

594

AUSTRALASIAN ANTARCTIC EXPEDITION

1911-14.

UNDER THE LEADERSHIP OF SIR DOUGLAS MAWSON, Kt., D.Sc., B.E.

SCIENTIFIC REPORTS.

SERIES C.—ZOOLOGY AND BOTANY.

VOL. III. PART 3.

ASCIDIÆ SIMPLICES.

BY

SIR WILLIAM A. HERDMAN, C.B.E., F.R.S., UNIVERSITY OF LIVERPOOL.

WITH SIX PLATES.

PRICE: FOUR SHILLINGS.

Printed by Alfred James Kent, Government Printer, Phillip-street, Sydney.—1923.

ISSUED SEPTEMBER, 1923.

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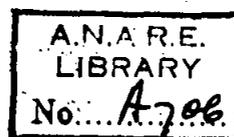
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91(90)594.3

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TUNICATA.

ASCIDIÆ SIMPLICES.

THE SIMPLE ASCIDIANS.

By Sir WILLIAM A. HERDMAN, C.B.E., F.R.S., Emeritus-Professor of Natural History in
the University of Liverpool.

With Six Plates.

INTRODUCTION

THE collection of Tunicata obtained by the Australasian Antarctic Expedition (1912-14), under the leadership of Sir Douglas Mawson, in the S. Y. "Aurora," comprises about 360 specimens belonging to about forty species; nearly equally divided between Simple and Compound Ascidians. Twenty species of Simple Ascidians, of which five seem new to science, are described in the present Report.

These specimens were collected at far southern localities in the region between Tasmania and Wilkes Land, the antarctic quadrant lying between 90° and 180° E. longitude. Shore collections were made (by Mr. H. Hamilton) at Macquarie Island in S. lat. 55°. Various shallow-water dredgings, down to 60 fathoms, were made, sometimes through channels in the ice, in Commonwealth Bay, Adelie Land (S. lat. 67° E. long. 142° 36') by Mr. J. G. Hunter, Biologist to the Expedition. During the winter cruise of 1912, Professor T. T. Flynn dredged some of the specimens from 65 fathoms, off Maria Island, Tasmania; and, finally, large collections were made at twelve stations in S. lat. 63° to 66° along the coast of Wilkes Land between E. long. 92° and 145°. The official particulars of these stations are as follows:—

| Station. | Date. | Locality. | Depth. | Temperature | Nature of bottom. |
|----------|----------|---|-----------------|-------------|----------------------------|
| I | 22/12/13 | Lat. South 66° 50', Long. East 142° 6' (In Commonwealth Bay, Adelie Land). | fathoms. 354 | -1.85°C. | Small amount of ooze. |
| II | 28/12/13 | Lat. South 66° 55', Long. East 145° 21' | 318 | -1.84°C. | Ooze. |
| III | 31/12/13 | Lat. South 66° 32', Long. East 141° 39' | 157 | -1.62°C. | Ooze with few small rocks. |
| IV | 2/1/14 | Lat. South 65° 48', Long. East 137° 32' | 230 | -1.4°C. | Ooze. |
| V | 6/1/14 | Lat. South 64° 34', Long. East 127° 17' | 1,700 | -0.32°C. | Ooze. |

| Station. | Date. | Locality. | Depth. | Temperature | Nature of bottom |
|----------|---------|--|-----------------|-------------|---|
| VI | 14/1/14 | Lat. South 63° 13', Long. East 101° 42'. | fathoms. 870 | -0.23°C. | Ooze. |
| VII | 21/1/14 | Lat. South 65° 42'. Long. East 92° 10' | 60 | Not taken | Few small rocks and red algæ; no ooze. |
| VIII | 27/1/14 | Lat. South 66° 8'. Long. East 94° 17' | 120 | Not taken | Few small granitic rocks; no ooze. |
| IX | 28/1/14 | Lat. South 65° 29', Long. East 95° 27' | 240 | +1.38°C. | Small amount of ooze and granitic rock. |
| X | 29/1/14 | Lat. South 65° 6', Long. East 96° 13' | 325 | -1.65°C. | Ooze. |
| XI | 31/1/14 | Lat. South 64° 44', Long. East 97° 28' | 358 | Not taken | Ooze. |
| XII | 31/1/14 | Lat. South 64° 32', Long. East 97° 20' | 110 | Not taken | Rock with very small amount of ooze. |

Most of the collection was preserved in 70 per cent. alcohol, incisions being made in the outside tunics of the larger animals, and in some cases formaline was used. In most cases the specimens were found to be in a satisfactory condition for identification; some few that were not (such as some of the more massive Simple and Compound Ascidians) may have been dead when collected, as I have suspected to be the case in previous collections from arctic and antarctic seas when the more delicate internal tissues were decomposed, although the tougher exterior of the animal seemed normal.

The present collection forms no exception to the general rule in regard to series of arctic and antarctic Tunicata, which I have had occasion to point out in previous reports, viz., that most of the species are of large size, and so a very bulky collection may consist mainly of a large number of individuals belonging to comparatively few species. The contrast in both these respects between this circumpolar Tunicata fauna and that from the tropical and sub-tropical parts of the same ocean, as shown, for example, by Professor Stanley Gardiner's "Sea-Lark" collections (now in my hands), and my own collection of Ceylon Tunicata, is most marked. The warmer Indian Ocean, in contrast to the colder antarctic region south of it, shows a large number of species represented each by few individuals of small size.

The occurrence, in a single haul of the dredge from cold polar waters, of great numbers of some one or two large species has been recorded in the case of various groups of more or less sedentary animals (*e.g.*, Sponges, Alcyonaria, Echinoderms, &c.), and one of the most striking features of the present collection is the gigantic *Ascopera mawsoni*, of which (a collector's note informs us) about a thousand specimens came up in the dredge at Station XII, off Wilkes Land, from a depth of 110 fathoms.

As would be expected, there are some species that are common to most antarctic collections, and which are evidently abundant and characteristic members of the

circumpolar marine fauna, such as *Halocynthia setosa*, *Styela lactea*, and *Holozoa cylindrica*. I give here a table showing a list of the species in the Australasian collection and their occurrence in some of the other more important Antarctic collections:—

| Species. | Chal- lenger. | Scotia. | Dis- covery. | Charcot. | Val- divia. | Gauss. | Belgica. | South Georgia. | Southern Cross. |
|------------------------------------|------------------|---------|-----------------|----------|----------------|--------|----------|-------------------|--------------------|
| <i>Ascopera mawsoni</i> , n.... | (?) | ... | ... | ... | ... | × | ... | ... | ... |
| <i>Bathypora splendens</i> ... | ... | ... | ... | × | × | × | ... | ... | ... |
| <i>Molgula lutulenta</i> , n. ... | ... | ... | ... | ... | ... | ... | ... | ... | ... |
| <i>Molgula concomitans</i> ... | ... | ... | × | ... | ... | ... | ... | ... | ... |
| <i>Molgula euplicata</i> , n.... | ... | ... | ... | ... | ... | ... | ... | ... | ... |
| <i>Boltenia antarctica</i> ... | ... | ... | ... | ... | ... | ... | × | ... | ... |
| * <i>Microcosmus spinifer</i> ... | ... | ... | ... | ... | ... | ... | ... | ... | ... |
| * <i>Rhabdocynthia draschii</i> | ... | ... | ... | ... | ... | ... | ... | ... | ... |
| <i>Halocynthia discoveryi</i> ... | ... | ... | × | × | ... | × | ... | ... | ... |
| * <i>Halocynthia cerebriformis</i> | × | ... | ... | ... | ... | ... | ... | ... | ... |
| <i>Halocynthia setosa</i> ... | ... | × | × | × | ... | × | ... | ... | ... |
| <i>Halocynthia flynni</i> , n.... | ... | ... | ... | ... | ... | ... | ... | ... | ... |
| <i>Styela lactea</i> (?verrucosa) | × | × | ... | × | × | × | ... | × | × |
| <i>Styela subpinguis</i> , n. ... | ... | ... | ... | ... | ... | ... | ... | ... | ... |
| * <i>Styela personata</i> ... | ... | ... | ... | ... | ... | ... | ... | ... | ... |
| <i>Styela insinuosa</i> ... | ... | ... | ... | × | ... | ... | ... | ... | ... |
| * <i>Polycarpa rigida</i> ... | × | ... | ... | ... | ... | ... | ... | ... | ... |
| <i>Ascidia challengerii</i> | × | ? | ... | ? | × | ? | ... | ... | ... |
| <i>Ascidia placenta</i> ... | × | ... | ... | ... | ... | × | ... | ... | ... |
| <i>Corella dohrni</i> ... | ... | ... | ? | ? | ... | ? | × | ? | ... |

The five species marked n. are described as new to science.

The (?) to *Ascopera mawsoni* in the "Challenger" column is to indicate that the closely related *Ascopera gigantea* was obtained by the "Challenger" Expedition.

The ? to *Ascidia challengerii* in the "Charcot" column is to indicate that the closely related *Ascidia charcoti* may be the same species.

Those species marked with a star * are also recorded in the Catalogue of the Tunicata in the Australian Museum, Sydney, N.S.W.

These various expeditions worked in Antarctic and Sub-antarctic waters as follows:—

"Challenger" Expedition, Kerguelen Island and southwards, in 1874; "Southern Cross," in 1898–1900, Cape Adare, S. Victoria Land, 90°–180° E.; "S. Georgia" includes the Hamburg Museum collections from the Falklands and S. Georgia and Magellan; "Belgica," in 1897–9, to 71° S., near Graham Land; "Valdivia," in 1898–99, to north of Enderby Land (63° S.), and East of Bouvet Island; "Scotia," in 1902–4, Falklands and South Orkneys; "Discovery," 1901–4, McMurdo Bay, Coulman Island, east end of "Barrier"; "Gauss" Süd-Polar Expedition, 1901–3, from Simons' Bay by Kerguelen to Kaiser Wilhelm II Land; "Charcot," first and second French Expeditions, 1903–5 and 1908–10, south of Cape Horn, to 70° S., and S. Shetlands towards Adelaide Island; and "Aurora," Mawson, 1912–14, Tasmania to Wilkes Land.

Each of these expeditions, of course, obtained other species which are not on the "Mawson" list, and therefore are not recorded on the preceding table. Every succeeding expedition still adds considerably to our knowledge of the large Antarctic Tunicate fauna, and no doubt it is because of the enormous difficulties in collecting

in these polar seas that some of the collections are so small and probably do not represent adequately the fauna present in the region explored. In many cases only one or two specimens have been obtained of species which may really be abundant in some part of the locality. Previous expeditions from the "Challenger" onwards obtained only single individuals of the genus *Ascopera*, and the "Mawson" expedition in one successful haul from 110 fathoms brought up a thousand specimens.

In addition to the five species described as new in this Report, the remaining fifteen species of the collection have enabled me in nearly all cases to contribute something to the knowledge either of the characters or of the affinities or the distribution, and to add some figures of structures which in my opinion were either required for the diagnosis of the species or differed somewhat from those already published. One of the most interesting and remarkable forms, which I have illustrated fully on Plate IX, is not a new species, but the handsome deepwater *Bathypera splendens*, Michaelson, which had previously been very rarely found, and of which the "Mawson" Expedition obtained five specimens, at two localities far south.

The other species are of a more ordinary character belonging to well-known genera, and all falling into one or another of the three old-established families: Molgulidæ, Halocynthiidæ and Ascidiidæ:

DESCRIPTION OF THE SPECIES.

Family MOLGULIDÆ.ASCOPERA MAWSONI, *n. sp.*

(Plate VIII, figs. 1-6.)

Body pear-shaped, on a short stalk ending in a bunch of fibres embedded in mud. Branchial and atrial apertures anterior, large and open, measuring 3 to 5 cm. across. Colour (after preservation) light gray, said to be "pale red" when alive.

