OF PLATES.

Unless otherwise indicated, all of the figures were drawn by Mrs. Lilian Hulsebus Crone after camera lucida sketches by the author. Where figures were copied from other works their source is indicated.

PLATE 1.

FIG. 1. *Campanularia verticillata* (Linnæus). Portion of main stem and hydrothecæ (enlarged).
2. *Campanularia verticillata*. Hydrotheca (enlarged).
3. *Campanularia verticillata*. Gonangium (enlarged).
4. *Campanularia volubilis* (Linnæus). Two hydrothecæ (enlarged).
5. *Campanularia volubilis*. Hydrotheca (greatly enlarged).
6. *Campanularia volubilis*. Hydrotheca (greatly enlarged).
7. *Campanularia integra* Macgillivray. Hydrotheca and gonangium (enlarged).

PLATE 2.

FIG. 1. *Campanularia spiralis* Nutting. Hydrotheca and gonangium (enlarged). (Only about one half of the pedicel is shown.)
2. *Campanularia ritteri* Nutting. Part of colony (enlarged).
3. *Campanularia integra* Macgillivray. Hydrotheca (drawn to same scale as figs. 1 and 2.)
4. *Campanularia ptychocyathus* Allman. Part of colony (enlarged). (After Allman.)

PLATE 3.

FIG. 1. *Campanularia grœnlandica* Levinsen (from the type of "*C. lineata*" Nutting) (enlarged).
2. *Campanularia grœnlandica*. Part of colony (enlarged).
3. *Campanularia hincksii* Alder, hydrotheca (enlarged).
4. *Campanularia hincksii*. Hydrothecal margin (greatly enlarged).
5. *Campanularia hesperia* Torrey. Hydrotheca (enlarged). (After Torrey.)
6. *Campanularia denticulata* Clark. Hydrotheca (enlarged).
7. *Campanularia denticulata*. Gonangium (enlarged).

PLATE 4.

FIG. 1. *Campanularia raridentata* Alder. Hydrotheca (enlarged). (After Hincks.)
2. *Campanularia kincaidi* Nutting. Type colony (enlarged).
3. *Campanularia kincaidi*. Hydrotheca (greatly enlarged).
4. *Campanularia urceolata* Clark. Part of colony of type of "*C. reduplicata*" Nutting (enlarged).
5. *Campanularia urceolata*. Part of male colony (enlarged).
6. *Campanularia tincta* Hincks. Hydrothecæ (enlarged).
7. *Campanularia tincta*. Hydrotheca (greatly enlarged).

PLATE 5.

FIG. 1. *Campanularia tulipifera* Allman (enlarged).
2. *Campanularia subrufa* Jäderholm. Part of branch (enlarged).
3. *Campanularia subrufa*. Gonangium (enlarged).
4. *Campanularia macroscypha* Allman. Hydrotheca (enlarged). (After Allman.)
5. *Campanularia lævis* Hartlaub. Hydrothecæ (enlarged). (After Hartlaub.)
6. *Campanularia lævis*. Gonangium (enlarged). (After Hartlaub.)

PLATE 6.

FIG. 1. *Campanularia brevicaulis* Nutting. Two hydrothecæ (enlarged).
2. *Campanularia brevicaulis*. Hydrotheca (greatly enlarged).
3. *Campanularia gigantea* Hincks (enlarged). (After Hincks.)
4. *Campanularia obtusidens* Jäderholm. Hydrothecæ (enlarged). (After Jäderholm.)
5. *Campanularia marginata* Allman. Part of branch (enlarged).
6. *Campanularia marginata*. Part of type-specimen of "*C. insignis*" Allman (enlarged).
7. *Campanularia marginata*. Base of hydrotheca, showing pedicel (enlarged).

PLATE 7.

FIG. 1. *Campanularia flexuosa* (Hincks). Colony with expanded hydranths. From living specimen (enlarged).
2. *Campanularia flexuosa*. Branch of another specimen with corrugated gonangium (enlarged).
3. *Campanularia flexuosa*. Hydrotheca (enlarged).
4. *Campanularia flexuosa*. Hydranth (greatly enlarged).
5. *Campanularia flexuosa*. Gonangium, showing ova and planula (enlarged).
6. *Campanularia flexuosa*. Basal web between tentacles (greatly enlarged.)

PLATE 8.

FIG. 1. *Campanularia neglecta* (Alder). Part of colony (enlarged).
2. *Campanularia neglecta*. Hydrotheca (enlarged).
3. *Campanularia magnifica* Fraser. Part of colony (enlarged).
4. *Campanularia magnifica*. Part of another colony (enlarged).
5. *Campanularia speciosa* Clark. Hydrotheca (enlarged).
6. *Campanularia exigua* (Sars). Part of branch (enlarged).
7. *Campanularia exigua*. Hydrotheca (enlarged).
8. *Campanularia exigua*. Gonangium (enlarged).

PLATE 9.

FIG. 1. *Campanularia fragilis* (Hincks). Branch (enlarged.)
2. *Campanularia calceolifera* Hincks. Branch (enlarged).
3. *Campanularia calceolifera*. Expanded hydranth (enlarged).
4. *Campanularia calceolifera*. Gonangium (enlarged).
5. *Campanularia amphora* (L. Agassiz). Branch (enlarged).
6. *Campanularia amphora*. Hydrotheca (enlarged).
7. *Campanularia amphora*. Gonangium (enlarged).

PLATE 10.

FIG. 1. *Campanularia angulata* (Hincks). Branch (enlarged).
2. *Campanularia coronata* Clarke. Branch (enlarged).
3, 4. *Campanularia coronata*. Hydrothecæ (enlarged).
5. *Campanularia fusiformis* Clark. Part of colony with gonangium (enlarged).
6. *Campanularia lennoxensis* Jäderholm. Hydrotheca (enlarged). (After Jäderholm.)
7. *Campanularia lennoxensis*. Gonangium (enlarged). (After Jäderholm.)

PLATE 11.

FIG. 1. *Clytia johnstoni* (Alder). Hydrotheca (enlarged).
2. *Clytia johnstoni*. Gonangium (enlarged).
3. *Clytia johnstoni*. Gonangium from an American specimen (enlarged).
4. *Clytia johnstoni*. Hydrotheca from an American specimen (enlarged).
5. *Clytia johnstoni*. Medusa, oral view (enlarged).
6. *Clytia johnstoni*. Medusa, side view (enlarged).
7. *Clytia noliformis* (McCrady). Part of colony (enlarged).
8. *Clytia noliformis*. Part of another colony (enlarged).
9. *Clytia noliformis*. Drawing of "*C. simplex*" (after Congdon).
10. *Clytia noliformis*. Drawing of gonangium of "*C. simplex*" Congdon. (After Congdon.) (This is on a much larger scale than fig. 9.)

PLATE 12.

FIG. 1. *Clytia bicophora* Agassiz. Part of colony (enlarged).
2. *Clytia bicophora*. Hydranth (enlarged).
3. *Clytia bicophora*. Hydrotheca (enlarged).
4. *Clytia longicyatha* Allman. Branch (enlarged). (After Allman.)
5. ?*Clytia longicyatha*. Hydrotheca of a specimen shrunken by alcohol (enlarged).
6. *Clytia cylindrica* L. Agassiz. Hydrotheca (enlarged).
7. *Clytia cylindrica*. Gonangium (enlarged).
8. *Clytia sargassicola* Nutting. Part of colony (enlarged).
9. *Clytia sargassicola*. Hydrotheca (enlarged).

PLATE 13.

FIG. 1. *Clytia bakeri* Torrey. Upper part of colony (enlarged).
2. *Clytia bakeri*. Lower part of stem, showing segmentation (enlarged).
3. *Clytia edwardsi* (Nutting). Part of colony (enlarged).
4. *Clytia edwardsi*. Colony, natural size.
5. *Clytia attenuata* Calkins. Part of colony (enlarged).

PLATE 14.

FIG. 1. *Clytia minuta* Nutting. Colony (enlarged).
2. *Clytia minuta.* Part of colony, showing straggling mode of growth (enlarged).
3, 4. *Clyria minuta.* Hydrothecæ (enlarged).
5. *Clytia universitatis* (Torrey). Branch (enlarged).
6. *Clytia universitatis.* Gonangium (enlarged).

PLATE 15.

FIG. 1. *Clytia fragilis* Congdon. Part of colony (enlarged). (After Congdon.)
2. *Clytia hendersoni* Torrey. Branch with hydrothecæ (enlarged). (After Torrey.)
3. *Clytia hendersoni.* Branch with gonangia (enlarged). After Torrey.)
4. *Orthopyxis caliculata* (Hincks). Hydrotheca (enlarged).
5. *Orthopyxis compressa* (Clark). Part of colony (enlarged).
6, 7, 8. *Orthopyxis compressa.* Hydrothecæ, showing degrees of thickening of the walls (enlarged).
9, 10. *Orthopyxis compressa.* Gonangia (enlarged).

PLATE 16.

FIG. 1. *Orthopyxis clytioides* (Lamouroux). Hydrotheca (enlarged).
2. *Orthopyxis clytioides.* Hydrotheca and retracted hydranth (enlarged).
3. *Orthopyxis crenata* (Hartlaub). Hydrotheca (enlarged).
4. *Orthopyxis crenata.* Hydrotheca and retracted hydranth (enlarged).
5. *Orthopyxis crenata.* Hydrotheca (enlarged).
6. *Orthopyxis everta* (Clark). Part of colony (enlarged).
7, 8. *Orthopyxis everta.* Gonangia, front and side views (enlarged).

PLATE 17.

FIG. 1. *Gonothyræa loveni* (Allman). Colony (enlarged).
2. *Gonothyræa loveni.* Gonangia with meconidia (enlarged).
3. *Gonothyræa gracilis* (Sars). Part of colony (enlarged). (After Allman.)
4. *Gonothyræa clarkii* (Marktanner-Turneretscher). Colony (enlarged).
5. *?Gonothyræa inornata* Nutting. Part of type colony (enlarged).
6, 7. *?Gonothyræa inornata.* Gonangia (enlarged).

PLATE 18.

FIG. 1. *Obelia geniculata* (Linnæus). Part of colony (enlarged).
2. *Obelia geniculata.* Part of colony, showing cœnosarc (enlarged).
3, 4, 5. *Obelia geniculata* Medusæ, dorsal, ventral, and lateral views (enlarged).
6. *Obelia hyalina* Clarke. Colony (enlarged).
7. *Obelia hyalina.* Hydranth (enlarged).
8. *Obelia braziliensis* (Meyen). Part of branch (enlarged). (After Meyen.)
9. *Obelia braziliensis.* Gonangium (enlarged). (After Meyen.)

PLATE 19.

FIG. 1. *Obelia dubia* Nutting. Branch (enlarged).
2. *Obelia gracilis* Calkins. Branch (enlarged).
3. *Obelia gracilis.* Hydranth (enlarged).
4. *Obelia gracilis.* Gonangium (enlarged).
5. *Obelia plicata* (Hincks). Part of branch (enlarged).
6. *Obelia plicata.* Gonangium (enlarged).

PLATE 20.

FIG. 1. *Obelia corona* Torrey. Part of branch (enlarged).
2. *Obelia corona.* Hydrotheca (enlarged).
3. *Obelia austrogorgia* Jäderholm. Part of colony (enlarged).
4. *Obelia austrogorgia.* Hydrotheca (enlarged).
5. *Obelia bicuspidata* Clark. Branch (enlarged).
6. *Obelia bicuspidata.* Hydrotheca (greatly enlarged).
7. *Obelia dichotoma* (Linnæus). Part of branch (enlarged).

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PLATE 21.

FIG. 1. *Obelia commissuralis* McCrady. Living colony (enlarged).
2. *Obelia commissuralis.* Living hydranth (enlarged).
3. *Obelia commissuralis.* Gonangium (enlarged).
4. *Obelia commissuralis.* Medusa, lateral view (enlarged).
5. *Obelia commissuralis.* Medusa, dorsal view (enlarged).

PLATE 22.

FIG. 1. *Obelia surcularis* Calkins. Branch, showing modified termination (enlarged).
2. *Obelia surcularis.* Hydranth (enlarged).
3. *Obelia flabellata* (Hincks). Branch (enlarged).
4. *Obelia flabellata.* Medusa (enlarged).
5. *Obelia borealis* Nutting. Part of type colony (enlarged).
6, 7. *Obelia borealis.* Gonangia (enlarged).

PLATE 23.

FIG. 1. *Obelia longissima* (Pallas). Part of colony (enlarged).
2. *Obelia longissima.* Part of another colony showing corrugated hydrothecæ (enlarged).
3. *Obelia longissima.* Hydrotheca (greatly enlarged).
4. *Obelia griffini* Calkins. End of branch (enlarged).
5. *Obelia griffini.* Hydrotheca and gonangium (enlarged).
6. *Obelia fragilis* Calkins. Part of branch (enlarged).

PLATE 24.

FIG. 1. *Obelaria gelatinosa* (Pallas). Branch (enlarged).
2. *Obelaria gelatinosa.* Hydrotheca (greatly enlarged).
3. *Obelia gelatinosa.* ("*Obelia castellata*" Clarke). Hydrotheca (enlarged). (After Clarke.)
4. *Obelaria gelatinosa.* ("*Obelia castellata*" Clarke.) Gonangium (enlarged). (After Clarke.)
5. *Obelaria gelatinosa.* Part of compound stem (enlarged).
6. *Silicularia pedunculata* (Jäderholm). Part of colony (enlarged). (After Jäderholm.)
7. *Silicularia pedunculata.* Hydranth and pedicel (enlarged). (After Jäderholm.)
8. *Silicularia pedunculata.* Gonangium (enlarged). (After Jäderholm.)

PLATE 25.

FIG. 1. *Silicularia rosea* Meyen. Hydrotheca (enlarged). (After Meyen.)
2. *Silicularia rosea.* Gonangium (enlarged). (After Meyen.)
3. *Silicularia reticulata* (Hartlaub). Hydrotheca (enlarged). (After Hartlaub.)
4. *Silicularia reticulata.* Gonangium (enlarged). (After Hartlaub).
5. *Silicularia atlantica* (Marktanner-Turneretscher). Part of colony (enlarged). (After Marktanner-Turneretscher.)
6. *Silicularia repens* (Allman). Hydrotheca and gonangium (enlarged). (After Hartlaub.)
7. *Silicularia hemispherica* (Allman). Hydranth (enlarged). Part of *Challenger* type.
8. *Silicularia hemispherica.* Hydranth and gonangium (enlarged). Part of *Challenger* type.
9. *Thaumantias inconspicua* Forbes. Part of colony (enlarged).

