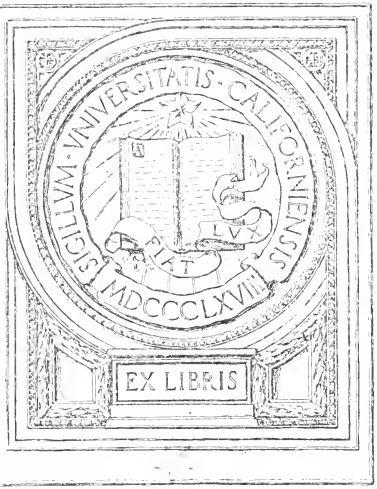


Pamphlets by

California Authors.

Scientific.

Volume 4

PROCEEDINGS

OF THE

WASHINGTON ACADEMY OF SCIENCES

VOL. II PP. 315-340. OCTOBER 10, 1900

PAPERS FROM THE HARRIMAN ALASKA EXPEDITION.

VI.

THE BRYOZOA.

BY

ALICE ROBERTSON.

[Pls. XIX-XXI.]

WASHINGTON, D. C.

PUBLISHED BY THE ACADEMY

1900

PROCEEDINGS

OF THE

WASHINGTON ACADEMY OF SCIENCES

VOL. II, PP. 315–340. OCTOBER 10, 1900.

PAPERS FROM THE HARRIMAN ALASKA EXPEDITION.

VI.

THE BRYOZOA.

[PLATES XIX-XXI.]

BY ALICE ROBERTSON.

THE following report is based on the Bryozoa obtained by Professor W. E. Ritter, of the University of California, while in Alaska as a member of the Harriman Alaska Expedition during the months of June and July, 1899. The localities at which collections were made are: Muir Inlet, Garforth Island, Sitka, Juneau, Yakutat Bay, Prince William Sound, Kadiak, and Fakir Islet. There are in all thirty-seven species, five of which are new. These contain representatives of the three divisions of the Ectoprocta, one of the Entoprocta, and one of the fresh-water forms. I have adopted the system of classification which is given by Hincks ('80). As may be seen by perusal of the list of species, the Bryozoan fauna of Alaska is essentially arctic, consequently the work of Smitt ('65–'68), who has made such a complete study of northern forms, has been of invaluable assistance. In order not to crowd the text unnecessarily, and at the same time to make clear what form is intended, the synonymy includes, as a rule, only the specific names of these two writers, and the foreign distribution is given mainly upon their authority.

The only work which has heretofore been published on the Bryozoa of Alaska waters is that of Mr. Hincks in the report on the Polyzoa of Queen Charlotte Islands ('82–'84). Many species are common to Alaska, Queen Charlotte Islands, Puget Sound, and California, and under local distribution I have included all the localities on the western coast of North America, where I know, either from personal knowledge, or on the authority of others, that a particular species exists.

Class **BRYOZOA** Ehrenberg.

Group *ECTOPROCTA* Nitsche.

Order *GYMNOLÆMATA* Allman.

Suborder *CHEILOSTOMATA* Busk.

Family *EUCRATIIDÆ*.

GEMELLARIA Savigny.

GEMELLARIA LORICATA Linnæus.

Gemellaria loricata Hincks ('80), pl. III, figs. 1–4.
Gemellaria loricata Smitt ('67), pl. XVII, fig. 54.

Habitat.—Very abundant on the rocks at low tide.

Local distribution.—Juneau, 20 fms.; Orca, Prince William Sound; Yakutat; Virago Sound, Queen Charlotte Islands.

Foreign distribution.—Scandinavia; Spitzbergen, 3–10 fms.; Greenland; Hammerfest; Havösund; Labrador; St. George Banks, 50–85 fms.; White Sea; Ostend; Britain, from littoral region to deep water, 80 fms.

Family *CELLULARIIDÆ*.

MENIPEA Lamouroux.

MENIPEA TERNATA Ellis & Solander.

Menipea ternata Hincks ('80), pl. VI, figs. 1–4.
Cellularia ternata Smitt ('67), pl. XVI, figs. 10–14.

Habitat.—In considerable quantity growing with *Bugula* upon *Styela* and upon the rocks.

Local distribution.—Yakutat, Puget Sound; Virago Sound, Queen Charlotte Islands.

Foreign distribution.—Spitzbergen, chiefly in the littoral region; Hammerfest; Lofoten; White Sea; Jütland, 10 fms.; Belgium; Great Britain.

As compared with specimens from Northumberland, England, those from the Pacific Coast are stouter and more vigorous. By measurement the internodes are found to be shorter and slightly wider. Thus, in the Yakutat form the average length of an internode consisting of three ~~zœcia~~ is 42 mm., its width from tip to tip of the avicularia 33 mm.; in the English form the length of an internode is 52 mm., its width 28 mm.

MENIPEA TERNATA Ellis & Solander.

B. forma *gracilis* SMITT ('67), pl. XVI, figs. 16–24.

Habitat.—In considerable quantity on the rocks at low tide.

Local distribution.—Orca, Prince William Sound. This elongated form of *Menipea ternata* is also reported from Cumshewa Harbor, Queen Charlotte Islands.

Foreign distribution.—Spitzbergen at 200 fms; Franklin-Pierce Bay; Barents Sea.

The ~~zœcia~~ of this species are very much elongated, and internodes consisting of three ~~zœcia~~ range from 60 to 90 mm. in length. Many internodes, however, consist of five or seven zœcia, and it is upon these that the ~~œcia~~ seem to occur. The avicularia, both lateral and frontal, may be present or absent. In many instances in which an internode consists of more than three ~~zœcia~~, a frontal avicularium appears below the aperture of each. In such cases, lateral avicularia are sparingly developed. One may be found on the lower zœcia, but not, as a rule, upon all. When œcia occur, they fill that portion of the next upper ~~zœcium~~ which is below the aperture, and the frontal avicularia occupy a narrow space between the œcium and the edge of the aperture. In some cases they seem to be sessile upon the ~~œcia~~.

MENIPEA ERECTA sp. nov.

(Pl. XIX, figs. 1, 2.)

Habitat.—On an ascidian.

Local distribution.—Sitka, Alaska, 10 fms.