Test very thin and paper-like, fairly tough and smooth, but bearing many slender tag-like processes from 1 to 2 mm. in length, and placed about the same distance from one another: smaller intermediate papillæ are also present (see pl. VIII, fig. 3).

Mantle thin and gelatinous, with a few muscle-bands mainly on the right side; occupying only about half the space inside the test. Branchial siphon larger than atrial. A narrow gelatinous cord runs from the posterior end of the mantle down to the test at the base of the stalk.

Branchial sac exceedingly delicate, with seven large folds on each side. Internal longitudinal bars wide and distinct (fig. 4), but transverse vessels irregular and inconspicuous, the stigmata being for the most part not arranged in definite rows or series (fig. 5).

Dorsal Lamina a plain membrane.

Dorsal Tubercle very large and prominent, opening directed posteriorly, both horns coiled inwards with about two and a half turns (fig. 6).

Tentacles compound, much branched, large and small alternately, eight of each, largest measuring about 2.5 cm. Between these sixteen lie other very much smaller ones (fig. 6).

Viscera consisting of alimentary canal and gonads on left side towards dorsal edge, and renal organ and remaining gonads on right side of body.

There are eight large specimens of this species in the collection, the largest measuring 32 cm. by 16 cm., the stalk being 8 cm. by 2 to 3 cm., but many more specimens were obtained (see below).

Locality.—Off Queen Mary Land, Station XII; 31st January, 1914; lat. S. 64° 32', long. E. 97° 20'; depth 110 fathoms; bottom rock with very small amount of ooze. On same occasion a small specimen of *Holozoa cylindrica* was obtained floating, no doubt detached from the bottom. A very small specimen of

Ascopera (pl. VIII, fig. 2), which is probably a young *A. mawsoni*, was found in a bottle labelled "Dredgings, Commonwealth Bay, Adelie Land, 21st January, 1913."

The genus *Ascopera* was formed in 1882 for the reception of two new species of Molgulidæ of large size, dredged by the Challenger Expedition in 1874 at Station 150 (to the south of Kerguelen Island) from a depth of 150 fathoms. These two species were described as *A. gigantea* and *A. pedunculata*, and the present species is undoubtedly closely related to *A. gigantea*, but differs notably (1) in having small tag-like projections all over the test, and (2) in the much more regular shape and arrangement of the stigmata (compare fig. 5 with the figures in the Challenger report). These characters are seen in all the specimens of the present collection, and no transitions to the characters of the Challenger specimens are found. Consequently, I consider it justifiable to describe the present as a new species. At the locality in question—off Queen Mary Land—this species must be present in enormous abundance, as a note written by Mr. J. G. Hunter, the Biologist to the expedition, reads:—"Station XII yielded an immense number of specimens of a large stalked simple Ascidian—pale red, with thin test, averaging 8 to 9 inches long. There must have been nearly one thousand specimens of this large form."

The discovery of this new species, *A. mawsoni*, necessitates, however, a slight modification of the generic diagnosis of *Ascopera* as given in the Challenger Report. It is there stated that the test is free from tag-like processes. That is true of the Challenger species *A. gigantea* and *A. pedunculata*, but not of *A. mawsoni*. The omission of that minor character from the definition of the genus is, however, unimportant.

A much smaller species, *A. nana*, Herdman, probably belonging to this genus, was described in the Catalogue of Tunicata in the Australian Museum (1899) from specimens obtained at Port Jackson. An additional species of the genus, *A. bouvetensis*, Mchl., was described in 1904, by Michaelsen from the collection made by the "Valdivia" on the German "Tiefsee Expedition" of 1898-9. It was obtained from a depth of 439 m. to the east of Bouvet Island.

As *Ascopera mawsoni* is evidently, from the experience of Mawson's Expedition, present in enormous quantities in, at least, one locality far south, and probably in others also, it is remarkable that such a large and conspicuous form has not been reported by other Antarctic Expeditions.

The single small specimen of *Ascopera* obtained by Drygalski's ("Gauss") South Polar Expedition (1901-3), from 380 m., and described by Hartmeyer as a young *A. gigantea*, is in my opinion more probably a young *A. mawsoni*, although the papillæ on the surface of the test shown in Hartmeyer's pl. 45, fig. 4, do not resemble in shape and appearance the tags on my adult specimens of that species; but that difference may possibly be due to age and growth.

Finally, it is possible that, as Hartmeyer has suggested, my *Molgula longicaulis*, obtained in McMurdo Bay during the National Antarctic Expedition in the "Discovery" (1901-4), ought to be placed with other stalked forms in the genus *Ascopera* rather than in *Molgula*.

BATHYPERA SPLENDENS, *Michaelsen*.

(Plate IX, figs. 1-17.)

Halomolgula ovoïda, Ritter, Univ. California Pub. Zool., (1907), 4, 1,

Pyura kiowillia, Sluit., Deux. Exp. Antarct. Franc. (1908-10), Tuniciers, p. 12 (1914).

Body globular, measuring about 3.5 by 3 cm., attached to coarse sand by a small area at posterior end, or by a short stalk of about 5 mm. The whole surface of the body covered with minute, regular, closely-placed, hard, pointed, calcareous papillæ, showing white against a dark-grey ground-work, and giving a characteristic ornamented appearance to the species (see figs. 1, 2, &c.).

Test thin, but tough and prolonged on the outer surface into most regularly arranged papillæ, containing calcareous spicules, which form a pattern, and extend over even the invaginated extension of the test which lines the branchial and atrial siphons. The characters of these compound papillæ can be best seen from the figures (figs. 6-11).

The branchial and atrial apertures are both bilabiate and slit-like (figs. 3 and 4), each about 5 mm. in length and placed with their long axes at right angles to one another, the branchial extending dorso-ventrally and the atrial laterally.

The base of both branchial and atrial siphons shows a well-marked fringe of white calcareous spicules projecting for several millimetres into the cavity, and marking the inner edge of the inflected test.

The branchial sac has six well-marked folds on each side, with twelve to sixteen bars on a fold and five or six in the interspaces (fig. 12). The character of the stigmata is shown in figures 13 and 14.

Dorsal lamina having its front portion fringed with long teeth or languets, sometimes forked at the free end (fig. 15), crossed by delicate ridges, three or four to each languet. The posterior part of the lamina is a plain membrane.

Tentacles twelve in number, of two sizes alternating, and generally with still smaller ones between. In the largest specimen examined there are many such smaller intermediate tentacles of various sizes, forming a continuous fringe.

Dorsal tubercle small, cordate, opening anterior with both horns turned inwards.

Viscera near the posterior end of the body, just inside the point of attachment. The alimentary canal extends along the posterior end of the left side. The narrow elongated gonad on the right side extends around the posterior end from the ventral to the dorsal edge. The gonad on the left side lies in the loop of the intestine (fig. 5), and also extends from the ventral to the dorsal edge of the posterior end of the body. Endocarps engorged with blood corpuscles (fig. 16), project from the inner surface of the mantle. The mantle also shows (fig. 17), ramifying over its muscle bundles a system of fine vessels having terminal enlargements engorged with corpuscles.

Localities.—

Station I, 22nd December, 1913, 358 fathoms; four specimens measuring respectively 5, 3.5, 3, and 2 cm. in greatest diameter. Two of these specimens have short stalks, about 5 mm. in length; the others are merely attached by the posterior end of the test.

Station VIII, 27th January, 1914, 120 fathoms; one specimen measuring 3.5 by 3 cm.

This is a very remarkable species, with a most characteristic, ornamental, appearance (see figs. 2, 3, 4, &c.). It was first found by the "Valdivia" expedition to the north of Enderby Land, at a depth of 4,636 m., and was described by Michaelsen in 1904 as the type of a new genus, *Bathypera*, in the family Molgulidæ. The "Gauss" expedition, in 1903, found six very young specimens off Kaiser Wilhelm II Land, in depths of 350 to 2,916 m., which Hartmeyer, in 1911, refers to Michaelsen's genus and species.

Hartmeyer, however, in 1909 (Bronn., v. iii, supp., p. 1328) had diagnosed *Bathypera* anew, under the family Molgulidæ, but omitted all reference to the characteristic appearance due to the clumps of calcareous spicules on the test.*

The second "Charcot" Expedition (1908-10) next obtained a specimen from the "Pourquoi Pas?" dredgings (no depth given), which Sluiter (1914) refers to the family Cynthiidæ (Pyuridæ), and describes as a new species under the name *Pyura liouvillei*. From Sluiter's figures and description there can be no doubt that the "Charcot" specimen belongs to, at least, the same genus as those of Michaelsen and Hartmeyer, and even probably to the same species, and yet he makes no mention of *Bathypera splendens*. In the meantime, Ritter in examining the ascidians collected by the "Albatross" off the coast of Southern California in 1904, found what is clearly a very closely-related, if not identical form, which he described in 1907 under the name *Halomolgula ovoida*, n. gen. et sp. He had 150 specimens at his disposal, dredged from 1,000 fathoms off the south of Point Conception, and from his full description

* Hartmeyer in "Bronn" (*loc. cit.*) recognises Ritter's genus *Halomolgula*, and points out that *Halomolgula* shows certain resemblances to *Bathypera*, but adds that the outstanding generic character of *Halomolgula* is the presence of these calcareous bodies in the test. But *Bathypera splendens* has these same calcareous bodies (see Michaelsen's original description), which character in fact is the outstanding resemblance which proves that *Halomolgula* is a synonym of *Bathypera*.

and figures it is evident that he was dealing with Michaelsen's *Bathypera*, if not indeed with the species *B. splendens*. He gives the calcareous spicules projecting from the test as a diagnostic generic character of *Halomolgula*, and in their arrangement and in the appearance and most details of the internal structure his description and figures agree closely with our Antarctic species, and would clearly fall into the genus *Bathypera*. His *H. ovoida* has, however, nine folds on each side of the branchial sac, and for that and other reasons, such as the dorsal tubercle and the tentacles, I am inclined to consider the Antarctic form to be a distinct species from the Californian, which must, therefore, be named *Bathypera ovoida* (Ritter).

Ritter, then, quite independently of previous investigators, had come to the conclusion (like Michaelsen and Hartmeyer) that this remarkable form (*Bathypera* or *Halomolgula*), ornamented with calcareous spicules projecting from the test, was a Molgulid; and I can only suppose that Sluiter, in referring what is obviously the same species to the genus *Pyura* (a Cynthiid) was misled by the unusual position of the left gonad in the intestinal loop. The fact is that *Bathypera*, as the genus must be called, is in some respects a border-line form, and has the branchial sac of a Molgulid, combined with the visceral arrangement of some Cynthiids, but which may be found in both families. The lobes of the branchial and atrial apertures give no indication in either direction. It is true that the branchial aperture in *Bathypera splendens* does not show the characteristic six-lobed condition of the Molgulidæ, but, on the other hand, neither does it have the four lobes characteristic of Cynthiidæ. In that respect it is an exceptional form in either family—and similarly for the bilobed atrial aperture. Other exceptional forms in regard to the character of the apertures are well known in both families. The branchial sac is, however, characteristically Molgulid. The stigmata are not arranged in rows or straight series, as in Cynthiidæ, but are more or less curved, and in places may be coiled to form infundibula. The appearance of the mantle also, in the body after the removal of the test (fig. 5), is that of a Molgulid.

There are a few minor discrepancies between Sluiter's description of his "*Pyura liouwillia*" and the "Mawson" specimens now before me, the chief of which is that in dealing with the papillæ ("petites protubérances") he makes no mention of the remarkable and characteristic calcareous spicules which occupy these papillæ, give them their white colour, and have the curious appearances which I have described and figured, and which are also recognised by Michaelsen, Hartmeyer, and Ritter. Possibly some accident in the preservation may have led to their disappearance. Otherwise Sluiter's description and figures leave no doubt that his specimens are so far identical with ours that they belong at least to the genus *Bathypera*, if not, indeed, to the same species, *B. splendens*.