PLATE 26.

FIG. 1. *Bonneviella grandis* (Allman). Hydrotheca (enlarged).
2, 3. *Bonneviella regia* (Nutting). Hydrothecæ of type (enlarged).
4. *Bonneviella regia.* Hydrotheca and gonangia (drawn to same scale as fig. 2.)
5. *Bonneviella regia.* Gonangium (much enlarged).

PLATE 27.

FIG. 1. *Bonneviella superba* Nutting. Hydrotheca (enlarged).
2. *Bonneviella superba.* Hydrotheca (natural size).[1]
3. *Bonneviella superba.* Gonangia (enlarged).
4. *Bonneviella ingens* Nutting. Hydrotheca (enlarged).

[1] This figure illustrates the actual size of the largest hydrotheca that has ever been seen or figured by any writer, so far as the author has been able to discover.

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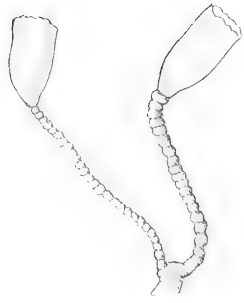

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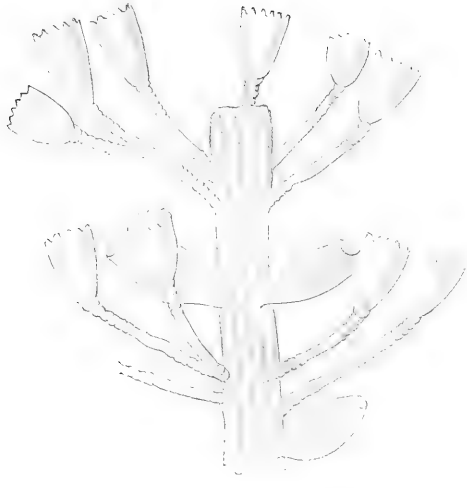

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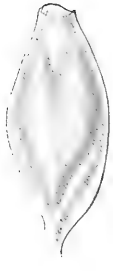

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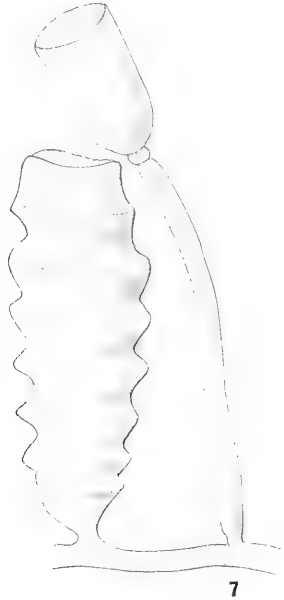

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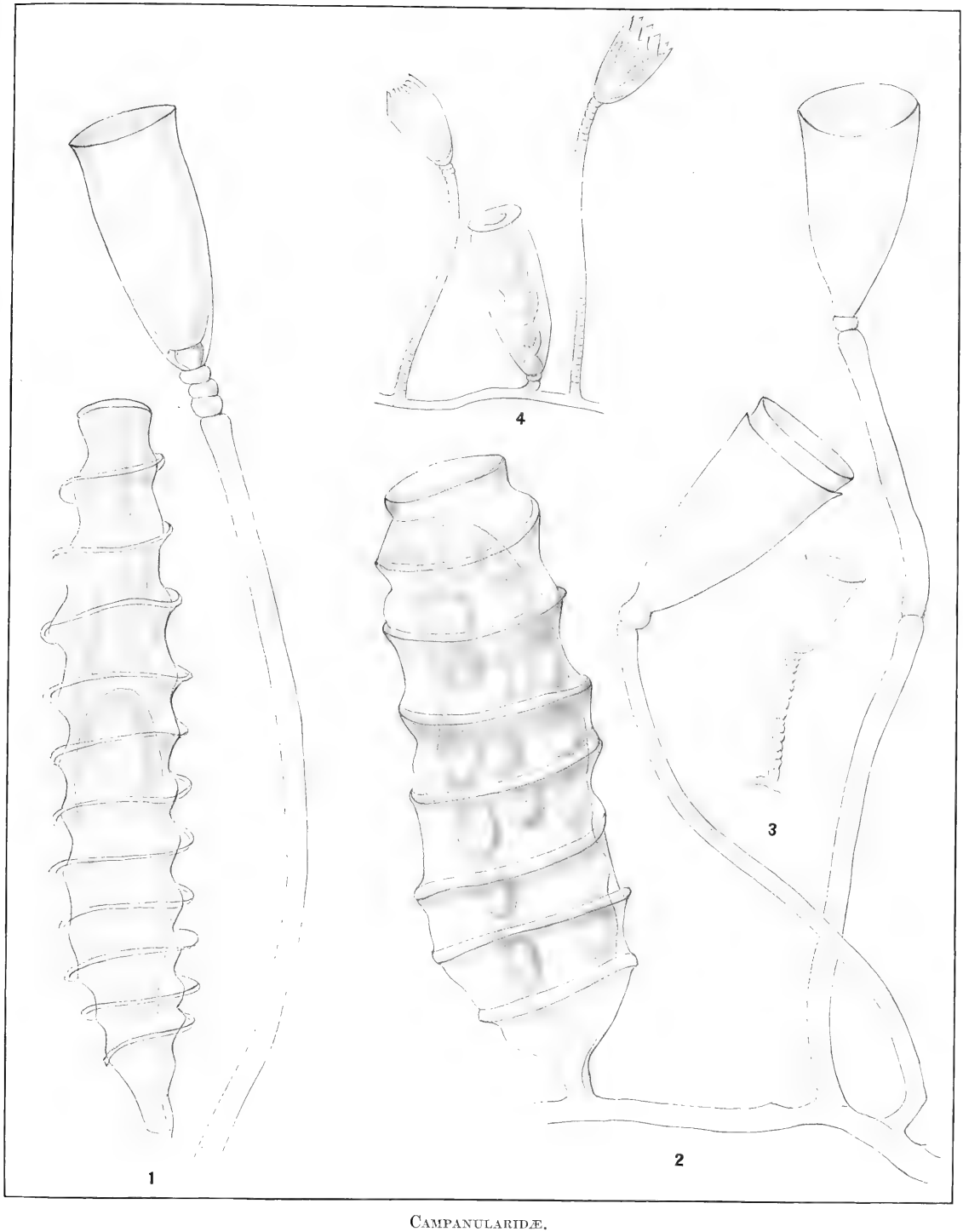

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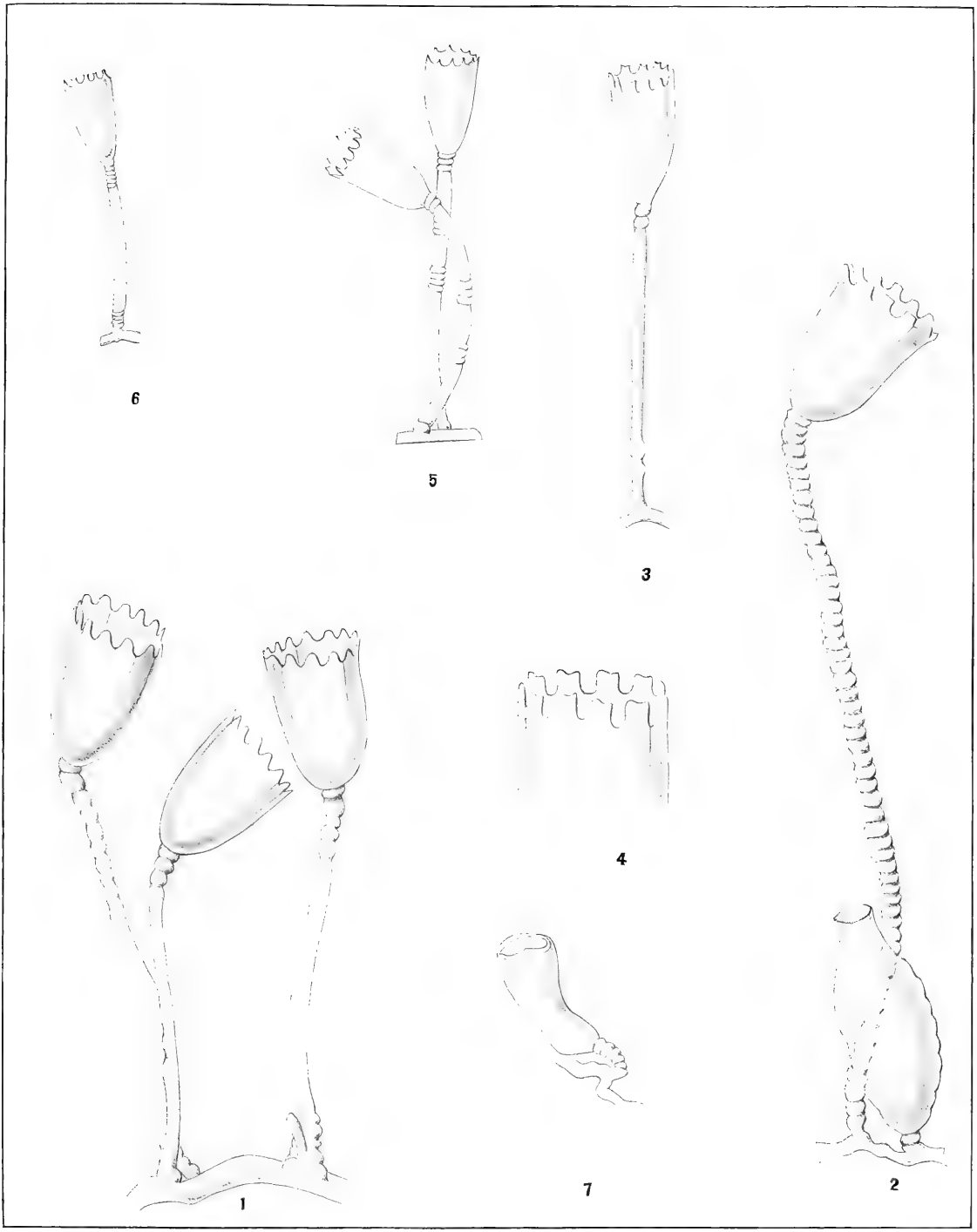

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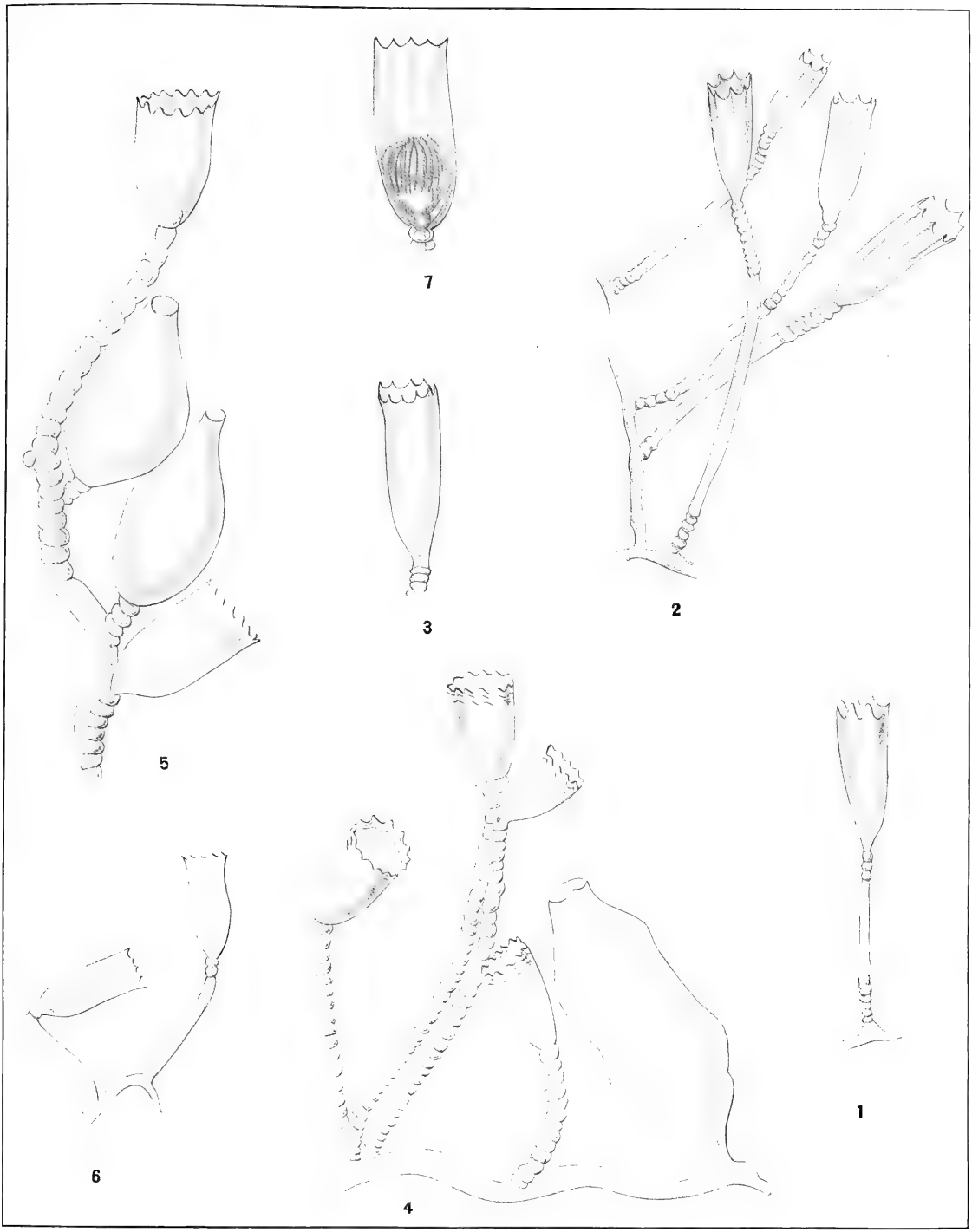