Zoarium dichotomously branched, internodes usually consisting of 5 to 7 zœcia. Zœcia biserial, alternate, narrowed below; aperture (fig. 1, *ap.*) broadly ovate, occupying two-thirds of the front; margin (*m.*) raised, crenulate, with two blunt spines (*sp.*) on the upper outer angle; operculum (*op.*) a flattened spine; sometimes growing broad, when it is frequently more or less bifid. Lateral avicularia wanting; frontal avicularia (*f. a.*) few. Œcia (*œ.*) large, globose,

more or less striated. Radical fibers (fig. 2, *r.f.*) developed mainly upon the lower zœcia.

The general habit of this colony resembles that of Scrupocellaria. The branches are very calcareous and erect, tending to flare outward. They differ in this respect from the preceding species whose branches curl inward. The number of zœcia in an internode is five or seven as a rule, but there is considerable variation in this regard. Toward the middle of a branch the number increases and 9, 11, or 13 are frequently found. In one case 21 zœcia occur before the internode bifurcates. On the lowest one or two zœcia of a colony, very small lateral avicularia may sometimes be detected. Frontal avicularia appear only at infrequent intervals. The zœcium situated at the bifurcation of a branch usually possesses one below the aperture (fig. 1, *ap.*). They appear occasionally upon other zœcia also, but no constancy is maintained.

This species is closely allied to *M. duplex* Smitt ('67), and to *M. jeffreysii* Norman ('68), in its habit of growth. There are differences in zœcial characters, however. Comparing pl. XIX, fig. 1, with pl. XVI, fig. 25, Smitt ('67), it will be seen that this form differs from *M. duplex* in its possession of opercula and spines, and in its lack of avicularia. In comparison also with the original drawing, Norman ('68), or with the figures given by Hincks ('80) it differs from *M. jeffreysii* in the number of spines, in the lack of avicularia, and in the very different shape and inclination of the opercula.

SCRUPOCELLARIA Van Beneden.

SCRUPOCELLARIA SCABRA Van Beneden.

(Pl. XIX, figs. 3, 4.)

Scrupocellaria scabra HINCKS ('80), pl. VI, figs. 1, 2. HINCKS ('89), pl. XXI, fig. 1.

Cellularia scabra SMITT ('67), pl. XVII, fig. 29.

Habitat.—Growing entangled in seaweed.

Local distribution.—Kadiak.

Foreign distribution.—British coast; North Sea; Scandinavian and Arctic seas; Spitzbergen; Davis Strait; Greenland; Reykjavik Harbor; Madeira. Form without vibracula: Greenland; St. Lawrence.

The form of *S. scabra* which occurs in this collection lacks all traces of vibracula. These structures are usually considered a characteristic mark of this genus, nevertheless there seems to be sufficient reason for placing it here, at least provisionally.

The habit of growth is decidedly scrupocellarian. The branches are stiff and calcareous, and the internodes rather long, varying from 3 or 5 in the lower part of a colony, to 12 or 15 in the upper. Both lateral and frontal avicularia are developed upon each zœcium and are of large size (fig. 3, *lat. f.a.*). On those internodes where œcia (*œ.*) occur the frontal avicularia are pushed to one side and form an irregular line between the two series of cells. Commonly but one spine (*sp.*) is developed at the upper outer angle. The opercula (*op.*) vary from a simple, spinous process to a broad, sub-triangular structure marked with the peculiar hand-like sculpturing which characterizes this species. The zœcium which is situated at the bifurcation of a branch possesses a short spine at the top, and in the particular case represented, the aperture is partially covered by two opercula instead of an operculm and a spine, as is the usual case (*op.*, *op'*). In comparison with a specimen from Norway, the appearance of the colony is more robust, the spines are shorter and thicker, and the zœcia slightly longer and broader. Fig. 4 represents the dorsal surface. Upon the zœcia of the lower portion of the colony, radical fibers are developed, but no vibracula are visible.

According to Mr. Hincks, vibracula are of uncertain occurrence in this species. Such as are found are of a rudimentary character, and he remarks: "They are commonly wanting on many of the cells." It is possible that in a larger quantity of material some zœcia may be found upon which vibracula or traces of such structures are present. This form differs from the normal in this one particular only. Both Hincks and Jullien ('82) have described as *S. scabra* a form which not only lacks vibracula, but differs from the type in other important respects, and for the present I shall be guided by the precedent they have set.

CABEREA Lamouroux.

CABEREA ELLISII Fleming.

Caberea ellisii HINCKS ('80), pl. VIII, figs. 6–8.
Caberea ellisii SMITT ('67), pl. XVII, figs. 55–56.

Habitat.—Found growing on a shell dredged at 20 fms.; obtained also on the rocks at low tide.

Local distribution.—Juneau; Orca, Prince William Sound; Cumshewa Harbor, Queen Charlotte Islands; Vancouver Island.

Geographical distribution.—Labrador and Maine; St. George Banks, 28–150 fms.; Greenland, 100 fms.; Iceland, 15–20 fms.; Scandinavia and Finmark, 50–80 fms., not uncommon; Shetland, 40–70 fms., abundant; Orkneys; off the coast of Antrim, 62–72 fms.

Family *BICELLARIIDÆ*.

BUGULA Oken.

BUGULA MURRAYANA Johnston.

Bugula murrayana HINCKS ('80), pl. XIV, figs. 2–9.
Bugula murrayana SMITT ('67), pl. XVIII, figs. 19–22.

Habitat.—Abundant on the rocks.

Local distribution.—Orca, Prince William Sound; Juneau; Houston-Stewart Channel and Virago Sound, Queen Charlotte Islands; Puget Sound, dredged.

Geographical distribution.—Scandinavian coasts; Grötsund, Finmark, 100 fms.; Spitzbergen; Greenland; Labrador; Gulf of St. Lawrence; New England; St. George Banks; North Sea; Orkneys; Shetland; coast of Britain.

Compared with specimens from the Northumberland coast, England, the Orca form attains a very strong and vigorous growth. The normal type prevails, but differs from the English form in the greater opaqueness of the zœcial walls and in the size and greater abundance of the spines. A variety also occurs which is extremely flustrine in appearance. The segments are short and broad, often possessing 18 to 24 zœcia in alternate rows, and they spread out from the center forming a fan-like growth. In all essential marks, size and number of spines, position and size of avicularia and œcia, shape of zœcia, etc., this variety agrees with the typical form.

BUGULA PURPUROTINCTA Norman.

(Pl. XX, figs. 5, 6.)

Bugula purpurotincta HINCKS ('80), pl. XII, figs. 8–12.
Bugula purpurotincta NORMAN ('68).