The *Bathypera* "forms" (whether one or two species) have now been found as follows:—

"Valdivia" Expedition (Michaelsen), north of Enderby Land, 2,534 fathoms.

"Albatross" (Ritter), off coast of California, 1,000 fathoms.

"Gauss" (Hartmeyer), off Kaiser Wilhelm II Land, 191-1,592 fathoms.

"Pourquoi-Pas?" (Sluiter), "Dragage IX (No. 108), Dragage XVIII (Nos. 835, 840)." No depths given.

"Mawson" (Herdman), off Adelie Land, and off Wilkes Land, 120 and 358 fathoms.

I think it probable that Ritter's Californian specimens belong to a distinct species, *Bathypera ovoida* (Ritter) and that all the rest are *B. splendens*, Michaelsen.

MOLGULA LUTULENTA, *n. sp.*

(Plate VIII, figs. 7-10.)

Body of ovate form, measuring about 3×2 cm., thickly covered with a dense coating of fine mud attached to delicate hairlike processes of the test (fig. 7). The mud particles are very readily rubbed off leaving the hairs projecting as a fine down. Apertures on anterior end, inconspicuous, about 1 cm. apart.

Test thin and membranous.

Mantle closely attached to inner surface of test; muscular, with strong bands running radially from the base of the sphincters.

Branchial sac with nine folds on each side, four to six bars on a fold, stigmata in some parts coiled into infundibula, in other parts straight or slightly curved (fig. 9). Many of the interstigmatic vessels bear little papillæ, which may grow together to form short transverse bars on the inner surface of the branchial sac (fig. 9).

Dorsal lamina a plain lamina with a slightly crenate free edge (fig. 8).

Tentacles about eighteen, of different sizes, with other much smaller intermediate ones, the smallest of which are simple papillæ (fig. 10).

Dorsal tubercle very simple, shallow, crescentic, with the opening directed anteriorly and to one side. Sub-neural gland large, diffuse, lobulated (fig. 10, *s.n. gl.*)

Locality.—Station X, 29th January, 1914, 340 fathoms: two specimens; the smaller is about 1.5 cm. in length.

MOLGULA CONCOMITANS, *Herdman.*

One specimen was dredged at Station X, 29th January, 1914, 340 fathoms, which agrees well with the description of this species, obtained at McMurdo Bay by the "Discovery" expedition, in all respects except that the musculature of the mantle is not so strong, and that there are seven folds on each side of the branchial sac; and a few more longitudinal bars in the spaces between folds. The "Discovery" specimen had seven folds on the right side and only six on the left, but that need not be regarded as a serious difference; it may be only an individual variation. In regard to the musculature of the mantle, the difference may be due to the fact that

the "Discovery" specimen was preserved in strong spirit, which has a tendency to contract the mantle so as to emphasise the muscle bands, while the present specimen is preserved in formalin, which leaves the mantle softer and more flabby.

This species has a characteristic soft, grey-coloured, test, covered with fine hairs or little tags, with no muddy investment, and not pedunculated nor attached. It is certainly not the same as *M. maxima*, Sl., and *M. pedunculata*, Hrdm., as Sluiter supposes.

In the present specimen I find about six bars on a fold and six or seven bars in the interspace. The stigmata are mostly straight, but in places may be curved. The small blood-spaces in the horizontal membranes of the branchial sac along with internal longitudinal vessels are engorged with blood corpuscles, and stand out as a conspicuous net-work on the inner surface of the branchial sac. Traces of this engorged system of fine vessels on the inner surface of the branchial sac are shown in my figure of the branchial sac of the "Discovery" specimen (that Report, pl. V, fig. 5). The alimentary canal on the left side of the body extends from the posterior end along both dorsal and ventral edges nearly to the anterior end; and along with the large gonad in the intestinal loop occupies the greater part of the left side of the body. The right side has a large yellow, sausage-shaped, gonad; behind which is a large curved renal organ.

The dorsal tubercle is prominent, cordate, with the opening directed posteriorly and both horns turned inwards.

A second specimen obtained at Station I, Adelie Land, 354 fathoms, clearly belongs to the same species as the above.

MOLGULA EUPPLICATA, *n.sp.*

(Plate X, figs. 1-6.)

Body.—Shape ovate, 5 × 3.5 cm., not attached; apertures both anterior, sessile, about 1.5 cm. apart.

Test thin and semi-transparent, covered with fine hairs, with a little sand, shell fragments and polyzoa adhering, especially at posterior end.

Mantle thick, opaque, and muscular, especially round siphons.

Branchial sac with eight or nine folds on each side, the most ventral ones being very slight and reduced to one or two bars. The larger folds have six to nine bars, and there are one to three bars in each interspace. There are fairly frequent broad transverse vessels, and very numerous fine connecting vessels which cross the stigmata transversely and obliquely (fig. 4). Many of the blood vessels of the branchial sac are in places engorged with dark-coloured blood corpuscles, so as to form conspicuous networks (figs. 5 and 6). The stigmata are very irregular.

Dorsal lamina a short plain membrane.

Tentacles fourteen to sixteen, of two sizes, placed alternately. The larger ones are much branched.

Dorsal tubercle prominent, but simple, circular or cordate; opening directed postero-laterally, both horns turned inwards (fig. 3, *a*; fig. 3, *b* shows another specimen where the opening is directed laterally.

Viscera.—The alimentary canal and the left gonad occupy the posterior end and the postero-dorsal edge of the left side. The right side showed an elongated gonad and large curved renal organ (fig. 2).

Localities.—

1. Station I, 22nd December, 1913, 358 fathoms; one specimen.
2. Station X, off Wilkes Land, 340 fathoms; one specimen measuring about 3×2 cm.
3. Commonwealth Bay, Adelie Land, lat. 67° S., long. $142^{\circ} 36'$ E., 3rd and 4th September, 1912, 25 to 30 fathoms; one specimen, measuring 4×3 cm.
4. Locality doubtful—possibly Station X; one specimen, measuring 2.5×2 cm.

I place all these specimens in the one species although they present slight differences from one another in the folds of the branchial sac, and the number of bars on a fold and in the interspace. The characteristic arrangement (as shown in fig. 4) is to have one bar near the base of each fold dividing the space into a narrow area close to the fold and a much wider space extending to the next fold. In the larger (older) specimen a few additional slighter bars make their appearance in the interspace.

This species and *Molgula lutulenta* (see above) have an unusually large number of folds. There seem to be no other Molgulids recorded with nine folds on each side with the exception of *Halomolgula* (= *Bathypera*) *ovoida*, Ritter. In regard to the external appearance of this species, as there are very long funnels of invaginated test at the apertures it is probable that when expanded in life the siphons may have been considerably elongated.

*Family HALOCYNTHIIDÆ.**BOLTENIA ANTARCTICA, v. Ben. and Sel. Long.*

(Plate X, figs. 7-9.)

Body measuring about 3×2.5 cm., stalk may be up to 30 cm. in length, and varies from 1 to 2 mm. in diameter. The stalk is attached to the middle of the ventral edge. The apertures are very distinctly four-lobed, placed far apart, the branchial near the stalk and the atrial at the opposite extremity of the body (fig. 8). The test is thin but tough, with a fine coating of minute hairs all over the surface.

The branchial sac has seven folds on each side. There are thirteen to fifteen bars on a fold, and two or three in the interspace. There may be as many as twelve to fourteen stigmata in a mesh, but other parts do not show so many. A narrow horizontal membrane crosses the mesh (fig. 7).

About eight large compound tentacles and some smaller intermediate ones making about fourteen in all.

Dorsal tubercle rather large, cordate, with the opening anterior, and both horns coiled inwards (fig. 9).

Localities.—(1) Station VIII, 27th January, 1914, 120 fathoms, five specimens; (2) Station X, 29th January, 1914, 340 fathoms, four specimens; (3) Station XII, 31st January, 1914, 116 fathoms, one specimen.

I have no doubt that this is the species described by E. van Beneden and M. de Selys-Longchamps from the "Belgica" collection under the name *Boltenia antarctica*. Their specimens, seven in number, were obtained at lat. 70° S., long. $80^{\circ} 48'$ W. from a depth of 580 metres. The external characters and most of the details of internal structure of our specimens in the "Mawson" collection agree closely with those from the "Belgica." There are, however, a few minor differences which I might refer to: *B. antarctica* is described as having about twelve tentacles which may be of somewhat different sizes. Our specimens show eight large tentacles and some smaller, about fourteen in all. In the branchial sac the "Belgica" specimens have fifteen to twenty bars on a fold and two or three in the interspace, while ours show thirteen to fifteen on a fold and two or three between folds. The number of stigmata in the larger meshes is greater (twelve to fourteen) in ours than in the "Belgica" specimens, but this is evidently a character which varies much, even in different parts of the same branchial sac.

I agree with the authors of the "Belgica" Report that their *Boltenia antarctica* is a distinct species from the *B. bowvetensis* of Michaelsen.

MICROCOSMUS SPINIFER (*Herdman*).

Cynthia spinifera, Herdman, Cat. Austr. Mus. (1899), p. 32.

M. acanthifera, Hartmeyer, Bronn, p. 1341.

One specimen of this species, measuring 13 mm. in diameter, was found adhering to one of the specimens of *Rhabdocynthia draschii* from 65 fathoms off Maria Island, Tasmania. It agrees in all respects with my description of *Cynthia spinifera* in the Catalogue of Tunicata in the Australian Museum (1899).

I notice that Hartmeyer (Bronn, p. 1341) quite unnecessarily gives a new name (" *acanthifera* ") to this species, presumably on the ground that the name " *spinifera* " was pre-occupied by the " *Ascidia spinifera* " of Quoy and Gaimard. But that species obtained during the voyage of the " *Astrolabe*," is really a *Boltenia*, and consequently the name *spinifera* is not pre-occupied in the genus *Cynthia* (*Halocynthia*), to which I referred the species. But even if *Boltenia* be included in Hartmeyer's *Pyura* (= *Halocynthia*) there is still another reason why his name " *acanthifera* " is unnecessary and non-valid, and that is that Hartmeyer himself (in " Bronn ") recognises that my species really belongs to the genus *Microcosmus* (not *Pyura*), in which there is no other species *spinifera*, and therefore by the rules of nomenclature my original specific name holds good, and consequently the correct name of the species is *Microcosmus spinifer* (Herdman).

RHABDOCYNTHIA DRASCHII (*Herdman*).

(Plate XI, figs. 1-9).

Microcosmus draschii, Herdman, Cat. Tun. Austr. Mus., p. 20.

About twenty specimens of this large species of *Rhabdocynthia*—distinguished from *Halocynthia* by the presence of abundance of fusiform calcareous spicules in the body-wall—were dredged by Professor T. T. Flynn from 65 fathoms, 12th December, 1912, off Maria Island, Tasmania. They average about 6 × 4 cm., with dirty white or yellowish grey, soft leathery tests, and the two large square apertures on the wide anterior end (fig. 1.) When the apertures are closed they assume the cross-form shown in fig. 2. The dark-brown mantle is very muscular, and bristles with the abundant echinated spicules (see also Cat. Tunicata in Austr. Mus., 1899, Pl. Cyn. III) which are visible to the eye on opening the test (fig. 3). In most of the other internal characters—the numerous folds of the branchial sac (at least ten, and usually more), the large and small tentacles (eight to twelve of each), the very wide pre-branchial zone and the dorsal languets—these specimens from Tasmania agree with the description of the Australian Museum specimens from Port Jackson and Port Stephens. But there is one organ which shows a notable difference. The dorsal tubercle in the original description and figures is shown as a rounded elevation with an elaborate pattern all over its surface, while in the specimens now before me in the " Mawson " collection the tubercle, though large, is not prominent, and is of an ordinary type, consisting of two rather irregularly coiled

loose spirals (see figs. 7 and 8). I can only suggest that in some of the much larger Australian Museum specimens (up to 16×12 cm.) the tubercle had become much more complicated, so as to resemble that of *Microcosmus julinii*, v. Drasche.

