HYDROIDA FROM ALASKA AND PUGET SOUND.

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The following notes are based on a small collection of hydroids from the Pacific coast and St. Pauls Island, Alaska, sent to the writer by Mr. Trevor Kincaid, of the University of Washington.

A considerable proportion of the material was collected by the Young Naturalist's Society, in connection with the University of Washington, which organized a dredging expedition in Puget Sound in the summer of 1895. So far as the writer is informed, this is the first dredging that has been done in those waters, and it has resulted in a very interesting series of new forms, as well as the extension of the known range of a number of species. As might have been anticipated, the fauna of Puget Sound, beyond the littoral zone, is most closely allied to that of more northern waters, a number of forms collected in Alaska by Mr. W. H. Dall[1] appearing in the material secured by dredging in Puget Sound.

The following table of distribution of the previously described species contained in this collection will at once show the subarctic nature of the hydroid fauna of Puget Sound:

Geographical distribution of Hydroids.

Names of species.	Puget Sound (21) and the present paper.	Great Britain (16) (3).	Norway (16) (25) and Sweden (27.)	Denmark (18) (19) (31) and Heligoland (14).	Spitzbergen (20) and Iceland (16).	Greenland (19).	Alaska (10) (22).	New England (1) (2) (28) (30).	Labrador (16).	California (11) (21).
Syncoryne mirabilis (Agassiz) (2)	+	+	....	....	+	....	....	+	....	....
Campanularia circula Clark (10)	+	....	....	....	....	....	+	....	....	....
Obelia plicata Hincks (16)	+	+	....	....	....	....	....	....	....	....
Calycella syringa (Linnæus)	+	+	+	+	+	+	+	+	....	....
Lafoëa dumosa Fleming	+	+	+	+	+	....	+	+	+	+
Lafoëa fruticosa Sars	....	+	+	+	+	+	+	+	....	....
Lafoëa gracillima (Alder) (3)	+	+	+	....	+	....	+	+	....	....
Halecium halecinum Linnæus	+	+	+	....	+	+	+	+	+	....
Sertularia variabilis Clark [2] (10)	+	....	....	....	....	....	+	....	....	....
Sertularia argentea Ellis and Solander (13)	+	+	+	+	....	+	....	+	+	+
Sertularia tenera Sars (25)	....	....	+	+	+	....	+	....	....	....
Sertularella tricuspidata (Alder) (3)	+	+	....	+	+	+	+	+	+	....
Sertularella rugosa (Linnæus)	....	+	+	+	....	+	+	+	+	....
Thuiaria gigantea Clark (10)	....	....	....	....	....	....	+	....	....	....
Thuiaria turgida Clark (10)	....	....	....	....	....	....	+	....	....	....
Selaginopsis mirabilis (Verrill) (28)	+	....	....	....	....	....	+	+	....	....
Plumularia californica Marktanner (21)	+	....	....	....	....	....	....	....	....	+

Note.—The numbers in parentheses have reference to the bibliography at the end of the paper.

[1] Report on the Hydroids collected on the coast of Alaska and the Aleutian Islands, Proc. Acad. Nat. Sci., Philadelphia, 1876.

[2] This name is also used by S. F. Clarke in connection with an entirely different species. See Bull. Mus. Comp. Zool., XXV, No. 6, p. 75, pls. IV, V.

ANALYSIS OF TABLE.

Species common to Puget Sound and Great Britain	8
Species common to Puget Sound and Scandinavia	5
Species common to Puget Sound and Denmark and Heligoland	4
Species common to Puget Sound and Spitzbergen	6
Species common to Puget Sound and Greenland	4
Species common to Puget Sound and Alaska	8
Species common to Puget Sound and New England	8
Species common to Puget Sound and Labrador	4
Species common to Puget Sound and Pacific coast south of Vancouver	3

Taking Spitzbergen, Iceland, and Greenland together, as representing the Arctic area thus far explored, and regarding the species found there as strictly Arctic species, what may be called the meridional distribution southward is significant:

Arctic species in Puget Sound	7, or 70 per cent
Arctic species in Great Britain	9, or 90 per cent
Arctic species in Norway and Sweden	7, or 70 per cent
Arctic species in Denmark and Heligoland	6, or 60 per cent
Arctic species in Alaska	8, or 80 per cent
Arctic species in New England	10, or 100 per cent
Arctic species in Labrador	[1]5
Arctic species in California	2

The fact that the hydroid fauna of New England is more thoroughly Arctic than that of Great Britain is surprising at first sight, but may be accounted for by the fact that the Arctic current sweeps southward along a great part of the New England coast.

The fact that the Puget Sound fauna is equally related to that of Great Britain, Alaska, and New England would seem to be a strong indication that the distribution has been southward from the Arctic regions along meridional lines.

The sharp differentiation between the fauna of Puget Sound and the region between Vancouver Island and southern California shows, apparently, that the limit of the Arctic fauna is not far south of Puget Sound, a point much more northerly than on the Atlantic side. This is doubtless due to the Japan current on the Pacific coast and the Arctic current on the Atlantic coast.