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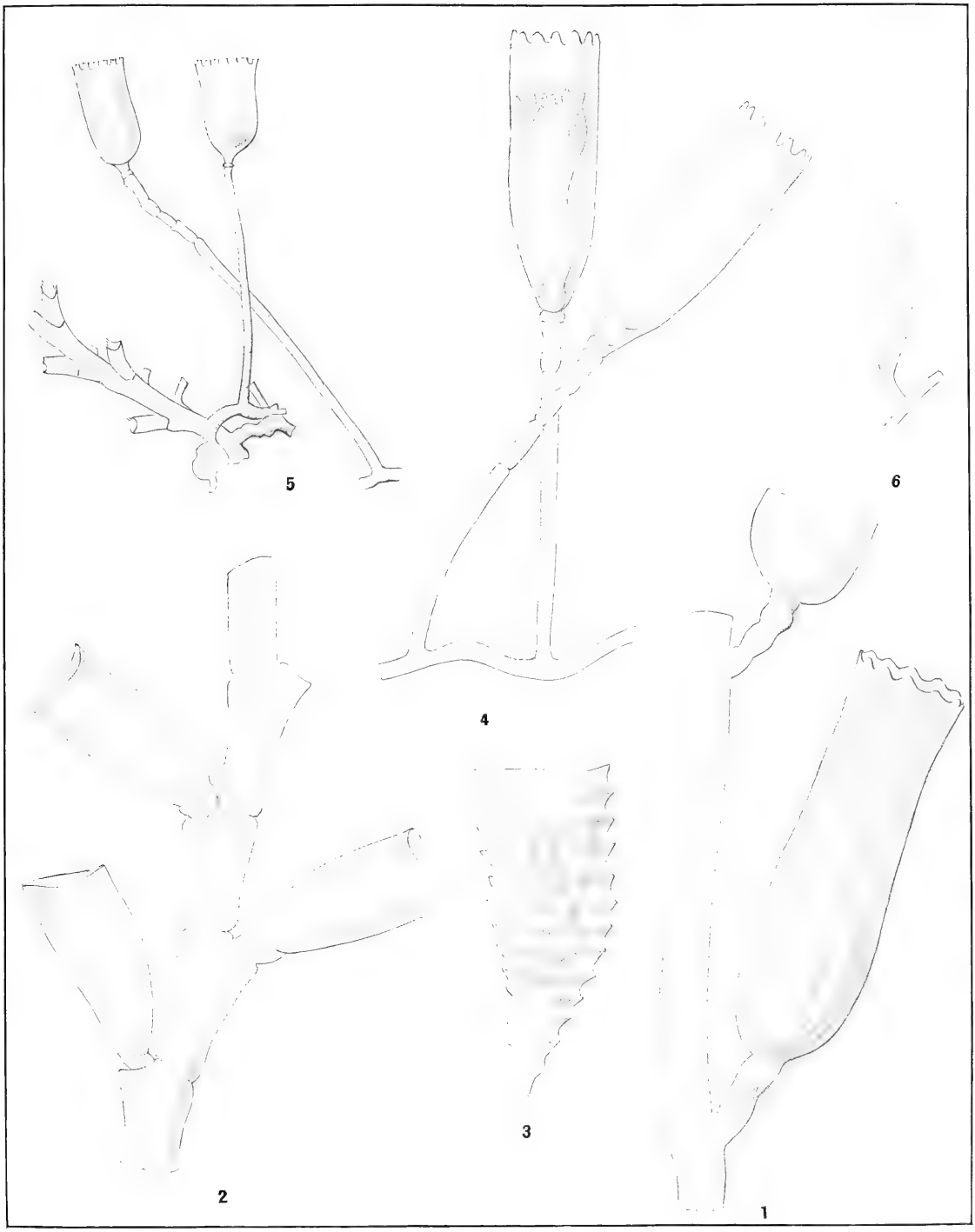

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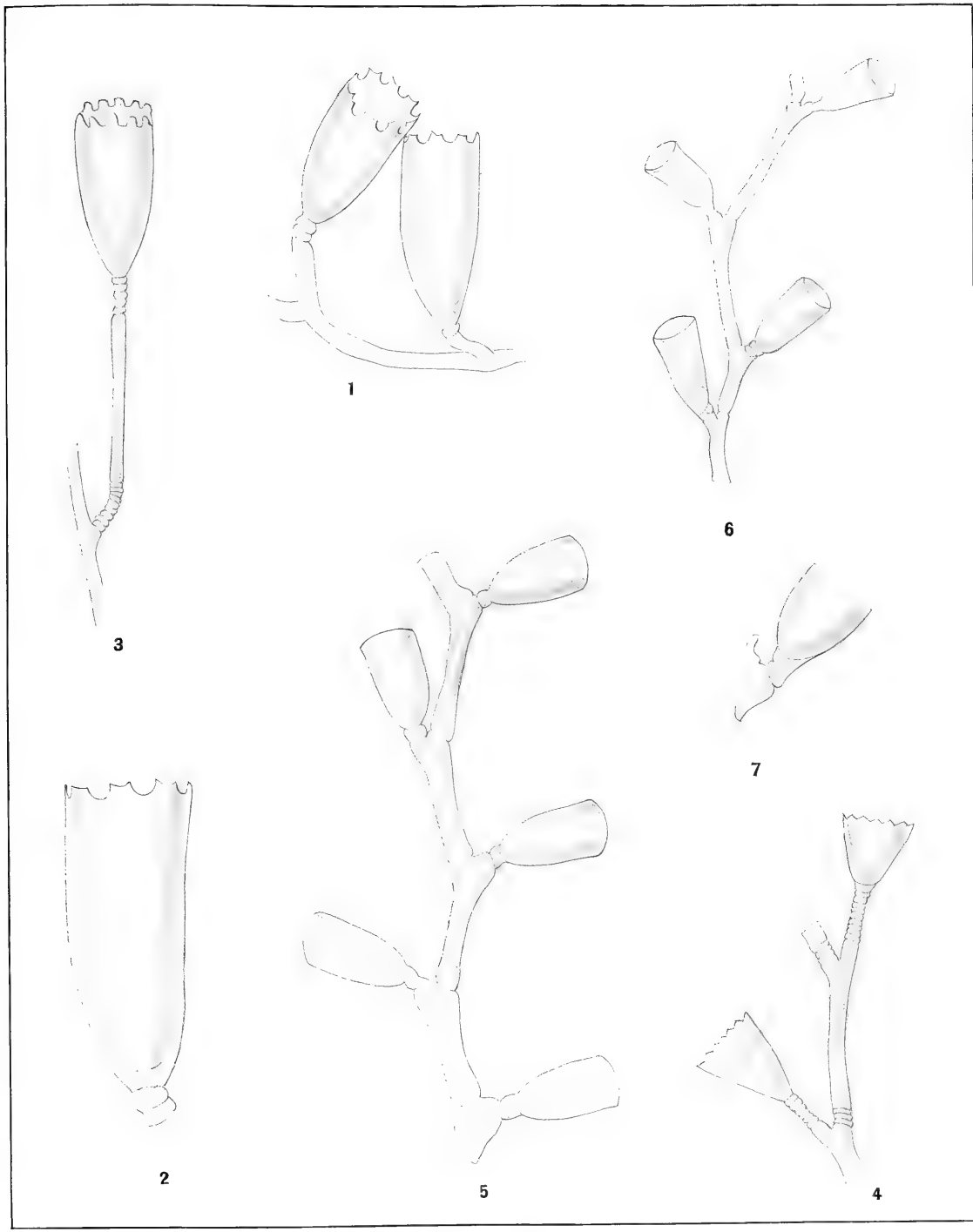

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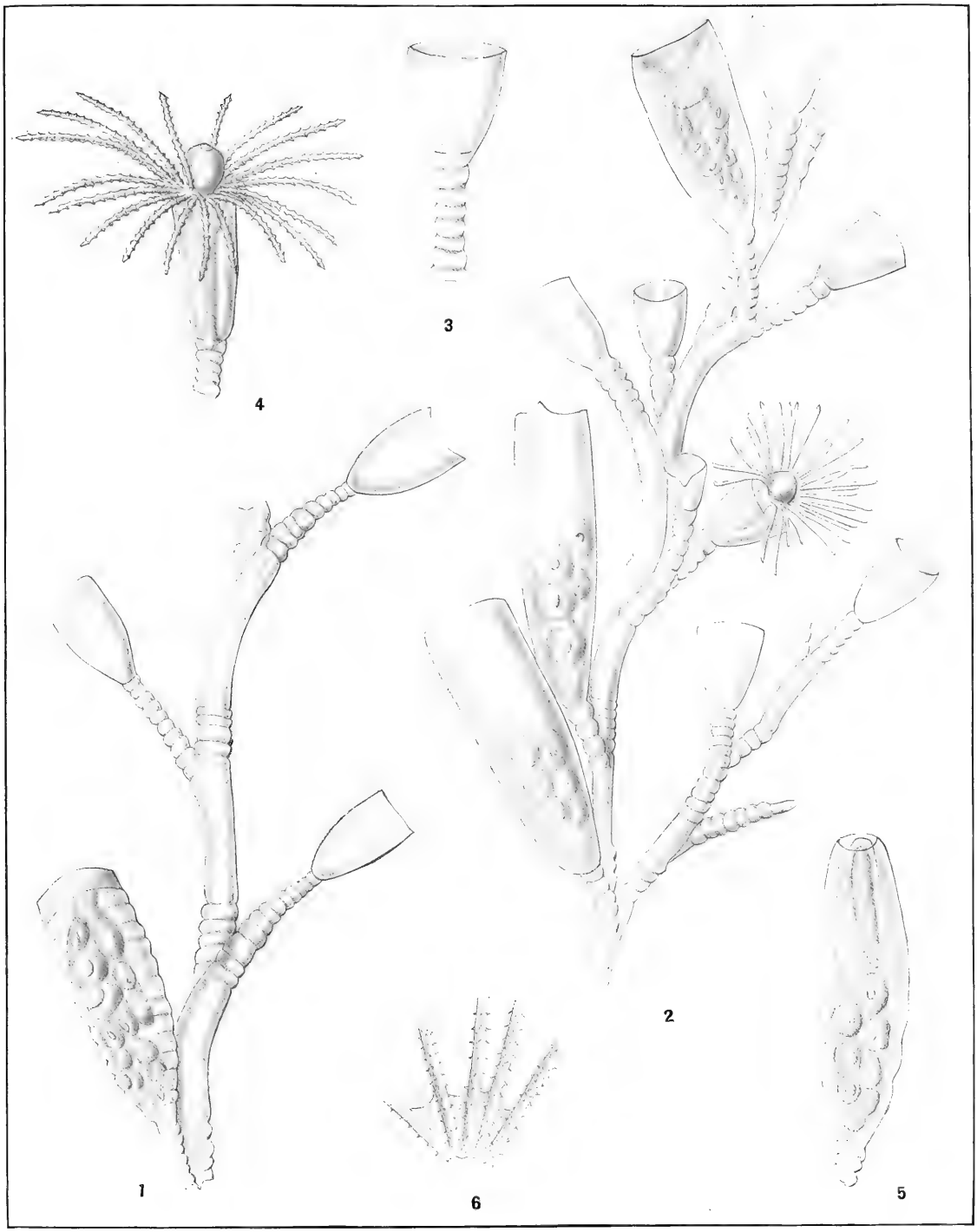

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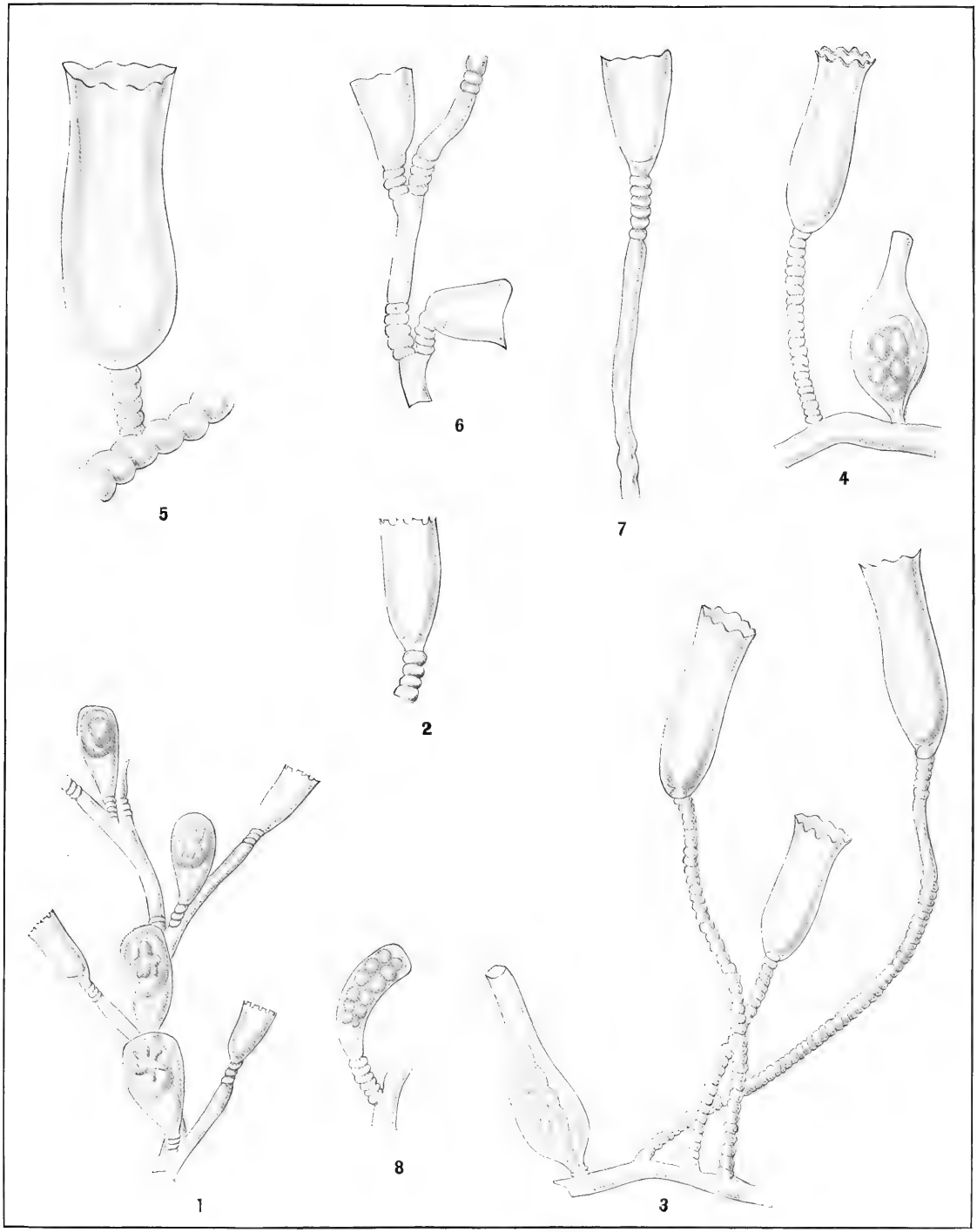