In the original description, with considerable hesitation (p. 23), I placed this species in the genus *Microcosmus*, notwithstanding the presence of dorsal languets. I now think that was a wrong course to adopt, and that the species must be regarded as a *Rhabdocynthia* because of the dorsal languets (fig. 9), the spicules in the body-wall (figs. 3-5), and the fairly wide intestinal loop.

I notice that Hartmeyer, in "Bronn" (p. 1345) places this species as a synonym of *M. (Cynthia) claudicans* (Sav.), which it is certainly not. Savigny's *Cynthia claudicans* is a small European species, "très-commune sur les Huîtres qu'on apporte à Paris," and Savigny could scarcely have failed to notice the abundant and conspicuous spicules which can be both seen with the eye and felt with the fingers when the animal of *R. draschii* is cut open.

HALOCYNTHIA DISCOVERYI, *Herdman*.

(Plate. XI, figs. 10-13.)

There are about a dozen large specimens of this characteristic Antarctic species in the Mawson collection, and three or four smaller ones adhering to these. Most of them (about nine) were obtained at Station I, 22nd December, 1913, 358 fathoms; and a few from Station VIII, 27th January, 1914, 120 fathoms; and also from Station III, 21st December, 1913, 157 fathoms; and one from Commonwealth Bay, Adelie Land, 3rd September, 1912, 25-30 fathoms.

This species was established in 1910 for a specimen obtained by the British National Antarctic Expedition in the ship "Discovery," at the Winter Quarters in McMurdo Bay. In addition to the characteristic external appearance (fig. 10), the furrowed and corrugated test prolonged into ridges and knobs, and the long divergent siphons giving a cleft appearance, perhaps the best distinguishing feature of this species is the spread-out, undulating or serpentine dorsal tubercle, one form of which I showed in the "Discovery" report, at pl. IV, fig. 12, and of which I give another form here (pl. XI, fig. 13).

The German South Polar Expedition in the "Gauss" obtained four small specimens off Kaiser Wilhelm II Land at 170-385 metres, and in describing these Hartmeyer figures a simpler form of dorsal tubercle which is probably, as he suggests, an earlier stage of what I have figured.

In 1914, Sluiter described as a new variety of this species, var. *septemplicata*, thirteen specimens from the second French Antarctic Expedition under Dr. Charcot, and which he found had seven folds on each side of the branchial sac in place of the six I had recorded in the original description. The four specimens of the German Expedition were smaller than the "Discovery" one, and Sluiter's largest was twice

that size; but the present Mawson specimens are larger still, and by far the largest that have yet been found. One measures $6 \times 5 \times 2$ cm., and a well-shaped average one is $5 \times 4 \times 2$ cm., the siphons being each about 2 cm. in length. In another example, where the total length was 5 cm., the branchial siphon measured 2.5 cm.

In some specimens the siphons are distinctly four-sided or quadrangular in section, the ridges running down from between the lobes of the apertures (pl. XI, fig. 10).

The branchial sac may have either six or seven folds on each side. It has always six very distinct folds and may have a seventh on the ventral edge, close to the endostyle, which, however, is very slightly developed and has only three or at most four bars, while the larger, more dorsally-placed folds have from six to nine bars. There are three or four bars in each interspace between folds. On the whole the folds tend to diminish in height from the dorsal to the ventral edge. The thick, corrugated, white, invaginated test which lines the long branchial and atrial siphons ends internally in each case in a well-marked diaphragm which greatly reduces the lumen of the tube.

The remarkable dorsal tubercle shows some variation. Sluiter finds in his specimens both the complicated serpentiform dorsal tubercle that I originally described, and also, in smaller examples, the simpler form figured by Hartmeyer. In the present collection every specimen shows it as a more or less spread out and undulating form (fig. 13), with central and lateral U-shaped loops open anteriorly; but some are less elongated, more condensed, simpler, and more tubercle-like than others. Still, it is a most characteristic feature and one of the surest guides to the identification of the species.

Gonads are well developed on both sides of the body, in the form of very many yellow masses, of rounded or quadrangular shape and hermaphrodite structure, united together by ducts into a single large gonad on each side.

I do not attach much importance to the difference in details of the branchial sac given by Sluiter for his variety. I find similar variations in different parts of one specimen. The compound sparsely branched tentacles (fig. 12), the languets of the dorsal lamina (fig. 11), and other details given in the descriptions of Hartmeyer and Sluiter agree well with my present specimens, and there can be no doubt we are all dealing with one and the same species.

HALOCYNTHIA CEREBRIFORMIS (*Herdman*).

(Pl. X, figs. 10-11.)

Cynthia cerebriformis, Herdman, "Challenger" Report (1882), p. 136.

? *Cynthia multiradicata*, Herdman, Cat. Tun. Austral. Mus. (1899), p. 30.

Two specimens of this Australian species were collected by Professor Flynn, at 65 fathoms, off Maria Island, Tasmania, 12th. December, 1912. One has a nearly

globular body measuring 4×3.5 cm. across, and borne on a stout stalk about 4 cm. long, spreading out into roots at the base. The other specimen is longer, more pear-shaped, measuring 5×3.5 cm., and has very little stalk, the half-dozen branching roots spreading direct from the narrower posterior end of the body. Both specimens are rather browner in colour than the "Challenger" specimen, from Port Jackson, 30-35 fathoms, from which the species was described. In that specimen also the corrugations on the surface of the test were pronounced, and more convoluted, which accounts for the specific name "cerebriformis," but these and a few other slight differences are probably individual variations only. The anterior end of the body, for example, is not so much bent over to the right side as in the "Challenger" specimen, but still both apertures are distinctly on the right-hand side of the anterior extremity. The apertures again are not so prominent, and both siphons are alike in size. The invaginated test lining the atrial siphon ends in a diaphragm with a series of crenations or lobed processes at its free margin.

The test and mantle agree exactly with the "Challenger" description. The branchial sac, with its six large folds on each side, also agrees well; but there are occasional transverse vessels much wider than the rest, and some of the meshes are elongated transversely and may contain as many as ten stigmata. So I would now define the meshes as having six to ten stigmata (fig. 10), and the stigmata are rather longer than those shown in the "Challenger" figure. The tentacles in one specimen are fourteen, of two sizes, large and small alternating, with additional still smaller intermediate ones between. The internal longitudinal bars number about ten on each side of a fold, and ten in the interspace between two folds.

A number of small specimens, 2-3 mm. long, probably young, of *Polycarpa* (? *P. pilella*) are attached to the anterior part of the test of the larger of our specimens.

This species certainly comes very near to *Cynthia multiradicata* Herdm., from Port Stephens, described in the "Catalogue of Tunicata in the Australian Museum" (1899), p. 30, and I am now inclined to think that it may possibly be the same species. The internal structural features (branchial sac, &c.) agree fairly well; and as to the external characters, the chief difference is in the position of the apertures in relation to the place of attachment, and this may have been affected in the Australian Museum specimen (*Cynthia multiradicata*) by its unusual position, as it is attached to another ascidian (*Styela whiteleggii*) by a large number of roots springing from the ventral edge not far from the branchial aperture. The corrugations on the surface of the test take the form of knobs rather than convolutions.

If this specimen is included, I have now examined four examples, all differing a little from one another, of what may be the one species, viz., the "Challenger" *C. cerebriformis* (Port Jackson), the Australian Museum *C. multiradicata* (Port

Stephen), and the two "Mawson" specimens from Tasmania; and of the latter two, now before me, one has a stalk like the "Challenger" form, and the other has abundant roots like the Australian Museum specimen, though not developed to such an extent. I believe, notwithstanding these differences in external appearance, the essential agreement in internal structural characters justifies me in regarding it as at least probable that all four belong to the one somewhat variable species, and in that case the diagnosis given in the "Challenger" report should be modified in the direction I have indicated above.

HALOCYNTHIA (PYURA) SETOSA, *Sluiter*.

1. Station I, 22nd December, 1913, 358 fathoms; four specimens measuring 9, 6, 5, and 4 cm. respectively in length.
2. Commonwealth Bay, Adelie Land, 14th December, 1913, 45-50 fathoms; two small specimens about 3 cm. in length.
3. Commonwealth Bay, 21st December, 1913; one small specimen.

This is a characteristically Antarctic species which has now been found at Ile Booth Wandel by the French Antarctic Expedition under Dr. Charcot, at the South Orkneys by the "Scotia" Expedition, at McMurdo Bay by the "Discovery," at Kaiser Wilhelm II Land by the "Gauss," and off Adelie Land by the "Mawson" Expedition.

I notice that Sluiter, in his report on the Tunicata of the second "Charcot" Expedition (p. 10), takes exception to my mild criticism of the figure of this species (his *Pyura setosa*) given in the Report on the First French Antarctic Expedition. I will merely remark now that his figure (pl. V, fig. 57) gives no indication whatever of the very pronounced and characteristic echinations which cover the long spines. Now these echinations, like little hooks and spinules, are plainly visible to the unaided eye (see my figures 1 and 2, pl. II, in the report on the "Discovery" Tunicata), while their exact appearance under a low power of the microscope is shown in figs. 2A, 2B, and 2C. I have now re-examined these spines, and maintain that my figures are correct, that the spines stand up or "bristle" from the test in all directions, and that their echinations are conspicuous, giving an appearance very different from the smooth, curved, soft-looking processes of Sluiter's original figure.

HALOCYNTHIA FLYNNI, *n.sp.*

(Plate XII, figs. 9-12.)

Body ovate, rounded at posterior end, where attached, and rather broader and flatter in front (which may be in a contracted condition). Branchial aperture at dorsal edge of anterior end, atrial on dorsal edge a little way back, sessile; both four-lobed. Surface wrinkled, colour yellowish-brown. Size, 2 × 1.5 cm.

Test coriaceous, tough, but not thick. Branchial siphon lined by test with numerous little sharp-pointed processes arranged in many irregular rows (fig. 12).

Mantle fairly muscular (fig. 9).

Branchial sac, with six folds on each side, six to eight bars on a fold and two or three in the interspace; occasional wider transverse vessels, and narrow horizontal membranes crossing some of the meshes (fig. 11); four or five stigmata in a mesh. In the folds the stigmata have a twisted or undulating appearance (fig. 11), due perhaps to contraction.

Dorsal lamina with narrow-pointed languets (fig. 10).

Tentacles not large and rather sparsely branched, number uncertain.

Dorsal tubercle simple, between crescentic and cordate, opening antero-lateral.

Viscera.—Alimentary canal forming a narrow loop at posterior end of left side (fig. 9). Gonads on both sides, elongated and curved.

Locality.—Off Maria Island, Tasmania, 12th December, 1912, 65 fathoms; one specimen—which I have named in honour of Professor T. T. Flynn, who contributed this and several other interesting species to the collection.

STYELA LACTEA, *Herdman*.

? *Cynthia verrucosa*, Lesson, Cent. Zool. (1830), p. 151.

Tethyum verrucosum, Michaelsen, Hartmeyer, and others.

1. Commonwealth Bay, Adelie Land, 14th December, 1913, 45–50 fathoms; one specimen about 3 cm. in length.
2. Same locality, 3rd September, 1912, 25 fathoms; two specimens about 15 mm. in diameter.
3. Station I, 22nd December, 1913, 358 fathoms; one specimen 4 cm. in length and one (very large for this species) measuring 13 × 9 cm.
4. Station VII, 21st January, 1914, 60 fathoms; two specimens measuring respectively 6 and 7 cm. in length.
5. Station III, 21st December, 1913, 157 fathoms; one specimen 4 cm. in length.