Among the species collected by Mr. Kincaid and the Young Naturalists' Society, were two which, although previously known, had not before been reported from American coasts, namely, *Obelia plicata* Hincks[2] and *Sertularia tenera* Sars.[3] The latter species not having been previously described in any English publication, so far as I can discover, the accompanying figure (see Plate LXII) and description may be of service.

[1] All the species from Labrador in the list.

[2] British Hydroid Zoophytes, 1868, p. 159.

[3] Bidrag til Kundskaben om Norges Hydroider, p. 20

SERTULARIA TENERA Sars.

(Plate LXII, figs. 1 *A*, *B*.)

Trophosome.—Colony attaining a height of one-half inch. Hydrocaulus growing from a creeping root stalk. Stem flexuous, there being a bend opposite the origin of each branch, divided into regular internodes, each of which bears a branch near its proximal end, and three hydrothecæ, one in the axil of the branch and a subopposite pair on the distal end of the internode. Branches alternate, divided into regular internodes, each of which usually bears four, sometimes two, pairs of subopposite hydrothecæ.

Hydrothecæ flask-shaped, free for half their length, the distal end becoming gradually more slender and terminating in a bilabiate orifice.

Gonosome.[1]—Gonangia ovate with a round aperture, growing from the branches below the bases of the hydrothecæ.

Locality.—St. Paul Island, Alaska. Collected by Mr. Trevor Kincaid.

The collection contained five apparently new species, as described below.

CAMPANULARIA KINCAIDI, new species.

(Plate LXII, figs. 2 *A–C*.)

Trophosome.—Hydrocaulus springing from a creeping root stalk, unbranched, peduncles long, rather slender, with three to ten annulations immediately below the hydrotheca, two to five at the proximal end, and sometimes a few on the middle part.

Hydrothecæ small, sometimes minute, about three times as long as broad, tubular, with parallel sides; aperture armed with seven to ten long, sharply pointed teeth; hydrothecæ fluted lengthwise, the number of flutings corresponding to the number of teeth.

Gonosome.—Unknown.

The amount of variation among individual hydrothecæ is very great, both as to size and the number of teeth and flutings, the smaller and presumably younger ones having but few teeth. The general shape and ornamentation seem quite constant, however. The flutings are very deep and distinct, as indicated in fig. 2 *C*, which represents the outline of the orifice. The hydrothecæ of this species greatly resemble those of *Obelia bicuspidata* Clark[2] in shape, but the teeth of the latter are quite different, and the manner of growth of the two species precludes any likelihood of their being identical. The present form bears some resemblance to *C. hincksii*,[3] but is very much smaller, while the

[1] Not found by the original describer, Sars. It is figured, however, in Hydroiden von Ost-Spitzbergen, Marktanner-Turneretscher, pl. 11, fig. 14; pl. 12, fig. 5. The latter figure shows that the gonangium is provided with an acrocyst.

[2] Report on the Hydroids collected on the coast of Alaska and the Aleutian Islands by W. H. Dall, Proc. Acad. Nat. Sci., Philadelphia, 1876, p. 50, pl. IX.

[3] A Catalogue of the Zoophytes of Northumberland and Durham, Trans. Tyneside Nat. Field Club, 1857, p. 37, pl. II, fig. 9.

teeth are acuminate instead of square. Found growing on specimens of *Hydrallmania distans* collected by the Young Naturalists' Society in Puget Sound, 1895. Named in honor of Mr. Trevor Kincaid, of Washington University, who is doing much to advance our knowledge of the marine fauna of the far Northwest.

CAMPANULARIA LINEATA, new species.

(Plate LXII, fig. 3 *A*, *B*.)

Trophosome.—Hydrocaulus springing from a creeping root stalk and consisting of unbranched pedicels which are more or less annulated throughout and two or three times as long as the hydrothecæ.

Hydrothecæ exceedingly thin and delicate in texture, large, larger than *Clytea johnstoni*, about one and one-half times as deep as wide, sides parallel, bottom rounded in the form of a half sphere, aperture armed with twelve to fourteen evenly rounded teeth. At each interdental space the margin is sharply crimped, the edge of the crimping forming a distinct straight line down the side of the hydrotheca nearly to the bottom.

Gonosome.—Unknown.

Locality.—Puget Sound, found growing on *Halecium geniculatum*. Collected by the Young Naturalists' Society, 1895.

This very large and strikingly ornamented species is probably most nearly allied to *C. hincksii* Alder,[1] from which it differs in its extensively corrugated stem, and the proportions, shape of teeth, and delicate texture of the hydrothecæ.

It will be noticed that the longitudinal lines on the hydrothecæ are very different from the flutings of the preceding species. In the latter the sharp ridges formed by the flutings are continuous with the points of the teeth, while in *C. lineata* the ridges are continuous with the interdental spaces.

The comparative sizes of the two species are correctly illustrated by the figures, which are camera lucida sketches with the same magnification.

This species is also closely related to *C. grœnlandica* Levinsen,[2] from which it differs in the almost exactly parallel sides of the hydrothecæ and more extensively annulated peduncles.

HALECIUM GENICULATUM, new species

(Plate LXIII, figs. 1 *A*–*D*.)