Habitat.—Very abundant upon *Styela* and upon the rocks.

Local distribution.—Yakutat Bay; Orca; Pribilof Islands; Puget Sound; Tomales Bay, California.

Foreign distribution.—Rather abundant on the northern coasts of Britain; Christiansund; Bejan, 40–60 fms.; Lofoten; Bahusia; Norway, common, 30–130 fms.; St. George Banks, 110–115 fms.

This species grows in large bushy tufts often 7.5 cm. in height, and the colonies are frequently united by a sort of cable formed by the radical fibers. It is remarkable not only for its luxuriant growth but also for the rich purple which most of it displays in the living as well as in the dried condition. The color is particularly noticeable in that

which was obtained at the Point, in the more exposed situation. It is located in part in the tissue lining the zœcia, and in part in the degenerated polypides. These constitute the so-called 'brown bodies' of other Bryozoa which in this species are purple. A small number of specimens was picked up at the Pribilof Islands, Alaska, by Professor Kincaid, of the Washington University. These have been preserved in the dried state and the color is very distinct. Material obtained at other points near Yakutat, and some of the same, or of a closely allied species, from Puget Sound and California, do not show this color, but are rather of a yellowish tinge.

In some respects this species varies from the type described by Norman and Hincks. Thus, these authors report but one spine for *Bugula purpurotincta*, and a denticle in front of it. The Yakutat form possesses three spines and the number seems to be invariable. As represented in Pl. XX, fig. 5, a long spine (*sp.*) is present at the summit of the zœcium. This probably corresponds to the one reported for this species. But at the upper extremity of the aperture, structures occur on each side, which may properly be called spines (*sp.' sp.''*), one of which may perhaps correspond to the denticle of the English form. The long spine (*sp.*) at the top of the zœcium frequently measures 15 mm., while the other two are smaller, measuring on an average about 5 mm. The aperture (*ap.*) is long, and extends almost to the bottom of the zœcium. The avicularia (*av.*) are of unusually large size, and are always placed just below the aperture. The œcia (*œ.*) are remarkably small. They do not rise more than 3 or 4 mm. above the zœcium, while in many cases the embryo measures 10 mm. in length. Fig. 5 represents two embryos (*emb.*), which lie for the most part in the upper portion of the zœcia. In his description of *B. purpurotincta*, Mr. Hincks speaks of the extreme shallowness of the œcia, and says that they only partially cover the embryo in its later stages.

Whether these deviations from the type can be considered as mere individual variations or whether they have specific value is still an open question. Provisionally, at least, this form is placed in the present species. If upon further study it should prove to be new, I would suggest the name *Bugula pacifica*, since it seems to be characteristic of this coast.

BUGULA FLABELLATA J. V. Thompson.

Bugula flabellata HINCKS (80), pl. XI, figs. 1–3.
Bugula avicularia forma 2, *B. flabellata* SMITT ('67), pl. XVIII, fig. 11.

Habitat.—On a limpet shell.

Local distribution.—Sitka, 10 fms.

Foreign distribution.—Britain; Heligoland; Ostend; Roscoff; Adriatic; Florida, deep water; Madeira; Cape of Good Hope.

Family *CELLARIIDÆ.*

CELLARIA Lamouroux.

CELLARIA BOREALIS Busk.

Cellaria borealis Smitt ('67), pl. xx, fig. 17.
Salicornaria borealis Busk ('55), pl. 1, figs. 1–3.

Habitat.—Abundant on rocks.

Local distribution.—Yakutat; Orca, Prince William Sound; Houston-Stewart Channel, Cumshewa Harbor, Virago Sound, Queen Charlotte Islands.

Foreign distribution.—Greenland.

This fine species is very abundant at Orca, where it grows in thick masses three or four inches in height. The branching is very profuse in the younger portions of the colony. In the older portion, the first six or eight internodes form an articulated stem without lateral branching. At the point where it begins, three and sometimes four internodes arise from the distal end of one. Above this the branching is dichotomous, while the tallest internodes are tipped with three or four very small ones. The young, actively growing portion is conspicuous for its bright flesh-color, which causes it to stand out boldly against the dark background of rock.

Family *FLUSTRIDÆ.*

FLUSTRA Linnæus.

FLUSTRA LICHENOIDES sp. nov.

(Pl. XX, figs 7, 7*a*, 8.)

Habitat.—Upon shells, worm tubes, ascidians, and upon the rocks at low tide.

Local distribution.—Yakutat; Orca, Prince William Sound; Puget Sound; Point Cavallo, California.

Zoarium unilaminar, consisting of broad, foliaceous fronds. Zœcia in alternate rows, arched above, narrowed below, the upper margin of the cell raised and armed on each side with three or four spines; the uppermost spine on each side stands upright and stiff, the other two or three are flattened and bend inward, the ends frequently meeting. Œcia globose. Avicularia none. Radical fibers, by which the fronds are attached, growing from the under side of the zœcia.

The zoarium does not rise much above the substratum, but spreads out in convoluted masses. From the point of origin of a colony, smaller fronds spring, frequently overlapping the older ones, and the whole has much the appearance of a brown lichen. The radical fibers spring from the upper corner of the dorsal side of the zœcia (fig. 8, *r. f.*). These frequently anastomose and form a network by which the colony or frond is anchored. In some cases fibers from the dorsal surface of an overlapping frond attach themselves to the margin of the zœcia of the lower frond. Again, the laminæ are united back to back. They are easily separable, however, and their union is effected by means of short fibers. The margin of the distal part of the zœcium is much elevated and the spines are very prominent (fig. 7). There is considerable variation in their development, both in number and size. The two horn-like ones at the top are always present. Below these are usually two flattened ones on each side, which fold over the zœcium just below the ovicell (*fl. sp.*). Sometimes, however, there are three flattened spines on each side, and again but one. Even on the same frond these variations in number are found, as well as considerable variation in size. No structure which could be called an avicularium has been detected, although a considerable quantity of material has been examined, both from Alaska and from Puget Sound.

Family *MEMBRANIPORIDÆ.*

MEMBRANIPORA Blainville.

MEMBRANIPORA LACROIXII Andouin.

Membranipora lacroixii HINCKS ('80), pl. XVII, figs. 5–8.
Biflustra lacroixii SMITT ('72), Flor. Bry. pt. 11, pl. IV, figs. 85–88.

Habitat.—On shell.

Local distribution.—Kadiak.