This is a common southern form which has been recorded from Kerguelen Island by the "Challenger" Expedition, from South Georgia by Michaelsen, from Ile Booth Wandel by the "Charcot" Expedition, from the Falklands and the South Orkneys by the "Scotia," from Cape Adare by the "Southern Cross," and from Kerguelen and Kaiser Wilhelm II Land by the German "Valdivia" and "Gauss" Expeditions, in addition to those in the present collection.

Hartmeyer, in his report on the Ascidiæ of the "Valdivia" Expedition, p. 250 (1912), argues that the "Challenger" species *S. lactea*, from Kerguelen, with its soft white test and barrel-like shape, is distinct from *S. (Cynthia) verrucosa*, Lesson, of more globular form and covered with spine-bearing papillæ; and he considers that the small globular forms which in my report on the "Scotia" material I referred to *S. lactea* ought

really to be called *S. verrucosa*. I have already myself commented ("Scotia" report, 1912) on the close relationship, if not identity, of these forms, and of Sluiter's *S. flexibilis*, and it may be, as several writers have suggested since, that with age and growth the characteristic papillæ tend to disappear,* and that the "verrucosa" form is really the young of the adult "lactea" form represented in the "Challenger" report at pl. XIX, fig. 7 (see also Sluiter in his report upon the second "Charcot" Expedition, p. 16, although I do not agree that *Styela spectabilis* is also only a gigantic specimen of *S. verrucosa*). Finally, I would point out again that Lesson's figure of his *Cynthia verrucosa* shows five lobes around each aperture, while all specimens, both large and small, that I have referred to *S. lactea* have both apertures most distinctly four-lobed.

STYELA SUBPINGUIS, *n.sp.*

(Plate XII, figs. 1-5.)

? *Styela pinguis*, Herdman, Cat. Tun. Austral. Mus. (1899), p. 37.

Body oblong-ovate, attached at posterior end; branchial aperture anterior, but not quite terminal; atrial on dorsal edge of anterior end about 1.5 cm. from branchial; both four-lobed, sessile; surface smooth, colour white; length 5 cm., breadth 2 cm.

Test white, opaque, soft, thickened at posterior end.

Mantle thin, muscle bundles fine, forming a delicate network.

Branchial sac with four well-marked folds on each side; 10-12 bars on a fold, and at least the same number in interspace, bars wide, ribbon-like; meshes large, with about ten very long stigmata, crossed by a narrow horizontal membrane (figs. 2 and 3).

Dorsal lamina a plain smooth membrane.

Tentacles sixteen in number, of two sizes.

Dorsal tubercle irregularly cordate, aperture anterior, one horn turned in and the other slightly out (fig. 5).

Alimentary canal long, occupying dorsal edge of left side; œsophagus narrow, stomach ovate, with longitudinal ribs, intestine very long and rather convoluted, anus lobed (fig. 4).

Gonads, one on each side, forked, the dorsal branch being the longer (fig. 4). Endocarps abundant.

Localities.—

1. Station I, 22nd December, 1913, 358 fathoms; one specimen.

2. Station X, 29th January, 1914, 340 fathoms; one specimen.

* But against that I can state that in the present collection even the largest specimens, up to 13 cm. in length, have well-marked papillæ and spines, although these are not so regularly and closely placed as in the small globular specimens (see my figures in the Report of the "Scotia" Expedition, Trans. R.S. Edin., xlviii, p. 311, figs. 1-6, 1912).

These specimens show a close resemblance externally, and in some respects internally, to *Styela pinguis*, Herdm., from Port Jackson, but differ so markedly in the alimentary canal and gonads that I think it best to describe this form as a new species. It will be noticed incidentally that it is from much deeper water, as well as far further south. In regard to the external appearance, the larger specimen (pl. XII, fig. 1) is of that slightly hyaline milk-white tint which, as the result of experience, I suspect to be of a red colour when living. The smaller specimen has still a slight pinkish tint in places.

The presence of occasional very long stigmata in the branchial sac, extending across even one of the wider transverse vessels (see fig. 3), is very unusual in the genus. The characters of the alimentary and reproductive viscera can be seen from fig. 4. The folds on the stomach-wall are about ten on each side, and there are about ten prominent lobes on the margin of the anus. Numerous small endocarps are scattered all over the inner surface of the mantle.

The atrial aperture is more nearly anterior than in the Port Jackson specimens of *S. pinguis* which I have examined, but it is possible that this may be the same species. I cannot find any very convincing points of agreement, nor yet any very important points of difference except the condition of the gonads, which may, however, be in a different reproductive phase.

Finally, in some respects (test, branchial sac, and alimentary canal) our specimens show some resemblance to *S. serpentina*, Sluiter, from the second "Charcot" Expedition. If all three species ever come to be united, the name which has priority is *Styela pinguis*, Herdman.

STYELA PERSONATA, *Herdman*.

Three specimens of this Port Jackson species (see Cat. Tun. Austral. Mus., p. 41) were dredged off Maria Island, Tasmania, from 65 fathoms. The largest measures 5 × 4 cm., and the two smaller about 4 × 3 cm. One of the latter is remarkable as having two atrial apertures, both opening into the one cloaca—a condition which has been described as an occasional abnormality in a few other Ascidiæ, and is probably the persistence of an early post-larval character. The two smaller specimens are narrower than is typical for the species, but in other respects agree with the larger individual. The tentacles seem to vary from twenty to thirty, with some smaller intermediate ones.

The dorsal tubercle is also variable, from broadly cordate to U-shaped, with both horns turned in, or one in and the other out.

STYELA INSINUOSA, *Sluiter*.

(Plate XII, figs. 6-7.)

This species was obtained at two localities:—

1. Station X, 29th January, 1914, 340 fathoms; one specimen measuring 4 × 1.4 cm., of a pinkish-gray colour.

2. Commonwealth Bay, Adelie Land, 3rd September, 1912, 25 fathoms; four specimens ranging from 2.5 to 1.5 cm. in length, and all of a pale yellowish-gray colour.

Notwithstanding the slight difference in colour, these five specimens all clearly belong to this well-marked species. The branchial sac (fig. 7) is especially characteristic, and I agree with Sluiter that the four broad ribbon-like bars and the crowded stigmata behind them represent greatly reduced folds. In the spaces between these bars I find an average of about thirty stigmata, but some have more. The transverse vessels are distinctly of three sizes, and I find the longitudinal bars generally even wider than is shown by Sluiter (see fig. 7). In all other respects my specimens agree perfectly with the description and figures given by Sluiter in his report on the Tunicata of the second French Antarctic Expedition, p. 24. Even the external appearance of this little species—the erect, cylindrical form with two prominent apertures at the anterior end (fig. 6) and the surface of the test cut up into regular little scale-like areas—is most characteristic and easily recognisable.

POLYCARPA RIGIDA, *Herdman*.

(Pl. XII, fig. 8.)

? *P. longisiphonica*, Hrdn., "Challenger" Report, Tunicata (1882), p. 177.

? *P. jacksoniana*, Hrdn., Cat. Tun. Austr. Mus. (1899), p. 50.

There are about thirty specimens in the present collection which were dredged by Professor T. T. Flynn from 65 fathoms off Maria Island, Tasmania, and which in some respects agree with *P. rigida* as described in the "Challenger" report, and in other respects resemble *P. jacksoniana* of the Australian Museum Catalogue. *P. longisiphonica* is no doubt a closely-related form. All three species, if distinct, belong to the same section of *Polycarpa*, and all have been recorded from Bass Strait, and from Port Jackson or Port Stephens, or both. It is much to be desired that some Australian Zoologist should study these forms in the living condition, and determine whether the slight differences that have been described from preserved specimens can be maintained as constant or are bridged over by intermediate conditions.

The present specimens from near Tasmania all show the characteristic rigid, brittle, sandy condition of the test, and all show more or less of the curvature of the body with the convexity ventral which is figured in both species (*P. rigida* and *P. jacksoniana*) in my Australian Museum Catalogue. A few notes may be added from the specimens before me for comparison with the published descriptions.

The branchial sac has 10–11 bars on a fold, and may have as many in the interspace. The transverse vessels may be very wide and are of at least three orders, with, usually, seven narrower between a pair of the widest, so as to give the formula 1, 3, 3, 3, 2, 3, 3, 3, 1—where 1 represents the widest order and 3 the narrowest. The

meshes are usually a little elongated transversely, and contain about five short, wide stigmata each. The stigmata are in some places reduced to minute round openings, irregularly arranged. There are in some places wide horizontal membranes, like shelves, projecting from the transverse vessels. The numerous small hermaphrodite polycarps are deeply imbedded in the thickness of the mantle, as was noted in the "Challenger" report (p. 176).

There remain the tentacles and the dorsal tubercle (see fig. 8), and these are the organs which seem most unlike in the original descriptions of the three species *rigida*, *longisiphonica*, and *jacksoniana*, but with the more abundant material which I have now before me these differences tend to disappear, the gaps being bridged over by intermediate forms. The dorsal tubercle is always simple and U-shaped, but the horns may turn inwards or outwards or one in each direction. I find all the shapes which I had previously figured and others, but still there is a general resemblance between them all. The tentacles also, though differing in detail in individuals, show a common character which is recognisable. To the eye, they are short, stumpy, and rather distant; but when a portion of the cirlet is examined with the microscope it is found that only the larger tentacles had been seen, and that there are much smaller ones between, which, however, vary greatly in number and in size—thus accounting for the differences in the original descriptions of the species. The larger tentacles show the ridges of thickened epithelium producing the appearance of double parallel lines (fig. 8), which I figured in the "Challenger" report in the case of *Polycarpa longisiphonica*. One of the difficulties of identifying Ascidiæ in preserved collections from the Antarctic or other remote seas lies in the fact that in many cases only a single specimen exists—or very few—and in the absence of any knowledge as to the range of individual variation in the species the only course is to describe the individual.

With the considerable series from Tasmania in the collection before me, I am sure that they all belong to the species which I described in 1899 as *P. jacksoniana*, but I also think it most probable that the Australian Museum forms to which I gave that name ought to have been referred to the species which I had previously described from the "Challenger" collection as *P. rigida*, and very possibly, in the light of the variations I have now found, *P. longisiphonica* may also belong to the same species. I am sorry that the appropriate name *jacksoniana* must lapse, but *rigida* has priority.

*Family ASCIDIIDÆ.**ASCIDIA CHALLENGERI, Herdman.*

(Plate XIII, figs. 1-4.)

The collection contains about three dozen specimens from several localities and various depths, which after full consideration I have decided to refer to this species, although some of them show variations which I shall describe below. There are a couple of dozen specimens from Station XII, 110 fathoms; five specimens from Commonwealth Bay, 55-60 fathoms; four specimens from Station I, 358 fathoms; and two specimens from Station VII, 60 fathoms; also three specimens collected by Professor T. T. Flynn off Maria Island, Tasmania, 12th December, 1912, 65 fathoms, the largest nearly 20 cm.

These specimens vary in size from 5 to 20 cm. in length. The atrial aperture is in most cases about one-quarter of the way from the anterior to the posterior end, but may be as far as halfway down the body. The test varies considerably in thickness, toughness, and opacity. The shallower-water specimens from Commonwealth Bay have the more rounded contour, softer test, and less prominent apertures characteristic of the "Challenger" species *A. meridionalis*, while those from the deeper water of Station I have the thicker and stiffer test and general appearance of *A. challengerii*. The shape is generally, especially in the larger specimens, rather wider and with less of a basal prolongation than that figured for the latter species in the "Challenger" report (pl. XXX). A specimen 15 cm. in length is from 6 to 7 cm. in breadth.

The internal organs agree in general with the description of the "Challenger" species, which was found in shallow water round Kerguelen Island. The branchial sac shows in some parts eight to ten stigmata in a mesh, and in other parts fourteen to eighteen stigmata. Intermediate papillæ are present on the internal longitudinal bars (fig. 4) in some branchial sacs and not in others. The dorsal tubercle shows the general characters described in the "Challenger" report, but has both horns turned inwards (see fig. 3).