Trophosome.—Hydrocaulus but slightly fascicled proximally, simple for the most part, branching very irregularly with a tendency to an

[1] A Catalogue of the Zoophytes of Northumberland and Durham, Trans. Tyneside Nat. Field Club, 1857, p. 37.

[2] Medusea, Ctenophorer, og Hydroider fra Grönlands Vestkyst, Copenhagen, 1893, p. 26, pl. v, figs. 10–12.

alternate arrangement; branches and branchlets composed of unusually long internodes, each of which gives off a hydrophore at its distal end and shows two or three decided annulations at its proximal end, the annulations on the distal part of the branches being decidedly oblique. The internodes on the ultimate branchlets are arranged so as to give a decidedly zigzag appearance, although this largely disappears as we approach the larger branches and main stem.

Hydrothecæ occur either singly or in pairs at the distal end of each internode; their pedicels are sometimes annulated proximally, but free from annulations on the distal parts of the branches; margins usually moderately everted, but sometimes greatly so, as in *H. beani;* the characteristic circlet of bright dots is very strongly marked. Hydranths large, bodies thick, ovate; tentacles sixteen to twenty.

Gonosome.—Gonangia borne singly in the axils of the branches and branchlets, regularly ovoid in one view, barnacle-shaped in the other; aperture large, terminal. The appearance of the contents of some of them would indicate the possible presence of an acrocyst at a later stage of development.

Locality.—Puget Sound. Collected by the Young Naturalists' Society in the summer of 1895.

This species is most closely allied to *H. labrosum* Alder, from which it differs in the limited amount of fasciculation of the hydrocaulus, in the much longer internodes of the stem, in the comparatively slight amount of annulations throughout, and in the position of the gonangia, which are axillary in *H. geniculatum*, while they are borne in rows on the branches of *H. labrosum.*

The stems in the specimens secured are so invested with parasitic growths that they appear much more compound than they really are. In fact, the fasciculation is very limited and in some specimens not apparent. The specimen also resembles *H. gracile*[1] Bale,[2] which is, however, monosiphonic, and, judging from the figure, not distinctly geniculate.

HALECIUM CORRUGATUM, new species.

(Plate LXIII, figs. 2 *A*, *B*.)

Trophosome.—Hydrocaulus springing from a creeping root stalk, stem simple, not fascicled, and seldom branched, the branching when present having no regularity whatever. Ordinarily the hydrocalus consists of single pedicels supporting hydrothecæ and resembling in manner of growth the simple unbranched campanularians. Pedicels closely and very distinctly annulated or corrugated throughout. Hydrothecæ small, with everted margins and the characteristic necklace

[1] The name *Halecium gracile* is preoccupied, having been used by Verrill in 1874. Invertebrate Animals of Vineyard Sound, 1874, p. 328.

[2] On Some New and Rare Hydroida in the Australian Museum Collection, Proc. Linn. Soc., New South Wales, 1888, p. 759.

of dots; the reduplication of margins is not so extensive as in many Halecidæ, there being seldom more than two to each hydranth.

Hydranth large, nonretractile, with a somewhat slender, slightly gibbous body and about twenty tentacles.

Gonosome.—Not known.

This species is the only one known to me among the Halecidæ in which the parasitic habit has so profoundly modified the manner of growth that all regularity in branching has been lost. It resembles somewhat the *Haloikema lankasterii*[1] Bourne[2] in this respect, but the latter species is not stated to be parasitic and appears to be rather a very simple, sparingly branched form. The complete annulations of the pedicels is also a novel feature.

Locality.—Puget Sound. Collected by the Young Naturalists' Society in 1895. The specimens were found growing on *Sertularella tricuspidata*.

HYDRALLMANIA DISTANS, new species.

(Plate LXIII, figs. 3 *A–D*.)

Trophosome.—Stem long, slender, flexuous; cauline internodes long, nonhydrothecate, each giving forth a branch just above its proximal end; branches alternate, hydrothecate, divided into internodes considerably shorter than those of the main stem, each internode giving origin to an ultimate branchlet or hydrocladium. Hydrocladia alternate, laterally compressed, composed of unequal internodes, each bearing a group of three to five (usually four) hydrothecæ on its anterior aspect.

Hydrothecæ tubular, flattened, curved forward and outward, arranged so as to project alternately to the right and left. Aperture triangular or flattened oval, opening outward and forward, furnished with operecula, only slightly gibbous proximally, the sides being nearly parallel, the top of one reaching not more than about one-third the height of the next above.

Gonosome.—Unknown.

Locality.—Puget Sound. Dredged by the Young Naturalists' Society in the summer of 1895.

This species seems to me to be fairly distinct from *H. falcata*, with which I have directly compared it, being more slender throughout, with hydrothecæ much less crowded, more slender, and having their distal ends more distinctly curved outward and forward. The internodes in *H. falcata* bear groups composed of a considerably greater number of

[1] The genus *Haloikema* appears to me to be founded on insufficient characters, embodying no really new features, according to the author's description and the type specimen which I have examined. The hydranths are more or less nonretractile in many species of the old genus *Halecium*. The simple stem is found in *H. tenellum* Hincks, and the manner of growth strongly resembles that of a young specimen of the last-mentioned species, from which, however, it is very well separated by other characters.