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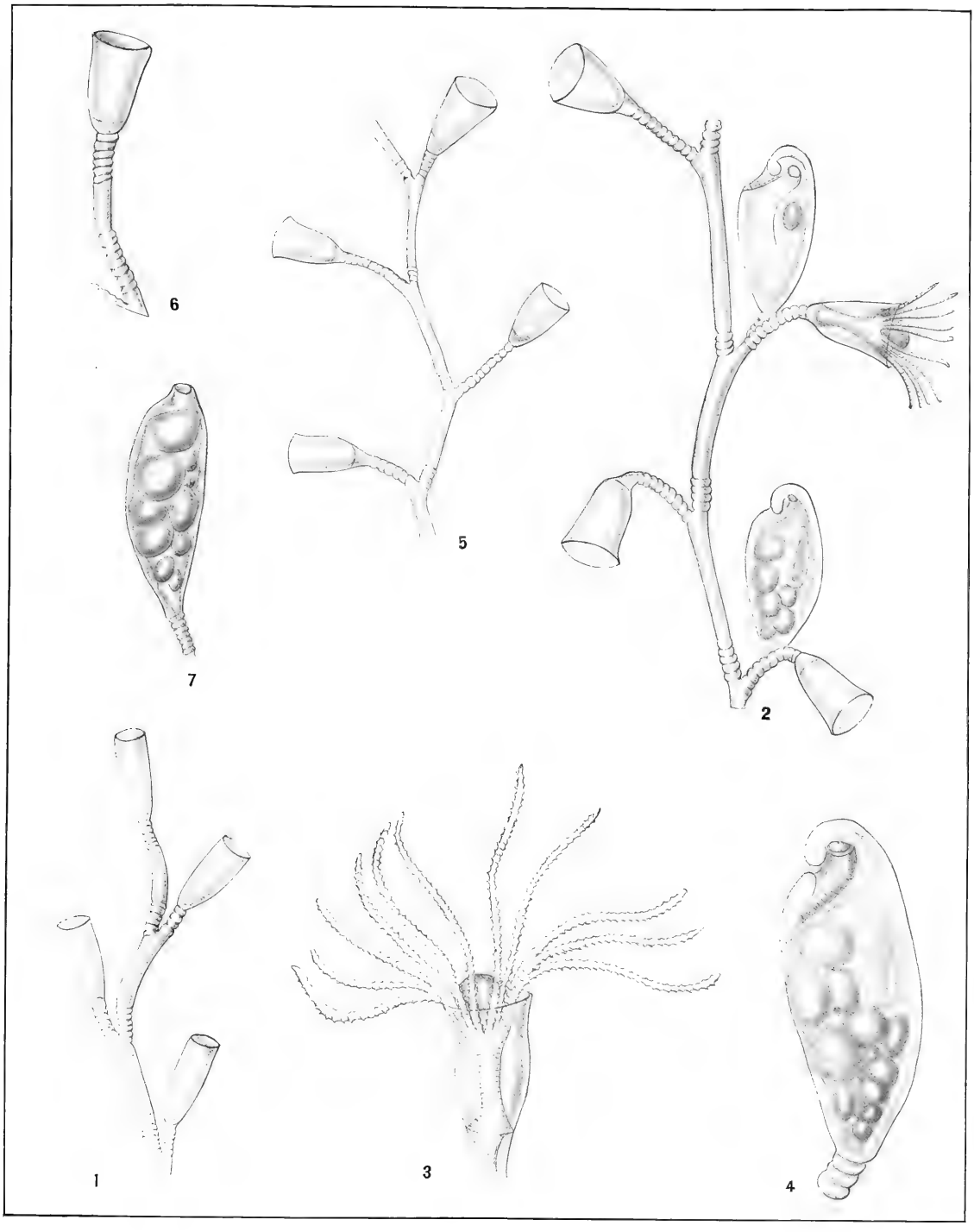

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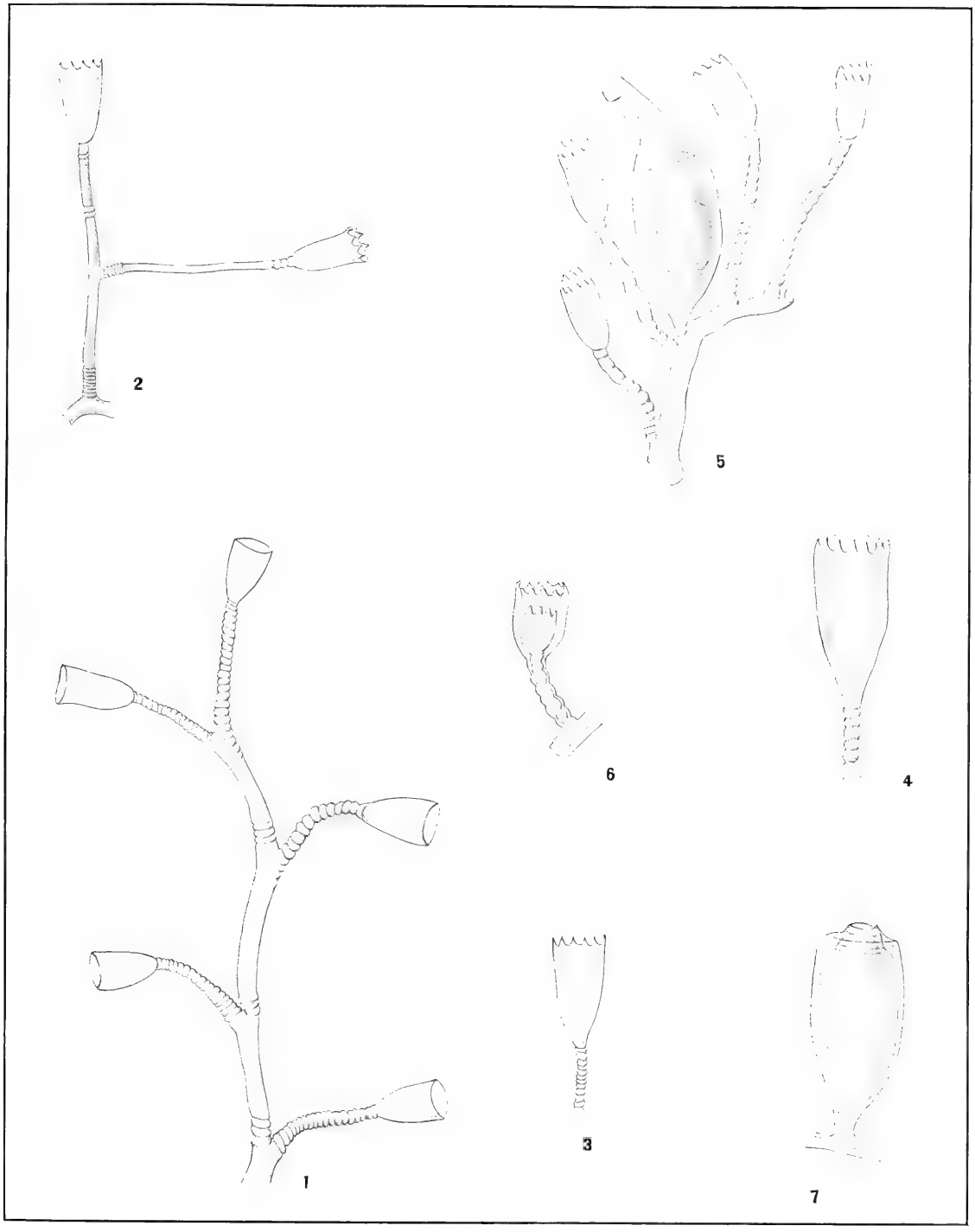

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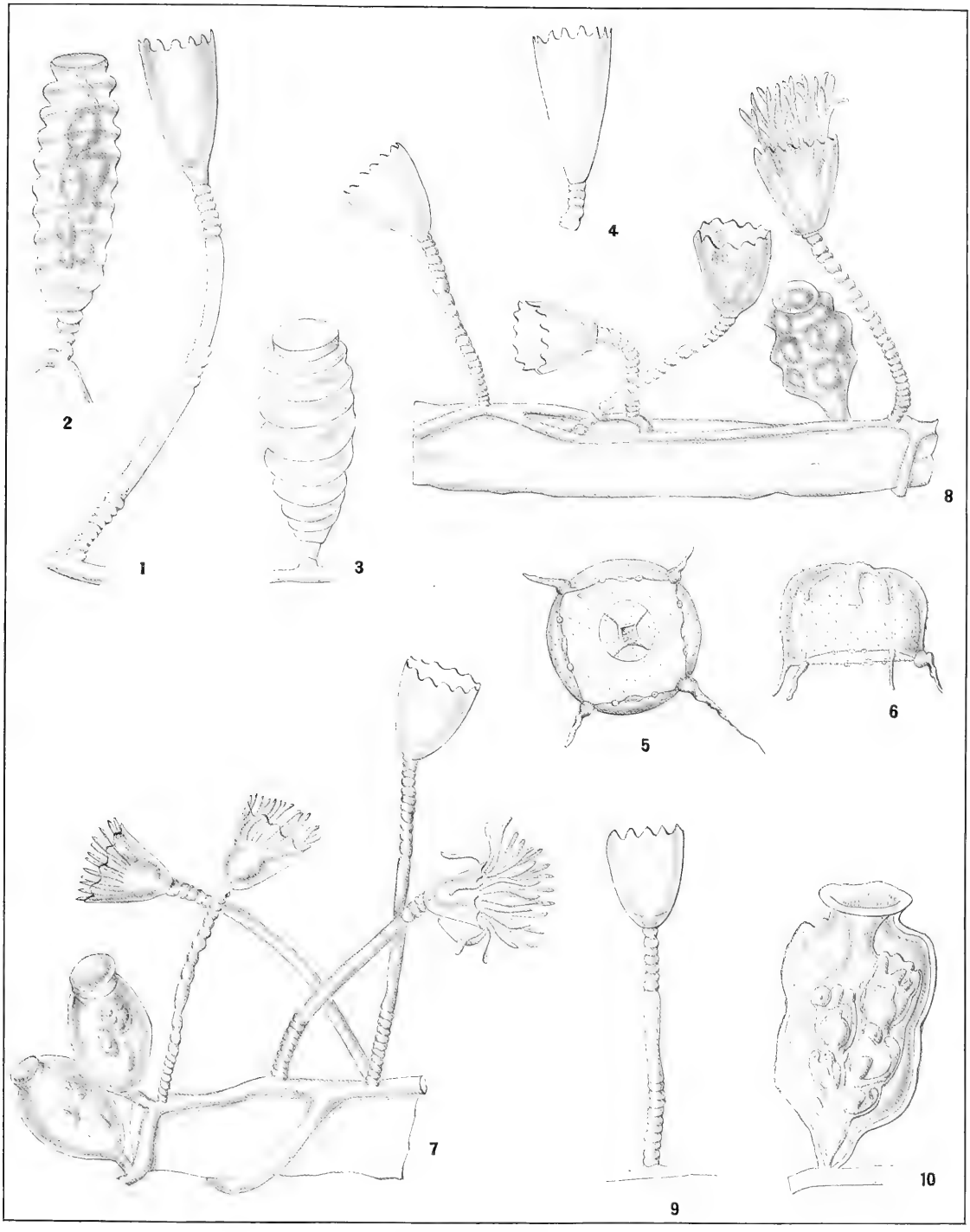