The tentacles are longer and more slender than those of the Kerguelen specimens, and are not all of the same length, but are in general larger and smaller placed alternately (fig. 3). In this respect they show an approach to those of *A. meridionalis* from the Straits of Magellan and off the south-east coast of South America. In fact, the present deep-water Antarctic specimens which I refer to *Ascidia challengerii* to some extent bridge the gap between that species and *A. meridionalis*.

Of the four specimens from Station I, one had no dorsal tubercle, two were in imperfect condition at the anterior end, and the fourth has a large dorsal tubercle of the type of *A. challengerii*, but with both horns turned outwards, one to the right and the other to the left (see fig. 2).

It is possible that, when larger series of specimens from many localities in southern seas have been examined, it may be found that *A. meridionalis* can be united by intermediate forms with *A. challengeri*.

Three specimens of moderate size (5 to 8 cm. in length and 3.5 cm. in breadth) from Station X, 29th January, 1914, 340 fathoms, with a soft, smooth test slightly prolonged and thickened at the posterior end, may be younger deep-water forms of *A. challengeri*. They show a close resemblance to the figure (his pl. XLII, fig. 13) given by Hartmeyer of the young of that species. The branchial sac has rather shorter papillæ than the typical *A. challengeri*, the tentacles are from fourteen to eighteen, large and small alternately, and the dorsal tubercle is U-shaped, with both horns turned inwards.

Finally, it seems possible that *A. charcoti* Sluiter, obtained at several localities in Antarctic seas by both the "Charcot" Expeditions, may belong to this common and widely distributed southern species. It is described and figured by Sluiter as of a red colour in life, but many red Ascidiæ are found to be afterwards of a grayish colour when preserved in alcohol.

ASCIDIA PLACENTA, *Herdman*.

(Plate XIII, figs. 5-6.)

? *Ascidia meridionalis*, *Herdman*.

Five specimens of *Ascidia* from Station II, 318 fathoms, ranging from 6 to 10 cm. in length, agree fairly well in character with the "Challenger" species *A. placenta*, which was obtained to the south of Kerguelen Island at 150 fathoms. The only doubt that remains as to giving this name to these specimens is whether *A. placenta* may not be a younger and softer or more flaccid form of *A. meridionalis*, obtained by the "Challenger" in the Straits of Magellan and elsewhere off the southern end of South America. These specimens from Station II had not had their tests slit open, and the result is that the internal tissues are more or less broken down and in a poor state of preservation. I can, however, give the following notes from my examination of them. The external appearance and the soft, crinkled condition of the test closely resemble the figures of the "Challenger" report. The unplicated branchial sac is shown in fig. 5, and the dorsal tubercle in fig. 6. The tentacles are long and slender and number about sixty, with a few additional much smaller ones. They agree in number with the "Challenger" *A. meridionalis* rather than with *A. placenta*. In some places the larger tentacles are distinctly of two sizes placed alternately. Two smaller specimens (3 to 5 cm.) from Station VII, 21st January, 1914, 60 fathoms, and not in sufficiently good condition for detailed examination, probably belong to this species, or may be young specimens of *A. challengeri*.

CORELLA DOHRNI, *van Beneden and Selys-Longchamps.*

Plate XIII, figs. 7-8.

? *Corella eumyota*, Traustedt, Vid. Medd. (1881), p. 271.? *Corella antarctica*, Sluiter (1905).

Four specimens, which agree best with the description of *C. dohrni* given by M. de Selys-Longchamps in the Report on the Tunicata of the "Belgica" Expedition, were obtained by the "Mawson" Expedition at Station II, 31st January, 1914, from 358 fathoms.

They are of roughly quadrangular shape (pl. XIII, fig. 7), from 3 to 5 cm. in length, and from 2 to 3 cm. in breadth. The test is thick, measuring up to nearly 1 cm. where thickest, and is stiff, but transparent. The body when removed from the test is relatively small, and the viscera at the posterior end are very small. The muscles of the mantle are much stronger on the left side, especially along its dorsal and ventral edges. There are numerous long slender tentacles—about 70, of two sizes, with additional much smaller ones between (fig. 8). A large fat Amphipod occupied the greater part of the branchial sac in one, and could certainly not have got in or out through the branchial aperture in its present condition. The "Belgica" specimen was obtained at lat. 70° S.; long. 80° 48' W., 580 m., a locality in the neighbourhood of Graham's Land.

The question remains whether *Corella dohrni* is a distinct species or may belong to the widely distributed *C. eumyota* (= *C. antarctica*, Sluiter) which has been already recorded from Antarctic seas by Herdman (at the Aucklands, in "Discovery" report) and by Sluiter (at Ile Booth Wandel, 30 to 40 metres, in the first "Charcot" report). The "Mawson" specimens agree in all essential details with the "Belgica" description of *C. dohrni*, but are also in fair agreement with Sluiter's description of *C. antarctica*. If the latter is *not* the same as *C. eumyota*, then I think it probable that *dohrni* is the same as *antarctica*, and that Sluiter's name will have to be applied to the present species.

Family CLAVELINIDÆ.
? *Stereoclavella* sp. (?), &c.

In a small bottle labelled "Dredgings from Commonwealth Bay, 21st December, 1913," I find a very small (young) specimen of *Ascopera mawsoni*, one Molgulid test with no body inside, one small (young) *Halocynthia setosa*, and one young *H. discoveryi*, two small specimens of *Styela* sp. (probably young of *S. insinuosa*), and a little colony or group of ascidiozooids of a (?) Clavelinid, which may be a *Stereoclavella*, but is too imperfect to identify or describe with certainty. It may, on the other hand, be a compound Ascidian like Hartmeyer's "Synoicide incerti generis" of the "Gauss" Expedition, shown on his pl. LII, fig. 9.

EXPLANATION OF THE PLATES.

“Enlarged” means with the eye or a hand lens; “magnified” means with a low power of the microscope, magnifying 40 to 50 diameters.

PLATE VIII.

Ascopera mawsoni, n.sp. (figs. 1-6).

Molgula lutulenta, n.sp. (figs. 7-10).

- Fig. 1. Outline of one of the smaller adult specimens of *Ascopera mawsoni*, quarter natural size.
2. Young specimen of same, natural size.
3. Part of outer surface of test, showing tags, enlarged.
4. Portion of branchial sac from inside, natural size.
5. Part of branchial sac from inside, magnified.
6. Dorsal tubercle and tentacles, slightly enlarged.
7. *Molgula lutulenta*, natural size.
8. Part of dorsal lamina, magnified.
9. Part of branchial sac, from inside, magnified.
10. Tentacles (tn.), dorsal tubercle (d.t.), nerve ganglion (n.g.), subneural gland (s.n.gl.), dorsal lamina (d.l.), and neighbouring parts, magnified.

PLATE IX.

Bathypera splendens, Mich.

- Fig. 1. One of the specimens, from the left side, natural size.
2. Another more regular specimen, from the left side, natural size.
3. Branchial aperture ($\times 2$).
4. Atrial aperture, enlarged.
5. The largest specimen with test removed, left side.
6. Arrangement of papillæ with calcareous spicules on the surface of the test, magnified.
7. Arrangement of papillæ on the invaginated test lining the branchial siphon; magnified.
8. Papillæ on surface of test seen in profile, magnified.

9. Isolated papillæ from the test, showing clumps of calcareous spicules; (a) young stage still enclosed in epithelial covering, (b) group of three spicules inside the epithelial covering through which the clump of spicules breaks when older and larger, magnified.
10. Group of more regularly rounded papillæ from the lining of the branchial siphon, magnified.
11. One of the most regular of the papillæ from the branchial siphon, more highly magnified.
12. Part of the wall of the branchial sac from the inside, showing two folds and the interspace between, natural size.
13. Small portion of branchial sac from inside, magnified.
14. Another part of branchial sac, magnified.
15. Part of dorsal lamina showing forked languets, enlarged.
16. Portion of an endocarp from the inner surface of mantle, magnified.
17. Part of the mantle showing muscle bundles, and system of blood-channels with masses of corpuscles in dilated ends, magnified.

PLATE X.

Molgula euplicata, n.sp. (figs. 1-6).

Boltenia antarctica, v. Ben. and Sel. Longch. (figs. 7-9).

Halocynthia cerebriformis, Herdman (figs. 10-11).

- Fig. 1. *Molgula euplicata*, left side, natural size.
2. Another specimen, with test removed, right side, natural size.
 3. (a) and (b), two variations found in the dorsal tubercle, enlarged.
 4. Part of branchial sac, showing a fold and part of an interspace; magnified.
 5. Part of a branchial sac showing engorgement of the small interstigmatic vessels with deeply pigmented corpuscles, magnified.
 6. Part of a branchial sac showing similar engorgement of two bars of a fold and neighbouring small vessels, magnified.
 7. Part of branchial sac of *Boltenia antarctica*, magnified.
 8. Outline of *Boltenia antarctica*, natural size.
 9. Dorsal edge of branchial sac and dorsal tubercle, enlarged.
 10. Part of branchial sac of *Halocynthia cerebriformis*, magnified.
 11. Tentacle, dorsal tubercle and neighbouring parts of same, magnified.

PLATE XI.

Rhabdocynthia draschii, Herdman (figs. 1-9).*Halocynthia discoveryi*, Herdman (figs. 10-13).

- Fig. 1. *Rhabdocynthia draschii*, removed from its test, natural size.
2. One of the apertures in the closed condition, natural size.
3. Mantle, showing muscle bundles and spicules ($\times 5$).
4. Group of calcareous spicules from the mantle, magnified.
5. Part of one of the spicules, highly magnified, to show sheath and rows of very fine echinations ($\times 300$).
6. Part of the branchial sac, from inside, magnified.
7. Dorsal tubercle of one specimen, enlarged.
8. Another dorsal tubercle, showing a variation, enlarged.
9. Three languets from the dorsal lamina, enlarged.
10. *Halocynthia discoveryi*, natural size.
11. Part of the branchial sac and dorsal languets, magnified.
12. Group of tentacles, magnified.
13. Dorsal tubercle, magnified.

PLATE XII.

Styela subpinguis, n.sp. (figs. 1-5).*Styela insinuosa*, Sluiter (figs. 6-7).*Polycarpa rigida*, Herdman (fig. 8).*Halocynthia flynni*, n.sp. (figs. 9-12).

- Fig. 1. *Styela subpinguis*, n.sp., right side, natural size.
2. Part of branchial sac, from inside, showing a fold and part of an interspace, magnified.
3. Another part, showing the wider meshes between folds, magnified.
4. Alimentary canal and gonads, enlarged. R and L indicate the right and left sides respectively.
5. Dorsal tubercle, magnified.
6. *Styela insinuosa*, Sluiter, natural size.
7. Part of branchial sac, magnified.

8. *Polycarpa rigida*, Herdman, tentacles and dorsal tubercle, magnified.
9. *Halocynthia flynni*, n.sp., with test removed, left side, natural size.
10. Dorsal languets, magnified.
11. Part of branchial sac, showing fold and interspace, magnified.
12. Rows of minute tags on test lining branchial siphon, magnified.

PLATE XIII.

Ascidia challengerii, Herdman (figs. 1-4).

Ascidia placenta, Herdman (figs. 5-6).