Foreign distribution.—Coasts of Britain; Mediterranean; coast of Florida, 13–60 fms.; St. Lawrence.

MEMBRANIPORA MEMBRANACEA Linnæus.

Membranipora membranacea HINCKS ('80), pl. XVIII, figs. 5, 6.
Flustra membranacea JOHNSTON ('47), pl. LXVI, figs. 1–3.

Habitat.—Upon kelp forming circular patches.

Local distribution.—Yakutat; Pribilof Islands, Alaska; Queen Charlotte Islands, incrusting stem of a seaweed.

Foreign distribution.—Universally distributed on the coasts of Britain; Hvidingsoe; Hongesund; Roscoff; Adriatic; Lyalls Bay, New Zealand; Australia.

MEMBRANIPORA LINEATA Linnæus.

Membranipora lineata HINCKS ('80), pl. XIX, figs. 3-6.
Membranipora lineata SMITT ('67), pl. XX, fig. 23; Flor. Bry. pt. II, pl. II, fig. 62.

Habitat.—A small patch on *Cellaria borealis*.

Local distribution.—Orca, Prince William Sound.

Geographical distribution.—Common on the coasts of Britain; Roscoff; Scandinavia, in shallow water, common; Baltic; Spitzbergen; Davis Strait, 100 fms.; Iceland, 15–20 fms.; Nova Zembla; Kara Sea; South Labrador; Adriatic; Florida; New Zealand.

MEMBRANIPORA UNICORNIS Fleming.

Membranipora unicornis HINCKS ('80), pl. XX, fig. 4.
Membranipora lineata 5, forma *unicornis*, BB, stadium longius adultum SMITT ('67), pl. XX, fig. 30.

Habitat.—Upon other Bryozoa and on hydroid stems.

Local distribution.—Juneau; Yakutat; Orca; Houston-Stewart Channel, Queen Charlotte Islands.

Foreign distribution.—Britain; Bohuslän; Spitzbergen; Greenland; Nova Zembla.

MEMBRANIPORA SPINIFERA Johnston.

Membranipora spinifera HINCKS ('80), pl. XIX, figs. 1, *a*, *b*, *c*.

Habitat.—Upon a stone.

Local distribution.—Orca, Prince William Sound.

Foreign distribution.—Abundant upon the British coast, France.

MEMBRANIPORA SANDALIA sp. nov.

(Pl. XX, figs. 9, 9*a*, 9*b*; Pl. XXI, fig. 10.)

Habitat.—Upon sponge.

Local distribution.—Yakutat.

Zoarium forming a rather loose crust, brittle and delicate, and only partially attached; spreading out in a fan-shaped expansion, the gelatinous margin of which is often convoluted; the apposed surfaces often growing together and forming irregular ridges over the colony. Zœcia oblong, quadrangular in the younger stages, much narrowed below in the older, and disposed in alternate series. In the adult stage, the upper half of the zœcial front is occupied by a membranous area, containing the crescent-shaped orifice at its distal end. The lower half is traversed by a network of calcareous lines or ribs

which extend from the lateral margins and converge, either to a central line extending from the base of the zœcia or to the base of a raised portion of the zœcial wall just below the aperture. An avicularium is developed upon this raised portion, with mandible directed to one side. Œcia ?

This species seems to afford a transition between the Flustridæ and the Membraniporidæ. It possesses flustrine characteristics in the shape of the zœcium in the younger stages, and in the free frond-like growth of part of the colony. Where it is attached, however, the mode of adherence is membraniporidan. The thickened rim of the zœcium grows fast to the substratum, and upon removal of the crust the oblong shape of the under surface is left in outline. The type of avicularia is that of *Membranipora*, as is also the secondary calcification of a portion of the front wall.

In a colony of moderate size, three stages of growth can easily be distinguished. Upon the growing edge the zœcia are but faintly outlined, and the aperture occupies the whole of the front (fig. 9*a*, *ap.*). This shape is retained through the next four or five rows, but the second stage begins in the calcification of the lower half of the zœcia and the strengthening of their lateral walls. Fig. 9*b* represents an early stage of calcification. This begins sometimes as fine lines proceeding from the side and basal walls (*l.*), sometimes as thickened growths resembling denticles (*d.*). Soon the future aperture is outlined by the formation of a calcareous rim which does not quite unite below it (fig. 9, *ap.*). Meanwhile the calcareous thickenings along the lateral (fig. 9, *lat.*) and basal (fig. 9, *bas.*) margins of the proximal end of the zœcia converge toward a smaller area (*ar.*), which is left uncalcified just below the aperture. The secondary thickenings gradually unite more or less, leaving quite wide spaces, or lacunæ between them, which are covered only by the membranous material of the original aperture. In the third stage, represented by Pl. XXI, fig. 10, a large sessile avicularium (*av.*) is present upon the area below the aperture. Calcification has continued, and the whole of the lower portion of the zœcium has become involved. It is now covered by a thin calcareous crust which slightly obscures the calcareous network previously formed, and covers the muscular portion of the avicularium with a delicate granular layer. The avicularium seems elevated upon a kind of mound, and possesses a pointed mandible directed slightly upward or in the direction of the rim of the aperture (fig. 10, *man.*). The mandible turns in some cases to the right, in others to the left. Œcia are not known.

Family *CRIBRILINIDÆ*.

CRIBRILINA Gray.

CRIBRILINA ANNULATA Fabricius.

Cribrilina annulata HINCKS ('80), pl. XXV, figs. 11, 12.
Escharipora annulata SMITT ('67), pl. XXIV, figs. 8–10.

Habitat.—A small colony growing upon an ascidian.

Local distribution.—Yakutat.

Foreign distribution.—Britain; Greenland; Nova Zembla; Kara Sea; Hammerfest; Spitzbergen, 3–30 fms.; Bergen; Labrador; Grand Menan, Bay of Fundy; Gulf of St. Lawrence.

Family *MYRIOZOIDÆ*.

SCHIZOPORELLA Hincks.

SCHIZOPORELLA BIAPERTA Michelin.

Schizoporella biaperta HINCKS ('80), pl. XL, figs. 7–9.
Escharella linearis forma *biaperta* SMITT ('67), pl. XXIV, figs. 70, 73.
Hippothoa biaperta SMITT ('72), pl. VIII, figs. 173–176.

Habitat.—On shells of brachiopods.

Local distribution.—Juneau; Houston-Stewart Channel; Virago Sound, Queen Charlotte Islands.