[2] Notes on the Hydroids of Plymouth, Journ. Marine Biol. Assoc., I, pp. 395–398.

hydrothecæ than do those of *H. distans*. In *H. falcata* each hydrotheca attains a level above the middle of the next one above it, while in *H. distans* it only attains the level of one-third the height of its successor.

Through the courtesy of Mr. Charles Fuchs, of San Francisco, I have obtained a copy of the original description and figure of *Hydrallmania (Plumularia) franciscana* Trask.[1]

It appears from both the original descriptions and the figure that *H. franciscana* differs from *H. falcata* and *H. distans* in having the hydrothecæ distinctly flask-shaped and much narrowed at their distal ends, being, according to the figure, more than twice as wide near the proximal end as near the aperture. *H. franciscana* approaches *H. falcata* and differs from *H. distans* in having the hydrothecæ closely crowded together on the front of the stem.

LAFOËA DUMOSA Fleming.

Specimens of this species collected in Puget Sound are provided with well-developed gonosomes. The history of the discovery of the identity of this structure and the genus *Coppinia* of Authors is an exceedingly interesting one. The Lafoëidæ have been known and studied by several generations of naturalists, who over and over again have scanned abundant material for the long sought reproductive bodies, and all in vain until Levinsen announced the final clearing of the mystery and the discovery of the gonosome of one species at least, *L. fruticosa*.[2]

The story in brief is this: Dalyell in 1847–48 published a work entitled "Rare and Remarkable Animals of Scotland," in which he described under the name *Sertularia arctica* a remarkable form of hydroid which appeared as a parasitic growth forming an encrusting mass on the other hydroids. Hincks[3] makes this species the type of the family Coppinidæ and genus *Coppinia*, characterized as follows:

> Zoophyte consisting of a number of long tubular hydrothecæ crowded closely together and united by an adherent cellular mass, which involves the lower portion of them, the upper portion remaining free; ova developed in the cavities of the cellular mass, and escaping as planulæ; polypites cylindrical and very extensile. The ova are produced in the cavities or compartments which pervade the common connecting substance, and give a tessellated appearance to its upper surface.[2]

Coppinia is described as follows by Allman:[4]

> In this singular hydroid the hydrothecæ and gonangia spring directly from a creeping retiform hydrorhiza, while the gonangia, which are very numerous, become closely adherent to one another by their sides, so as to form with the proximal portion of the hydrothecæ and with the hydrorhiza a continuous encrusting basis spreading over the surface to which the hydroid had attached itself. Each Gonan-

[1] Proc. Cal. Acad. Nat. Sci., I, p. 113, pl. IV, fig. 3.

[2] Meduser, Ctenophorer, og Hydroider fra Grönlands Vestkyst., Copenhagen, 1893, p. 20. pl. VII, figs. 2, 3.

[3] British Hydroid Zoophytes, p. 218.

[4] Monograph of the Gymnoblastic or Tubularian Hydroids, Ray Society, 1870, 1871, 1872, pp. 54, 55.

gium in the female contains a single sporosac with a single ovum; and this ovum, after a time, becomes extra-capsular in order to undergo within an acrocyst some of the earlier stages of its development.

This author also says *Coppinia* is found on *Sertularia abietina* and *Hydrallmania falcata* from deep water.

The Hydranths are furnished with a verticel of filiform tentacles disposed around the base of a short conical hypostome. They are, however, often imperfect and apparently destitute of mouth and tentacles.

In 1865, under the name *Lafoëa calcarata*, Alexander Agassiz[1] describes a species which produced medusæ. It is almost certain, however, that this species would not be included in the family Lafoëidæ as at present understood.

In 1875 Canon Norman[2] described a new genus, *Scapus*, as follows:

Zoophyte in the form of a spongious mass rolled in cylindrical form around the stems of branching Hydrozoa (*Acryptolaria*) and consisting of a series of somewhat closely packed subquadrate hydrothecæ, closed in above, except at the center, where the hydrotheca projected in the form of a short, simple cylindrical horny tube.

In describing the species *Scapus tubulifer*, the author says that these "hydrothecæ" are packed closely together, and that they are "bottle-shaped, expanded below and forming the mass, and contracted above into narrow projecting tubes." If Canon Norman's interpretation is correct, we have here the only "bottle-shaped" hydrothecæ known to me. The figure given would indicate that the specimen upon which it was based was dried. If this is so, it might be hard to determine whether the bottle-shaped structures were hydrothecæ or gonangia. In view of later discoveries, it seems not unlikely that the latter is the case. Indeed, Marktanner-Turneretscher does not hesitate to call them gonangia.