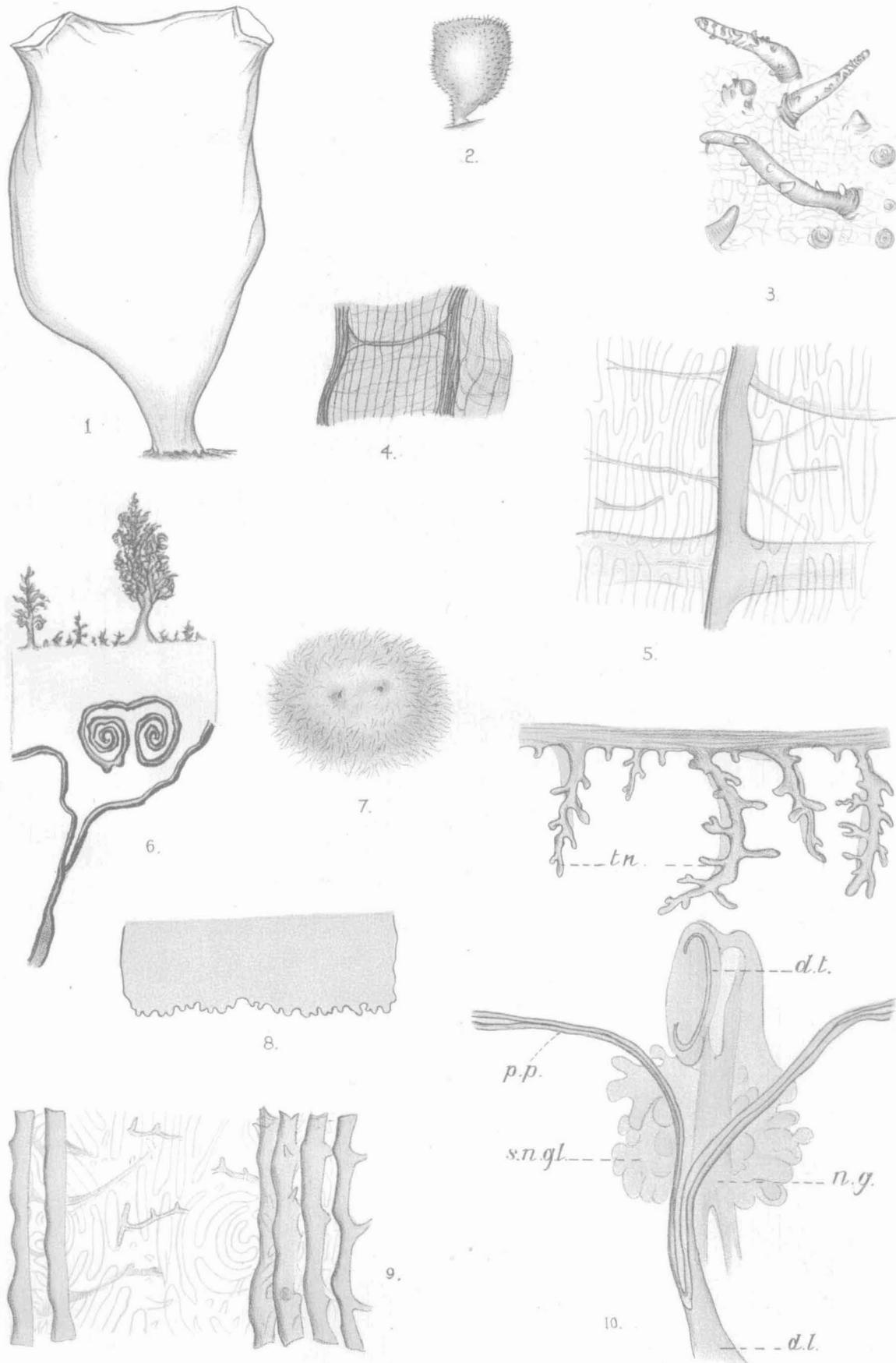
Corella dohrni, van Ben. and Sel. Longch. (figs. 7-8).

- Fig. 1. *Ascidia challengerii*, Herdman, interior of branchial siphon and base of a large tentacle, magnified.
2. Dorsal tubercle of same, magnified.
 3. Dorsal tubercle, &c., of another specimen, magnified.
 4. Part of branchial sac; magnified.
 5. Part of branchial sac of *Ascidia placenta*, Herdman, magnified.
 6. Dorsal tubercle and tentacles of same, magnified.
 7. *Corella dohrni*, van Beneden and Selys-Longchamps, left side, natural size.
 8. Tentacles of same, showing the three sizes, magnified.

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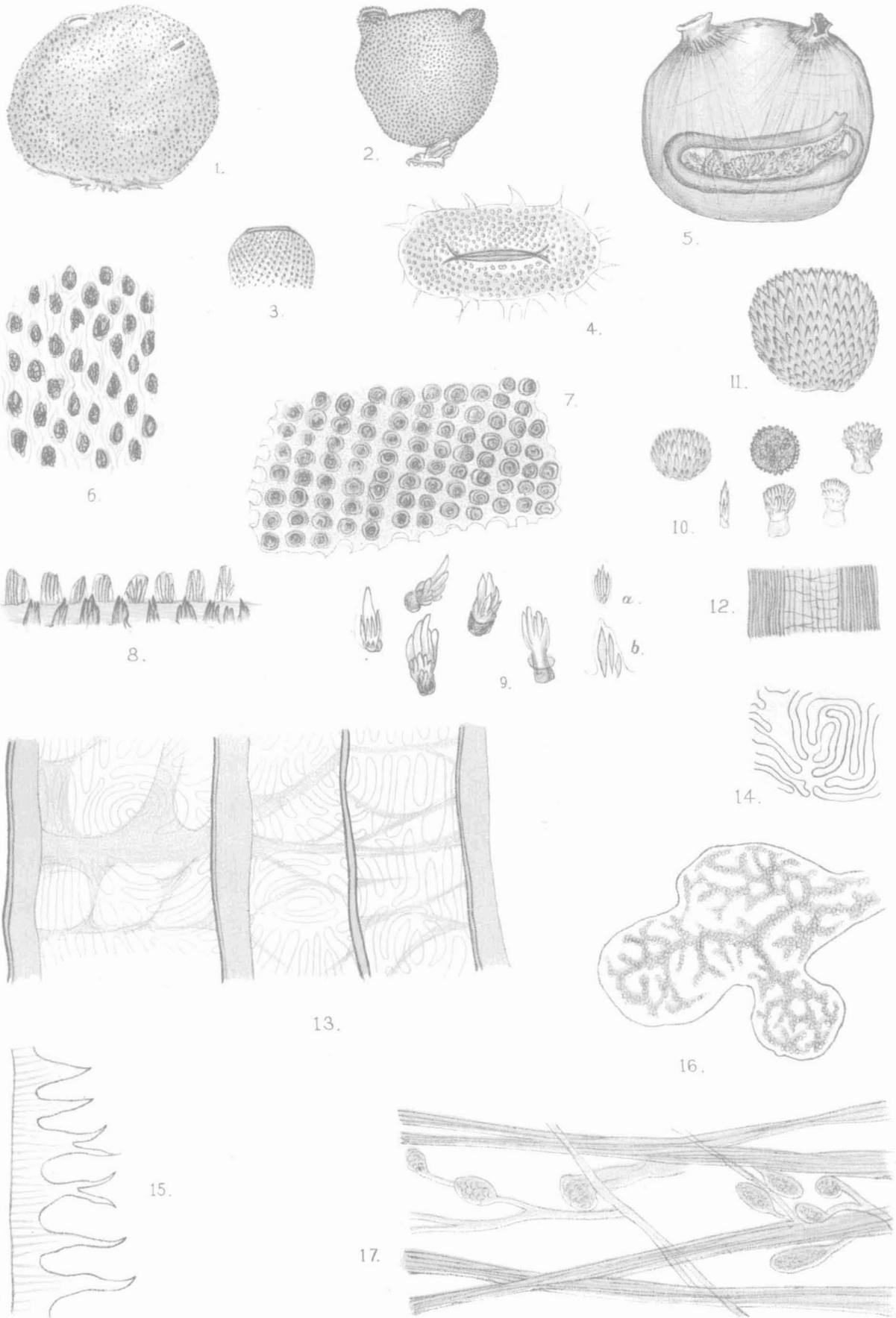
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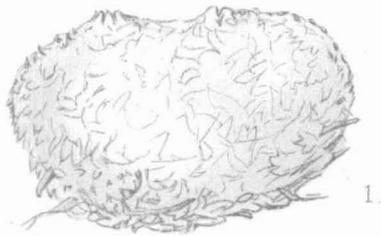
W.A.H. del.

Figs. 1-6 *Ascopera mawsoni*, n.sp.
Figs. 7-10 *Molgula lutulenta*, n.sp.



W.A.H. del.

Bathypora splendens.



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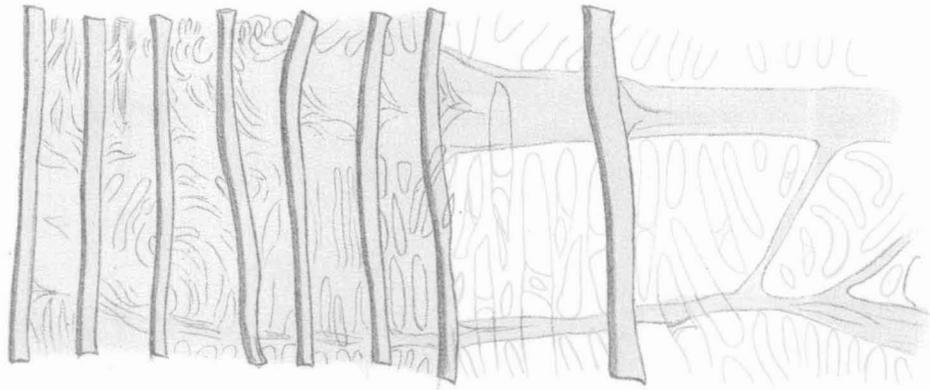


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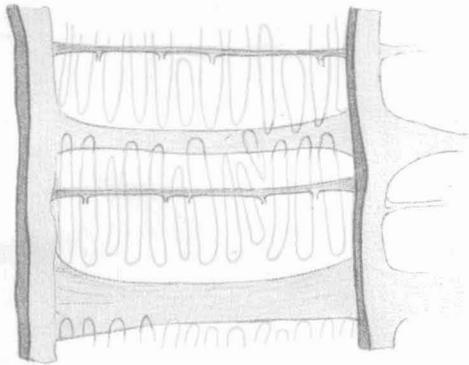