Foreign distribution.—Spitzbergen; Greenland; Kara Sea; Florida.

SCHIZOPORELLA HYALINA Linnæus.

Schizoporella hyalina HINCKS ('80), pl. XVIII, figs. 8–10.
Mollia hyalina SMITT ('67), pl. XXV, fig. 84.

Habitat.—On shells and on other Bryozoa.

Local distribution.—Sitka; Juneau; Orca; Yakutat; Houston-Stewart Channel; Virago Sound; Fort Point and Santa Cruz, California.

Foreign distribution.—Arctic seas; Spitzbergen; Greenland; Mediterranean; Africa; Australia.

SCHIZOPORELLA INSCULPTA Hincks.

Schizoporella insculpta HINCKS ('83), pl. XVII, fig. 5.

Habitat.—On *Alcyonidium mytili*.

Local distribution.—Sitka, both in the littoral region, and dredged at 10 fms.; Virago Sound, Cumshewa Harbor, Queen Charlotte Islands; Vancouver Island; Alki Point, Puget Sound.

MYRIOZOUM Donati.

MYRIOZOUM COARCTATUM Sars.

Myriozoum coarctatum SMITT ('67), pl. XXV, fig. 92.

Local distribution.—Juneau; Orca; Yakutat; Cumshewa Harbor, Houston-Stewart Channel, Queen Charlotte Islands.

Foreign distribution.—Norway; Finmark; Hammerfest; Komagfyord.

MYRIOZOUM CRUSTACEUM Smitt.

Myriozoum crustaceum SMITT ('67), pl. XXV, figs. 88–91.

Habitat.—Incrusting ascidians, shells, and *M. coarctatum*. Abundant.

Local distribution.—Juneau; Orca; Yakutat; Kadiak.

Geographical distribution.—Common in the Arctic regions; Finmark; Spitzbergen; East Greenland.

Family *ESCHARIDÆ*.

LEPRALIA Johnston.

LEPRALIA FOLIACEA Ellis & Solander.

Lepralia foliacea HINCKS ('80), pl. XLVII, figs. 1–4.

Local distribution.—Juneau.

Foreign distribution.—Southern coasts of Britain; Hebrides, most northern locality; Mediterranean; Adriatic; Algiers; Roscoff; Naples; Cape of Good Hope; Indian Ocean.

SMITTIA Hincks.

SMITTIA TRISPINOSA Johnston.

Smittia trispinosa HINCKS ('80), pl. XLIX, figs. 1–8.
Escharella jacotini SMITT ('67), pl. XXIV, figs. 53–57.

Habitat.—On shell and stone.

Local distribution.—Sitka; Juneau; Houston-Stewart Channel, Cumshewa Harbor, Virago Sound, Queen Charlotte Islands.

Foreign distribution.—Common on the coast of Britain; Norway Arctic seas; Gulf of St. Lawrence; Florida; Mazatlan; Cape Horn; Aden; Adriatic; East Indies; Bass Straits.

Family *CELLEPORIDÆ*.

CELLEPORA (part) Fabricius.

CELLEPORA INCRASSATA Lamarck.

Habitat.—Incrusting *Cellaria borealis*. The branched form also found.

Local distribution.—Juneau; Berg Inlet; Orca; Pribilof Islands; Houston-Stewart Channel, Virago Sound, Queen Charlotte Islands.

Foreign distribution.—Finmark; Spitzbergen; Greenland; Bank of Newfoundland.

Suborder *CYCLOSTOMATA* Busk.

Family *CRISIIDÆ.*

CRISIA (part) Lamouroux.

CRISIA CORNUTA Linnæus.

Crisia cornuta (*a :* sine cornibus) SMITT ('65), pl. XVI, figs. 2, 3.
Crisia geniculata HARMER ('91), pl. XII, figs. 7, 8.

Habitat.—Upon shells and other Bryozoa.

Local distribution.—Sitka; Juneau; Yakutat; Orca.

Foreign distribution.—Britain; Roscoff; Mediterranean; Bahusia; Norway.

Family *TUBULIPORIDÆ.*

ENTALOPHORA Lamouroux.

ENTALOPHORA CAPITATA sp. nov.

(Pl. XXI, figs. 11, 12, 13.)

Habitat.—Upon stems and roots of hydroids.

Local distribution.—Sitka; Juneau, 10 fms.

Zoarium consisting of a number of zœcia arising from a flattened or incrusting base, many of them uniting to form one or more short columns which terminate in a rounded head. Zœcia tubular, distal ends free; those forming the column opening upon all sides of it. The surface of the head composed of the orifices pressed close together, or projecting slightly through the granular matrix, which is perforated by rather large pores.

This species was obtained in two slightly different forms whose main features, however, are similar. Figs. 11 and 12 represent them of natural size. The one in fig. 11 was dredged in 10 fms., and is a deep purple color. The base is elliptical. The zœcia on the periphery are decumbent, while those in the center are almost upright, their tubular orifices projecting somewhat beyond the granular matrix in which they are imbedded. At each end of the long diameter of the base a number of zœcia have united to form a column. The smaller of these is represented, somewhat enlarged, by fig. 13. Here the column arises out of a forest of tubes so that its base is somewhat

obscured. The top spreads out into a rounded head whose diameter is greater than that of the stalk. Upon the surface the orifices are, for the most part, closely approximated and assume a hexagonal shape. A very few project slightly and are circular. The transition from the top of the column into the mound-like surface is not definitely marked by any border or rim such as is shown for *Stomatopora fungia* (Hincks '80) or for *Tubulipora penicillata* (Smitt '66). The second form, represented of natural size in fig. 12, is white in color, and was obtained at low tide, partially incrusting a hydroid stem. In this case the colony has attached itself by encircling the stem in an irregular way, and has formed a column terminated by the mound-like head.

Family *LICHENOPORIDÆ.*

LICHENOPORA Defrance.

LICHENOPORA VERRUCARIA Fabricius.

Lichenopora verrucaria HINCKS ('80), pl. LXIV, figs. 4, 5.

Habitat.—Upon *Cellaria borealis.*

Local distribution.—Orca; Virago Sound, Queen Charlotte Islands.

Foreign distribution.—Bahusia; Norway; Finmark; Arctic seas; Bay of Fundy; St. George Banks; Britain, north and west.

Suborder *CTENOSTOMATA* Busk.

Family *ALCYONIDIIDÆ.*

ALCYONIDIUM Lamouroux.