Norman hat unter dem Namen *Scapus tubulifer* ein anderes Aggregat von Gonotheken beschrieben, welch er auf *Acryptolaria exserta* angetroffen hat; es besteht aus lauter Gonotheken, zwischen denen keine Hydrotheken stehen.[3]

Allman, writing in 1877, in discussing *Cryptolaria conferta*[4] says:

On the branches of the specimen here described there occurred here and there certain very remarkable bodies the real nature of which I have not succeeded in placing beyond doubt. They are of an irregular fusiform shape, and at the spots where they occur surround the branch like minute sponges. A closer examination shows them to consist of a multitude of flask-shaped, apparently chitinous receptacles, adnate to one another by their sides, and springing by a narrow base from an irregular network of tubes which encircle the branch. The distal extremity of each is prolonged into a free neck-like extension, which terminates in an even circular orifice.

[1] North American Acalephæ, Illustrated Catalogue, Mus. Comp. Zool., 1865, No. II, p. 124.

[2] Submarine Cable Fauna, Ann. and Mag. Nat. Hist., 4th ser., XV, p. 173, pl. XII, fig. 3.

[3] Hydroiden von Ost-Spitzbergen, Zool. Jahrb., VIII, Abth. f. Syst., p. 403.

[4] Report of the Hydroida collected during the Exploration of the Gulf Stream, Mem. Mus. Comp. Zool., 1877, No. 2, V, p. 18.

Each receptacle gives exit after a time to a single spherical body, which is retained for a period in an external membranous sac connected by a narrow neck to the orifice of the flask-shaped receptacle.

It is scarcely possible not to recognize in these bodies an assemblage of true hydroid gonangia.

The author goes on to say that these bodies closely resemble a colony of *Coppinia* with the hydrothecæ wanting, and adds:

Another view, however, suggests itself. May they not represent the gonosome of the hydroid with which they are associated? In favor of this interpretation it may be urged that nothing that can be regarded as a gonosome occurs in the specimen, and that if we look upon them as merely a parasitic hydroid we should have in these bodies a gonosome without its correlative trophosome. Further, the tubular base from which the gonangia spring forms a close irregular plexus which embraces the fascicled stem of the supporting hydroid, and I believe I have traced a communication between this plexus and the cavities of the outermost tubes of the stem.

Allman, however, does not feel sure of this interpretation, and leaves the question to be settled by further research.

Two years later S. F. Clarke[1] in discussing *Cryptolaria longitheca* says:

Centered about the upper portions of the stem of one of the finest specimens were a number of peculiar bodies, very like in character to the similiar bodies described by Professor Allman as occurring on the stems of *C. conferta*. They are polygonal in form, largest at the distal end, tapering to the base, crowded so closely together that the walls of the adjoining bodies are in contact throughout their length, and are provided with a small tubular orifice arising from the center of the distal end; at the base they are connected by branching stolons, but I was unable to make out any connection between these remarkable bodies and the stems of *Crytpolaria* upon which they were growing.

The fact of these two slightly different forms of these peculiar colonies having been found upon these two closely allied forms of *Cryptolaria* is an argument in favor of the suggestion of Professor Allman, that these bodies are the gonangia of the species of *Cryptolaria* to which they are attached, and that there may exist some communication between them as yet undiscovered. I worked with great care on sections, transverse, longitudinal, and oblique, of cleared and stained specimens, but was unable to detect any connection between them.

In 1888 Allman again refers to the matter in his *Challenger* report, and concludes that he was mistaken in his previous surmise. He says:

It is now evident that the structure in question is an independent growth, having nothing to do with the gonosome of the hydroid on which it had taken up its abode.[2]

In 1893, in an excellent systematic discussion of the family Campanularidæ, Levinsen reopens the question with some very positive testimony.[3] Speaking of *Coppinia arcta* the author claims that Allman is mistaken in describing the hydranths as often rudimentary and without tentacles, Allman's figure showing that undeveloped instead

[1] Report of the Hydroida collected during the Exploration of the Gulf Stream, Bull. Mus. Comp. Zool., No. 10, V, p. 244.

[2] Report on the Hydroida dredged by H. M. S. *Challenger*, 1888, Pt. 2, p. 38 (note).

[3] Meduser, Ctenophorer, og Hydroider fra Grönlands Vestkyst., Copenhagen, 1893, pp. 20–23, pl. VII, figs. 2, 3.

of rudimentary hydranths were described. Hincks also is mistaken in describing the hydrothecæ as operculate. Continuing, Levinsen says:

I, as well as Allman and Hincks, have found these bodies on *Hydrallmania falcata* and *Diphasia abietena*, but only on such specimens as are overgrown with *Lafoëa dumosa*, or *Filellum serpens*. I have also found them on *Lafoëa fruticosa* and *Grammaria abietina*. Just such species with which no one has heretofore found gonophores.

On the other hand, the author regards it a suspicious circumstance that in *Coppinia* the gonangia largely predominate. The importance of this discussion of Levinsen's lies, however, largely in the following announcement:

A closer investigation shows, however, that the network from which *Coppinia* springs is connected with the stem or tube of that of *Lafoëa*, *Filellum*, or *Grammaria*, together with which it (*Coppinia*) appears.[1]

In *Lafoëa fruticosa* the gonangia, as well as the curiously modified hydrothecæ, arise from the superficial peripheral tubes which form a richly branched network. It follows, therefore, that *Coppinia arcta is simply the gonosome of species of Lafoëa, Filellum, and Grammaria.*" [The emphasis is Levinsen's.]