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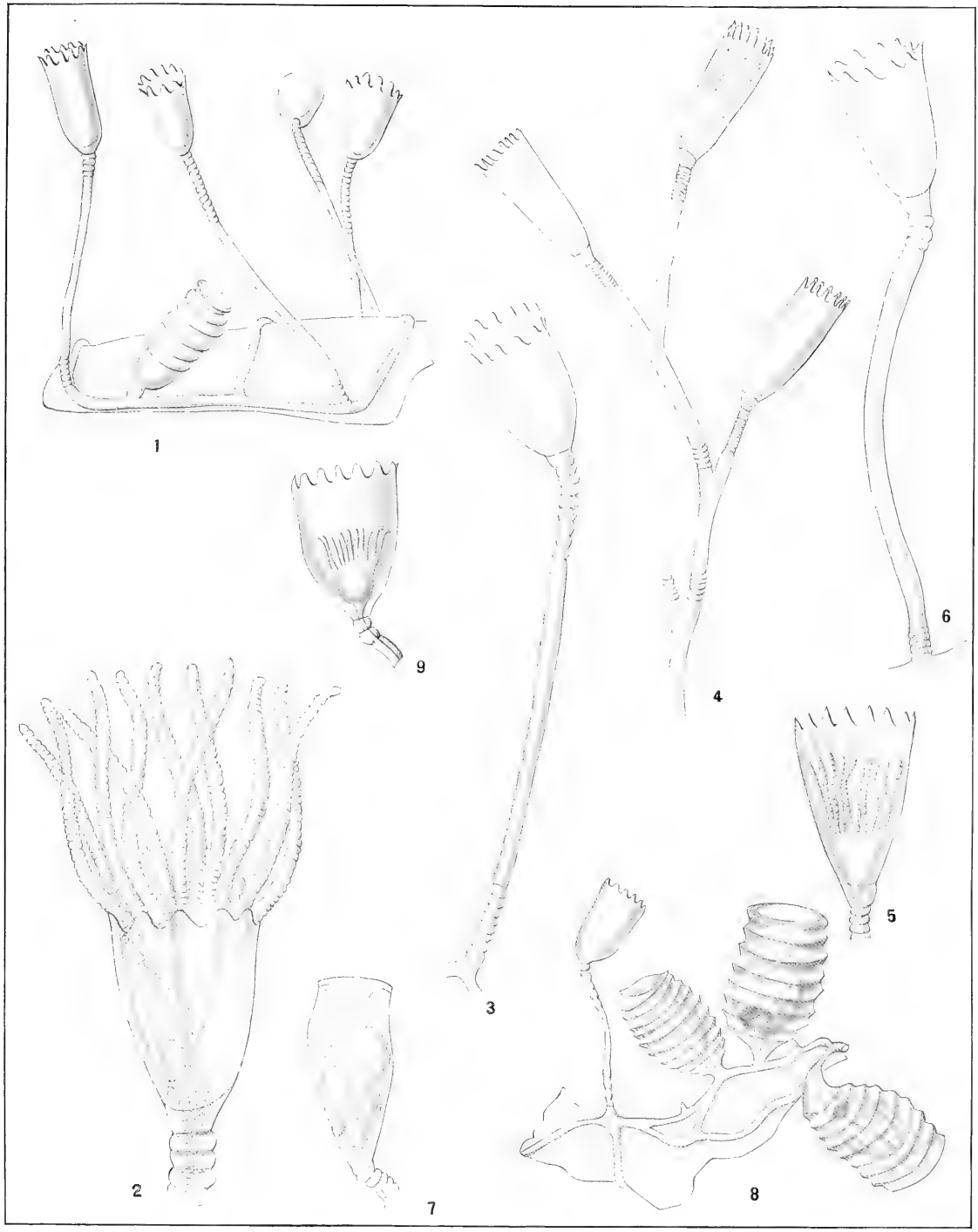

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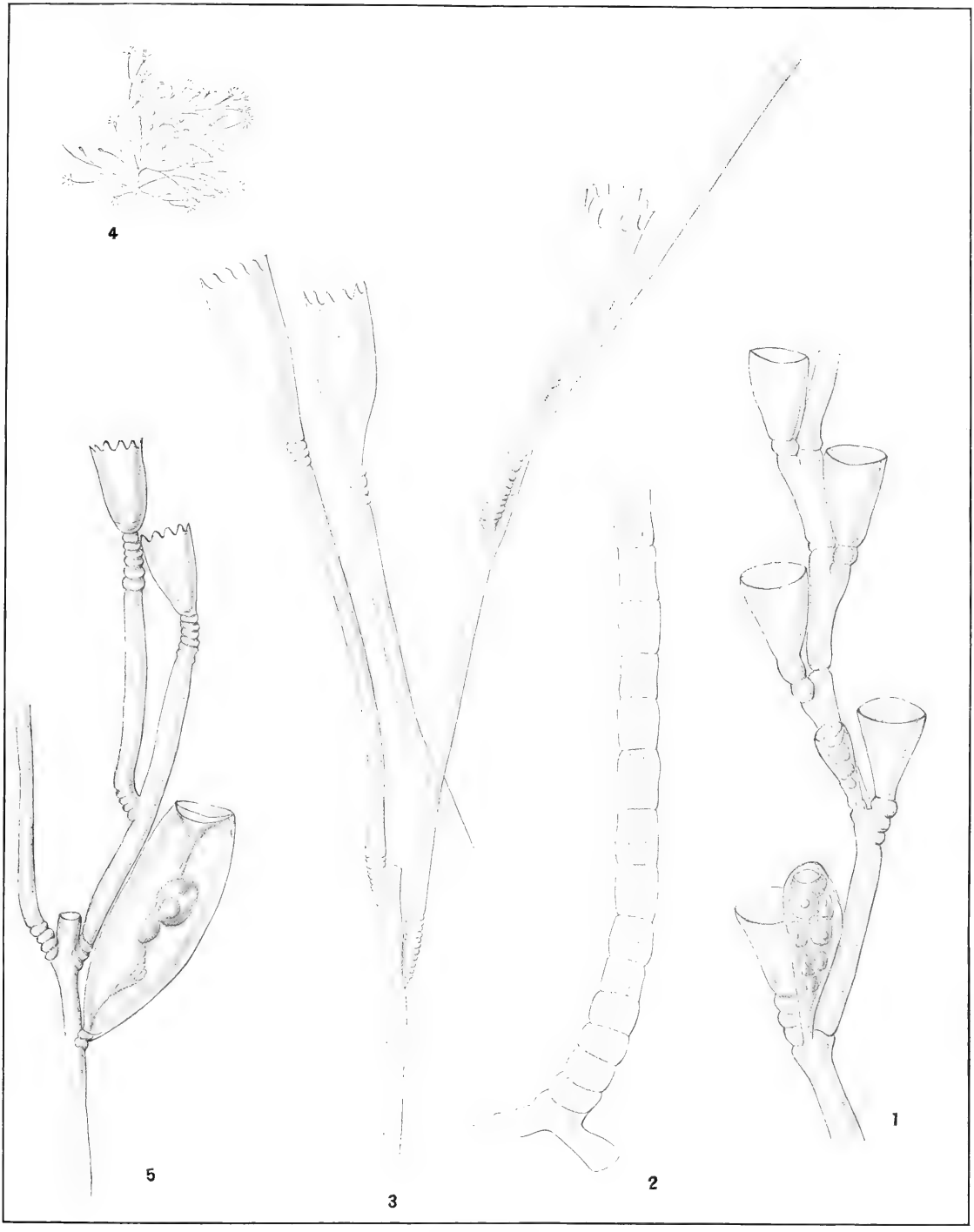

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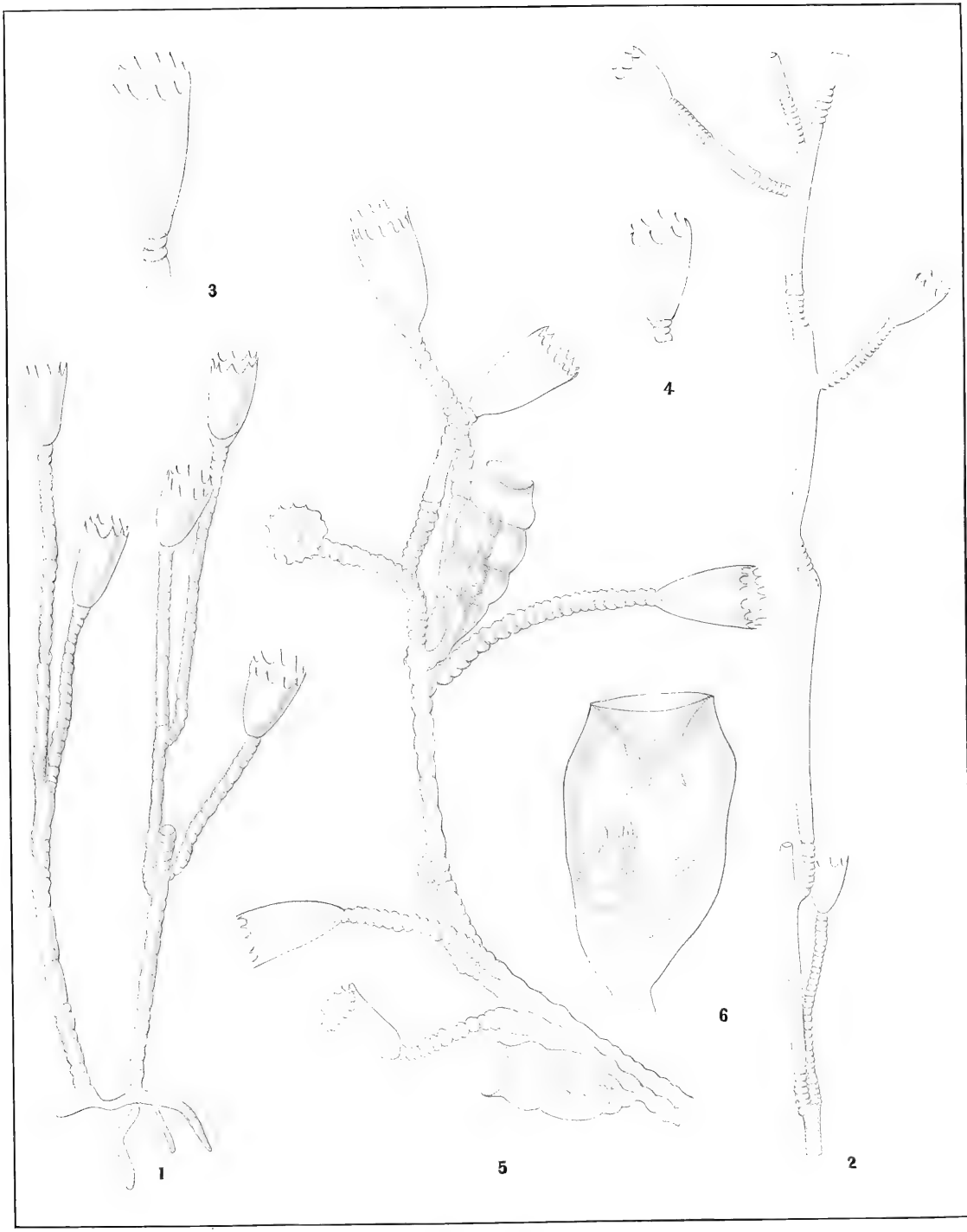

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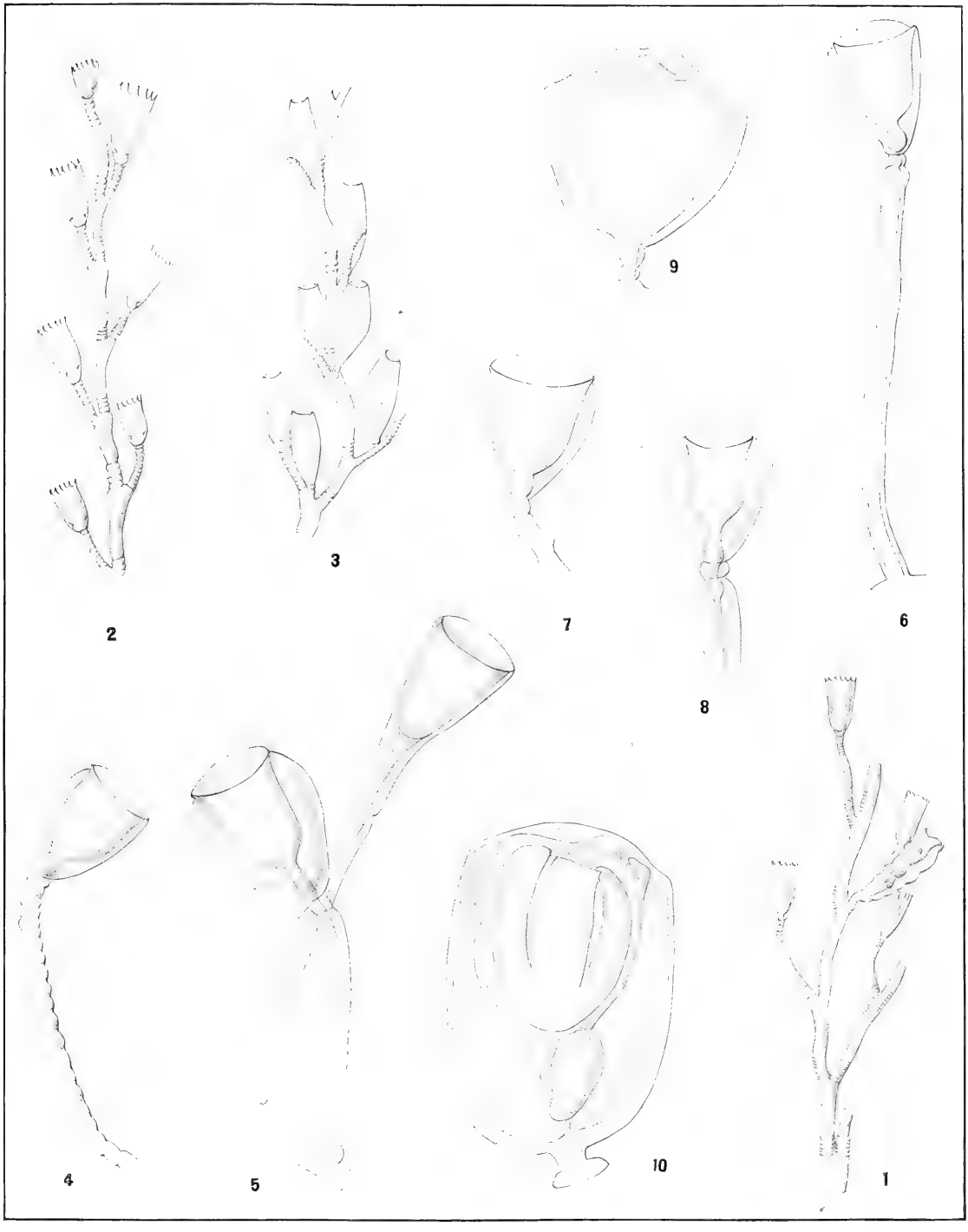