ALCYONIDIUM GELATINOSUM Linnæus.

Alcyonidium gelatinosum HINCKS ('80), pl. LXIX, figs. 1–3.
Halodactylus diaphanus FARRE ('37), pls. XXV, XXVI, figs. 1–16.

Local distribution.—Muir Inlet; Orca; Garforth Island; Virago Sound, Queen Charlotte Islands.

Foreign distribution.—Coasts of Britain; Norway; Sweden; North America; White Sea; Nova Zembla; Kara Sea; Natal.

ALCYONIDIUM MYTILI Dalyell.

Alcyonidium mytili HINCKS ('80), pl. LXX, figs. 2, 3.
Alcyonidium parasiticum SMITT ('65), pl. V, figs. 8–19.

Habitat.—Growing on ascidians, shell, and on *Fucus.*

Local distribution.—Sitka; Yakutat; Fakir Islet; Garforth Island.

Foreign distribution.—Bahusia, 5–20 fms.; Baltic Sea; coasts of Britain.

ALCYONIDIUM POLYOUM Hassall.

Alcyonidium polyoum HINCKS ('80), pl. LXIX, fig. 9.
Sarchochitum polyoum JOHNSTON ('47), pl. LXXI, fig. 1.

Habitat.—On stones, kelp, and on hydroid stems.

Local distribution.—Orca, Prince William Sound; Yakutat.

Foreign distribution.—Dublin Bay; Northumberland; Roscoff.

The species which I have identified as *A. polyoum* forms circular colonies an inch or more in diameter. In its young state only, can it be described as forming a thin crust. At that stage the boundaries of the zœcia are distinctly marked off, and it resembles *A. mytili* very closely. It may be distinguished, however, by the position of the zœcia and by the orifice. The zœcia toward the center tend to become upright, and those on the periphery are partially raised, so that the upper portion projects from a gelatinous matrix. They are rounded or barrel-shaped, and the orifice opens upon a distinct papilla. The orifice contains a great number of black setæ, some of which project quite far beyond it even when it is closed. The primary crust is quite transparent, but soon thickens into a somewhat fleshy mass of a dark brown color.

ALCYONIDIUM CERVICORNIS sp. nov.

(Pl. XXI, figs. 14, 15, 16, 17.)

Habitat.—On seaweed and on *Cellaria borealis.*

Local distribution.—Orca and Juneau.

Zoarium consisting of a rounded ball-like mass of a dark-brown color. Zœcia imbedded in the gelatinous mass, the orifices projecting above the surface. The surface bristling with tall, red, branching, hollow spines which project from spaces between the zœcia.

The distinguishing mark of this species consists in the great number of hollow branching spines which beset the surface. Figure 14 is a habit sketch, natural size, of a colony. Fig. 15 represents a portion of the surface showing a number of the spines and the projecting orifices (*or.*) of the zœcia. The spines arise from definite portions of the surface, between the zœcia. They are hollow and the interior contains a stainable tissue which extends to the tips of the branches. Each spine consists of a central stem which forks at the top into four branches or prongs. Fig. 16 represents the branches viewed from above. Sometimes the tips of the prongs divide, as represented by fig. 17, and the resemblance to antlers is very marked. In other respects this species bears a resemblance to *A. polyoum.*

The colony is gelatinous and composed of but one layer, and the polypides, which are inclined somewhat to the surface, lie imbedded in the matrix. The orifices are circular and open upon distinct papillæ.

Family *FLUSTRELLIDÆ.*

FLUSTRELLA Gray.

FLUSTRELLA HISPIDA Fabricius.

Flustrella hispida HINCKS ('80), pl. LXXII, figs. 1–5.
Flustrella hispida JOHNSTON ('47), pl. LXVI, fig. 5.

Local distribution.—Yakutat, forming branching masses; Lands End; Fort Point, California.

Foreign distribution.—Common in Britain; Bahusia; Finmark; Greenland; Heligoland; Roscoff; France.

Family *VESICULARIIDÆ.*

BOWERBANKIA Farre.

BOWERBANKIA IMBRICATA Adams.

Bowerbankia imbricata HINCKS ('80), pl. LXXIII, figs. 1, 2.
Bowerbankia densa FARRE ('37), pl. XX and XXI, figs. 1–16.

Habitat.—Creeping over other Bryozoa.

Local distribution.—Orca; Yakutat; Lime Point, California; Virago Sound, Queen Charlotte Islands.

Foreign distribution.—Common on the coast of Britain; White Sea; Caspian Sea; Ostend; Roscoff.

Suborder *PHYLACTOLÆMATA* Allman.

Family *PLUMATELLIDÆ.*

PLUMATELLA Lamarck.

PLUMATELLA REPENS Linnæus.

Plumatella repens ALLMAN ('56), pl. V, figs. 1–8.
Plumatella repens JOHNSTON ('47), 2d ed., p. 403, fig. 76.

Local distribution.—Water-lily pond at Kadiak; Lake Washington, Seattle; Mountain Lake, San Francisco.

Foreign distribution.—Through Great Britain; Lake Lucerne; Lake Como; Alpine lakes; lakes in the Pyrenees; France; Italy; Germany; Prussia; Sweden; Denmark.

Group *ENTOPROCTA* Nitsche.

Family *PEDICELLINIDÆ*.

PEDICELLINA Sars.

PEDICELLINA NUTANS (?) Ballyell.

Pedicellina nutans HINCKS ('80), p. 569, woodcut figs. 37, 38, 40.

Habitat.—On roots of hydroids and Bryozoa.

Local distribution.—Yakutat; Tomales Bay, California.

Foreign distribution.—Coast of England.

This form is placed here provisionally. It conforms in general with the diagnoses of Hincks and of Ehlers ('90). Tentacles possess one characteristic, however, which is not mentioned by these writers. They contain a yellowish-brown pigment which is very conspicuous, at least after the animal is killed, and which is very persistent. It is not destroyed even when the tissue is treated with the reagents necessary for imbedding and staining. It seems to be lodged in the outer layer of cells of the tentacles, and is not found in the lophophore nor in any other part of the animal, so far as I have been able to observe.

LIST OF SPECIES.

CHEILOSTOMATA.