The figure given by this author shows a distinct connection between the modified hydrothecæ of *Coppinia* and the stem tubes of *Lafoëa fruticosa*, but does not indicate very plainly a similar connection between the gonangia of *Coppinia* and the stem tubes of *Lafoëa*.

Here, then, we have a remarkable disagreement between competent authorities. Allman, after proposing the theory that *Coppinia* is simply the gonosome of the species on which it grows, is forced upon further research to distinctly abandon it. Clarke, with the same theory in mind, makes a very careful study of material sectioned and stained, and is unable to find any real connection between *Coppinia* and the stem tubes of the species on which it grows. Levinsen announces confidently that he has demonstrated such a connection and the theory originally proposed by Allman as well.

Among some material collected in Puget Sound by the Young Naturalists' Society of Seattle were a number of specimens of *Lafoëa dumosa* with the so-called *Coppinia* growing in dense masses on the stems. The present writer gladly embraced the opportunity to carefully investigate the question so long in dispute regarding the identity of *Coppinia* with the gonosome of the species upon which it grows. This investigation was completed and the drawings made before I had seen any account of Levinsen's researches, and therefore has the merit of an independent discovery of the real nature of *Coppinia*, together with interesting details not mentioned by Levinsen or other previous writers.

A number of transverse sections were made of the compound stem of the *Lafoëa dumosa* and the encrusting growth of so-called *Coppinia*. These sections were double stained, and upon examination were found to reveal the following facts:

First. There are well-defined lateral connections between the axial

[1] En nærmere Undersøgelse viser nu, at det Netværk, hvorfra *Coppinia* udgaar, hænger sammen med Stammen eller Rørene af den *Lafoëa*, *Filellum*, eller *Grammaria*, sammen med hvilken den optræder.

and peripheral tubes of *Lafoëa*. (Shown between *a. t.* and *p. t.*, Plate LXIV, fig. 1.)

Second. There are direct connections between the sarcodal contents of the peripheral tubes of *Lafoëa* and the modified hydrothecæ of *Coppinia*. (Shown between *p. t'.* and *m. h'.*, Plate LXIV, fig. 1.)

Third. There are indirect connections between the peripheral tubes of *Lafoëa* and the modified hydrothecæ of *Coppinia* through the mediation of the mass of tubes of *Coppinia* which surround the tubes of *Lafoëa*. (*P. t''.* to *m. h''.*, through *t. b.*, Plate LXIV, fig. 1.)

Fourth. There is a direct cross connection of sarcode between the axial tubes of *Lafoëa* and the gonangia of *Coppinia* directly through (in a horizontal plane) the axial tube of *Lafoëa*. (Plate LXIV, fig. 2.)

Fifth. There is an indirect connection of sarcode between the peripheral tubes of *Lafoëa* and the gonangia of *Coppinia* through the mediation of the network of tubes of *Coppinia* surrounding the fascicled stem of *Lafoëa*. (Shown in Plate LXIV, fig. 1, between *g'*, *tb'*, and *p. t''.*)

My sections therefore completely demonstrate that the gonangia of *Coppinia* are nothing more nor less than the gonangia of *Lafoëa dumosa*, and that the hydrothecæ of *Coppinia* are simply modified hydrothecæ of *Lafoëa dumosa*. Further than this, normal hydrothecæ containing normal hydranths of *Lafoëa* are sometimes interspersed among the gonangia. (Plate LXIV, fig. 1*h*.)

A still further discovery, however, was made through the study of these sections. A careful examination showed that interspersed among the female gonangia containing ova were male gonangia containing spermaries in which were mature spermatozoa. (Plate LXIV, figs. 1*s*, 4.)

The male gonangia were much more slender than the female and very much less numerous, the proportion of male to female being about one to twenty. The only contents that could be made out in each male gonangium was a long saclike sperosac or spermary containing mature spermatozoa.

Bisexual colonies are rare among the hydroida,[1] and, so far as the present writer knows, have not hitherto been found in campanularian forms.

The large, strongly modified hydrothecæ do not show the characteristic hydranths of *Coppinia* in the part of the specimen included by the sections examined, but are closed at the end and show no indication of tentacles. Further up on the stem these structures intergrade with other hydrothecæ, which are open at the end and contain hydranths with tentacles, such as those usually described as pertaining to *Coppinia*.

[1] Allman says (Monograph of the Gymnoblastic or Tubularian Hydroids, Ray Society, 1870, 1871, 1872, p. 148), "As an almost universal rule, then, the Hydroida are diœcious; in other words, every colony is unisexual." The only exceptions mentioned by this author are *Hydra, Plumularia pinnata,* and *Dicoryne conferta.*

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[1] It appears that Dr. Clarke originally spelled his name "Clark" and added the final *e* in his later papers. The present author has always written the name as spelled on the title page of the paper in question.

EXPLANATION OF PLATES.

Plate LXII.