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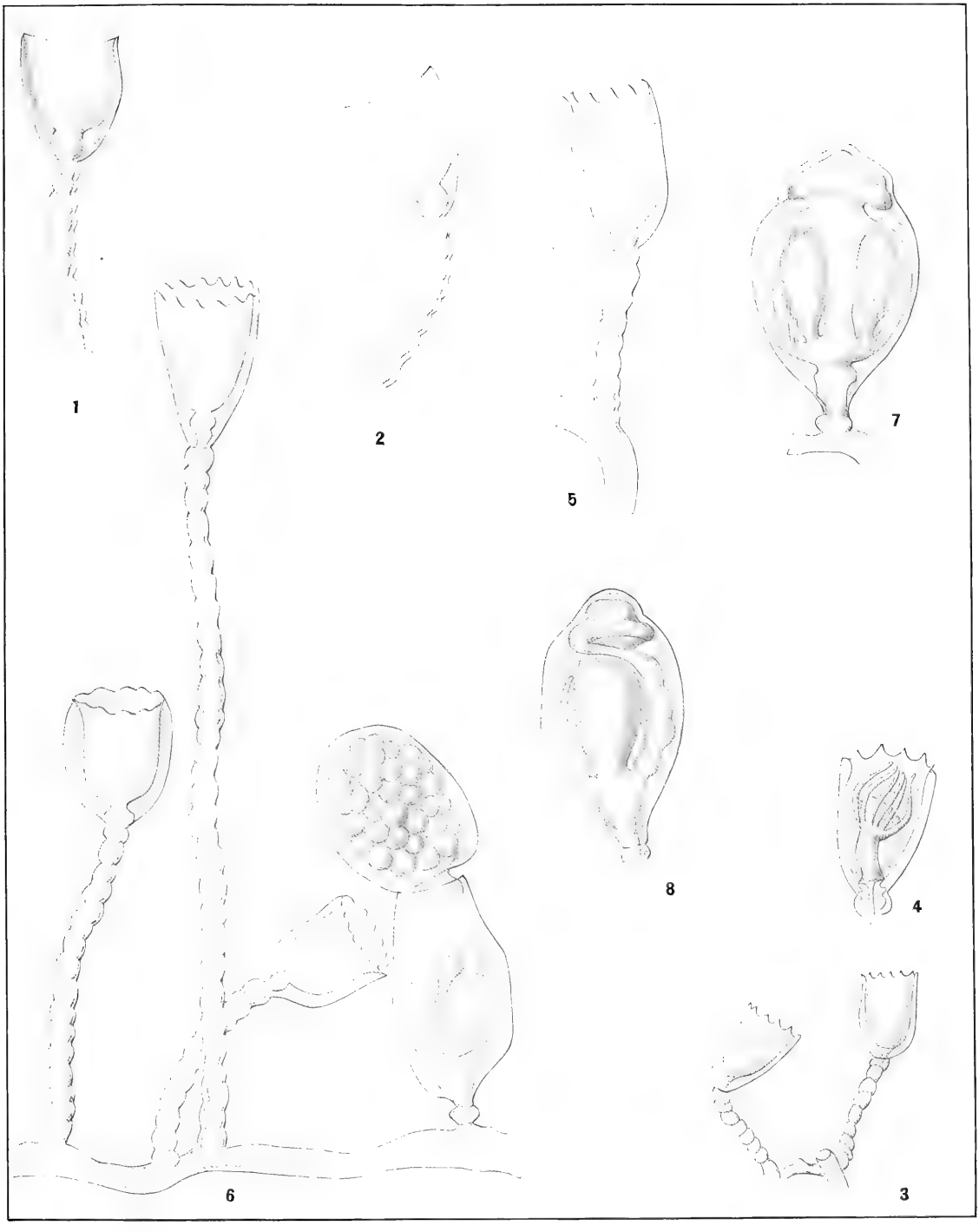

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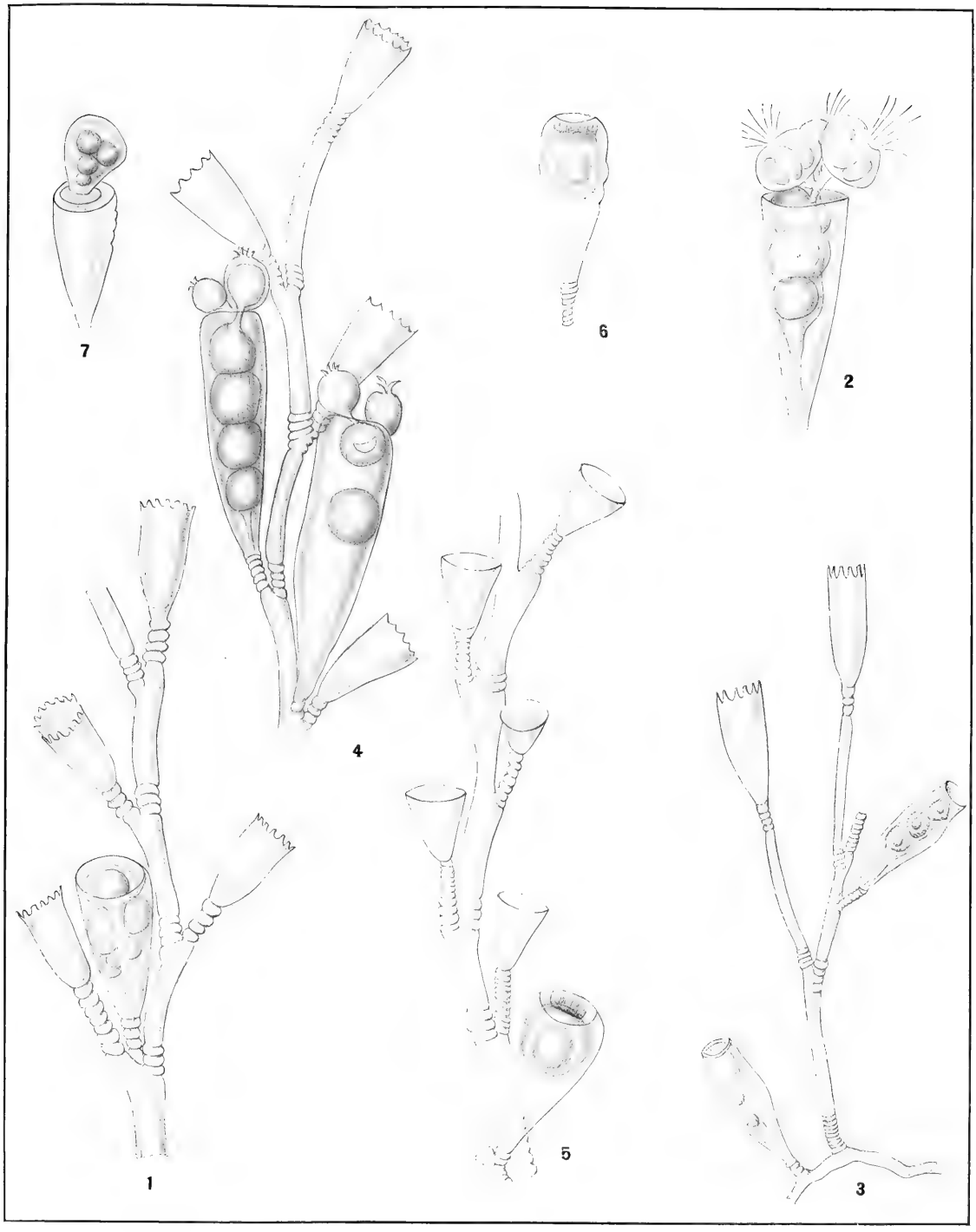

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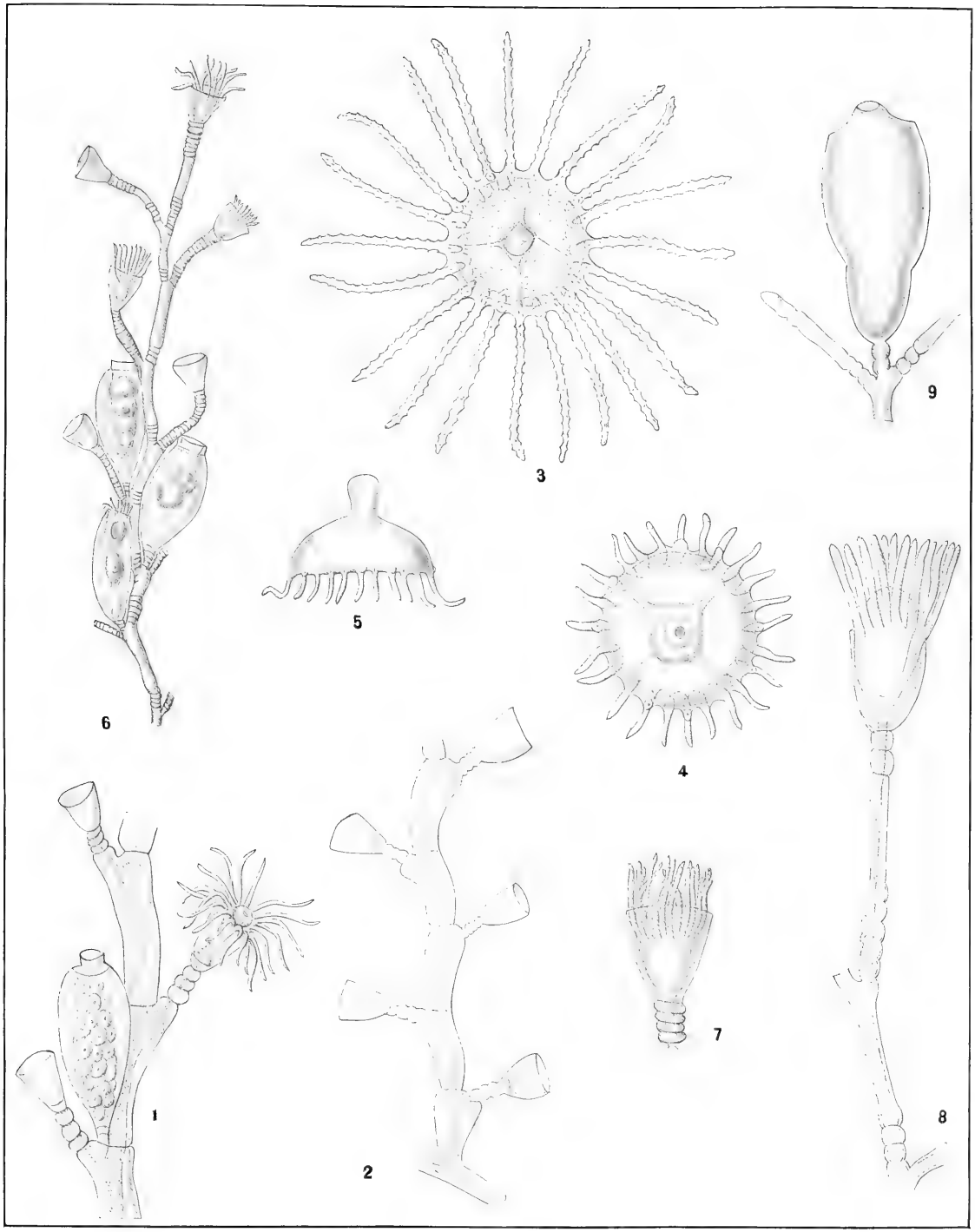

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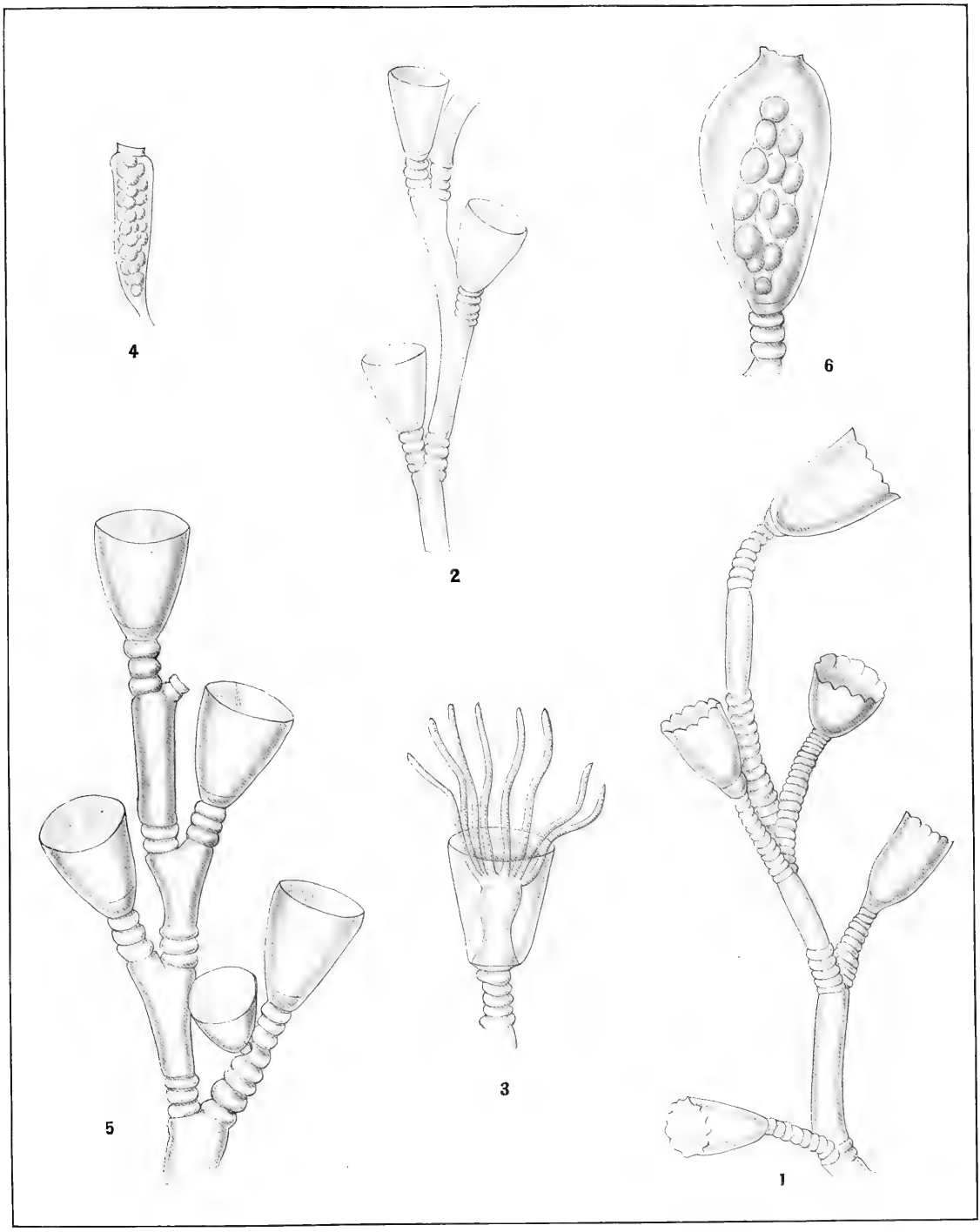