Gemellaria loricata.
Menipea ternata.
Menipea ternata forma *gracilis.*
Menipea erecta sp. nov.
Scrupocellaria scabra.
Caberea ellisii.
Bugula murrayana.
Bugula purpurotincta.
Bugula flabellata.
Cellaria borealis.
Flustra lichenoides sp. nov.
Membranipora lacroixii.
Membranipora membranacea.
Membranipora lineata.
Membranipora unicornis.
Membranipora spinifera.
Membranipora sandalia sp.nov
Cribrilina annulata.
Schizoporella biaperta.
Schizoporella hyalina.
Schizoporella insculpta.
Myriozoum coarctatum.
Myriozoum crustaceum.
Lepralia foliacea.
Smittia trispinosa.
Cellepora incrassata.

CYCLOSTOMATA.

Crisia cornuta.
Entalophora capitata.
Lichenopora verrucaria.

CTENOSTOMATA.

Alcyonidium gelatinosum.
Alcyonidium mytili.
Alcyonidium polyoum.
Alcyonidium cervicornis sp. nov.
Flustrella hispida.
Bowerbankia imbricata.

PHYLACTOLÆMATA.

Plumatella repens.

ENTOPROCTA.

Pedicellina nutans (?).

BIBLIOGRAPHY.

Allman, G. J.

1856 A Monograph of the Fresh-water Polyzoa, including all the known Species, both British and Foreign. Ray Society, London, 1856.

Busk, George.

1855 Zoophytology. Quart. Journ. Micr. Sc. (n. s.), 1855, Vol. III.

Ehlers, E.

1890 Zur kenntniss der Pedicellineen. Abhand. d. königl. Gesellsch. d. Wiss. zu Göttingen, Bd. XXXVI, 1889–90, p. 141.

Farre, A.

1837 Observations on the Minute Structure of Some of the higher forms of Polypi. Phil. Trans., 1837, p. 387.

Harmer, Sidney F.

1891 On the British Species of Crisia. Quart. Journ. Micr. Sc. (n. s.), 1891, 32.

Hincks, Thomas.

1880 British Marine Polyzoa.

1882 Report on the Polyzoa of Queen Charlotte Islands. Ann. N. H., 1882, Vol. 10, series 5.

1883 Ibid. Ann. N. H., 1883, Vol. 11, series 5.

1884 Ibid. Ann. N. H., 1884, Vol. 13, series 5.

1889 Polyzoa of the St. Lawrence: A Study of Arctic Forms. Ann. N. H., 1889, Vol. 3, series 6.

Johnston, George.

1847 A History of the British Zoophytes. 1847, 2d ed.

Jullien.

1882 Dragages du Travailleur. Bryozaires: Espèces draguées dans l'océan Atlantique en 1881. Bull. de la Soc. Zool. de France, 1882, T. VII. [I was unable to obtain this paper, but give it on the authority of Hincks ('89).]

Norman, A. M.

1868 Notes on Rare British Polyzoa, with descriptions of New Species, Quart. Journ. Micr. Sc., 1868, VIII (n. s.).

Smitt, F. A.

1865 Om Halfs- Bryozoernas Utveckling ock Fettkroppar. Svenska Vetenskaps-Academien, Öfversigt, 1865, 22.

1867 Bryozoa marina in regionibus arcticis et borealibus viventia. Ibid., 1867, 24.

1865–68 Kritisk förteckning Öfver Skandinaviens Hafs-Bryozoer. I. Cyclostomata; II. Ctenostomata; III and IV. Cheilostomata. Ibid., 1865–1868, 22, 23, 24.

1872 ~~Filaridan~~ Bryozoa, Pt. II, Kongl. Svenska Vetenskaps-Academien Handlingar, 1872, 11.

ABBREVIATIONS USED IN THE FIGURES.

av.—avicularium.
ar.—area.
art.—articulation.
ap.—aperture.
b.—beak.
bas.—basal.
bifur.—bifurcation of branch.
d.—denticle.
emb.—embryo.
f. a.—frontal avicularium.
fl. sp.—flattened spine.
l.—lines of calcification.
lat.—lateral.
m.—margin.
man—mandible.
mus. app.—muscular apparatus.
œ.—œcium.
op.—operculum.
or.—orifice.
ped.—peduncle.
r. f.—radical fiber.
sp.—spine.
zœ.—zœcium.

PLATE XIX.

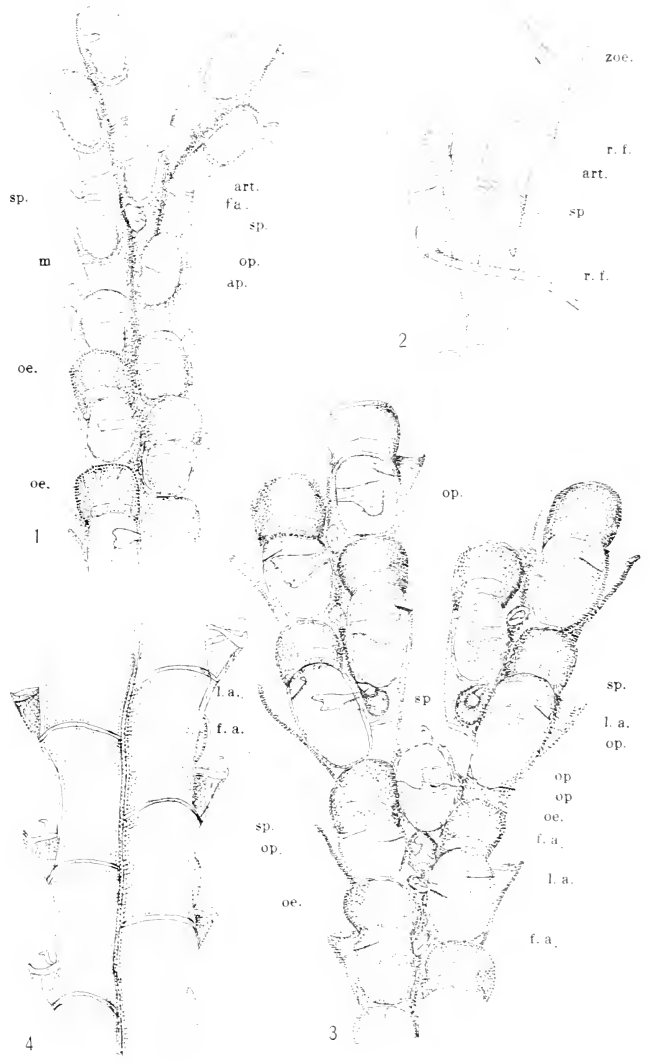
[All figures drawn by aid of a camera lucida except 7*a*, 11, 12, and 13.]