Fig. 1. *Sertularia tenera* Sars.
A. Portion of colony with gonangium.
B. A pair of hydrothecæ, enlarged.
2. *Campanularia kincaidi* Nutting.
A. Portion of colony showing characteristic hydrothecæ.
B. A single unusually large hydrotheca.
C. Outline of aperture.
3. *Campanularia lineata* Nutting.
A. Hydrotheca with pedicel.
B. Side view of another hydrotheca.

Plate LXIII.

Fig. 1. *Halecium geniculatum* Nutting.
A. Portion of colony showing hydranths and gonangium.
B, *C*, *D*. Single gonangia.
2. *Halecium corrugatum* Nutting.
A. Portion of a colony growing on *Sertularella tricuspidata*.
B. A single hydrophore, enlarged.
3. *Hydrallmania distans* Nutting.
A. Side view of branch showing arrangement of hydrothecæ.
B. Anterior view of branch.
C. Anterior view of a pair of hydrothecæ, enlarged.
D. Single hydrotheca, side view, showing aperture.

Plate LXIV.

Fig. 1. Cross section of stem and gonosome of *Lafoëa dumosa*.
a. t. Axial tube of colony.
g., *g.'* Female gonangia.
h. Hydrotheca containing a normal hydranth.
m. h., *m. h.*,' *m. h.*'' Greatly elongated modified hydrothecæ.
o. Ovum.
p. t., *p. t.*,' *p. t.*'' Peripheral tubes of main stem.
tb., *tb.'* Tubules or secondary tubes forming a network around the peripheral tubes, and connecting the latter with the gonangia and modified hydrothecæ.
s. Male gonangium containing the spermary.
2. Part of a section similar to the above, showing the sarcodal connection between the axial tube and the gonangium.
ax. Axial tube.
bs. Blastostyle of the female gonangium.
c. t. Connecting tubule between the gonangium and the peripheral tube,
g. The female gonangium.
ov. Ovum.
p. Peripheral tube traversed by sarcodal connection between the blastostyle and axial tube.
3. A single female gonangium, enlarged.
bs. Blastostyle.
ov. The single developing ovum.
4. A single male gonangium, enlarged.
s. Spermary.

Fig. 1.

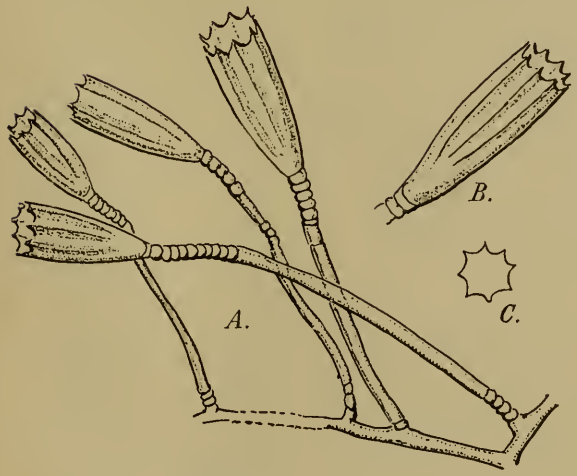


Fig. 2.

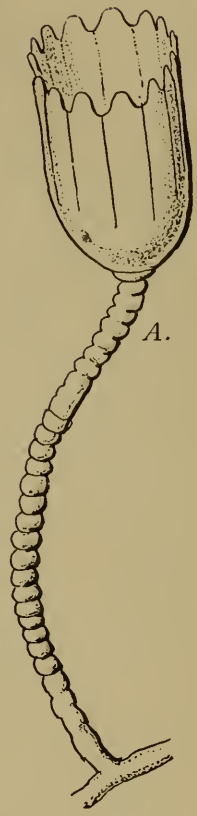
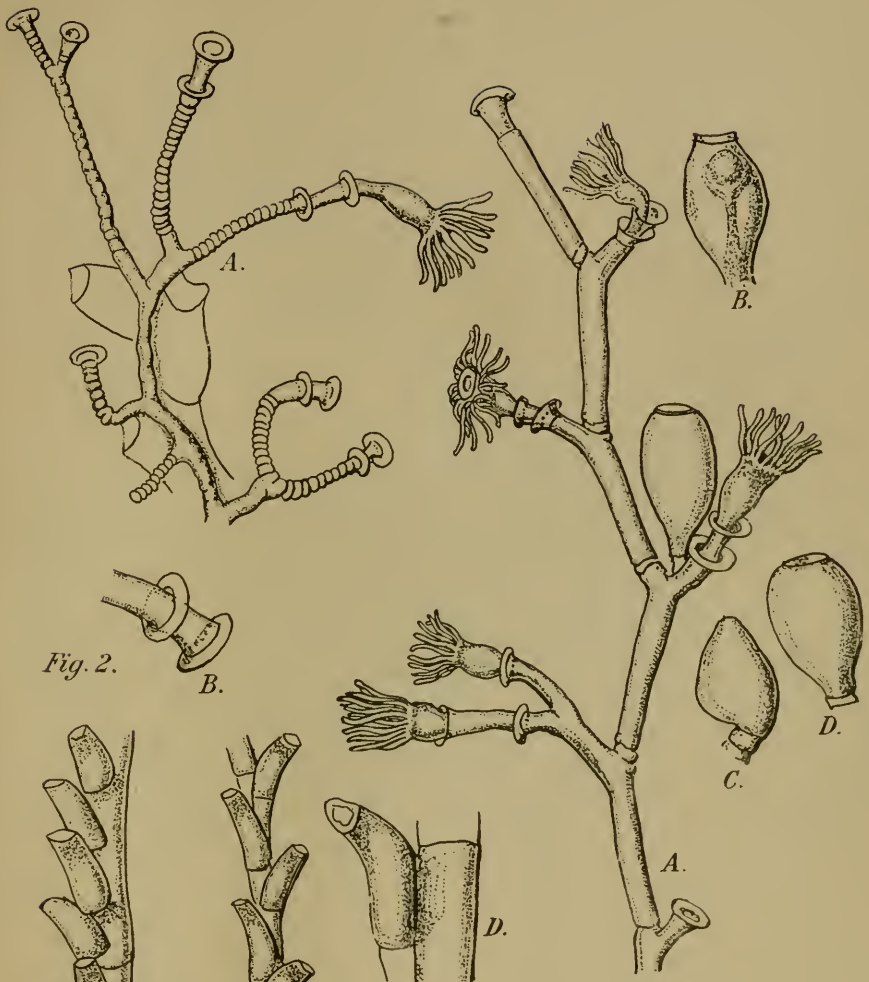