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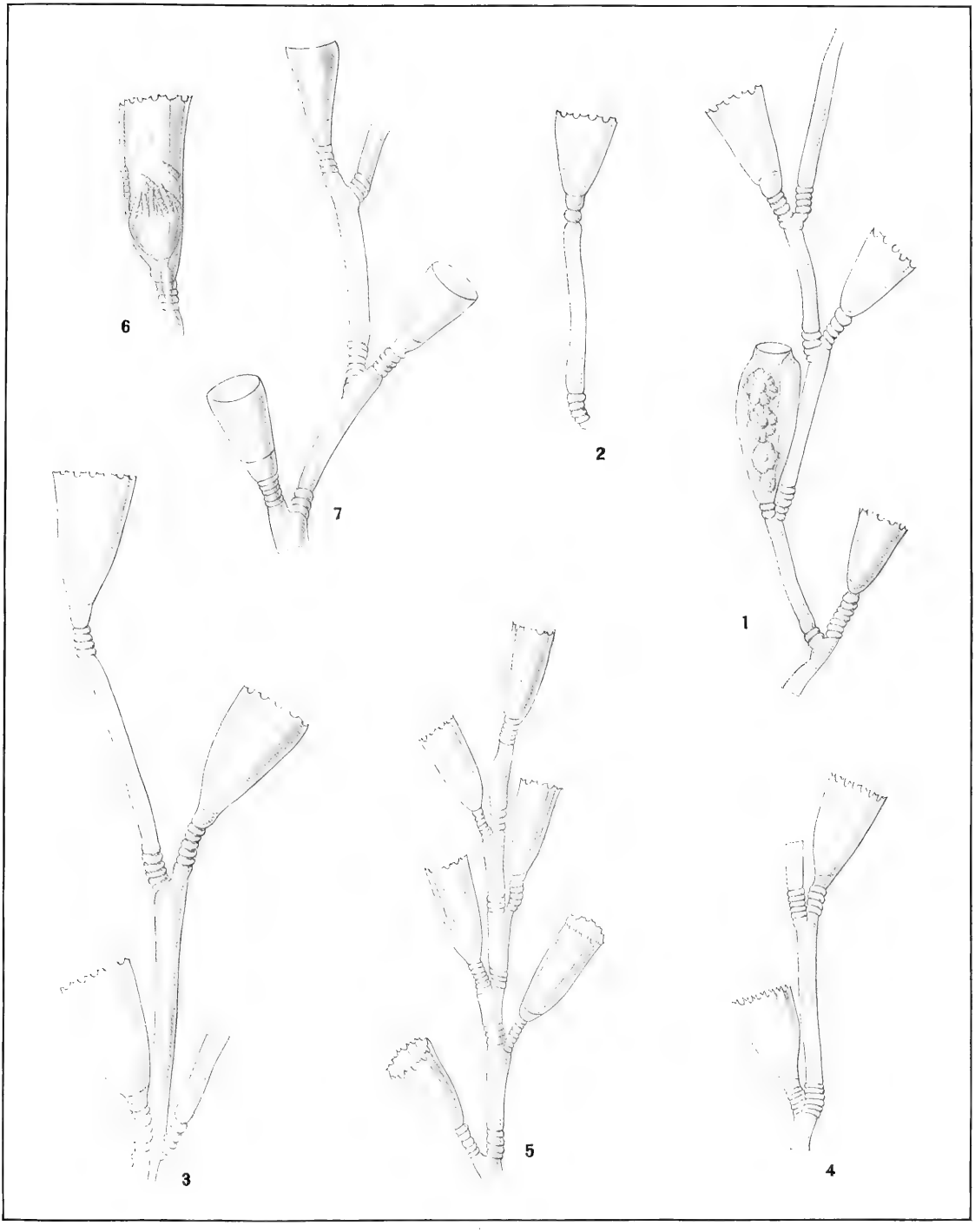

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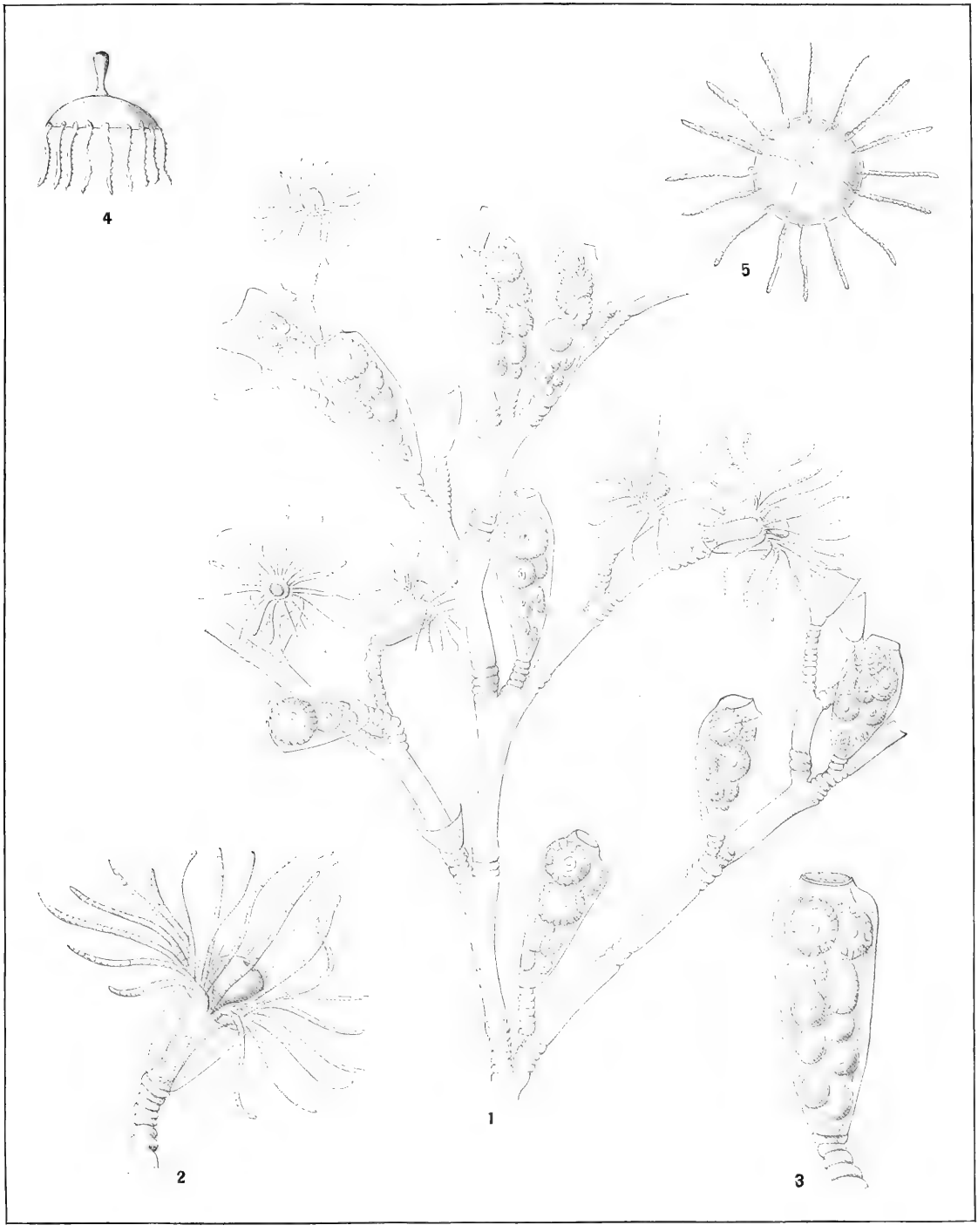

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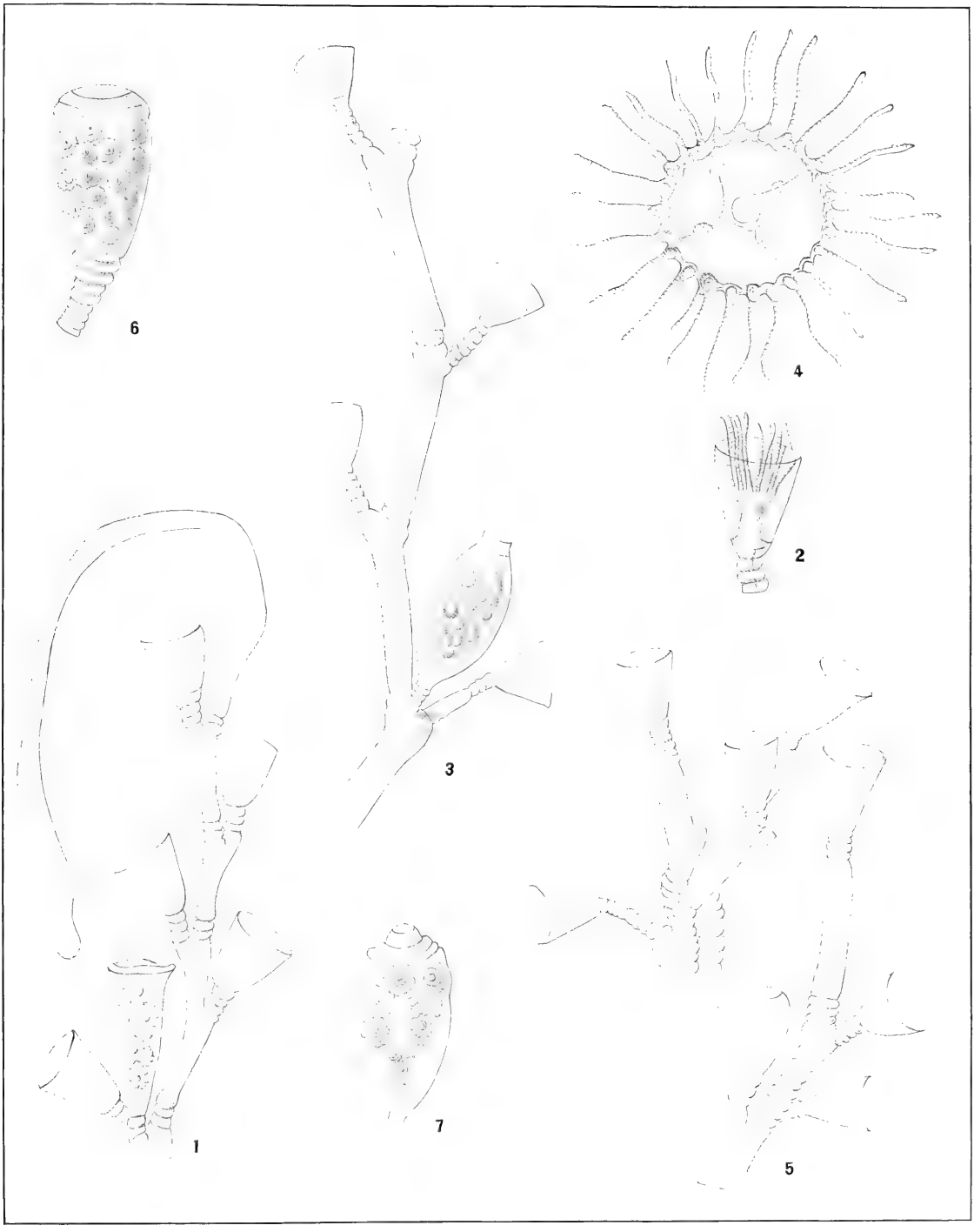

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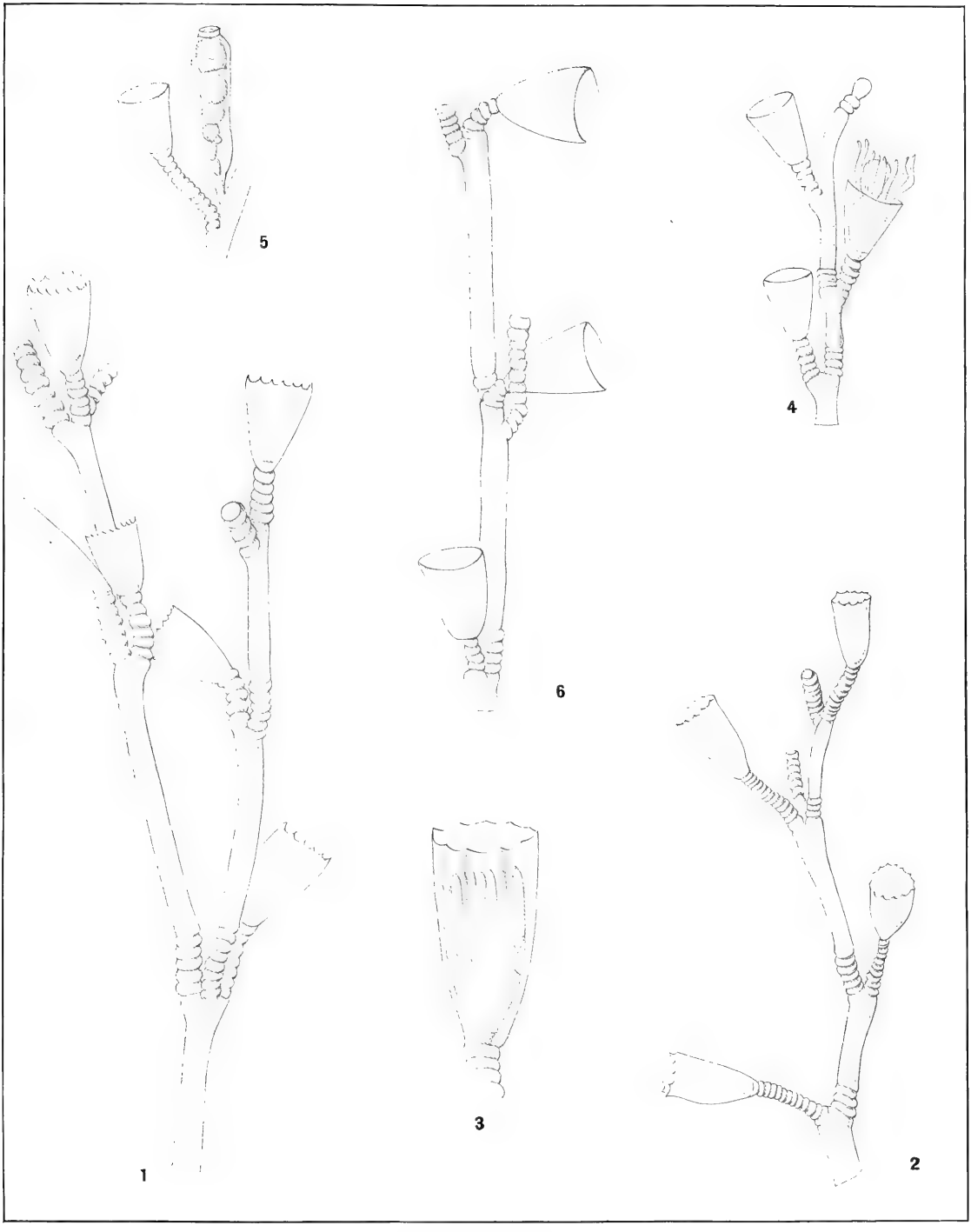