FIG. 1. *Menipea erecta* sp. nov. Frontal view, showing bifurcation of an internode and main points of structure; spine (*sp.*), operculum (*op.*), frontal avicularia (*f. a.*), œcia (*œ.*), and mode of articulation (*art.*).

2. Dorsal view of the same, showing the radical fibers (*r. f.*) and the place of their attachment upon the zœcia.

3. *Scrupocellaria scabra* Van Beneden, frontal view.

4. Dorsal view of the same, showing absence of vibracula.



Alaska Bryozoa

PLATE XX.

FIG. 5. *Bugula purpurotincta* Norman, frontal view. The two lower zœcia on the left show the small size of the œcia (*œ.*) compared with that of the embryo (*emb.*) (*av.*) avicularium.

5*a*. An avicularium which had broken away from its zœcium; peduncle (*ped.*), mandible (*man.*), beak (*b*), muscular apparatus (*mus. app.*).

6. Dorsal view of the same, showing spine (*sp.*) and avicularium (*av.*) as seen from the back, and the mode of bifurcation (*bifur.*).

7. *Flustra lichenoides* sp. nov. Frontal view, showing œcia (*œ.*) and variation in the number of flattened spines (*fl. sp.*).

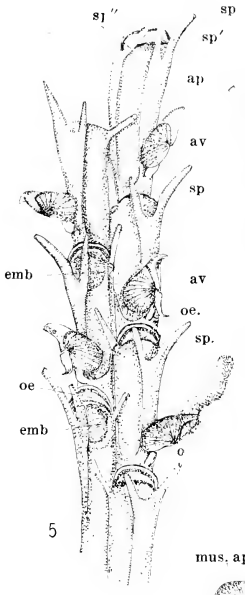
7*a*. A single frond of the same, natural size.

8. Dorsal surface of the same, showing the radical fibers (*r. f.*) and their mode of attachment to the zœcia.

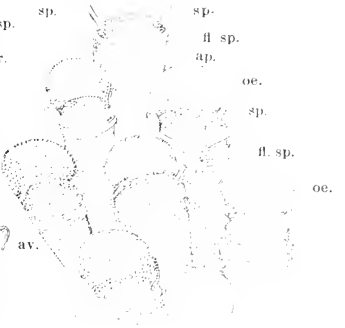
9. *Membranipora sandalia* sp. nov. Upper surface, representing a few zœcia in the second stage. The aperture (*ap.*) occupies the distal end of the zœcium. Below it is the uncalcified area (*ar.*) upon which an avicularium will be formed, and toward which the calcareous thickenings converge.

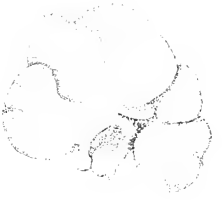
9*a*. One zœcium of the same near the edge of the colony. It is oblong in shape and the aperture (*ap.*) occupies the whole of the front.

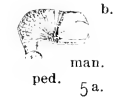
9*b*. A zœcium of the same, showing the beginnings of calcification (*l.*) and (*d.*). The future aperture (*ap.*) is already laid off.

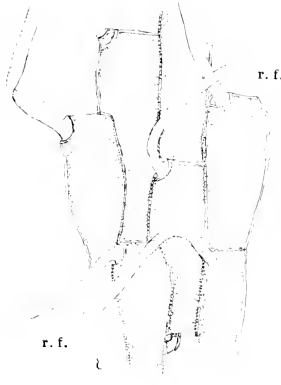

sp
sp
ap
av
sp
emb
av
oe.
sp.
oe
emb
5

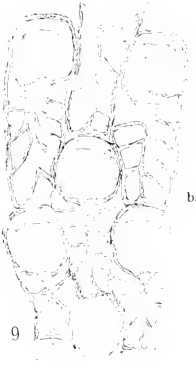

sp.
bifur.
6


sp.
fl sp.
ap.
oe.
sp.
fl. sp.
oe.
av.




mus. ap.
b.
man.
ped.
5a.


r. f.
r. f.
8


ap.
ar.
lat.
bas.
9


ap.
9a

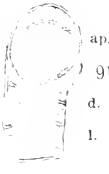

ap.
9b
d.
l.

PLATE XXI.

FIG. 10. The adult stage of *Membranipora sandalia*, in which the surface is covered with a fine calcareous layer, obscuring the network previously formed. A large sessile avicularium (*av.*) is found upon the area below the aperture.

11. *Entalophora capitata* sp. nov. Natural size of the purple variety with elliptical base. Orifices of the upright zœcia (*or.*).

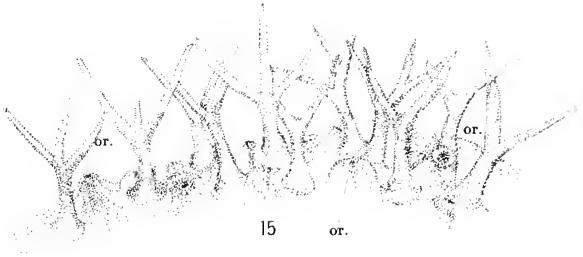
12. The white variety of the same, natural size.

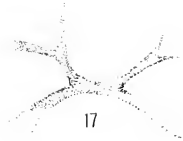
13. The smaller of the two columns represented by fig. 11. Only part of the base (*bas*) shown in the drawing.

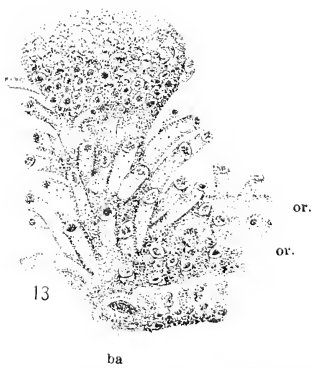
14. *Alcyonidium cervicornis* sp. nov. A colony, natural size.

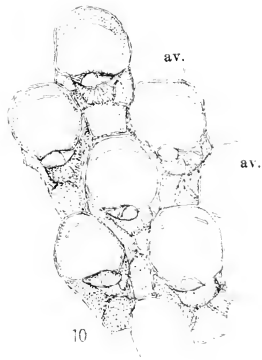
15. Part of the surface of the same, showing spines, and orifices of the zœcia (*or.*).

FIGS. 16 and 17. Two of the spines of the same, showing two modes of branching. The drawing is intended to show the branching top of the spine as it appears when viewed directly from above.









Alaska Bryozoa