Fig. 3.

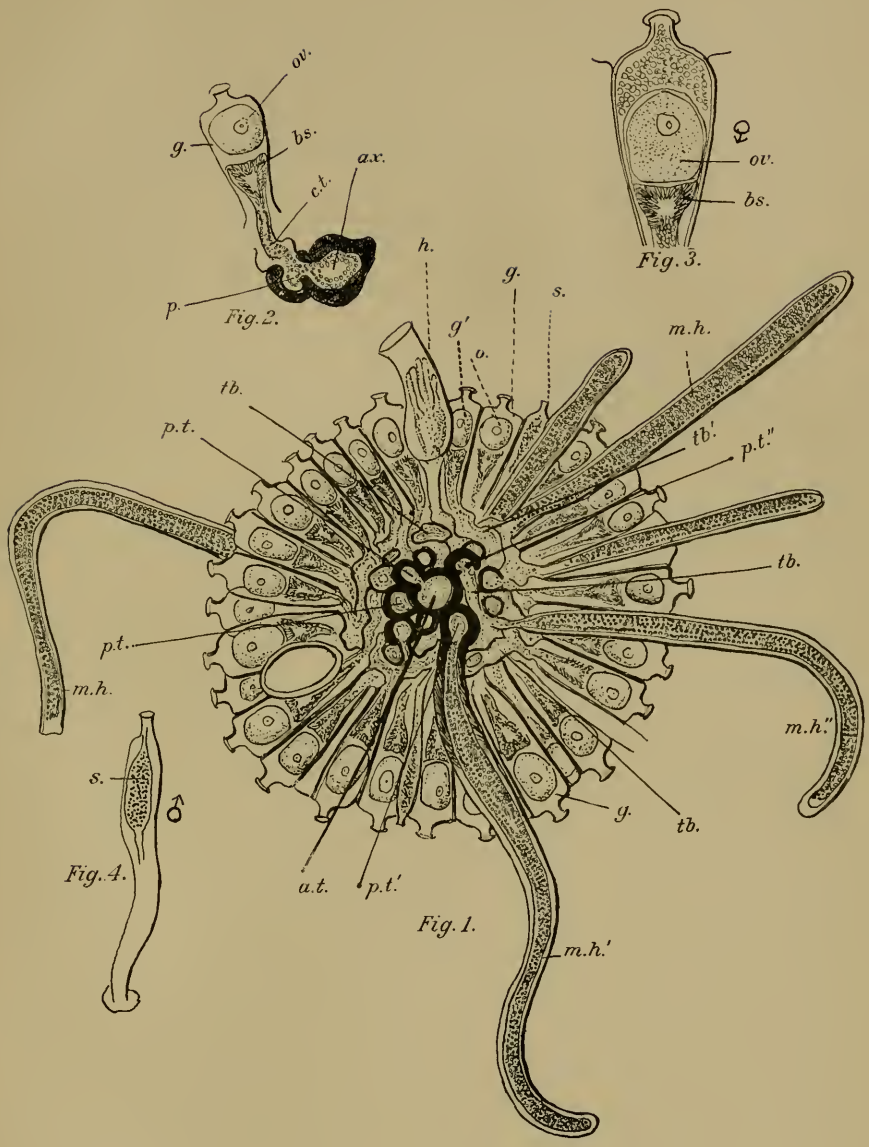
NEW HYDROIDA FROM THE PACIFIC COAST AND ALASKA.

FOR EXPLANATION OF PLATE SEE PAGE 753.



NEW HYDROIDA FROM PUGET SOUND.

FOR EXPLANATION OF PLATE SEE PAGE 753.



THE GONOSOME OF LAFOËA.

FOR EXPLANATION OF PLATE SEE PAGE 753.