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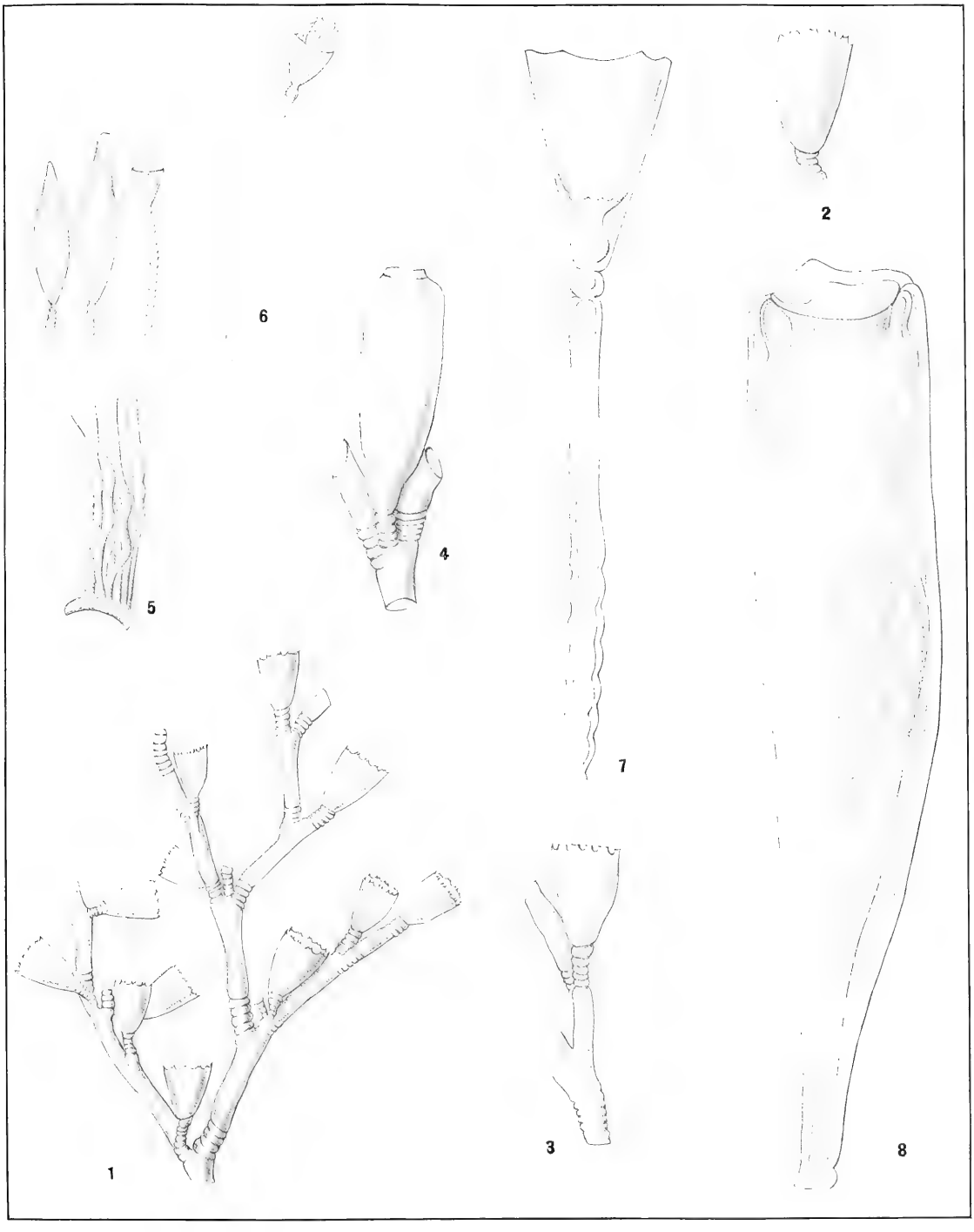

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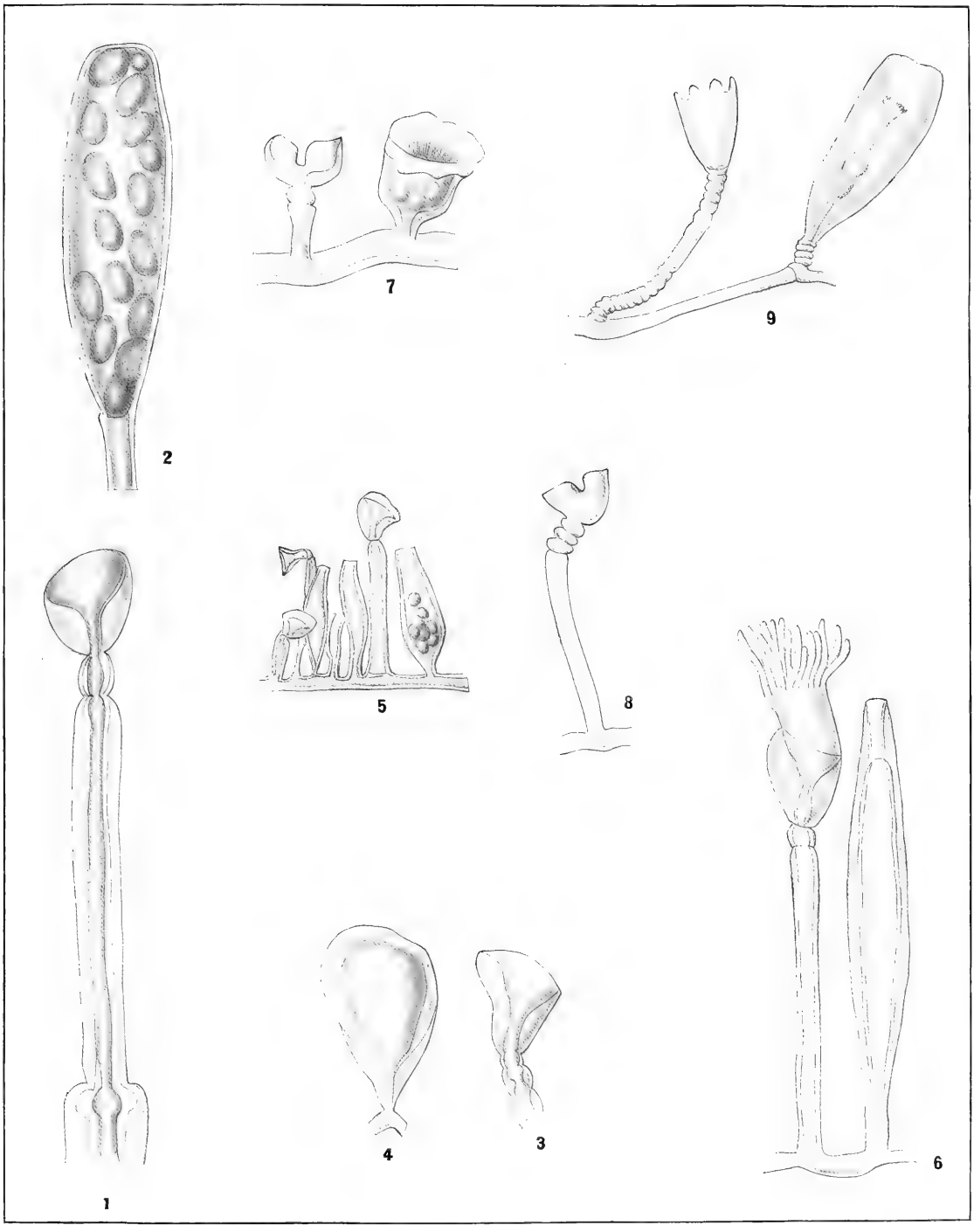

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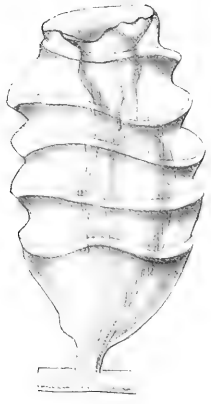

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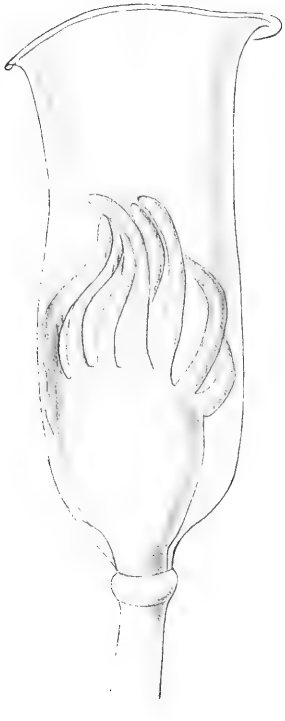

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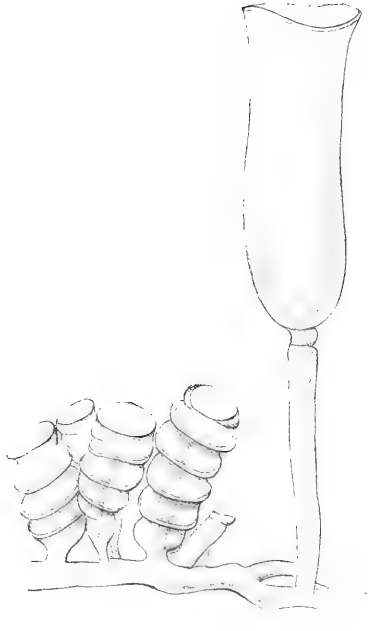

4

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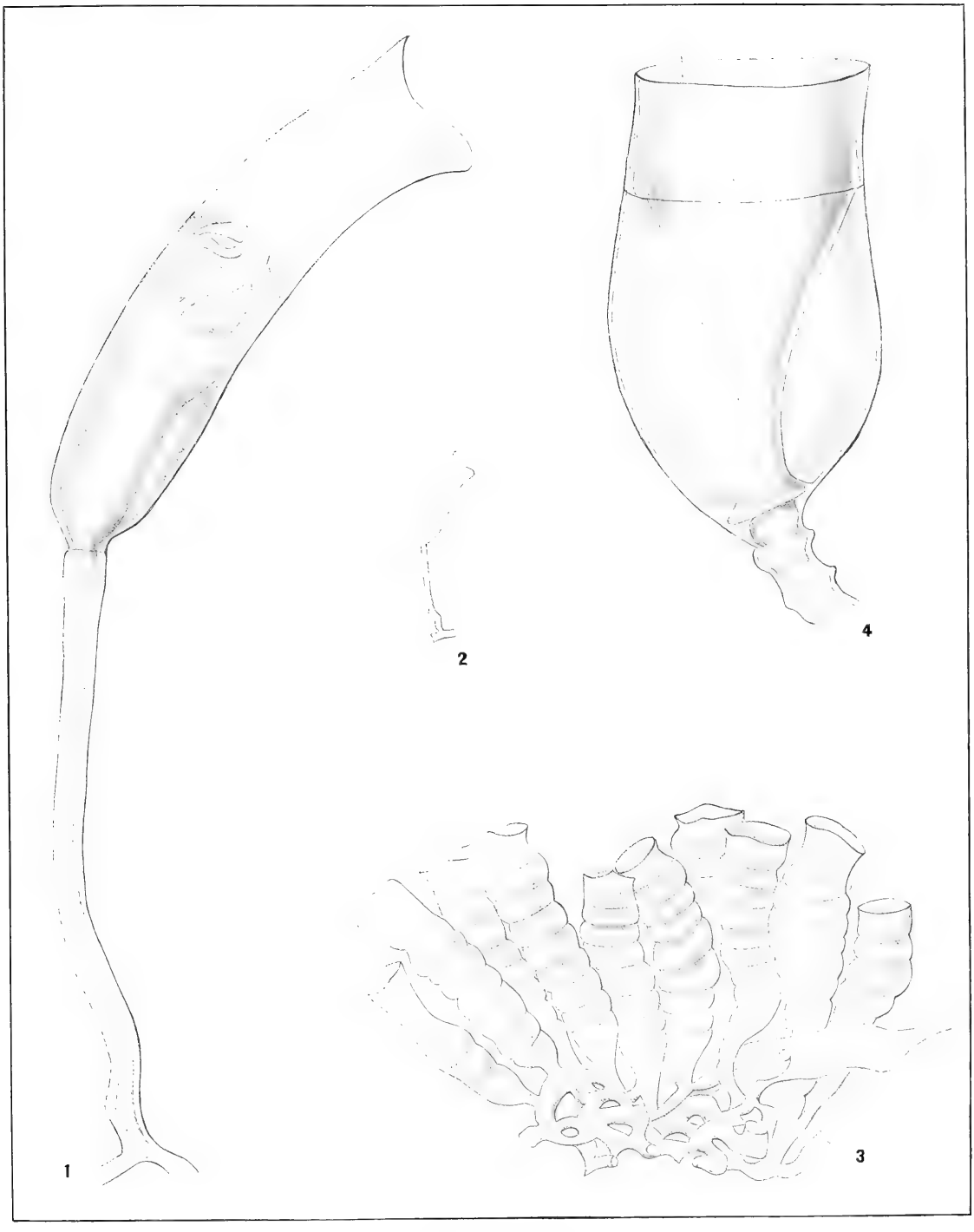
For explanation of plate see page 118.



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[Figures in black-faced type indicate references to formal systematic descriptions or, when following names of authors, to the annotated bibliography.]

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