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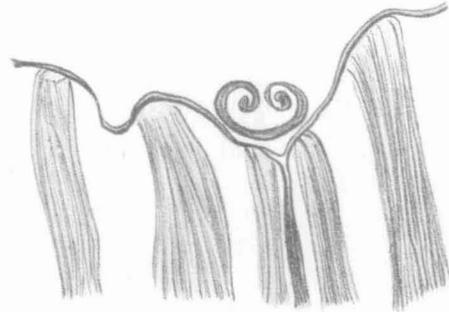
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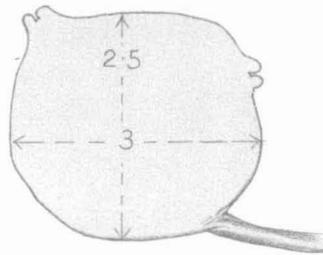
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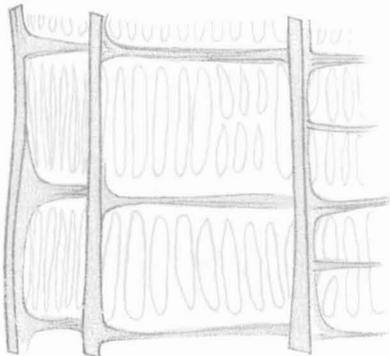
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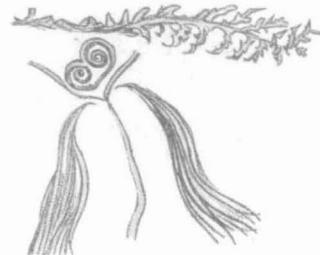
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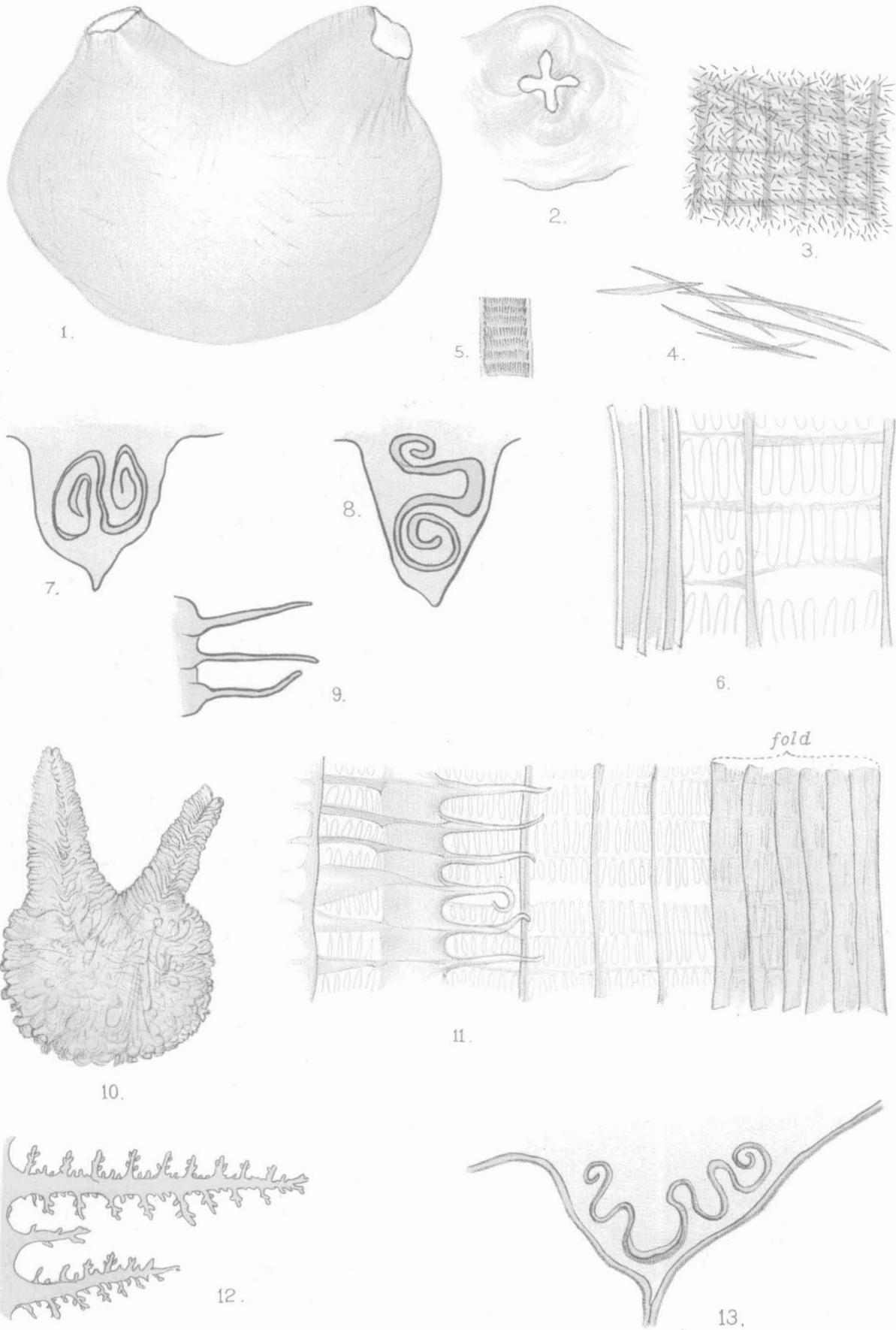
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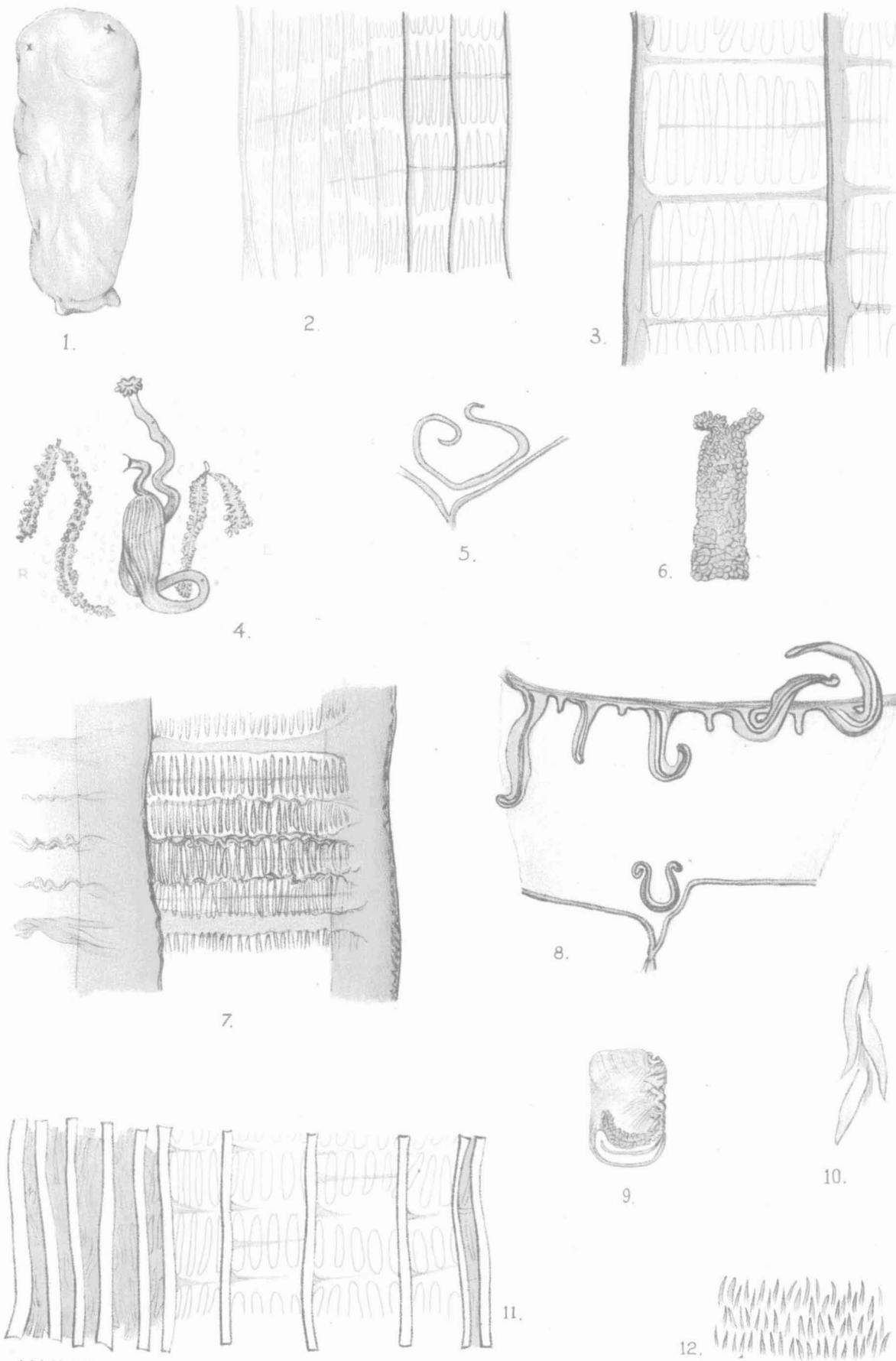
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Figs. 1-6 *Molgula euplicata*, n. sp.
Figs. 7-9 *Boltenia antarctica*.
Figs. 10-11 *Halocynthia cerebriformis*.



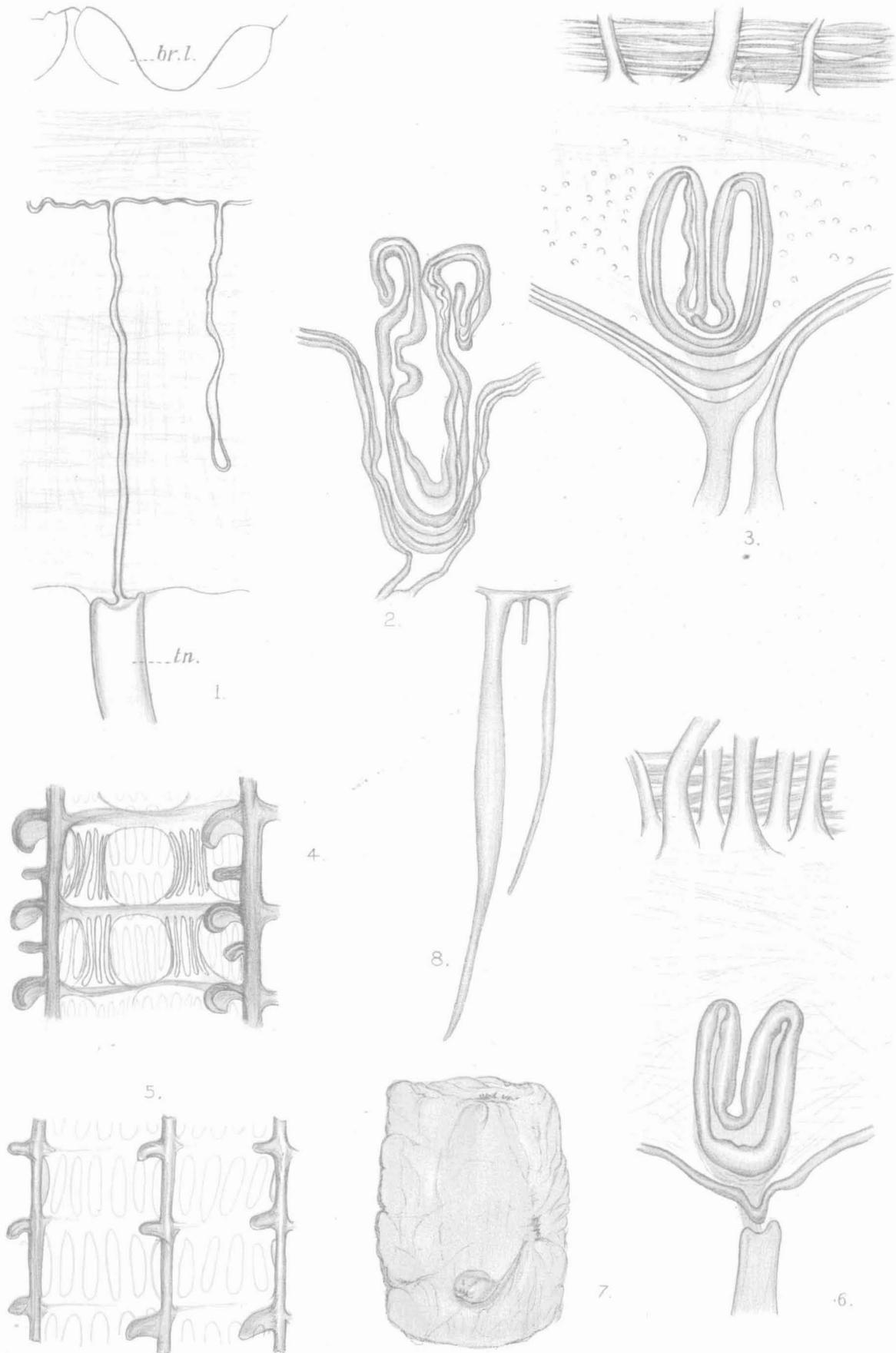
W.A.H.del.

Figs.1-9 *Rhabdocynthia draschii*.
Figs.10-13 *Halocynthia discoveryi*.



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Figs. 1-5 *Styela subpinguis*, n.sp.
Figs. 6-7 *Styela insinuosa*.
Fig. 8 *Polycarpa rigida*.
Figs. 9-12 *Halocynthia flynni*, n.sp.



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Figs. 1-4 *Ascidia challengeri*.
Figs. 5-6 *Ascidia placenta*.
Figs. 7-8 *Corella dohrni*.



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